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Insights to systematic risk and diversification across a joint probability distribution

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Abstract

This paper analyses and develops insights to systematic risk and diversification when random, imperfectly dependent, losses are aggregated. Systematic risk and diversification are shown to vary across layers of component losses according to local dependence and volatility structures. Systematic risk is high and diversification is weak overall if high risk layers are heavily dependent on the aggregate loss. This result explains weak diversification observed in financial markets despite weak to moderate correlations overall. A coherent risk setup is assumed in this paper, where risks are measured using distortion and allocated using the Euler principle.

Keywords: Distortion risk; spectral risk; Euler allocation; systematic risk; diversification; layer; Value-at-Risk.

1. Introduction to systematic risk and diversification

Suppose x is one of several continuous, non-negative and random component losses aggregating to x_+ . For example x may be the loss from an insurance class and x_+ is the loss aggregated across all classes. Or x may be the credit loss on a portfolio of loans and x_+ is the aggregate credit loss across all portfolios. Component losses are imperfectly dependent leading to risk diversification.

A comprehensive risk setup for the aggregation of losses consists of the following three areas: the standalone risk of x ignoring the presence of other losses, the aggregate risk of x_+ allowing interaction between losses and diversification effects, and the allocation of aggregate risk to x representing un-diversifiable systematic risk. This paper applies the following well established risk setup.

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