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Evaluating Value-at-Risk Forecasts: Predictive Accuracy and Calibration in the Croatian Equity Market

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Abstract

Can relationships between stocks improve forecasts of market downside risk? This study examines the predictive value of financial networks for Value-at-Risk (VaR), distinguishing forecast accuracy from calibration. We use daily returns on CROBEX, the Zagreb Stock Exchange's benchmark stock market index, and its historical constituents across 42 index-revision windows from March 2005 to March 2026. After removing a common market component from individual stock returns, we construct networks of significant residual correlations. Our predictor measures the average strength of significant negative correlations, capturing offsetting relationships between stocks. An expanding-window forecasting exercise produces 26 out-of-sample predictions of the next window's fifth percentile of daily returns. Adding the network measure to an autoregressive benchmark reduces mean squared prediction error by 25.1%. A separate backtest compares network-conditioned quantile forecasts with an expanding historical quantile and a GARCH(1,1) benchmark using 3,234 daily returns. The network-conditioned forecast achieves the lowest average pinball loss, a scoring rule for quantile forecasts. However, its breach rate is 9.1%, exceeding the nominal 5%, while both competing forecasts produce too few breaches. The findings indicate that network information improves downside-risk forecasting, but lower forecast loss does not imply correct coverage. Because the network-conditioned threshold remains unchanged within each revision window, it should be distinguished from a conditional daily VaR forecast. The results support the use of network information in risk modelling while identifying calibration and adaptation to daily market conditions as priorities for further development.

Keywords: CROBEX; Downside Risk; Financial Networks; Pinball Loss; Quantile Forecasting