

Research on the Formation Mechanism of International Financial Market Benchmark Interest Rate Based on Data Mining Technology

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Abstract: Interest rate marketization is an important link in Chinese financial system reform. As the front end of the interest rate mechanism, establishing and perfecting the market-oriented interest rate formation mechanism will directly affect the effective operation of the financial system and the allocation efficiency of financial resources. However, many financial products, such as floating rate bonds, interest rate swaps and forward transactions, are usually closely linked to the market benchmark interest rate, which is the basis for trading and pricing these financial products. Decision tree is one of the important research aspects in data mining. It analyzes all kinds of massive, complex and noisy data, and provides effective theoretical guidance for the formation mechanism of benchmark interest rate in international financial market. In this paper, data mining technology can find the law behind the formation mechanism of benchmark interest rate in the international financial market from massive financial data, effectively reduce the operational risk of financial institutions, so the financial risk early warning has broad application value and market prospects.

1. Introduction

In the interest rate system, the benchmark interest rate is in a key position. The benchmark interest rate generally refers to the rate of return on investment with no risk or lowest risk, and its change determines the direction of other interest rate changes, thus affecting the prices of other financial assets [1]. With the deepening of financial marketization reform, the transformation of financial institutions and the sustainable development of financial markets require the establishment of a market-oriented interest rate formation mechanism, thus playing a price-oriented role in guiding the steady development of the financial system and promoting the structural adjustment of the real economy [2]. However, many financial products, such as floating rate bonds, interest rate swaps and forward transactions, etc. Generally, it is closely related to the market benchmark interest rate, which is the basis of transaction and pricing of these financial products [3]. The global financial market has been impacted, with the bankruptcy of some large investment banks, financial market panic [4]. At present, how to establish the market benchmark interest rate has become an important topic of deepening the reform and development of Chinese financial market. Therefore, this paper analyzes and studies the application and existing problems of data mining technology in the financial industry, in order to highlight its advantages in the financial industry data processing and avoid financial risks.

2. Summary of Data Mining Technology and Its Application in Financial Market

2.1 The concept of data mining

Definition of data mining: the process of finding useful information hidden in massive incomplete, seemingly irregular, or inaccurate data that is nearly randomly generated for users. These data are huge, incomplete, complex, fuzzy, and of different formats, which are not easy for people to understand [5]. Their analysis is based on certain assumptions, and then through analysis of data to prove the hypothesis is correct or wrong. Because the analysts are different, the assumptions they establish may be different, and the effectiveness of the method is based on the

analyst's various assumptions, so it may limit the effectiveness of the method. In the process of inputting the data set into the neural network, the connection weight between the neurons is adjusted according to a certain way, so that the network can store the connotation of the data set in the manner of connecting the weight matrix [6]. Among them, classification and prediction become one of the most important contents in data mining, which are widely used in financial business intelligence activities such as communication, financial institutions, retail industry, etc. The process of classification is to judge the new data category according to the classification function or classification model made by the known sample data. Data mining is a method of knowledge discovery. The unique or common attributes of an instance can be determined by using multidimensional correlation database at the same time.

According to the concept of data mining, the typical structure of a data mining system is shown in Figure 1.

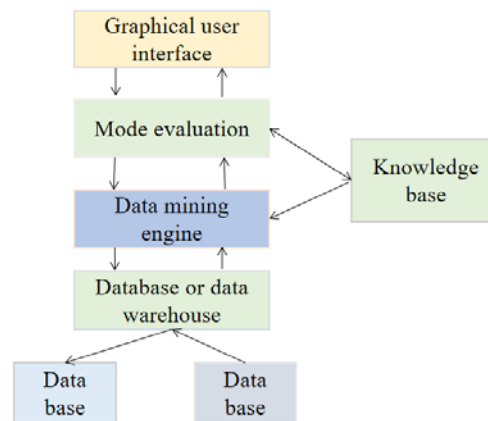


Figure 1 Common data mining structures

The massive data in the database and various storage media are stored in the database through data preprocessing, conversion and other links. The mining system and specific algorithms read out useful information in the places where the data are stored according to people's wishes. On the basis of the analysis of financial data, accurate forecasting techniques can be used to know the trend of information exchange and financial risk prevention. In addition, various risk incentives can be determined through correlation analysis, such as financial ratio, enterprise credit rating, internal control, etc. Then, the risk level of each audit scope is determined by the risk inducement standard. Under the supervision of the training database, useful things are extracted, and the mining results are limited to the range specified by the user through the pattern evaluation and the comparison of relevant strategies in the knowledge base, and the final results are displayed to the customer through the easy to read way such as charts. It can also be established in the direction of providing statistical information such as maximum, minimum, sum, average and others, as well as in the direction of data warehouse, data cube, multi feature and discovery driven data cube, feature and comparative analysis, and isolated point analysis.

2.2 The process and steps of data mining

The data mining process is shown in Figure 2. It is a complex process of repetition, circulation and recursion, which can not be realized simply by a single thread and process step. When a process is found to be inconsistent with human will requirements, it is necessary to return to the previous steps for readjustment and re execution. Then based on the existing data information, and under the assumption that a certain condition is strictly established, establish a most appropriate and concise mathematical model. Finally, the results of the model and the world are analyzed to obtain the results.

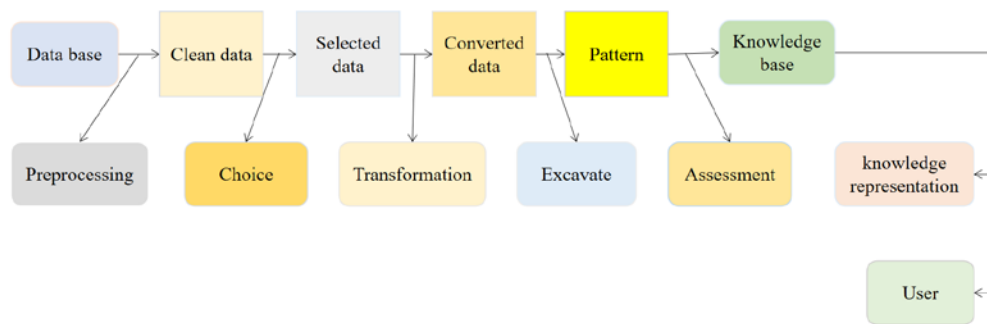


Figure 2 Data mining steps

In the test of internal control, the data mining decision tree method can be used to classify financial enterprise audit data, and then some samples are extracted from various data for test internal control. Data mining can mine data on the basis that the premise is not very clear. In fact, this is the essential difference between data mining and traditional data mining analysis (such as report, query, online application analysis, etc.) [7]. In this process, we will encounter a large number of incomplete outliers with noise, only to clean the data and deal with the missing fields, and ignore some special cases, so that the data source format looks consistent in the general direction, which is suitable for the algorithm used in the system.

3. Current Situation and Problems of International Benchmark Interest Rate

Benchmark interest rate plays a key role in the international money market. It is usually based on market supply and demand, plays a guiding role in the interest rate changes in the entire financial market, and is the basis for pricing financial products recognized by the market. Compared with the high interest rate, the risk of low interest rate is lower. If both the net derivatives position and the net lending position of the bank make it advantageous for the bank to understate the interest rate, the bank will be very willing to understate the interest rate [8]. For example, when the market has strong interest rate cut expectations, the long-term bond yield will be lower than the short-term bond yield on the bond yield curve, which means that the market benchmark interest rate has been adjusted before the official interest rate. Banks using these media to engage in services are not fundamentally different from traditional banking services, nor do they eliminate the inherent risks of finance [9]. Driven benchmark interest rates, such as the London Interbank Offered Rate and the European Interbank Offered Rate. Second, the transaction-driven benchmark interest rate. From the international experience, the current benchmark interest rates adopted by the developed economies such as the United Kingdom, the United States, and the Eurozone have two main modes: First, the quotation of Western countries has given up the direct availability of credit. Management, canceled the upper and lower limits of interest rates and relaxed the management of the asset-liability structure, and objectively promoted the process of financial liberalization. Because at this time most people will regard the fluctuation of interest rate as the result of business expansion [10]. However, when the market business is at a low ebb, especially during the financial turmoil, banks are very afraid of high reported interest rates, especially when the media pay attention to the reported interest rate level of banks.

After the outbreak of the financial crisis in 2008, especially the collapse of Lehman Brothers, the credit risk of counterparties has gradually increased, the global financial regulatory environment has become increasingly strict, the banking concentration has increased, and the loose monetary policy environment with zero interest rate or even negative interest rate has led to a slowdown in the growth rate of transactions in the global money market [11]. Since these banks have the highest credit rating in the market, lending funds to them can be regarded as risk-free and represents the risk-free rate of return for the same period in the market. The rules of the game for financial markets should be formulated in accordance with internationally accepted standards. At present, Chinese deposit and loan interest rates are basically controlled by the state and lack of effective competition, which is not conducive to the formation of market interest rates reflecting the supply and demand of

RMB [12]. The government's ability to regulate the economy through fiscal means is weakening. It can only achieve the strategic goal of the government's economic development by strengthening financial control. Although the role of interest rates and capital flows has been greatly strengthened in the international process of financial globalization, and the exchange rate is more sensitive to it, the impact of inflation on the exchange rate cannot be ignored. The unsecured credit loan turnover decreased significantly, LIBOR's potential market base gradually shrank, and secured financing gradually increased, and its share in the money market gradually increased [13]. The long-term interest rate control has led to limited funding sources in the banking system and poor transmission mechanism of monetary policy. It has also made the theory of free market interest rates and the elimination of interest rate control once again become the consensus of all parties.

The Eurozone currency market is also facing similar structural changes. According to the 2014 Eurozone money market report released by the European Central Bank in 2015, the volume of unsecured lending in the Eurozone currency market has declined significantly since 2003. Borrowers and lenders are different in different markets. The cost of actually borrowing funds between banks is also different [14]. The interest rate parity theory has profound implications for this, and the overshoot theory further points out that in the process of interest rate, price and exchange rate adjustment, the rhythm of price and interest rate is different, and the exchange rate will inevitably overshoot. Based on the guidance of macroeconomic policy, the risk pricing ability of banks and other financial institutions under the traditional financial system is relatively low, and they prefer to distribute financial resources, especially credit resources to state-owned enterprises. In addition, LIBOR and other quotation driven benchmark interest rates have potential conflicts of interest in their formation process. After the financial crisis, there have been many scandals of manipulation of benchmark interest rates. Practice has proved that the radical reform of marketization in the short term mostly ends in failure [15]. The same is true with the yield of national debt as the market benchmark interest rate. National debt is the financial product with the highest credit rating in the market of a country. The yield of national debt is generally regarded as the risk-free yield of the market. This is the fundamental reason why the market benchmark interest rate is formed by the bond yield in the developed countries, such as the United States.

4. Performance of Interest Rate Transmission in International Financial Market

4.1 The process of interest rate marketization accelerated

In the process of financial globalization, governments all over the world have generally implemented the reform of deregulation of interest rates, making interest rates more flexible and balanced. Transaction data between dealers in the three-way repo market and general repo transaction data of the three-way repo will not be included in the Fed's transactions in the repo market to ensure that the repo interest rate is determined by the private sector. However, these results also show to the regulatory authorities that there are indeed market anomalies. As long as such anomalies are caused by non-compliance transactions, there is market manipulation. On this basis, the regulatory authorities can require the relevant banks to provide more detailed transaction information.

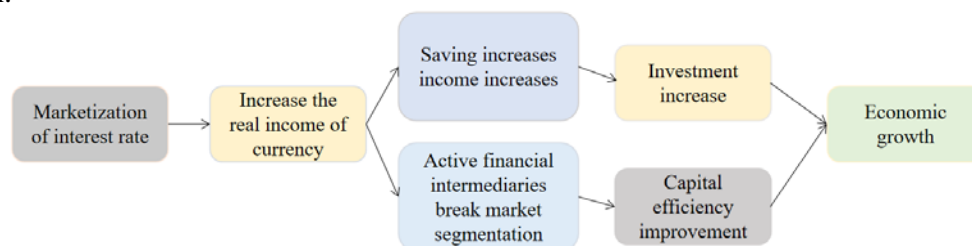


Figure 3 The transmission mechanism of interest rate marketization to promote economic growth

The decision level of interest rate, the core price of financial market, is increasingly reasonable and effective, and its information is more and more open, transparent and grasped, which plays an important regulatory role in economic operation (Figure 3 shows the transmission mechanism of

interest rate marketization to promote economic growth). For each regression equation, the price difference of default swap and the implied volatility of options in the price are added as risk correction terms, and the relationship between the reporting interest rate and risk compensation pricing mechanism is detected. The authority of the market benchmark interest rate is usually reflected in the fact that it is determined and published by authoritative intermediaries according to strict and standardized procedures. The openness is to maintain transparency in the market during the process of determining, and investors can easily obtain all kinds of relevant information.

4.2 Frequent adjustment of interest rate

The rise in interest rates in the 1980s was basically caused by high inflation, but it also contained some official factors. Many countries have since regarded inflation as the number one enemy and adopted a relatively strong anti-inflation policy, such as tightening monetary policy. Raising interest rates to curb inflation, the Reagan administration has made deposit rates as high as 25%. If the market benchmark interest rate is always in fluctuations only for the pursuit of real reflection of market changes, this will make the pricing of other financial products incomprehensible. It is suggested that the Financial Stability Board should be the coordinator to organize the regulatory agencies of various countries to systematically study the relevant issues of the market benchmark index system and establish an information sharing mechanism. These adjustment measures have had a significant impact on the world economy. Subsequently, Canada, Japan, South Korea and the European Central Bank also adopted the interest rate policy of tightening before loosening. At present, scholars in the industry have reached an agreement on the Internet financial risks. They believe that from the perspective of market risk dispersion and market efficiency improvement, the current financial Internet and Internet Finance actually enlarge the financial risks. A new overnight unsecured lending rate is developed for the existing real transaction data of the money market. At present, the ECB is still in full communication and exchange with market participants on the formation mechanism of the rate. It is expected that the rate will be completed by 2020.

4.3 The relationship between exchange rate and interest rate parity is obvious

Under the free interest rate system, the change of foreign interest rate will affect the exchange rate and domestic interest rate, which will lead to the international transmission of interest rate; at the same time, the change of exchange rate between the two countries will also cause the change of interest rate between the two countries, which will form the international transmission of exchange rate to interest rate. Internet finance promotes the innovation of traditional financial system and the establishment of new financial market system. The key point lies in the substantive breakthrough in risk control, rather than simple technology upgrading or institutional and product innovation, or simply transferring offline fund-raising to the Internet. In emerging financial markets, network operation has broken the operation process and service mode of traditional financial services. "Virtualization" and "intelligence" have enabled the supply and demand sides of financial products and services to independently complete transaction matching through "many to many", "one to many" or "many to one" with the help of network platform, such as Japan. For the gradual reform of the interest rate marketization order, the interbank interbank offered rate in the money market is first liberalized, followed by the lending rate of the credit market, and the deposit interest rate should be carefully supervised and finally released. The Fed raised interest rates, causing the European Central Bank to feel pressure and increase interest rates, resulting in an "interest rate war." In financial market transmission, interest rates and exchange rate variables change simultaneously, but sometimes they are dominated by exchange rates, sometimes with interest rates. Especially in some special occasions, there are temporary strong disturbance factors that affect the supply and demand of the market. For example, the failure of the market trading system and the liquidity difficulties of individual market members will cause large fluctuations in market interest rates in the short term.

5. The Formation Mechanism of International Financial Market Benchmark Interest Rate in the Process of Interest Rate Marketization

5.1 Speed up the pace of interest rate marketization reform and establish the basis for the formation of market benchmark interest rates

The market benchmark interest rate is formed in the market, which contains an important prerequisite, the marketization of interest rate. At present, China still has relatively strict interest rate control in many fields. The central bank is responsible for setting most interest rates, which makes the formation of the market benchmark interest rate lack the necessary basis. The benchmark interest rate in the interest rate system is represented by various legal interest rates, such as refinancing interest rate, rediscount interest rate, legal deposit and loan interest rate, etc. The deposit and loan interest rate of other various terms and the interest rate of various securities are all set according to the benchmark interest rate and the upper and lower limits stipulated by the state. The company's reporting of the benchmark interest rate after considering its own derivatives position may actually cause market manipulation. This kind of risk company does not seem to attract attention. In addition, when considering the interest rate, it also considers how to avoid the negative impact of the media. In addition, due to the uneven credit status of the trading entities in the interbank borrowing market, the interbank offered rate between different trading entities reflects a certain credit risk premium. The above characteristics of the interbank offered rate and the risk-free or low risk of the benchmark interest rate are Does not match. Therefore, the pace of reform of interest rate marketization should be accelerated, so that market entities can fully exercise their pricing autonomy in transactions. It lays a good foundation for the formation of benchmark interest rates in China.

5.2 Promote the development of money market and capital market, and create conditions for the formation of market benchmark interest rates

Long-term interest rates are mainly reflected in bond prices, bond prices are rising, long-term interest rates are falling, and long-term interest rates are affected by short-term interest rates. The development of money market and capital market, especially the development of financial institutions' interbank market and national debt market will play an important role in the formation of Chinese market benchmark interest rate. In the traditional financial market, the interactive game between market participants such as financial asset demanders, financial asset suppliers, financial asset potential suppliers and financial risk regulators. The most prominent trend in the world's monetary policy is to increase the dependence on the operation of the money market, which shows that the interest rate in the money market will become the core of the whole interest rate system after taking the lead in completing the marketization.

The general composition of the general decision tree. We can see that there will be some differences between the representative process of the current non-leaf nodes and the specific analysis process. Under such circumstances, people will have closer continuity between the process embodiment of current decision-making and the process embodiment of analysis.

If there are t events, they have the same probability, then their probability is $y(t)/l$, and the amount of information transmitted by an event is $S(t)$

$$S(t) = \frac{y(t)}{l} \quad (1)$$

If there are i events whose given probability distribution is $i=(i_1, i_2 \cdots i_n)$, then the amount of information conveyed by the distribution is called the entropy of k_j .

$$k_j = \frac{R_j}{D_j} \times U_j \times Re_j \quad (2)$$

If a record set R is divided into mutually independent classes T_j according to the value of the

class attribute, the information required to identify which class an element of T belongs to is S_j , where f_{ij} is the probability distribution of R_j , namely:

$$R_j = \frac{f_{ij}}{T_j} \times S_j \quad (3)$$

The information gain degree is the difference between two information quantities, one of which is the amount of information of an element for which S_j needs to be determined, and the other amount of information is an element of n that needs to be determined after the value of the obtained attribute S_r . The amount of information, the information gain formula is:

$$S_j = \frac{1}{\sum_{i=1}^n (S_r)}, (0 < (S_j) \leq 1) \quad (4)$$

Judging from international experience, the risk-free benchmark income usually comes from the transaction prices in the money market and the national debt market, especially the money market. Due to its relatively short term and high liquidity, the yield it generates often becomes the benchmark interest rate of the market, such as LIBOR, etc. However, the long-term financial system under high-pressure control will inevitably lead to financial monopoly, and the transmission effect will make the economy inefficient, while the failure of the financial system will affect the interests of those with vested interests in the traditional financial market. The interest rate of each country is more internationalized, which also makes the flow of international funds in the bond market of each country tend to be frequent. Under the circumstances that some interest rate changes and the interest margin changes of each country are expected, it may lead to the emergence of bond market storm.

5.3 Give full play to the role of market intermediaries and provide institutional guarantee for the formation of market benchmark interest rate

Market intermediaries, including transaction organizers and service providers, can play an important role in the formation of market benchmark interest rates. The difference is that the inter-bank pledge repo rate includes all members of the inter-bank market and there is no special restriction on the pledged bonds, while the inter-bank interest rate bond pledge repo rate refers to the repo transaction rate of the deposit institutions with the interest rate bond as the pledge. British regulatory authorities and industry associations further standardize the operation of reporting benchmark interest rates, and try to isolate the possible internal and external communication interference before the bank reporting interest rate team calculates interest rates, including the establishment of market intelligence use specifications, the separation mechanism between interest rate reporting and derivatives trading interests, etc. However, since the benchmark interest rate is generally a market-oriented interest rate formed by the spontaneous quotation or transaction of market members, and has the characteristics of strong timeliness and high supervision cost, it is urgent for the market self-discipline organization to play a role in formulating quotation behavior norms and carrying out daily monitoring and supervision. Due to their special market position, they can accurately grasp the trading information of the money market and the bond market in real time, and maintain extensive contact with market members, thus being qualified to become the establishment institution of the market benchmark interest rate in our country. Therefore, the repo interest rate is comparable to the bond yield. The repo interest rate of less than one year can be used to replace the bond yield of the same period, but the bond variety should be used as far as possible when conditions are ripe.

5.4 Strengthen the behavior supervision of trading subjects to ensure the credibility of the market benchmark interest rate

The market benchmark interest rate comes from the transaction price in the market. Theoretically, there is the possibility of artificially manipulating the price, especially the market benchmark interest rate as the pricing basis for financial products is directly related to the vital interests of

many transaction subjects. For monetary policy, Keynesianism pays more attention to the function of the policy itself. Monetarism, on the other hand, focuses on the control of money supply. They advocate a “single rule” of fixed growth rate in monetary policy. The bank’s awareness of operational risk prevention should be strengthened by punishing banks that fail to act by compliance departments. Banks are required to take stock of and feedback on reputation risks and compliance risks arising from interest rate reporting. Due to the difference between the participating institutions and the pledge bonds, the credit risk of the deposit-type inter-agency interest rate bond pledge repurchase rate is relatively lower, resulting in a certain difference between the two interest rates, compared with the inter-bank pledge repo rate, the deposit-type inter-agency interest rate. The bond pledge repurchase rate is lower and the volatility is relatively smaller. Combined with the specific situation in China, due to the relatively short time for the establishment of the money market and the bond market, the market structure is not perfect, the relevant rules and regulations are not very sound, and it is easy for insider trading to manipulate the market price. Therefore, the function and role of the new financial market to fully activate and effectively allocate social resources and create greater wealth and social value are fully utilized.

6. Conclusion

At present, the mitigation mechanism for financial risks mainly depends on financial markets and banks. Specifically, it absorbs the expected risks and relies on provisions to absorb unpredictable risks on capital. Interest rate liberalization will inevitably lead to fluctuations in capital and asset prices, which will have an impact on market risk, liquidity risk and credit risk. Interest rates have a strong regulatory effect on economic operations, and the theory of financial deepening analyzes the role of interest rates in stimulating investment and consumption. The financial industry has a special nature different from that of the general industry. It can guide the allocation of scarce resources such as funds, and dominate the direction of economic development and the development momentum of the entire macro economy. Faced with increasingly complicated financial transactions and increasing types of transactions, the current research field of mining technology is still mainly focused on bank customer relationship analysis, credit risk prediction and securities trend prediction. The powerful advantages of data mining technology are applied to financial risk analysis, and new thinking and exploration are carried out on data processing and method analysis of financial risks, so as to make up for the shortage of financial risk data and provide strong support for the application of financial risks. We should pay more attention to the application of data mining technology in market prediction, price trend, fraud detection, customer relationship management, etc. With the maturity of data mining technology and the accelerated pace of financial industry informatization, data mining is sure to play an important role in Chinese financial industry.

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