The Value of Value at Risk: Statistical, Financial, and Regulatory Considerations

Summary of Presentation

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Value at risk (VaR) has emerged as a major tool for measuring market risk, and it is used internally by banks for risk management and as a regulatory tool for ensuring the soundness of the financial system. A large amount of research work into VaR has emerged, and various aspects of VaR have been extensively documented. There are two areas of VaR-related research that we feel have been relatively neglected: the relationship of VaR to statistical theory and the financial-economic foundations of VaR. Most VaR methods are based on normality, however; as stated by Alan Greenspan (1997), "the biggest problems we now have with the whole evaluation of risk is the fat-tailed problem, which is really creating very large conceptual difficulties."

Common methods for measuring VaR fall into two major categories—parametric modeling of the conditional (usually normal) distribution of returns and nonparametric methods. Parametric modeling methods have been adapted from well-known forecasting technologies to the problem of VaR prediction. As a result, they seek to forecast the entire return distribution, from which only the tails are used for VaR inference.

Value at risk, however, is not about common observations. Value at risk is about extremes. For most parametric methods, the estimation of model parameters is weighted to the center of the distribution and, perversely, a method that is specifically designed to predict common events well is used to predict extremes, which are neglected in the estimation. Nonparametric historical simulation, where current portfolio weights are applied to past observations of the returns on the assets in the portfolio, does not suffer from these deficiencies. However, it suffers from the problem of tail discreteness and from the inability to provide predictions beyond the size of the data window used.

Danielsson and de Vries (1997) apply semiparametric extreme value theory to the problem of value at risk, where only the tail events are modeled parametrically, while historical simulation is used for common observations. Extreme value theory is especially designed for extremum problems, and hence their semiparametric method combines the advantages of parametric modeling of tail events and nonparametric modeling of common observations. Danielsson and de Vries (1997) develop estimators for both daily and multiday VaR predictions, and demonstrate that for their sample of U.S.

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stock returns, the conditional parametric methods underestimate VaR and hence extreme risk, which, according to historical simulation, suffers from undesirable statistical properties in the tails. The semiparametric method, however, performs better than either a parametric conditional variance-covariance method or nonparametric historical simulation.

Conditional parametric methods typically depend on the conditional normality for the derivation of multiperiod VaR estimates, primarily because of the self-additivity of the normal distribution. The Basle Accord suggests using the so-called square-root-of-time rule to obtain multiday VaR estimates from one-day VaR values, where multiperiod volatility predictions are obtained by multiplying one-day volatility by the square root of the time horizon. However, relaxation of the normality assumption results in this scaling factor becoming incorrect. Danielsson and de Vries (1997) argue that the appropriate method for scaling up a single-day VaR to a multiday VaR is an alpha-root rule, where alpha is the number of finite-bounded moments, also known as the tail index. This eventually leads to lower multiday VaRs than would be obtained from the normal rule. Hence, the normality assumption may be, counterintuitively, overly conservative in a multiperiod analysis.

Danielsson, Hartmann, and de Vries (1998) examine the impact of these conclusions in light of the current market risk capital requirements and argue that most current methodologies underestimate the VaR, and are therefore ill-suited for market risk capital. Better VaR methods are available, such as the tail-fitting method proposed by Danielsson and de Vries (1997). However, financial institutions may be reluctant to use these methods because current market risk regulations may, perversely, provide incentives for banks to underestimate the VaR.

Danielsson, Jørgensen, and de Vries (1998) investigate the question of why regulators are interested in imposing VaR regulatory measures. Presumably, VaR reporting is meant to counter systemic risk caused by asymmetric information, that is, in a perfect market there is no need for VaR reports. But, as we argue, even if VaR reveals some hidden information, VaR-induced recapitalization may not improve the value of the firm. In our opinion, the regulatory basis for VaR is not well understood and merits further study.

References

The authors' research papers are available on the World Wide Web at http://www.hag.hi.is/~jond/research.

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