

Research on the Evolution Path of Supply Chain Financing for Small and Medium-sized Enterprises

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Abstract: Information asymmetry is the main reason why it is difficult and expensive for small and medium-sized enterprises to obtain financing. This paper uses the system dynamics method to construct an evolution model of the supply chain financing system of small and medium-sized enterprises, simulates the dynamic changes of the financing amount of the supply chain financing system of small and medium-sized enterprises, and explores the relationship between various influencing factors and their effects on the financing amount. The research shows that the supply chain financing of SMEs is a complex and dynamic system, and the overall financing amount has a significant cumulative effect, and is more sensitive to the solvency of SMEs, the relationship between core enterprises and financial institutions, government support, and the degree of supply chain information sharing. In order to alleviate the financing difficulties of small and medium-sized enterprises, the government should increase support for the supply chain financing of small and medium-sized enterprises, banks and other financial institutions should strengthen the supply chain financing service capabilities of small and medium-sized enterprises, small and medium-sized enterprises should pay attention to the improvement and upgrading of internal management, and the main body of the supply chain should strengthen cooperation and communication.

Keywords: SME, Supply chain finance, Evolutionary pathways, System dynamics.

1. Introduction

According to the research "2021 Report on the Financing and Development of China's Small, Medium and Micro Enterprises", small and medium-sized enterprises account for 96.5% of China's market entities, contribute 60% of GDP and 80% of employment, which shows the importance of small and medium-sized enterprises in the national economy. However, due to the macroeconomic downturn, small and medium-sized enterprises are facing the problem of difficult and expensive financing, resulting in increased survival pressure and difficult development.

Xionghua Tao^[1] analyzed the financing problems and current situation of small and medium-sized enterprises in China, and believed that information asymmetry is the fundamental reason for the difficulty and high cost of financing for small and medium-sized enterprises. Wandfluh, M.^[2] argue that supply chain finance can reduce the information asymmetry between borrowers and borrowers to a certain extent. Changsheng Bao^[3] believes that supply chain financing can play a certain alleviating effect on the financing of small and medium-sized enterprises. Songhua^[4] found that supply chain financing has achieved the optimization of the financing structure and cash flow of micro, small and medium-sized enterprises, as well as the visibility of the funds of core enterprises. Silvestro^[5] argue that due to the changes in the composition and transmission channels of corporate credit risk, banks should carry out inspections or spot checks on supply chain enterprises, so as to more effectively manage and prevent credit risks in supply chain finance business.

In summary, supply chain financing can reduce information asymmetry, thereby facilitating the access of small and medium-sized enterprises to finance. Therefore, it is of great significance to analyze the influencing factors of the supply chain financing system of SMEs, construct the evolution

model of supply chain financing for SMEs, and explore the evolution path of supply chain financing for SMEs.

2. Model

2.1. Suitability analysis of the model

Systems dynamics is an approach that applies multiple disciplines such as mathematics, physics, and computer science to analyze and solve complex systemic problems by building models. The system dynamics method can use simulation to analyze nonlinear, multi-level, multi-feedback, complex and changeable system problems, which is suitable for the research of supply chain financing system of small and medium-sized enterprises.

2.2. System boundaries and model assumptions

2.2.1. System boundaries

First of all, this study will use supply chain finance as the main object of research, so the system boundary should include all links and participants related to supply chain finance. Secondly, in the process of determining the system boundary, the interaction between the supply chain financing system and the external environment needs to be considered. Finally, the availability and operability of data need to be taken into account in the determination of system boundaries.

2.2.2. Model assumptions

First, we assume that there is a stable cooperative relationship between the various actors in the supply chain financing system. Second, we assume that the market environment in the supply chain financing system is relatively stable. Third, we assume that the behavior of each actor in the supply chain financing system is rational. Fourth, we assume that the external environmental factors in the supply chain financing system are constant. Finally, we assume that the influencing factors in the supply chain financing system are

linear.

2.3. Cause and effect diagrams

According to the analysis of the correlation between the

influencing factors index system, the causal relationship diagram of the supply chain financing system of small and medium-sized enterprises is formed as shown in Figure 1.

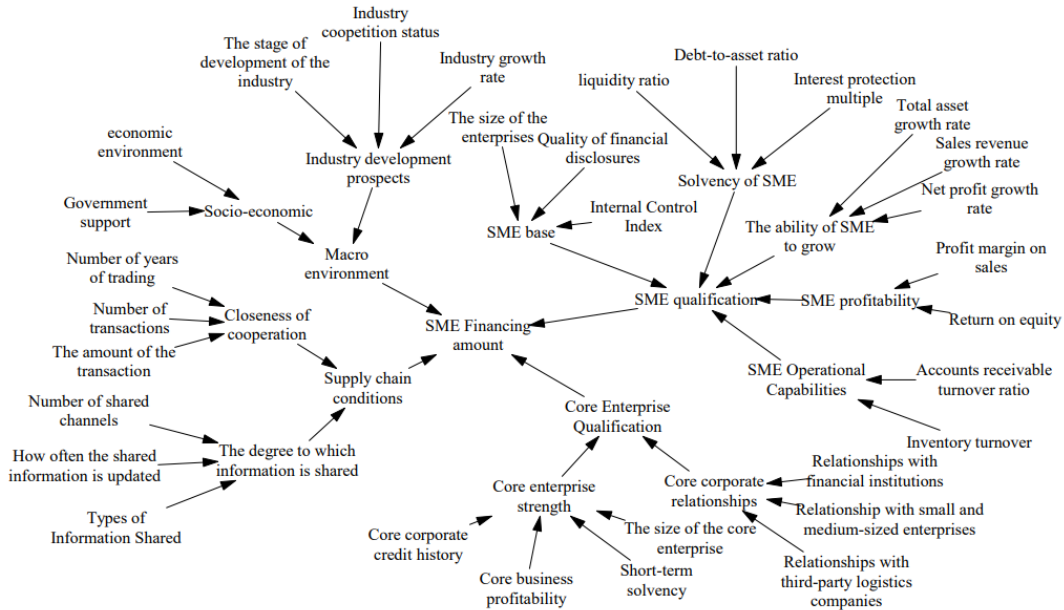


Figure 1. Cause and effect diagrams

2.4. System flow diagram

According to the causal diagram, the dynamic model of the

supply chain financing system of small and medium-sized enterprises can be established, and the system flow stock diagram can be obtained, as shown in Figure 2.

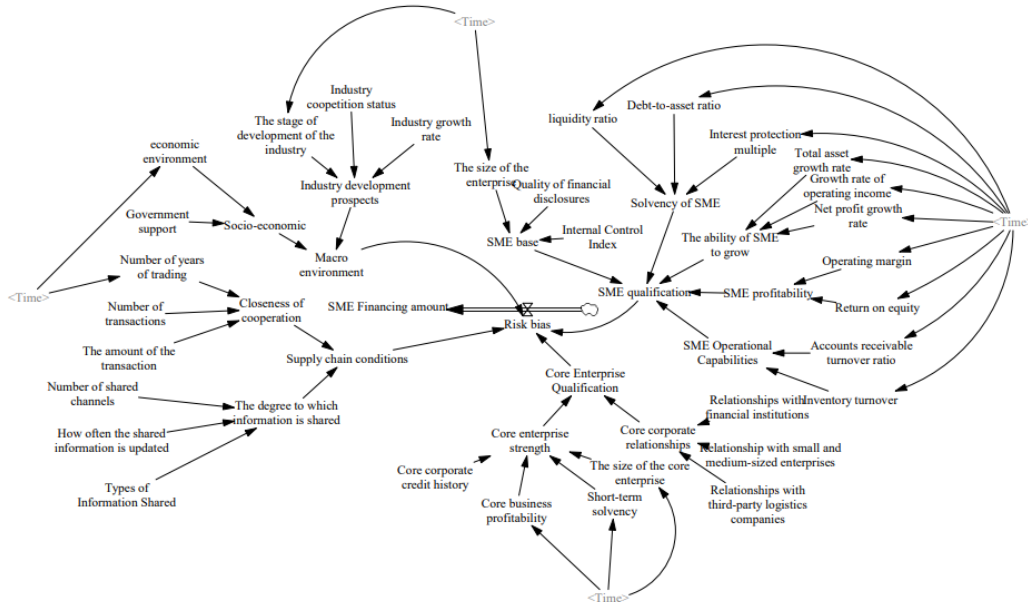


Figure 2. System flow diagram

3. Case simulation

3.1. Case Overview

With the modernization of the automobile industry and the continuous improvement of national support for new energy vehicles, automobile supply chain finance has gradually become a new direction for the innovation and development of commercial banks. Chongqing RTJG Company is a high-tech enterprise based on science and technology, R&D and production. The company mainly produces automotive

transmission boxes, new energy vehicle reducer assemblies, communication boxes, new energy vehicle electronic control boxes, etc. In this paper, the data of RTJG's annual reports from 2015 to 2021 are selected for simulation and analysis.

3.2. Simulation

In the Vensim PLE software, the weights of the influencing factors and the Vensim equation were input into the established dynamic model of the supply chain financing system of small and medium-sized enterprises, and the system was simulated and analyzed.

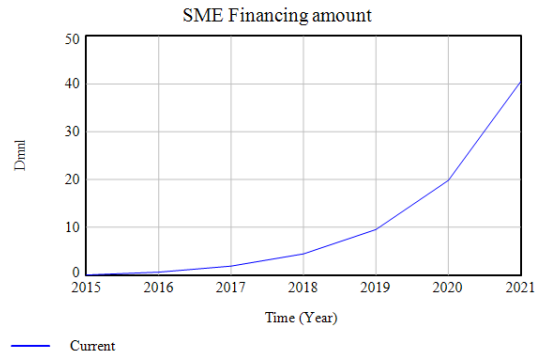


Figure 3. Trends in SME financing quotas

In Figure 3, the financing quota indicator is a state variable, also known as stock, which is a cumulative amount that gradually increases over time. The supply chain financing limit of SMEs is affected by four subsystems: macro environment, SME qualification, core enterprise qualification, and the overall status of the supply chain.

3.3. Sensitivity analysis

Sensitivity analysis refers to changing the value of a variable in the model and observing the changes in the model results through the re-operation of the model. Since you can only change the value of one of these variables at a time when you run the model again, the change of the variables may not change the performance of the model, or sometimes it may have little effect on the results of the model. Only the key variables can make the model results change, and finding the key variables that can change the model results is the significance of building the model. We need to compare the

changes in the model results through multiple simulations to find out the key variables in the model, and then change the values of the key variables to optimize the system to achieve our desired goal or state.

3.3.1. Improving the solvency of small and medium-sized enterprises

Through the simulation and analysis of the status risk subsystem of small and medium-sized enterprises, the indicators of growth ability, solvency and operating ability are selected to run the model repeatedly, and it can be found that the interest protection ratio has a strong sensitivity to debt repayment ability and credit risk. Adjust the assignment of the "Interest Guarantee Multiple" indicator in the model, increase it by 10 times on the basis of the initial assignment, and name it "Current1", and then reduce it by 10 times on the basis of the initial assignment, name it "Current2", and before the adjustment is "Current", and get Figure 4 as follows:

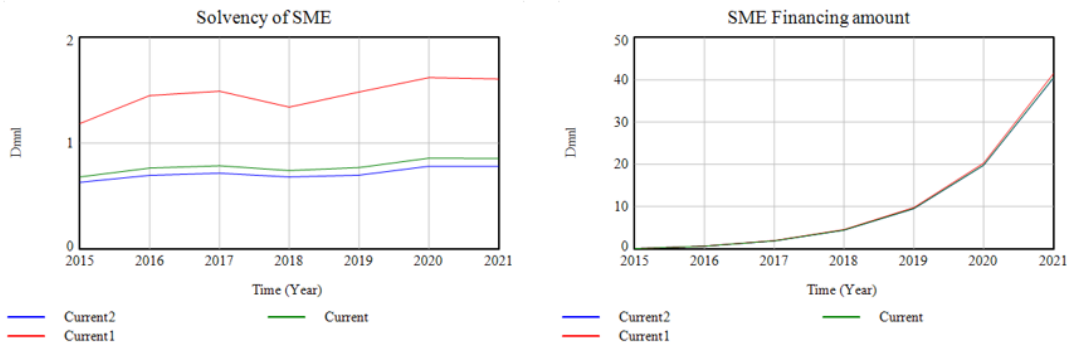


Figure 4. Interest protection multiple sensitivity analysis

The above figure reflects that the debt repayment capacity of SMEs has been increased after the measures of increasing the interest protection ratio have been adopted, and thus the supply chain financing limit of SMEs has been increased, while the debt repayment capacity and supply chain financing line of SMEs have decreased when the interest protection ratio has been reduced. Financial institutions need to evaluate small and medium-sized enterprises, carry out supply chain financing business with small and medium-sized enterprises with strong solvency, and establish strategic cooperative relationships to achieve a win-win situation.

3.3.2. Improve the relationship between core enterprises and financial institutions

Through the simulation analysis of the core enterprise

qualification subsystem, the relationship between the core enterprise and each subject has the greatest impact on the system, and the strategy of improving the relationship between the core enterprise and financial institutions is proposed. In view of this measure, the assignment of the indicator of "the relationship between core enterprises and financial institutions" in the model is adjusted, which is increased by 10 times on the basis of the initial assignment and named it "Current1", and then reduced by 10 times on the basis of the initial assignment, named "Current2", and "Current" before adjustment, and Figure 5 is obtained as follows:

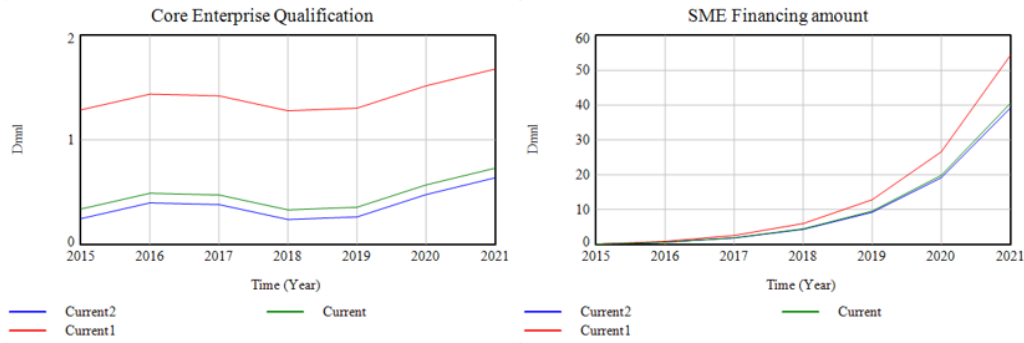


Figure 5. Relationship sensitivity analysis with financial institutions

The above figure reflects that the qualification and financing quota of core enterprises have increased after the measures have been taken to improve the relationship between core enterprises and financial institutions, indicating that the relationship between core enterprises and financial institutions can reduce the financing risk of SME supply chain. This is due to the fact that compared with other entities, core enterprises and financial institutions play more of a role in assisting and cooperating in the entire supply chain financing, and their respective rights and obligations need to be clarified in the cooperative relationship to prevent conflicts of interest.

3.3.3. Increase government support

Through the simulation analysis of the macro environmental risk subsystem, it is found that the government support has a great sensitivity to the macro environmental risk. On the basis of the initial value, the "government support" indicator in the model is increased by 10 times and named it "Current1", and secondly, on the basis of the initial assignment, it is reduced by 10 times, and it is named "Current2", which is current before adjustment, as shown in Figure 6:

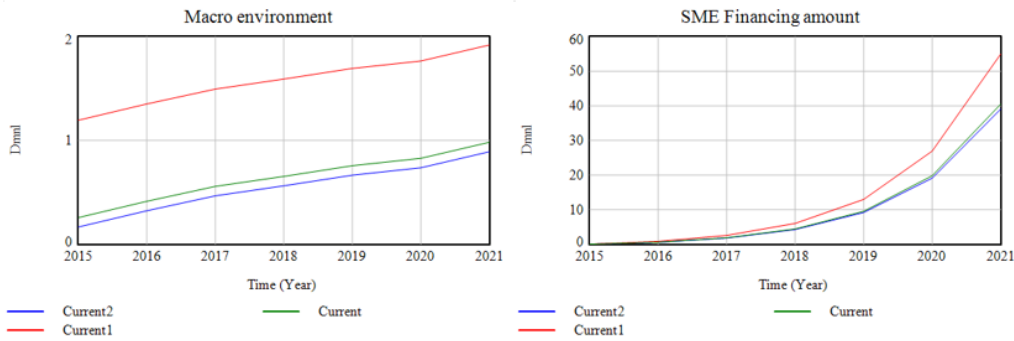


Figure 6. Sensitivity analysis of government support

The above chart reflects that the macro environment has improved after the increase in government support, which in turn has promoted the supply chain financing of SMEs and obtained more financing amounts. When banks and other financial institutions review financing enterprises, they will pay attention to whether their industries are supported by national policies, and the national policies will reduce the possibility of risks.

3.3.4. Improve information sharing in the supply chain

Through the simulation and analysis of the overall situation

subsystem of the supply chain, it is found that the system is sensitive to the frequency of shared information updates. On the basis of the initial value, the indicator of "shared information update frequency" in the model is increased by 10 times and named it "Current1", and secondly, on the basis of the initial assignment, it is reduced by 10 times, and it is named "Current2", which is adjusted to Current, as shown in Figure 7:

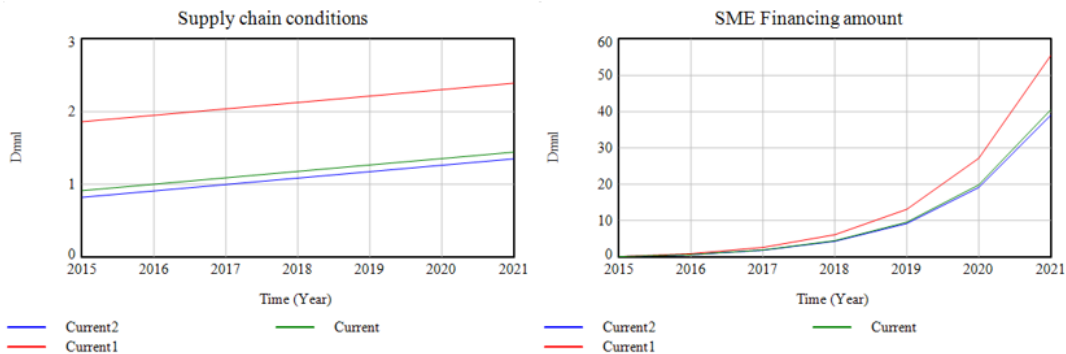


Figure 7. Frequency sensitivity analysis of shared information

The above figure reflects that increasing the frequency of shared information updates will promote the degree of information sharing in the supply chain, thereby promoting SMEs to obtain higher quotas in supply chain financing, on the contrary, when the degree of shared information is low, it will increase the possibility of SMEs credit risk, which is not conducive to SMEs obtaining financing in supply chain financing.

4. Conclusion

(1) By combing the literature related to supply chain financing, the index system of influencing factors of supply chain financing for SMEs was constructed in accordance with the principles.

(2) The supply chain financing of small and medium-sized enterprises is a complex system, and the overall financing amount has a significant cumulative effect.

(3) The system is more sensitive to the solvency of small and medium-sized enterprises, the relationship between core enterprises and financial institutions, the degree of government support and the degree of supply chain information sharing, and it is necessary to pay close attention to these four aspects when putting forward management suggestions.

In order to promote the supply chain financing of small and medium-sized enterprises, all entities should adopt the following management measures:

(1) The government should increase support for the supply chain financing of small and medium-sized enterprises. The government can increase policy support, provide clear policy guidance, and provide more favorable policies for the supply chain financing of small and medium-sized enterprises. At the same time, the government should also strengthen supervision, establish a sound regulatory mechanism, standardize the order of the supply chain financing market for small and medium-sized enterprises, and reduce risks.

(2) Banks and other financial institutions should strengthen the supply chain financing service capabilities of small and medium-sized enterprises. Banks and financial institutions can improve the financing convenience and efficiency of small and medium-sized enterprises by establishing a more complete system of supply chain financing products and services. In addition, banks and financial institutions can also

strengthen the risk assessment and control of SMEs, reduce the risk of supply chain financing, and increase the financing success rate of SMEs.

(3) Small and medium-sized enterprises should pay attention to the improvement and promotion of internal management. SMEs can improve supply chain synergies by optimizing supply chain management and strengthening cooperation with suppliers and customers. In addition, small and medium-sized enterprises should also strengthen internal financial management and risk prevention measures, improve their own financing conditions and financing capabilities, and provide guarantees for the smooth progress of supply chain financing.

(4) All entities in the supply chain should strengthen cooperation and communication. All links and participants in the supply chain should strengthen cooperation, achieve information sharing and resource integration, and improve the synergy effect of the supply chain. In addition, all parties in the supply chain should also strengthen communication and negotiation to solve relevant problems in supply chain financing and jointly promote the development of supply chain financing.

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