

Retraction

Retracted: Interbank Offered Interest Rate Risk Measurement Based on Embedded Sensor Network

Mobile Information Systems

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] W. Xie, "Interbank Offered Interest Rate Risk Measurement Based on Embedded Sensor Network," *Mobile Information Systems*, vol. 2022, Article ID 5601513, 12 pages, 2022.

Research Article

Interbank Offered Interest Rate Risk Measurement Based on Embedded Sensor Network

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Interbank lending rate is the main benchmark interest rate in the domestic currency market, looking for an appropriate financial time series model to describe its stochastic fluctuation process, and choosing an appropriate risk measurement method to measure the domestic interbank lending interest rate risk. The risk management of the interest rate market has great theoretical and practical significance. This article is aimed at studying the interbank interest rate risk measurement based on the embedded sensor network and proposes the key technology of sensor network, sensor network MAC layer protocol, LEACH energy model, and other methods in the article. Related experiments have been carried out on the interbank interest rate risk measurement. The experimental results show that the interbank interest rate risk measurement model based on the embedded sensor network is much more efficient than the traditional interest rate risk measurement model. This has reduced the bank's loss of interest rate by at least 7%.

1. Introduction

Interest rate risk is a type of financial risk. In essence, it is the change in the price and income of financial products caused by changes in interest. From a superficial point of view, the causes and effects of interest risk are diverse. In recent years, with the continuous acceleration of the domestic interest rate marketization process, domestic interest rate tools for macro control have become more frequent, and the interest rate environment for commercial bank operations has continued to change, and interest rate risks have become more obvious. Since interest rate risk is “bilateral,” that is, the uncertainty of the two directions of loss and benefit, commercial banks can easily assume excessive risks in order to increase their benefits. Analyzing and measuring the risk of interbank loan interest rates is very important to the risk management of commercial banks. At the same time, it is extremely effective to find a suitable financial time series model to describe its stochastic fluctuation process and to choose a suitable risk measurement method to measure the domestic interbank lending rate risk.

The core task of the financial market is risk management and risk price setting. When setting the risk price of financial

products related to interest rate risk management, it is particularly important to accurately predict the changes and tendencies of interest rates provided by banks. In the case of changes in the economic environment, it is important for the central bank to carry out more effective financial supervision by scientifically using interest rate prediction methods and exploring the establishment of an interbank loan interest rate risk prediction model, and it can also encourage commercial banks.

The innovation of this article lies in the research of embedded sensor networks and a full understanding of the characteristics of sensor networks such as strong compactness, high sensitivity, and strong interoperability. Secondly, in the simulation experiment, it is proposed to conduct experiments on the changes of interbank lending rates from the perspective of technical forecasting, etc., to verify the feasibility of the risk measurement model.

2. Related Work

With the continuous development of science and technology, wireless sensor networks have attracted the research interest of a large number of researchers. Wireless sensor

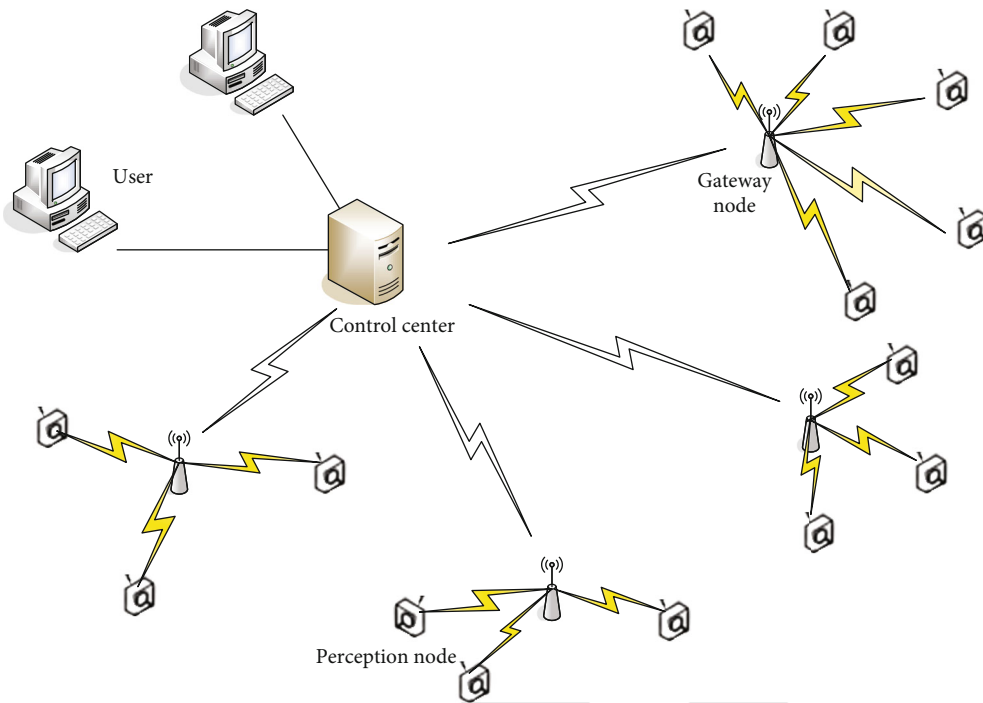


FIGURE 1: Structure diagram of sensor network.

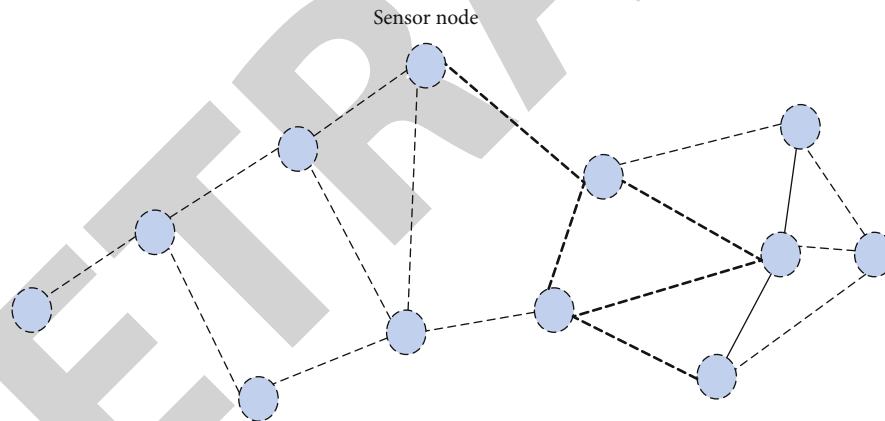


FIGURE 2: Wireless sensor plane network structure diagram.

network is one of the most popular IoT network technologies. The efficiency of the trust evaluation process largely depends on the trust derivation, because it dominates the overhead in the process, and the performance of WSN is particularly sensitive to overhead due to limited bandwidth and power. So Duan et al. proposed an energy-aware trust derivation scheme using game theory methods in his research, which manages overhead while maintaining sufficient security of WSN [1]. Also, in the research on the security of WSN, Seo et al. proposed a certificateless effective key management (CL-EKM) protocol in the research, which is used for secure communication in dynamic WSN characterized by node mobility [2]. Structural health monitoring (SHM) using wireless sensor networks (WSN) has aroused research interest because of its ability to reduce the costs

associated with the installation and maintenance of SHM systems. In his research, Adam et al. conducted a comprehensive investigation of SHM using WSN and outlined algorithms for damage detection and location, network design challenges, and future research directions. At the same time, he also compared and discussed solutions to network design problems [3]. Location is one of the key technologies in wireless sensor networks (WSN), because it provides basic support for many location-aware protocols and applications. Cost and power consumption constraints make it impossible to equip each sensor node in the network with a global positioning system (GPS) unit, especially for large WSNs. In a survey, Han et al. reviewed the most successful MANAL algorithm, focusing on the achievements in the past ten years, striving to conduct a comprehensive review of the

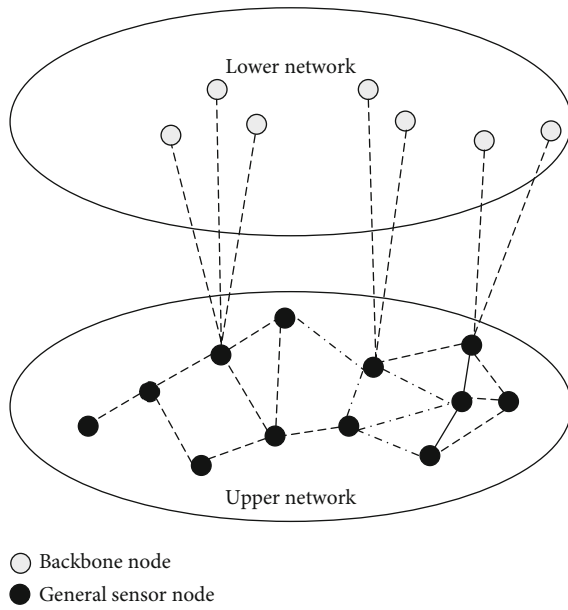


FIGURE 3: Sensor hierarchical network structure diagram.

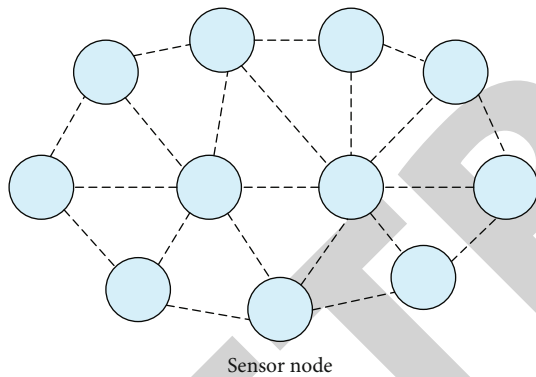


FIGURE 4: Wireless sensor mesh network structure diagram.

latest breakthroughs in this field and provide links to the most interesting and successful progress in this research field [4]. It is also in the research on energy-saving optimization of sensors. In Luo et al.'s research, he focused on minimizing energy consumption and maximizing the network life of data relay in a one-dimensional (1D) queue network [5]. Underwater wireless sensor network (UWSN) technology is widely used in various underwater monitoring and exploration applications and has proven its high status. Goyal et al. proposed a paper based on the UWSN survey, which contains data aggregation to highlight its advantages and limitations [6]. In the era of big data, sensor networks have become pervasive, generating large amounts of data for various applications. Yang et al. mainly focus on the reliability of data storage in heterogeneous wireless sensor networks, in which robust storage nodes are deployed in the sensor network, and data redundancy is utilized through coding techniques [7]. In the research of these researchers, most of them are researches on wireless sensor networks, but not on the further development of sensor networks.

3. Sensor Networks and Interbank Lending Rates

3.1. Embedded Sensor Network

3.1.1. Wireless Sensor Network. The wireless sensor network is composed of a large number of wireless sensor nodes. These wireless sensor nodes generally have signal acquisition and simple processing functions and have simple wireless communication capabilities [8–11]. These sensors self-organize into a certain network topology according to the needs of the network and complete information transmission and interaction in one or more hops. One-hop forms are mostly star links. There is a node with strong processing and communication capabilities in the center. The central node is responsible for gathering, organizing, and processing the collected data and sending it to a higher-level center. Multihop methods are generally networks with self-organizing functions. Because sensor nodes have weak communication capabilities and short communication distances, they need to send information through multihops. In multihops, all nodes are equal, which constitutes a network with self-organization ability [12, 13]. Figure 1 shows the sensor network structure.

(1) *Wireless Sensor Network Structure.* The layout is relatively simple in the flat network structure wireless sensor network. This kind of network topology is relatively simple and easy to maintain. The status of each node in the structure is the same, and the functional characteristics are also the same. However, since there is no central management node, the formation of the network adopts a self-organizing coordination algorithm, which reduces the scalability of the planar structure [14]. Figure 2 shows the structure of the wireless sensor plane network.

The hierarchical network structure is divided into two parts, the upper layer and the lower layer. The central backbone node and general sensor nodes are scattered in these two layers. A flat network structure is used between backbone nodes or general sensor nodes, while a hierarchical network structure is used between backbone nodes and general nodes. Generally, sensor nodes do not have functions such as routing, management, and aggregation processing. The network is divided into clusters according to the needs of application types and geographic locations, and each cluster is divided into cluster heads and member nodes [15]. This structure increases the capacity of the entire network, but the algorithm requirements for cluster head selection are more stringent. Figure 3 shows the wireless sensor hierarchical network structure diagram.

Mesh network structure is the focus of recent network research, which is mainly used in the network structure of AP access nodes in large-scale networking [16]. Mesh network nodes are generally static, and the network structure is relatively stable and only changes when the nodes are connected and exited. Mesh network supports many users, high stability, and throughput and is generally used in the construction of backbone networks. Simple installation and



FIGURE 5: Application of wireless sensor network.

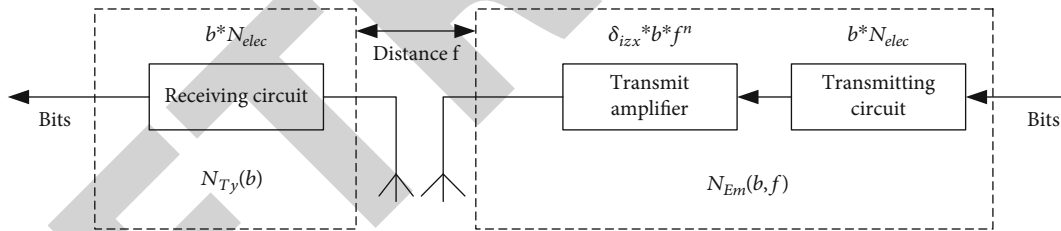


FIGURE 6: Radio energy consumption model.

automatic networking the installation and layout of the wireless mesh network is not difficult, and there are not too many complicated settings.

In the mesh network structure, there are usually multiple routing paths between network nodes. If any node fails, the nodes can intelligently find a new routing path through the routing algorithm without affecting the network communication capabilities of other nodes. Figure 4 shows the mesh network structure diagram.

(2) *Key Technologies of Wireless Sensor Networks.* As a cutting-edge research field that has attracted much attention in the world today, WSN has had an increasing impact on people's production and life. On the basis of traditional communication network theory, researchers have thoroughly studied the inherent theoretical laws of WSNs and

concluded a new theoretical system [17, 18]. The main technologies related to WSN can be summarized as network communication protocol, time synchronization, and so on. The application of wireless sensor network is shown in Figure 5.

3.1.2. *MAC Layer Protocol of Wireless Sensor Network.* In WSN, the MAC layer has the right to govern the use of wireless channels to promote effective data communication. Its main function is to allow multiple users to effectively share wireless channel resources, avoid conflicts, and improve channel utilization [19]. Disadvantages of wireless sensor network are as follows: (1) for physical layer, the main attack methods are congestion attack and physical damage; (2) for link layer, the main attack methods are collision attack, exhaustion attack, and unfair competition.

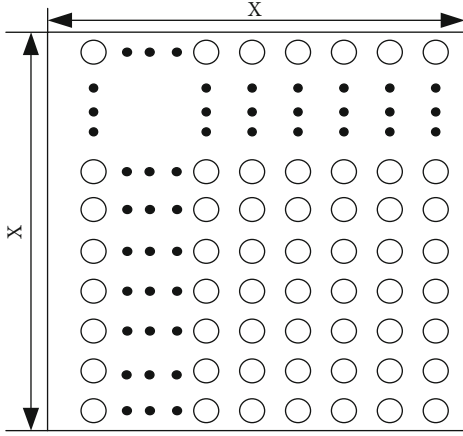


FIGURE 7: Network structure model.

TABLE 1: Bank transactions in the interbank market over the years.

	The first season	Second quarter	The third quarter	Fourth quarter
2015	5600	6400	7100	7300
2016	7620	7860	7302	7650
2017	8621	7560	6580	8741
2018	9630	9800	9600	9883

TABLE 2: Changes in interbank offered rates.

	June	December	Average interest rate ranking
2014	3.01	3.22	5
2015	3.06	3.31	4
2016	3.00	3.18	6
2017	3.28	3.22	3
2018	3.22	3.34	2
2019	3.28	3.29	1

S-MAC protocol is a typical MAC protocol based on competition. This protocol is proposed to improve the limited energy of node batteries in WSN. It assumes that the network allows some delay and allows nodes to sleep periodically, so achieved a better energy-saving effect.

As a classic contention-based protocol, S-MAC uses a periodic listening/sleeping mechanism that enables nodes to sleep for a long time, reducing the time the node is in the idle listening state, so it reduces idle listening energy consumption generated, where HN is the initial energy. Compared with the MAC protocol without sleep state, the energy saved by S-MAC is approximately:

$$I_s = \frac{U_{\text{Sleep}}}{U_{\text{frame}}} * I_0 = I_0(1 - HN), \quad (1)$$

$$U_{\text{frame}} = U_{\text{Listen}} + U_{\text{Sleep}}. \quad (2)$$

Among them, I_s is the remaining energy for idle listening, I_0 is the energy consumed by the wireless receiving

module while listening, U_{Sleep} and U_{Listen} are the sleep time and listening time of the node, respectively, and the sum is the duration of a listening sleep period, that is U_{frame} .

Due to the random backoff algorithm adopted by the S-MAC protocol, every time a node conflicts, the energy consumed is

$$I_{\text{no}} = I * NR_{\text{new}} * I_{\text{id}}. \quad (3)$$

Due to the periodic sleep mechanism of the S-MAC protocol, when a node wants to transmit a data packet, it must wait for the receiving node to end its sleep before transmitting, which means that an additional delay will be generated, that is, the sleep delay [20]. When analyzing the delay performance, we only need to analyze the delay caused by carrier sensing, transmission, and sleep. When the sensor node receives the data packet, it will immediately start carrier sensing and transmit the data to the next hop node. The average delay at m hops is

$$H(m) = s_{pc,m} + s_{sv}. \quad (4)$$

In the MAC protocol without sleep, the delay caused by m hops is

$$L(m) = \sum_{m=1}^M (s_{pc,m} + s_{sv}). \quad (5)$$

Then, the average delay is

$$P[L(m)] = m(s_{pc,m} + s_{sv}). \quad (6)$$

It can be seen that the multihop delay is proportional to the number of hops, and the linear slope is the sum of the carrier sensing time and the transmission time.

Suppose node x wants to send data to node y . We denote the sleep delay caused by m hops in the process as $s_{c,m}$. The length of a listening sleep cycle is recorded as Z_C . Then, the time delay after passing the m -th hop is

$$L(m) = s_{c,m} + s_{dc,m} + s_{sx}. \quad (7)$$

When nodes y and n exchange RTS/CTS, the next hop node j of n is still listening, so j knows when the information transmission from y to n ends. The adaptive listening mechanism will immediately wake up node j when the previous hop transmission is completed. Similarly, when n transmits data packets to j , n will also perform adaptive listening. Therefore, the delay of the $m + 1$ th hop is

$$L(m + 1) = s_{dc,m+1} + s_{sx}. \quad (8)$$

Because the distance between nodes n and y is two hops, when n transmits the CTS control packet, y cannot overload the monitoring of the CTS packet like j and cannot wake up when the message transmission between x and n ends. Therefore, when n sends a message to j during the dormant period, y cannot receive the CTS packet sent by j because it

TABLE 3: Changes in monthly interbank lending rates among banks.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	3.06	3.01	3.12	3.20	3.25	3.22	3.23	3.26	3.02	2.98	3.11	3.34
2019	3.21	3.26	3.20	3.24	3.20	3.28	3.23	3.26	3.27	3.21	3.26	3.29
2020	3.31	3.36	3.30	3.29	3.34	3.42	3.40	3.38	3.37	3.21	3.28	3.42

TABLE 4: Table of autocorrelation test results.

Lag period	ACF	PACF	Lag period	ACF	PACF
1	0.046	-0.046	7	0.011	-0.020
2	-0.078	-0.076	8	-0.055	-0.098
3	-0.070	-0.079	9	-0.071	-0.104
4	0.010	0.012	10	0.026	-0.025
5	-0.049	-0.008	11	0.106	0.048
6	-0.006	-0.031	12	-0.033	-0.045

TABLE 5: Backtest inspection results.

u	N	N/T	LR
0.03	56	0.0568	0.4011
0.04	59	0.0546	0.3986
0.05	63	0.0561	0.3693
0.06	65	0.0587	0.3566

happens to be dormant, so it cannot wake up in time when the data transfer between n and j ends. j has to wait for the listening period of y to continue sending messages. Therefore, the delay of the $m + 2$ th hop is

$$L(m) = s_{c,m+2} + s_{dc,m+2} + s_{sx}. \quad (9)$$

From the above analysis, the delay of m hop node is:

$$L(m) = s_{c,1} + s_{dc,1} + s_{sx} + s_{dc,2} + s_{sx} + \dots + s_{c,m-1} + s_{dc,m} + s_{sx}. \quad (10)$$

According to the S-MAC protocol adaptive listening process, it can be known that:

$$U_f = s_{dc,m} + s_{sx} + s_{dc,m+1} + s_{sx} + s_{s,m+2}. \quad (11)$$

Therefore, formula (10) can be simplified to obtain:

$$L(m) = s_{c,1} + \left(\frac{m}{2} - 1\right)U_f + s_{dc,m-1} + s_{dc,m} + 2s_{sx}. \quad (12)$$

Since the source node can generate data packets at any time in an U_f cycle, it is assumed that the $s_{c,1}$ of the first hop node obeys the uniform distribution on the $(0, U_f)$, so its average value is $U_f/2$. Therefore, the average delay of an m hop network is

$$P[L(m)] = \frac{mU_f}{2} + 2s_{dc} + 2s_{sx} - \frac{U_f}{2}. \quad (13)$$

It can be seen from formula (13) that if you want to reduce idle listening and save energy, you need to increase the sleep time in U_f , but the increase in U_f will increase the delay. What is described above is the contradiction between node energy consumption and time delay.

3.1.3. Improved Topology Control Algorithm Based on LEACH Algorithm. LEACH is a classic hierarchical clustering topology control algorithm. The algorithm first proposed a strategy for clustering the network. The cluster heads are randomly selected according to probability through a periodic cycle, and ordinary nodes are added to the corresponding clusters according to the requirements to achieve the purpose of network clustering [21].

(1) *LEACH Energy Model.* LEACH's radio energy consumption model is shown in Figure 6. The spatial model used varies with the distance between nodes.

In this model, the energy consumed by the sensor node sending bits data to another node at distance f , $N_{Em}(b, f)$, consists of two parts, the transmitting module and the amplifying module. The expression of $N_{Em}(b, f)$ is

$$N_{Em}(b, f) = \begin{cases} bN_{elec} + b\delta_{zx}f^2, & f < f_0 \\ bN_{elec} + b\delta_{pl}f^4, & f \geq f_0 \end{cases}. \quad (14)$$

Among them, N_{elec} is the energy consumption of the wireless circuit to send and receive unit data, $f_0 =$

$\sqrt{\delta_{zx}\sqrt{\delta_{pl}}}$ is the transmission distance threshold, δ_{zx} and δ_{pl} are the amplifier's energy consumption and attenuation parameters for unit data amplification, and its value is determined by the amplifier.

When a node receives bits data, the energy consumption is mainly circuit consumption, and $N_{Ty}(b)$ is used to represent it.

$$N_{Ty}(b) = bN_{elec}. \quad (15)$$

(2) *Optimal Number of Cluster Heads and Optimal Communication Radius Model.* LEACH uses the cluster head algorithm to generate the expected number of cluster heads x . Assuming that I nodes are uniformly deployed in an $X * X$ square area, the network structure model is shown in Figure 7. After the algorithm runs, x cluster

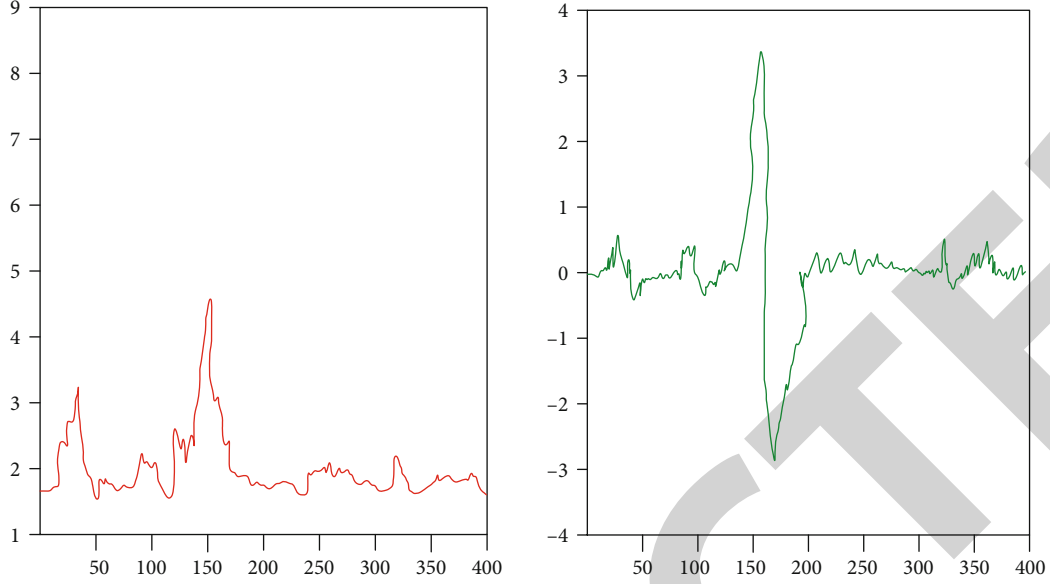


FIGURE 8: The volatility graph of the interborrowing interest rate: (a) volatility graph of overnight call interest rate; (b) volatility graph of the daily return rate of overnight call interest.

areas will be generated. The average number of nodes in each cluster is I_x .

Each cluster member node transmits data only once during a data frame. Assuming that the distance to the cluster head is relatively short, the free space fading model $\delta_{zx}f^2$ is used. Therefore, the energy consumption of each frame of data transmitted by the cluster head and member nodes can be expressed as follows:

$$N_{kl} = \left(\frac{I}{x} - 1\right) bN_{elec} + bN_{ws} \frac{I}{x} + bN_{elec} + b\delta_{zx}f_{toBS}^4, \quad (16)$$

$$N_{non-kl} = bN_{elec} + b\delta_{pl}f_{tokl}^2. \quad (17)$$

Among them, f_{toBS} and f_{tokl} are the distance between the cluster head and the base station and the distance between the cluster head and the member nodes, respectively.

Assuming that each cluster area is a circle with a radius of r , then $r = X/\sqrt{\pi x}$ can obtain the expected $N[f_{tokl}^2]$ of the square of the distance from the member node to the cluster head. The expression is as follows:

$$N[f_{tokl}^2] = \iint (m^2 + n^2) \rho(m+n) dm dn = \frac{1}{2\pi} \frac{X^2}{x}, \quad (18)$$

$$N_{non-kl} = bN_{elec} + b\delta_{pl} \frac{1}{2\pi} \frac{X^2}{x}. \quad (19)$$

The energy consumption of transmitting data frames in each cluster area is

$$N_{cluster} = N_{kl} + \left(\frac{I}{x} - 1\right) N_{non-kl}. \quad (20)$$

In a network with large-scale deployment of nodes, the cluster head is usually far away from the base station, so the multipath attenuation model is adopted; while the member nodes in the cluster only communicate with the cluster head and the distance is relatively short, so the free space model is adopted. Finally, the total energy consumption of x cluster regions can be obtained as follows:

$$N_{Total} = xN_{cluster} = b \left(2N_{elec}Y + N_{ws}Y + b\delta_{zx}f_{toBS}^4 + Y\delta_{pl} \frac{1}{2\pi} \frac{X^2}{x} \right). \quad (21)$$

Taking the derivative of x in formula (21) and making the derivative equal to 0, the optimal number of clusters x_{opt} can be obtained:

$$x_{opt} = \frac{\sqrt{I}}{\sqrt{2\pi}} \sqrt{\frac{\delta_{zx}}{\delta_{pl}} \frac{X}{f_{toBS}^2}}. \quad (22)$$

3.1.4. Embedded System. The concept of embedded is a relatively vague concept compared to traditional personal PCs. The embedded system is composed of hardware and software. The main part of the hardware is the embedded processor and its program memory or memory [22, 23]. Centered on application and based on computer technology, software and hardware can be tailored to meet the strict requirements of application system on function, reliability, cost, size, and power consumption. According to the space requirements for program storage and operation, you can use on-chip program memory and memory or use off-chip external memory and memory. The hardware part generally also has peripherals and power supplies. The power supply is a necessary equipment for embedded systems. It is responsible for providing efficient and stable power supply for all

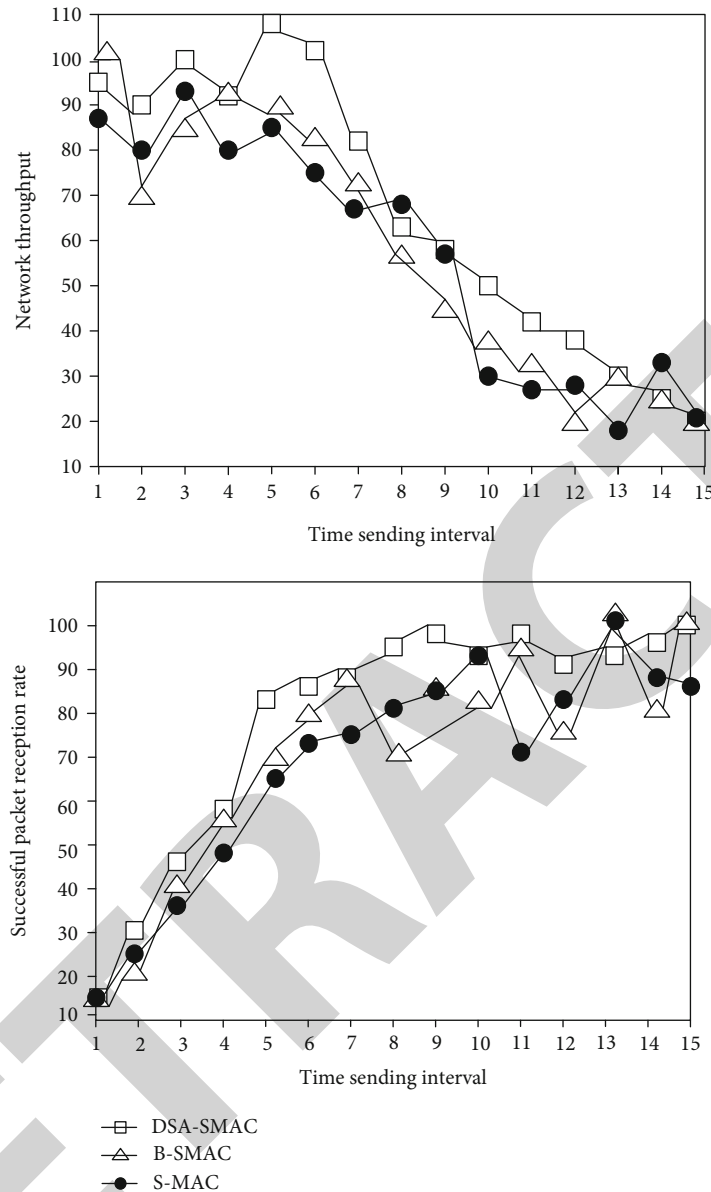


FIGURE 9: Packet receiving rate.

modules. There are various types of peripherals. Generally, what kind of external equipment is used depends on the specific needs of the embedded system. Assume that the core of the software part is the operating system. Embedded operating systems have their own characteristics. They have their own advantages and disadvantages in terms of real-time, space-occupancy, tailorability, and support for peripherals. Users can choose flexibly during use [24, 25].

3.2. Interbank Offered Rate. Interbank offered rate, also called interbank offered rate, is an interest rate used to raise funds between commercial banks in the money market [26]. The subjects participating in the proposed interest rate estimation are banks with high credit ratings. Compared with other interest rates, they provide funds and demand in the

currency market through an open market orientation. The main influencing factors are as follows: (1) the benchmark interest rate of the People's Bank of China, (2) whether the liquidity of each bank is sufficient, and (3) liquidity required by financial markets in the short term.

3.2.1. Influencing Factors of Fluctuations in Interbank Lending Rates. The interbank lending rate generally represents the cost of obtaining wholesale funds for financial institutions and can reflect the supply and demand of funds in a timely manner. It is the most sensitive financial market interest rate and the financial market as a whole. The interbank loan interest rate is highly conductive, and its changes rapidly expand and are communicated to the market interest

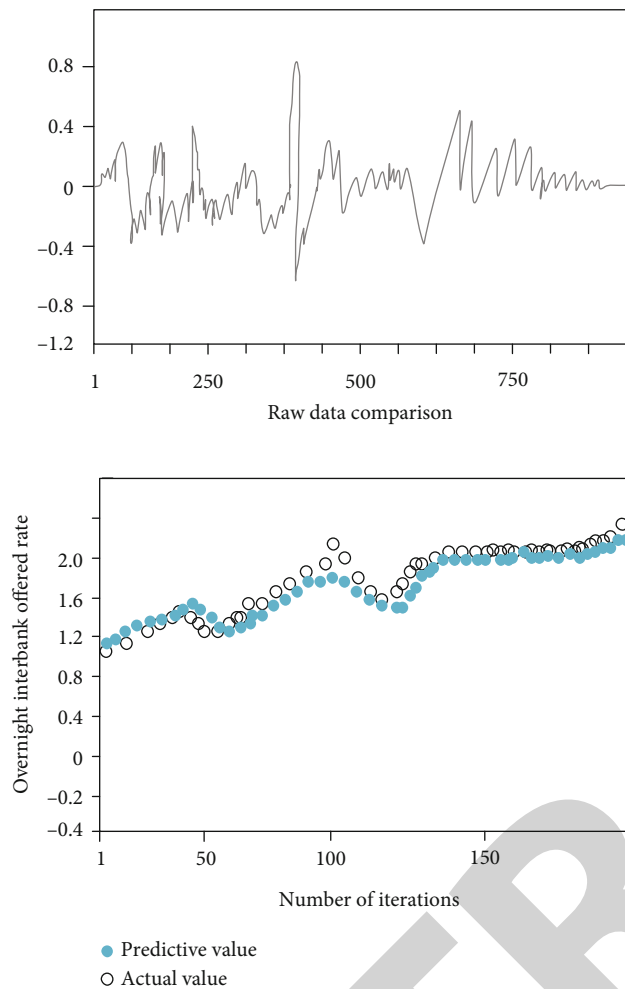


FIGURE 10: Forecast result graph.

rate system, thereby bringing changes to the market interest rate as a whole [27].

3.2.2. The Basic Method of Interest Rate Forecasting. The main content of interest rate prediction includes the direction of interest rate changes and the level of interest rate changes. Scientific and accurate interest rate analysis and prediction results provide a reliable decision-making basis for the measurement and management of interest rate risk. Generally speaking, the methods of interest rate forecasting can be divided into judgment forecasting methods, econometric forecasting methods, and technical forecasting methods. That is to solicit and synthesize the opinions of the salespersons of the enterprise and the business personnel of the commercial department and synthesize the forecast of the enterprise.

3.3. Risk Measurement. Essentially, interest rate risk refers to changes in the value and income of financial products caused by changes in interest rates. Since the interest rate risk management of domestic commercial banks started late, many banks still use traditional static risk measurement

methods such as sensitivity difference analysis, period difference analysis, and convexity analysis to measure interest rate risk. However, with the progress of interest rate marketization and domestic restrictions on access to foreign banks and the liberalization of business scope, commercial banks will face increasingly fierce competition. The traditional interest rate risk measurement methods can no longer meet the interest rate risk requirements of commercial banks. At present, the most popular risk measurement method in the world is the VaR model method. In order to improve the level of interest rate risk management, domestic commercial banks have begun to gradually adopt the VaR model method.

4. Investigation Experiment on the Interest Rate Risk of Interbank Offered

4.1. Survey on the Transaction Volume of Banks in the Interbank Lending Market over the Years. The interbank lending market, as a market for the financing of financial institutions, is an important part of the money market. In order to further understand the development of the domestic interbank offered interest rate market, changes in the interbank offered rate mainly reflect the current money market conditions; that is, when the currency is loose, the interbank rate will go down; when the currency is tight, the rate will rise. It is often at the end of the month, the end of the quarter, and the end of the year that interest rates rise; this experiment investigated the changes in the transaction volume of the domestic interbank offered market in recent years. Table 1 shows the results of this survey experiment.

It can be seen from the data in Table 1 that over time, the transaction volume of the domestic interbank lending market has exploded, and the transaction volume in 2018 has increased by at least 30% over 2015.

4.2. Investigation of Changes in Interbank Lending Rates. The interbank lending rate is an important factor affecting its transactions, and it is also an important indicator of the interbank lending rate risk measurement. In this study, the interbank lending rates of domestic banks in different periods were also investigated. Table 2 shows the changes in domestic interbank lending rates in recent years.

It can be seen from the data in Table 2 that in recent years, the domestic interbank lending rate has remained above 3%, and the interest rate has changed significantly. With the change of time, the interbank lending rate has also shown an upward growth. In order to more intuitively see the growth trend of the interbank lending rate, Table 3 gives examples of the changes in the interbank lending rate in the past two years.

It can be seen from Table 3 that the average interbank lending rate in 2018 was less than 3.20%, while the average interbank lending rate in 2019 reached more than 3.23% and reached more than 3.30% in 2020.

4.3. Experiments on Measuring the Interest Rate Risk of Interbank Lending. The purpose of the autocorrelation test is to test whether the daily rate of return of the interbank

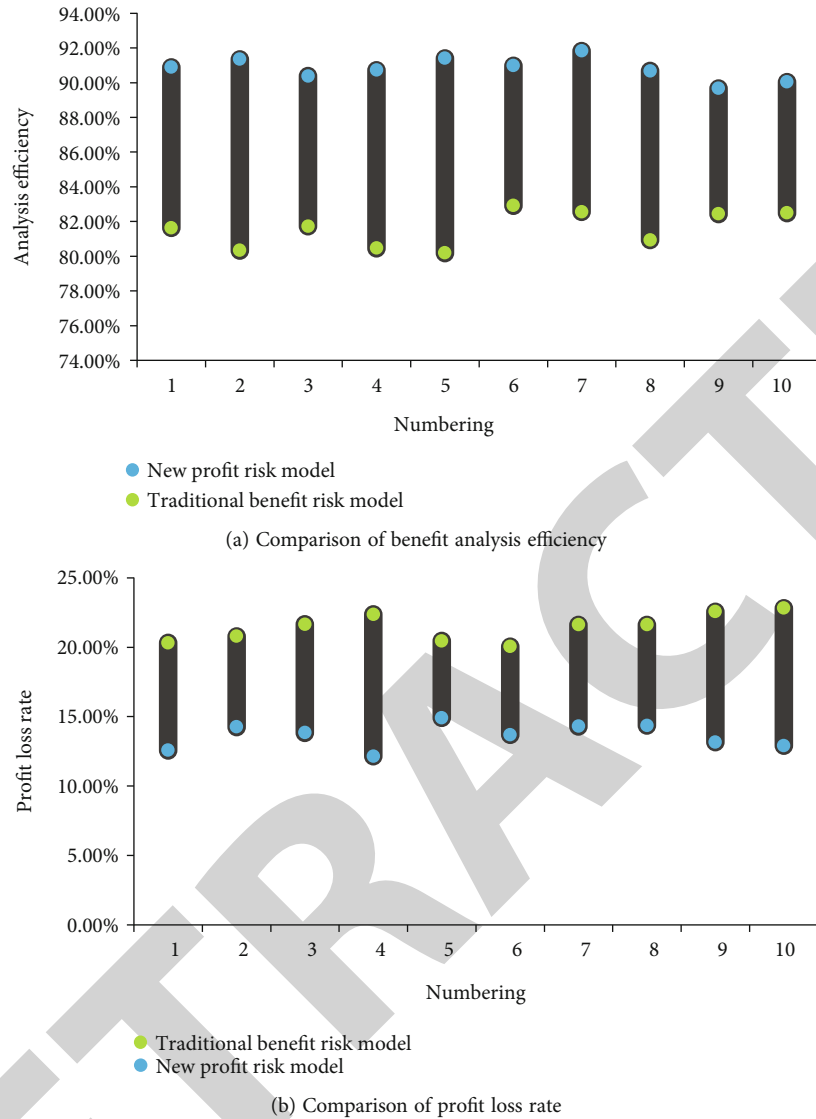


FIGURE 11: Results of comparison with traditional profit and risk models.

lending rate in each period has correlation and correlation characteristics. A total of 12 data are selected in this experiment. Table 4 shows the autocorrelation coefficient and partial autocorrelation coefficient of the daily yield of the overnight call rate.

After completing the autocorrelation test, this experiment conducted a backtest test on the interbank interest rate risk measurement model based on the embedded sensor network. Table 5 shows the VaR backtest test results of the residual sequence with a confidence of 90%.

It can be seen from the results in Table 5 that at different confidence levels, the *LR* value is greater than the quantile of the chi-square distribution with the degree of freedom at the corresponding confidence level. Therefore, the interbank interest rate risk measurement model based on the embedded sensor network is explained. It has passed the accuracy test, and the model can be used when measuring the interbank lending interest rate risk.

5. Risk Measurement Model of the Interbank Offered Interest Rate Based on the Embedded Sensor Network

5.1. Data Stability Test Based on the Interbank Lending Interest Rate Risk Measurement Model. This article will use the overnight lending rate data in the sample for model estimation. Before model estimation, we must analyze the characteristics of these data to determine whether it is suitable for model estimation based on interbank lending rate risk measurement. Figure 8 shows the results of data verification.

As can be seen from Figure 8(a), there is a clear trend in the overnight lending rate, so we can determine that it is a nonstationary series, so it cannot be directly processed. In order to obtain stable time series data, this article uses the logarithmic return rate of the overnight call interest rate for analysis. From Figure 8(b), it can be seen that the daily return rate of the overnight call interest rate fluctuates

around a certain mean value, and there is no obvious trend. According to the unit root, the test statistics can determine that the daily rate of return of the overnight call rate is a stationary series. After judging the data sequence, the risk measurement model can proceed to the next step.

5.2. Data Packet Reception Rate of Wireless Sensor Network Protocol. Figure 9 is a comparison curve of the successful reception rate of data packets of the three protocols in the wireless sensor network.

It can be seen from the figure that the successful reception rate of DSA-SMAC protocol data packets is slightly higher than that of B-SMAC and S-MAC protocols, which are 4% and 5% higher, respectively. When the network load is large, the successful reception rate of the data packets of the three protocols is relatively low. This is because the channel will become more congested and cause greater delay. The sent data is prone to collisions, and the destination node cannot receive the data in time. As the network load decreases, the successful reception rate of the three data packets gradually increases.

5.3. Interbank Offered Rate Risk Forecast. The embedded sensor network uses a large number of sensors to send, receive, and process data. In this article, the interbank interest rate risk measurement model based on the embedded sensor network is tested. Figure 10 shows the forecasting effect.

It can be seen from Figure 10 that the interbank lending interest rate risk measurement model based on the embedded sensor network has a better fitting effect in the prediction of the first 50 days of data and has a strong ability to capture and fit extreme points. There is less hysteresis, which further improves the predictive ability.

Changes in interbank offered rates have a great impact on banks and other institutions, and only a sound risk assessment system can avoid a large amount of loss of profits. Therefore, in order to verify the benefit analysis efficiency and benefit loss rate of the interbank offered interest rate risk measurement model based on the embedded sensor network designed in this paper, this paper designs a comparison with the traditional benefit risk model. The experimental results are shown in Figure 11.

As can be seen from the figure, the interest analysis efficiency of the interbank interest rate risk measurement model based on the embedded sensor network reached 90.79%, while the interest analysis efficiency of the traditional interbank interest rate risk measurement model reached 81.56%, which shows that the interbank interest rate risk measurement model based on the embedded sensor network is 9.23% more efficient than the interest analysis efficiency of the traditional interbank interest rate risk measurement model and the interbank based on the embedded sensor network. The interest loss rate of the interbank interest rate risk measurement model has dropped to 13.61%, while the benefit analysis efficiency of the traditional interbank interest rate risk measurement model is still 21.42%, which shows that the interbank interest rate based on the embedded sensor network. Compared with the traditional interbank offered interest rate risk measurement model,

the risk measurement model reduces the loss rate of 7.81%. The experimental results show that the interbank interest rate risk measurement model based on the embedded sensor network can improve the efficiency of profit analysis and can also reduce the rate of profit loss.

6. Conclusions

Both the money market and the capital market use capital transactions as the medium. The flow of capital from one market to another creates a correlation between the fluctuations between the two markets. Studying the correlation characteristics between the markets enables us to grasp the future trends of the market and serve the government. More information is available in the development of a risk prevention policy. Ramasamy R uses a reverse simulation model to study the risks and rewards associated with the Malaysian Islamic Interbank Offered Rate (IIBOR) and compare the results with the conventional interbank offered rate (CIBOR). For interbank networks, Ren X first discusses the mechanisms of systemic risk contagion related to asset recovery rates and capital requirements. Then, under the condition of general regularity of financial networks, some new results are discussed, namely, existence, uniqueness, and continuity results, which can be used as the basic support for systemic risk measurement, through numerical analysis of simulation in practice. According to the research in this article, the following conclusions can be drawn: An accurate interbank offered interest rate risk measurement model can not only effectively cover the market risk of commercial banks but also save capital and reduce costs for banks. The embedded sensor network-based interbank interest rate risk measurement and evaluation model can effectively evaluate the interest rate risk, so as to provide a certain basis for companies to change their development strategies in time. The disadvantage is that there is no research on data fusion between data transmission between multiple sensors, which has certain limitations.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that he has no competing interests.

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