

Agenda for Research Consortium for Systemic Risk Meeting
Tuesday, December 1st, 2015
One Broadway, 6th Floor Exec Ed Suite, Cambridge, MA

Talks are 12 minutes long followed by an 8 minute period of Q&A. The objective is to present ideas and research-in-progress so as to communicate information and share knowledge. Detailed derivations, literature reviews, etc. are discouraged. As a reminder, the CSRA makes no policy recommendations. Please ensure that talks focus on analytics and research rather than advocacy of regulatory and policy positions.

Factors, correlation and connectedness

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| 10:00 | A. Lo and R. Stein (MIT) | <i>Introduction and objectives for the day</i> |
| 10:20 | Mila Getmansky Sherman (UMass Amherst) | <i>Sovereign, Bank and Insurance Credit Spreads: Connectedness and System Networks</i> |
| 10:40 | Dror Kenett (OFR) | <i>The multilayer structure of the financial system</i> |
| 11:00 | Paul Mende (MIT) | <i>Covering and uncovering equity market risk (factors)</i> |
| 11:20 | Richard Stanton (UC Berkeley) | <i>A New Dynamic House-Price Index for Mortgage Valuation and Stress Testing</i> |

11:40 **LUNCH**

New Methods

Initiatives from MIT CFP and LFE

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| 13:00 | Gary Nan Tie (Mu Risk LLC) | <i>Information theoretic augmentation of stress scenarios</i> |
| 13:20 | Bertrand Maillet (U. Paris-Dauphine and Orléans) | <i>An R-SOM Analysis of the Link between Financial Market Conditions and a Systemic Risk Index based on ICA-Factors of Systemic Risk Measures</i> |
| 13:40 | Mark Flood (OFR) | <i>Measuring the Unmeasurable: An application of uncertainty quantification to financial portfolios</i> |
| 14:00 | Deborah Lucas (MIT) | <i>Getting to the heart of the matter: MIT-Harvard SIFI Contest</i> |
| 14:20 | Roger Stein (MIT) | <i>Update on Systemic Risk Dashboard</i> |

14:40 **BREAK**

*Legal, policy
and regulatory
issues*

15:10 **Akhtarur Siddique (OCC)** *Fall of the Greenspan Put and Rise of the Jumpy Trader:
Aftermath of the Great Recession*

15:30 **Eric Posner (U of Chicago)** *The Trial of AIG*

15:50 **Gustavo Schwenkler (BU)** *The Systemic Effects of Benchmarking*

16:10 **Agostino Capponi (Columbia)** *Clearinghouse's incentives behind setting transaction
fees and collateral requirements*

16:30 **Paul Hiebert (ECB)** *Characterising the financial cycle: a multivariate and
time-varying approach*

16:50 **Samim Ghamami (Federal Reserve)** *Derivatives central counterparties (CCPs):
their risk management and CCP risk capital*

17:10 **A. Lo and R. Stein (MIT)** *Closing comments*

17:25 **ADJOURN**

*The behavior of markets and market
participants*

Presentation Abstracts

Roger Stein (MIT)

Roger M. Stein is Senior Lecturer in Finance at the MIT Sloan School of Management and also holds the position of Research Affiliate at the MIT Laboratory for Financial Engineering.

He has been actively engaged in developing, implementing and writing about new approaches to applied risk modeling and financial prediction for almost 25 years. He and his teams have developed, implemented, and delivered products and services that have become industry benchmarks in banking and finance.

In addition to his academic work, Stein has held a number of senior positions in industry. He was the Chief Analytics Officer at State Street GX as well as Senior Managing Director of Product Strategy. Before this, he was managing director of research and academic relations globally for Moody's Corporation and prior to this, president of Moody's research labs. Earlier in his career, he was co-head of research at Moody's KMV.

Stein has written over fifty professional and academic articles and has coauthored two full-length texts on applied analytics. His current research interests are in the areas of systemic risk, credit risk, model risk and validation, biomedical funding, and the interface between data mining and financial theory. He is also Affiliated Researcher at the Berkeley Center for Risk Management Research.

Stein is on the editorial board of several finance journals. He is also the founder and president of the Consortium for Systemic Risk Analytics and a member of the Advisory Council of the Museum of Mathematics; the Board of PlaNet Finance, USA, and the Academic Advisory Board of the EC's Systemic Risk Tomography Project (SYRTO).

Stein holds a master's degree and PhD from the Stern School of Business, New York University.

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Andrew Lo (MIT)

Andrew W. Lo is the Charles E. and Susan T. Harris Professor at the MIT Sloan School of Management and director of the MIT Laboratory for Financial Engineering. He received his Ph.D. in economics from Harvard University in 1984. Before joining MIT's finance faculty in 1988, he taught at the University of Pennsylvania's Wharton School as the W.P. Carey Assistant Professor of Finance from 1984 to 1987, and as the W.P. Carey Associate Professor of Finance from 1987 to 1988.

He has published numerous articles in finance and economics journals, and has authored several books including *The Econometrics of Financial Markets*, *A Non-Random Walk Down Wall Street*, *Hedge Funds: An Analytic Perspective*, and *The Evolution of Technical Analysis*. He is currently co-editor of the *Annual Review of Financial Economics* and an associate editor of the *Financial Analysts Journal*, the *Journal of Portfolio Management*, and the *Journal of Computational Finance*.

His awards include the Alfred P. Sloan Foundation Fellowship, the Paul A. Samuelson Award, the American Association for Individual Investors Award, the Graham and Dodd Award, the 2001 IAFE-SunGard Financial Engineer of the Year award, a Guggenheim Fellowship, the CFA Institute's James R.

Vertin Award, the 2010 Harry M. Markowitz Award, and awards for teaching excellence from both Wharton and MIT.

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Mila Getmansky Sherman (UMass Amherst)

Sovereign, Bank and Insurance Credit Spreads: Connectedness and System Networks

Macrofinancial risk has become increasingly important over time as global markets have become increasingly more connected. We apply several econometric measures of connectedness based on Granger-causality networks to the changes of sovereign risk of European countries and credit risk of major European, U.S., and Japanese banks and insurers to investigate the evolution of these connections. Credit risk for banks and insurers is measured using a version of the Merton Model (Contingent Claims Analysis) applied to risk-adjusted balance sheets. We highlight connections among banks, insurers, and sovereigns by quantifying the effects of risk transmission within and across countries and financial institutions.

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Dror Kenett (OFR)

The multilayer structure of the financial system

This paper analyzes the potential for the emergence and propagation of risk within the financial system through a multilayer network representation. The layers of the network encompass assets, funding, and collateral. Various entities in the financial system occupy these layers: for example, asset managers occupy the asset layer, and central counterparties occupy the collateral layer. Some entities span layers: for example, leveraged managers such as hedge funds span the asset and funding layers. Banks are notable in spanning all three layers, and thus are central to the spreading of risks. We discuss how a multilayer network can generate more extensive vulnerabilities and more abrupt, multi-stage, cascades than those that appear in a single-layer network. Using a multilayer network representation can result in new tools to monitor and manage financial stability. We discuss the applications and challenges that the multilayer network framework can address, and the data required to calibrate the network, as well as the data gaps that exist.

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Paul Mende (MIT)

Covering and uncovering equity market risk (factors)

We present and explain some unexpected results in the application of PCA to financial market risk.

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Richard Stanton (UC Berkeley)

A New Dynamic House-Price Index for Mortgage Valuation and Stress Testing

Due to lack of data, the U.S. primarily uses repeat-sales indices to measure real estate returns, despite the serious shortcomings of these indices. Making use of a newly available data set that contains both time-varying characteristics for all properties in the U.S. and transaction details for those properties that traded, we develop a new dynamic house-price index that overcomes these shortcomings by allowing house prices and returns to depend on house characteristics and on local and national macroeconomic factors. We estimate the index using Markov Chain Monte Carlo

(MCMC) linear filtering techniques, and find significant differences, in both the level and volatility of prices, between our estimates and those from the Federal Housing Finance Board's weighted-repeat-sales (WRS) price index. Our dynamic house price index is specifically designed for use in the Monte Carlo simulations typically applied in mortgage valuation and stress testing.

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Gary Nan Tie (Mu Risk LLC)

Information theoretic augmentation of FED stress scenarios

Financial institutions are obliged to use the FED scenario macro variable values in stress testing, but little guidance is given on how to then augment these with risk factor values needed to value the particular portfolio held by an institution. To address economic consistency and unbiased choice of valuation, we introduce an information theoretic paradigm to extend FED stress scenarios into portfolio stress tests.

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Bertrand Maillet (U. Paris-Dauphine and Orléans)

An R-SOM Analysis of the Link between Financial Market Conditions and a Systemic Risk Index based on ICA-Factors of Systemic Risk Measures

Due to the recent financial crisis, several systemic risk measures have been proposed in the literature for quantifying financial system wide distress. In this article, we propose an aggregated Index for financial systemic risk measurement based on EOF and ICA analyses on the several systemic risk measures released in the recent literature. We use this index to further identify the states of the market as suggested in Kouontchou et al. [2003]. We show, by characterizing market conditions with a Robust Kohonen Self-Organizing Maps algorithm that this measure is directly linked to crises market states and there is a strong link between return and systemic risk.

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Mark Flood (OFR)

Measuring the Unmeasurable: An application of uncertainty quantification to financial portfolios

We extract from the yield curve a new measure of fundamental economic uncertainty, based on McDiarmid's distance and related methods for optimal uncertainty quantification (OUQ). OUQ seeks analytical bounds on a system's behavior, even where the underlying data-generating process and system response function are incompletely specified. We use OUQ to stress test a simple fixed-income portfolio, certifying its safety i.e., that potential losses will be "small" in an appropriate sense. The results give explicit tradeoffs between: scenario count, maximum loss, test horizon, and confidence level. Unfortunately, uncertainty peaks in late 2008, weakening certification assurances just when they are needed most.

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Eric Posner (U of Chicago)

The Trial of AIG

I will discuss the legal framework that binds the Lender of Last Resort, using the AIG lawsuit as a case study. Shareholders of AIG sued the Fed and the government, arguing that the bailout of AIG was an expropriation of 80% of AIG's equity in violation of the Takings Clause of the U.S. Constitution. A few months ago, a trial court ruled that the Fed acted unlawfully but refused to award damages. The case is now on appeal. I will explain why the court ruled as it did, but also will discuss the broader issue, which is how the principles of emergency liquidity support (as articulated by Bagehot and many others) can be incorporated into the law. Many critics, not just AIG's shareholders, argue that the government violated the "rule of law" during the financial crisis, but hardly anyone has explained how the law should be updated so that in the next crisis, the government can behave lawfully. I will argue that the Fed should be given the power of eminent domain, along with the obligation to compensate shareholders based on fundamental values rather than crisis-driven prices.

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Gustavo Schwenkler (BU)

The Systemic Effects of Benchmarking

We show that the competitive pressure to beat a benchmark may induce institutional trading behavior that exposes retail investors to tail risk. In our model, institutional investors are different from a retail investor because they derive higher utility when their benchmark outperforms. This forces institutional investors to take on leverage to overinvest in the benchmark. Institutional investors execute fire sales when the benchmark experiences shock. This behavior increases market volatility, raising the tail risk exposure of the retail investor. Ex post, tail risk is only short lived. All investors survive in the long run under standard conditions, and the most patient investor dominates. Ex ante, however, benchmarking is welfare reducing for the retail investor, and beneficial only to the impatient institutional investor.

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Agostino Capponi (Columbia)

Clearinghouse's incentives behind setting transaction fees and collateral requirements

We analyze a clearinghouse's incentives behind setting transaction fees and collateral requirements. The clearinghouse's requirements affect not only the size and riskiness of her participating client base, but also the transaction fees charged to clients by her clearing member. We analytically characterize the equilibrium collateral levels and find that they depend on both the riskiness of the contract and the costliness of operating a client clearing business, relative to the depth of clients' private trading benefits. We show that the clearinghouse imposes a very low collateral requirement when the contract is safe and the operational cost of client clearing is low, but switches to a high collateral requirement when the contract is risky and client clearing expensive. In the latter case, the clearinghouse also lowers fee requirements to incentivize the member's participation.

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Paul Hiebert (ECB)

Characterising the financial cycle: a multivariate and time-varying approach

We introduce a methodology to characterise financial cycles combining a novel multivariate spectral approach to identifying common cycle frequencies across a set of indicators, and a time varying aggregation emphasising systemic developments. The methodology is applied to 13 European Union countries as well a synthetic euro area aggregate, based on a quarterly dataset spanning 1970-2013. Results suggest that credit and asset prices share cyclical similarities, which, captured by a synthetic financial cycle, outperform the credit-to-GDP gap in predicting systemic banking crises on a horizon of up to three years. Financial cycles tend to be long, particularly in upswing phases and with important dispersion across country cases. Concordance of financial and business cycles is observed only two thirds of the time. While a similar degree of concordance for financial cycles is apparent across countries, heterogeneity is high – whereby a cluster of countries tends to exhibit a high synchronisation in their financial cycle phases.

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Samim Ghamami (Federal Reserve)

Derivatives central counterparties (CCPs): their risk management and CCP risk capital

Following the 2009 G-20 clearing mandate, international standard setting bodies have outlined a set of principles for central counterparty (CCP) risk management. They have also devised formulaic CCP risk capital requirements on clearing members for their central counterparty exposures. There is still no consensus among CCP regulators and bank regulators on how central counterparty risk should be measured coherently in practice. A conceptually sound and logically consistent definition of the CCP risk capital in the absence of a unifying CCP risk measurement framework is challenging. Incoherent CCP risk capital requirements may create an obscure environment disincentivizing the central clearing of over the counter (OTC) derivatives transactions. We discuss risk measurement frameworks within which all layers of the default waterfall resources of typical derivatives CCPs can be specified coherently. The proposed frameworks can be used to develop logically consistent CCP risk capital rules.