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Mechanism Analysis of Strategy Choice of Bankruptcy Reorganization Participants under Government Incentive Mechanism

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This study constructs an evolutionary game model of government, creditors, investors, and enterprises participating in bankruptcy reorganization, analyzes the strategy selection mechanism of the four parties under the government incentive mechanism, systematically analyzes the strategy selection process of each participant, discusses the effectiveness of government incentives in promoting the bankruptcy reorganization process, and finds out the stable point in the replication dynamic system. Finally, MATLAB 2018 software is used to numerically model the influence of key elements of the system. The research shows that under the government's incentive mechanism, creditors participate in bankruptcy reorganization in the form of debt-to-equity swaps, investors participate in bankruptcy reorganization in the form of providing high-quality assets, and enterprises participate in bankruptcy reorganization in the form of reform and transformation which is a stable strategy to replicate the dynamic system; the strategy of the enterprises will affect the strategy choice of creditors and investors; the completion of bankruptcy reorganization is inseparable from the government's incentives, and the government's strategy will directly affect the strategic choice of enterprises; and the government's support and constraint strength satisfy the following quantitative relationship: when $M_1 > S_3 - C_1$ and $L_1 > B_1 - C_1$, it can better promote the bankruptcy and reorganization process.

1. Introduction

Under the appropriate government intervention, enterprises on the verge of bankruptcy can adequately solve the debt crisis through bankruptcy and reorganization, which is a topic worthy of attention at present. Due to high leverage and expansion of mergers and acquisitions, some enterprises have heavy debt burdens, run into cash flow difficulties, and face the risk of bankruptcy and liquidation. Compared with bankruptcy and liquidation, bankruptcy reorganization is an essential part of helping enterprises change the status quo, realize the transformation and upgrading of economic structure, and maintain the smooth operation of society [1]. Therefore, bankruptcy reorganization is an important method to revive enterprises in debt distress [2–4].

At present, relevant scholars have conducted extensive research on bankruptcy reorganization, and some scholars have studied the evaluation methods of bankruptcy reorganization value. Gilson et al. took 61 enterprises as research objects and analyzed the value of bankruptcy reorganization using the cash flow method. The results showed that the reorganization value of enterprises obtained by using different evaluation methods was very different [5]. Franceschini et al. used the balanced scorecard to evaluate corporate performance and established a performance evaluation index matrix from four dimensions [6]. Some scholars studied the perspective of the impact of bankruptcy reorganization on enterprises' performance, and the main findings are as follows. Doherty compared the bankruptcy reorganization of large listed companies with the recovery of enterprises after bankruptcy and found that bankruptcy reorganization can bring more profits to the enterprises than bankruptcy liquidation [7]. White proved through research that bankruptcy and reorganization could help companies improve their competitiveness and promote market balance [8]. Game theory is an important theory for the study of

interactive decision-making in systems. Related scholars have applied game theory to bankruptcy problems and have brought remarkable results. Fu et al. used the method of game theory to propose sufficient conditions to avoid enterprises' bankruptcy [9]. Li et al. used the game method to study the optimal control problem of enterprises on the verge of bankruptcy and liquidation and discussed the critical condition of enterprise's bankruptcy [10]. Thomson used cooperative game theory to study the problem of the distribution of the bankruptcy value of enterprises among creditors [11]. Lorenzo-Freire et al. constructed a cooperative game model with transferable utility to study the value distribution of all parties under the bankruptcy mechanism [12].

Existing research shows that most of the current work aimed at the value assessment of bankruptcy reorganization, the impact on the financial situation of enterprises, and the use of game theory methods to analyze the critical conditions of bankruptcy and distribution of the bankruptcy value. However, the research on the quantitative analysis of each subject's participation in bankruptcy reorganization is still in its infancy. Bankruptcy reorganization is a dynamic system, but few literatures analyze it from a dynamic perspective, and the research on the strategy of balancing the interests of each subject in the bankruptcy reorganization system has not yet formed a scientific system. Bankruptcy reorganization is a diversified and complex dynamic process. Various interests of all parties coexist, and conflicts of interest among various stakeholders are inevitable. The essence of bankruptcy reorganization is the balance and coordination of interests of multiple parties. An evolutionary game is a suitable method to solve dynamic problems. Therefore, using this method can better study the game relationship between the behaviors of various subjects in the bankruptcy reorganization system. From a dynamic perspective, we will deeply explore the process of all parties participating in bankruptcy reorganization under the government's incentive mechanism and the behavior evolution and stability maintenance mechanism of all subjects, analyze how the government affects the process of bankruptcy reorganization under appropriate intervention, and explore the process of four parties participating in bankruptcy reorganization, so as to explore the interaction mechanism of complex behaviors of four parties and help all parties find strategic choices to maximize interests.

The innovation of this paper is as follows: (1) From a dynamic perspective, it reveals the interaction of interests of various subjects involved in bankruptcy reorganization, analyzes the impact of the behavior of each reorganization party on the bankruptcy reorganization system, and helps all parties to formulate scientific plans to better participate in bankruptcy reorganization. (2) Aiming at the interest relations, behavior strategies, and game relations of the government, creditors, investors, and enterprises participating in bankruptcy reorganization, this study constructs a bankruptcy reorganization game model involving four subjects, analyzes the stability of decision-making of various game participants, and reveals the evolution law of the four-party behavior strategies participating in bankruptcy reorganization. (3) At present, most scholars focus on studying bankruptcy reorganization from a macroperspective, while

this work studies the process of each subject participating in bankruptcy reorganization from a microperspective. It is found that when government subsidies and constraints meet certain quantitative relationships, the replicated dynamic system has a stable strategy combination, which provides a basis for enterprises to successfully carry out bankruptcy reorganization.

2. Evolutionary Game Model of Bankruptcy Reorganization

2.1. Problem Description. The government, creditors, investors, and enterprises participate in bankruptcy reorganization. The interests of all parties are different. The government's demand is to avoid bankruptcy; the creditors' demand is to obtain a higher amount of liquidation; the investors' demand is to obtain enterprise control for stable income; and the enterprises' demand is to avoid bankruptcy liquidation. If the interests of all parties are satisfied, the dynamic replication system cannot reach a stable state. Therefore, all parties adjust their own interests through negotiation to achieve a balance of interests.

This study addresses the following questions: (1) In order to successfully carry out bankruptcy reorganization, what strategies should the government, creditors, investors, and enterprises adopt? (2) How do the enterprises' strategic choices affect the creditors, investors, and government strategies? (3) How does the strategic choice of creditors and investors affect the evolution of replication dynamic systems?

2.2. Basic Hypothesis of the Model

Hypothesis 1: The government, enterprises, investors, and creditors constitute the main players in the bankruptcy reorganization system. The probability of the government participating in bankruptcy reorganization with particular support is x, and the probability of participating in bankruptcy reorganization without particular support is $1-x$; the probability of creditors participating in a bankruptcy reorganization in the form of debt relief is y, and participating in bankruptcy reorganization through debt-to-equity swap is $1-y$; the probability of investors participating in a bankruptcy reorganization in the form of providing liquidity is z, and the probability of participating in a bankruptcy reorganization in the form of providing high-quality assets is $1-z$; the probability of participating in a bankruptcy reorganization in the form of reform and transformation is k, and the probability of participating in a bankruptcy reorganization in the form of maintaining the status quo is $1-k$ [13–16].

Hypothesis 2: Government participation in bankruptcy reorganization can encourage all parties to cooperate in bankruptcy reorganization. The cost of particular support given by the government is recorded as C_1. When enterprises choose reform transformation, the tax received by the government is recorded as S_1; when

enterprises choose to maintain the status quo, the tax received is recorded as S_2. When the government participates in bankruptcy reorganization without particular support, it increases the probability of bankruptcy and reorganization failure, which affects the local financial ecology, and the negative impact is recorded as B_1.

Hypothesis 3: When enterprises go into bankruptcy liquidation, it will have a greater impact on the creditors' benefit. In order to reduce losses, the creditors choose the debt relief strategy. The debt relief cost is recorded as C_2. After the investors inject funds into the enterprises, they will repay the creditors' debt and improve the creditors' performance, which is recorded as W_1. The reduction of the debt burden of the enterprises is recorded as D_1, and the profit obtained by the reform and transformation of the enterprises is recorded as F_1. The government has formed a positive impression of the creditors' cooperation in bankruptcy reorganization, and the reduction of the creditors' local operating costs is recorded as C_3; when the creditors participate in bankruptcy reorganization through debt-to-equity swap, the cost is recorded as C_4, which greatly reduces the financial burden and is recorded as D_2. Creditors use this strategy to increase the disposal rate of nonperforming assets, and reduced losses are recorded as E_1. After the investors inject funds, the enterprises' gain income is recorded as W_2, and the fund saved by the investors is recorded as N_1. Positive effects of government on creditors are recorded as B_2. To avoid bankruptcy and increase government taxes, the enterprises that choose to reform and transform are recorded as S3. When the enterprise maintains the status quo, the additional burden that the creditors will bring to itself in the form of a debt-to-equity swap is recorded as J_1.

Hypothesis 4: When the investors choose to provide a liquidity strategy, the investment fund is recorded as H_1, the income is recorded as W_5, the income obtained by the enterprises receiving funds for reform and transformation is recorded as W_3, the improvement of creditors' performance is recorded as W_4, and the increase in government tax revenue for enterprises to improve their operating capabilities is recorded as S_4. Investors actively promote bankruptcy and reorganization, giving the government a positive impression of cooperating with bankruptcy and reorganization and

recording the positive impact on investors' future operations as B_3. When the enterprises choose to maintain the status quo, the negative effect on the investors is recorded as R_1. When the investors choose to provide the enterprises with a strategy of quality assets, the value of the provided high-quality assets is recorded as C_5, and the income obtained is recorded as G_4. After the enterprises obtain high-quality assets, their stable income is recorded as W_6. The enterprises repay the loan to the creditors, improve the creditors' performance as W_7, and increase the government tax as S_5. Investors actively promote bankruptcy reorganization and the positive effect brought to the investors is recorded as B_4, and when the enterprises maintain the status quo, the negative benefit to the investors is recorded as R_2.

Hypothesis 5: The enterprises' asset value is recorded as V_1. When the enterprises choose to reform and transform, the income is recorded as W_8, the capital cost is recorded as C_6, the social benefit created by the local government is recorded as B_5, and the government will record certain support for enterprises that cooperate with bankruptcy reorganization as M_1 (such as tax reduction), so as to stabilize the total social and economic income, improve the government's management ability, and improve their own reputation; when the enterprise chooses to maintain the status quo, the income is recorded as W_9 and the cost is recorded as C_7. The government increases the restraint on the operation of enterprises that do not cooperate with bankruptcy and reorganization, which is recorded as L_1. Among them, the cost increased by the enterprise in the operation process is recorded as C_8.

The quartet game matrix of bankruptcy reorganization composed of the government, creditors, enterprises, and investors is given Table 1.

3. Analysis of the Stability of Each Game Subject's Strategy

3.1. Government Expected Revenue. Assuming that the expected revenue of the government participating in bankruptcy reorganization by giving a particular support strategy is U_x and the expected revenue of choosing not to give particular support strategy is U_{1-x}:

$$
\begin{aligned}
U_x &= yzk(-C_1 + S_1 + S_4 + B_5 - M_1) + yz(1-k)(-C_1 + S_2 + L_1) + y(1-z)k(-C_1 + S_1 + S_5 + B_5 - M_1) \\
&\quad + y(1-z)(1-k)(-C_1 + S_2 + L_1) + (1-y)zk(-C_1 + S_1 + S_3 + S_4 + B_5 - M_1) + (1-y)z(1-k)(-C_1 + S_2 + L_1) \\
&\quad + (1-y)(1-z)k(-C_1 + S_1 + S_3 + S_5 + B_5 - M_1) + (1-y)(1-z)(1-k)(-C_1 + S_2 + L_1), \\
U_{1-x} &= yzk(S_1 + S_4 + B_5 - B_1) + yz(1-k)(S_2 - B_1) + y(1-z)k(S_1 + S_5 + B_5) + y(1-z)(1-k)(S_2 - B_1) \\
&\quad + (1-y)zk(S_1 + S_4 + B_5 - B_1) + (1-y)z(1-k)(S_2 - B_1) + (1-y)(1-z)k(S_1 + S_5 + B_5) + (1-y)(1-z)(1-k)(S_2 - B_1).
\end{aligned}
$$

$$(1)$$

TABLE 1: The benefits matrix of the quartet evolutionary games of bankruptcy reorganization.

Government		Particular support		Not to give particular support (Creditor)	
Investor / Enterprise		Debt relief	Debt-to-equity swap strategy	Debt relief	Debt-to-equity swap strategy
Injects funds	Reform and transformation	$-C_1 + S_1 + S_4 + B_5 - M_1 - C_2 + W_1 + C_3 + W_4 - H_1 + W_5 + B_3D_1 + W_3 + V_1 + W_8 - C_6 + M_1 + F_1$	$-C_1 + S_1 + S_3 + S_4 + B_5 - M_1 - C_4 + E_1 + B_2 + W_4 - H_1 + W_5 + B_3D_2 + W_2 + W_3 + V_1 + W_8 - C_6 + M_1$	$S_1 + S_4 + B_5 - B_1 - C_2 + W_4 + W_1 - H_1 + W_5D_1 + W_3 + V_1 + W_8 - C_6 + F_1$	$S_1 + S_4 + B_5 - B_1 - C_4 + E_1 + W_4 - H_1 + W_5D_2 + W_2 + W_3 + V_1 + W_8 - C_6$
	Maintain the status	$-C_1 + S_2 + L_1 - C_2 + W_1 + C_3 - H_1 + W_5 + B_3 - R_1D_1 + V_1 + W_9 - C_7 - L_1 - C_8$	$-C_1 + S_2 + L_1 - C_4 + E_1 + B_2 - J_1 - H_1 + W_5 + B_3 - R_1 + N_1D_2 + V_1 + W_9 - C_7 - L_1 - C_8 + W_2$	$S_2 - B_1 - C_2 + W_1 - H_1 + W_5 - R_1D_1 + V_1 + W_9 - C_7$	$S_2 - B_1 - C_4 + E_1 - J_1 - H_1 + W_5 - R_1 + N_1D_2 + V_1 + W_9 - C_7 + W_2$
Provide enterprises with high-quality asset	Reform and transformation	$-C_1 + S_1 + S_5 + B_5 - M_1 - C_2 + W_7 - C_5 + G_4 + B_4W_6 + V_1 + W_8 - C_6 + M_1$	$-C_1 + S_1 + S_3 + S_5 + B_5 - M_1 - C_4 + E_1 + B_2 + W_7 - C_5 + G_4 + B_4D_2 + W_2 + W_6 + V_1 + W_8 - C_6 + M_1$	$S_1 + S_5 + B_5 - C_2 + W_7 - C_5 + G_4W_6 + V_1 + W_8 - C_6$	$S_1 + S_5 + B_5 - C_4 + E_1 + W_7 - C_5 + G_4D_2 + W_2 + W_6 + V_1 + W_8 - C_6$
	Maintain the status	$-C_1 + S_2 + L_1 - C_2 - C_5 + G_4 + B_4 - R_2V_1 + W_9 - C_7 - L_1 - C_8$	$-C_1 + S_2 + L_1 - C_4 + E_1 + B_2 - J_1 - C_5 + G_4 + B_4 - R_2D_2 + V_1 + W_9 - C_7 - L_1 - C_8 + W_2$	$S_2 - B_1 - C_2 - C_5 + G_4 - R_2V_1 + W_9 - C_7$	$S_2 - B_1 - C_4 + E_1 - J_1 - C_5 + G_4 - R_2D_2 + V_1 + W_9 - C_7 + W_2$

The government's replication dynamic equation is

$$F(x) = \frac{dx}{dt} = x(U_x - \overline{U}) = (1-x)(U_x - U_{1-x}) = x(1-x)(B_1 - C_1 + L_1 - kB_1 - kL_1 - kM_1 + kS_3 + kzB_1 - kyS_3),$$

$$= x(1-x)[(1-y)kS_3 + (1-k)(L_1 + B_1) + zkB_1 - kM_1 - C_1],$$

$$F'(x) = (1-2x)[(1-y)kS_3 + (1-k)(L_1 + B_1) + zkB_1 - kM_1 - C_1]. \tag{2}$$

The form in which the government chooses to participate in bankruptcy reorganization is related to y, so thisstudy can judge the situations of $F(x)$ and $F'(x)$ by analyzing the size of y [16–18].

Proposition 1. *In the case of $y < y_0$, giving particular support is the government's stabilization strategy; when $y > y_0$, giving no particular support is a stable strategy. The threshold is $y = 1 - ((k-1)(L_1 + B_1) - zkB_1 + Km_1 + C_1) * Ks_3^{-1} = y_0$.*

Proof. $A(y) = (1-y)Ks_3 + (1-k)(L_1 + B_1) + zkB_1 - Km_1 - C_1$, $\partial A(y)/\partial y < 0$, $A(y)$ is the decreasing function of y; the conditions for $x = 1$ to be stable are as follows: $y < y_0$, $A(y) > 0$, $F(x)|_{x=1} = 0$, and $F'(x)|_{x=1} < 0$. The conditions for $x = 0$ to be stable are as follows: y_0, $A(y) < 0$, $F(x)|_{x=0} = 0$, and $F'(x)|_{x=0} < 0$; when $y = y_0$, $A(y) = 0$, $F(x) = 0$, and $F'(x) = 0$, the stability cannot be determined at this time [16].

Inference 1: Enterprises are on the verge of bankruptcy, which affects social stability. The greater the negative effect it brings to the government, the government will choose to give particular support; the government will subsidize the parties in bankruptcy reorganization, and when the subsidy increases, it may bring the government under financial pressure, the government will be more inclined to choose not to give particular support; creditors participating in bankruptcy reorganization in the form of debt-to-equity swaps reduce the risk of bankruptcy and liquidation of enterprises and increase government tax revenue; the government will tend to choose to give particular support at this time.

In the process of bankruptcy and reorganization, as the probability of creditors participating in bankruptcy reorganization in the form of debt relief increases, the government's stabilization strategy changes to no particular support and vice versa. Therefore, in the process of bankruptcy and reorganization, when the government gives particular support, it will adopt reasonable regulation of the market to safeguard the interests of all parties in accordance with the law and ensure the smooth operation of the market. At this point, creditors will be prompted to participate in bankruptcy reorganization through debt-for-equity swaps.

The phase diagram of government participation in bankruptcy reorganization strategy selection is shown in Figure 1.

In Figure 1, the probability of the government participating in bankruptcy reorganization with particular support is V_1 and not giving particular support is V_2. After calculation, we can get the following:

$$V_1 = \int_{L_1+B_1-C_1}^{S_3-C_3-M_1+zB_1-yS_3} \int_0^1 \{[(k-1)(L_1 + B_1) - zkB_1 + C_1 + kM_1]/kS_3\},$$

$$dxdy = -\left[\frac{(L_1 + B_1 + M_1 - zB_1)}{S_3} - \frac{(B_1 - C_1 + L_1)}{kS_3}\right](L_1 + B_1 + M_1 - S_3 - zB_1 + yS_3), \tag{3}$$

$$V_2 = 1 - V_1.$$

Proof: According to the expression of V_1, calculate to get $\partial V_1/\partial B_1 > 0$, $\partial V_1/\partial M_1 < 0$, and $\partial V_1/\partial S_3 > 0$. Therefore, B_1 and S_3 increase or M_1 decreases or both can prompt the government to choose to give particular support.

3.2. Creditors Expected Revenue. Assume that the expected return of creditors participating in bankruptcy reorganization in the form of debt relief is U_y, and the expected return of participating in bankruptcy reorganization in the form of debt-to-equity swap is U_{1-y} [19–21].
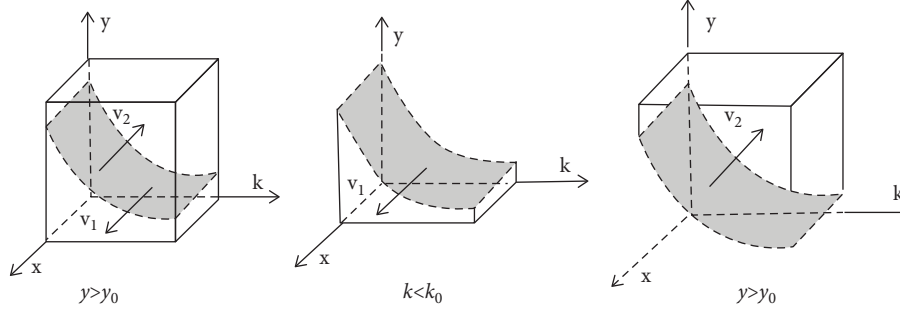
FIGURE 1: Replication dynamic phase diagram of government.

$$U_y = xzk(-C_2 + W_1 + C_3 + W_4) + xz(1-k)(-C_2 + C_3 + W_1) + x(1-z)k(-C_2 + +W_7) + x(1-z)(1-k)(-C_2)$$
$$+ (1-x)zk(-C_2 + W_1 + W_4) + (1-x)z(1-k)(-C_2 + W_1) + (1-x)(1-z)k(-C_2 + W_7) + (1-x)(1-z)(1-k)(-C_2),$$
$$U_{1-y} = xzk(-C_4 + E_1 + B_2 + W_4) + xz(1-k)(-C_4 + E_1 + B_2 - J_1) + x(1-z)k(-C_4 + E_1 + B_2 + W_7)$$
$$+ x(1-z)(1-k)(-C_4 + E_1 + B_2 - J_1) + (1-x)zk(-C_4 + E_1 + W_4) + (1-x)z(1-k)(-C_4 + E_1 - J_1)$$
$$+ (1-x)(1-z)k(-C_4 + E_1 + W_7) + (1-x)(1-z)(1-k)(-C_4 + E_1 - J_1).$$

$$(4)$$

The creditors' replication dynamic equation is as follows:

$$
\begin{aligned}
F(y) &= \frac{dy}{dt} \\
&= y(U_y - \overline{U}) \\
&= y(1-y)(U_y - U_{1-y}) \\
&= y(1-y)(C_4 - C_2 - E_1 + J_1 - kJ_1 - xB_2 + zW_1 - xzC_3) \\
&= y(1-y)[(1-k)J_1 + C_4 - C_2 - E_1 - xB_2 + zW_1 - xzC_3], \\
F'(y) &= (1-2y)[(1-k)J_1 + C_4 - C_2 - E_1 - xB_2 + zW_1 - xzC_3].
\end{aligned}
$$

$$(5)$$

The creditors' strategy choice is related to k, so this study can judge the situation of F(y) and F′(y) by analyzing the size of k [16].

Proposition 2. *In the case of $k < k_0$, the creditors' participation in bankruptcy reorganization through debt-for-equity swap is a stable strategy of the system, and the threshold is $k = (J_1 - C_2 + C_4 - E_1 - xB_2 + zW_1 - xzC_3) * J_1 - 1 = k_0$.*

Proof. B(k)=$(1-k)J_1 + C_4 - C_2 - E_1 - xB_2 + zW_1 - xzC_3$, $\partial B_k/\partial k < 0$, and B($k$) is the decreasing function of k. The conditions for $y = 1$ to be stable are as follows: $k < k_0$, B(k)>0, F(y)$|_{y=1} = 0$, and F′(y)$|_{y=1} < 0$; the conditions for $y = 0$ to be stable are as follows: $k > k_0$, B(k) < 0, F(y)$|_{y=0} = 0$, and F′(y)$|_{y=0} < 0$; when $k = k_0$, B(k) = 0, F(y) = 0, and F′(y) = 0, the stability of the system is difficult to determine at this time [16].

That is, the enterprises' strategy will affect the creditors' strategic choice. When the probability of the enterprises' choice of reform and transformation increases, the creditors' strategic choice will be converted into a debt-to-equity swap and vice versa. Further analysis shows that the enterprises' choice of reform transformation has strengthened vitality and optimized resource allocation. Creditors are more willing to participate in bankruptcy reorganization through debt-to-equity swaps, which convert creditors' debt into share dividends with value added to provide creditors with a stable source of funds in the future. Conversely, if the enterprises choose to maintain the status quo with a higher probability, the enterprises' expectations for improving their operating capability are not clear, and creditors will choose a debt relief strategy based on their own interests.

According to Proposition 2, the phase diagram of creditors' strategy selection is shown in Figure 2.

In Figure 2, the probability of creditors participating in bankruptcy reorganization in the form of a debt relief strategy is V_3, and the creditors' choosing to participate in bankruptcy reorganization in the form of a debt-for-equity swap is V_4. After calculation, we can get:

$$V_3 = \int_0^1 \int_0^1 (J_1 - C_2 + C_4 - E_1 - xB_2 + zW_1 - xzC_3)/J_1 \, dy,$$

$$dk = 1 - \frac{(C_2 - C_4 + E_1 - xB_2 - zW_1 - xzC_3)}{J_1},$$

$$V_4 = 1 - V_3.$$

(6)

Inference 2: When government support increases and enterprises work hard for reform and transformation, creditors will be more willing to participate in bankruptcy and reorganization through debt-to-equity swaps. This is because, in the environment of government support, it is easier for enterprises to turn losses into profits and creditors' investment risks are reduced; when enterprises do not have the ability to improve their current operations, creditors will choose debt relief to avoid risks.

Proof: According to the expression of V_3, calculate to get $\partial V_3/\partial C_2 < 0$, $\partial V_3/\partial C_4 > 0$, $\partial V_3/\partial E_1 < 0$, $\partial V_3/\partial B_2 < 0$, $\partial V_3/\partial W_1 > 0$, and $\partial V_3/\partial C_3 > 0$. Therefore, the increase of C_4, C_3, and W_1 or the decrease of C_2, B_2, and E_1 or both can prompt creditors to choose the debt relief strategy.

3.3. Investors Expected Revenue.
Assume that the expected revenue of the investors choosing to inject funds strategy is U_z, and the expected revenue of choosing to provide the enterprises with high-quality asset strategy is U_{1-z} [16–19].

$$U_z = xyk(-H_1 + W_5 + B_3) + xy(1-k)(-H_1 + W_5 + B_3 - R_1) + x(1-y)k(-H_1 + W_5 + B_3)$$
$$+ x(1-y)(1-k)(-H_1 + W_5 + B_3 - R_1 + N_1) + (1-x)yk(-H_1 + W_5) + (1-x)y(1-k)(-H_1 + W_5 - R_1)$$
$$+ (1-x)(1-y)k(-H_1 + W_5) + (1-x)(1-y)(1-k)(-H_1 + W_5 - R_1 + N_1),$$
$$U_{1-z} = xyk(-C_5 + G_4 + B_4) + xy(1-k)(-C_5 + G_4 + B_4 - R_2) + x(1-y)k(-C_5 + G_4 + B_4)$$
$$+ x(1-y)(1-k)(-C_5 + G_4 + B_4 - R_2) + (1-x)yk(-C_5 + G_4) + (1-x)y(1-k)(-C_5 + G_4 - R_2)$$
$$+ (1-x)(1-y)k(-C_5 + G_4) + (1-x)(1-y)(1-k)(-C_5 + G_4 - R_2).$$

(7)

The investors' replication dynamic equation is

$$F(z) = z(1-z)(C_5 - G_4 - H_1 + N_1 - R_1 + R_2 + W_5 - kN_1 + xB_3 - xB_4 - kR_1 - kR_2 - yN_1 + ykN_1)$$
$$= z(1-z)\{(1-k)[N_1(1-y) + R_2] + C_5 - G_4 - H_1 - R_1 + W_5 + xB_3 - xB_4 - kR_1\},$$

$$F'(z) = (1-2z)\{(1-k)[N_1(1-y) + R_2] + C_5 - G_4 - H_1 - R_1 + W_5 + xB_3 - xB_4 - kR_1\}.$$

(8)

The investors' strategy choice is related to k, so this study can judge the situation of $F(z)$ and $F'(z)$ by analyzing the size of k [16].

Proposition 3. *In the case of $k < k_0$, injecting funds is the investors' stabilization strategy; when $k > k_0$, providing the enterprises with high-quality asset is a stable strategy. The threshold is $k = 1 - (C_5 - G_4 - H_1 - R_1 + W_5 + xB_3 - xB_4 - kR_1) * [N_1(1-y) + R_2]^{-1} = k_0$.*

Proof. $C(k) = (1-k)(R_1 - yQ_1) + C_6 - C_5 - D_2 - Q_1 + S_4 + xB_3 - xB_4$, $\partial C_k/\partial k < 0$, and $C(k)$ is the decreasing function of k. The conditions for $z = 1$ to be stable are as follows: $k < k_0$, $C(k) > 0$, $F(z)|_{z=1} = 0$, and $F'(z)|_{z=1} < 0$; the conditions for $z = 0$ to be stable are as follows: $k > k_0$, $C(k) < 0$, $F(z)|_{z=0} = 0$, and $F'(z)|_{z=0} < 0$; when $k = k_0$, $C(k) = 0$, $F(z) = 0$, and $F'(z) = 0$, this moment, the stability cannot be determined at this time [16].

Proposition 3 shows that the enterprises' strategic choices will affect the investors' stability strategy. When the probability of the enterprises' choice of reform and transformation increases, the investors' stability strategy will change to provide the enterprise with high-quality assets and vice versa. It can be seen that the enterprises' choice of reform transformation has released a positive signal to investors. Providing high-quality assets helps the debtor to pay off debts while prompting the enterprises to restore their operating capacity, effectively avoiding enterprises bankruptcy, and the investors' stabilization strategy is to provide high-quality assets to the enterprises; on the contrary, if the enterprises choose to maintain the status quo, the investors inject funds into enterprises to remission the current debt crisis of enterprises, the enterprises
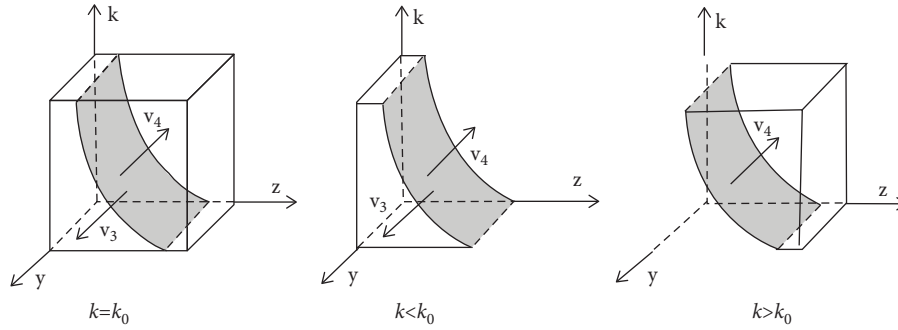
FIGURE 2: Phase diagram of creditors' strategy selection.

can operate normally and obtain income, and it reduces the risk of creditors' asset loss. At this point, investors will choose to inject capital into the enterprises.

According to Proposition 3, the phase diagram of the investors' strategy is shown in Figure 3.

$$
V_5 = \int_{C_5-G_4-H_1+N_1-R_1+R_2+W_5-kN_1+B_3-B_4-kR_1-kR_2+yN_1+ykN_1}^{C_5-G_4-H_1+N_1-R_1+R_2+W_5-kN_1-kR_1-kR_2+yN_1+ykN_1} \int_0^1 \left[1 - \frac{C_5 - G_4 - H_1 - R_1 - W_5 + xB_3 - xB_4 - kR_1}{N_1(1-y) + R_2} \right],
$$

$$
dzdk = -(B_3 - B_4)\left[\frac{G_4 - C_5 + H_1 + R_1 - W_5 - xB_3 + xB_4 + kR_1}{N_1(1-y) + R_2} + 1 \right]. \tag{9}
$$

Inference 3: As the opportunity for creditors to get rich returns increases and the government's particular support increases, investors will choose the inject funds strategy; the reform transformation of enterprises and the large number of funds injected by investors will lead to excessive capital risks, and investors will tend to choose to provide high-quality asset strategy [16–18].

Proof: According to the expression of V_5, calculate to get $\partial V_5/\partial B_3 > 0$, $\partial V_5/\partial B_4 < 0$, $\partial V_5/\partial G_4 < 0$, $\partial V_5/\partial H_1 < 0$, $\partial V_5/\partial W_5 > 0$, and $\partial V_5/\partial R_2 > 0$.

In Figure 3, the probability that the investors choose to inject funds is V_5, and the probability that the investors choose to provide high-quality assets is V_6. After calculation, we can get:

Therefore, the increase of B_3, W_5, and R_2 or the decrease of G_4, B_4, and H_1 or both can increase the probability that the investors choose to inject funds into the enterprises.

3.4. Enterprises Expected Revenue. Assume that the expected revenue of the enterprises choosing to reform transformation strategy is U_k, and the expected revenue of choosing to maintain the status quo strategy is U_{1-k}.

$$
\begin{aligned}
U_k = {}& xyz\left(D_1 + W_3 + V_1 + W_8 - C_6 + M_1 - C_7 + M_1 + F_1\right) + xy(1-z)\left(W_6 + V_1 + W_8 - C_6 + M_1\right) \\
& + x(1-y)z\left(D_2 + W_3 + V_1 + W_8 - C_6 + M_1\right) + x(1-y)(1-z)\left(D_2 + W_6 + V_1 + W_8 - C_6 + M_1\right) \\
& + (1-x)yz\left(D_1 + W_3 + V_1 + W_8 - C_6 + F_1\right) + (1-x)y(1-z)\left(W_6 + V_1 + W_8 - C_6\right) \\
& + (1-x)(1-y)z\left(D_2 + W_3 + V_1 + W_8 - C_6\right) + (1-x)(1-y)(1-z)\left(D_2 + W_6 + V_1 + W_8 - C_6\right), \\
U_{1-k} = {}& xyz\left(D_1 + V_1 + W_9 - C_7 - L_1 - C_8\right) + xy(1-z)\left(V_1 + W_9 - C_7 - L_1 - C_8\right) + x(1-y)z\left(D_2 + V_1 + W_9 - C_7 - L_1 - C_8 + W_2\right) \\
& + x(1-y)(1-z)\left(D_2 + V_1 + W_9 - C_7 - L_1 - C_8 + W_2\right) + (1-x)yz\left(D_1 + V_1 + W_9 - C_7\right) + (1-x)y(1-z)\left(V_1 + W_9 - C_7\right) \\
& + (1-x)(1-y)z\left(D_2 + V_1 + W_9 - C_7 + W_2\right) + (1-x)(1-y)(1-z)\left(D_2 + V_1 + W_9 - C_7 + W_2\right).
\end{aligned}
$$

$$\tag{10}$$

The enterprises' replication dynamic equation is
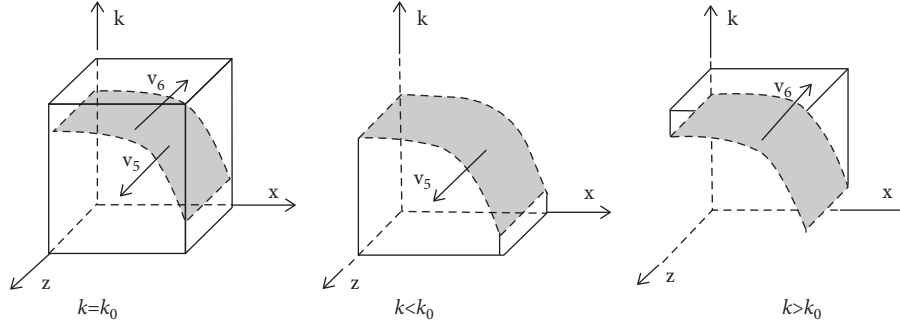
Figure 3: Replication dynamic phase diagram of investors.

$$F(k) = k(1-k)(C_6 - C_7 + W_2 + W_6 + W_8 - W_9 + xC_8 + xL_1 + xM_1 + yW_2 + zW_3 - zW_6 + yzF_1),$$
$$F'(k) = (1-2k)(C_6 - C_7 + W_2 + W_6 + W_8 - W_9 + xC_8 + xL_1 + xM_1 + yW_2 + zW_3 - zW_6 + yzF_1).$$

(11)

The enterprises' strategy choice is related to x, so this study can judge the situation of F(k) and F'(k) by analyzing the size of x [16].

Proposition 4. *In the case of $x > x_0$, reforming transformation is the enterprises' stabilization strategy; when $x < x_0$, maintaining the status quo is a stable strategy. The threshold is as follows:* $x = (C_6 - C_7 - W_2 - W_6 - W_8 + W_9 - yW_2 - zW_3 + zW_6 - yzF_1)(C_8 + L_1 + M_1)^{-1} = x_0$.

$is suggests that as the government's strategic choices will affect the enterprises' strategy and when the probability of government involvement in a bankruptcy reorganization without particular support increases, enterprises will turn to the status quo strategy. Therefore, the government's

reasonable regulation of the market and the interests of all parties can be better protected and the market can function well. At this time, the enterprise' stabilization strategy is reform transformation; in the same way, when the government participates in bankruptcy and reorganization without particular support, it will increase the risk of bankruptcy liquidation of the enterprise. At this time, the enterprise chooses to maintain the status quo.

According to Proposition 4, the phase diagram of the enterprises' strategy is shown in Figure 4.

In Figure 4, the probability of an enterprise participating in bankruptcy and reorganization in the form of reform and transformation is V_7 and maintaining the status quo is V_8. After calculation, we can get

$$V_7 = \int_{C_7 - C_6 + W_2 + W_6 + W_8 - W_9 + yW_2 + zW_3 - zW_6 + yzF_1}^{1} \int_0^1 C_6 - C_7 + W_2 - W_6 - W_8 + W_9 - yW_2 - zW_3 - zW_6 - yzF_1/C_8 + L_1 + M_1,$$

$$dkdx = \frac{(C_7 - C_6 + W_2 + W_6 + W_8 - W_9 + yW_2 + zW_3 - zW_6 + yzF_1)(C_7 - C_6 + W_2 + W_6 + W_8 - W_9 + yW_2 + zW_3 - zW_6 + yzF_1 - 1)}{C_8 + L_1 + M_1},$$

$$V_8 = 1 - V_7.$$

(12)

Inference 4: When the cost of reform transformation decreases, the earnings of the enterprises after receiving financial support from investors increase, and the government's restraining force on enterprises that do not cooperate with bankruptcy reorganization increases, the enterprises will tend to adopt a reform-transformation strategy; when the enterprises continue to operate, they can still get a considerable income. Enterprises tend to choose the strategy of maintaining the status quo.

Proof: Calculate to get $\partial V_7/\partial C_7 > 0$, $\partial V_7/\partial C_6 < 0$, $\partial V_7/\partial W_6 > 0$, $\partial V_7/\partial W_9 < 0$, $\partial V_7/\partial F_1 > 0$, $\partial V_7/\partial C_8 > 0$, and $\partial V_7/\partial L_1 > 0$. Therefore, C_7, W_6, F_1, C_8, and L_1

increase or C_6 and W_9 decrease or both can prompt enterprises to choose reform and transformation strategy.

4. Stability Analysis of Equilibrium Point of the Quadrilateral Evolutionary Game System

4.1. Stability Analysis of Strategy Combination under the Particular Support from Government. When the condition $(1-y)kS_3 + (1-k)(L_1 + B_1) + zkB_1 - kM_1 - C_1 < 0$ is met, the government participates in bankruptcy reorganization in the form of particular support. At this time, the stable equilibrium point of the replication dynamic system is given in Table 2.
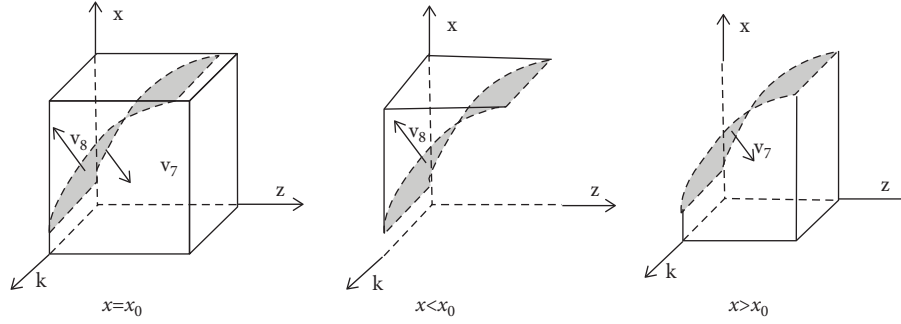
FIGURE 4: Replication dynamic phase diagram of enterprises.

TABLE 2: Analysis of the stability of the system when the government chooses to give particular support.

Equilibrium point	Eigenvalues	Symbol	Stability
(1, 1, 1, 1)	$B_1 - C_1 - M_1$, $C_3 - C_2 - B_2 + C_4 - E_1 + W_1$, $B_3 - B_4 + C_5 - G_4 - H_1 + W_5$, $C_7 - C_6 + C_8 + F_1 + L_1 + M_1 + W_3 + W_8 - W_9$	$(+ \ - \ - \ +)$	×
(1, 1, 1, 0)	$B_1 - C_1 + L_1$, $C_3 - C_2 - B_2 + C_4 - E_1 + J_1 + W_1$, $B_3 - B_4 + C_5 - G_4 - H_1 - R_1 + R_2 + W_5$, $C_7 - C_6 + C_8 + F_1 + L_1 + M_1 + W_3 + W_8 - W_9$	$(\backslash \ - \ - \ +)$	Unstable
(1, 1, 0, 0)	$B_1 - C_1 + L_1$, $C_4 - C_2 - B_2 - E_1 + J1$, $B_3 - B_4 + C_5 - G_4 - H_1 - R_1 + R_2 + W_5$, $C_7 - C_6 + C_8 + L_1 + M_1 + W_6 + W_8 - W_9$	$(\backslash \ + \ \backslash \ +)$	Unstable
(1, 0, 0, 0)	$B_1 - C_1 + L_1$, $C_4 - C_2 - B_2 - E_1 + J1$, $B_3 - B_4 + C_5 - G_4 - H_1 + N_1 - R_1 + R_2 + W_5$, $C_7 - C_6 + C_8 + L_1 + M_1 - W_2 + W_6 + W_8 - W_9$	$(\backslash \ - \ - \ -)$	Unstable
(1, 0, 1, 1)	$B_1 - C_1 - M_1 + S3$, $C_3 - C_2 - B_2 + C_4 - E_1 + W_1$, $B_3 - B_4 + C_5 - G_4 - H_1 + W_5$, $C_7 - C_6 + C_8 + L_1 + M_1 - W_2 + W_3 + W_8 - W_9$	$(+ \ - \ - \ -)$	×
(1, 0, 0, 1)	$S_3 - M_1 - C1$, $C_4 - C_2 - B_2 - E1$, $B_3 - B_4 + C_5 - G_4 - H_1 + W_5$, $C_7 - C_6 + C_8 + L_1 + M_1 - W_2 + W_6 + W_8 - W_9$	$(\backslash \ - \ - \ -)$	ESS when (1) is satisfied
(1, 1, 0, 1)	$- C_1 - M_1$, $C_4 - C_2 - B_2 - E1$, $B_3 - B_4 + C_5 - G_4 - H_1 + W_5$, $C_7 - C_6 + C_8 + L_1 + M_1 + W_6 + W_8 - W_9$	$(- \ - \ - \ +)$	Unstable
(1, 0, 1, 0)	$B_1 - C_1 + L_1$, $C_3 - C_2 - B_2 + C_4 - E_1 + J_1 + W_1$, $B_3 - B_4 + C_5 - G_4 - H_1 + N_1 - R_1 + R_2 + W_5$, $C_7 - C_6 + C_8 + L_1 + M_1 - W_2 + W_3 + W_8 - W_9$	$(\backslash \ - \ - \ -)$	ESS when (2) is satisfied

$\backslash$ indicates that the sign of the eigenvalue cannot be uncertain; × represents an unstable point; ESS represents a stable point.

As can be seen from the table, there are two stabilization strategies (1, 0, 0, 1) and (1, 0, 1, 0) under the particular support given by the government. Among them, (1, 0, 0, 1) indicates that the stability strategy of the system is a particular support strategy for the government, the creditors choose the debt-to-equity swap strategy, the investors choose the strategy of providing high-quality assets, and the enterprise chooses the reform and transformation strategy [22–25]. Under this combination of strategies, it can promote the process of bankruptcy reorganization. Through further research, it is found that when the condition $M_1 > S_3 - C_1$ is met, (1, 0, 0, 1) can become a stable point, that is, the government subsidy level should be greater than the difference between the government's tax increased and the support cost during the enterprises' reform transformation. When the condition $L_1 < C_1 - B_1$ is satisfied, (1, 0, 1, 0) becomes the stable point of the system. The stable strategies for replicating dynamic systems are as follows: the government provides particular support, creditors provide debt-to-equity swap strategies, investors inject funds, and companies maintain the status quo. The results are inconsistent with the previous replication dynamic

analysis results. The investors' choice to inject funds and the enterprises' choice to maintain the status quo are not conducive to the process of bankruptcy reorganization. Therefore, in order to prevent (1, 0, 1, 0) from becoming a stable point, it is necessary to make $L_1 > C_1 - B_1$; by increasing the support and constraints on all parties, the government promotes the replication of the dynamic system with a stable point of (1, 0, 0, 1) and maximizes social welfare [16].

4.2. Stability Analysis of Strategy Combination under the Government Not Giving Particular Support.

When condition $(1 - y)kS_3 + (1 - k) \ (L_1 + B_1) + zkB_1 - kM_1 - C_1 > 0$ is satisfied, the government will participate in bankruptcy reorganization without giving particular support strategy [16]. The stable equilibrium point of the replication dynamic system is given in Table 3.

As can be seen from Table 3, when the government does not give particular support, there is no stable equilibrium point for enterprises to participate in bankruptcy and reorganization in the form of reform and transformation. This

TABLE 3: Analysis of the stability of the system when the government chooses not to give particular support.

Equilibrium point	Eigenvalues	Symbol	Stability
(0, 1, 1, 1)	$B_1 - C_1 - M_1, C_4 - C_2 - E_1 + W_1, C_5 - G_4 - H_1 + W_5, C_7 - C_6 + F_1 + W_3 + W_8 - W_9$	(+ + − +)	×
(0, 1, 0, 1)	$-C_1 - M_1, C_4 - C_2 - E_1, C_5 - G_4 - H_1 + W_5, C_7 - C_6 + W_6 + W_8 - W_9$	(− − − +)	Unstable
(0, 1, 0, 0)	$B_1 - C_1 + L_1, C_4 - C_2 - E_1 + J1, C_5 - G_4 - H_1 - R_1 + R_2 + W_5,$ $C_7 - C_6 + W_6 + W_8 - W_9$	(\ − + \)	Unstable
(0, 0, 0, 0)	$B_1 - C_1 + L_1, C_4 - C_2 - E_1 + J1, C_5 - G_4 - H_1 + N_1 - R_1 + R_2 + W_5,$ $C_7 - C_6 - W_2 + W_6 + W_8 - W_9$	(\ − − +)	Unstable
(0, 0, 1, 1)	$B_1 - C_1 - M_1 + S3, C_4 - C_2 - E_1 + W_1, C_5 - G_4 - H_1 + W_5,$ $C_7 - C_6 - W_2 + W_3 + W_8 - W_9$	(+ + − −)	×
(0, 0, 0, 1)	$S_3 - M_1 - C1, C_4 - C_2 - E_1, C_5 - G_4 - H_1 + W_5, C_7 - C_6 - W_2 + W_6 + W_8 - W_9$	(\ − − +)	Unstable
(0, 1, 1, 0)	$B_1 - C_1 + L_1, C_4 - C_2 - E_1 + J_1 + W_1, C_5 - G_4 - H_1 - R_1 + R_2 + W_5,$ $C_7 - C_6 + F_1 + W_3 + W_8 - W_9$	(\ − + +)	Unstable
(0, 0, 1, 0)	$B_1 - C_1 + L_1, C_4 - C_2 - E_1 + J_1 + W_1, C_5 - G_4 - H_1 + N_1 - R_1 + R_2 + W_5,$ $C_7 - C_6 - W_2 + W_3 + W_8 - W_9$	(\ − − −)	ESS when (3) is satisfied

\ indicates that the sign of the eigenvalue cannot be uncertain; × represents an unstable point; ESS represents a stable point.
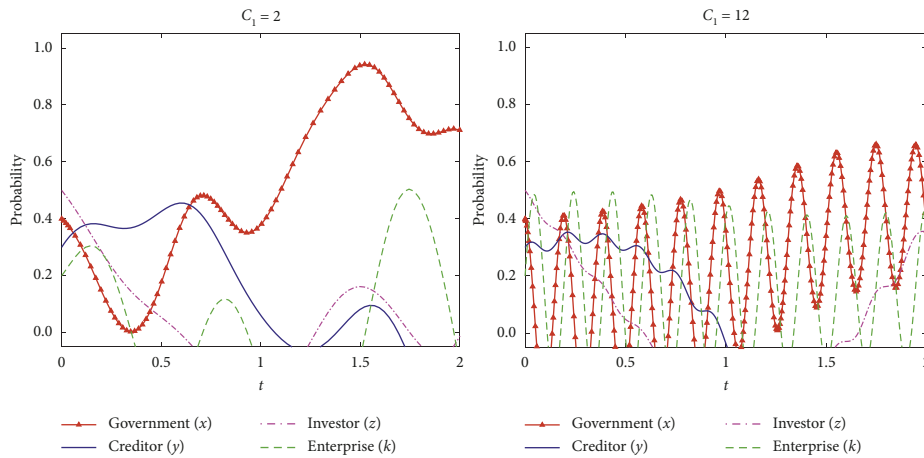

FIGURE 5: The impact of government support costs on system evolution.

shows that without particular support from the government, it cannot incentive and constraint the enterprises and it is difficult to ensure the healthy operation of the market economy. In order to avoid (0, 0, 1, 0) becoming the stable point, the government's restraint on enterprises must meet this condition: $L_1 > B_1 - C_1$; the analysis result is consistent with the above analysis [18–21].

5. Multiagent Simulation Analysis

5.1. Initial Parameter Settings in the Bankruptcy Reorganization System.
Assume that the initial value of each parameter is $C_1 = 7, B_1 = 5, C_2 = 2, W_1 = 1, F_1 = 1, C_3 = 1, C_4 = 3,$ $W_2 = 9, E_1 = 2, N_1 = 2, B_2 = 1, S_3 = 2, J_1 = 2, H_1 = 3, W_3 = 4,$ $W_5 = 2, B_3 = 6, R_1 = 3, C_5 = 4, G_4 = 5, W_6 = 3, B_4 = 6, R_2 = 3,$ $W_8 = 3, W_9 = 2, C_6 = 4, M_1 = 8, C_7 = 3, L_1 = 6, C_8 = 1, x = 0.4,$ $y = 0.2, z = 0.3,$ and $k = 0.5$. This paper uses MATLAB software to simulate the system evolution process of government

support and rewards and punishments under different initial states. According to the simulation analysis, as a result, the strategies of each agent are discussed.

5.2. The Impact of Government Support Costs on Replicating Dynamic Systems.
Set $C_1 = 2$ and $C_1 = 12$, respectively, and the strategy evolution process of all parties in bankruptcy and reorganization is shown in Figure 5.

The cost of government support will affect the government's own strategic choice, as well as the behavior evolution of the other three parties. The concrete analysis shows that the behavior of enterprises is most affected by the cost of government support. This is because the increase in government support cost leads to the government's willingness to choose the strategy of giving particular support, the lack of government support, and the lack of external incentives for enterprises, which will choose the strategy of maintaining the status quo.
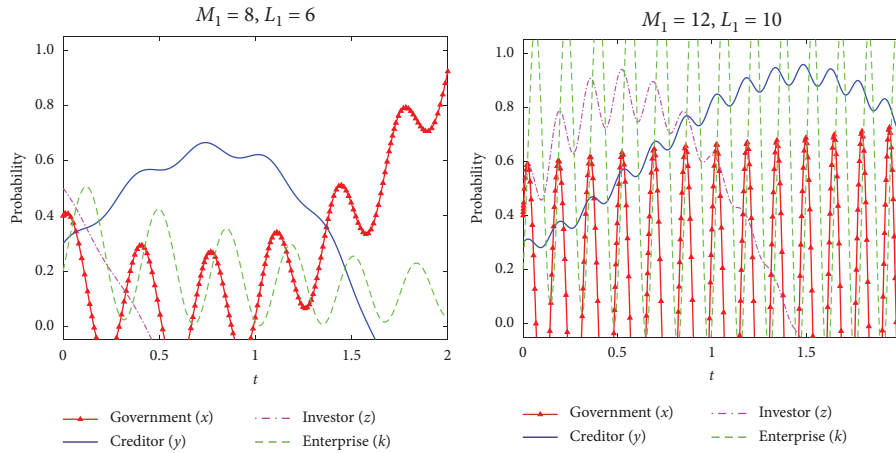
FIGURE 6: The influence of government support and binding force on system evolution.
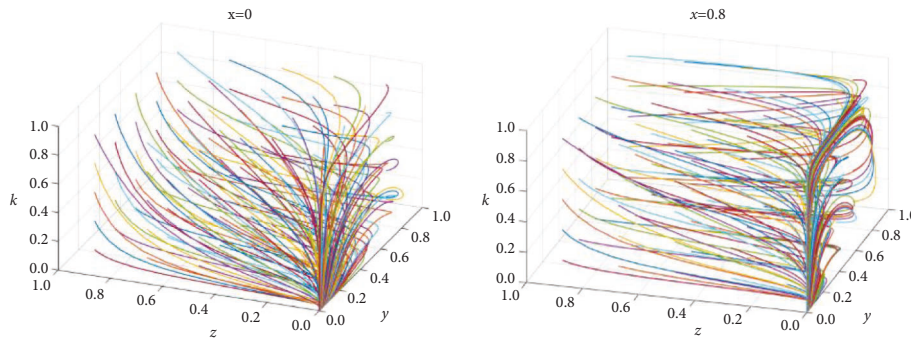

FIGURE 7: The impact of government support mechanisms on system evolution.

5.3. The Influence of the Government Support and Binding Force on the Evolution of the Bankruptcy Reorganization System. Set $M_1 = 8$, $L_1 = 6$, $M_1 = 12$, and $L_1 = 10$, respectively; the evolution process of all parties in the bankruptcy reorganization system is shown in Figure 6.

It can be seen from the figure that the government's support and binding force will affect the evolution of the system. When the government's support and binding force increase, the strategic choices of enterprises and investors will also change. At this time, the probability of creditors' choosing to give debt relief strategy to the enterprises will gradually decrease and finally stabilize at 0.

5.4. Influence of Particular Government Support Mechanism on Evolution Results. This study further discusses the impact of government support on the strategies of all parties and the evolution of the bankruptcy reorganization system. Let $x = 0$, $x = 0.8$, respectively, simulate and analyze the evolution of different initial strategies in three-dimensional space, and the result is shown in Figure 7.

From the figure, we can find that the stability point of the bankruptcy reorganization system is not unique, and the creditors' strategy choice basically tends to give companies preferential debt strategies to reduce bad debt losses; when $x = 0.8$, it is difficult to find a stable point in the system. However, through further analysis, it is found that when the

government's support reaches a certain threshold, the enterprises will always choose to work hard, and the creditors will participate in bankruptcy and reorganization in the form of debt-to-equity swaps, which is a stable strategy for the system at this time.

6. Conclusion

As the global macroeconomy continues to decline, the competition in the capital market is more intense than ever. More and more enterprises are in business difficulties due to poor management. Through bankruptcy reorganization, some enterprises that have bankruptcy reasons but still have an operational value have the opportunity to get out of financial difficulties and restore their ability to sustainable operation. Bankruptcy reorganization not only helps to realize the optimal allocation of resources but also helps to resolve financial risks and prevent some enterprises from bankruptcy liquidation, which is of great significance to all social parties. This study constructs an evolutionary game model in which four subjects participate in bankruptcy and reorganization, analyzes the strategy selection mechanism of the four parties under the government incentive mechanism, systematically analyzes the strategy selection process of each participant, and analyzes the interactive mechanism of the complex behaviors of each game player systematically studied the evolutionary stability strategies of

the game players. This study obtains the following results: (1) Under the government incentive mechanism, creditors participate in bankruptcy reorganization in the form of debt-to-equity swaps, investors participate in bankruptcy reorganization by providing high-quality assets, and enterprises participate in bankruptcy reorganization in the form of reform and transformation; this is the optimal strategy for system. (2) The strategy of the enterprises will affect the strategic choices of creditors and investors. When the enterprises choose to reform and transform, creditors will participate in bankruptcy reorganization in the form of debt-to-equity swaps, and investors will choose a strategy of providing high-quality assets to the enterprises. (3) The completion of bankruptcy reorganization is inseparable from the government's incentives. With the increase in the probability of particular support given by the government, the enterprises' strategy has changed from maintaining the status quo to reform transformation. (4) When the government does not provide particular support, there is no system stability equilibrium combination that enables enterprises to choose reform transformation. (5) When the government's support and constraint strength meet the quantitative relationship $M_1 > S_3 - C_1$ and $L_1 > B_1 - C_1$, that is, when the government subsidy level should be greater than the difference between the government's tax increase and the support cost, the enterprises will choose the strategy of restructuring and transformation, creditors will participate in bankruptcy reorganization by way of debt-to-equity swap, and investors will choose the strategy of fund injection, which is a stable strategy combination that replicated a dynamic system.

This study provides theoretical support for bankruptcy reorganization from the perspective of academic research. Based on the dynamic perspective, the in-depth analysis of the theoretical significance of the process of bankruptcy reorganization enriches the theoretical system of bankruptcy reorganization and greatly expands the relevant theory of the strategic choice of all participants in bankruptcy reorganization. This work studies bankruptcy reorganization in a brand-new way, trying to improve the bankruptcy reorganization system, optimize the existing research on bankruptcy reorganization, and enrich the relevant literature. This study provides practical guidance for improving the success rate of bankruptcy reorganization, analyzes the impact of the behavior of each reorganization party on the bankruptcy reorganization system from a dynamic perspective, helps the government set up reasonable reward and punishment measures, helps creditors set up reasonable preferential schemes, and enables all parties to formulate scientific plans to better participate in bankruptcy reorganization. The study sums up the optimal strategy choices for all parties involved in debt restructuring, guides the parties to make scientific decisions to avoid bankruptcy and liquidation of enterprises, and maximizes the enthusiasm of all parties.

It should be noted that the strategy space of each participant in the game model in this study has been simplified to a certain extent. For the time being, factors such as the differentiation of individual enterprises and the investment ability of investors have not been included in the model construction. Government subsidies and tax subsidies have only been preliminarily analyzed, and the more complex mechanisms behind them have not been carefully investigated. Further research into the role of these factors is the next step for further work.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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