

The Triangular Transmission of Crash Risk: A Wavelet-Copula Analysis of Volatility Spillovers from the US and Commodities via East Asia to Southeast Asia (2000-2024)

Irvan Dzaki Praditya

Department of Finance, National Formosa University, Huwei, Taiwan

Jo-Yu Wang

Department of Finance, National Formosa University, Huwei, Taiwan

Abstract

This study investigates the structural evolution of financial contagion and systemic risk transmission from the United States and global commodity markets to the emerging economies of Southeast Asia (SEA). Challenging traditional bivariate models, we propose a "Triangular Transmission" hypothesis: volatility originating in US technology sectors and commodities—specifically Bitcoin and Crude Oil—is amplified and mediated through the industrial supply chains of East Asia (EA). We employ a comprehensive daily dataset of 15 major equity indices and 3 commodities spanning from 2000 to 2024. To capture the non-linear and multi-scale nature of crashes, we use a robust five-stage hybrid methodology: (1) Time-scale decomposition using the Maximal Overlap Discrete Wavelet Transform (MODWT); (2) Normality testing using D'Agostino's K^2 Test; (3) Asymmetric volatility filtering via GJR-GARCH; (4) Tail risk modeling using Extreme Value Theory (EVT); and (5) Dependence analysis using Copula functions estimated via Bayesian Markov Chain Monte Carlo (MCMC) methods. Empirical results validate the triangular pathway, identifying the US Semiconductor Sector as the primary contagion vector to East Asian hubs, which subsequently transmit volatility to Southeast Asia. Furthermore, we provide evidence of a structural decoupling in China and Vietnam, suggesting the emergence of a "Sinocentric" risk cluster independent of US volatility. These findings emphasize that ASEAN risk management must account for upstream East Asian linkages and asymmetric commodity impacts.

Keywords

Bitcoin, Copula Functions, Crash Risk, Crude Oil, Extreme Value Theory (EVT), Wavelet Analysis (MODWT).