A Markov Switching GPD-INGARCH Process For Cyber Risk Analysis

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1 Abstract

The increasing adoption of digital technologies and the use of big data and cloud computing makes the vulnerability to cyber-attacks a crucial issue for the stability of the economic system. Financial and insurance companies are particularly susceptible as they hold large amounts of confidential customer information, making them a prime target for cyber criminals. As a result, cyber risk has become one of the most significant risks for these sectors and for the economy as a whole.

Overall, the paper seeks to provide insights into the frequency of cyber-attacks to help inform risk management and decision-making strategies for businesses in these sectors. We propose a new integer-value GARCH process with generalised Poisson difference innovations and Markov switching dynamics. We apply the model to detect cyber-risk regimes with different features of the attacks frequencies, such as expected number of attacks and dispersion. We propose a Bayesian inference approach which accounts for extra sample information through the prior distribution and an efficient Monte Carlo algorithm for posterior approximation.

We apply our econometric framework to a daily dataset of cyber threats of different types such as crimes, espionage, warfare, and hacktivism, and provide new insight into the dynamics of the cyber risk and an effective forecasting tool. Our results can help businesses better protect themselves and their customers from such threats.

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