Centre Interfacultaire Bernoulli - CIB

Winter school on systemic risk

Abstracts

9 to 13 January 2017

CIB conference room

Hamed Amini

Contagion and security in inhomogeneous financial networks

We derive rigorous asymptotic results for the magnitude of contagion in a large financial network and give an analytical expression for the asymptotic fraction of defaults, in terms of network characteristics. Our results extend previous studies on contagion in random graphs to inhomogeneous directed graphs with a given degree sequence and arbitrary distribution of weights. We introduce a criterion for the resilience of a large financial network to the insolvency of a small group of financial institutions and quantify how contagion amplifies small shocks to the network. We then study the problem of optimal investment in security, under network contagion risk. *Joint work with Rama Cont and Andreea Minca.*

Rama Cont

Channels of contagion in financial systems

Understanding the mechanisms underlying systemic risk requires to shift from the traditional focus on single-portfolio risk modeling and examine the link between the structure of the financial system and its stability, with a focus on contagion mechanisms which may lead to large scale instabilities in the financial system. Some channels of contagion which have played an important role in past crises are: insolvency contagion through counterparty exposures, withdrawal of liquidity in funding channels and price-mediated contagion [4,5,8] through fire sales of assets. The course is a review of some recent work on the mechanisms underlying these channels of contagion, with a focus on the nature and granularity of the “Network” underlying each contagion mechanism and the implications of these results for the monitoring and regulation of systemic risk.

Stéphane Crépey

XVA analysis from the balance sheet

In the aftermath of the financial crisis, regulators launched a major effort of banking reform aimed at securing the financial system by raising collateralisation and capital requirements. Notwithstanding finance theories, according to which costs of capital and of funding for collateral are irrelevant to decisions, banks have introduced an array of XVA metrics to precisely quantify them. In particular, the KVA (capital valuation adjustment) is emerging as a metric of key relevance. We introduce a capital structure model acknowledging the impossibility for a bank to replicate jump-to-default related cash flows. Because of this counterparty credit risk incompleteness, deals trigger wealth transfers from bank shareholders to bank creditors and shareholders need to set capital at risk. On this basis we devise a theory of XVAs, whereby so-called contra-liabilities and cost of capital are sourced from bank clients at trade inceptions, on top of the fair valuation of counterparty credit risk, in order to compensate shareholders for wealth transfers and risk on capital. *Joint work with Claudio Albanese.*

Damir Filipovic

Systemic risk and central clearing counterparty design

We examine the effects on a financial network of multilateral clearing via a central clearing counterparty (CCP) from an ex ante and ex post perspective. The CCP is capitalized with equity and a guarantee fund and it can charge a volume-based fee. We propose a CCP design which improves aggregate surplus, and reduces banks' liquidation and shortfall losses. We characterize the CCP's equity, fee and guarantee fund policies that reduce systemic risk and are incentive compatible for banks. A simulation study based on real market data shows that central counterparty clearing can reduce systemic risk and improve banks' utility. *Joint work with Hamid Amini and Andreea Minca*.
Thomas Hurd

Thomas Hurd

Cascade models in large financial networks

This minicourse aims to provide a unified mathematical framework for the primary channels that can transmit damaging shocks through financial systems. It will explore extensions of the material contained in my book, “Contagion! Systemic Risk in Financial Networks”. It is intended for quantitative finance practitioners, financial regulators and a broad range of academics including economists, physicists, applied mathematicians and computer scientists.

Outline of Topics:

1. Cascade Mechanisms and Cascade Equilibrium: extending the Eisenberg-Noe 2001 framework to other contagion mechanisms, including Gai-Kapadia 2010 and the Asset Fire Sale Model.
2. Random Graph constructions: Assortative configuration graphs, scale-free preferential attachment graphs and inhomogeneous random graphs.
3. Finance Cascade analytics: Random Financial Networks, the Without Regarding condition, locally tree-like independence, Cascade Mapping Theorems.

Youri Kabanov

Clearing in financial systems

1. The Eisenberg-Noe-Suzuki model. Existence of the clearing vectors via fixpoint theorems. Uniqueness theorem.
2. The Rogers-Veraart model. Calculation of the largest clearing vector.
3. The Suzuki-Elsinger model with crossholdings.
4. The Elsinger model with seniorities of liabilities.
5. The Fisher model with CDS.
6. Models with illiquid securities.

Andreea Minca

Modeling systemic risk

This short series of lectures will present the state of the art in modeling systemic risk. We will be discussing cascade models in inhomogeneous random financial networks, which are amenable to data. Next, we will discus a novel framework for the control on interbank contagion. Particular emphasis is placed on core-periphery networks, and on strategies of risk mitigation in such networks. A new type of stochastic control is discussed, when uncertainty is about network structure. The control is adapted to a link-revealing filtration, which models the spatial progression of contagion. Last, time permitting, we will develop models that are rooted into insurance mathematics, so that we provide answers to questions pertaining to central clearing.

The outline is as follows:

1. Inhomogeneous random graphs and large cascade tests.
2. Control of interbank contagion under partial and complete information.
3. Central clearing model using star networks with Sparre-Andersen processes representing the nodes' capital; Fair membership strategies.

Lakshithe Wagalath

Risk management for whales

We propose a portfolio risk model which integrates market risk with liquidation costs. The model provides a framework for computing liquidation-adjusted risk measures such as Liquidation-adjusted VaR (LVaR). Calculation of liquidation-adjusted Value-at-Risk for simulated and real-life examples reveals a substantial impact of liquidation costs on portfolio risk for portfolios with large concentrated positions. *Joint work with Rama Cont.*