# Exploring Value-at-Risk

By Dr Quintin Rayer | February 28, 2019



Advisers need to be able to assess portfolio and fund risks for their clients. Market risk is often seen as variability in returns, or volatility, although this has limitations. Value-at-Risk (VaR) addresses losses but needs to be correctly understood to appreciate its strengths and weaknesses. VaR relates to uncertainties in returns, probabilities, magnitudes of adverse outcomes and relationships between assets.

## Background

The most commonly used risk measure tends to be volatility. Although measuring return variability, volatility makes no distinction between gains and losses. Using volatility, an increase of +10% implies just as much risk as a fall of -10%. However, gains are not exactly "risk" in most investors' eyes. As a risk measure, VaR considers only losses, addressing this weakness.

VaR is widely used but can be criticised; it can also be calculated in different ways, giving different values. But it does provide a numerical risk estimate that explicitly addresses some of volatility's flaws.

Regulators and portfolio managers have widely adopted VaR to measure downside risk. Generally, it is expressed in monetary terms, although for funds it can be stated as a percentage.

VaR provides an estimate of the expected loss from an investment or portfolio. This loss is over a specified period and with a given chance of occurring. It often assumes 'normal market conditions' and uses information such as historical data and statistical models, or simulations for more advanced techniques. For interested readers, further detail is provided in[1].

### Definition and typical VaR statement

As a measure of market risk, VaR is typically defined as the maximum loss which can occur with $X$% confidence over some holding period. This means the 'least bad' in the 'bad times' when losses occur. Say markets are deemed to be 'OK' 95% of the time, and 'bad' in the remaining 5% of the time, then the worst loss in the 95% of 'OK times', means the best (least bad) in the 5% of 'bad times'.

A typical VaR statement might be: a £500,000 portfolio has a 95% monthly VaR of £34,000. This means that during a "1-in-20 worst" month, the portfolio is expected to lose at least £34,000. Note it is 'at least' £34,000 so losses can be larger than this amount. During the "19-in-20 months" (19/20 = 95%) when markets are 'OK', losses are expected to be no worse than £34,000. This is illustrated in the figure below.
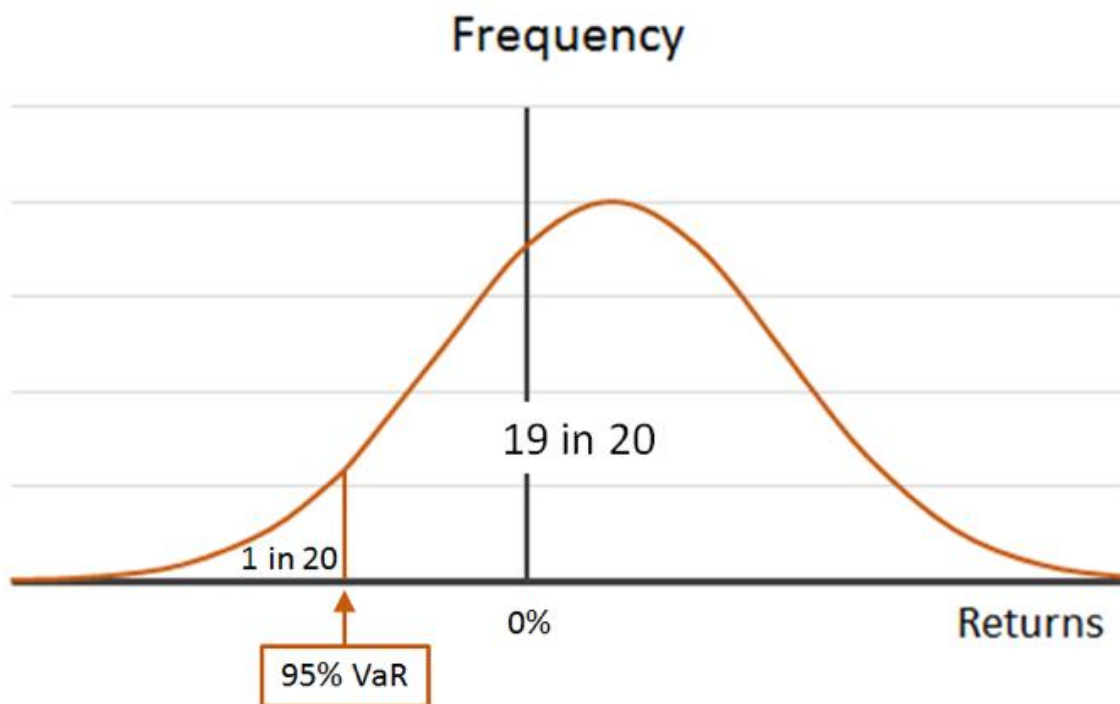
A fund may express this in percentage terms. A 95% monthly VaR of 6.7%, would mean that during the 1-in-20 worst month, the fund value would be expected to decline by at least 6.7%. Again, losses can be higher than this.

## Calculation

VaR calculation involves four elements:

1. The time horizon for the potential loss
2. The degree of certainty required for the estimate
3. Probability distributions for asset returns
4. Calculation of VaR estimate

The time horizon depends on the purpose the VaR estimate is needed for. Traders might consider losses over one day, while investors are usually interested in more prolonged periods, perhaps months or years. A rule of thumb might be the time it would take to get out of the investment, allowing for how often it is reviewed.

A degree of certainty is required for the estimate, the confidence level. Typically, the estimated largest likely loss the portfolio will suffer 95 times out of 100 over a long enough period (95%), or 99 times out of 100 (99%). The more risk averse the investor, the higher the confidence level required and the smaller the VaR value that is acceptable. One investor might be content to accept a 1-in-20 month loss of -10% (slightly more often than once every two years on average), while a more risk-averse investor might feel that they would only tolerate a 1-in-100 month loss of -5% (on average slightly less than once in eight years).

The probability distribution reflects the anticipated returns distribution of the portfolio assets. Returns are often assumed to be normally distributed, and statistics used to estimate a VaR value. The calculation determines the boundary of the tail losses for the appropriate confidence level.

## Different approaches

However calculated, the result is an estimate. Market return distribution shapes can differ, particularly for losses. Using the normal distribution is known as 'parametric' VaR. Other returns distributions can be used, for example, historical returns. Regardless, one cannot rely on the distribution remaining the same in the future and using different methods results in different VaR values.

Other methods allow non-normal returns and may be known by names such as semi-parametric VaR, or historical simulation VaR. More sophisticated techniques can enable fund managers to explore inter-relationships between different assets (and asset classes) and make allowance for different returns distributions.

## Summary

It is important for advisers to understand the concepts behind VaR so they can appreciate what it tells them about investment risks. This can enable a better quality of discussion with fund managers when considering fund choices to meet client needs. With a stronger grasp, advisers will be better placed to use VaR when evaluating risks between funds and the implications for their clients' portfolios.

## References

[1] Q. G. Rayer, Portfolio Construction Theory, 6th ed., London: Chartered Institute for Securities and Investment, July 2018.

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This article was written by Dr Quintin Rayer, Head of Research and Ethical Investing at P1 Investment Management. It has also been published on the DISCUS website