Study of the Economic Importance of the VaR Method and its Application in the Financial Sector

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Annotation*: This article examines the economic nature and importance of the Value at Risk (VaR) method and its potential applications in finance. VaR is an important parameter in the calculation of potential financial losses and is analyzed through three different methods of risk management and evaluation. It also enables financial organizations to generate valuable resources and information for decision-making*

Key words: *Value at Risk (VaR), Historical method, Variance-Covariance method, Monte Carlo simulation, Risk measurement, Portfolio diversification, Financial stability*

Introduction. The Value at Risk (VaR) model helps determine market risk by showing how much a portfolio's value will decline over a specified number of years, expressed as a percentage of a confidence interval. The result represents the change in market prices or rates over a given period with a given probability. Indicators determined by the VaR method are important in managing market risks. In managing market risk, there are related objectives: measure the extent of exposure by trade, profit center, and various aggregates, charge each position a cost of capital appropriate to its market value and risk, allocate capital, risk limits, and other scarce resources such as accounting capital to profit centers, provide information on the firm's financial integrity and risk management technology to contractual counterparties, regulators, auditors, rating agencies, the financial press, and others whose knowledge might improve the firm's terms of trade, or regulatory treatment and compliance, evaluate and improve the performance of profit centers, in light of the risks taken to achieve profits, protect the firm from financial distress costs.

Research methodology. There are three methods of calculating Value at Risk (VaR) including the historical method, the variance-covariance method, and the Monte Carlo simulation.

Historical VaR, also known as empirical VaR or non-parametric VaR, is a method of calculating Value at Risk that relies on historical data to estimate the potential loss of an investment or portfolio. It involves analyzing the historical returns of an investment or portfolio over some time to determine the likelihood of experiencing a certain level of loss in the future.

The variance-covariance method for the value at risk calculates the standard deviation of price movements for an investment or security. Assuming stock price returns and volatility follow a normal distribution, the maximum loss within the specified confidence level is calculated.

The Monte Carlo simulation is a probabilistic model that can include an element of uncertainty or randomness in its prediction. When you use a probabilistic model to simulate an outcome, you will get different results each time. For example, the distance between your home and office is fixed.

The results of analysis and discussion. We can use several different methods with different formulas to calculate VaR, but the simplest formula for calculating VaR manually is the historical method. In this case, m is the number of days from which historical data is taken and v_i is the number of variables on day i.

Value at risk formula (using the historical method):

$$\mathbf{v_m\ (v_i / v_{(i-1)})}^{1}$$

Marginal VaR is a calculation of the additional risk that a new investment position will add to a portfolio or a firm. It is simply an estimate of the change in the total amount of risk, not the precise amount of risk that a position is adding to or subtracting from the whole portfolio. That more precise measurement is known as incremental VaR. To convert the VaR method to different time periods, indicators in Table 1 are given.

[1] https://fbs.eu/en/glossary/value-at-risk-179

Table 1

Investment	VaR method	Standard Deviation	Time Period	Calculated VaR
1 QQQ	Historical	N/A*	Daily	-4.0%
2 QQQ	Variance-Covariane	2.64%	Daily	-6.16%
3 QQQ	Monte Carlo simulation	N/A*	Monthly	-15%

The Value at Risk (VaR) uses both the confidence level and the confidence interval. A risk manager uses the VaR to monitor and control the risk levels in a company's investment portfolio. VaR is a statistical metric measuring the amount of the maximum potential loss within a specified period with a degree of confidence. While confidence level and confidence interval are interconnected and can be part of a risk assessment, they are not exactly alike.

- Value at risk (VaR) is a statistic that quantifies the amount of potential loss that could occur within an investment, a portfolio of investments, or a firm over a specified time period.
- A VaR assessment helps financial institutions identify high-risk investments and determine the cash reserves they will need to cover potential portfolio losses.
- The VaR uses both the confidence interval and confidence level to build a risk assessment model.
- A confidence interval is two sets of values that probability indicates a parameter will fall between.
- The confidence level reflects the level of probability (expressed as a percentage) that the confidence interval will contain the population parameter.

The confidence level determines how sure a risk manager can be when they are calculating the VaR. The confidence level is expressed as a percentage, and it

indicates how often the VaR falls within the confidence interval. If a risk manager has a 95% confidence level, it indicates he can be 95% certain that the VaR will fall within the confidence interval. In Table 2[2], we study the time conversion element for one stock (or one investment) in the variance-covariance method.

Table 2

Confidence level	The Maximum Loss-below the Expected or Average Return as a Function of Standard Deviation (σ) and Time (T)
95% confidence	-1.65 x σ x √ T
99% confidence	-2.33 x σ x √ T

In Table 3[3], we work on the Formulas in QQQ. Recall that the daily standard deviation for QQQ is 2.64% since inception. But we want to calculate the monthly VAR, and assuming 20 trading days in a month, we multiply by the square root of 20.

Table 3

Confidence level	Low below the Expected (Average) Return as Function of Standard Deviation (σ) and Time (T)*
95% confidence	-1.65 x 2.64% x √ 20 = -19.5%
99% confidence	-2.33 x 2.64% x √ 20 = -27.5%

These worst losses (-19.5% and -27.5%) are losses below expected or average returns. With the variance-covariance method, we can say with 95% confidence that we won't lose more than 19.5% in any given month.

By bridging the confidence interval and confidence level, the risk manager can calculate the value at risk. The confidence level of the VaR estimate is the quantile the risk manager uses to calculate the VaR. This, however, should not be

[2] https://www.investopedia.com/articles/04/101304.asp
[3] https://www.investopedia.com/articles/04/101304.asp

confused with the confidence interval. The confidence interval is an interval that has a probability of including the VaR estimate.

Banks use the VaR method to determine how much bank capital they need to set aside. Bank regulators often request that a bank's value at risk be broken down as a capital requirement. If a bank is exposed to the level of risk indicated in the value at risk within a given period, the bank believes that it should set aside 3-5 times the value at risk for that period as reserve capital.

Value at Risk helps commercial and investment banks offset potential losses in marketable portfolios from adverse market movements over a period of time. These can then be compared with existing capital and cash reserves to ensure that firms can cover losses without putting them at risk.

Value at Risk is calculated for different periods depending on how long the bank plans to hold its portfolio and how quickly it can sell the portfolio. Banks use Value at Risk, measured over a 10-day period, to determine how much capital they need to hold to cover their trading activity.

The economic value of the Value at Risk (VaR) method provides a quantitative basis for risk assessment and management in finance. Important indicators that show the economic potential of the VaR method:

1. Measuring and quantifying risks: and its importance VaR allows financial institutions to calculate the potential downside risk associated with investment portfolios and trading strategies. Provides a numerical measure of risk to help assess the impact of erratic market movements. By evaluating the economic effects, we can see the risks and coordinate them with investment strategies, as well as avoid large exposures and strong financial losses, which allows us to make wise decisions. If we can analyze this risk, it will ensure stability in the financial markets.

2. Portfolio diversification and asset allocation: and its importance VaR helps optimize portfolio diversification by determining the contribution of individual assets to the overall portfolio risk. Manages asset allocation strategies based on risk preferences and investment objectives. If we determine the economic effect, it will increase the efficiency in the allocation of capital, which will lead to improved

investment returns for a given level of risk. Promotes a balanced portfolio that can withstand market volatility and contribute to long-term economic growth.

3. Regulatory compliance and financial stability: and its importance Supervisory authorities often use VaR indicators to assess the risk level of financial institutions and act as a key component in regulatory compliance and stress tests. By identifying the economic impact, it strengthens financial stability by ensuring robust risk management practices in organizations and ensures transparency and accountability in the financial system, enhancing trust among investors and stakeholders.

4. Strategic Decision-Making: and its importance VaR provides valuable insights for strategic decision-making and helps financial professionals to align risk with business objectives and to identify potential vulnerabilities and develop risk mitigation strategies. Also, economic impacts help proactively manage risks, reduce the likelihood of financial crises and market disruptions, and support efficient resource allocation by aligning risk appetite with organizational goals.

5. Investor confidence and market efficiency: and its importance Investors use VaR to measure the risk associated with their investment decisions, and it contributes to market efficiency by providing a standardized measure for comparing and evaluating risk across different financial instruments. contributes. It also improves investor confidence by providing a transparent and standardized metric to assess these risks, whose economic impact supports efficient capital allocation that promotes overall economic growth.

Conclusions and suggestions. Although VaR is useful for predicting the risks associated with investment and finance, it can lead to incorrect conclusions if assumptions are found to be flawed. Also, different methods give different results: while Monte Carlo simulations are relatively optimistic, you can get a pessimistic forecast with the historical method. Calculating VaR for large portfolios can be somewhat complicated: VaR for each asset cannot be simply calculated, as many of these assets will be correlated. Any VaR calculation is only as good as the data and assumptions that go into it.

VaR is a single indicator of the level of risk in a given portfolio, and the method is easy to understand when expressed as a price or percentage. It can be applied to assets such as bonds, stocks, and currencies, and is used by banks and financial institutions to assess the profitability and risk of various investments and allocate risk based on VaR.

Application of this mathematical method for the finance and banking sector will lead to effective results. By assessing the risks, we can determine the expected economic conditions. Understanding the VaR method becomes more clear through the confidence level.

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