Laboratory for Financial Engineering

Founded in 2001, the Laboratory for Financial Engineering (LFE) is a partnership between academia and industry, designed to support and promote quantitative research in financial engineering and computational finance. The principal focus of LFE is the quantitative analysis of financial markets using mathematical, statistical, and computational models. The goal of the lab is not only to spur advances in financial engineering but also to develop better ways to teach students and executives how to apply financial technology in corporate settings. LFE is directed by Andrew W. Lo, the Charles E. and Susan T. Harris professor at the MIT Sloan School of Management.

LFE research projects are grouped into three program areas:

- Capital Markets focuses on the mainstream of financial engineering: the pricing and hedging of financial securities, the determinants of capital market equilibrium, and the empirical and econometric analysis of financial market data.
- Risk Management focuses on the entire spectrum of issues surrounding the process of rational decision making where risk is involved.
- Financial Technology focuses on the computational and methodological aspects of financial engineering, including mathematical, statistical, numerical, and visualization algorithms.

The following are examples of recent projects funded by LFE.

Securitizing Society's Biggest Challenges

As disruptive as the financial crisis has been, the important lessons to be learned from the spectacular failure of financial technologies gone awry may actually pave the way for some of the most significant achievements of the 21st century. To that end, LFE researchers have worked to design new types of structured financing vehicles that could revolutionize the way science is funded by applying the principles of modern finance to contingent claims on the outcomes of scientific research. Although the lab's researchers have focused on biomedical innovation, their findings can be applied to other challenges facing society such as global warming and the energy crisis.

Psychophysiology of Real-Time Financial Risk Processing

A longstanding controversy in economics and finance is whether financial markets are governed by rational forces or by emotional responses. To study the importance of emotion in the decision-making process, LFE researchers were given access to a population of traders at a large bank in New York City, where they measured the traders' physiological characteristics as they engaged in trading activity. The findings of this research could provide a better understanding of the cognitive processes that underlie financial risk processing (analysis of the data is currently under way).

Systemic Risk

The establishment of a means to measure and monitor systemic risk on an ongoing basis is a high priority for financial regulatory reform, and LFE has been very active in researching the best ways to achieve this aim. In particular, the lab's researchers are working to compare the different metrics outlined in a recent survey of systemic risk measures completed by the Office of Financial Research and to identify which would have been the most informative for navigating through the recent financial crises. The goal is to determine whether combining multiple measures of systemic risk can improve the predictive power of the individual indicators.

Consumer Credit Risk Models

Current credit bureau analytics, such as credit scores, are based on slowly varying consumer characteristics and therefore are not as relevant for tactical risk management decisions by chief risk officers and policymakers. By applying machine-learning techniques to a large data set containing customer transactions and credit bureau data for a sample of a major commercial bank's customers, LFE researchers expect to be able to construct forecasting models that can significantly improve classification rates of delinquencies and defaults among credit card holders. The researchers will then apply the models and methods to two specific challenges in consumer credit risk management: deciding when and how much to cut individual-account credit lines and forecasting aggregate consumer credit delinquencies for the purpose of enterprise-wise and macro-prudential risk management.

Sponsors and Donors

LFE gratefully acknowledges its sponsors and donors, including Bunge Ltd., Citigroup, Gifford Fong Associates, Harris & Harris Group Inc., J.P. Morgan, State Street Global Advisors, and Thomson Reuters.

Andrew W. Lo
Director