Financial Statistics and Risk Management Program

Issue #8, Spring 2015

FSRM Newsletter

From the FSRM Director

Welcome to this issue of the FSRM newsletter. It is our pleasure to share program news, activities and events with you.

As spring finally comes, I am proud to announce that FSRM program has produced and will produce about total 100 graduates in its fifth year ending summer of 2015. They have launched or will launch their career in various financial corporations, including commercial banks, insurance companies and consulting firms. This success would not happen without their hard work as well as the collaborative efforts of the whole FSRM family, including our faculty, staff, external advisory committee and alumni. I would like to take this opportunity to express my gratitude to this highly motivated and truly dedicated group of people.

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I am also proud to announce that FSRM will host the Fifth International IMS Finance Insurance Probability and Statistics workshop this June. This is a great opportunity for globally distinguished academic experts and practitioners to communicate and to present themselves to the statistician society and financial industry. We encourage all our friends and alumni to participate the conference.

In this issue, we review some activities of FSRM and practitioner seminar series. One of FSRM faculty members Prof. Harry Crane and four students are introduced in faculty profile and student profiles. Prof. Harry Crane, joining Rutgers in 2012, is one of the most popular professors, teaching probability and inference courses in the FSRM program. Stanley Shen, one of FSRM students, passed his FRM and CFA, and is working for an energy service company. The three other students introduced in this issue will start their career in financial consulting firms after graduation. Chencheng Cai and Pratik Ramprasad, two of our FSRM students, will report their research on option pricing.

I hope you will enjoy the news and profiles. As always, we welcome any news, comments and suggestions you may have, and will be glad to hear news from you. Please keep the feedback coming. Wish you and your families all the best and fulfillment of your goals and dreams in next academic year.

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Annual Picnic and Family Day

An outdoor picnic on the second Sunday of Fall semester has become a tradition for the FSRM community to welcome new students as well as to celebrate the coming of new academic year. On September 14, FSRM students, faculty members, staff, their families and friends were invited for a picnic in Donaldson Park, which sits on the beautiful Raritan River near campus.

Under the leadership of FSRM assistant director Anh Luu, many student volunteers spent several weeks on food preparation, transportations and logistics. Thanks to their help, everyone enjoyed themselves.

Photo: Yusong Stanley Shen

It was a great opportunity for the new students to make a smooth transition to FSRM program and to build relationship with other students and faculty members. In addition, the out-of-class activity helped the students and faculty members to know each other better.

Delicious food, lawns, trees, sunshine and friends made a perfect afternoon. Smiles spread across everyone's face and were recorded in the photos.

Practitioner Seminar Series

Black-Litterman Asset Allocation and Mean-Variance Portfolio Optimization when Means and Covariances are Unknown

By Prof. Tze Leung Lai, Stanford University

Prof. Lai is Professor of Statistics and, by courtesy, of Health Research and Policy and of the Institute of Computational and Mathematical Engineering at Stanford University. He is also Director of Financial and Risk Modeling Institute at Stanford University and Co-director of the Biostatistics Core of the Stanford Cancer Institute and Center for Innovative Study Design at Stanford University School of Medicine. He is the author of numerous research papers and co-author of several text books, including "Statistical Models and Methods for Financial Markets" with Prof. Haipeng Xing which is used by some instructors in the FSRM program. Prof. Lai has teamed up with Haipeng Xing again as they are also the co-authors of about to be published book "Active Risk Management: Financial Models and Statistical Methods".

Markowitz's celebrated mean-variance portfolio optimization theory assumes that the means and covariances of the underlying asset returns are known. In practice, they are unknown and have to be estimated from historical data. Plugging the estimates into the efficient frontier that assumes known parameters has led to portfolios that may perform poorly and have counter-intuitive asset allocation weights; this has been referred to as the "Markowitz optimization enigma."

Prof. Lai first reviewed different approaches in the literature to address these difficulties, and in particular the Black-Litterman approach that has received much recent interest. He explained the root cause of this enigma and proposed a new approach to resolve it. At last he discussed the connections of their approach to that of Black and Litterman. Prof. Lai's talk as well as his humor left a deep impression on FSRM students.

Notes on the Role of Transaction Costs in Portfolio Analysis

By Jerome Benveniste, Ph.D., Highbridge Capital Management, LLC

Dr. Jerome Benveniste was a member of the Quantitative Trading Group at Highbridge Capital Management, LLC for twelve years, the last six as Managing Director and Portfolio Manager. He was involved in nearly every aspect of Highbridge's quantitative business, including forecast generation, risk modeling, transaction cost modeling, and optimization. Before joining Highbridge, he was a mathematician working in the areas of differential geometry, Lie theory, and ergodic theory and was on the faculty of Case Western Reserve and Stanford Universities. Jerome holds a Ph.D. from the University of Chicago and an A. B. from Harvard University, both in mathematics.

In traditional portfolio theory, following Markowitz, it is assumed that an investor can trade immediately and costlessly to obtain a portfolio that optimally expresses her views on future security returns while controlling risk exposures. Dr. Benveniste said that this assumption results in a particular approach to the sort of analysis routinely done on trading strategies: statistical evaluation of forecasts, attribution of portfolio returns to individual forecasts, examination of risk exposures, and sizing of positions. Over the last fifteen years, however, it has become increasingly evident that transaction costs must be considered in studying any trading strategy in which the forecasts are not essentially constant over very long horizons. The transaction costs introduce a dynamical component to the analysis, as the investor must balance the eagerness to adapt to the changing forecasts against the costs of trading rapidly. Dr. Benveniste discussed how the traditional approaches to risk analysis, forecast evaluation and attribution, and capacity need to be modified in the light of these considerations in this talk.

Models and Algorithms Behind the US Equity Derivative Markets

By Xiang Wu, Ph.D., Bank of American- Merrill Lynch

Dr. Wu is currently a senior trader on the Equity Options Automated Market Making team at Bank of America, Merrill Lynch. He received his Ph.D. in Computer Engineering from the University of Texas at Austin. His dissertation research was dedicated to scheduling algorithms for high performance on-chip networks. His innovative work on applying data mining techniques to the modern semiconductor manufacturing process earned him a share of the best student paper award from the International Conference on Integrated Circuit Design and Technology (ICICDT). After graduation, Dr. Wu joined J.P. Morgan Chase as a quantitative researcher to design and develop pricing libraries for a wide range of markets and products, achieving significant performance and inter-operability improvement. He was also part of the team that built the holistic risk management framework to meet the new and much stricter regulation requirements. He is now managing a portfolio of thousands of listed derivatives across all major exchanges. Outside of trading in the market, he spends his time on discovering novel approaches to harvest risk premiums across the equity universe, robust risk management methods to maximizing risk adjusted returns and efficient algorithms that exploit market microstructure patterns.

Dr. Wu talked about the general structure of US equity derivative markets in the beginning. He covered basic products and particularly VIX and VXX that make volatility more easily tradable by investors from all walks. Dr. Wu also went into more technical details about how models and algorithms function the US electronic options markets. In the end of his talk, he shared his own experience of job hunting and gave our students many practical tips.

Seven Sins of Quantitative Investing

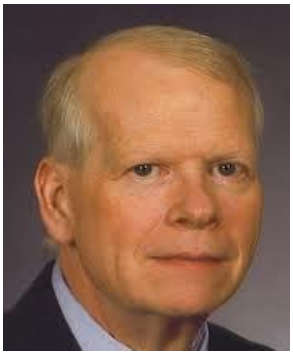
By Yin Luo, CFA, Deutsche Bank

Yin Luo is a Managing Director and Global Head of Quantitative Strategy at Deutsche Bank. Yin joined Deutsche Bank in New York in October 2009. Prior to Deutsche Bank, Yin spent over 12 years in investment banking and at a management consulting firm with various roles in quantitative research, fundamental research, portfolio management, investment banking and consulting. Yin was ranked 1st in the Institutional Investor's II-All America equity research survey in quantitative research in four consecutive years (2011-2014). He and the global quant strategy team were also ranked 1st in II-Europe and II-Asia surveys. Yin has a Bachelor of Economics degree from Renmin University of China, an MBA in Finance from University of Windsor, a Master of Management and Professional Accounting from University of Toronto. He is a CFA Charterholder, a US CPA, and a CGMA (Chartered Global Management Accountant).

Mr. Luo discussed the seven common biases in model building, and compared various data normalization techniques and addressed the issues of signal decay/turnover/transaction costs. He also illustrated the asymmetric payoff patterns and the impact of short availability, showed the optimal rebalancing frequency, and compared active management via multi-factor models versus smart beta investing via factor portfolios in this presentation.

Utilizing 'Big Data' to Generate Alpha in Portfolios of Consumer Equities

By Richard C. Davis, President &CEO, Consumer Metrics Institute, Inc.



Mr. Richard C. Davis is the founder and President of the Consumer Metrics Institute. He has been interested in the development of technologies that empower investors for over 30 years ago. Under his direction the Consumer Metrics Institute has focused on turning upstream economic data into information that an investor can use to assess the scope of the systemic risks associated with the equity markets. Mr. Davis graduated from college with a B.S. Cum Laude in Physics. Before founding the Consumer Metrics Institute, he held a number of positions, including founding principal of a NASD broker/dealer and registered investment advisor, and senior IT management positions with Fortune 500 firms. He even took a 5 year non-profit sabbatical, which included a stint as the CEO of an American orchestra.

Mr. Davis explored several kinds of new quantitative "fundamentals" that can be extracted daily from "Big Data", along with the challenges encountered while collecting and processing the vast amounts of data involved. In this talk, he showed how significant and consistent alpha can result from utilizing at least four of these new metrics, and demonstrated how to use "Big Data" tactically to anticipate revenue surprises -- before earnings reports, before guidance and in some cases even before corporate insiders fully grasp what is happening at the far end of their distribution channels.

Generating Alpha with Equity P/E Factor Models

By Nathan Tidd, Tidd Laboratories

Mr. Nathan Tidd is the founder of Tidd Laboratories, Inc., a quantitative research firm that helps active equity managers outperform using the unique insights from the firm's innovative P/E Factor Models. Prior to founding Tidd Labs, he served on the operating committee of MSCI Inc., where he headed the Barra Portfolio Analytics division. Mr. Tidd has previously held executive and management positions at Morgan Stanley, Barra International, hedge fund Horizon Management Ltd, and software provider Corel Inc. He holds an MBA from INSEAD, an undergraduate degree in Finance from Brigham Young University, and is a CFA Charterholder.

Adapting familiar multi-factor modeling techniques to a new framework, Equity P/E Factor Models explain equity prices based on how firms generate profits (or not), delivering useful insights such as factor valuations that signal "alpha periods" and market premiums that reflect market expectations for firm-specific growth. In this presentation, Mr. Tidd provided an overview of the methodology and illustrated example usage for asset selection, buy/sell timing decisions, and portfolio analysis.

Is There Alpha in Stock Buybacks?

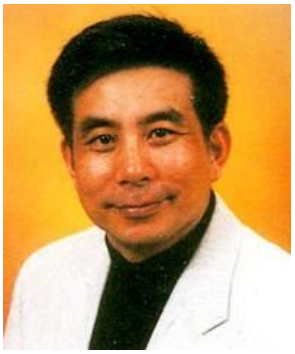
By David Krein, MarketAxess

David Krein is Head of Research for MarketAxess, the leading electronic bond trading platform. He plays a leading role in evaluating market microstructure, developing new trading capabilities and data products, and understanding client transaction costs and best execution metrics. Previously, he was Head of Research for Nasdaq Global Indexes and Senior Director of Product Development and Analytics for Dow Jones Indexes, and the president of DTB Capital, a firm he founded in 2006. Before establishing DTB Capital, Mr. Krein spent more than 10 years in various trading, structuring and technology positions at leading investment banks, including UBS and Merrill Lynch. Mr. Krein earned an MBA with Honors from The University of Chicago and a bachelor's degree in mechanical engineering with Distinction from Cornell University.

Stock buybacks programs are a popular topic, as listed companies among the largest net purchasers in today's market. Mr. Krein explored the mechanics of stock buyback programs, and introduced their role in the context of management activities. In this seminar, he introduced many issues regarding stock buybacks in details, including the performance implications for investors, the strategies to build an investment strategy to capture the alpha, the processes for collecting relevant market data, and the barriers to high-quality output.

Quantitative Practices in Credit Risk for CCAR/DFAST Stress Testing

By Hengzhong Liu, Ph.D., Fifth Third Bancorp



Dr. Hengzhong Liu earned a PhD in Financial Economics. Dr. Hengzhong Liu is a veteran risk quant professional in financial and banking industry. In his industrial career of 20 plus years after his early years of academia life, he headed various quant and strategy groups as SVP and/or MD for consumer, commercial and wholesale banking and lending in Citi Group, and CIT Group. He is currently heading the CCAR program for commercial/wholesale portfolio in Fifth Third Bancorp.

Comprehensive Capital Analysis and Review (CCAR) and Dodd Frank Annual Stress Testing (DFAST) are the most quantitative and the most comprehensive exercise of modeling and analysis to assess aggregate risk and to ensure capital sufficiency for large banks operating in United States. Talents in CCAR and DFAST are among the most demanded in the current job market. After a briefly introduction of CCAR and DFAST in the beginning, Dr. Liu explained the quantitative aspect of credit risk forecasting in the stress testing for CCAR and DAFST. He discussed the Basel default-based construct of expected credit losses, estimation of the credit losses over future time horizon, model risk assessment and capital buffer. After the presentation, he talked about practical issues he had in work beside generic methods.

Multi-period Portfolio Selection and Bayesian Dynamic Models

By Prof. Gordon Ritter, New York University- Rutgers University

Prof. Gordon Ritter is an Adjunct Professor at the Courant Institute (NYU), where he teaches graduate-level courses in the Mathematics in Finance program, and at Rutgers where he teaches in the Financial Statistics and Risk Management (FSRM) program. Concurrently with his academic roles he has held several prestigious buy-side positions in the area of statistical arbitrage alpha research and portfolio management. He completed his PhD at Harvard University in mathematical physics, where he published original research in top international journals across several fields including quantum field theory, quantum computation, and abstract algebra. He is a recipient of Harvard's award for excellence in teaching. He also holds an Honors BA from the University of Chicago in Mathematics.

Prof. Ritter presented joint work with Petter Kolm on a new theoretical framework for multi-period optimization with transaction costs which recasts the problem as estimation of a hidden state sequence in a Markov chain. This framework is general enough to encompass the vast majority of the multi-period portfolio choice and portfolio tracking problems that have thus far appeared in the literature. He explained that constraints are incorporated gracefully with no change to the fundamental theory. The framework leads naturally to practical optimization methods which are shown to converge for a large class of cost functions.

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Faculty Profile

Professor **Harry Crane** researches problems at the interface of probability theory, statistical inference, and combinatorics. Such problems arise in various applications in which a latent structure drives the phenomenon of interest, e.g., interacting particle systems, social network dynamics, and clustering applications. Crane is especially interested in understanding how fundamental modeling principles, e.g., exchangeability, stationarity, and the Markov property, affect the validity of certain assumptions, e.g., sparsity, and the resulting statistical inferences. Professor Crane's research has been published in a range of journals, including statistical theory, methods, and applications, theoretical and applied probability, combinatorics, algebra, and statistical physics.

In addition to mentoring and guiding student-led research projects, Professor Crane has taught introductory courses in the FSRM program (FSRM 582-583), which cover the basics of probability theory and mathematical statistics. His teaching stresses the core concepts needed to master advanced techniques from the higher level courses.

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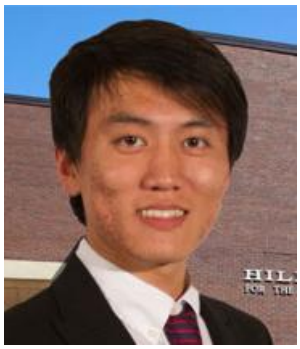
Student Profiles

Yusong Stanley Shen joined FSRM in Fall 2013 after earning his bachelor's degree in Risk Management and Insurance at East China Normal University, Shanghai. Stanley is now Risk Analyst at Oxbow Carbon LLC in West Palm Beach, Florida. He is currently a June 2015 CFA Level III candidate and he's also accumulating working experience for Certified FRM Designation. Stanley has gained many valuable hands-on working skills and career development skills from the FSRM faculty, courses, practitioner seminars and events. He also benefited a lot from the FSRM lab, and enjoyed playing with the Bloomberg Terminals – which allows him to quickly adapt to his job where he needs to use Bloomberg Terminal on a daily basis to find information and data.

In Oxbow, Stanley is responsible for evaluating, monitoring and reporting gross margin risk for the company's core businesses. He is also providing independent quantitative risk assessments for large proposed deals as essential intelligence for the decision making process.

"It's only a one and half years' FSRM journey, and now I'm starting my career in the 14th floor private office with picturesque South Florida tropical ocean view. Joining the FSRM program at Rutgers has been the most important and correct decision that I have made in my life. The FSRM faculty members, especially Prof. O'Reilly, gave me a lot of academic and career support. I learned many working skills from FSRM course offerings, and the knowledge taught in classes is very practical and can be easily applied to real work - I have been using Monte Carlo Simulation and Regression Analysis almost every day in the risk management process at Oxbow. The ability to apply these statistical methods to work is also an important factor that makes me stand out the candidate pool for this job."



Di Wu earned his bachelor's Degree in Mathematics from University of Washington-Seattle in 2013. Before joining FSRM, he interned at Investment Banking Department of China CITIC Bank and at Huarong Securities Co., Ltd. He participated in the design and analysis for two large syndicated loan projects and several investment projects including investment return and risk calculations for the deals. Di built a multi-factor index rating system for the core competitiveness of publicly traded Chinese securities companies and created a classification model based on the factor differences and similarities among the Chinese securities companies.

He is offered the position of Business Analyst at Genpact LLC as a full-time employee, reporting to a VP of the team. As an analyst of the team, he will work with other analysts on the complex analytics projects that could be delivered from the company or at the client location and also work with the offshore team to support large multi-year engagements. Moreover, he will be assigned to support team leaders to develop case studies and knowledge initiatives within the organization.

"The FSRM program builds on my mathematical and programming skills by adding advanced statistical analysis and modeling in finance, which make me ready for an entry level opportunity in the industry, and

allow me to build career around my core financial statistical expertise and supporting programming skills."

Xiaoxian Emily Zheng joined the FSRM program after graduating from Zhejiang University with a Bachelor's degree in Economics. She has always been interested in conducting data analysis and applying statistical knowledge to the real world. Through the two years' academic training in FSRM, she not only learned advanced models in statistics but also gained practical knowledge in financial analysis and risk management. The program offered a great platform for her to communicate with leading researchers and practitioners by hosting weekly seminars, which kept her fingers on the pulse. Due to the flexible course schedules, she could manage her time more efficiently. She is now pursuing both CFA and FRM certificates.

Attributing to the program's career development seminars, she was able to get the high frequency data analyzing and modeling intern position in BNY ConvergEx Group, during the summer and get the business analyst full time position in Genpact upon graduating. She will further implement knowledge learned from FSRM in the industry.

"The FSRM program has helped me to clarify my career paths by offering information about career development seminars, risk management conferences and meetings and related reading resources. It arouses and enhances my interest in risk management, portfolio management and data mining. Job searching is a hard process and I assume it will be harder without the support from the program. I will always be grateful to the faculty members, especially our associate director Dr. O'Reilly. They are always there to answer my questions and show me the right way."

Jonathan Posner, from New Jersey, studied Economics as an undergrad at Tulane University, graduating in 2011. He knew he wanted to go back to school to get his Masters in Statistics, but decided to wait a few years so he could first join Americorps and also spend time traveling the world. In 2013 he decided to enroll in the FSRM program, which allowed him to study statistics and apply it to another interest of his-finance.

Coming into the program he felt that he was not very marketable as a job candidate, as he had no prior relevant working experience and nothing that stood out on his resume. After finishing the internship in December, he was able to find a job with a management consulting firm, Analytic Partners in New York City, as a Marketing Science Analyst. In this role he has to rely heavily on statistics and the technical skills he learned in the FSRM program.

"The program to be very rigorous in the first year, gaining many skills that helped me land a summer internship at Gartner. FSRM provided great technical skills in the classroom and great workshops outside of it to help with the job search process."

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FSRM Student Research Projects on Option Pricing

Numerical Solution of the Heston Model for Option Pricing with a Probability Density Function Approach

By Chencheng Cai

My project focuses on providing the numerical solution for the joint distribution of stock price and its volatility. In the case of Heston model, both stock price and volatility are assumed to be stochastic processes, so that volatility smile and skew can be explained. To achieve a stable numerical solution on the discretized price and volatility space, 2D Crank-Nicholson scheme for finite difference will be applied to provide both a histogram estimation for the joint distribution of price and volatility and the evolution of probability density over time. This results will reveal more information on an option's higher moments (e.g. variance). As a summary, I will apply Crank-Nicholson method to provide an accurate and stable numerical solution for the joint distribution of price and volatility, which is governed by the partial difference equation derived from the Heston's model.

Complete Analytical Solution of the Asian Option Pricing and Value-at-Risk Problems - A probability Density Function Approach

By Pratik Ramprasad

The goal of my project is to find the configurations of the numerical methods which best approximate the exact analytical solution for Asian option pricing, as derived by Dr. Ismailov. Specifically, in the case of binomial trees, it is impossible to use the entire tree to value the option because that would lead to combinatorial explosion. Instead, we use Monte Carlo simulations with a random number generator. Here the issue is that the numbers generated are not truly random, and there is a possibility of clustering of observations, which in turn leads to a biased result. In this project, I will identify the range of parameters and the ideal random number generator to compute accurate approximations for the price of an Asian option using a binomial tree.

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