

# Comparative Analyses of Expected Shortfall and Value-at-Risk: Their Estimation Error, Decomposition, and Optimization

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## Abstract

We compare expected shortfall with value-at-risk (VaR) in three aspects: estimation errors, decomposition into risk factors, and optimization. We describe the advantages and the disadvantages of expected shortfall over VaR. We show that expected shortfall is easily decomposed and optimized while VaR is not. We also show that expected shortfall needs a larger size of sample than VaR for the same level of accuracy.

## Suggested Citation

↓ Yamai, Yasuhiro & Yoshiba, Toshinao, 2002. "[Comparative Analyses of Expected Shortfall and Value-at-Risk: Their Estimation Error, Decomposition, and Optimization](#)," [Monetary and Economic Studies](#), Institute for Monetary and Economic Studies, Bank of Japan, vol. 20(1), pages 87-121, January.

Handle: *RePEc:ime:imemes:v:20:y:2002:i:1:p:87-121*

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