Analysis on the Advantages and Disadvantages of Early Repayment in China's Current Interest Rate System

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Abstract
With the growing of China's real estate industry, housing mortgage loan sensitization also has developed into a rapid period. Therefore, under the current interest rate system of our country of personal housing loan of prepaying behavior research has become an unprecedented importance, and has strong practical significance. Owing to the constructed the mathematical model is simple, hoping that through the efforts of the future, researching problem on the loan under the condition of stochastic interest rate, we can apply the theory to the specific life.

Key words
interest rate; early repayment; penalty; net present value theory

SUBJECT CLASSIFICATION
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Mathematics model

Introduction
In 2017, China's economic growth has increased for the first time in nearly seven years, reaching 6.9%. On the one hand, the global economic weakness that has lasted for many years has begun to reverse. The simultaneous recovery of the US, Europe and Japan has led to the rapid growth of foreign trade demand. The contribution rate of net exports to the domestic economy has changed from negative to positive, which is an important factor for China's economic performance in 2017 to better in 2016. On the other hand, although the output of industries such as high pollution, high energy consumption, high emission and high inventory is affected by the deepening reform of supply side, it does not affect the performance of the whole industry. The growth rate of value added of industries above medium scale is still faster than that in 2016, which further confirms the improvement of both internal and external demand and the growth of new momentum. The gradual increase of economic vitality will be the biggest highlight of the whole year's economy. Better economic development also provides room for adjustment to the whole risk prevention and deleveraging work. In 2017, the central bank insisted on neutral monetary regulation, by maintaining liquidity balance to guide the internal derailment of the financial system. The effect of deleveraging is remarkable throughout the year, M2 growth continues to decline, and financial system funds are tightening, resulting in a significant rise in money market interest rates. With the tightening of real estate credit and tighter regulation, the financing cost and difficulty of the whole industry have increased. Since 2018, the interest rates on bank loans in major cities have generally risen. It really takes a lot of courage for consumers to choose to buy a house at this time. For Bank of China, Agricultural Bank, Construction Bank and Industrial and Commercial Bank of China, the interest rates of first apartment and second apartment have generally risen by 10%-20%. The interest rates of different cities may be different, and the interest rates of other banks may rise higher than this level[1].
2 Analysis of reasons for early repayment of loans

In the real estate market, early repayment refers to the borrower's application for early repayment to the bank providing the loan. Under the condition that there is no credit loan in the previous month, the borrower will pay off all the remaining loans at one time according to the bank's regulations. When purchasing a house, the borrower applies for a loan from the bank mostly because he does not have enough funds to afford the whole purchase. Then after a period of time, there will be buyers choose to repay the loan in advance, the reasons are as follows:

(1) When the purchaser's income increases or has a certain amount of savings, that is, when the funds is sufficient, and these buyers do not know much about financial management or narrow investment channels, if they feel that they can not let the assets appreciate more efficiently, they will tend to repay in advance. Because if you deposit money in the bank, its interest is not enough to cover the interest of the mortgage, then using this money to repay the loan in advance is a reasonable choice.

(2) From the analysis of the above examples, we can see that no matter what kind of repayment method the buyers adopt, the sooner they repay the loan, the more cost-effective they will be. Because more capital is paid in the early stage, the base of interest will be smaller, so that interest can be reduced. Therefore, if the buyer is in the early stage of repayment, and the interest rate of the mortgage has increased or tends to increase, then for the purpose of reducing interest expenditure, the buyer may choose to repay the loan in advance.

(3) Housing accumulation fund refers to the long-term housing reserve deposited by state organs, state-owned enterprises, urban collective enterprises, foreign-invested enterprises, private enterprises in cities and towns and other urban enterprises, institutions, private non-enterprise units, social organizations and their employees. Generally speaking, provident fund can only be earmarked for funds, that is to say, it must be used for matters related to houses. Therefore, if buyers pay more provident fund every month, then the use of provident fund to advance the repayment of loans is also common [2].

(4) Although consumer credit has been introduced in China for a long time and gradually accepted by consumers, the traditional consumption concept of reluctance to indebtedness still has a deep-rooted impact on Chinese residents. Some homebuyers think of backing their mortgage, and their mood turns from sunny to cloudy. They don't want to sleep at night because they don't want to eat every day. They just want to pay off the loan as soon as possible and get rid of the bitter sea. Therefore, from a psychological point of view, this is also an important factor to prompt some buyers to repay their loans in advance.

3 The impact of early repayment on Commercial Banks

The impact of early repayment of loans by buyers on commercial banks has both good and bad aspects. Although on the surface, early repayment of loans can enable banks to recover their own funds faster, in fact, it is not beneficial and harmless, and it is likely to have a negative impact on the normal operation of banks. Banks will take the form of liquidated damages to restrict the early repayment of mortgage loans. The specific impact of early repayment on commercial banks is as follows:

(1) the beneficial effect of early repayment on commercial banks.

(1.1) . early repayment will reduce the credit risk faced by commercial banks.

In the housing loan, the purchasers make up for the shortage of funds by applying for loans from commercial banks, thus forming the creditor's rights and liabilities relationship between the purchasers and commercial banks. In this case, whether borrowers can repay their principal and interest on time is uncertain, that is to say, commercial banks may face the credit risk of consumer default. If consumers choose to repay in advance, the credit risk of commercial banks will be greatly reduced.
(1.2) early repayment can enhance the liquidity of commercial banks.

Profitability, security and liquidity are the operational objectives of commercial banks. Liquidity is the basis of commercial banks' operation. If a commercial bank lacks liquidity, it will probably face the risk of runs or even be unable to survive. When we say that a bank has liquidity, we generally mean that the bank can get enough funds at a reasonable price at any time to meet the demand of its customers to withdraw funds at any time. As a long-term asset in the balance sheet of commercial banks, personal housing loan has poor liquidity and liquidity. If the borrower chooses to repay the loan in advance, the long-term assets with poor liquidity will become the cash assets of the commercial banks, thus the liquidity of the assets of the whole commercial banks will be enhanced.

(2) the adverse effects of early repayment on commercial banks.

(2.1) the capital allocation plan of commercial banks was disrupted.

Commercial banks have strict scheduling plans for capital management. Once buyers choose to repay loans in advance, it will inevitably affect the capital cost and capital structure of the commercial banks. Capital cost refers to the cost of acquiring and using capital. Capital structure refers to the composition and proportion of all capital of commercial banks. As a long-term asset of commercial banks, personal housing mortgage loan is built on the basis of commercial banks' absorbing deposits as a liability project. If the buyer who buys a house by loan repays in advance, it will disrupt the capital dispatching plan of the commercial bank, which will change the capital structure of the commercial bank and affect the operation and management of the commercial bank.

(2.2) the damage of commercial banks' earnings

For the current business model of China's banks, the income of housing loan business still accounts for a high proportion of bank income, and personal housing loan because of fixed real estate as collateral, and insurance companies as collateral, its risk is lower than other bank loan projects [3]. If buyers choose to repay in advance, it will directly reduce the interest income of banks. In order to compensate for the losses, many banks will charge some liquidated damages.

(2.3) increase in cost of commercial banks

As one of the high-quality loans, housing loan has always been an important resource for major commercial banks to compete for. In order to improve their competitiveness, some commercial banks often give home buyers tax or other forms of preferential treatment. Ultimately, these costs will be compensated by interest on housing loan, but if the home buyers suddenly repay the loan in advance, then No. In the form, the cost of tax and fees will be increased, and the cost of personnel and equipment will also be wasted.

(2.4) increase reinvestment risk

Reinvestment risk refers to the risk that the return on reinvestment, such as the interest received during the holding period, the principal recovered at maturity and the proceeds of capital obtained at the time of sale, may be lower than the return on the original investment. As a profit-oriented commercial bank, the bank must reinvest the funds recovered in advance, and the reinvestment of the funds will inevitably face a series of uncertainties such as credit risk, market risk and interest rate risk, which will lead to the increase of reinvestment risk cost of commercial banks.

4 penalty

Through the above analysis, we can conclude that in fact, when the buyers choose to repay in advance, the disadvantages
outweigh the advantages for the commercial banks. For the default of early repayment, the banks will charge a certain proportion of the default penalty. Moreover, this kind of action of collecting liquidated damages is a very common phenomenon in the international community. As a key factor to balance the economic interests between buyers and commercial banks, liquidated damages are levied in proportion to the terms agreed upon by both parties when signing the mortgage contract. Once the borrower chooses to pay the liquidated damages in the form of the following clauses: He will pay a penalty in advance if he has paid off all his loans in advance. The liquidated damages are usually calculated as a percentage of the remaining principal amount (usually between 2% and 5%) or as the sum of interest paid for several months. However, the maximum amount of liquidated damages that commercial banks can get will be bound by law. The penalty period usually does not exceed 3 years, the highest is 5 years [4]. After the validity period, the ratio of liquidated damages will be cancelled or gradually reduced, or only 1% of the balance. As the Levy of liquidated damages is a risk management method for commercial banks for customers who may repay their loans in advance, commercial banks will generally provide several different liquidated damages schemes to provide buyers who want to borrow. If the borrower chooses a contract with liquidated damages, commercial banks will offer a lower loan interest rate, that is to say, the interest rate of a contract with liquidated damages is generally 0.25% to 1.00% lower than that of a contract without liquidated damages. However, at present, there are no uniform provisions on the amount of default payments by major banks in China. Such as:

(1) China Merchants Bank: In less than one year, interest will be charged for at least three months relative to the actual amount of repayment, while in one year, interest will only be charged for one month.

(2) Construction Bank: 3% of the amount of advance repayment will be charged in less than one year, 2% in one to two years and 1% in two to three years.

(3) Agricultural Bank: The loan is less than one year and is charged at the monthly interest rate of principal. After one year of loan, no liquidated damages will be charged.

(4) ICBC: If the loan is less than one year old, 5% of the amount of advance repayment will be charged, and no liquidated damages will be charged if the loan is repaid in advance after one year.

(5) Bank of China: the loan is less than 1 years, and the penalty is 3 months.

(6) Bank of Communications: There are provisions on early repayment, which is at least six times the monthly repayment. Some early repayments can be repaid free of charge once a year.

5 Construction of early repayment model for homebuyers

When the interest rate of housing loan rises and the purchaser has fully considered other aspects of consumption expenditure, such as medical treatment, transportation, children's education and so on. After maintaining a reasonable consumption structure, he still has enough funds to pay the housing loan in advance, so as a rational consumer, he will have the impulse to pay in advance to avoid damage. Lose more interest. So under what circumstances is prepayment beneficial to consumers, we will build a relationship model between interest rate and prepayment to quantitatively analyze the relationship.

Before building the model, we need to introduce a very important concept in Financial Mathematics - net present value theory. Net present value refers to the difference between the present value of future income of an investment and its investment cost. It is based on the principle that money has time value, and the cost value of initial investment can not be directly compared with the value of future cash flow generated by the investment. Assuming that the expected future cash inflows can be achieved, the total cash flow generated can be converted to the value at a certain discount rate to compare with the capital cost of the initial investment. When the net present value is positive, it means that the investment still has excess return after repayment of principal and interest, that is, it can be invested; when the net present value is zero, it means that the cost and benefit offset each other; when the net present value is negative, it means that the future income of
the investment is not enough to make up for the investment cost, so it is not worth investing. The NPV method has a wide range of applicability, because it considers the time value of money and can reflect the net income of various investment schemes. But it also has some limitations, for example, it can not reveal the actual rate of return that each investment scheme itself may achieve.

Before giving a specific model of the relationship between interest rate and early repayment, let’s make the following assumptions:

1) The borrower is a rational person, because of the economic motivation of saving interest, he will consider repaying the whole loan balance in advance when the interest rate of the mortgage rises.

2) The transaction cost of borrowers' early repayment of loans is only the liquidated damages of commercial banks, and the amount of liquidated damages is a certain proportion of the remaining principal.

3) Borrowers are well-funded and have a source of income for early repayment at any time, that is, they have the ability to choose early repayment at any time when the interest rate on mortgage rises.

4) The borrower adopts the method of equal principal and interest repayment, that is, the amount payable in each period is equal to a constant [5].

Based on the above assumptions, the net present value of advance repayment can be obtained when the lender chooses the interest rate at t-time.

\[ NPV_t = PV_{t,r} - P_t - m \times P_t = PV_{t,r} - (1 + m)P_t \]  

(1)

In which, \( P_t \) is the remaining loan amount at t time, \( PV_{t,r} \) the interest rate at t time. The discounted economic value of a loan’s residual principal-interest annuity, \( m \). The transaction cost rate of prepayment for the borrower is here the penalty for breach of contract, which is multiplied by the amount of the remaining loan, that is, the liquidated damages received by the commercial bank, \( NPV_t \). For at t time \( r_t \) The net present value of prepayment under interest rate conditions. When it is more than 00:00, it chooses to repay in advance, because the cost of prepayment is less than the present value of the installment after discounted; if it is less than zero, it does not choose to repay the loan in advance, because the cost of prepayment is greater than the present value of the installment repayment.

\[ PV_{t,r} = \sum_{i=t+1}^{N} \frac{A}{(1 + r_t)^{i-t}} \]  

(2)

In which, \( N \) The term of the loan established in the original mortgage contract for which there is no advance payment. \( A \) The amount of principal and interest repayable by the borrower in the first installment, in this case the equivalent amount, that is, the same amount for each installment. By inserting (2) into (1) and using interpolation to analyze the critical value, we can draw a conclusion: \( \frac{\partial NPV}{\partial r_t} > 0 \) That is, the net present value increases with the increase of the interest rate on loan repayment. The loan interest rate when the net present value is set to 0 is \( r^* \), when \( r_t > r^* \), \( NPV_t > 0 \) Therefore, buyers should choose prepayment; when \( r_t < r^* \), \( NPV_t < 0 \). At this point, buyers can choose not to repay the loan in advance.
6 Proposals for repayment of loans in advance

For borrowers, the purchase contract is usually drawn up by commercial banks, they can only passively accept the terms listed in the contract. When the central bank's monetary policy frequently announces the increase of loan interest rate, the interest expenditure of buyers will increase significantly. At this time, early repayment of loans is a good way to reduce interest expenditure. Method. However, when choosing whether to repay the loan in advance, the borrower should first consider his own economic conditions. On the basis of not affecting his normal life and operation, there is no suitable investment channel for the time being. Then, according to the above-mentioned interest rate relationship model, the borrower can judge whether it is suitable when the interest rate rises. Early repayment.

At present, most of our country's housing mortgage loans adopt the equal principal-interest repayment method. This method of repayment is characterized by that although the total amount of monthly repayment is fixed, in the early stage of repayment, the proportion of monthly interest is larger. With the advancement of repayment period, the proportion of interest is decreasing and principal is decreasing. The proportion is increasing, so if the borrower has the ability to pay in advance at the beginning of the repayment, it can save a large part of the interest expenditure.

Reference


