Network Topology of Dynamic Credit Default Swap Curves of Energy Firms and the Role of Oil Shocks

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Evidence on the credit risk of energy firms is mainly obtained from conventional market-based frameworks involving stock returns, and the few studies that consider credit risk data use the level of credit default swap (CDS) spreads only, i.e. the CDS spreads of one single maturity, such as the 5-year. However, the level of CDS spreads may be insufficient to understand the complex and multi-layered dynamics and interconnectedness of credit risk across energy firms, which necessitates the inclusion of the slope and curvature of CDS spreads in the analysis. In this paper, we examine the joint dependency of the level, slope, and curvature factors of the CDS curves of energy firms to make inferences regarding the interconnectedness of their long-, short-, and medium-term default risk. Using daily data on CDS curves of 21 US and European energy firms from July 18, 2008 to March 19, 2021 and the generalized variance decomposition approach augmented by a network typology, the results show heterogeneity and time evolution in the level of interconnectedness of default risk across various credit horizons and between US and European firms.

Notably, the interconnectedness of default risk across some credit horizons tends to increase during major crisis periods such as the oil price crash of 2014-2015 and the COVID19 outbreak, indicating credit deterioration and vulnerability of the energy system to a possible clustered default during various crisis periods. Further analysis shows evidence that oil demand shocks and oil supply shocks have an impact on interconnectedness, although the impact is not homogenous across the three default factors. The findings are useful for both international investors and policymakers who continuously seek to better understand the connectedness of default factors and refine the means of monitoring the systemic vulnerability of US and European energy firms.

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