Systemic Risk Identification, Modelling, Analysis, and Monitoring: An Integrated Approach

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Abstract

Over the last fifteen years, computational intelligence applications have proliferated solutions to financial engineering problems, bringing a new fertile area of collaboration between professional engineering and financial communities. Computational systems based on machine learning techniques have become indispensable in virtually all financial applications, from portfolio selection to proprietary trading and risk management. The new challenges for the financial community involve working with the abundance of data from a variety of types that were not previously available and could now help solve financial problems proven hard to solve earlier. The bar has been raised with new regulatory, and compliance and risk management requirements. As the field is intensively evolving, we need a new set of tools and methods to face the challenges posed.

Systemic risk presents one of the major challenges. Research capacity is critical in understanding systemic risk and informing new regulation. Banking regulation has not kept pace with all the complexities of financial innovation. The academic literature on systemic risk is rapidly expanding. The majority of papers analyse a single source or a consolidated source of risk and its effect. A fraction of publications quantify risk measures or formulate penalties for systemically important financial institutions that are of practical regulatory relevance. The challenges facing systemic risk evaluation and regulation still persist, as its definition is somewhat unsettled and that affects attempts to provide solutions. Our understanding of systemic risk is evolving and the awareness of data relevance is rising gradually; this challenge is reflected in the focus of major international research initiatives. There is a consensus that the direct and indirect costs of a systemic crisis are enormous as opposed to preventing it, and that without regulation the externalities will not be prevented; but there is no consensus yet on the extent and detail of regulation, and research expectations are to facilitate the regulatory process. This report outlines an integrated approach for systemic risk evaluation based on multiple types of interbank exposures through innovative modelling approaches as tensorial multilayer networks, suggests how to relate underlying economic data and how to extend the network to cover financial market information. We reason about data requirements and time scale effects, and outline a multi-model hypernetwork of systemic risk knowledge as a scenario analysis and policy support tool. The argument is that logical steps forward would incorporate the range of risk sources and their interrelated effects as contributions towards an overall systemic risk indicator, would perform an integral analysis of sources and their interrelations through rigorous mathematical formulation of models capturing quantitative and qualitative information, and would develop a domain representation framework based on knowledge engineering. The incorporation of a range of risk sources involves identification of relevant data scope and availability, the integral analysis requires the formulation of multi-level models and risk measures, the instantiation of the hypernetwork in the systemic risk domain allows formal representation of the evolving understanding of systemic risk. Thus the outlined project aligns with the focus of current and anticipated international research initiatives and contributes to the effort towards systemic risk evaluation and regulation.

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BIO

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