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Cooperation or Competition: An Evolutionary Game Study between E-commerce and Courier Enterprises in China

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Abstract: *There has been a special competing relationship between express and e-commerce in the development of the economy of China, and with the rapid development of e-commerce in China, this relationship has also intensified. In view of the unbalanced distribution of benefits and unstable cooperation between e-commerce and express, a reasonable analysis of the relationship between the two can help promote the healthy development of e-commerce and courier enterprises. The study uses evolutionary game theory to construct a game model between courier and e-commerce, assuming the assumption of limited rationality of the participating game subjects, and explores the evolution of the paths between the two parties in the cooperation process, with a view to finding the interest factors affecting the linkage between the two. The research results show that: reducing the cost of cooperation between e-commerce and courier enterprises will have a positive impact on the attitude of both parties; increasing additional benefits and establishing a fair benefit mechanism will help the long-term stability of the cooperation relationship between the two parties, and future policies should focus on building a balanced benefit distribution mechanism and building a risk control system.*

Keywords: *Courier enterprises, E-commerce, Evolutionary game, Model optimization*

1. Introduction

1.1. General

The boom in online payments has led to the rise of the e-commerce industry, with an increasing number of people choosing to shop online, and the courier industry that accompanies electronic commerce has also developed by leaps and bounds. However, in the rapid development of e-commerce and courier enterprises, there are also some hidden dangers that are occurring. On the one hand, e-commerce and courier industry development rely on each other; on the other hand, e-commerce and courier enterprises also constitute a special competing relationship. E-commerce itself wants the courier industry to reduce the time to provide goods to consumers; the courier industry wants to reduce costs and complete the business scope of e-commerce with the least amount of labour. At the same time, the two sides cooperate in the value chain aside from connecting with the consumer. E-commerce enterprises will choose the service and price of more favourable courier enterprises as suppliers, courier enterprises according to their own advantages, choose to ship a larger volume of e-commerce for bidding, and ultimately constitute a complex dynamic game relationship [1].

Similar studies have found that e-commerce and courier service have been deeply involved in the social economy, which is claimed to be a critical factor that affects e-commerce customer satisfaction, and previous studies have shown that customer satisfaction in turn affects customers' intention to repurchase [2-5]. Izzah et al. [6] determined that win–win development of e-commerce and courier enterprises is becoming a tendency with corresponding recommendations provided.

Wei [7] declared the dynamic evolution model is used to analyze the evolution direction of the influence factors, and then proposes to build an integrated information platform to achieve information exchange. Zhong et al. [8] studied the coordination of a new three-echelon LSSC consisting of an e-commerce mall, a courier enterprise, and a terminal distribution service provider. The goal of the study was to investigate the optimal solutions and profits for each party within semicentralized and centralized LSSC alliances.

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Li et al. [9] used evolutionary game dynamics to explore the cooperation between courier enterprises, e-commerce enterprises and the "e-commerce platform" introduced into the system of jointly improving courier service quality.

Zhang et al. [10] studied equilibrium strategies of e-commerce and courier enterprises under public supervision. Delivery firms rely mostly on comparative profit between high- and low-quality logistics services to make decisions, while e-firms consult to monitor cost. The results indicate that the delivery firms rely mostly on comparative profit between high- and low-quality logistics services to make decisions, while the e-firms consult to monitor cost rather than regulatory success rated to make selections between active and passive regulation.

Ying et al. [11] investigate the contradictions between electronic commerce and its matching courier service. The evolutionary model of the e-commerce and courier industry is established and analyzed.

According to the above research literature, there are abundant results in the analysis of the optimization of the game behaviour of e-commerce and couriers in the information age [12-15], but only a few scholars have focused on the effect of changes in e-commerce on the behaviour of courier enterprises [16-18], and there is also a lack of attention to changes in the behaviour of courier enterprises themselves in previous studies. Based on this, the study first explores the changes in the game behaviour of e-commerce and couriers in the electronic information era and finds the behavioral interface between the two by analyzing the behavioral interaction mechanism between them. Second, an evolutionary game model of the adoption (incorporation) behaviour of local e-merchants and courier enterprises is established, and simulation software is used to simulate the behavioral factors under different time series, based on which the behaviors of both parties are found to fit together.

2. Cooperation And Interaction Between E-commerce and Courier Enterprises

2.1. Description of the Problem

The different business characteristics and business logic of e-commerce and courier enterprises make it necessary for them to rely on each other in competition and form collective thinking, but because of the maximization of limited rationality, resulting in the inability of e-commerce and courier enterprises to form long-term stable interactions [19]. Overall, the integration of e-commerce and courier enterprises mainly faces the following problems.

The problem of distribution of interests. Although e-commerce and courier enterprises cooperated to some extent, e-commerce companies mainly cooperate out of cost considerations to reduce prices of transportation and it is difficult for courier enterprises to ensure the price of the basis for improving service quality. Low price is the main goal of courier enterprises, and it is difficult to provide personalized services in circulation, distribution, timing and other aspects of e-commerce, ultimately leading to a mismatch between the cost of the two sides and service expectations, affecting the quality of service. At this time, it will evolve into a situation of mutual noncooperation between e-commerce and courier enterprises.

The problem of cost sharing. As fresh food, medicine and other transport objects that require high technology protection gradually enter the market, diversified market demand means that courier enterprises need to continuously invest in scientific and technological innovation, and the cost of innovation is difficult for the courier enterprises to bear alone.

Express supply and demand imbalance. Due to the large differences in the number of online shoppers in different regions, the accompanying imbalance in the development of services and e-commerce leading to the majority of merchants struggling to meet the demand of consumers, which makes it difficult for long-term cooperation between courier enterprises and e-commerce to occur, at which point the results and both sides of the behavioral choices tend not to cooperate.

Risk protection. Chinese logistics enterprises are now in a period of rapid development, risk resistance and diversified services are not perfect, so as e-commerce enterprises cooperate they will have questions about the business capacity of courier enterprises, worrying that they cannot guarantee the existing needs of e-commerce and payout standards, the lack of risk-sharing capacity.

2.2. Game Analysis of E-commerce and Courier Enterprise Linkage Development Behaviour

The study takes e-commerce and courier enterprises as two game subjects based on limited rationality

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and limited information and implements the linkage, division of labour and association between them by matching certain resources. It is assumed that e-commerce enterprises and courier enterprises are the game subjects of the model. For the two sides of the linkage cooperation behaviour, e-commerce enterprises can choose {cooperation, noncooperation}, courier enterprises can choose {implementation, non-implementation}, where the probability of e-commerce enterprises choosing cooperation for X does not choose cooperation for the probability of 1-X; courier enterprises choose to implement the probability of Y and choose not to implement the probability of 1-Y. Among them, the implementation behaviour of courier enterprises is mainly to cooperate with e-commerce enterprises, including not limited to targeted services to e-commerce enterprises, emergency delivery in key areas and other businesses.

The study simulates the actual working process of e-commerce and couriers, focusing on the cooperative and competitive behaviour of e-commerce enterprises and courier enterprises and setting the basic benefits for both parties as constant.

Hypothesis I: When e-commerce enterprises do not cooperate, courier enterprises do not work together with e-commerce companies. At this time, e-commerce enterprises can obtain the benefits of S_1, and courier enterprises can obtain the benefits of S_2.

Hypothesis 2: When e-commerce enterprises cooperate and courier enterprises cooperate, the actual cooperation behaviour of e-commerce enterprises and courier enterprises will be weighted because of the long-term cooperation and thus short-term costs. At this time, e-commerce enterprises that pay the cost of C_1 will be e-commerce and courier enterprises after the cooperation of e-commerce gains is set to VE. In addition, courier enterprises will also be part of the cooperation for the courier, the main form of performance for the assumption of courier freight insurance. For long-term cooperation with courier manufacturers to open the VIP channel, the study will set this part of the cost as C_2. This cost will bring sustainable benefits in the long run, and the long-term benefits brought by the cooperation of courier enterprises are set to VL.

Hypothesis 3: E-commerce enterprises do not cooperate, courier enterprises implement. The cost borne by the courier enterprises will be recorded as C_4; at this time, the cost game choice of e-commerce enterprises remains unchanged but will be constrained by the courier enterprises. At the same time, courier enterprises may also fail to obtain timely feedback and choose not to cooperate, and ultimately, the two sides cannot reach a strategic cooperation state.

Hypothesis 4: The cooperation of e-commerce enterprises and courier enterprises is not implemented. Consider the costs borne by e-commerce enterprises as C_3, when e-commerce enterprises have a stronger intention to cooperate and will take the initiative to take measures to subsidize courier enterprises. Through Hypotheses 1-4, a dynamic game payment matrix between e-commerce and courier enterprises is constructed, as shown in Table 1.

Table 1: Dynamic game payment matrix between e-commerce and courier enterprises.

Gaming subjects and strategy choices		courier enterprise B	
		Implementation Y	Non-implementation 1-Y
E-commerce A	Cooperation X	($S_2 - C_2 + VL$,$S_1 - C_1 + VE$)	($S_2 - C_3 + C_1$,$S_1 - C_1$)
	Non-cooperation 1-X	($S_2 - C_1$,$S_1 - C_4 + C_2$)	(S_2 , S_1)

2.3. Evolutionary Game Model Utility Analysis

Based on the above assumptions, (X, Y) represents the probability of behaviour during the dynamic evolution of e-commerce-courier enterprise cooperation development, and the model is constructed to explore the equilibrium state of the dynamic game between the two.

Based on the analysis above, the expected utility functions of the benefits for both sides of the game can be constructed.

The expected utility function utility of the e-commerce strategy can be obtained as:

$$\overline{E_g} = XF_g^a + (1 - X)F_g^n \tag{1}$$

The expected utility function utility of the courier enterprise strategy can be obtained as:

$$\overline{E_b} = YE_b^p + (1 - Y)E_b^n \tag{2}$$

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2.4. Evolutionary Stability Strategy Solving

Based on the optimization analysis of e-commerce and courier enterprises, the study solves for the evolutionary stabilization strategy.

The replication dynamic equation for courier enterprises to implement matching escalation measures is:

$$F(b) = \frac{dy}{d_y} = (1-Y)(E_b^p - \bar{E}_b) = Y(1-Y)[X(V_E + C_3) + (1-X)(C_1 - C_3 + C_2)] \quad (3)$$

Let $\mathrm{F(b)} = \frac{\mathrm{dy}}{\mathrm{d_y}} = 0$, then $\mathrm{Y_1^* = 0, Y_1^* = 1, X_1^* = \frac{C_1 - C_3 + C_2}{V_E + C_3}}$.

By replicating, the dynamic equation can be seen when $\mathrm{F(b) = 0, F(b) < 0, Y_1^*}$ is a stable strategy

$$\mathrm{F(g) = \frac{dx}{d_x} = (1-X)(E_g^a - \bar{E}_g) = X(1-X)[Y(C_i + N_i - U_i F_i) + (1-Y)(C_j + N_j - U_j F_j) - C_i]} \quad (4)$$

Let $\mathrm{F(a) = \frac{dx}{d_x} = 0}$, then $\mathrm{X_1^* = 0, X_1^* = 1, Y_1^* = \frac{C_2 + C_4 - C_1}{V_L + C_4}}$.

According to the evolutionary game, stability can be known when $\mathrm{F(b) = 0, F'(b) < 0, Y_1^*}$ is a stable strategy. The evolutionary stable strategy is shown in Figure 1.

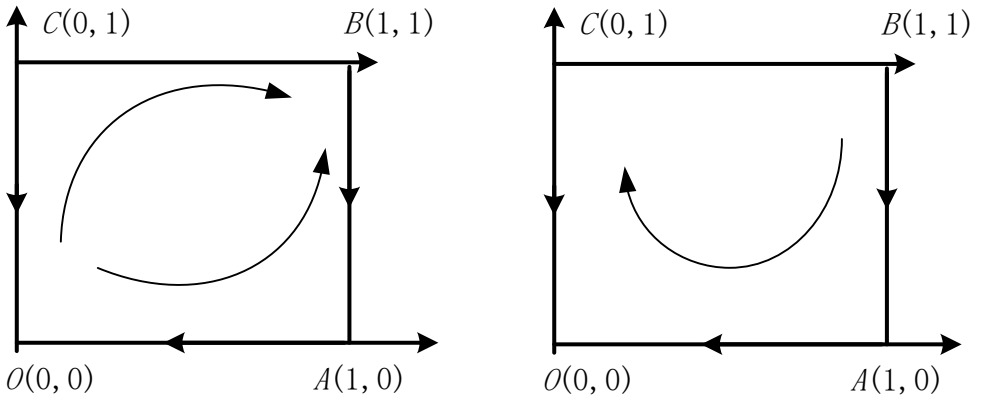

Figure 1: Replication dynamic phase diagram of e-commerce and courier enterprises.

Five equilibria of this game matrix are obtained as *A*(0,0), **B**(1,0), *C*(0,1), *D*(1,1), $\mathrm{E}(x^*, y^*) = \left(\frac{C_1 - C_3 + C_2}{V_E + C_3}, \frac{C_2 + C_4 - C_1}{V_L + C_4}\right)$.

Under the same goal constraint of e-commerce and courier enterprises, the probability of choice of both parties' behaviour will show clustering development. The probability change values of x and y are between 0 and 1, so it can be known that $(x^*, y^*) = \left(\frac{C_1 - C_3 + C_2}{V_E + C_3}, \frac{C_2 + C_4 - C_1}{V_L + C_4}\right)$ are greater than 0 and less than 1. Through the above assumptions, it can be known that the game boundary between e-commerce and courier enterprises depends on the boundary value of C_1, C_3, and C_2; only when the loss of e-commerce enterprises is less than their default penalty e-commerce enterprises will choose to cooperate with courier enterprises cooperation only when the benefits gained by courier enterprises are less than their default losses. Courier enterprises will take the initiative to cooperate with e-commerce enterprises to focus on the relevant business regulation. Based on this calculation of the five equilibrium points, the Jacobi matrix determinant and trace are obtained, as shown in Table 2.

Table 2: Determinant and trace of the jacobian matrix

Balancing point	Det J	Tr J	Results
A(0,0)	+	-	*ESS*
B(1,0)	+	+	Unstable
C(0,1)	+	+	Unstable
D(1,1)	+	-	*ESS*
$E(x^*, y^*)$	+	*0*	Saddle point

From the analysis in Table 2, it can be seen that there are only two cases of stable strategies in the evolutionary game: the strategic behaviour is (no implementation, no cooperation) and (implementation,

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cooperation), and the equilibrium points corresponding to the two cases are *A*(0, 0) and *D* (1,1). As seen from Figure 2, the curve *CEB* divides the quadrilateral into two parts. The upper right part of the region is the *CEBD*. Regardless of how the behaviour of the parties in this region changes, the strategic equilibrium point can ensure that the two sides converge on (1, 1); that is, the e-commerce enterprises choose to implement cooperative behaviour, and the courier enterprises choose to implement cooperation to ensure that the strategic behaviour of both sides will eventually reach a cooperative state.

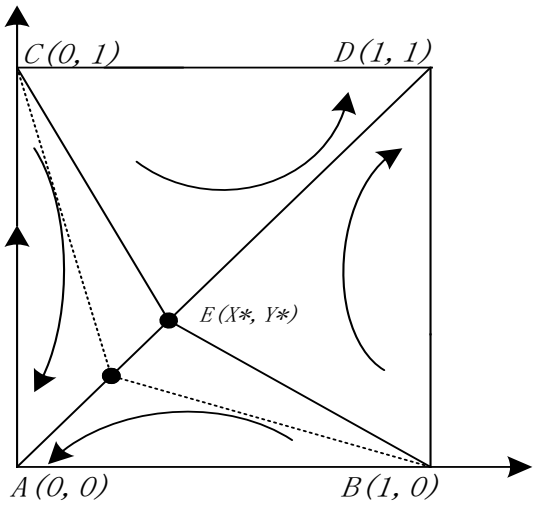

Figure 2: Dynamic evolution process of the system without central intervention.

The lower left part of the region is *CABE*; no matter how the behaviour of the parties in this region changes, the strategic equilibrium point can guarantee that both sides converge at (0, 0), i.e., The e-commerce enterprise chooses not to implement cooperative behaviour, and the courier chooses not to implement cooperative behaviour through the evolutionary game matrix to describe the behaviour of both sides to choose the probability of equilibrium strategy, described as follows:

$$S = \frac{1}{2}\left(\frac{C_2+C_4-C_1}{V_L+C_4}, \frac{C_1-C_3+C_2}{V_E+C_3}\right) \tag{5}$$

According to the above study, it can be seen that at this time, the area of *CEDB* is affected by the initial willingness of e-commerce and couriers, the joint action of the two sides, etc. The larger the area of the *CEDB*, the greater the probability that the system will reach Pareto optimality will also increase.

Analysis of the direction of movement of point E shows that the direction of movement of $(x^*, y^*) = \left(\frac{C_1-C_3+C_2}{V_E+C_3}, \frac{C_2+C_4-C_1}{V_L+C_4}\right)$ is influenced by the cost of cooperation between e-commerce C_1 and courier enterprises C_3, as well as by the value of the difference between e-commerce and courier cooperation, specifically C_1-C_3 and C_4-C_1. The actual cooperation in the courier industry and the adjustment of courier enterprises is a long-term process, so the cooperation process between e-commerce and courier enterprises is often in a passive stage. There is a need for e-commerce enterprises to take the initiative to adjust and then contribute to the strategic objectives of both sides to achieve mutual benefits.

On this basis, the direction of travel of point *E* (*x*, y**) is further analyzed. According to the change in the denominator, the change in the values of *VE* and *VL* will have a positive or negative impact on the direction of travel of point *E*. (1) *VE* is the risk coefficient of courier enterprises to implement guidance measures alone. This coefficient is mainly determined by the courier enterprise input costs and sunk costs, only to reduce the risk coefficient of courier enterprises to ensure that courier enterprises have a greater possibility of cooperation with e-commerce, specific measures can be signed through the e-commerce strategic framework agreement, increase the amount of allocation, etc., to boost the confidence of courier enterprises to invest and promote cooperation between the two sides to reach. (2) Reduce *VL*, that is, the cost of cooperation between e-commerce and courier enterprises. Lowering the cooperation cost of e-commerce is conducive to enhancing the cooperation enthusiasm of e-commerce enterprises, specifically including improving the subcontracting and sorting efficiency of courier enterprises and ensuring the profit growth point of e-commerce enterprises, thereby reducing the communication risk between e-commerce enterprises and courier enterprises and promoting faster transformation of e-commerce enterprises. As shown in Figure 3, by adjusting the level of relevant factors and variables, *E*(*x*, y**) is

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shifted to the upper right so that both e-commerce and courier enterprises can improve their motivation to complete cooperation, and finally, the evolutionary game point converges at $B(1,1)$ to ensure that both sides reach a Pareto optimal equilibrium. By analyzing the results of the evolutionary game, we can see that when courier and e-commerce enterprises cooperate, e-commerce enterprises will play a decisive role in the behaviour of courier enterprises because they take initiative in the game.

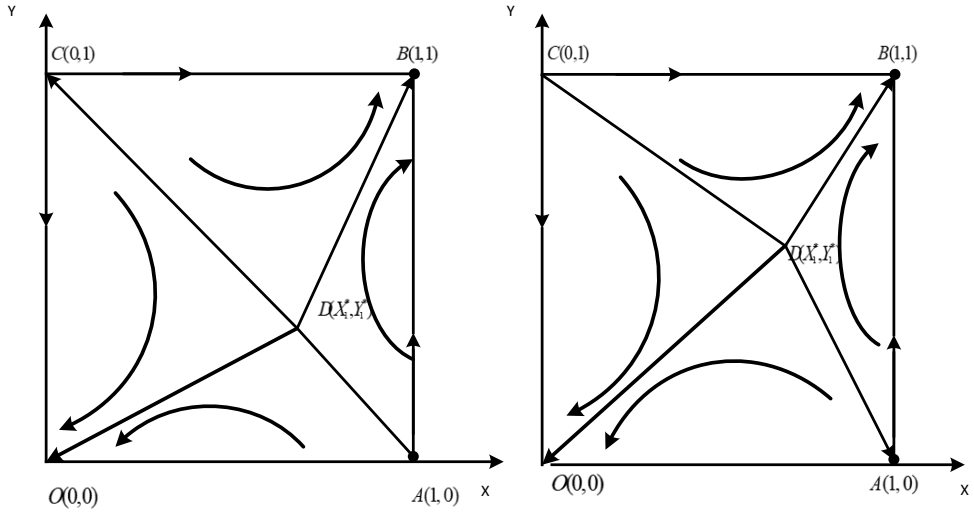

Figure 3: Influence of parameter change on the dynamic evolution path.

Based on the above research, it can be seen that as e-commerce and courier enterprises become increasingly harmonious, the two sides will change from a zero-sum game to a collaborative game model, in which changes in costs and risk factors will also change toward win–win development, prompting both sides to achieve maximum benefits at minimal cost. How to make dynamic judgments on the above factors in the time series and promote the quality and efficiency of e-commerce and courier enterprises has also become a key issue in the development of e-commerce and courier enterprises.

It is foreseeable that with the rapid development of e-commerce courier enterprises, the contradiction between supply and demand between e-commerce and courier companies will gradually increase at this stage. The existing evolutionary game analysis fails to reflect the changes in various demand factors; therefore, it is necessary to upgrade and expand evolutionary game analysis to clarify the relationship between various factors and the development of e-commerce and courier enterprises and to meet the development requirements of economic growth in e-commerce and the courier industry. Based on this evolutionary game matrix, MATLAB simulation equations are constructed to dynamically solve the win–win game factors of e-commerce and courier enterprises to dynamically adjust the overall allocation rules and promote the integration and unification of e-commerce and courier enterprises.

3. MATLAB Model Simulation and Analysis

3.1. Simulation Analysis of the Game Between E-commerce and Courier Enterprises

Through the above study, it can be seen that under certain goal constraints, e-commerce and courier enterprises will rely on each other's industry resources, technology accumulation, talent pools and other advantages in the overall cooperation and development process to promote a win–win situation for both sides. However cost control, egoism, and refusal to cooperate together, may result in the breakdown of cooperation between the two sides. In the game strategy of e-commerce and courier enterprises, which factors will affect the stability of cooperation, and how can we explore the various influencing factors on the cooperation mechanism of e-commerce and courier enterprises and then build a stable cooperation mechanism to ensure the achievement of the final goal of both sides? The study introduces MATLAB software to simulate this evolutionary game process, with reference to the specific parameters of past e-commerce into differential values, through the e-commerce enterprise to pay the cost C_1, courier enterprise cooperation revenue C_2, courier enterprise to obtain the value of revenue S_2, e-commerce enterprise gains VE, courier enterprise cooperation brought long-term revenue VL and other values to analyse the impact of each variable factor on strategic behaviour. The values assigned to each game factor are shown in Table 3, and the simulation results are shown in Figures 4-7.

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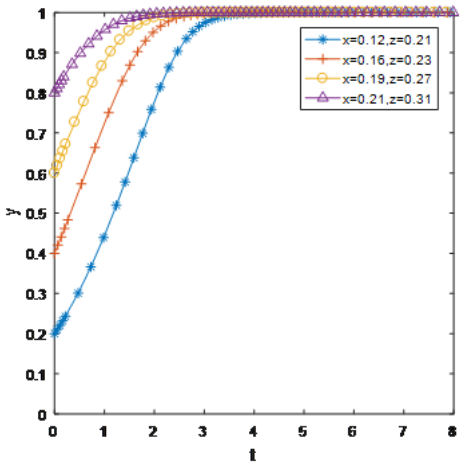
Case 1: Assume in Table 3 that neither the cost of e-commerce nor the cost of couriers is involved as the main variable and adjust the cost C_1 of e-commerce enterprises to reach a strong implementation state while raising the value of courier enterprises to obtain the benefit of S_2. The simulation results are shown in Figures 4 and 5. From Figure 4, it can be seen that in the case of strong implementation of e-commerce, the behaviour of the two sides of the game tends to be stable, at T=3 shows a stable development state, and with the increase in the value of x and y, the overall willingness to cooperate increases. From Figure 5, it can be seen that when the e-commerce implementation is weak, the cooperation between the two sides will show a disorderly state when the two sides cannot reach cooperation. This shows the strong position of e-commerce enterprises in this process; that is, when the cooperation intention of e-commerce enterprises is low, no matter how they change, courier enterprises cannot unilaterally pull cooperation.

Case 2: As shown in Table 3, as the cooperation benefit C_2 of courier enterprises increases, courier enterprises obtain the benefit value S_2, while keeping other values unchanged, analyse the behaviour of courier enterprises and e-commerce enterprises, and obtain the simulation analysis, as shown in Figure 6. After raising the cost of default of courier enterprises, the slope of the game curve between the two sides will keep increasing with the change in values and then reach the state of cooperation. When the cost of default of courier enterprises is gradually increased, T will become increasingly stable when T=4. Compared with the previous cost of default of courier enterprises, it can be seen that increasing the cost of default of courier enterprises will help both sides reach cooperation more quickly.

Case 3: As shown in Table 3, by simultaneously increasing the benefits VE obtained by e-commerce, the long-term benefits VL from cooperation between courier enterprises. Converge to 1 and stabilize at T=2.5, while ensuring that the nature of other variables between the two parties remains unchanged. Changing the cost of courier versus the cost of e-commerce helps to increase the willingness of both parties to cooperate, and the change in the cost of e-commerce inputs has a greater effect on the cooperation effect of both parties compared to the cost of default of the courier enterprise. The reason for this may be that a change in e-commerce input costs is more likely to induce a rapid transition between the two parties and help synchronize their gaming behaviour compared to heavy investment by courier enterprises.

Table 3: Numerical simulation of different assignment

Scale	C_1	C_2	C_3	V_E	V_L	S_1	S_2	X	Y	Description
Fig. 4	0	0	0	2.3	2	2	2	0.12	0.3	$X<Y$
Fig. 5	5	5	6	2.3	4	\	3	0.21	0.4	$X<Y$
Fig. 6	5	3	7	2.3	10	3	1	0.12	0.5	$X<Y$
Fig. 7	5	3	7	2.3	10	3	1	0.82	0.6	$X>Y$



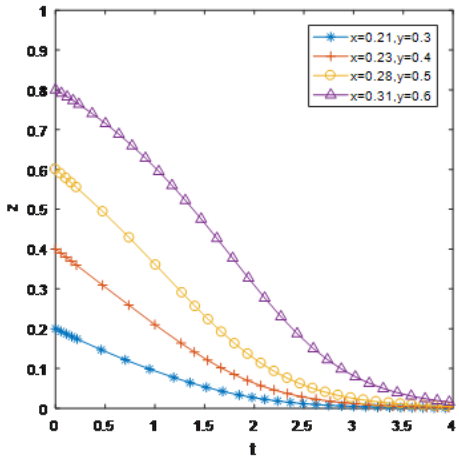


Figure 4: Strong implementation of e-commerce enterprises. (Left)

Figure 5: Weak implementation of e-commerce enterprises. (Right)

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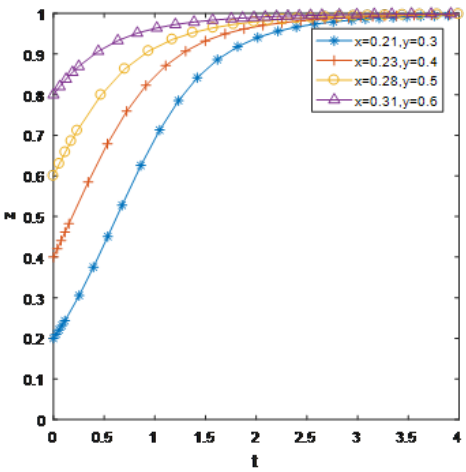

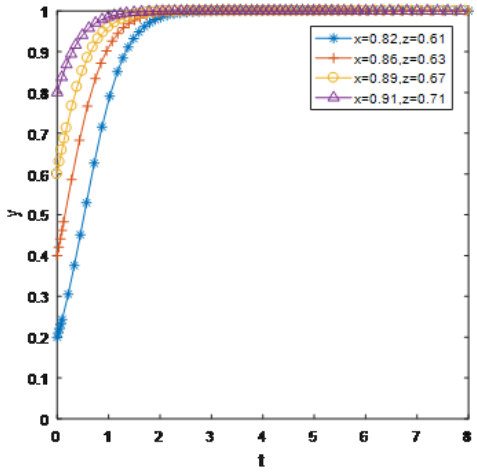

Figure 6: Strong cooperation behaviour of courier enterprises. (Left)

Figure 7: Weak cooperation behaviour of courier enterprises. (Right)

3.2. MATLAB Simulation Results and Study

The analysis of the above results reveals that there is a U-shaped growth relationship between e-commerce and courier enterprise development compared to traditional cooperative behaviour. Initially, both parties will refuse to invest and choose to develop separately. To facilitate cooperation between the two parties as soon as possible, a reward and punishment mechanism is introduced to promote the equilibrium of e-commerce and courier enterprises by increasing or decreasing their risk factors. The study shows that as the risk factor for e-commerce and courier enterprises decreases and the input cost increases, e-commerce will take the initiative to participate in the measures to enhance the linkage with courier enterprises to ensure that e-commerce companies reap the benefits of the partnership with courier enterprises. The stability of the simulation further confirms the checks and balances in the evolutionary game, indicating that relying solely on one party's strength will not successfully reach the final solution of the game and that the intervention of courier enterprises and government forces is needed to promote the evolutionary game and reach an equilibrium state, forming a reasonable development path for e-commerce and couriers enterprises.

Therefore, in the later stages of the evolutionary game between e-commerce and courier enterprises, cooperation can be carried out in a way that e-commerce enterprises adjust their measures first and courier enterprises follow. Through the strong participation of e-commerce enterprises in the game to develop rules to build confidence in the cooperation of courier enterprises, while stimulating the enthusiasm of consumer participation, a positive cycle of investment–participation-return is achieved to achieve the Pareto optimum. At the same time, to fundamentally solve the coordination problem of e-commerce and courier service, it is recommended that the government participate in the development of e-commerce-related policies and regulations, such as raising the basic wages of couriers and implementing tax breaks to ensure the profit margins of courier enterprises.

4. Conclusion

This study explores the factors influencing the behavioral game between e-commerce and courier enterprises and analyses how e-commerce and courier enterprises can seek common ground while reserving differences on the basis of cooperation to ensure that the minimum cost can leverage the maximum benefit. The study finds that the synergistic development of e-commerce and courier enterprises is an evolutionary process based on the interests of both sides of the game, the cost of trust and strategic interaction. When the cost of the game is controllable, the choice of interaction strategy between e-commerce and courier enterprises depends on the initial conditions of both sides and the enterprises' own interests.

The system dynamics analysis shows that increasing the additional benefits of cooperation, reducing the costs of cooperation and increasing the penalties for breach of contract can effectively promote the establishment of cooperative relationships.

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Based on this, the following recommendations are made: first, the integration of human resources of courier enterprises, sorting and delivery for different types of e-commerce, and staff ratios should be optimized to improve the income of courier enterprises, and promote the integrated development of e-commerce and couriers. Second, to build a perfect reward and punishment mechanism, through the credit rating of enterprises, credit classification, black and white list to protect the basis of cooperation between the two sides, the results of cooperation between e-commerce and courier enterprises should be outlined for the code of conduct for both sides to abide by. Third, an information sharing platform should be built. E-commerce enterprises can improve the operational efficiency of courier enterprises by sharing key information such as waybill data, inventory replenishment data and cargo flow. Modern information centres can be established through technologies such as the Internet of Things, cloud computing and blockchain to improve cooperation models to reduce cooperation costs and further improve delivery quality.

References

[1] Zhang, J, Wang, Y. Dynamic game analysis of e-commerce and courier service provider relationships: a price competition perspective[J]. Journal of Business Research, 2019, 126:340-352.
[2] Luo H, Zhang X, Huang J, et al. An empirical study on customer repurchase willingness of fresh e-commerce products based on customer perceived value[C]. In: 2019 16th International Conference on Service Systems and Service Management (ICSSSM), Shenzhen, China, IEEE: 1–6.
[3] Liu Y. Customer review elements of agricultural products e-commerce and their influence on satisfaction based on big data crawlers[C]. In: 2021 2nd International Conference on Big Data Economy and Information Management (BDEIM), Sanya, China, IEEE: 392-395.
[4] Suroso J S, Kaburuan E R, Setyo J, et al. Identification of e-commerce business approaches to improve customer satisfaction[C]. In: 2020 8th International Conference on Orange Technology (ICOT), Daegu, Korea, IEEE: 1-5.
[5] Ariesty W, Sari R K. The effect of information quality, trust and satisfaction to e-commerce customer loyalty in sharing economy activities[C]. In: 2021 7th International Conference on Electrical, Electronics and Information Engineering (ICEEIE), Malang, Indonesia, IEEE: 499-503.
[6] Izzah N, Rifai D ,Yao L. Relationship-courier partner logistics and e-commerce enterprises in Malaysia: a review[J]. Indian J. Sci. Technol, 2016,9(9):1-10.
[7] Han W. The analysis on Chinese e-commerce tax losses based on the perspective of information asymmetry [J]. Electron. Commer. Res, 2020, 20:651-677.
[8] Zhong Y, Guo F, Tang H, Chen X. Research on coordination complexity of e-commerce logistics service supply chain[J]. Complexity,2020:1-21.
[9] Li M, Wang Y, Zhang J. Evolutionary game dynamics in the cooperation between courier enterprises, e-commerce enterprises, and e-commerce platforms for improving courier service quality[J]. Journal of Service Science and Management, 2020, 13(2):137-146.
[10] Zhang X, Zhou G, Cao J ,et al. Evolving strategies of e-commerce and express delivery enterprises with public supervision[J]. Res. Transp. Econ, 2020, 80:100810.
[11] Xu Y, Zhang X, Cao J, Chen Y, Ye X. Collaboration and evolution of e-commerce and express delivery industry supply chain[J]. Discrete Dyn. Nat. Soc, 2016, 2016:1-12.
[12] Wang Y, Lei L, Zhang D, Lee L H. Towards delivery-as-a-service: effective neighborhood search strategies for integrated delivery optimization of e-commerce and static O2O parcels[J]. Transp. Res. B Methodo. 2020, 139:38-63.
[13] Prajapati D, Chelladurai H, Zhou F, et al. Sustainable multi-products delivery routing network design for two-echelon supplier selection problem in B2B e-commerce platform[J]. RAIRO - Oper. Re,. 2022,56:2115-2137.
[14] Prajapati D, Zhou F, Zhang M, et al. Sustainable logistics network design for multi-products delivery operations in B2B e-commerce platform[J]. Sādhanā, 2021, 46(2):100.
[15] Inoue Y, Hashimoto M. Changes in consumer dynamics on general e-commerce platforms during the COVID-19 pandemic: an exploratory study of the Japanese market[J]. Heliyon, 2022, 8(2):e08867.
[16] Meng F, Ji Q, Zheng H, et al. Modeling and solution algorithm for optimization integration of express terminal nodes with a joint distribution mode[J]. J. Organ. End User Comput. (JOEUC), 2021, 33(4):142-166.
[17] Diaz R, Phan C, Golenbock D, Sanford B. A prescriptive framework to support express delivery supply chain expansions in highly urbanized environments[J]. Ind. Manag. Data Syst, 2022, 122(7): 1707-1737.
[18] Pu S, Xia C. Exact approach for integrated delivery optimization of e-commerce and online-to-offline parcels[J]. Asia-Pac. J. Oper. Re.2023, 40(03):2250026.
[19] Chen Y, Liu Y. Limited rationality and instability of long-term interactions between e-commerce and courier enterprises[J]. International Journal of Logistics Management, 2021, 32(2):456-470.