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Game Analysis on the Risk of Overestimate Collateral in China

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Abstract –The risk of overestimate for collateral value is divided into active and passive overestimate. Passive overestimate can be resolved by a serious of measures, such as improve assessment level, improve assessment methods and strengthen supervision. But active overestimate is due to the asymmetric information which makes the borrower can indirectly control assessment report, leading to the risk is undertook by the bank. Therefore, a dynamic game model with incomplete information was established to analyze the influential factors of game behavior and the existence condition of game equilibrium in the case of the two stakeholders influence each other. Finally, a series of relevant proposals were put forward so that to promote the healthy and sustainable development for credit market.

Keywords –Collateral; The risk of overestimate; Stakeholders; Game analysis

1. Introduction

In the credit decision process, the borrower's first source of repayment is a main consideration for the bank, which assess the liquidity according to the borrower's credit record, income level, development prospect and industry policy, etc. However, the rate of mortgage repayment is not optimistic in the case of asymmetric information. The bank credit asset can not be protected effectively. Therefore, collateral is able to eliminate asymmetric information as secondary source of repayment. Borrowers delegate appraisal firms to assess collateral, and then provide the assessment report to the bank who decide whether and how much to loan. It is just because of this appraisal pattern that cause borrowers have a great opportunity to get a good assessment report by overestimating the collateral value. However, Bank as users of the assessment report, cannot determine whether there are overestimation. At the same time, the profit drive of borrowers make the function of collateral to eliminate asymmetric information is not obvious, finally the bank still have to afford the overestimation risk.

The risk of overestimating the collateral value can be divided into two types: active and passive overestimate. Active overestimate, refers to collateral value assessment is often influenced by borrowers, bank and appraisal firms. As a rational 'economic man', borrowers provide a good assessment report by collateral overestimation to the bank so that to get more loans. Borrowers indirectly manipulating assessment report that is one of the main reasons of collateral overestimation. Another reason is that lower-level employees within the bank would conspire with borrowers, due to the pressure of the loan indicators. Passive overestimate, refers to a fixed format for reporting, a permanent use of 'replacement cost method' lead to virtual-high of collateral value caused by the lower professional level of the appraisal firms. Passive overestimate can be resolved by improve the professional level of appraisal firms, assessment methods and strengthen regulatory measures. While the risk of active overestimate is a burning question. Therefore, in order to guard against borrowers indirectly manipulate assessment report, a dynamic game model with incomplete information was established to analyze the influential factors of game behavior and the existence condition of game equilibrium in the case of the two stakeholders influence each other. It will play an important role in promoting healthy development of the credit market.

2. Game model description

2.1. Basic assumption

The game subjects: borrowers and the bank. Because the different benefit drives of the two-party subjects, they have launched an intense game in the case of asymmetric information.

Suppose that there are two types of borrowers: high-risk (H) and low-risk (L). The collateral value of H assessed properly is V and collateral benefit is aV, Overestimate is V' and collateral benefit is $a'V'(V'>V, a>0)$. The collateral value of L assessed properly is V' and collateral benefit is $a'V'$. H could get bad assessment report (B) by the normal assessment, and get good assessment report (G) by overvalued. However, L can get good assessment report (G) only through the normal assessment. H's overestimation of costs is C_1,

Losses after being found is F. At this time, there are two choices for the bank: reexamination (S) and un- reexamination (T). The cost of reexamination is C_2, if not reexamined, the bank's losses from the overestimated is –N.

2.2. Game order

The first stage, introduce a virtual 'natural person' through the Harsanyi transformation to select the type of borrowers first for asymmetric information. Each Borrower knows their types, which is private information. The bank know that there are two types of borrowers and the probability of the H and L are respectively P_H and P_L ($P_H + P_L = 1$). But they do not know which type the borrowers should belong to specifically. According to their types, borrowers choose good assessment report or bad assessment report. Based on observed information, the bank will choose whether to review. Therefore, this is a dynamic game model with incomplete information. At the second stage, when the type of borrowers was L, could get a good assessment report through the normal assessment and the benefit is $a'V'$, this is the optimal decisions for L, namely: $P(G/L) = 1$. There are two choices when the type of borrower is H: one is getting good assessment report by overvalued and the benefit is $a'V'$, the other is getting good assessment report by the normal assessment and the benefit is aV. Optimal strategy is the first choice for H because $a'V' > aV$, the conditional probability is $\alpha = P(G/H)$. The third stage, the bank would take action based on the observed information. The optimal strategy is un-reexamination for the bank when they observed the bad assessment report. When they observed the good assessment report, the optimal strategy is reexamination because the bank can not make sure that whether this report is from H by overvalued or from L by normal assessment, the conditional probability is $\beta = P(S/G)$. The final benefits of both sides after intense game are shown in Figure 1(First row of figures represent the benefit of borrowers, the second row represent the benefit of the bank).

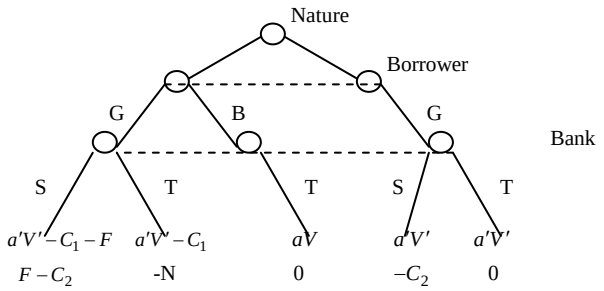

Figure 1. Dynamic Game Model with Incomplete Information

Definition: perfect Bayesian equilibrium is an union of strategy combination [α^*, β^*] and posterior probability $[P(H/G), P(L/G)]$. It meets the requirements of $\alpha^* \in \arg\max U_2$ and $\beta^* \in \arg\max U_1$. The expected revenue of L is $a'V'$, the expected revenue of H:

$$U_1 = \alpha[\beta(a'V' - C_1 - F) + (1-\beta)(a'V' - C_1)] + (1-\alpha)aV$$

the maximized condition of U_1 : $\partial U_1 / \partial \alpha = 0$, get $a'V' - \beta F - C_1 - aV = 0$, now the optimal decisions for the bank :

$$\beta^* = \frac{a'V' - aV - C_1}{F}$$

the optimal strategy is not reviewing for the bank when they observed the bad assessment report，the benefit is 0. When they observed the good assessment report, their expected revenue:

$$U_2 = \beta[P(H/G)(F - C_2) + P(L/G)(-C_2)] + (1-\beta)[P(H/G)(-N) + P(L/G)0]$$

the maximized condition of U_2 : $\partial U_2 / \partial \beta = 0$, get

$$P(H/G)(F+N) - C_2 = 0 \qquad (1)$$

Since the Bayesian rationality of the Bank, so mending information as follows: first type combination of borrowers is {H, L}, action combination of borrowers is {G,B}. The bank acquire prior probability P_H and P_L by experience. Secondly, the bank need to master $\alpha = P(G/H)$ and $\beta = P(T/G)$ 。Therefore, based on Bayesian:

$$P(H/G) = \frac{P(G/H)P_H}{P(G/H)P_H + P(G/L)P_L} = \frac{\alpha P_H}{\alpha P_H + P_L} \qquad (2)$$

Take (2) into (1) can get the optimal decisions for L:

$$\alpha^* = \frac{P_L}{P_H} * \frac{C_2}{F + N - C_2}$$

3. Game equilibrium analysis

Four influential factors of the bank's optimal decision β^*: $a'V'$, aV, C_1, F. Analyze from the perspective of H: Borrowers manipulating assessment report through overvalued must be discovered by the bank, therefore normal assessment is borrower's optimal strategy when H believes that the bank's reviewed strategy is $\beta > \beta^*$. And then provide the bad assessment report to the bank, namely: $\alpha^* = 0$. H will sure to provide the good assessment report to the bank when H believes that $\beta < \beta^*$, namely: $\alpha^* = 1$ .Overvalued and normal assessment are random selection when H believes that $\beta = \beta^*$, namely: $\alpha^* \in [0,1]$. Analyze from the perspective of the bank: The lower C_1 and aV are , the higher β^* is; the higher $a'V'$ is, the higher β^* is. Namely the cost of overestimation become lower, the benefit of overestimation get higher, while the benefit of normal assessment get the lower. At this time, borrowers incline to overvalue and the bank incline reexamination. The higher F is, the lower β^* is. Indicate that if F is larger, overestimate is best for borrowers and reexamination is best for bank.

Four influential factors of H's optimal decision α^*: P_L, P_H, $F - C_2$, N. Analyze from the perspective of the bank: the possibility of overestimate is large when the bank believes that the strategy of manipulating assessment report by overvalued is $\alpha > \alpha^*$. Therefore the good assessment report is most likely provided by H. At this time, the optimal strategy for the bank is reexamination, namely: $\beta^* = 1$. In the similar way, the bank incline un-reexamination when they believes $\alpha < \alpha^*$, namely $\beta^* = 0$. reexamination and un-reexamination are random selected if the bank believes that $\alpha = \alpha^*$, namely: $\beta^* \in [0,1]$. Analyze from the perspective of borrowers: the larger P_L is, the larger α^* is. The possibility of H become larger, the possibility of reexamination get larger when they got a good

assessment report. The benefit of reexamination is $F - C_2$. The larger $F - C_2$, and $F > C_2$ are, the larger N is, the lower α^* is. All of the above imply that when the bank's benefit of reexamination become larger, the cost of reexamination get lower, the borrower's losses of overestimation get higher, and the possibility of reexamination for the bank become larger.

4. Suggestions

Based on the analysis above, two appropriate measures and suggestions are put forward. One is that reexamination mechanism should be adopted within assessment, and dynamic management of the whole assessment must be carried out. Although the bank generally has the capacity to carry out the re-evaluate guarantee for cyclical, but most just be formalization because of the restriction of appraisal firm's professional level, it has not played an important role in reducing risk. Therefore, first of all, the bank should carry out internal reexamination before loans, secondly enhance re-evaluation of cyclical during the course of loans, and then working out guarantee capacity annual report. At last, the bank should re-evaluate credit degree and sort documents. Nevertheless, this measure is restricted by a large number of businesses, the few of evaluators and low professional quality of evaluators. The other is to translate borrower's delegation model into the bank's delegation model. The bank select appraisal firms through the open tender, and based on their demands to choose the content and format of assessment report. The bank can classify the cost of assessment into the fixed-price of collateral so to convert it into the borrower's cost of loans. At the same time, deposit system is carried out for appraisal firms. If false assessment is not found in the period of cooperation then can return deposit and continue to cooperate. Or confiscate deposit and terminate cooperative relation, moreover the final loss should be undertaken by appraisal firms. Not only does this allow the bank protect the security of credit assets from outside, but also eliminate the possibility of collusion for staff and borrowers from inside. Through these measures can promote the healthy and sustainable development for credit market.

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