Supplementary Material

Evolutionary game theory is an approach that investigates how individuals achieve equilibrium states through learning and adjusting strategies in repeated interactions. Tripartite evolutionary games represent an extended form within the theory of evolutionary games, involving dynamic interactions among three participants. The operational steps are similar to those of general evolutionary games but require consideration of a greater number of strategic combinations and more complex dynamic relationships. Next, we outline the detailed steps of this this methodology.

Step 1: Define the set of strategies available to each participant. Establish the payoff matrix based on the strategic interactions among participants, which quantifies the fitness outcomes for each combination of strategies. During this stage, the replicator dynamics equation is also defined.

Step 2: Set the initial values for each participant's strategies x, y, and z, and determine the time step size, the number of iterations, and other relevant parameters for the evolutionary process.

Step 3: Calculate the fitness of each participant based on the payoff matrix and the current distribution of strategies, i.e., the payoff associated with each strategy. Additionally, compute the average fitness of the population, which is utilized for subsequent strategy updates.

Step 4: Utilize the replicator dynamics equation to update the strategy distribution of each participant. This equation, which adjusts the proportion of strategies based on differences in fitness, is typically given by $F(x) = \frac{dx_i}{dt} = x_i(f_i - \bar{f})$, where f_i is the fitness of strategy i, and $\bar{f}$ is the average fitness of the population. The specific update formulas are as follows.

$$x(t+1) = x(t)\frac{1 + F(x(t))\Delta t}{1 + \max\left(F\big(x(t)\big), F\big(y(t)\big), F\big(z(t)\big)\right)\Delta t}$$

$$y(t+1) = y(t)\frac{1 + F(y(t))\Delta t}{1 + \max\left(F\big(x(t)\big), F\big(y(t)\big), F\big(z(t)\big)\right)\Delta t}$$

$$z(t+1) = z(t)\frac{1 + F(z(t))\Delta t}{1 + \max\left(F\big(x(t)\big), F\big(y(t)\big), F\big(z(t)\big)\right)\Delta t}$$

Here, $x(t)$, $y(t)$, and $z(t)$ represent the distributions of strategies x, y, and z at time t, respectively; $F(x(t))$, $F(y(t))$, and $F(z(t))$ are the growth rates of strategies x, y, and z at time t, respectively; and Δt is the time step size.

Step 5: Repeat Step 4, continuously calculating fitness and updating strategy distributions. Keep track of each participant's strategy distribution until they reach a set number of iterations or until the distribution changes very little, indicating stabilization.

Step 6: Plot the changes in strategy distribution over time to visually represent the evolutionary process. Additionally, conduct sensitivity analysis by varying other parameters to observe changes in the evolutionary process.

In this paper, we employ MATLAB software to conduct numerical simulations of the aforementioned steps. To reproduce the results presented in the manuscript, we conduct a parameter sensitivity analysis using H_1 as a representative example, following the steps previously described.

Step 1: The strategies available to each participant and payoff matrix are as shown in Table 3 in the manuscript, which are not repeated here for brevity.

Step 2: The data in evolutionary game models is typically generated based on the assumptions of the model or the set parameters. These data are primarily derived from theoretical reasoning and mathematical models, used to simulate and analyze the behavior and strategy evolution of different participants in the game. Evolutionary game data focuses more on simulating dynamic behaviors under different scenarios, with the setting of parameters and variables often aligned with the theoretical framework of the research question. Taking Meituan Youxuan in a residential community in Zhengzhou, Henan Province as an example, the products mainly consist of high-frequency, essential fresh produce and fast-moving consumer goods (FMCG), with fresh produce accounting for over 70% of the total orders collected by the group leader in a single day. In terms of procurement channels, CGB typically relies on two types of suppliers: one that directly sources products from farmers or origin-producing regions, and another that consists of integrated suppliers who acquire various SKUs from the market to supply the platform. In the direct supply model, farmers sell to the platform with a markup of 5%-10%, while the platform adds a 15% markup to the purchase price. In the supplier model, the markup for suppliers ranges from 10% to 20%, with the platform adding another 10%-15%. Thus, the retail price of agricultural products on the platform is 20%-35% higher than the farmer's purchase price. Through centralized procurement and a reduction in intermediaries, CGB can offer products at lower prices, typically 10%-30% cheaper than regular retail prices. Additionally, both the platform and group leaders optimize prices to ensure the maximum benefit for community members. Currently, the average transaction value for CGB is around 20 yuan, with each transaction typically including 2-3 items, with individual product prices as low as 5 yuan. Based on research on the operation of CGB platforms such as Meituan Youxuan and Didi, it is found that group leaders typically receive commissions ranging from 10% to 15% of the unit product price. According to the conditions for satisfying the equilibrium point, the analysis of real-world cases, and the assignment of references, the initial values of other related variables are as follows: $Q = 50, p = 5, w = 3, r = 0.1,\ I_1 = 30,\ I_2 = 50,\ S_1 = 15,\ S_2 = 25,\ K_1 = 30,\ K_2 = 45, C = 30,\ T_1 = 10,\ T_2 = 20,\ T_3 = 10,\ L = 20,\ M = 15,\ H_1 = 20,\ H_2 = 20$. The initial probability (x, y, z) of the model is set as $(0.3, 0.3, 0.3)$.

Step 3: The fitness for the supplier choosing and not choosing Gen-AI empowerment is represented in Equations (1) and (2) in Section 4, respectively. The fitness for the CGB platform choosing and not choosing Gen-AI empowerment is illustrated in Equations (6) and (7), respectively. The fitness for the group leader choosing active service and passive service is represented in Equations (11) and (12), respectively. The average profit for the supplier, the CGB platform and group leader is provided in Equations (3), (8) and (13), respectively.

Step 4: The replicator dynamics equations for each participant are as follows.

$$\begin{cases} F(x) = \dfrac{dx}{dt} = - x(x-1)(H_1 - S_1 - I_1 + K_1 + yzT_1) \\ F(y) = \dfrac{dy}{dt} = - y(y-1)(H_2 - I_2 + K_2 - S_2 + xzT_2) \\ F(z) = \dfrac{dz}{dt} = - z(z-1)(L - C + M + xyT_3) \end{cases}$$

Set the time step t from 0 to 10, and use the specific update formulas to calculate the distributions of strategies x, y, and z at time t.

Step 5: Repeat Step 4, continuously calculating fitness and updating strategy distributions, with results shown in the column for $H_1 = 20$ in Table 1.

Step 6: Plot the changes in strategy distribution over time to visually represent the evolutionary process, as shown in Fig.1(d). Fig.1(d) indicates that the time steps from $t = 0$ to $t = 1$ are critical for significant changes in strategy distribution. Subsequently, the strategy distribution stabilizes, suggesting that the system may have reached an equilibrium state.

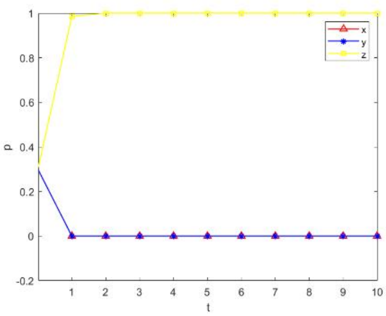
Furthermore, we examine the strategy choices for members with H_1 values of 5, 10, and 15, repeating the previously described process for each case. The results are shown in Table 1 and Figures 1(a), 1(b), and 1(c). Fig.1(e) presents the visual representation of the strategy distributions for H_1 values of 5, 10, 15, and 20 using MATLAB's plotting functionality.

Table 1: Values of (x, y, z) as H_1 Varies.

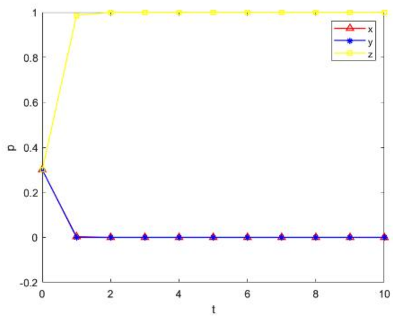
t	(x, y, z)			
	$H_1 = 5$	$H_1 = 10$	$H_1 = 15$	$H_1 = 20$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(2.724e-05, 2.724e-05, 0.985463)	(4.63712e-05, 4.63712e-05, 0.985839)	(0.363866, 0.00453573, 0.987036)	(0.999248, 0.942344, 0.999248)
2	(-1.95325e-07, -1.95325e-07, 0.999991)	(3.43341e-09, 3.43341e-09, 0.999903)	(0.36746, 0.000309219, 0.999908)	(0.999979, 0.999935, 0.999979)
3	(2.59018e-08, 2.59018e-08, 0.999999)	(4.35512e-09, 4.35512e-09,	(0.367712, 2.19702e-05,	(1.00012, 1, 1.00012)

		0.999999)	0.999999)	
4	(2.37367e-07, 2.37367e-07, 1)	(1.02448e-07, 1.02448e-07, 1)	(0.36773, 1.53818e-06, 1)	(0.999843, 1, 0.999843)
5	(-7.01307e-07, -7.01307e-07, 1)	(7.24848e-07, 7.24848e-07, 1)	(0.367731, 1.79334e-07, 0.999999)	(1.001, 1, 1.001)
6	(-1.79387e-07, -1.7937e-07, 1)	(-7.04319e-09, -7.04319e-09, 1)	(0.367731, 5.37269e-08, 0.999992)	(0.999749, 1, 0.999749)
7	(-5.41783e-08, -5.41783e-08, 1)	(2.73335e-07, 2.73335e-07, 1)	(0.367732, 1.60252e-08, 0.999884)	(0.999517, 1, 0.999517)
8	(-4.26736e-07, -4.26736e-07, 1)	(6.70298e-07, 6.70298e-07, 1)	(0.367732, 1.38595e-09, 1.00058)	(0.999755, 1, 0.999755)
9	(-1.09201e-07, -1.09201e-07, 1)	(5.6242e-08, 5.6242e-08, 1)	(0.367732, 1.15445e-11, 1.00017)	(0.999985, 1, 0.999985)
10	(5.36774e-07, 5.36774e-07, 1)	(4.5109e-07, 4.5109e-07, 1)	(0.367732, 1.15445e-11, 0.999883)	(0.999964, 1, 0.999964)

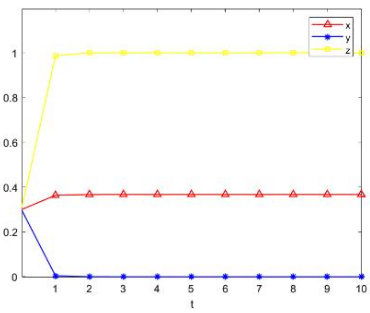
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



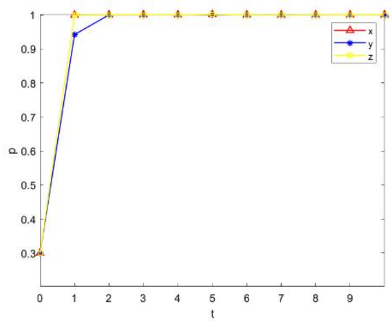
(a): Parameter values used: $H_1 = 5$.

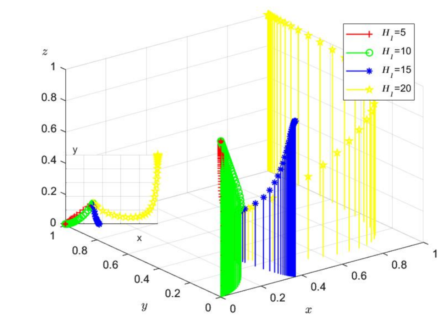


(b): Parameter values used: $H_1 = 10$.



(c): Parameter values used: $H_1 = 15$.





(d): Parameter values used: $H_1 = 20$.

(e) Changes of H_1 based on the evolution of the tripartite game system.

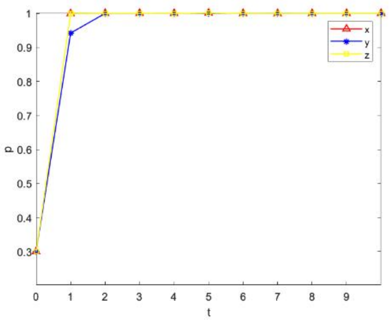
Fig.1: Effect of H_1 changes on the evolution of the tripartite game system.

The other strategies I_1, I_2, C, K_1, K, T_1, T_2, T_3, H_2, S_1, S_2, L, and M can be derived in similar manner. To ensure clarity and precision, the data are systematically detailed in the subsequent sections.

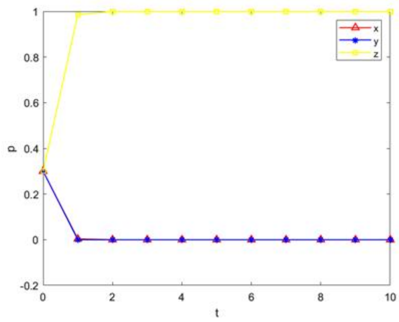
Table 2: Values of (x, y, z) as I_1 Varies.

t	(x, y, z)			
	$I_1 = 30$	$I_1 = 40$	$I_1 = 50$	$I_1 = 60$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.999248, 0.942344, 0.999248)	(0.00350972, 2.37719e-05, 0.985839)	(1.548979e-07, 2.36323e-05, 0.985256)	(2.13235e-10, 2.16919e-05, 0.98503)
2	(0.999979, 0.999935, 0.999979)	(2.37719e-05, 3.43341e-09, 0.999903)	(6.3719e-08, 8.58287e-08, 0.999893)	(-1.86044e-07, 2.24125e-09, 0.999897)
3	(1.00012, 1, 1.00012)	(1.98482e-07, 4.35512e-09, 0.999999)	(-3.86615e-08, 1.04221e-10, 0.999999)	(-1.02654e-06, 1.15751e-13, 0.999999)
4	(0.999843, 1, 0.999843)	(1.41396e-08, 1.02448e-07, 1)	(2.57615e-07, 7.3405e-14, 1)	(8.91094e-08, 6.06353e-18, 1)
5	(1.001, 1, 1.001)	(1.29386e-10, 7.24848e-07, 1)	(-7.32427e-07, 3.65885e-17, 1)	(-5.50584e-0, 3.06989e-22, 1)
6	(0.999749, 1, 0.999749)	(1.05723e-12, -7.04319e-09, 1)	(3.60141e-07, 3.30923e-20, 1)	(-4.70653e-08, 1.55971e-26, 1)
7	(0.999517, 1, 0.999517)	(1.0562e-14, 2.73335e-07, 1)	(-1.36889e-07, 7.04516e-24, 1)	(2.59894e-07, 7.8574e-31, 1)
8	(0.999755, 1, 0.999755)	(9.80701e-17, 6.70298e-07, 1)	(1.02589e-07, 1.43351e-26, 1)	(4.36102e-07, 4.15255e-35, 1)
9	(0.999985, 1, 0.999985)	(7.94956e-19, 5.6242e-08, 1)	(-5.14371e-08, 1.64995e-29, 1)	(9.01826e-08, 2.08257e-39, 1)
10	(0.999964, 1, 0.999964)	(7.3437e-21, 4.5109e-07, 1)	(4.01079e-07, 1.3942e-32, 1)	(7.27235e-08, 1.0913e-43, 1)

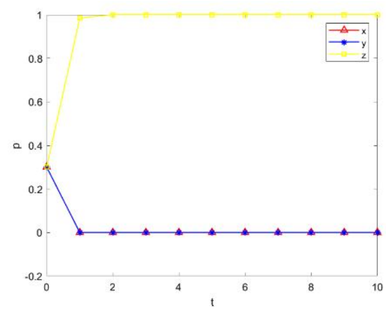
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



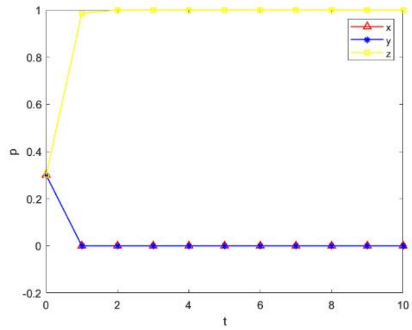
(a): Parameter values used: $I_1 = 30$.



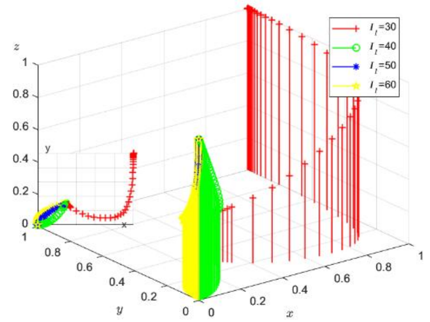
(b): Parameter values used: $I_1 = 40$.



(c): Parameter values used: $I_1 = 50$.



(d): Parameter values used: $I_1 = 60$.



(e) Changes of I_1 based on the evolution of the tripartite game system.

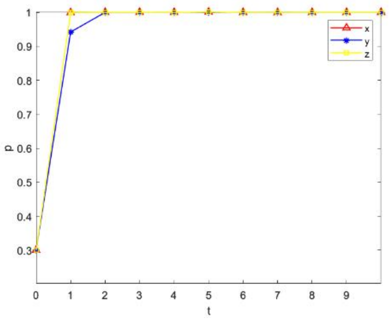
Fig.2: Effect of I_1 changes on the evolution of the tripartite game system.

Table 3: Values of (x, y, z) as I_2 Varies.

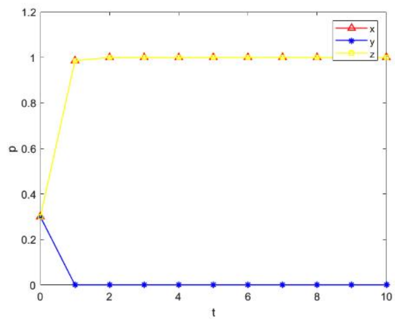
t	(x, y, z)			
	$I_2 = 50$	$I_2 = 60$	$I_2 = 70$	$I_2 = 80$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.999248, 0.942344, 0.999248)	(0.985753, 0.000314565, 0.985753)	(0.9985299, 6.42667e-09, 0.985299)	(0.985, -1.66662e-07, 0.985)
2	(0.999979, 0.999935, 0.999979)	(0.99989, 0.000281133, 0.99989)	(0.999836, 2.2304e-07, 0.999836)	(0.999897, -1.17665e-08, 0.999897)
3	(1.00012, 1, 1.00012)	(0.999967, 0.000280966, 0.999967)	(0.999999, 3.93948e-07, 0.999999)	(0.999999, 3.03694e-08, 0.999999)
4	(0.999843, 1, 0.999843)	(0.99974, 0.000281467, 0.99974)	(1, 2.2182e-07, 1)	(1, -3.73307e-07, 1)
5	(1.001, 1, 1.001)	(0.999983, 0.00028095,	(1, 5.03943e-07, 1)	(1, -7.99523e-07, 1)

		0.999983)		
6	(0.999749, 1, 0.999749)	(1.00011, 0.000280687, 1.00011)	(1, 6.30323e-08, 1)	(1, -3.94536e-08, 1)
7	(0.999517, 1, 0.999517)	(1.00044, 0.000280015, 1.00044)	(1, 5.69427e-07, 1)	(1, 9.48457e-08, 1)
8	(0.999755, 1, 0.999755)	(0.999824, 0.000281437, 0.999824)	(1, -6.06526e-08, 1)	(1, 1.1715e-07, 1)
9	(0.999985, 1, 0.999985)	(0.999963, 0.000281141, 0.999963)	(1, 4.65812e-07, 1)	(1, 1.3636e-08, 1)
10	(0.999964, 1, 0.999964)	(0.999925, 0.000281228, 0.999925)	(1, 1.13096e-07, 1)	(1, 9.38665e-08, 1)

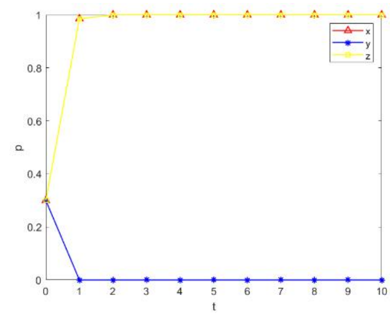
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



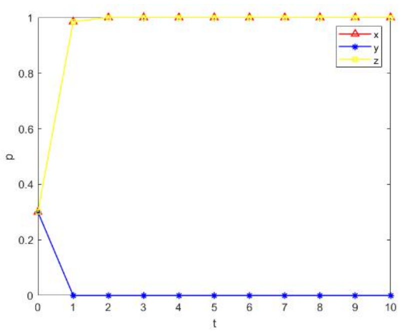
(a): Parameter values used: $I_2 = 50$.



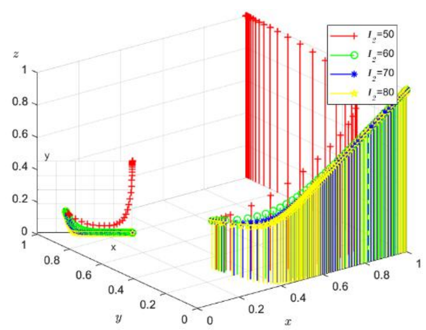
(b): Parameter values used: $I_2 = 60$.



(c): Parameter values used: $I_2 = 70$.



(d): Parameter values used: $I_2 = 80$.



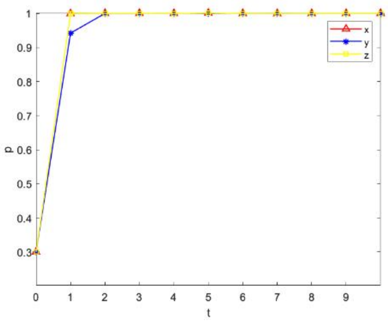
(e) Changes of I_2 based on the evolution of the tripartite game system.

Fig.3: Effect of I_2 changes on the evolution of the tripartite game system.

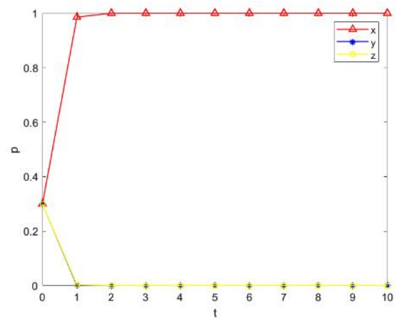
Table 4: Values of (x, y, z) as C Varies.

t	(x, y, z)			
	$C = 30$	$C = 40$	$C = 50$	$C = 60$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.999248, 0.942344, 0.999248)	(0.985839, 4.63712e-05, 0.00350972)	(0.985256, 2.36343e-05, 1.54897e-07)	(0.98503, 2.16919e-05, 2.13235e-10)
2	(0.999979, 0.999935, 0.999979)	(0.999903, 3.45341e-09, 2.37719e-05)	(0.999893, 8.58287e-08, 6.6319e-08)	(0.999897, 2.24125e-09, -1.86044e-07)
3	(1.00012, 1, 1.00012)	(0.999999, 4.35512e-09, 1.98482e-07)	(0.999999, 1.04221e-10, -3.86615e-08)	(0.999999, 1.15751e-13, -1.02654e-06)
4	(0.999843, 1, 0.999843)	(1, 1.02448e-07, 1.41396e-08)	(1, 7.3405e-14, 2.57615e-07)	(1, 6.06353e-18, 8.91094e-08)
5	(1.001, 1, 1.001)	(1, 7.24848e-07, 1.29386e-10)	(1, 3.65885e-17, -7.32427e-07)	(1, 3.069353e-22, -5.50584e-07)
6	(0.999749, 1, 0.999749)	(1, -7.04319e-09, 1.05723e-12)	(1, 3.30923e-20, 3.60141e-07)	(1, 1.55971e-26, -4.70653e-08)
7	(0.999517, 1, 0.999517)	(1, 2.73335e-07, 1.0562e-14)	(1, 7.04516e-24, -1.36889e-07)	(1, 7.8574e-31, 2.59894e-07)
8	(0.999755, 1, 0.999755)	(1, 6.70298e-07, 9.80701e-17)	(1, 1.43351e-26, 1.02589e-07)	(1, 4.15255e-35, 4.36102e-07)
9	(0.999985, 1, 0.999985)	(1, 5.6242e-08, 7.94956e-19)	(1, 1.64995e-29, -5.14371e-08)	(1, 2.08257e-39, 9.01826e-08)
10	(0.999964, 1, 0.999964)	(1, 4.5109e-07, 7.3437e-21)	(1, 1.3941e-32, 4.01079e-07)	(1, 1.0913e-43, 7.27235e-08)

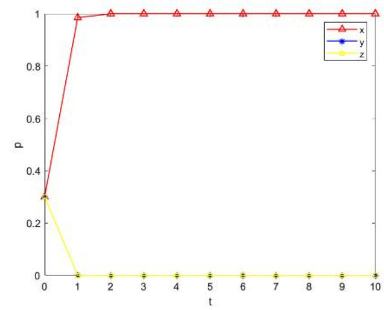
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



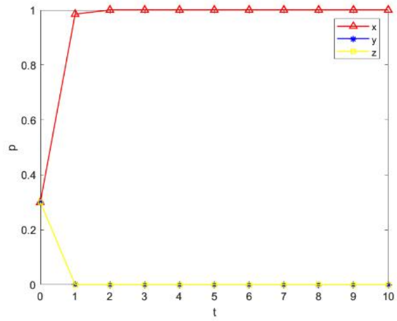
(a): Parameter values used: $C = 30$.



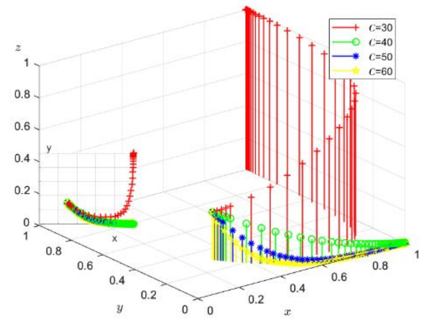
(b): Parameter values used: $C = 40$.



(c): Parameter values used: $C = 50$.



(d): Parameter values used: $C = 60$.



(e) Changes of C based on the evolution of the tripartite game system.

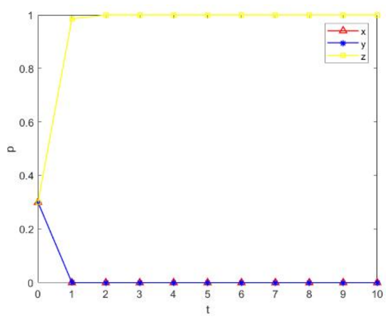
Fig.4: Effect of C changes on the evolution of the tripartite game system.

Table 5: Values of (x, y, z) as K_1 Varies.

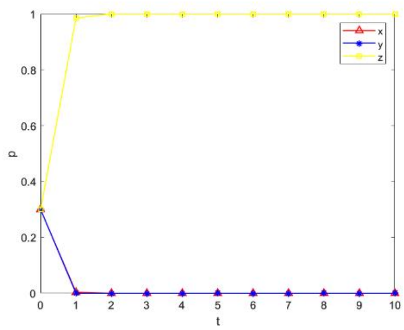
t	(x, y, z)			
	$K_1 = 10$	$K_1 = 20$	$K_1 = 30$	$K_1 = 40$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(1.54897e-07, 2.36343e-05, 0.985256)	(0.00350972, 4.63712e-05, 0.985839)	(0.999248, 0.942344, 0.999248)	(1.00006, 0.993105, 0.999925)
2	(6.3719e-08, 8.58287e-08, 0.999893)	(2.37719e-05, 3.45341e-09, 0.999903)	(0.999979, 0.999935, 0.999979)	(1.00002, 1, 1)
3	(-3.86615e-08, 1.04221e-10, 0.999999)	(1.98482e-07, 4.35512e-09, 0.999999)	(1.00012, 1, 1.00012)	(1, 1, 1)
4	(2.57615e-07, 7.3405e-14, 1)	(1.41396e-08, 1.02448e-07, 1)	(0.999843, 1, 0.999843)	(0.999777, 1, 1)
5	(-7.32427e-07, 3.65885e-17, 1)	(1.29386e-10, 7.24848e-07, 1)	(1.001, 1, 1.001)	(1.00007, 1, 1)
6	(3.60141e-07,	(1.05723e-12,	(0.999749, 1,	(0.999131, 1, 1)

	3.30923e-20, 1)	-7.04319e-09, 1)	0.999749)	
7	(-1.36889e-07, 7.04516e-24, 1)	(1.0562e-14, 2.73335e-07, 1)	(0.999517, 1, 0.999517)	(1.00062, 1, 1)
8	(1.02589e-07, 1.43351e-26, 1)	(9.80701e-17, 6.70298e-07, 1)	(0.999755, 1, 0.999755)	(1.00035, 1, 1)
9	(-5.14371e-08, 1.64995e-29, 1)	(7.94956e-19, 5.6242e-08, 1)	(0.999985, 1, 0.999985)	(0.999935, 1, 1)
10	(4.01079e-07, 1.3941e-32, 1)	(7.3437e-21, 4.5109e-07, 1)	(0.999964, 1, 0.999964)	(0.999972, 1, 1)

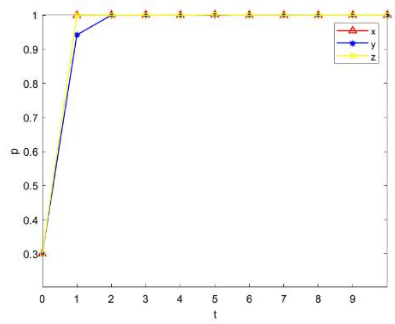
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



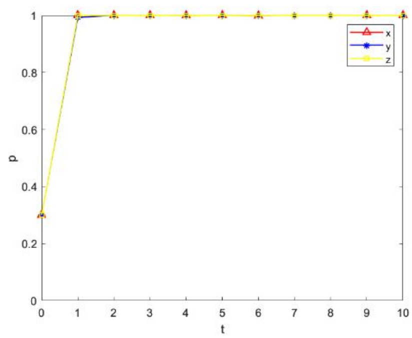
(a): Parameter values used: $K_1 = 10$.



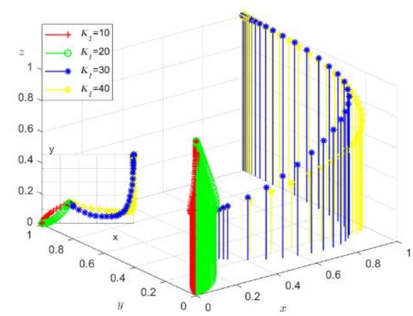
(b): Parameter values used: $K_1 = 20$.



(c): Parameter values used: $K_1 = 30$.



(d): Parameter values used: $K_1 = 40$.



(e) Changes of K_1 based on the evolution of the tripartite game system.

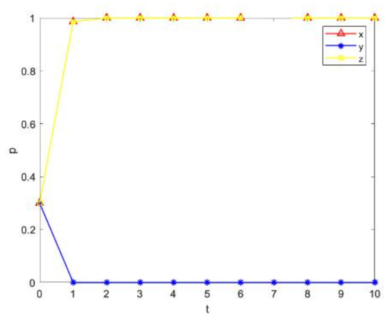
Fig.5: Effect of K_1 changes on the evolution of the tripartite game system.

Table 6: Values of (x, y, z) as K_2 Varies.

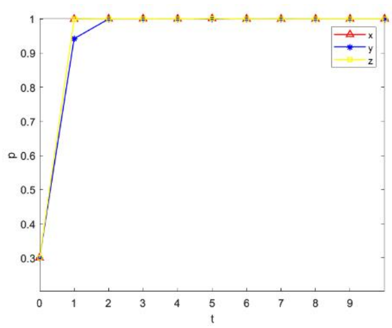
t	(x, y, z)			
	$K_2 = 35$	$K_2 = 45$	$K_2 = 55$	$K_2 = 65$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.985753, 0.000314565,	(0.999248, 0.942344, 0.999248)	(1.00002, 1.00014, 1.00002)	(0.999995, 1.00035, 0.999995)

	0.985753)			
2	(0.99989, 0.000281133, 0.99989)	(0.999979, 0.999935, 0.999979)	(1, 1.00019, 1)	(1, 1.00016, 1)
3	(0.999967, 0.000280966, 0.999967)	(1.00012, 1, 1.00012)	(1, 1.00012, 1)	(1, 1.00064, 1)
4	(0.99974, 0.000281467, 0.99974)	(0.999843, 1, 0.999843)	(1, 1.00006, 1)	(1, 0.999999, 1)
5	(0.999983, 0.00028095, 0.999983)	(1.001, 1, 1.001)	(1, 1.00003, 1)	(1, 0.999876, 1)
6	(1.00011, 0.000280015, 1.00011)	(0.999749, 1, 0.999749)	(1, 1.00005, 1)	(1, 0.999829, 1)
7	(1.00044, 7.04516e-24, 1.00044)	(0.999517, 1, 0.999517)	(1, 1.00004, 1)	(1, 0.999904, 1)
8	(0.999824, 0.000281437, 0.999824)	(0.999755, 1, 0.999755)	(1, 0.999842, 1)	(1, 0.99983, 1)
9	(0.999963, 0.000281141, 0.999963)	(0.999985, 1, 0.999985)	(1, 0.999604, 1)	(1, 0.999462, 1)
10	(0.999925, 0.000281228, 0.999925)	(0.999964, 1, 0.999964)	(1, 0.999706, 1)	(1, 0.999766, 1)

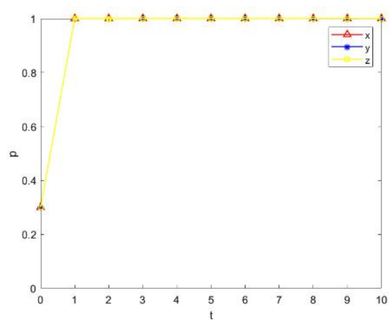
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



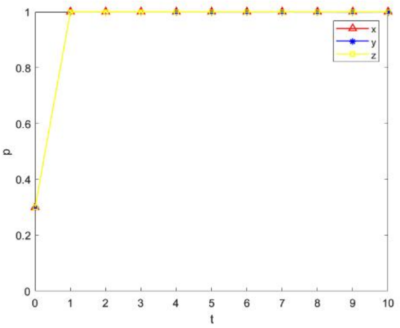
(a): Parameter values used: $K_2 = 35$.



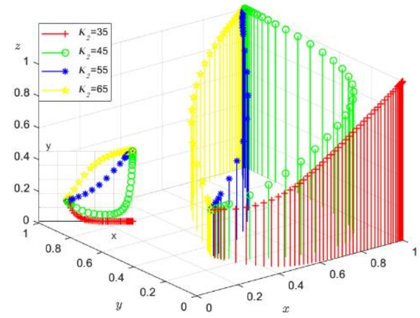
(b): Parameter values used: $K_2 = 45$.



(c): Parameter values used: $K_2 = 55$.



(d): Parameter values used: $K_2 = 65$.



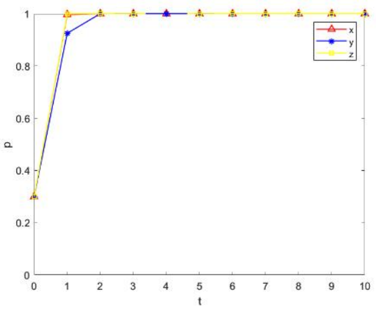
(e) Changes of K_2 based on the evolution of the tripartite game system.

Fig.6: Effect of K_2 changes on the evolution of the tripartite game system.

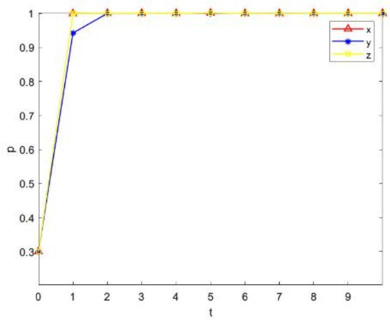
Table 7: Values of (x, y, z) as T_1 Varies.

t	(x, y, z)			
	$T_1 = 5$	$T_1 = 10$	$T_1 = 15$	$T_1 = 20$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.996511, 0.925109, 0.999233)	(0.999248, 0.942344, 0.999248)	(0.999946, 0.954168, 0.999514)	(0.999864, 0.962271, 0.999564)
2	(1, 1.00002, 1.00001)	(0.999979, 0.999935, 0.999979)	(1.00073, 0.999996, 1)	(1.00069, 0.999998, 1)
3	(1, 1, 0.999708)	(1.00012, 1, 1.00012)	(1.00046, 1, 1)	(0.999591, 1.00064, 1)
4	(1, 1, 1.0008)	(0.999843, 1, 0.999843)	(1.00012, 1, 1)	(1.00073, 1, 1)
5	(1, 1, 0.99972)	(1.001, 1, 1.001)	(0.999947, 1, 1)	(1.00008, 1, 1)
6	(1, 1, 1.00007)	(0.999749, 1, 0.999749)	(0.999947, 1, 1)	(1.00002, 1, 1)
7	(1, 1, 0.999945)	(0.999517, 1, 0.999517)	(1.00012, 1, 1)	(1.00009, 1, 1)
8	(1, 1, 1.00003)	(0.999755, 1, 0.999755)	(0.99989, 1, 1)	(0.999957, 1, 1)
9	(1, 1, 0.999882)	(0.999985, 1, 0.999985)	(0.999847, 1, 1)	(0.999873, 1, 1)
10	(1, 1, 0.999949)	(0.999964, 1, 0.999964)	(0.999883, 1, 1)	(0.999836, 1, 1)

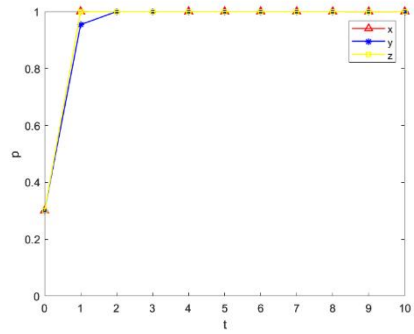
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



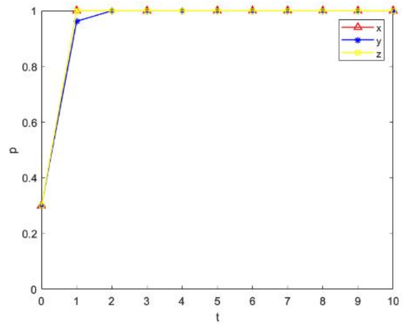
(a): Parameter values used: $T_1 = 5$.



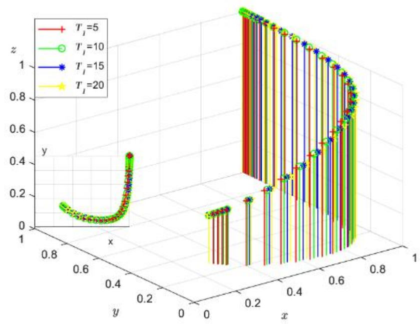
(b): Parameter values used: $T_1 = 10$.



(c): Parameter values used: $T_1 = 15$.



(d): Parameter values used: $T_1 = 20$.



(e) Changes of T_1 based on the evolution of the tripartite game system.

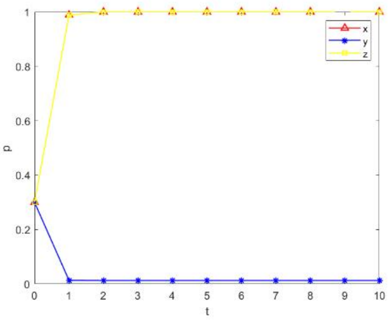
Fig.7: Effect of T_1 changes on the evolution of the tripartite game system.

Table 8: Values of (x, y, z) as T_2 Varies.

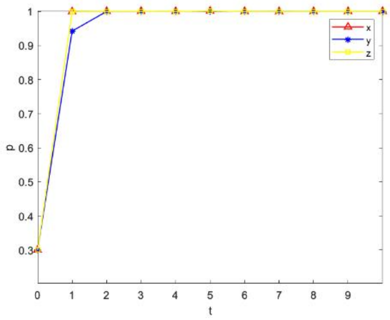
t	(x, y, z)			
	$T_2 = 10$	$T_2 = 20$	$T_2 = 30$	$T_2 = 40$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.988457, 0.0135119, 0.988457)	(0.999248, 0.942344, 0.999248)	(0.999948, 0.999964, 0.999948)	(0.999968, 0.99975, 0.999968)
2	(0.999932, 0.0129303, 0.999932)	(0.999979, 0.999935, 0.999979)	(1, 1.00071, 1)	(1, 1, 1)
3	(1.00005, 0.0129246, 1.00005)	(1.00012, 1, 1.00012)	(1, 0.999957, 1)	(1, 1.00017, 1)
4	(0.999987, 0.0129277, 0.999987)	(0.999843, 1, 0.999843)	(1, 1.00063, 1)	(1, 1.00078, 1)
5	(1, 0.012927, 1)	(1.001, 1, 1.001)	(1, 0.999946, 1)	(1, 0.999819, 1)
6	(0.999979, 0.0129281, 0.999979)	(0.999749, 1, 0.999749)	(1, 1.00053, 1)	(1, 1.00002, 1)
7	(1.00001, 0.0129264, 1.00001)	(0.999517, 1, 0.999517)	(1, 0.999932, 1)	(1, 1.00012, 1)
8	(0.999999, 0.0129271,	(0.999755, 1,	(1, 1.00043, 1)	(1, 1.00084, 1)

	0.999999)	0.999755)		
9	(1.00017, 0.012919, 1.00017)	(0.999985, 1, 0.999985)	(1, 0.999919, 1)	(1, 1, 1)
10	(0.999868, 0.0129338, 0.999868)	(0.999964, 1, 0.999964)	(1, 0.999947, 1)	(1, 0.999948, 1)

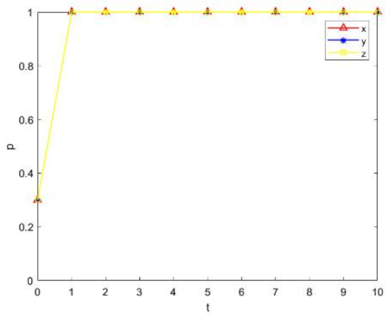
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



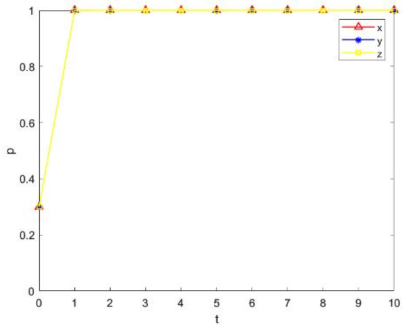
(a): Parameter values used: $T_2 = 10$.



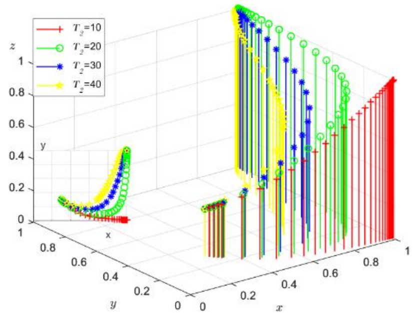
(b): Parameter values used: $T_2 = 20$.



(c): Parameter values used: $T_2 = 30$.



(d): Parameter values used: $T_2 = 40$.



(e) Changes of T_2 based on the evolution of the tripartite game system.

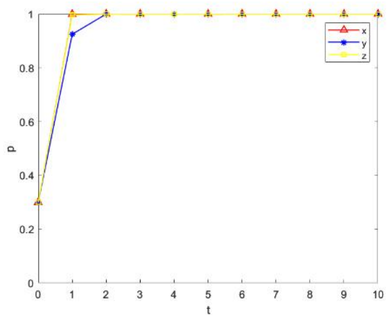
Fig.8: Effect of T_2 changes on the evolution of the tripartite game system.

Table 9: Values of (x, y, z) as T_3 Varies.

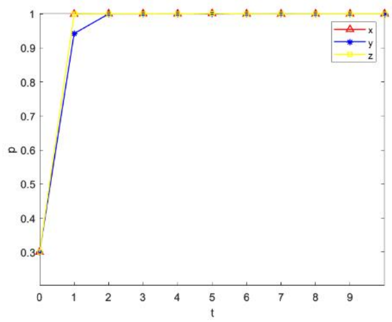
t	(x, y, z)			
	$T_3 = 5$	$T_3 = 10$	$T_3 = 15$	$T_3 = 20$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.999233, 0.925109, 0.996511)	(0.999248, 0.942344, 0.999248)	(0.999514, 0.954168, 0.999946)	(0.999564, 0.962271, 0.999864)
2	(1.00001, 1.00002, 1)	(0.999979, 0.999935, 0.999979)	(1, 0.999996, 1.00073)	(1, 0.999998, 1.00069)
3	(0.999708, 1, 1)	(1.00012, 1, 1.00012)	(1, 1, 1.00046)	(1, 1, 0.999591)

4	(1.0008, 1, 1)	(0.999843, 1, 0.999843)	(1, 1, 1.00012)	(1, 1, 1.00073)
5	(0.99972, 1, 1)	(1.001, 1, 1.001)	(1, 1, 0.999947)	(1, 1, 1.00008)
6	(1.00007, 1, 1)	(0.999749, 1, 0.999749)	(1, 1, 0.999947)	(1, 1, 1.00002)
7	(0.999945, 1, 1)	(0.999517, 1, 0.999517)	(1, 1, 1.00012)	(1, 1, 1.00009)
8	(1.00003, 1, 1)	(0.999755, 1, 0.999755)	(1, 1, 0.99989)	(1, 1, 0.999957)
9	(0.999882, 1, 1)	(0.999985, 1, 0.999985)	(1, 1, 0.999847)	(1, 1, 0.999873)
10	(0.999949, 1, 1)	(0.999964, 1, 0.999964)	(1, 1, 0.999883)	(1, 1, 0.999836)

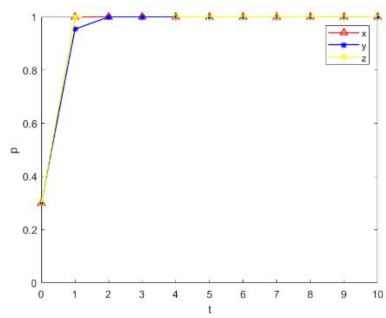
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



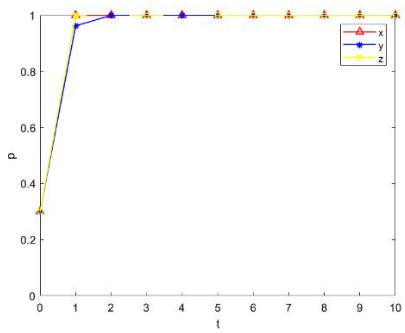
(a): Parameter values used: $T_3 = 5$.



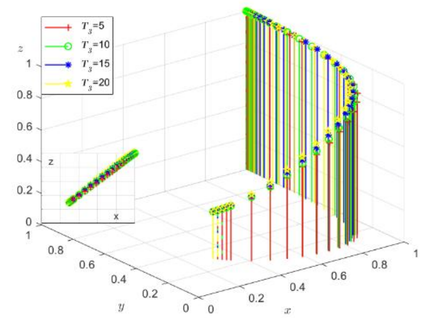
(b): Parameter values used: $T_3 = 10$.



(c): Parameter values used: $T_3 = 15$.



(d): Parameter values used: $T_3 = 20$.



(e) Changes of T_3 based on the evolution of the tripartite game system.

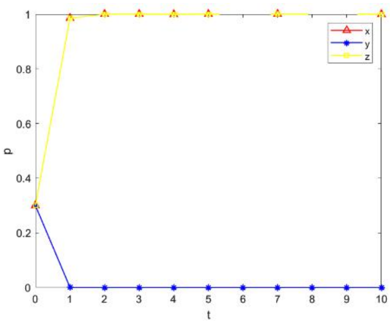
Fig.9: Effect of T_3 changes on the evolution of the tripartite game system.

Table 10: Values of (x, y, z) as H_2 Varies.

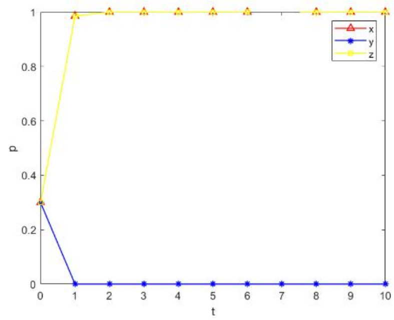
t	(x, y, z)

	$H_2 = 5$	$H_2 = 10$	$H_2 = 15$	$H_2 = 20$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.985513, 1.95737e-06, 0.985513)	(0.985753, 0.000314565, 0.985753)	(0.988089, 0.0539861, 0.988089)	(0.999248, 0.942344, 0.999248)
2	(0.999908, 1.51358e-08, 0.999908)	(0.99989, 0.000281133, 0.99989)	(0.999732, 0.887058, 0.999732)	(0.999979, 0.999935, 0.999979)
3	(0.999932, 1.03024e-08, 0.999932)	(0.999967, 0.000280966, 0.999967)	(0.999929, 0.999134, 0.999929)	(1.00012, 1, 1.00012)
4	(0.99895, 1.13427e-07, 0.99895)	(0.99974, 0.000281467, 0.99974)	(0.999954, 0.999994, 0.999954)	(0.999843, 1, 0.999843)
5	(0.999934, 7,34369e-09, 0.999934)	(0.999983, 0.00028095, 0.999983)	(0.999929, 1, 0.999929)	(1.001, 1, 1.001)
6	(1.00051, -3.83232e-08, 1.00051)	(1.00011, 0.000280687, 1.00011)	(1.00013, 1, 1.00013)	(0.999749, 1, 0.999749)
7	(1.00002, 2.11895e-09, 1.00002)	(1.00044, 0.000280015, 1.00044)	(0.999867, 1, 0.999867)	(0.999517, 1, 0.999517)
8	(1.00013, -9.20283e-09, 1.00013)	(0.999824, 0.000281437, 0.999824)	(1.00095, 1, 1.00095)	(0.999755, 1, 0.999755)
9	(1.00051, -2.76798e-08, 1.00051)	(0.999963, 0.000281141, 0.999963)	(1.00014, 1, 1.00014)	(0.999985, 1, 0.999985)
10	(0.999203, 3.06176e-08, 0.999203)	(0.999925, 0.000281228, 0.999925)	(0.999899, 1, 0.999899)	(0.999964, 1, 0.999964)

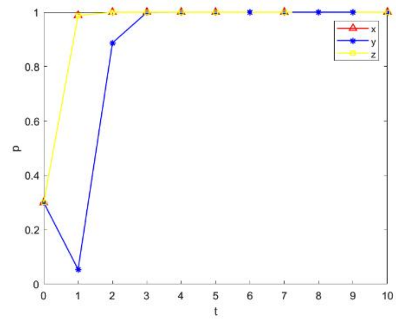
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



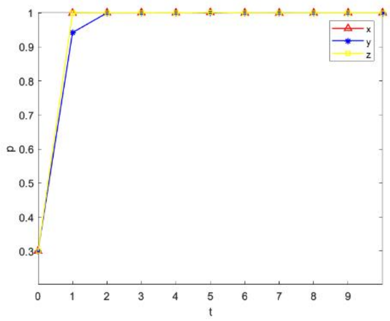
(a): Parameter values used: $H_2 = 5$.



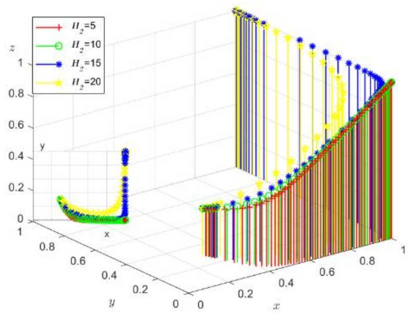
(b): Parameter values used: $H_2 = 10$.



(c): Parameter values used: $H_2 = 15$.



(d): Parameter values used: $H_2 = 20$.



(e) Changes of H_2 based on the evolution of the tripartite game system.

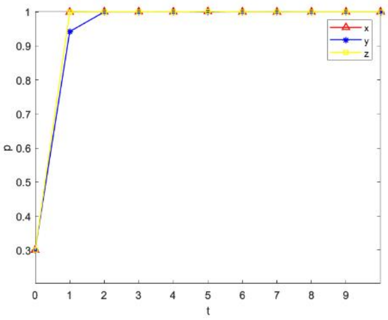
Fig.10: Effect of H_2 changes on the evolution of the tripartite game system.

Table 11: Values of (x, y, z) as S_1 Varies.

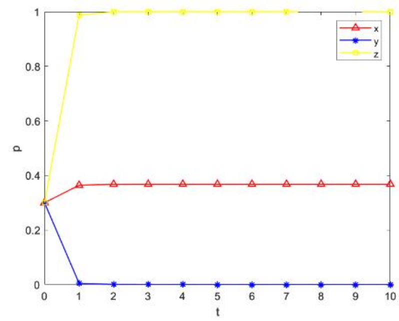
t	(x, y, z)			
	$S_1 = 15$	$S_1 = 20$	$S_1 = 30$	$S_1 = 40$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.999248, 0.942344, 0.999248)	(0.363866, 0.00453573, 0.987036)	(2.33336e-05, 2.724e-05, 0.985463)	(1.03428e-09, 2.22787e-05, 0.985123)
2	(0.999979, 0.999935, 0.999979)	(0.36746, 0.000309219, 0.999908)	(-1.67311e-07, -1.95325e-07, 0.99991)	(3.22443e-08, 2.80107e-08, 0.999985)
3	(1.00012, 1, 1.00012)	(0.367712, 2.19702e-05, 0.999967)	(2.21866e-08, 2.59018e-08, 0.999999)	(-2.0076e-07, 2.00278e-12, 1.00012)
4	(0.999843, 1, 0.999843)	(0.36773, 1.53818e-06, 1)	(2.03313e-07, 2.37367e-07, 1)	(-7.65576e-08, 1.31895e-16, 0.999999)
5	(1.001, 1, 1.001)	(0.367731, 1.79334e-07,	(-6.00663e-07, -7.01307e-07, 1)	(7.55578e-08, 8.6636e-21, 1)

		0.999999)		
6	(0.999749, 1, 0.999749)	(0.367731, 5.37269e-08, 0.999992)	(-1.53641e-07, -1.79387e-07, 1)	(1.94541e-07, 5.66959e-25, 1)
7	(0.999517, 1, 0.999517)	(0.367732, 1.60252e-08, 0.999884)	(-4.63999e-08, -5.41783e-08, 1)	(2.44802e-07, 3.70683e-29, 1)
8	(0.999755, 1, 0.999755)	(0.367732, 1.38595e-09, 1.00058)	(-3.65435e-07, -4.26736e-07, 1)	(2.51341e-07, 2.43415e-33, 1)
9	(0.999985, 1, 0.999985)	(0.367732, 1.36757e-10, 1.00017)	(-9.35147e-08, -1.09201e-07, 1)	(2.7351e-07, 1.62117e-37, 1)
10	(0.999964, 1, 0.999964)	(0.367732, 1.15445e-11, 0.999883)	(4.59648e-07, 5.36774e-07, 1)	(3.09581e-07, 1.09322e-41, 1)

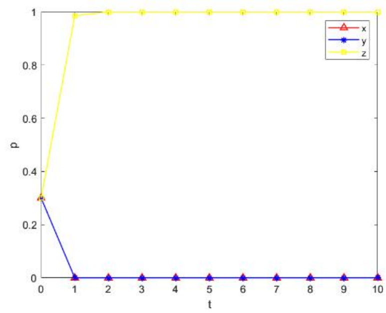
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



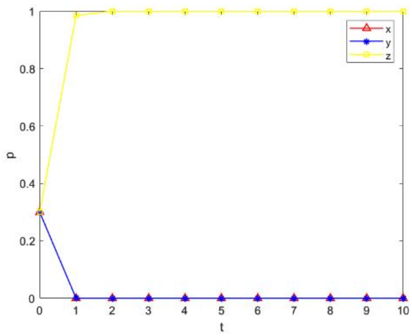
(a): Parameter values used: $S_1 = 15$.



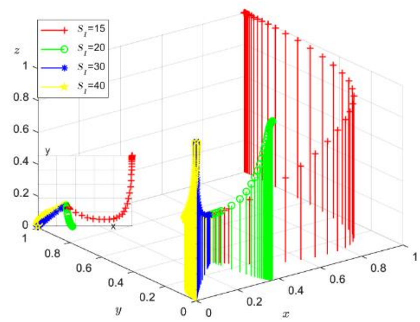
(b): Parameter values used: $S_1 = 20$.



(c): Parameter values used: $S_1 = 30$.



(d): Parameter values used: $S_1 = 40$.



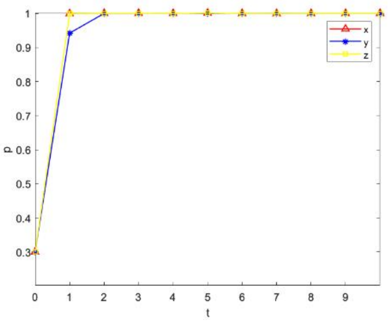
(e) Changes of S_1 based on the evolution of the tripartite game system.

Fig.11: Effect of S_1 changes on the evolution of the tripartite game system.

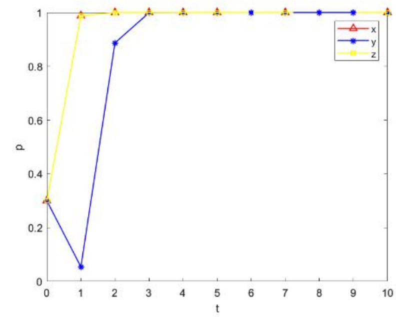
Table 12: Values of (x, y, z) as S_2 Varies.

t	(x, y, z)			
	$S_2 = 25$	$S_2 = 30$	$S_2 = 35$	$S_2 = 40$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.999248, 0.942344, 0.999248)	(0.988089, 0.0539861, 0.988089)	(0.985753, 0.000314565, 0.985753)	(0.985513, 1.95737e-06, 0.999248)
2	(0.999979, 0.999935, 0.999979)	(0.999732, 0.887058, 0.999732)	(0.99989, 0.000281133, 0.99989)	(0.999908, 1.51358e-08, 0.999979)
3	(1.00012, 1, 1.00012)	(0.999929, 0.999134, 0.999929)	(0.999967, 0.000280966, 0.999967)	(0.999932, 1.13427e-07, 1.00012)
4	(0.999843, 1, 0.999843)	(0.999954, 0.999994, 0.999954)	(0.99974, 0.000281467, 0.99974)	(0.99895, 1.13427e-07, 0.999843)
5	(1.001, 1, 1.001)	(0.999929, 1, 0.999929)	(0.999983, 0.00028095, 0.999983)	(0.999934, 7.34369e-09, 1.001)
6	(0.999749, 1, 0.999749)	(1.00013, 1, 1.00013)	(1.00011, 0.000280687, 1.00011)	(1.00051, -3.83232e-08, 0.999749)
7	(0.999517, 1, 0.999517)	(0.999867, 1, 0.999867)	(1.00044, 0.000280015, 1.00044)	(1.00002, 2.11895e-09, 0.999517)
8	(0.999755, 1, 0.999755)	(1.00095, 1, 1.00095)	(0.999824, 0.000281437, 0.999824)	(1.00013, -9.20283e-09, 0.999755)
9	(0.999985, 1, 0.999985)	(1.00014, 1, 1.00014)	(0.999963, 0.000281141, 0.999963)	(1.00051, -2.76798e-08, 0.999985)
10	(0.999964, 1, 0.999964)	(0.999899, 1, 0.999899)	(0.999925, 0.000281228, 0.999925)	(0.999203, 3.061776e-08, 0.999964)

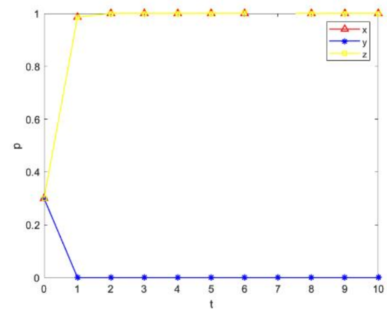
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



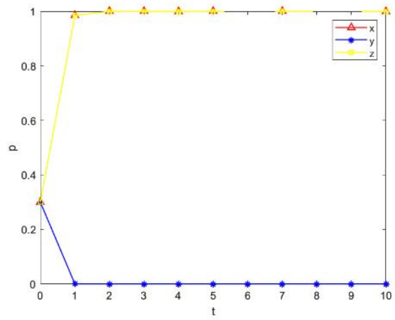
(a): Parameter values used: $S_2 = 25$.



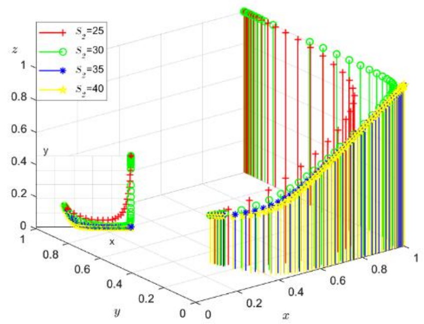
(b): Parameter values used: $S_2 = 30$.



(c): Parameter values used: $S_2 = 35$.



(d): Parameter values used: $S_2 = 40$.



(e) Changes of S_2 based on the evolution of the tripartite game system.

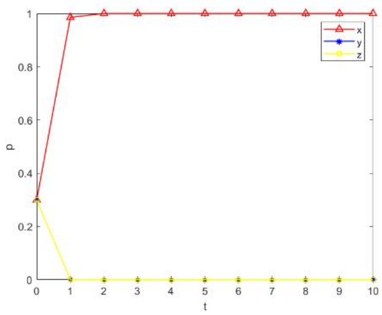
Fig.12: Effect of S_2 changes on the evolution of the tripartite game system.

Table 13: Values of (x, y, z) as L Varies.

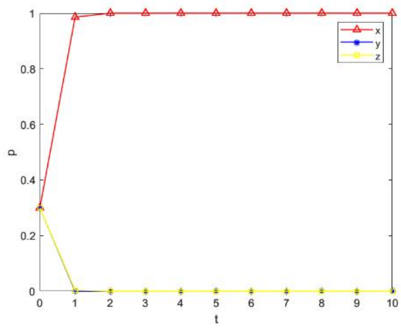
t	(x, y, z)			
	$L = 5$	$L = 10$	$L = 15$	$L = 20$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.985463, 2.724e-05, 2.33336e-05)	(0.985839, 4.63712e-05, 0.00350972)	(0.987036, 0.00453573, 0.363866)	(0.999248, 0.942344, 0.999248)
2	(0.99991, -1.95325e-07, -1.673111e-07)	(0.999903, 3.45341e-09, 2.37719e-05)	(0.999908, 0.000309219, 0.36746)	(0.999979, 0.999935, 0.999979)
3	(0.999999, 2.59018e-07, 2.21866e-08)	(0.999999, 4.35512e-09, 1.98482e-07)	(0.999999, 2.19702e-05, 0.367712)	(1.00012, 1, 1.00012)
4	(1, 2.37367e-07, 2.03313e-07)	(1, 1.02448e-07, 1.41396e-08)	(1, 1.53818e-06, 0.36773)	(0.999843, 1, 0.999843)
5	(1, -7.01307e-07, -6.00663e-07)	(1, 7.24844e-07,	(0.999999, 1.79334e-07,	(1.001, 1, 1.001)

		1.29386e-10)	0.367731)	
6	(1, -1.79387e-07, -1.53641e-07)	(1, -7.044319e-09, 1.05723e-12)	(0.999992, 5.37269e-08, 0.367731)	(0.999749, 1, 0.999749)
7	(1, -5.41783e-08, -4.63999e-08)	(1, 2.73335e-07, 1.0562e-14)	(0.999884, 1.60252e-08, 0.367732)	(0.999517, 1, 0.999517)
8	(1, -4.26736e-07, -3.65436e-07)	(1, 6.70298e-07, 9.80701e-17)	(1.00058, 1.38595e-09, 0.367732)	(0.999755, 1, 0.999755)
9	(1, -1.09201e-07, -9.35147e-08)	(1, 5.6242e-08, 7.94956e-19)	(1.00017, 1.36757e-10, 0.367732)	(0.999985, 1, 0.999985)
10	(1, 5.36774e-07, 4.59648e-07)	(1, 4.5109e-07, 7.3437e-21)	(0.999883, 1.15445e-11, 0.367732)	(0.999964, 1, 0.999964)

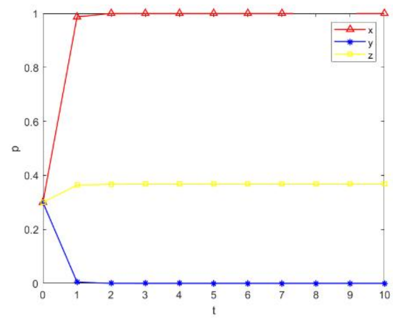
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



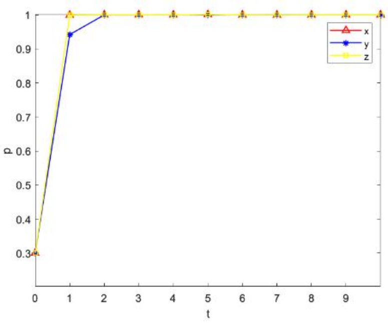
(a): Parameter values used: $L = 5$.



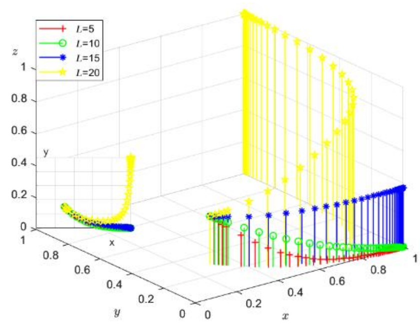
(b): Parameter values used: $L = 10$.



(c): Parameter values used: $L = 15$.



(d): Parameter values used: $L = 20$.



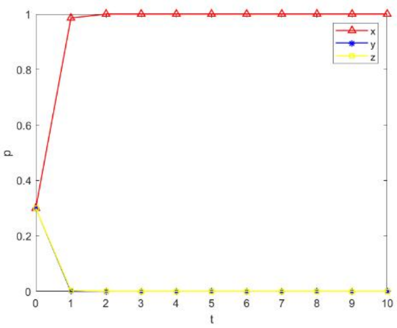
(e) Changes of L based on the evolution of the tripartite game system.

Fig.13: Effect of L changes on the evolution of the tripartite game system.

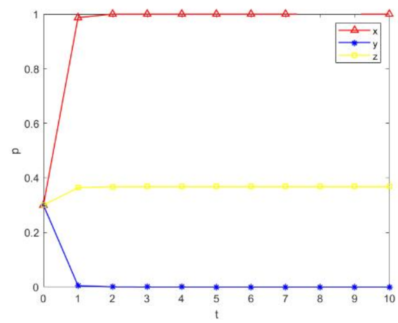
Table 14: Values of (x, y, z) as M Varies.

t	(x, y, z)			
	$M = 5$	$M = 10$	$M = 15$	$M = 20$
0	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)	(0.3, 0.3, 0.3)
1	(0.985839, 4.63712e-05, 0.00350972)	(0.987036, 0.00453573, 0.363866)	(0.999248, 0.942344, 0.999248)	(0.99984, 0.987675, 0.999984)
2	(0.999903, 3.45341e-09, 2.37719e-05)	(0.999908, 0.000309219, 0.36746)	(0.999979, 0.999935, 0.999979)	(1, 0.999998, 1.00027)
3	(0.999999, 4.35512e-09, 1.98482e-07)	(0.999999, 2.19702e-05, 0.367712)	(1.00012, 1, 1.00012)	(1, 1, 0.999917)
4	(0.999999, 1.02448e-07, 1.41396e-08)	(1, 1.53818e-06, 0.36773)	(0.999843, 1, 0.999843)	(1, 1, 1.00012)
5	(1, 7.24848e-07, -1.29386e-10)	(0.999999, 1.79334e-07, 0.367731)	(1.001, 1, 1.001)	(1, 1, 0.99994)
6	(1, -7.04319e-09, 1.05723e-12)	(0.999992, 5.37269e-08, 0.367731)	(0.999749, 1, 0.999749)	(1, 1, 1.0001)
7	(1, 2.73335e-07, 1.0562e-14)	(0.999884, 1.60252e-08, 0.367732)	(0.999517, 1, 0.999517)	(1, 1, 0.999993)
8	(1, 6.70298e-07, 9.80701e-17)	(1.00058, 1.38595e-09, 0.367732)	(0.999755, 1, 0.999755)	(1, 1, 1.00007)
9	(1, 5.6242e-08, 7.94956e-19)	(1.00017, 1.36757e-10, 0.367732)	(0.999985, 1, 0.999985)	(1, 1, 1.00003)
10	(1, 4.5109e-07, 7.3437e-21)	(0.999883, 1.15445e-11, 0.367732)	(0.999964, 1, 0.999964)	(1, 1, 0.999981)

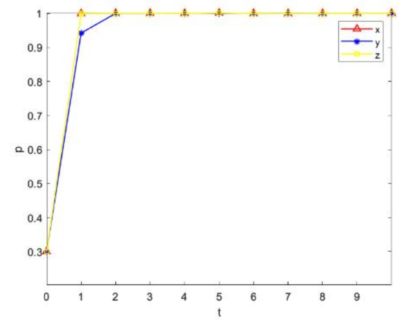
Note: (x, y, z) denote the probabilities of members adopting the strategies (empower, empower, AS), respectively.



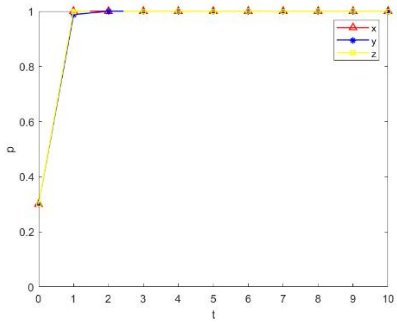
(a): Parameter values used: $M = 5$.



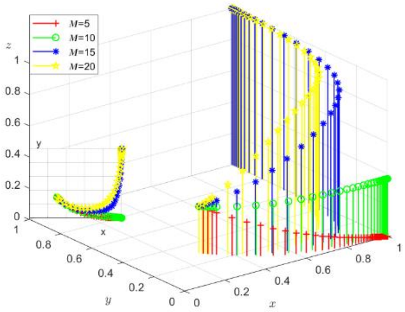
(b): Parameter values used: $M = 10$.



(c): Parameter values used: $M = 15$.



(d): Parameter values used: $M = 20$.



(e) Changes of M based on the evolution of the tripartite game system.

Fig.14: Effect of M changes on the evolution of the tripartite game system.