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Advanced Models of Systemic Risk and Financial Instability

The Nature of Systemic Risk

Financial scholars and market practitioners have come forward with a considerable variety of approaches to understanding and modelling systemic risk during the past two decades. Despite these intense efforts however, there exists currently no widely accepted, quantitative framework for systemic risk analysis and policy intervention, although regulators in some European countries have made some promising advances in this field. Whereas market risk and credit risk can count on well-established foundations in econometric analysis and security pricing, systemic risk has perhaps more in common with the definitional struggles and the resistance to calculability of operational risk (Power, 2003). Unlike these risk categories however, systemic risk transcends the boundary of the financial institution to become an issue that poses a significant challenge to those operating in the market but, at the same time, escapes the control of any single financial firm. Thus, the role of the regulator to ensure "the maintenance of the stability of the financial system as a whole" (BOE, 2006:1).

Fundamental Approaches to Conceptualise Systemic Risk

While financial risk management at trading desk or firm level is manifestly embedded in the tradition of probability models of risk, systemic risk has at present no favoured basis in any particular epistemic world view above and beyond those implied by existing, discipline-specific preferences. It is nevertheless possible to distinguish three distinct approaches in the literature on systemic risk, with fault lines conveniently lining up with three important philosophical traditions of explanatory discourse. First, within the nomological-deductive framework of financial economics and game theory, scholars have been developing models of financial fragility and contagion since the early 1980s and today, the results of this effort has spawned a large and still growing body of literature (Allen and Gale, 2007). Second, systemic risk has also been framed in the formal probabilistic language of traditional risk management, and models of extreme value theory for instance purport to make valuable contributions to our understanding of price instability in financial markets (Alexander et al., 2005). Third, in a more recent development motivated by the desire to improve systemic risk assessment and management, regulators in some European countries have started to implement increasingly complex and empirically realistic models of a nation's financial system, where a central element of these modelling exercises obeys a more recent trend in the explanatory project of the philosophy of the social sciences, namely the explanation of macro-social phenomena via causal reconstruction or process tracing (Mayntz, 2004).

The Covering Law Model of Economic Theory

Covering law models explain phenomena observed in the natural or social world by subsuming them under a set of law-like propositions. Equilibrium theory in economics and also game theory are examples of such formal frameworks, and indeed, the microeconomics of banking sits at the core of models of financial instability as theorised by this first strand of explanatory theory. Bank runs, just to name a well-known example, have been formulated in the seminal contribution by Diamond and Dybvig (1983) as the outcome of a coordination problem faced by depositors. Liquidity shortages, interlinkages via asset market exposures, or contagion in the interbank market are just a few of the many important issues related to financial crises that have been fruitfully addressed by financial economists. While these models are quite successful in illustrating a range of fundamental mechanisms at work in times of stress and while these mechanisms provide us with a better understanding of the possible causes of market and institutional breakdown, they typically lack the deep empirical content necessary for use in regulatory practice.

Probabilistic Models of Risk

Traditional risk management techniques in finance conceptualise risk in terms of probability distributions or, more specifically, volatilities and correlations of historical asset returns. Value-at-risk for instance is one such technique that is widely used to calculate market risk exposures of investment portfolios or to determine regulatory capital that banks are required to set aside to cover unexpected losses on their assets. Systemic risk in a probabilistic framework can be understood in two distinct, but interrelated ways. First, as the likelihood of a rare event affecting the proper functioning of the financial system, where fat-tailed probability distributions might be fit to asset returns to determine the likelihood of, say, a sharp drop in stock prices. Second, as uncovering the correlational structure of assets, which gives us some indication as to the linkage patterns between the banks' balance sheets and thus the risk of contagion in the event of an idiosyncratic or systemic shock. Probabilistic models of systemic risk have to grapple with the problem of structural change and in particular of sometimes abruptly evolving distributional patterns, especially during times of crisis. Thus, in the recent credit crisis for instance, the influence of product innovation and the relatively recent business model of 'originate and distribute' played a central role in the build-up of risk and the subsequent amplification and transmission of systemic shocks makes it hard to see how a purely probability-based conception of systemic risk could provide a satisfactory and relatively complete explanation of the ensuing crisis.

The Causal Mechanism View of Systemic Risk

Scholars in sociology and philosophy have come forward with an alternative explanatory framework that goes some way in overcoming the limits of both correlation analysis and the nomological-deductive approach, especially as it pertains to macro-social phenomena. At its centre is the concept of 'causal mechanism'. Statements about mechanisms can be thought of as generalising causal proposition about recurring processes. Causal mechanisms are viewed as representative, theoretical building blocks, parts of what Robert K. Merton referred to as theories of the middle range, that is, theories that mediate between "gross empiricism and grand speculative doctrines" (Merton, 1994). This explanatory approach – Renate Mayntz (2004) refers to it as 'causal reconstruction' – explains a particular macro-social structure, process, or occurrence by "identifying the processes through which it is generated" (Mayntz, 2004:238). This procedure has been illustrated quite remarkably in a book on contentious episodes in politics (McAdam et al., 2001). Though not explicitly identified as causal mechanism type of explanations, recent financial instability models proposed by the Austrian National Bank and, in particular, by the Bank of England, have made causal processes the centre piece of their integrative approach.

Regulatory Models of Financial Instability

The Bank of England Resilience Model

A couple of years ago, the Bank of England has embarked on an ambitious project to create an integrated modelling framework to help it "strengthen the analytical and quantitative underpinnings of the assessment of risks to the financial system, so as to improve the identification and management of these risks" (Haldane et al., 2007:16). The stated aim is to provide a suite of models that can help the Bank to determine aggregate statistics of risks for the financial system at large and to assess, through stress tests and what-if analyses, in more detail the transmission channels of risk and the systemic vulnerabilities to the UK financial system identified by the Bank's experts. The results of these simulations have been used for the first time in the July 2006 Financial Stability Report, where they informed the Bank's judgement on the resilience of the UK financial system.

Systemic Risk Monitor at the Östereichische Nationalbank

The systemic risk assessment tool of the National Bank of Austria forms part of a wider toolbox for risk-based supervisory analysis (OENB, 2005) that allows authorities to carry out off-site analysis and monitoring of the Austrian financial system. In the Systemic Risk Monitor, a standard suite of risk models determine the joint impact that correlated variations in underlying risk factors have on market and credit risk, and, as a conseuqence, on the balance sheets of Austrian banks and the expected level of distress in non-banking sectors (Boss et al., 2006). A network model is used to represent the actual intrabank exposures between Austrian banks and to simulate contagion of bank failures in the system. The Austrian National Bank's model uses detailed data from banks' balance sheets, loan registers, rating agencies, and market data providers to fit the model to prevailing economic and market conditions. Output from the model includes expected insolvencies within the financal system, default probabilities, and probabilities of contagion.

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