

Analysis of the Impact of Supply Chain Finance on the Financing Constraints of Small and Medium-Sized Enterprises in China

Yang Liu* and Yuxin Lin

School of Economics and Management (School of Tourism), Dalian University, Dalian 116622, P. R. China *Corresponding author: liuyang3@dlu.edu.cn

Introduction

Considering the current financing difficulties of small and medium-sized enterprises, this paper, from the perspective of evolutionary game theory and combined with financial theory, constructs a three-party evolutionary game model involving the core enterprises of supply chain finance, small and medium-sized enterprises and banking institutions. It discusses the equilibrium points obtained in the evolutionary game and their stability, and studies the evolutionary equilibrium selection of the behavioral strategies of the evolutionary subjects, providing an effective way to solve the financing problems of small and medium-sized enterprises in China.

Research Questions

1) Qualitatively analyze the theoretical mechanism of the impact of supply chain finance on the financing of small and medium-sized enterprises. 2) Build an evolutionary game model to study the impact of supply chain finance on small and medium-sized enterprises. 3) Based on the conclusions drawn from the evolutionary game model, put forward corresponding policy recommendations on how small and medium-sized enterprises can use supply chain finance to alleviate financing constraints.

Tables

Table 1. Tripartite payment income matrix in supply chain finance

		Financial institution			
		Core enterprises	Cooperation	No cooperation	
SMEs	Financing	Guarantee	$R_1 + R_4 - C_1 - L^*(i+s)$	$R_1 - C_1$	
			R ₂ +K-C ₂ -(N*L-1+L)(S+i)	$R_{2} - C_{2}$	
			$R_3 + (1-N)*L*(i+S)-C_3$	R ₃	
		No guarantee	$R_1 - C_1$	$R_1 - C_1$	
			R ₂	R ₂	
			$R_{3} - C_{3}$	R ₃	
	No financing	Guarantee	R ₁	R ₁	
			$R_{2} - C_{2}$	$R_{2} - C_{2}$	
			$R_{3} - C_{3}$	R ₃	
		No guarantee	R ₁	R ₁	
			R ₂	R ₂	
			$R_3 - C_3$	R ₃	

Mathematical Formulas

The resulting replicated dynamic equations are then correlated to obtain a system of related equations, as follows:

 $\begin{array}{l} F(x) = x^*(x-1)^*(C_1 - R_4 * y^* z + i^*L^* y^* z + L^*S^* y^* z) \\ F(y) = y^*(y-1)^*(C_2 - (i+K+S-i^*L-L^*S-i^*L^*N-i^*N^*S)y^* z) \end{array}$

 $F(y) = y \cdot (y - 1) \cdot (C_2 - (i + K + S - i \cdot L - L \cdot S - i \cdot L \cdot N - i \cdot N \cdot S)y \cdot z)$ $F(z) = z^* (z - 1)^* (C_3 - i^* L^* y^* z - L^* S^* y^* z + i^* L^* N^* y^* z + L^* N^* S^* y^* z)$

J=	$\frac{\partial F(x)}{\partial x}$ $\frac{\partial F(y)}{\partial x}$ $\frac{\partial F(z)}{\partial x}$	$\frac{\frac{\partial F(x)}{\partial y}}{\frac{\partial F(y)}{\partial y}} \\ \frac{\frac{\partial F(z)}{\partial y}}{\frac{\partial F(z)}{\partial y}}$	$\frac{\frac{\partial F(x)}{\partial z}}{\frac{\partial F(y)}{\partial z}}$ $\frac{\frac{\partial F(z)}{\partial z}}{\frac{\partial F(z)}{\partial z}}$
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Methodologies

Based on the perspective of evolutionary game and combined with financial theory, this paper constructs a three-party evolutionary model among core enterprises, small and medium-sized enterprises and banking institutions, discusses the obtained equilibrium points and stability, and studies the strategy choices among different subjects, providing new ideas for solving the financing difficulties of small and medium-sized enterprises in China.

Conclusion

First, this paper builds a credit tripartite evolutionary game model with SMEs as the main body. It analyzes the stability of each equilibrium point, gets the best strategy, and obtains conditions affecting SMEs' financing. It also analyzes stability to offer countermeasures and suggestions for easing their financing difficulties.

The main findings are as follows: When the three conditions of $R_4 > C_1 + L(i + s)$, $C_3 < (1 - N)L(i + s)$ and $C_2 + iL + NL(i + s) < i + K + S$ are satisfied, that is, according to the analysis of the equilibrium point of the evolutionary game model, it is the evolution to the optimal state. Core enterprises and banking institutions will choose active financing strategies, SMEs will actively choose to lend to banking institutions, core enterprises will actively provide corresponding guarantees for SMEs, and banking institutions will actively provide loans to SMEs under the guarantees of core enterprise, which can effectively promote the further development of China's economy.