

VOLATILITY, CORRELATION AND TAILS FOR SYSTEMIC RISK MEASUREMENT

Christian T. Brownlees*

Rob Engle*

Abstract

The 2007/2008 financial crisis has led market participants and regulators to seek better understanding and measurement of systemic risk. Systemic risk can be thought of as the possibility of a collective collapse of the entire economy. In this work we focus on the Marginal Expected Shortfall (MES) as a measure of systemic risk. It is defined as the marginal contribution of a firm to the whole system's expected downside loss. A firm's MES can be estimated using bivariate conditionally heteroskedastic models on the firm and the market returns. MES depends on firm volatility, correlation with the market and tail expectations of the model innovations. We propose GARCH, DCC and Nonparametric methods to measure MES and novel evaluation metrics to assess its predictions. An empirical application on a panel of large U.S. financial firms between 1990 and 2008 investigates the dynamics of systemic risk and provides linkages with firm characteristics such as leverage, size and financial industry group. The analysis shows that our framework provides effective MES forecasts at various horizons and highlights which lessons can be learnt from the recent financial crisis.

Keywords: Systemic Risk, Volatility, Correlations, Tails, Forecasting.

JEL classification: C22, C23, C53.

*Department of Finance, Stern School of Business, New York University, e-mail: ctb@stern.nyu.edu, rengle@stern.nyu.edu. An appendix with detailed results is available on request to the authors. Daily systemic risk analysis results are published on the Risk section of the Vlab (<http://vlab.stern.nyu.edu>).

Acknowledgments. We are grateful to Viral Acharya, Gianpiero Aielli, Farhang Farazmand, Lasse Pedersen, Thomas Philippon and Matthew Richardson for comments. All mistakes are ours.