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Research Article

An Evolution Model of Fintech Supports Technology-Based SMEs Innovation and Growth

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The survival and growth of technology-based small and medium-sized enterprises are faced with a complex and changeable market environment. Introducing the role of fintech, the paper builds an evolutionary model for growth of technology-based SMEs and analyzes fintech incentive mechanisms to guide corporate growth strategies based on some cases by the simulation. The research results show that the evolutionary game strategy that SMEs are willing to adopt is {cooperation, cooperation}. And, under the incentive mechanism of fintech, the evolutionary game strategy adopted by SMEs and fintech institutions is {cooperation, cooperation, participation}. In the growth of fintech institutions serving technology-based SMEs, the selection strategy of SMEs is more sensitive to changes in fintech institutions' willingness to participate in cooperation, cooperation costs, and cooperation benefits. The selection strategy of fintech institutions is more affected by changes in cooperation costs and incentive funds during the process of participating in cooperation.

1. Introduction

Technology-based small and medium-sized enterprises (SMEs) play an important role in economic development such as technological innovation, social employment and international exchanges in the economic development [1]. High-tech small and medium-sized enterprises are economic entities that take scientific research personnel as the main body and use innovation and technical knowledge as means to engage in the research and development, production, sales of high-tech products, and to realize the industrialization of scientific and technological achievements [2]. It shows that the sharing rates of technology-based SMEs in China's patent inventions, enterprise technological innovations and new product development are about 65%, 75% and 80%. However, as the number of high-tech SMEs has increased year by year and the level of technology has improved, the homogeneity of products and services has become more common, which has brought huge growth and survival pressure to high-tech SMEs, and the survival rate of SMEs is more low, and the ability to survive and develop is low [3]. They will suffer from financing problems in the process of growing. In addition, with the spread of COVID-19 epidemic and the disruption of the global supply chain, financial institutions have difficulty in lending to technology-based SMEs in consideration of factors such as risks and costs, and are unwilling to provide more services [4]. Many technology-based SMEs have lost contact with the financial institution industry and are facing suspension and bankruptcy at any time. Therefore, it is of great significance for how to promote the growth of technology-based SMEs to develop sustainably in the age of fintech [5].

Technology-based small and medium-sized enterprises are in a disadvantaged position in the market. There are the following points from some literature and practices: first, business growth. It illustrates the vulnerability of SMEs due to unsustainable business growth. Technology-based SMEs are knowledge-intensive industries, which technical talents are the source of technological innovation, including entrepreneurs and employees [6]. Many technology-based SMEs lack a large number of high-quality entrepreneurs, who have the strategic thinking, management decision-making abilities and management knowledge such as corporate culture, finance systems, and team cultivation [7]. In addition, in the face of large technology-based companies such as Google, Ali, Tencent, and other technology giants,

technology-based SMEs are small in scale and weak in market competitiveness, and there is a possibility of being annexed [8]. Second, financing constraints. Funds are an indispensable important basis for SMEs in carrying out technological innovation activities. With the improvement of technological innovation level of SMEs, the demand of funding is also expanding [9]. Compared with large-scale enterprises, SMEs have lower possibility of lending by financial institutions because they are small in scale, and lack of tangible property for valuation [10]. On the other hand, due to the loan business of SMEs is mostly multifrequency and low-amount, financial institutions need to spend and bear higher business costs and risks [11]. Therefore, most financial institutions are unwilling to provide financial services for SMEs. Third, policies and regulations: large technology companies have absolute advantages in terms of technology, capital and other resources, production costs, market competition, etc. [12]. Some oligarchs try to abuse their dominant market positions to monopolize, causing many technology-based SMEs to be eliminated. Compared with other countries such as Japan and Germany, the antimonopoly law-related penalties and regulations have not been fully effective in China [13], and it is difficult to create a free and fair market environment to protect the healthy development of technology-based SMEs.

In recent years, attention has been paid to the growth and innovation of SMEs. Shortage of funds, insufficient technical talents, and imperfect management systems have become the obstacles to development of SMEs [14]. Considering loan costs and risks of financial institutions, commercial banks more likely to refuse to lend because of the low credit level of SMEs, which includes many Internal factors [15, 16]. Enterprise agglomeration and collaboration are important factors for enterprise growth. Interrelated companies conduct cooperative research and development to enhance their core competitiveness, improve their own innovation level, and form a new supply chain value network [17]. In the network, many companies have begun to spontaneously adopt R&D cooperation methods to carry out knowledge diffusion and technology sharing within the clusters to enhance their own internal innovation capabilities [18]. Cluster enterprises choose the corresponding technological innovation model after considering factors such as the size of the enterprise, financial strength, and technical level [19]. For example, Silicon Valley has formed high-tech industrial clusters with small business clusters and unique geographical advantages. It has nurtured technology giants such as Intel, Apple, and Google and has promoted the United States to become a technology powerhouse. Through the exchange and interaction of resources such as technology, knowledge, and information [2], SMEs can obtain more cooperation opportunities and synergistic benefits in the cluster [20], which also enhance their competitive advantages and further enhance their development [21]. Government policy support is an important external factor influencing the growth of enterprises [22], policy supply, implementation, and support intensity and policy changes affect the success or failure of the cultivation of high-tech SMEs [23].

Facing the digital economy era and the innovation of fintech, some scholars have shown that it can be effectively promote the development of high-tech SMEs by exploring new financing models such as Internet finance, investment and loan linkages, and innovative financing models of banks [24]. Some large commercial banks have already taken actions to provide online financial business models based on big data, blockchain and other technologies to provide more convenient online credit financial services for SMEs [25, 26]. From the perspective of fintech innovation, technological finance mainly refers to the integration of technological industry and financial industry, which finance serving technological enterprises [27]. It is a series of system and mechanism arrangements that realize the close integration of technology and finance [28]. The continuous promotion and integration of technology and finance can improve the regional technological and economic strength [29]. After the empirical test of some scholars, it is verified that the development of technology finance not only has a significant correlation with the regional technological development level, but also affects the development of regional technological innovation capabilities [30], which can help SMEs improve the economy, ease financing constraints, and promote the high-quality development of technology-based small and medium-sized enterprises [31]. It shows that the efficiency of local technology finance policies, such as financial subsidies, financial supervision, and technology credit, has an uneven distribution of impacts on the resource allocation efficiency of technology-based small and medium-sized enterprises, especially the resource allocation of enterprises in the start-up period and transformation period [32]. However, financial development has not provided strong support for high-tech SMEs, and the corresponding financial mechanism is imperfect. It is difficult to solve the funding problems needed for the growth and development of high-tech SMEs under financial innovation [33].

Most research results and practical theories for technology-based SMEs are based on their own growth and external financing channels, which attempt to help technology-based SMEs develop by improving financing channels, management systems and government policy [34]. This paper builds an evolutionary game model for innovation and growth among technology-based SMEs and introduces fintech institutions mechanism to explore the final strategy adopted by technology-based SMEs. The remaining part of this paper proceeds as follows. Section2 spontaneous model of technology-based SMEs innovation and growth. Section 3 evolutionary model of fintech boost technology-based SMEs growth. Section 4 case and simulation analysis of fintech supports technology-based SMEs growth. Section 5 summarizes and concludes the study.

2. Spontaneous Model of Technology-Based SMEs Innovation and Growth

Technology-based SMEs take knowledge and technological innovation as their core competitiveness, and provide the society with knowledge, technology, and high-tech products to obtain large amounts of funds to achieve sustainable

development of enterprises [4]. For technology-based SMEs, insufficient resources are restricting the innovation and growth of enterprises. Each technology-based enterprise has independent core technology and resources, and the entire process of knowledge innovation and technology productization requires a variety of technical knowledge, technological talents and innovative resources to succeed. Compared with large-scale enterprises, it is difficult to retain high-knowledge and innovative talents to serve technology-based SMEs. However, cooperative technological innovation has become a new development model in the high-tech field, bringing more resource sharing for SMEs, thereby enabling SMEs to better carry out innovative activities [35]. In the network of technology-based enterprises clusters, some companies with mutual individuality can share knowledge, relationship transfer, and mutual learning of management systems [36], reduce the friction and obstacles in the process of enterprise development, and promote the further development of each other. Based on the above content, the following hypotheses are proposed.

Hypothesis 1. There are technology-based SME A and B, both of which are subject to the game with bounded rationality.

Hypothesis 2. In the cluster network, regardless of the external environmental impact, both technology-based SME A and B choose to cooperate or not to cooperate. Cooperation strategy is information sharing, including management system, financing channels and technical knowledge etc. Noncooperation means the company has exclusive knowledge and technology, commodity production channels, financing methods and marketing methods, and is unwilling to cooperate with the other company, to find ways of enterprise development on their own.

Hypothesis 3. The initial income of enterprise A and B is A_1 and A_2 respectively. When enterprise A and B have the willingness to cooperate and reach an agreement to become a partner, the additional benefits for both are ΔV, the additional income of enterprise A is $\theta\Delta V$, the additional income of enterprise B is $(1-\theta)\Delta V$, Where $\theta(0<\theta<1)$ is the additional income distribution coefficient; When the cooperation breaks down, due to the needs of its own business development, one of the parties will not be able to immediately interrupt the connection between the two, and there will still be some business exchanges. Among them, the party who chooses to withdraw from the cooperation early will earn speculative gains. Enterprise A and B are respectively T_1 and T_2. When both parties have no willingness to cooperate, the net income of the two business activities is the initial income.

Hypothesis 4. Enterprise A and B need to pay a certain cooperation cost (technology sharing, human resource allocation) during the cooperation process. At this time, the total cooperation cost paid by enterprise A and B is c, the cost paid by enterprise A is tc, the cost paid by enterprise B is $(1-t)c$, $t(0<t<1)$ is the cost-sharing ratio coefficient. When the partnership breaks down, part of the business is still in contact, and the party who chooses to continue needs to pay additional loss costs, Enterprise A and B are respectively L_1 and L_2, and the exiting party needs to bear default costs W as a certain penalty.

The proportion of enterprise A choosing cooperation strategy is x $(0\leq x\leq 1)$, then the proportion of choosing noncooperative strategy is $(1\text{-}x)$; the proportion of enterprise B choosing cooperation strategy is y $(0\leq y\leq 1)$, then the proportion of choosing noncooperative strategy For $(1\text{-}y)$. The income matrix of the game between enterprises A and B is shown in Table 1 below:

At the initial stage, due to the influence of their internal environmental factors, the selected game strategy of technology-based SME A and B is not necessarily optimal. Instead, they constantly adjust their own strategies according to the process of growth and cultivation of the enterprise and the passage of time, which they can obtain strategies for both sides to stabilize. According to the above hypothesis and Table 1, calculate the income of the technology-based SME A to choose the information cooperation strategy U_A^1, the income of the noncooperation strategy U_A^2 and the average income $\overline{U}_A$.

Benefits of enterprise A's choice of cooperation strategy:

$$U_A^1 = y(A_1+\theta\Delta V - tc) + (1-y)(A_1 + W - tc - L_1). \quad (1)$$

Benefits of noncooperative strategy of enterprise A:

$$U_A^2 = y(A_1 + T_1 - W) + (1-y)A_1. \quad (2)$$

Average income of enterprise A:

$$\overline{U}_A = xU_A^1 + (1-x)U_A^2. \quad (3)$$

From this, we can obtain the dynamic equation for replication of enterprise A:

$$\frac{\mathrm{d}x}{\mathrm{d}t} = x(1-x)[y(\theta\Delta V - T_1 + L_1) + W - tc - L_1]. \quad (4)$$

In the same way, the dynamic equation for replication of enterprise B can be obtained:

$$\frac{\mathrm{d}y}{\mathrm{d}t} = y(1-y)\{x[(1-\theta)\Delta V - T_2 + L_2] + W - (1-t)c - L_2\}. \quad (5)$$

According toequations (1) and (2), the two-dimensional power systems of technology-based SME A and B are:

$$\begin{cases} F_x = x(1-x)[y(\theta\Delta V - T_1 + L_1) + W - tc - L_1], \\ F_y = y(1-y)\{x[(1-\theta)\Delta V - T_2 + L_2] + W - (1-t)c - L_2\}. \end{cases} \quad (6)$$

The solution can get the local stable equilibrium points of the system, which are $(0, 0)$, $(0, 1)$, $(1, 0)$, $(1, 1)$, $(1-tc+L_2-W/(1-\theta)\Delta V - T_2 + L_2$, and $tc + L_1 - W/\theta\Delta V - T_1 + L_1)$.

According to Friedman's method of constructing the Jacobian matrix, the first-order partial derivatives of x and y of the copied dynamic equation are obtained, respectively. The Jacobian matrix is as follows:

Table 1: The income matrix of the game between technology-based SME A and B.

		Enterprise B	
		Cooperation	Noncooperation
Enterprise A	Cooperation	$A_1 + \theta\Delta V - tc, A_2 + (1-\theta)\Delta V - (1-t)c$	$A_1 + W - tc - L_1$, $A_2 + T_2 - W$
	Noncooperation	$A_1 + T_1 - W, A_2 + W - (1-t)c - L_2$	A_1 , A_2

$$J = \begin{bmatrix} (1-2x)\left[y\left(\theta\Delta V - T_1 + L_1\right) + W - tc - L_1\right], & x(1-x)\left(\theta\Delta V - T_1 + L_1\right), \\ y(1-y)\left[(1-\theta)\Delta V - T_2 + L_2\right], & (1-2y)\left\{x\left[(1-\theta)\Delta V - T_2 + L_2\right] + W - (1-t)c - L_2\right\} \end{bmatrix}. \quad (7)$$

And calculate the eigenvalues of the Jacobian matrix and the signs of the trace to judge the local stability in various situations, and obtain the evolutionary stability strategy [37], as shown in Table 2, the equilibrium points (0, 0) and (1, 1) is the local stable point, the saddle point is $\left(1 - tc + L_2 - W/(1-\theta)\Delta V - T_2 + L_2\right.$, $\left. tc + L_1 - W/\theta\Delta V - T_1 + L_1\right)$, The evolutionary stable strategy of the system is {cooperation, cooperation} or {no cooperation, no cooperation}.

It can be known that in the game process of technology-based SME A and B, the final strategy is affected by the saddle point. The straight line formed by the points (0,0), (1,0) and the saddle point determines the upper and lower squares. For part of the area, the more the coordinate value corresponding to the saddle point converges to (0, 0), the larger the area of the upper area, and the more likely it is for the SME A and B to choose a cooperation strategy. On the contrary, the SME A and B are more likely to choose a noncooperative strategy. In the game model of technology-based SME A and B, the position of the saddle point is affected by the income distribution coefficient, the cooperation cost sharing coefficient between the two parties, the cooperation income, the loss cost, the liquidated damages and the speculative income. Some scholars have shown that information technology sharing can promote collaborative innovation among technology-based SMEs. When the initial parameters reach a stable state, the cycle of collaborative innovation alliances among technology-based SMEs will become longer, which will boost the growth of technology-based SMEs [38].

3. Evolutionary Model of Fintech Boost Technology-Based SMEs Growth

Finance is an important force supporting the innovation and growth of technology-based SMEs. The development of technology-based SMEs not only requires internal technical support, but also requires a large amount of external financial support. In the process of research and development of new technology products for these enterprises, financing difficulties are the bottleneck restricting the development of enterprises. In the wave of fintech innovation, many financial institutions cooperate with technology-based SMEs, and use new technological tools to improve their business development and pay corresponding remunerations or give loan discounts. From the perspective of financing needs, financial institutions can solve the problem of insufficient funds for technology-based SMEs at different growth stages. Fintech institutions and technology-based enterprises can upgrade their business models through technological cooperation and fintech model in the digital age [39]. Based on the above content, this article adds the third-party game subject fintech institution C to the abovementioned technology-based SME A and B game model, and proposes the following hypotheses:

Hypothesis 5. Fintech institutions mainly meet the financing needs of technology-based SMEs in various stages of innovation and growth, and obtain technological tools for SMEs to improve their own business development. The collection of selection strategies of fintech institutions is {participate, not participate}. The three parties participating in the game are all bounded rationally, and the optimal strategy is selected through multiple games.

Hypothesis 6. When fintech institutions participate in the development of technology-based enterprises, the preferential policies provided by fintech institutions can reduce the total cost invested by enterprises A and B in the process of cooperation. The reduction is s, the interenterprise cost allocation coefficient remains unchanged. SME A and B can obtain cooperation benefits as R with the help of financial institutions, the distribution coefficient of cooperation income is $a\,(0 < a < 1)$, the income of enterprise A and B are aR, $(1-a)R$ respectively. Fintech institutions choose the strategy of "participating" in the development of technology-based enterprises, and their gains are represented by A_3.The fintech institution C chooses the strategy of "no participating," and the benefits it obtains are bA_3, $b(0 < b < 1)$ is the ratio of the income obtained by the fintech institution choosing the strategy of "no participating" to the income obtained by the fintech institution choosing the strategy of "participating."

Hypothesis 7. In participating in the collaborative innovation and growth of technology-based SMEs, fintech institutions must invest corresponding human and financial resources. They also need to supervise the business activities of technology-based SMEs. The total cost incurred is K_1. Fintech institutions give certain incentives to technology-based SMEs that actively participate in cooperation as K_2.

Table 2: Evolution and stability analysis of system equilibrium.

	det$J$	tr$J$	Stability
(0,0)	+	−	ESS
(0,1)	+	+	Unstable
(1,0)	+	+	Unstable
(1,1)	+	−	ESS
$(1 - tc + L_2 - W/(1-\theta)\Delta V - T_2 + L_2\ ,\ \ tc + L_1 - W/\theta\Delta V - T_1 + L_1)$	−		Saddle point

The proportion of fintech institution C choosing to participate in the strategy is z $(0 \le z \le 1)$, then the proportion of choosing the noncooperative strategy is $(1-z)$. And according to the above 7 assumptions, the payment matrix of the game between fintech institutions and technology-based SMEs is shown in Tables 3 and 4.

According to Tables 3 and 4, the expected benefits of technology-based SME A when adopting the strategy of "cooperation" U_A and the expected benefits when adopting the strategy "noncooperation" U_{1-A} and average return $\overline{U}_A$, respectively:

$$\begin{aligned} U_A &= yz\left[A_1 + \theta\Delta V - t(c-s) + K_2 + aR\right] + (1-y)z\left[A_1 - t(c-s) + K_2 + aR + W - L_1\right] \\ &\quad + y(1-z)\left(A_1 + \theta\Delta V - tc\right) + (1-y)(1-z)\left(A_1 + W - tc - L_1\right), \\ U_{1-A} &= yz\left(A_1 + T_1 - W\right) + (1-y)zA_1 + y(1-z)\left(A_1 + T_1 - W\right) + (1-y)(1-z)A_1, \\ \overline{U}_A &= xU_A + (1-x)U_{1-A}. \end{aligned} \tag{8}$$

The expected benefits and average benefits of technology-based SME B when adopting the strategy of "cooperation" U_B and the expected return U_{1-B} and average return $\overline{U}_B$ when adopting the strategy of "noncooperation" are as follows:

$$\begin{aligned} U_B &= xz\left[A_2 + (1-\theta)\Delta V - (1-t)(c-s) + K_2 + (1-a)R\right] + (1-x)z\left[A_2 - (1-t)(c-s) + K_2 + (1-a)R + W - L_2\right] \\ &\quad + x(1-z)\left[A_2 + (1-\theta)\Delta V - (1-t)c\right] + (1-x)(1-z)\left[A_2 + W - (1-t)c - L_2\right], \\ U_{1-B} &= xz\left(A_2 + T_2 - W\right) + (1-x)zA_2 + x(1-z)\left(A_2 + T_2 - W\right) + (1-x)(1-z)A_2, \\ \overline{U}_B &= yU_B + (1-y)U_{1-B}. \end{aligned} \tag{9}$$

The expected return of fintech institution C U_C when adopting the strategy of "participation" and the expected return U_{1-C} and average return $\overline{U}_C$ when adopting the strategy of "nonparticipation" are as follows:

$$\begin{aligned} U_C &= xy\left(A_3 - K_1 - 2K_2\right) + x(1-y)\left(A_3 - K_1 - K_2\right) + x(1-y)\left(A_3 - K_1 - K_2\right) + (1-x)(1-y)\left(A_3 - K_1\right), \\ U_{1-C} &= xybA_3 + x(1-y)bA_3 + x(1-y)bA_3 + (1-x)(1-y)bA_3, \\ \overline{U}_C &= zU_C + (1-z)U_{1-C}. \end{aligned} \tag{10}$$

It can be obtained from this that the dynamic equation for replication of technology-based SME A is as follows:

$$F_{(x)} = \frac{\mathrm{d}x}{\mathrm{d}t} = x(1-x)\left[z\left(aR + K_2 + ts\right)y\left(\theta\Delta V - T_1 + L_1\right) + W - tc - L_1\right]. \tag{11}$$

The dynamic equation for replication of technology-based SME B is as follows:

Table 3: Payment matrix of fintech institutions participating in the three-party game.

Fintech C		Enterprise B	
		Cooperation	Noncooperation
Enterprise A	Cooperation	$A_1 + \theta\Delta V - tc - s + K_2 + aR$, $A_2 + 1 - \theta\Delta V - (1-t)(c-s) + K_2 + (1-a)R$, $A_3 - K_1 - 2K_2$	$A_1 - tc - s - L_1 + K_2 + aR + W$, $A_2 + T_2 - W$, $A_3 - K_1 - K_2$
	Noncooperation	$A_1 + T_1 - W$, $A_2 - (1-t)(c-s) - L_2 + K_2 + (1-a)R + W$, $A_3 - K_1 - K_2$	A_1, A_2, $A_3 - K_1$

Table 4: Payment matrix of financial institutions nonparticipating in the three-party game.

Fintech C		Enterprise B	
		Cooperation	Noncooperation
Enterprise A	Cooperation	$A_1 + \theta\Delta V - tc$, $A_2 + 1 - \theta\Delta V - (1-t)c$, bA_3	$A_1 + W - tc - L_1$, $A_2 + T_2 - W$, bA_3
	Noncooperation	$A_1 + T_1 - W$, $A_2 + W - (1-t)c - L_2$, bA_3	A_1, A_2, bA_3

$$F_{(y)} = \frac{\mathrm{d}y}{\mathrm{d}t} = y(1-y)\{z[(1-a)R + K_2 + (1-t)s] + x[(1-\theta)\Delta V - T_2 + L_2] + W - (1-t)c - L_2\}. \tag{12}$$

The dynamic equation for replication of fintech institution C is as follows:

$$F_{(z)} = \frac{\mathrm{d}z}{\mathrm{d}t} = z(1-z)[(1-b)A_3 - K_1 - (x+y)K_2]. \tag{13}$$

Thus, the replication power system of technology-based SMEs A, B and fintech institution C is established as

$$\begin{cases} F_{(x)} = x(1-\mathrm{x})[z(\mathrm{aR} + K_2 + ts) + y(\theta\Delta\mathrm{V} - T_1 + \mathrm{L}_1) + W - tc - \mathrm{L}_1], \\ F_{(y)} = y(1-y)\{z[(1-a)R + K_2 + (1-t)s] + x[(1-\theta)\Delta V - T_2 + L_2] + W - (1-t)c - L_2\}, \\ F_{(z)} = z(1-z)[(1-b)A_3 - K_1 - (x+y)K_2]. \end{cases} \tag{14}$$

Proposition 1. *The equilibrium points of the dynamic evolutionary game of technology-based SME A, B and fintech institution C in the same equilibrium state are* $E_1 = (0,0,0)$, $E_2 = (0,0,0)$, $E_3 = (0,0,1)$, $E_4 = (0,1,0)$, $E_5 = (0,1,1)$, $E_6 = (1,0,0)$, $E_7 = (1,1,0)$, $E_8 = (1,1,1)$, *respectively.*

Proof 1. Separate orders $\mathrm{d}x/\mathrm{d}t = 0$, $\mathrm{d}y/\mathrm{d}t = 0$, $\mathrm{d}z/\mathrm{d}t = 0$ for the replication dynamic system of technology-based SME A, B and fintech institution C. It can be concluded that $E_1 = (0,0,0)$, $E_2 = (0,0,1)$, $E_3 = (0,1,0)$, $E_4 = (0,1,1)$, $E_5 = (1,0,0)$, $E_6 = (1,0,1)$, $E_7 = (1,1,0)$, $E_8 = (1,1,1)$ are the balance points of the system, and the proof is completed.

According to Friedman's method of constructing the Jacobian matrix, the first-order partial derivatives of x, y, and z of the dynamic equation are respectively calculated to determine the evolution and stability strategy of the system. The corresponding Jacobian matrix is as follows:

$$J = \begin{bmatrix} a_1 & x(1-x)(L_1 + \theta\Delta V - T_1) & x(1-x)(R_1 + K_2 + ts) \\ y(1-y)[L_2 + (1-\theta)\Delta V - T_2] & a_2 & y(1-y)[K_2 + R_2 + (1-t)s] \\ -z(1-z)K_2 & -z(1-z)K_2 & a_3 \end{bmatrix}, \tag{15}$$

where $a_1 = (1-2x)[z(aR + K_2 + ts)y \quad (\theta\Delta V - T_1 + L_1) + W - tc - L_1]$,

$$a_2 = (1-2y)\{z[(1-a)R + K_2 + (1-t)s] + x[(1-\theta)\Delta V - T_2 + L_2] + W - (1-t)c - L_2\} \quad (16)$$
$$a_3 = (1-2z)[(1-b)A_3 - K_1 - (x+y)K_2].$$

Bring the above eight equilibrium points into the Jacobian matrix, and the eigenvalues obtained by the solution are shown in Table 5.

In order to facilitate the analysis of the signs of the eigenvalues corresponding to each equilibrium point, without loss of generality, assuming the participation of financial institutions, the net income of three partner SME A, B and fintech institution C is greater than the net income of the three parties' independent development. i.e. $W - tc - T_1 > 0$, $W - (1-t)c - T_2 > 0$, $(1-b)A_3 - K_1 - 2\ K_2 > 0$. Considering the changes in parameters such as costs, cooperation benefits, and incentives paid by various participating entities when fintech institutions services technology-based SMEs, this article puts forward the following three propositions for discussion. □

Proposition 2. *When $K_2 + aR + W - t(c-s) - L_1 < 0$ and $K_2 + (1-a)R + W - (1-t)(c-s) - L_2 < 0$, the sum of the rewards and cooperation benefits of the fintech institution that the technology-based SME A adopts a cooperation strategy is less than the cooperation cost paid by the technology-based SME A with the participation of fintech institution C and the additional payment paid by the counterparty's midway exit. The sum of the cost of loss, and the sum of rewards and cooperation gains from fintech institutions that technology-based SME B adopts a cooperation strategy is less than the cooperation cost paid by SME B with the participation of fintech institutions and the additional loss cost paid by the counterparty's midway exit sum. At this time, the equilibrium point of the system is $E_2(0,0,1)$ and $E_8(1,1,1)$, then the evolution strategy of the system is {no cooperation, no cooperation, participation} and {cooperation, cooperation, participation}.*

Proposition 3. *When $W - tc - L_1 > 0$ or $W - (1-t)c - L_2 > 0$, the scientific and technology-based SME A adopts a cooperative strategy to obtain fintech institution rewards greater than the sum of the cost paid by SME A when the fintech institution C does not participate and the additional loss cost paid by the counterparty's midway exit. Or the SME B adopts a cooperative strategy to obtain fintech institution rewards greater than the sum of the cost paid by the SME B when the fintech institution C does not participate and the additional loss cost paid by the counterparty's enterprise withdrawing midway. At this time, the system equilibrium point is $E_8(1,1,1)$, then the system evolution strategy is {cooperation, cooperation, participation}.*

Proposition 4. *When $K_2 + aR + W - t(c-s) - L_1 > 0$ and $W - tc - L_1 < 0$ or $K_2 + (1-a)R + W - (1-t)(c-s) - L_2 > 0$ and $W - (1-t)c - L_2 < 0$, the sum of the rewards and cooperation benefits of the fintech institution that the technology-based SME A adopts a cooperation strategy is greater than the cooperation cost paid by the technology-based SME A with the participation of fintech institutions and the counterparty's half-way exit payment. The sum of the additional loss cost of the technology-based SME A, and the rewards of the fintech institution that the technology-based SME A adopts a cooperative strategy is less than the sum of the cost paid by the SME A when the fintech institution C does not participate and the additional loss cost paid by the counterparty's midway exit. Or technology-based SME B adopts a cooperation strategy to obtain fintech institution rewards and the sum of cooperation benefits is greater than the sum of the cooperation cost paid by the SME B with the participation of fintech institutions and the additional loss cost paid by the other party's company withdrawing midway, and SME B adopts a cooperative strategy to obtain fintech institution rewards that are less than the sum of the cost paid SME B when the fintech institution does not participate and the additional loss cost paid by the counterparty's enterprise withdrawing midway. At this time, the system equilibrium point is $E_8(1,1,1)$, then the system evolution strategy is {cooperation, cooperation, participation}.*

Proof 2. According to the Lyapunov stability theory, the asymptotic stability at the equilibrium point is judged by analyzing the eigenvalues of the Jacobian matrix. When the eigenvalues are all nonpositive, the equilibrium point is the stable point of the evolutionary game. These judges the system equilibrium point of the above three propositions, as shown in Table 6, and the proof is complete. □

4. Case and Simulation Analysis of Fintech Supports Enterprises Growth

In recent years, many governments have paid more and more attention to the development of technology-based SMEs and adopted a series of policies and actions to support the development of SMEs. In response to the innovation and financing of technology-based SMEs, more cities centered on the themes of high-tech enterprises and fintech, and encouraged banks to increase loans to technology-based enterprises through diversified fintech policies, so as to smooth the capital chain and solve problems. It is difficult for enterprises to obtain financing, so ensure sufficient funds. This article selects cities for research to understand the specific situation of technology-based SMEs. Then, we conduct case scenario simulations based on research. There are technology-based SME A, B and financial institution C in the innovation network. In order to judge the evolution path of each participant more intuitively, numerical experiments are used to analyze the influence of the selection of A and B evolution strategies of fintech institutions and SMEs and the changes of parameters on the evolution path. According to the above assumptions, the parameters in the payout matrix need to satisfy $W - tc - T_1 > 0$, $W - (1-t)c - T_2 > 0$, $(1-b)A_3 - K_1 - 2K_2 > 0$. Suppose the initial value of each parameter in the subject of the three-party game: $\Delta V = 20$, $\theta = t = a = b = 0.5$, $A_1 = 25$, $A_2 = 30$, $A_3 = 60$, $W = 30$, $R = 16$, $s = 16$, $c = 50$, $T_1 = 5$, $T_2 = 10$, $L_1 = 40$, $L_2 = 45$, $K_1 = 10$, $K_2 = 8$. In addition, the initial willingness to participate in fintech institutions and SME A and B is $x = y = z = 0.5$.

Table 5: Eigenvalues of Jacobian matrix.

Equilibrium point	λ_1	λ_2	λ_3
$E_1(0,0,0)$	$W - tc - L_1$	$W - (1-t)c - L_2$	$(1-b)A_3 - K_1$
$E_2(0,0,1)$	$K_2 + aR + W - t(c-s) - L_1$	$K_2 + (1-a)R + W - (1-t)(c-s) - L_2$	$-[(1-b)A_3 - K_1]$
$E_3(0,1,0)$	$\theta\Delta V + W - T_1 - tc$	$-[W - (1-t)c - L_2]$	$(1-b)A_3 - K_1 - K_2$
$E_4(0,1,1)$	$K_2 + aR + \theta\Delta V + W - t(c-s) - T_1$	$-[K_2 + (1-a)R + W - (1-t)(c-s) - L_2]$	$-[(1-b)A_3 - K_1 - K_2]$
$E_5(1,0,0)$	$-(W - tc - L_1)$	$(1-\theta)\Delta V - T_2 + W - (1-t)c$	$(1-b)A_3 - K_1 - K_2$
$E_6(1,0,1)$	$-[K_2 + aR + W - t(c-s) - L_1]$	$K_2 + (1-a)R + W - (1-t)(c-s) + (1-\theta)\Delta V - T_2$	$-[(1-b)A_3 - K_1 - K_2]$
$E_7(1,1,0)$	$-[\theta\Delta V - T_1 + W - tc]$	$-[(1-\theta)\Delta V - T_2 + W - (1-t)c]$	$(1-b)A_3 - K_1 - 2K_2$
$E_8(1,1,1)$	$-[K_2 + aR + W] - t(c-s) + \theta\Delta V - T_1$	$-[K_2 + (1-a)R + W - (1-t)(c-s) + (1-\theta)\Delta V - T_2]$	$-[(1-b)A_3 - K_1 - 2K_2]$

Table 6: The local stability of the equilibrium point of the system (Proposition 2, 3, 4).

Equilibrium point	Proposition 2			
	λ_1	λ_2	λ_3	Stability
$E_1(0,0,0)$	—	—	+	Unstable
$E_2(0,0,1)$	—	—	—	ESS
$E_3(0,1,0)$	+	+	+	Saddle point
$E_4(0,1,1)$	+	+	—	Unstable
$E_5(1,0,0)$	+	+	+	Saddle point
$E_6(1,0,1)$	—	+	—	Unstable
$E_7(1,1,0)$	—	—	+	Unstable
$E_8(1,1,1)$	—	—	—	ESS
Equilibrium point	Proposition 3			
	λ_1	λ_2	λ_3	Stability
$E_1(0,0,0)$	+	+	+	Saddle point
$E_2(0,0,1)$	+	+	—	Unstable
$E_3(0,1,0)$	+	—	+	Unstable
$E_4(0,1,1)$	+	—	—	Unstable
$E_5(1,0,0)$	—	+	+	Unstable
$E_6(1,0,1)$	—	+	—	Unstable
$E_7(1,1,0)$	—	—	+	Unstable
$E_8(1,1,1)$	—	—	—	ESS
Equilibrium point	Proposition 4			
	λ_1	λ_2	λ_3	Stability
$E_1(0,0,0)$	—	—	+	Unstable
$E_2(0,0,1)$	+	+	—	Unstable
$E_3(0,1,0)$	+	+	+	Saddle point
$E_4(0,1,1)$	+	—	—	Unstable
$E_5(1,0,0)$	+	+	+	Saddle point
$E_6(1,0,1)$	—	+	—	Unstable
$E_7(1,1,0)$	—	—	+	Unstable
$E_8(1,1,1)$	—	—	—	ESS

According to the above numerical settings, the dynamic changes of fintech institution C and technology-based SME A and B's different initial willingness change strategy choices are simulated. On this basis, it further explores the influence of the reduction in cooperation cost of technology-based SMEs, the distribution coefficient of cooperation benefits, the cooperation cost of financial institutions and the changes in incentive parameters on the evolution path of technology-based SMEs when fintech institutions participate in cooperation.

4.1. Scenario Analysis of the Main Body's Initial Willingness. In the growth process of technology-based SMEs, the willingness of enterprises and fintech institutions to participate in cooperation affects the choice of their development strategies. Figure 1 is a simulation analysis of the impact of changes in the initial willingness of fintech institution C and SME A and B on the adoption of strategies under the condition that other initial parameters remain unchanged. Assuming that the initial willingness of the three parties in the game is the same, that is, as shown in Figure 1, the initial willingness thresholds of fintech institutions and SME A and B are between 0.4 and 0.5.When the initial willingness of the three parties to participate in cooperation is less than the critical value of 0.4, x and y converge to 0, z converges to 1, and the final equilibrium point tends to (0, 0, 1). At this time, well-developed SME B's willingness to participate is faster than enterprise A's convergence rate; when the initial willingness of the three parties to participate

in cooperation is greater than the critical value 0.5, x, y, z converge to 1, and the final equilibrium point tends to (1, 1, 1). At this time, the larger the parameter value of the initial willingness to participate in cooperation of SME A, the faster its convergence speed; when the initial willingness of the three parties to participate in cooperation is at a moderate level, the initial willingness of financial institutions to participate in cooperation slowly rises. The willingness of SME A to participate in cooperation is also rising, while the willingness of SME B to cooperate is slowly decreasing. With the increasing willingness of fintech institution C and SME A to participate in cooperation, the willingness of SME B to cooperate continues to rise, eventually all choose to participate. When the willingness of the three parties to participate in cooperation is high, the willingness of fintech institutions and technology-based SMEs to participate in cooperation will rise directly, and finally converge to the equilibrium point (1, 1, 1). The results show that as the initial willingness of the three parties to participate in cooperation continues to increase, x and y converge to 1 faster, and z converges to 1 slower. Eventually, the three parties will tend to participate in the cooperation. In the process, when financial institutions have a strong willingness to participate in cooperation, technology-based SMEs will eventually choose to cooperate and reach long-term cooperation with financial institutions, obtain financial support, and achieve their own stable development.

Whether technology-based SMEs cooperate with fintech institutions is affected by similar technology-based SMEs. Figure 2 is a simulation analysis of the impact of changes in the initial willingness of technology-based SME A on the strategies adopted by the three parties under the condition that other parameters remain unchanged. It can be seen from Figure 2 that the initial willingness to cooperate between technology-based SME B and fintech institution C is in a neutral state, and the initial willingness of technology-based SME A is between 0.3 and 0.4. When the initial willingness value of technology-based SME A is less than 0.3, x, y all converge to 0, z converges to 1, and the final equilibrium point tends to (0, 0, 1). At this time, the technology-based SME B with a higher initial willingness to participate is affected by the willingness of enterprise A to participate, and it converges that the speed is faster; when the initial willingness value of technology-based SME A is greater than 0.4, x, y, and z all converge to 1, and the final equilibrium point tends to (1, 1, 1). At this time, the enterprise with a higher initial willingness value A's convergence to 1 is faster than that of technology-based SME B. When technology-based SME A's initial willingness to cooperate is less than enterprise B, as enterprise A's initial willingness continues to decrease, enterprise B's initial willingness declines faster, and the willingness to cooperate with fintech institutions has risen slowly. When the initial value of willingness to cooperate with technology-based SME A is greater than that of enterprise B, the willingness to cooperate with enterprise A continues to increase, and the willingness to cooperate with enterprise B first slowly decreases and then continues to rise. The willingness to cooperate with financial institutions still rises slowly, and finally converges to Equilibrium point (1, 1, 1). The results show that the willingness of technology-based SMEs to participate in cooperation continues to rise, and the willingness to participate in the same type of enterprise B and financial institutions will gradually become stronger. This is due to the fintech institutions that provide certain financial incentives to participating technology-based SMEs and the influence of market behavior, whether small and medium-sized enterprises adopt cooperation strategies is greatly affected by the willingness of peer companies to participate. When one party has less willingness to participate in cooperation, they will eventually choose a noncooperative strategy.

Whether technology-based SMEs cooperate with fintech institutions is affected by the willingness of financial institutions to cooperate. Figure 3 is a simulation analysis of the three parties' willingness to participate in cooperation under the condition that other parameters remain unchanged. It can be seen from Figure 3 that both technology-based SMEs A and B are in a neutral state, and the willingness of financial institutions to participate in cooperation is between 0.3 and 0.4. When the willingness of financial institutions to cooperate is less than the critical value of 0.3, x and y both converge to 0, z Converges to 1, and the final equilibrium point tends to (0, 0, 1). At this time, the willingness of technology-based SMEs A and B to participate in cooperation is greatly reduced. When the willingness of fintech institutions to participate in cooperation is greater than the critical value of 0.4, x, y, and z are all converges to 1, and the final equilibrium point tends to (1, 1, 1). At this time, the willingness of technology-based SMEs A and B to participate in cooperation increases sharply with the increase of financial institutions' willingness to cooperate, and finally converges to 1. The willingness of financial institutions to participate in cooperation continues to increase. The willingness of small and medium-sized technological enterprises to participate in cooperation has decreased sharply and then increased sharply, and finally reached cooperation with financial institutions. The results show that when financial institutions' willingness to cooperate is low, technology-based SMEs remain on the sidelines, and their willingness to cooperate sharply declines over time; the greater the willingness of financial institutions to cooperate, the greater the willingness of technology-based SMEs to participate in cooperation will increase. This is also due to the fact that cooperation with low- and middle- and low-tech enterprises can bring itself the development of financial technology and additional cooperation benefits, and financial institutions will change from a lower willingness to participate in cooperation to a higher willingness to cooperate.

Figure 4 is a simulation analysis of the three parties' final cooperation strategy when the willingness to participate in cooperation changes at the same time when other parameters remain unchanged. It can be seen from Figure 4 that when the willingness of technology-based SME A and company B to participate in cooperation is very low, even if the willingness of financial institutions to participate in cooperation is high, both x and y converge to 0, and z converges to 1, neither technology-based SMEs A nor B will adopt a cooperation strategy. When the willingness of technology-based SME A and enterprise B to participate in

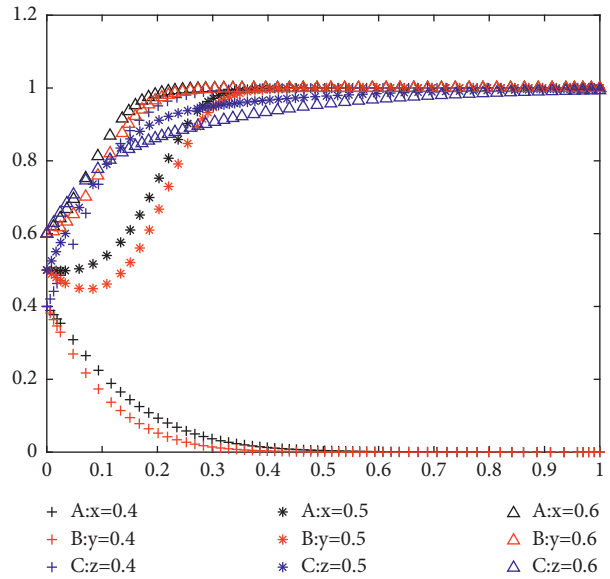

Figure 1: Evolutionary analysis of the simultaneous changes of the initial willingness to participate in cooperation (x), (y), and (z).

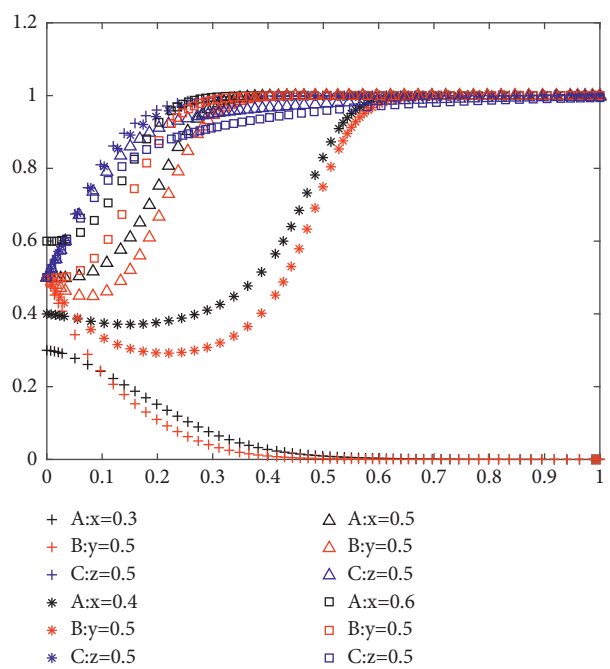

Figure 2: Evolutionary analysis of initial willingness to participate in cooperation (x) changes.

cooperation is high, even if the willingness of financial institutions to participate in cooperation is low, x and y will converge to 1, and z will converge to 1. That is, technology-based SMEs A and B are willing to cooperate with financial institution C, and the weaker technology-based SME A's willingness to participate in cooperation converges faster than company B.

4.2. Scenario Analysis of Changes in Enterprise Cooperation Costs. The changes in cost reduction brought about by the establishment of cooperation between fintech institutions and technology-based SMEs affect the strategies adopted by enterprises A and B in their growth and development. Figure 5 is a simulation analysis of the reduction in cooperation costs brought by fintech institutions to technology-based enterprises when other parameters remain unchanged. It can be seen from Figure 5 that the critical value of the cooperation cost reduction S is between 8 and 12. When the cooperation cost reduction is less than the critical value, x and y converge to 0, and the final equilibrium point converges to (0, 0, 1), With the continuous increase of S, the convergence speed of x and y slows down, and the reduction of technology-based small and medium-sized enterprises A

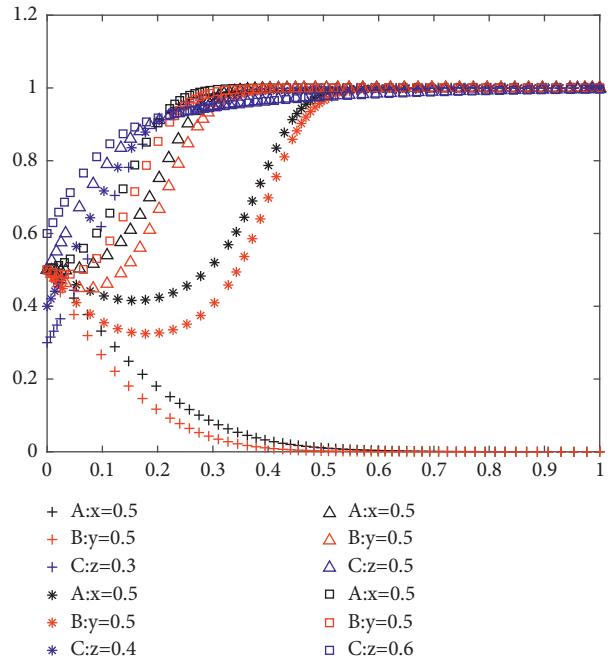

Figure 3: Evolutionary analysis of changes in initial willingness to participate in cooperation (z).

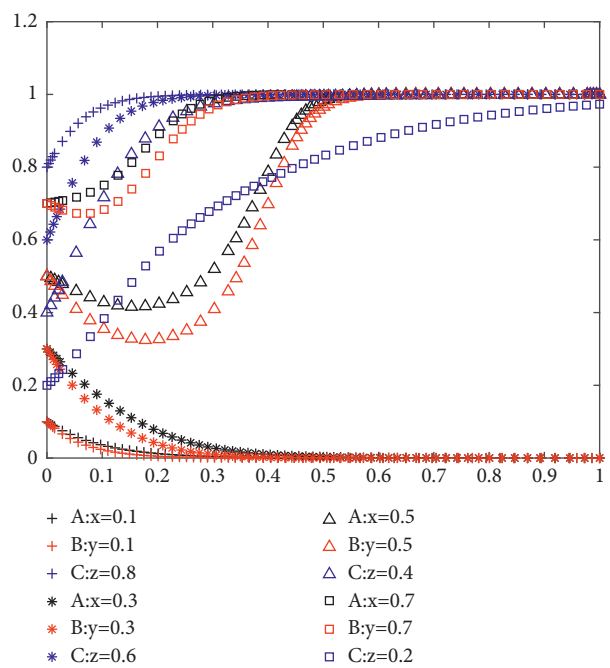

Figure 4: Evolutionary analysis of the initial willingness to participate in cooperation x and y simultaneously change.

is obvious. When the reduction in cooperation cost is greater than the critical value, x and y converge to 1, and the final equilibrium point converges to (1, 1, 1). As S continues to increase, the convergence speed of x and y accelerates. Similarly, the convergence speed of enterprise A is higher than that of enterprise B. The results show that when the reduction in cooperation costs is not enough to bring more benefits to the cooperation between technology-based SMEs, technology-based SMEs will not reach cooperation with fintech institutions. The cost reduction brought about by cooperation with fintech institutions affects whether technology-based SMEs adopt cooperation strategies, and it has a greater impact on the weaker technology-based SME A.

4.3. Scenario Analysis of Changes in Enterprise Revenue. The cooperation benefits brought by the collaborative innovation between fintech institutions and technology-based

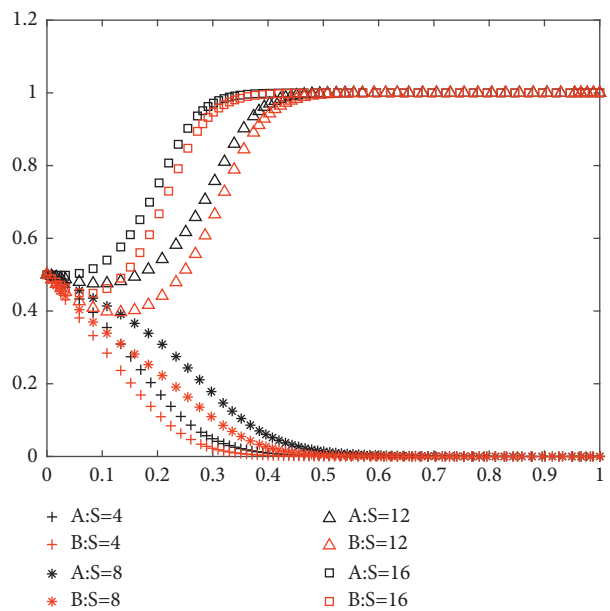

Figure 5: Evolutionary analysis of the change in the reduction of cooperation costs of SMEs with the participation of fintech institutions.

SMEs influence the strategies adopted by SMEs A and B in their growth and development. Figure 6 is a simulation analysis of the change in the amount of cooperation income R brought by financial institutions to scientific and technological enterprises when other parameters remain unchanged. It can be seen from Figure 6 that under the condition that other parameters remain unchanged, the critical value of the cooperation income R with fintech institutions is between 10 and 13. When the cooperation income is lower than the critical value, both x and y converge to 0, and the final equilibrium point Converges to (0, 0, 1), and R increases continuously, the speed at which x and y converge to 0 slows down. When the cooperative gain is higher than the critical value, x and y both converge to 1, and the final equilibrium point converges to (1, 1, 1), and with the continuous increase of R, the speed at which x and y converge to 1 accelerates, small and medium-sized enterprises are willing to adopt cooperative strategies. The results show that the higher the cooperation benefits brought by the collaborative innovation between fintech institutions and technology-based SMEs, the greater the willingness of technology-based SMEs to participate in cooperation. This is also due to the fact that cooperation with fintech institutions can bring externalities to technology-based SMEs. The financing channels reduce the pressure of shortage of funds, so as to better realize their own growth and development.

4.4. Scenario Analysis of Cooperation Costs in Fintech Services. The cost of collaborative cooperation between fintech institutions and technology-based SMEs affects the strategies adopted by technology-based SMEs A and B and fintech institution C. Figure 7 is a simulation analysis of the strategies adopted by the three parties to the cost changes of fintech institutions participating in the cooperation of technology-based SMEs. It can be seen from Figure 7 that the critical value of the cost K_1 paid by financial institutions to participate in cooperation is between 10 and 22. When the cost of participating in cooperation K_1 of fintech institutions is less than the critical value, x, y, and z all converge to 1, and the final equilibrium point converges to (1, 1, 1), fintech institutions are willing to cooperate with technology-based small and medium-sized enterprises A and B. When the cost of fintech institutions' participation in cooperation K_1 is greater than the critical value, x, y, and z all converge to 0, and the final equilibrium point converges to (0, 0, 0), fintech institutions and SMEs A and B are unwilling to cooperate, and the willingness of fintech institutions to participate has converged to 0 faster than technology-based SMEs A and B. The results show that when the cost of participating in cooperation is high, the benefits of fintech institutions are far less than those of noncooperative strategies. Fintech institutions will not be willing to cooperate, and high-tech SMEs will not seek help from fintech institutions.

4.5. Scenario Analysis of Incentive Changes in Fintech Cooperation. The financial rewards given by fintech institutions for participating in cooperative technology-based SMEs affect the strategies adopted by technology-based SMEs A and B and fintech institution C. Figure 8 is a simulation analysis of the strategy adopted by the three parties for changes in the financial reward K_2 given by fintech institutions to participating in cooperative SMEs. It can be seen from Figure 8 that the critical value of the financial reward K_2 given by fintech institutions for participating in cooperative technological SMEs is between 8 and 14. When the financial reward given by fintech institutions to participating technological SMEs is less than the critical value, x, y Both converge to 0, z converges to 1, and the final equilibrium point converges to (0, 0, 1), technology-based SMEs are unwilling to adopt cooperation strategies. When

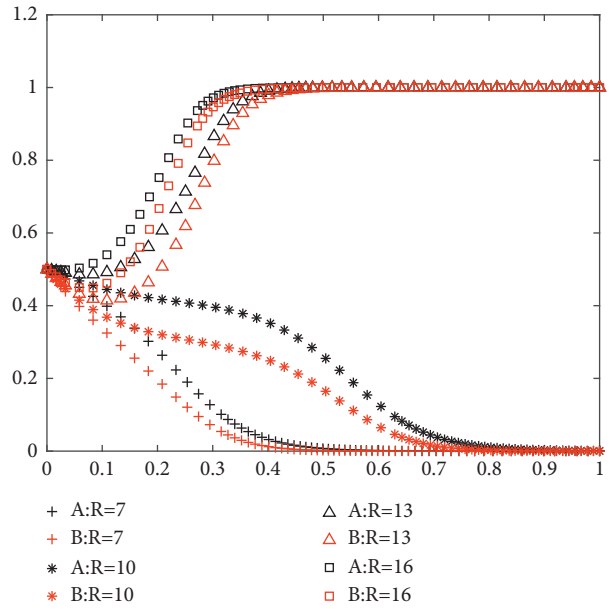

Figure 6: Evolutionary analysis of the changes in the cooperative income of SMEs with the participation of fintech institutions.

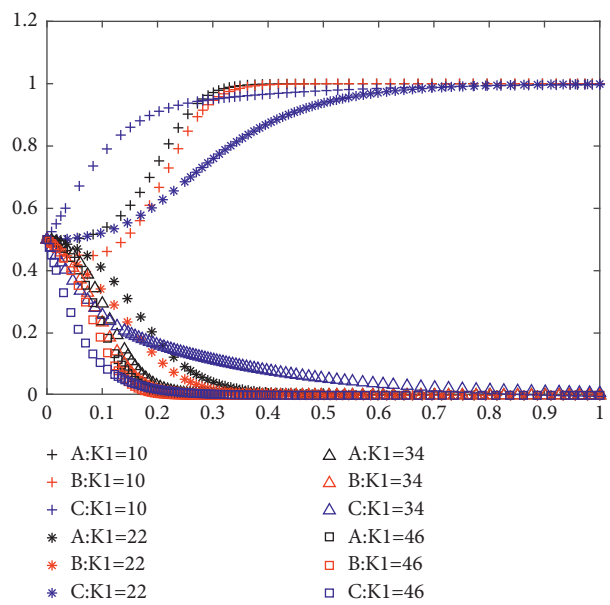

Figure 7: Evolutionary analysis of the cost changes of financial institutions participating in the cooperation of technology-based SMEs.

fintech institutions give financial rewards for participating in cooperative technology-based SMEs greater than the threshold value, x, y both converge to 1, z converges to 0, and the final equilibrium point converges to (1, 1, 0), financial institutions are unwilling to adopt cooperative strategies. The financial reward is between the critical values, x, y, z all converge to 1, and the final equilibrium point converges to (1, 1, 1), the three parties are willing to cooperate, and as the financial reward K_2 continues to increase, small and medium-sized technology-based Enterprises' willingness to participate in cooperation converges to 1 faster than fintech institutions. The results show that when financial institutions give relatively low financial rewards for participating in cooperative technology-based SMEs, due to the choice of peer companies and market behavior, the subjective willingness of technology-based SMEs to participate in cooperation is small, and when the financial reward reaches a certain standard, Technology-based SMEs will reach a

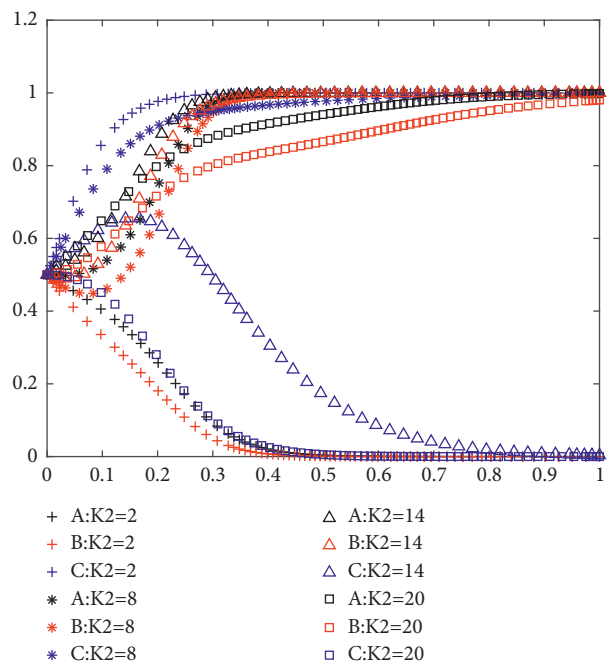

Figure 8: The evolution analysis of fintech institutions' funding support parameters for technology-based SMEs.

cooperation agreement with fintech institutions. Once fintech institutions give financial rewards to participating technology-based SMEs beyond the scope of fintech institutions' commitments, fintech institutions' willingness to participate in cooperation will show a slow increase and then a sharp decline. The final choice is noncooperative strategy.

5. Conclusions

Technology-based SMEs with better upstream development and strong strength provide technical knowledge, financing channels and corporate management methods to downstream companies of the same type with weaker downstream innovation and growth. Technology cooperation between technology-based SMEs cannot meet the funding gap needed in the later stages of enterprise growth, and technology-based SMEs have to seek support from other financing institutions. With the participation of fintech institutions in cooperation, technology-based SMEs can provide them with technical knowledge to obtain financial support, and financial institutions can also use the technology of the other company to complete their own business transformation. This paper establishes the evolutionary game model of technology-based SMEs A, B and fintech institution C, systematically analyzes the strategies adopted by the three-party game of technology-based SMEs A, B and fintech institution C, and conducts case simulation to analyze its influencing factors, and draws the following in conclusion:

(1) Technology-based SMEs A and B and financial institution C's willingness to participate in cooperation have different influences on each other's choice of strategies. The strategy adopted by technology-based SMEs is greatly affected by the willingness of peer companies to participate in cooperation. When companies with stronger development capabilities are less willing to participate, companies of the same type will not actively seek cooperation from fintech institutions. The influence of technology-based SMEs adopted strategies that are affected by fintech institutions' willingness to participate in cooperation is significant. When fintech institutions are more willing to participate in cooperation, SMEs will seek cooperation. Therefore, fintech institutions should increase their enthusiasm for establishing cooperation with SMEs, cooperate extensively with enterprises, provide corresponding financial support, and make full use of existing technical knowledge to realize digital business transformation.

(2) With the participation of fintech institutions, the reduction of cooperation costs and the changes in cooperation gains of technology-based SMEs have a significant impact on the strategies adopted by the tripartite entities. The reduction of the cooperation cost of fintech institutions is higher than the range that they can bear, and the willingness of fintech institutions to participate in cooperation is reduced; the profit value of SMEs after the participation of fintech institutions is lower than the expected range, and the establishment of SMEs and fintech institutions that the willingness to cooperate is reduced. Therefore, in order to promote cooperation between technology-based SMEs and fintech institutions, the distribution of cooperation costs and cooperation benefits must be fair and reasonable, so as to achieve mutual benefit and win-win results for multiple parties, and promote the sustainable growth of enterprises.

(3) Fintech institutions are more sensitive to the cost and financial support of participating in cooperation than high-tech SMEs. The cost and the value of financial support paid by fintech institutions in participating in the cooperation are within a certain range. Fintech institutions are willing to provide cooperation support to technology-based SMEs. Once they exceed expectations, fintech institutions will no longer establish cooperative relations. Therefore, when establishing cooperation between fintech institutions and high-tech SMEs, they should do what they can, formulate reasonable cooperation costs, appropriately increase support, guide enterprises to actively participate in the cooperation, and to a certain extent alleviate the financing pressure of high-tech SMEs.

In the growth process of technology-based SMEs, learning from the development experience and practice paths of stronger enterprises and reaching cooperative technological innovations can reduce the problems encountered in the growth of enterprises. Fintech institutions launch innovative technology credit products based on the development needs and characteristics of technology-based enterprises in the cluster network to improve the service strength of finance. In the fintech innovation, in addition to the impact of financial institutions on the development of technology-based SMEs, relevant government measures will also change the direction of development. In order to promote the development of fintech and promote the industrialization of scientific and technological achievements of SMEs, some local governments will issue relevant policies to help them establish a relationship, promote the cooperation between fintech institutions and SMEs, and realize "technology + policy + finance." The tripartite dialogue mechanism and docking platform of "enterprise creation" provides a full range of services for regional scientific and technological innovation.

Data Availability

The method in this article is computer mathematical simulation. Model parameter data are set based on enterprise interviews.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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