

Analysis of the Key Elements Contribute to the Financial Forecasting Models

--Analysis of the Financial Control and the Bayesian Model in Systemic Risk Evaluation

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Abstract: Due to various factors, the performance of the financial market is always hard to predict. However, modelling, a technique based on mathematical theory and data science technology, has been an effective approach to forecast potential risks. In this article, the purpose of the research is to analyze how the Bayesian Model plays its unique role in forecasting the effect of systematic risk globally, and which is still also in use in most of financial forecasting. The essay doesn't involve solid equations and numerical relationships among different factors, but it does broadly offer the resolutions for the risks. The risk could be a detrimental factor that leads to a complete financial failure or even a crisis that influences normal people's felicity. In this work, several ways to anticipate and decipher the risk are presented, all of which can reduce the risk effectively.

Keywords: Financial controlling, Financial Risk, Bayesian Model, Prediction

1. Introduction

Nowadays, due to the popularity of big data, people's lives have undergone earth-shaking changes. The popularity of big data makes people's life more convenient. For example, the sports bracelets that people usually wear can carry out statistical analysis on the data to provide people with personalized services and plans for the future, like what sports they are suited to do and which one is dangerous for them to do, especially for people who have some long-term illness like diabetes. In medicine, big data can predict some diseases and disasters that will come by analyzing past data and providing better solutions. This provides a guarantee for people's health. While helping individuals, big data is also helping businesses. In daily life, it is not difficult to observe that when we search for something on the website, the website will keep pushing information related to it. Especially on a shopping site like Taobao, when you search for something you want to buy, its home page will keep pushing your different brands of the product. This makes the choice of better goods (more affordable, better quality) more convenient by letting people make comparisons between goods easier, which allows people to buy better and more satisfying goods. It helps businesses as well as users. First, by analyzing the user's preferences, we can infer the needs. After that, the company will improve its products to meet

the needs of customers. This helps companies save a lot of time and effort on market research, allowing them to do things more efficiently to meet customer needs, improve people's lives, and profit from it. Second, through the analysis of big data and continuous push, the enterprise can get greater exposure, so that the enterprise can be understood by more people, and this gives the product a greater probability of being purchased. Third, companies can collect current data on various products in the market through big data. Through the analysis of the current data, we can predict the future market trend, to better improve our products and make more profits [1,2].

The fundamental concern in financial theory revolves around assessing the value and risk associated with financial assets, especially in uncertain conditions. Research in this field is primarily focused on how economic actors effectively allocate and use their resources in real-world situations and various contexts. The focus of this research is the concepts of time and uncertainty, which significantly complicate financial analysis [3]. To tackle this complexity, mathematical tools are introduced. Both rigorous theoretical analysis and computational methods are essential for conducting empirical experiments and tests. However, this research will only put emphasis on theoretical analysis by elaborating on the key elements and several considerations [4].

Sometimes, individuals create models themselves, while in other cases, models are made for use on internal company computers. Alternatively, consulting firms can develop general models that can be adjusted for specific client needs. Computer time-sharing services may also create models for their program libraries. An example is a useful model created by the Haskins & Sells Management Advisory Services group in San Francisco for a hospital client in California, who was considering a construction project. This model can be adapted for use in other institutions as necessary. It relies on the services of the International Time-Sharing Corporation, which has expertise in a specialized computer language called Business Planning Language. This language is particularly well-suited for constructing financial models [1,2].

2. Financial Control Evaluation

R. Mann and E. Mayer regarded "financial controlling" as an independent component within economic operations, encompassing financial and economic functions within management. This approach is adopted to fulfill both operational and strategic objectives [2, 5]. Another perspective is held that it is a sophisticated system that combines planning, analysis, and monitoring of current indicators to ensure they abide by the planned value. The form of the enterprise (corporate management) should also be considered as an indispensable factor that is associated with the anticipation of the entire tendency [5]. To be more specific, financial control plays a vital role in overseeing and mitigating financial risks within an organization. It involves the identification, evaluation, and administration of risks through a range of financial methods and approaches. Proficient financial control can assist an organization in attaining its financial goals while reducing the adverse and negative consequences of potential risks on its financial well-being [1].

3. Risk Evaluation

Uncertainty, in particular, necessitates the use of probability, statistics, and theories related to stochastic processes. For instance, optimizing resource allocation over time and across different contexts often requires the application of optimization models. From a scientific perspective, mathematical models are employed to represent the entirety of the financial market. Utilizing mathematical optimization techniques allows us to calculate and select the most appropriate solutions. By employing computer simulations to find satisfactory outcomes, the financial market can achieve stability and reasonableness with the aid of these mathematical tools [5].

Any deviation from the anticipated actual income is considered a financial risk, and it undeniably that the potential risk has far-reaching consequences for development. Consequently, risk assumes a critical role throughout the entire financial process. To assess financial risks, mathematics related to both uncertainty and certainty is often employed [3].

When we examine the nature of financial investment risk, it becomes evident that uncertainty is the root cause of these risks. Therefore, to comprehensively analyze these factors and their interrelationships, it is insufficient to rely solely on deterministic mathematical methods. In such situations, we require alternative methods. In this context, uncertain mathematical theory is responsible for abstracting the potential losses or gains resulting from investment uncertainty. This abstraction is quantified using various mathematical concepts like methodological distinctions, mathematical expectations, and standard deviations. Subsequently, these relationships are utilized to formulate mathematical equations, functions, and models. The research on financial investment risks plays a pivotal role in achieving risk management and fostering a harmonious trading market environment. In other words, Various methods for evaluating risks exist, and the choice of approach depends on the specific circumstances and needs of the model. When conducting risk assessments, it is advisable to consider the following:

- Analyzing historical statistical information.

- Employing risk modeling techniques that rely on statistical data.

- Seeking expert opinions and evaluations from professionals in the relevant field [6].

In real-life situations, systemic risk is the majority of attention since systemic risk pertains to the failure of a financial system, resulting in a significant economic decline. This failure can be due to interconnections within the financial system or natural disasters. Systemic risk is particularly damaging because it has the potential to set off a chain reaction of failures and resulting losses. This is where the Bayesian network plays its role [2].

4. Bayesian network

A Bayesian network (BN) is a probabilistic graphical model for representing knowledge about an uncertain domain where each node corresponds to a random variable and each edge represents the conditional probability for the corresponding random variables [6].

It has a wide range of applications in financial risk assessment. It can help financial institutions to assess the risk sensitivity of different factors to portfolios or financial markets and to make risk forecasts and decisions based on changes in these factors. In financial risk assessment, Bayesian networks can be used to model probabilistic dependencies between variables. For example, the rise and fall of the stock market, macroeconomic indicators, and industry development trends can be used as variables to construct a Bayesian network by analyzing historical data and expert knowledge [7]. Then, future risk situations can be predicted and evaluated through this network.

In addition to being used to predict market risk, Bayesian networks can also be used to assess the risk sensitivity of specific portfolios. For example, a Bayesian network model can be constructed using different asset classes (e.g., stocks, bonds, commodities, etc.) and the correlations between them as variables. Then, by changing the state of one of the variables, the risk profile of the portfolio can be inferred when the other variables change [8]. Moreover, Bayesian networks can be used to deal with uncertainty and incomplete information. It can combine probabilistic and statistical methods to model known information and update and infer it based on new information. In financial risk assessment, this is very helpful in dealing with uncertainties such as market fluctuations and policy changes [9]. All in all, the application of Bayesian networks in financial risk assessment can help financial institutions assess and manage risks more accurately and provide decision-making basis and support. It can help identify key risk factors, predict future risk scenarios, and provide better decision-making tools for portfolio managers.

By accessing to the Bayesian networks, the assessment of financial risk is a crucial task in financial management and investment decision-making. A common method of assessing risk is the use of risk factors or risk indicators to quantify different types of risk [7,9].

5. Application of Bayesian Model

There are several common methods that need to be considered and indicators for assessing financial risk through the Bayesian Model:

1. Volatility: Volatility reflects the degree of movement in an asset's price or market index. It is usually measured using the standard deviation or variance of historical returns. Higher volatility implies a higher degree of price movement and a higher degree of risk [2].

2. Beta: Beta measures the correlation between an individual asset and the market. A beta of less than 1 indicates that the price of the asset is less volatile than the market, while a beta of greater than 1 indicates that the price of the asset is more volatile than the market [3].

3. Value at Risk (VaR): VaR is used to estimate the maximum loss that a portfolio or asset could suffer at a given level of confidence. By calculating historical data or using a statistical model, the maximum possible loss of a portfolio over a given period can be determined [3, 6].

4. Leverage Ratio: The leverage ratio is the ratio of debt to assets or equity. A higher leverage ratio implies higher debt risk because of increased pressure to repay debt [3, 8].

5. Indicators to address liquidity risk: Liquidity risk refers to the risk that an investor will not be able to liquidate assets quickly enough when needed or sell them at a reasonable price. Indicators of liquidity risk include the degree of cash flow matching of the fund, trading volume, bid-ask spreads, etc. [9].

The above are just some common financial risk assessment methods and indicators. In fact, the assessment of financial risk involves several aspects, and it is necessary to comprehensively consider different factors and indicators to fully assess the risk situation. At the same time, it should be noted that financial risk assessment is a dynamic process that requires constant updating and adjustment. The results of risk assessment should be matched with the risk tolerance and investment objectives of the investor, enterprise, or institution and judged comprehensively in conjunction with other intelligence [4,7,9].

6. Conclusion

Bayesian networks have emerged as a powerful tool for financial risk assessment. These probabilistic graphical models enable financial institutions to assess risk sensitivity, make forecasts, and manage uncertainties in various scenarios. By leveraging Bayesian networks, financial institutions can identify key risk factors, predict future risk scenarios, and empower portfolio managers with better decision-making tools. The application of Bayesian models in assessing financial risk encompasses various factors and indicators, including volatility, beta, Value at Risk (VaR), leverage ratio, and liquidity risk. These methods contribute to a comprehensive understanding of the risk landscape and guide investors, enterprises, and institutions in making informed decisions that align with their objectives and risk tolerance. In a dynamic and ever-evolving financial landscape, the continuous evaluation and adjustment of risk assessments remain paramount. The interplay between big data and advanced mathematical tools, such as Bayesian networks, provides a powerful framework for navigating the complexities of the modern financial world, making informed decisions, and ensuring financial well-being.

Acknowledgment

Huacheng Cai and Haoqi Ge contributed equally to this work and should be considered co-first authors.

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