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Based on Dynamic game: The best behavioral strategies between campus loan company and students

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ABSTRACT. *This paper researches about the behavior choice and strategies campus loan and student based on game theory. Firstly, it discusses the current situation and causes of campus loans .Then, it still studies the business model of campus loan company and the reasons for its high interest. By determining the target customer group of campus loans company, it is easy to understand the main motivation behind them to apply for loans. Moreover, focusing on students' choice about repaying and strategies and action of campus loan company. Based on the actual situation and theoretical analysis, this paper constructed a perfect information dynamic game model and get the sub-game perfect Nash equilibrium. This article can provide a theoretical basis for universities to manage students application on campus loans. Also, financial institutions can formulate the better and complete policies based on this passage. University students who need loans can also get more scientific analysis to protect them from illegal campus loans.*

KEYWORDS: *Campus Loan Company, dynamic game, advance consumption, rational human*

1. Introduction

Campus Loans Company refer to financial institutions or platforms that provide loans to university students. [1] Since most of the students are adults (older than 18 years old), the supervision of universities and families is relatively loose, and they have the more opportunities to obtain money other than living expenses. However, they are not good at managing money management and their concept of consumption is not mature or rational. They are easily induced by public opinion and social trends, such as advanced consumption and excessive consumption. At the same time, due to the lack of social experience, it is impossible for university students to distinguish the true face of the campus loan and the profit manipulator. Therefore, it is more likely to fall into the predicament and trap of campus loan. In addition, once caught in it, high interest rates and extreme collection measures will have huge psychological pressure on students and also cause adverse social impacts. Under the intense pressure, lost of students choose suicide.

Although the government and insinuation have issued the "Notice on Further Strengthening the Remediation of Campus Internet Loans", and some provinces have already regulated and manged campus loan companies seriously. However, the campus loan still "lurking" in many universities with mask, which still has a huge adverse impact on students. Obviously, besides the strict supervision, raising students' awareness also can curb the rampant campus loans.

In response to the social problems caused by campus loans, scholars have analyzed the behavioral decisions and strategies of campus loan companies and students. Liting Wei [2] used dynamic game model and backward induction method to understand the relationship between repayment of university students and their attitude towards the credit, and also pointed out the motivation of campus loan companies for debt collection. However, they do not regard students as an irrational group and analyze the causes of campus loans. Also, they did not provide the suggestions for students who have already applied for campus loan.

Based on the current situation mentioned above, this article states that campus loans company have a great negative impact on university students and society. If university students can understand the essence of and the business model of campus loan companies, it is possible to reduce or even solve campus loan's problems. During the game between university students and campus loan companies, there is an order between campus loan company and university students, which can be regarded dynamic game or sequential game. As the latter player, the campus loan company knows the student's choice and behavior. Also, both of them know the each others' previous choices when making any decisions. [3] Therefore, in this case, this paper will use the perfect dynamic information game and the sub-game backward induction method to analyze these two parties' payoff under. The backward induction was first proposed by Zermelo, German logician, who studied the winning situation of chess. [4] In the dynamic game with perfect information, the backward induction method can find the Nash equilibrium point of the sub-game effectively. [5] In the analysis process of dynamic game in this article, the purpose of reverse induction is to "looking forward and finding reason backward". The reasoning process is deductive and the conclusion is inevitable. [6] dynamic game with perfect information and backward induction are widely used in papers about analysis of financial institutions. Xiaolin Gong's analyzes the risks of P2P online lending platforms and the necessity of supervision with the dynamic game theory. [7] This article uses the sub-game backward induction method, from the last choice in the fourth stage, the final stage, gradually find the best choice for students and campus loans company at each stage. Combined with the actual situation and various social reasons, this article will provide more scientific suggestions for relevant departments when regulating policies and give scientific analysis to students who prepare for the campus loan application.

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2. The causes and current situation of campus loan company

In 2002, after the first credit card for university students issued by China Merchants Bank, other banks started credit cards business for university students. However, since university students do not have a stable income and banks didn't control the amount of cards held by each person, it has caused the phenomenon of "card slaves", that is, keeping cards with cards. Many university students have overdraft, overdue repayments, and non-repayment. Due to the large number of university student credit card overdrafts and the increasing rate of non-performing credit cards, the CBRC prevent banks from issuing credit cards to university students in 2009, then clearly stated that" No more than two card-issuing banks must issue credit cards to customers and 18-year-olds. "In the 2011 *Commercial Bank Credit Card Business Supervision and Management Measures*. When banks stopped issuing credit cards to students, campus loans began to prevail among students.

With economic and social development, students' consumption and economic activities are becoming more frequent, Therefore, the demand for loans is also increasing. With the development of the Internet, credit consumption and advanced consumption are being accepted by most people. Under "Finance" [8], campus loans have also begun to grow on the Internet. However, huge hidden dangers are hidden behind the vigorous development of campus loans. In recent years, many media have exposed, huge interest [9], threats of nude photos [10], violent collection [11] and other social vicious events caused by campus loans. As a result, from 2016 to 2017, the CBRC and the Ministry of Education issued a series of rectification measures for campus loans, and specifically banned campus loans [12]. Under the iron-fist policy, campus loans have been curbed. However, after the crackdown on campus loans, there has been a resurgence trend, which still has a negative impact on universitystudents.

3. Campus loan business model and high interest reasons

The online loan platform under government supervision is not really hurting the university students behind the scenes. However, small and medium-sized campus loan platforms are major killers. There are three sources of their funding: the initial investment of the founder, the financing of the platform staff's friends and relatives, and credit cards handled by the platform. With a stable source of funding, publicity is also an essential part of campus loan companies. First of all, campus loan companies will hire campus agents who are student cadres as their spoke person. Secondly, the campus loans company will publish a lot of advertisements about their financial products, such as low-interest and unsecured borrowing money. Finally, sponsoring student activities and advertising on campus are also ways to legalize the informal campus loans.

Most campus loan promotional slogans are "1 minute application, 10 minute review, as fast as 1 day loan, 0 mortgage 0 guarantee [13]" The application threshold is low and the procedure is simple. Appliers can easily get the loans with the simple personal and family information, and they even does not need to apply face to face.

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Although the simple procedure could improves the student loan application rate, it also amplifies the risk of loans. According to the survey, the bad debt rate of small cash loans is generally more than 20%, and the highest one can reach 50%, while the bad debt rate of student credit cards and student loans in many years ago was only 8% [14]. The high bad debt rate will directly lead to the high interest rates and high overdue liquidated damages in order to make up the deficiency. Therefore, driven by high interest and high returns, the campus loan company will definitely take tough loan urging measures against students who cannot repay on time.

4. Dynamic game between campus loans companies and students

During the game between students and the campus loan companies, students' behavior appears before t campus loan companies'. The campus loan company will make corresponding choices based on the student's behavior choices. In order to understand the interaction between campus loan implementation measures and student repayment, this paper will use dynamic game with perfect information to analyze their behavior processes. Supposing that the campus loan company provides the financial assistance to students who apply for loans, when students need funds or need to purchase certain items. In order to reduce bad debts and get the repayment in time, most campus loan companies will check students' personal conditions and credit history. Most applicants only need to provide identification information and phone number to successfully get a loan. After checking credits, applicants who have passed the credit evaluation can obtain loan funds, vice versa. However, due to the business model of campus loan companies and their aimed customers, evaluation standards will be greatly relaxed in the process during reviewing credit and personal conditions. This so-called and cursory "verification" of the campus loan company is in vain, which will deal with the inspection by law enforcement and management agencies. Therefore, almost all applicants can successfully apply for loan funds through the assessment, and all applicants will have following two behavioral decision options: repayment and non-repayment.

5. Construction of a dynamic game model between campus loan companies and students

Supposing R_A be the funds, when the student application is successful, I is the loan interest, so the student's total repayment student is R_A+I. When a student is unable to repay, the risk assumed is C_A. Due to the loose verification policy, the verification cost of campus loans can be negligible. When the campus loan company decides to provide loans to the applicant, the company's loan expenditure is R_B, and the company's possible future revenue is R_B+I. Once the student is unable to repay or overdue, the company will choose to take measures against it or not. When the campus loan company decides to take a measure, the measure cost is C_B. Based on the information mentioned above, the dynamic game model of campus loan companies and student applicants can be represented in Figure 1

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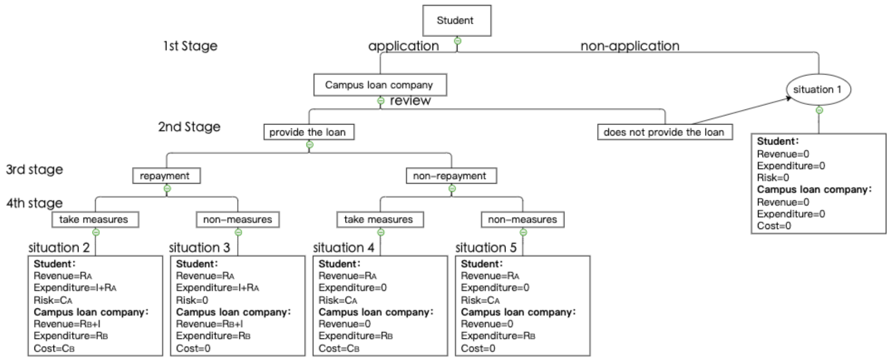

Figure. 1 The dynamic game model between students and campus loan companies on whether to repay and take measures

The dynamic game process shown in Figure 1 can be explained as: Regardless of whether the campus loan company will receive repayment, it has two options: take measures against the applicant or not. Since taking measures will not only incur the cost of measures, it will also exert influence in society. Therefore, based on maximizing self-interest, when the student applicant repay on time, the campus loan company will not take any measures. On the contrary, if the student loan applicant cannot repay on time, the campus loan company will definitely take measures.

Situation 1: In this case, since students neither do not have any loan need nor loan application for campus loan companies, students' expenditure, revenue, and risks are all zero. Campus loan companies also neither does not approve any loans nor take any measures against student, so their expenditure, revenue, and cost are all zero.

When a student applies for a loan, Campus Loan companies will review his/her credit history and personal financial situation, with two results: lending or not lending. After getting loans, students also have two option: repay on time and does not repay on time. Based on the repayment of student applicants, campus loan companies also choose whether to implement the measures or not. Therefore, there will be four situations shown in Figure 1:

Situation 2: In this situation, the student, who qualified with the inspection standard of the campus loan company, repay on time. Therefore, the student's expenditure is the loan principal and the interest on it, R_A+I; his/or her revenue is the loan provided from the campus loan company, which is R_A. At the same time, the campus loan company decided to provide loans to students and its expenditure is R_B. Since the student has repaid the loan on time, the revenue of the campus loan company is R_B+I. However, it still take measures against students who have repaid the loan, so the cost of measures is C_B.

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Situation 3: In this situation, the student, who qualified with the inspection standard of the campus loan company, did not repay within the prescribed time. Therefore, the student's expenditure is 0 and his or her revenue is the loan amount provided by the campus loan company, R_A. Although the student did not repay on time, the campus loan company did not take any measures. Students do not assume any risk of non-payment, C_A=0. Because students fail to repay on time, the campus loan company can neither recover the principal nor lose interest on the loan, so the company's revenue is R_B+I=0. The expenses of campus loan company are loans provided to the student, R_B. Because the company does not take any measures to collect loans from students, the company will not have the cost of implementing measures, C_B=0.

Situation 4: In this situation, the student, who qualified with the inspection standard of the campus loan company, did not repay within the prescribed time. Therefore, the student's expenditure is 0 and his or her revenue is the loan amount provided by the campus loan company, R_A. Because the student did not repay the loan on time, the campus loan company will to take loan urging measures to recover the repayment, which will lead to two results: students pay back and students still do not pay back. For the case where the student still fails to pay the money: the student’s income is the loan amount, R_A, the expenditure is 0, and the risk is C_A. The expenditure of the campus loan company is the loan R_B; the revenue is R_B+I=0; and the cost of implementing the measures is C_B. For the situation that the student repays the money after taking measures, which is the same as the situation 2.

Situation 5: In this situation, the student, who qualified with the inspection standard of the campus loan company, did not repay within the prescribed time. Therefore, the student's expenditure is 0 and his or her revenue is the loan amount provided by the campus loan company, RA. Because the student did not repay the loan on time, the campus loan company will to take loan urging measures to recover the repayment. In this case, the student's revenue is R_A. Due to the failure to repay on time, the student's expenditure is zero. However, because the company does not take any measures, students will not have the risk of being unable to repay, C_A=0. Since the student cannot repay, the campus loan company can neither recover the principal nor obtain interest, R_B+I=0, and the company’s expenditure is the loan amount provided to the student, R_B. The company will not take measures against students who fail to repay on time, and will not incur any cost of measures, C_B=0.

6. Sub-game perfect dynamic Nash equilibrium solution of dynamic game

In figure 1, there are four stages in this dynamic game: the first stage is that students decide whether to apply for a loan or not; the second stage is that based on the applicant's credit history and personal circumstance, the campus loan company decide whether provide loans or not; the third one is whether students repay on time or not; the fourth stage is whether the campus loan company adopts dunning measures based on the student's repayment status. For this dynamic game with perfect information, the backward induction method is used to solve the problem from the fourth stage.

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6.1 The fourth stage sub-game solution

Firstly, looking at the choice of campus loan companies in the case of "agree to borrow and be able to repay". In this case, the campus loan company can choose to take measures or not. When measures are taken, the company's payoff is R_B+I-R_B-C_B=I-C_B; if measures are not taken, the company's payoff is R_B+I-R_B-C_B=I. Comparing these two choices, it is obvious that I>I-C_B. Therefore, when the student repay the loan on time, the campus loan company will not take any measures. Secondly, under the condition of “agree to borrow and cannot repay money”, campus loan companies still have two options: taking measures and not taking measures. After taking measures, the company’s payoff is R_B+I-R_B-C_B=0-R_B-C_B=-R_B-C_B. When the campus loan company does not take measures, its payoff is R_B+I-R_B-C_B=-R_B. After comparing the payoff of these two choices, the result will be -R_B>-R_B-C_B. Therefore, when student can not repay on time, the campus loan company should not take any measures. However, if the student chooses to repay after the company taking measures, the company's payoff will be the same as in situation 2, R_B+I-R_B-C_B=I-C_B. If the cost of implementation measures is less than the interest received on the repayment, that is, C_B<I, the campus loan company will not take measures against students who do not repaid. However, according to the loan interest of campus loans, the annualized interest rate can be as high as 199.38%, much higher than the normal bank loan interest. Therefore, due to the high interest rates, campus loan companies will definitely take measures against students who fail to repay on time. All in all, the Nash equilibrium of the fourth stage of the sub-game is: if the student can repay on time, the campus loan company will not take any measures against him/her. On the contrary, once the student cannot complete the repayment on time, the campus loan company will take measures against students who does not repay on time because of the high interest.

6.2 The third stage sub-game solution

Based on the solution of the fourth stage, the third stage can be solved conveniently. When student decided to apply the loan and passed the credit and personal information assessment of the campus loan company, there will be two possible results: able to repayment and do not able to repayment on time. Although students do not clearly know which measure that the campus loan company will adopt, students will still have awareness of the risks they may face. At the same time, they know the campus loan company will take measures, if they can not repay on time. When students repay on time, their payoff is R_A-I-R_A-C_A=-I. When students cannot repay on time, their payoff is R_A-C_A. In order to compare the student's payoff in these two cases, we need to know the exact value of C_A.

According to the negative news reports of campus loans companies and the ban issued by the government, the measures taken by the campus loan company are extreme, resulting in a lot of student suicides and the tragedy of family. Therefore, the risk cannot be estimated using data, and we believe that C_A is much greater than R_A in terms of social and legal systems. Combining social influence and legal

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factors, once again comparing the income in these two cases, we can get $-I<R_A-C_A$. As a result, the Nash equilibrium of the third stage sub-game is: students must repay on time because of the huge risk of overdue repayment.

6.3 Second stage sub-game solution

Based on the equilibrium solution of the third and the fourth stage sub-games, the second stage sub-game can be solved as follows. It can be seen from the equilibrium solution in the third stage that students must choose to repay on time because of possible loan risk. According to the equilibrium solution of the sub-game in the fourth stage, the campus loan company will not take any loan urging measures for students when they can repay on time. In the second stage sub-game, if applicants fail to pass the verification, the expenditure and revenue of the campus loan company is the same as Situation 1, and the payoff is 0. If the applicants passes the verification, the expenditure and revenue of the campus loan company is the same as situation 3, and the payoff is $R_B+I-R_B-C_B=I$. Comparing theses two kinds of payoff shows that $0<I$. Based on the above analysis and facts, as long as the loan applicant provides basic information, Enticed by the high interest rates, the campus loan companies will definitely do not not conduct a rigorous review and render them pass the verification process. Therefore, the equilibrium solution of the second stage sub-game is: after providing basic information and submitting the loan application, the campus loan company will relax the verification policy and issue loans to all applicants.

6.4 First stage sub-game solution

Based on the equilibrium solution of the first four sub-games, the first sub-game is solved as follows. Once students applies for a campus loan, they will get the loan as soon as possible after the cursory verification. Due to the huge risk of overdue, students had to repay on time. After repayment, the campus loan company will not take any measures against students. In this case, students' expenditure and revenue are the same as in Situation 3, and their payoff is $R_A-I-R_A-C_A=-I$. Without any loan applications , students' expenditure and revenue are the same as in Situation 1, and the payoff is 0. Comparing these two kinds of payoff, we can see that $-I<0$. Based on the above analysis, the first stage of sub-game Nash equilibrium solution is: students should not submit loan applications.

According to the backward induction method, both parties are assumed to be rational human in a fixed environment, that is, participants will choose strategies to maximize their own payoff and be able to analyze complex processes. Therefore, students should not apply for loans to campus loan companies after weighing various results and circumstances. However, the actual choice of university students runs counter to rational human: most of them still choose to apply for campus loans. Due to the false propaganda by campus loan companies, students do not know that they have made a sub-optimal choice before applying for campus loans. According to Yisrael Aumann, this situation can be explained as ex- post rationality. However, students do not know the payoff before start of this game. Therefore, in this case, ex-post rationality is equivalent to ex-ante rationality, and game analysis can still be performed using backward induction. [15]

In the China Youth Daily's report on the survey of 2,000 university students' consumption, nearly 80% live form paycheck to paycheck. At the same time, the advanced consumption prevails among and affect university students. Due to the limited monthly living expenses, students will apply for a campus loan. Additionally, comparison and vanity are another two major reasons for campus loan application. The informal online campus loan application review process is quick in action with false and misunderstanding slogan, "low interest". University students will easily fall into the trap of illegal campus loans, which shows that there are a large number of irrational human in the campus loan market and target customer groups.

In summary, combined with game theory and actual situation analysis, the sub-game perfect Nash equilibrium solution of students and campus loan companies on whether they should repay on time and take measures for dynamic games is: students apply to campus loan companies for loan applications; The campus loan company reviews the applications and personal information submitted by the student ; the student who has successfully obtained the loan repay within the prescribed time; the campus loan company will not take measures against student who has already repaid on time.

7. Conclusions and recommendations

This paper studies the problem of campus loans and student behavior choice decision game. Starting from the current status of campus loans and university students' consumption concepts, the cause of campus loans and the business models of it are revealed. Based on the actual situation and theoretical analysis, dynamic game model with the perfect information of students and campus loan companies on whether to repay and take measures is constructed and solved to obtain the perfect Nash equilibrium solution of their sub-games. The main conclusion of this article is as follows: From students' perspective, not applying for a loan on the campus loan platform is the best strategy to avoid subsequent problems. However, combined with the actual situation and social status, when applying for a campus loan, the best strategy is that The campus loan company reviews the applications and personal information submitted by the student; the student who has successfully obtained the loan repay within the prescribed time; the campus loan company will not take measures against student who has already repaid on time. This article can provide a theoretical basis for universities to manage students application on campus loans. Also, financial institutions can formulate the better and complete policies based on this passage. University students who need loans can also get more scientific analysis to protect them from illegal campus loans.

This article briefly introduces the causes and business models of campus loan companies. Because the government has strictly controlled the loan of university students and the issuance of credit cards, campus loan companies have emerged as gimmicks with "quick lending, quick review, and zero mortgage". At the same time, based on the dynamic game model with the perfect information, this paper analyzed the possible behaviors of campus loan companies and students in different situations. According to the conclusion, the best strategy for students is not to apply for any campus loan. However, due to the less social experience and financial management capabilities and easy to affected by the advanced consumerism, the main target group of campus loans are irrational groups. Overdue repayment or non-repayment will caused negative impact in society such as, violent debt-recovery and suicide.Based on the above analysis, this article provides the following recommendations:

7.1 Government policy recommendations

Since campus loans are a product of the consumer era, completely banning or severely cracking down may be counterproductive. Previously, the government issued a series of iron-fisted policies, which not only did not eliminate the huge hidden danger of campus loans, but also made these companies have stronger anti-reconnaissance capabilities. The campus loans still hurts many university students. As a policy maker, we should pay close attention to the economic needs of students and loopholes in the campus loan industry in order to formulate more effective rectification plans. For example, restricting the loan amount of campus loan companies not only can reduce the bad debt rate of campus loan companies, but also forcefully help university students consume rationally. Secondly, establishing a unified interest disclosure system. The business model of campus loans has always been driven by high interest rates, which has led to vicious events such as violent debt-recovery. If this system can be established, the interest of campus loan companies will become transparent and visual,,which will both greatly reduce the possibility of students being deceived by false advertisements and reduce the platform's revenue and curb its scale of development. Finally, the establishment of grievance mechanisms and departments is particularly important. Many university students suffer from the campus loan companies, but they have no way of complaining. They just shall campus loan company ride roughshod over them and be in the deep debt. When students find that the company charges much higher debt interest, if they cannot find an effective complaint agency and law enforcement department, they are resigned to their bad luck and try to repay. This action is undoubtedly an encouragement and acquiescence to the illegal proceeds of campus loans and violent debt recovery.

7.2 Student education recommendations

The aimed consumers of campus loan companies are university students, and according to the analysis, they are irrational groups. Therefore, based on all clear choices and payoff, university students also could not choose the best strategies to maximize their interests. In addition, the lack of social experience and financial management ability is also one of the main reasons for the rampant campus loans. In

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many universities, the campus loan publicize themselves with banner student cadres. Therefore, university's supervision and family education are particularly important for students to eliminate campus loans. In terms of universities, the consumption of students should be formalized, but at the same time, they should help students establish correct consumption concepts and minimize the atmosphere of comparison and vanity. Universities can provide reliable part-time opportunities for students who have financial difficulties, which will solve economic problems and make them adapt to society in advance. Moreover, universities should strengthen the education in finance and credit reporting. Many university students do not have a correct understanding of personal credit or even do not know what it is. The lack of credit awareness and contract spirit will not only adversely affects the student's file but also greatly limits its future development. In the family, communication is the prerequisite for solving all problems. Most of students who apply for campus loans are fear to tell the truth to heir parents, and hope that the campus loan can relieve their urgent needs, but it is often counterproductive. Therefore, timely and candid family communication can not only understand the real economic situation of students, but also correct the wrong consumption concepts of the students, promptly retreat, and reduce the risk of being cheated.

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