The 2nd FINACT-IRAN Conference on Financial and Actuarial Mathematics
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Composite Quantile Regression Model and Adaptive Penalized Procedure for Estimating Value-at-Risk and Average Value-at-Risk

Ali Aghamohammadi
University of Zanjan, Iran

Value-at-Risk and Average Value-at-Risk are tow important risk measures based on statistical methods that used to measure the markets risk with quantity structure. Recently, linear regression models such as least squares and quantile methods are introduced to estimate these risk measures. One advantage of quantile regression, relative to the least square regression, is that the quantile regression estimates are more robust against outliers and non-normal errors in the response measurements. However, the relative efficiency of the quantile regression estimator with respect to the least square estimator can be arbitrarily small. To overcome this problem, composite quantile regression methods have been proposed in the literature which are resistant to heavy-tailed errors or outliers in the response and at the same time is more efficient than the traditional single quantile-based quantile regression method. In this paper, these two risk measures are estimated using composite quantile regression and composite quantile regression with an adaptive lasso penalty. To evaluate the performance of the proposed methods with the other models, a simulation study is conducted and at the end, applications to a real data set from Irans market are illustrated.

Keywords: Value-at-Risk, Average Value-at-Risk, Composite Quantile Regression, Statistical Inference.

This is a joint work with M. Sojoudi (IASBS, Zanjan).

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Deposits Survival in Banks: A Probability Approach in Liquidity Risk Management

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Bank Hekmat Iranian, Iran

Cash flow and liquidity are highly taken into account in asset liability management (ALM) and risk management (RM) in banking, particularly after 2007-2008 financial crises. Understanding the amount of cash inflow and outflow assists banks in professional asset management and optimal strategy determination. Money run-off and premature withdrawal in deposits are key challenges in liquidity risk management, so banks need a tool to estimate the rate of run-off money and pre-closing deposits to reduce their risk may be encounter in future. This paper try to find a survival probability for term deposits in Hekmat Iranian Bank and manage cash flow and gap risk under this model.

Keywords: Liquidity risk management, premature withdrawal deposits, run-off

This is a joint work with Omid Askari and Mohammad Azizi.

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Composite Quantile Regression Model and Adaptive Penalized Procedure for Estimating Value-at-Risk and Average Value-at-Risk

Davood Ahmadian
University of Tabriz, Iran

In this project we are surveying the stock Estimation of Tehran Stock Exchange in the time interval 1381-1392. In this regard we follow the three based methods of financial behavior, Markov chain and PE ratio. First we consider the recent empirical behavior research in finance which has uncovered two families of pervasive regularities: underreaction of stock prices to news such as earnings announcements, and overreaction of stock prices to a series of good or bad news. This model is based on psychological evidence and produces both underreaction and overreaction for a wide range of parameter values. By pursuing the proposed model we evaluate the stock price of many companies in different years. As well, a novel stock valuation model is put forward by using a Markov chain. The valuation procedure turns out to be very simple, since it requires the solution of a system of linear equations. The stock valuation model is in accordance with the empirical evidence whereby earning-price ratios can change as time proceeds. Moreover, it offers fresh insights into previous stock valuation models. At final, the method using the P/E ratio is described and applied in the paper. This ratio is used in the framework of the profit model of the fundamental analysis. At the first, the PE ratio and earning per share (EPS) values are tabulated from the 50 different companies. Within the realization of the empirical analysis, selected tests and determination index are used to statistical assessment of the relation between the P/E ratio and stock price. 1Speaker 1

This is a joint work with Z. Ahmadi.

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Forward Option Pricing Using Gaussian RBFs

Jamal Amani Rad
Shahid Beheshti University, Iran

We will present a method to numerically price options by solving the Fokker-Planck equation. The solution to this partial differential equation (PDE) describes the evolution of the conditional probability density $p(s;t)$ for the value s of the underlying asset at time t, given that the value is s_0 at time t_0. This enables the pricing of several contracts with pay-offs $\phi(s;K;T)$ (with strike-price K and time of maturity T) by simply integrating the conditional probability density function at time of maturity with the pay-off function for each contract.

This means that our method only requires the solution of one PDE to price several contracts. This is useful in practical applications where it is common to price many contracts simultaneously for the same underlying diffusion model.

From a numerical perspective the initial condition for the Fokker-Planck equation $p(s_0;t_0)$ is particularly challenging since it is a Dirac delta function. In [1] a closed-form expansion for the conditional probability density was introduced that is valid for small time-steps. We use this for the computation of $p(s;\Delta t)$ the first time-step. For the remaining time-steps we discretize the Fokker-Planck equation using BDF-2 in time and Radial Basis Function (RBF) approximation in space with Gaussian basis functions.

We will demonstrate the good qualities of our proposed method for European call options and barrier options.

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New Challenges in Risk Management of Structured Portfolios

Hamid Reza Arian
Royal Bank Canada, Canada

In this talk, we review a number of major challenges facing Risk Management of structure fixed income portfolios and relevant issues in modern fixed income risk management. We start with a quick introduction to mortgage-backed securities. Then we introduce Libor Market Model, also known as Brace-Gatarek-Musiela model, for simulation of the forward interest rate dynamics, with its applications in pricing and hedging of mortgage securities. We finally explain how mismodelling mortgage products brought wall street to its knees. Risk management of fixed income portfolios is an interesting topic for both developed countries as well as emerging markets, where mortgages and various types of fixed income securities are still not as commonly used.

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Market Consistent and Sub-Consistent Valuations in Incomplete Markets

Hirbod Assa
University of Liverpool, UK

From January 2016, all insurance companies that are regulated within Solvency II framework will have to value their asset and liabilities using a market-consistent method. This paper studies market-consistent and sub-consistent valuations in incomplete financial markets with two types (type I and II) of market consistency. While market consistency of type I holds under fairly weak assumptions, the type II consistency, which is the usual definition of market consistency in the literature, holds only if the market prices are linear for fully hedged assets. We also characterize the market consistent and sub-consistent evaluators in several different ways. We discuss how market-consistent and sub-consistent valuations can be regarded as a robust approach to hedging and pricing in the presence of market imperfections such as market incompleteness and frictions.

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On Stochastic Comparisons of Largest Claim Amounts in Two Multiple-Outlier Scale Portfolios

Ghobad Barmalzan
Shahid Beheshti University, Iran

Suppose $X_1, ..., X_n(X_1^*, ..., X_n^*)$ are independent random variables with $X_i \sim G(\lambda_1 t)(X_i^* \sim G(\lambda_1^* t)), i = 1, ..., m$ and $X_j \sim G(\lambda_2 t)(X_j^* \sim G(\lambda_2^* t)), j = m+1, ..., n$. Further, suppose $I_1, ..., I_n(I_1^*, ..., I_n^*)$ are independent Bernoulli random variables, independent of the X_i's(X_i^*'s) with $I_i \sim Ber(p_1)(I_i^* \sim Ber(p_1^*)), i = 1, ..., m$ and $I_j \sim Ber(p_2)(I_j^* \sim Ber(p_2^*)), j = m+1, ..., n$. In particular, in actuarial science, $Y_i = I_i X_i$ corresponds to the claim amount in a portfolio of risks. In this talk, under certain conditions, we discuss stochastic comparison between the largest claim amounts, $Y_{n:n}$, in the sense of the usual stochastic order (which implies stop-loss order). Finally, we find a lower bound for the survival function. The obtained results show that the heterogeneity of the risks in a given insurance portfolio tends to make the portfolio volatile, which in turn leads to requiring more capital.

Keywords: Usual Stochastic Order; Stop-Loss Order; Value-at-Risk; Largest Claim Amounts, Marshall-Olkin Extended Exponential Distribution; Multiple-Outlier Scale Portfolios.

This is a joint work with Abedin Haidari (Shahid Beheshti University) and Amir T. Payandeh Najafabadi (Shahid Beheshti University).

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A Simple Threshold-Type Model of Investor Behavior

Ali F. Bastani
IASBS, Iran

In this talk, we present and discuss a simple agent-based computational model of investor sentiment which accounts for psychological tensions of market participants and induces a herding behavior and at the same time reproduces the main stylized facts of real market data as closely as possible.

Keywords Agent-Based Computational Finance, Stylized Facts, Herding, Volatility clustering.

This is a joint work with B. Waissi (IASBS).

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Jointly Optimal XL Reinsurance; the Inverse Optimality Problems

Ahmad Bigdeli
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Several approaches to optimal reinsurance have been attempted in the actuarial literature. A common feature of most of the quoted works is that optimality is considered with respect to the interest of solely the direct insurer. Ignatov et al. (2004), considered the optimal reinsurance from the point of view of both the interests of the primary insurer and the reinsurer, as two parties jointly liable for the risk they share. Then, Kaishev and Dimitrova (2006) studied the problem of optimal excess of loss reinsurance with a limiting and a retention level based on "Risk Measure only. Afterward Dimitrova and Kaishev (2010) introduced another measure named "performance measure. According to their assumed risk model, the premium income is modeled by any non-negative, non-decreasing function, claim arrivals follow a Poisson process and claim amounts are modeled by any continuous joint distribution. As a "performance measure", "the expected profits of the direct insurer and the reinsurer, given their joint survival" is defined. "The probability of joint survival of the direct insurer and the reinsurer" is employed as "risk measure". Finally, the optimal excess of loss reinsurance treaty is obtained by combination of two introduced criteria. For the purpose, two optimality problem is defined, first the total premium income is divided and the parties are seeking the optimal retention and limiting level and the other is when they have fixed the retention and limiting level according to their risk aversion or any other criteria and are seeking for the optimal share of total premium. Dimitrova and Kaishev (2010) have considered the first one and we studied the last optimality problem in the present paper.

Keywords: Optimal excess of loss reinsurance, Risk process, Finite horizon ruin probability, Appell polynomials, Joint survival of cedent and reinsurer, Expected profit, B-Spline.

This is a joint work with A. Shahlaee (Shahid Beheshti University).

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Copulas and their Applications in Finance

Faezeh Dadkhahi Asl
University of Tehran, Iran

In recent decades, financial markets volatilities have in creased from so many sources like inflation, governance and the development of financial instruments. If current financial models could illustrate real world more completely and evaluate portfolio risk fairly accurate, it is possible to prevent probable future crisis. There are several risk measures that can calculate and manage the risk, e.g. variance, semi-variance, value-at-risk, conditional value-at-risk, etc. Accurate de- pendency modeling is the key factor to measure the risk correctly. Inappropriate models lead to wrong risk calculation. Correlation coefficient is one of the measures, which is used commonly. But it provides a correct evaluation if and only if the distributions of random variables are elliptical and also the correlations between them are linear. However most of researches in financial markets do not prove these conditions in all situations. So correlation coefficient is usually misleading. An alternative approach is using copulas. Copulas can be considered as the extension of correlation in a non-Gaussian universe. Technically, copulas allow us to model the dependency structure of random variables on their marginal distributions, without any initial assumptions about the marginals and the form of dependency. The applications of these functions in finance are mainly risk management and option pricing, although the literature shows its applications in portfolio management and derivatives pricing as well. The main challenge in implementing copulas is selection of optimal function among different families of copulas, which will definitely have influences on the final result. Some methods have arisen in order to answer this critical question including, Goodness-of-Fit test and using the property of long memory which exists in financial data.

The purpose of this research is to introduce copula and its main para- metric families as well as its applications in the risk evaluations area. Also we will discuss the methods of estimating copula parameters. Then we will explain those methods of choosing optimal copula. Finally to have a better view, through an empirical study we try to model the de- pendency structure of returns in Tehran Stock Exchange using copulas.

Keywords: Copula, Risk Management, Optimal Copula.

This is a joint work with Saeed Bajalan (University of Tehran), and Zahra Saedi (University of Tehran).

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Optimal Trading with Stochastic Liquidity and Volatility

Mojgan Ebrahimi
IASBS, Iran

We consider the execution of portfolio transactions with the aim of minimizing a combination of volatility risk and transaction costs arising from permanent and temporary market impact. For a simple linear cost model, we explicitly construct the *efficient frontier* in the space of time-dependent liquidation strategies, which have minimum expected cost for a given level of uncertainty. We may then select optimal strategies either by minimizing a quadratic utility function, or by minimizing Value at Risk. We consider the problem of mean-variance optimal agency execution strategies, when the market liquidity and volatility vary randomly in time. Under specific assumptions for the stochastic processes satisfied by these parameters, we construct a Hamilton-Jacobi-Bellman equation for the optimal cost and strategy. We solve this equation numerically and illustrate optimal strategies for varying risk aversion. These strategies adapt optimally to the instantaneous variations of market quality. We propose the use of a meanquadratic-variation criteria to determine an optimal trading strategy6 in the presence of price impact. We derive the Hamilton Jacobi Bellman (HJB) Partial Dierential7 Equation (PDE) for the optimal strategy, assuming the underlying asset follows Geometric Brownian8 Motion (GBM) or Arithmetic Brownian Motion (ABM). The exact solution of the ABM formulation is 9 in fact identical to the static (price-independent) approximate solution for the mean-variance objective 10 function in Almgren and Chriss (2001). The optimal trading strategy in the GBM case is in general a 11 function of the asset price. The static strategy determined in the ABM formulation turns out to be an 12 excellent approximation for the GBM case, even when volatility is large.

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A Recursive Formula for the Bayesian Premium in Collective Risk Models with Bivariate Risk Parameter

Saman Ebrahimpour
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Credibility theory is a strong pricing tool and cornerstone of actuarial science applied to non-life insurance. In credibility theory, the next period's insurance coverage cost is calculated based on past observations and the manual rate. In the greatest accuracy approach in credibility context, each policyholder is characterized by a risk parameter. In this paper, the Bayesian premium is calculated in the collective risk models when the risk parameter is bi-dimensional. One element of the risk parameter is associated to severity and the other one is tied to claim numbers. The severity distribution is from the linear exponential family. A recursive formula is obtained to calculate the Bayesian premium and the results are applied to a simulated data set.

Keywords: Credibility theory, Bayesian premium, Credibility premium, Collective risk model, Linear exponential family, Bivariate risk parameter

This is a joint work with A. Hassan Zadeh (Shahid Beheshti University)and M. R. Farid Rohani (Shahid Beheshti University).

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"Finance of Climate Change"?

Arash Fahim
Florida State University, USA

The long-term cost of climate change is far beyond the cost of abatement techniques of curbing the emission of carbon. Many local and international efforts have been put in place to reduce and postpone the adverse effect of such changes. While the industrial countries such as US, China, EU, India, Russia, Japan and Germany are major source of carbon pollution, one developing country is crawling to the top of the polluting nation's list; Iran. While other countries on the top of list except US, has much lower per capita pollution, Iran beats all others in that too. Among developing countries Iran is one of the most industrial and polluting countries which in expected to play a more constructive role in emission reduction. Now that a nuclear deal has reached, we expect Iran to be even more industrial and consequently polluter. As an accepting nation of Kyoto protocol, Iran is required to implement measures to reduce emission of carbon. Those measures are already in place in several countries as well as local governments in the form of market structures for incentivizing more green production regime. Since the creation of these carbon markets, many questions has raised about their effectiveness on reducing the pollution. Some of these questions can be answered via studying mathematical models. We present a selection of these questions and discuss the answers that some mathematical models can give to them.

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Some New Results on Stochastic Comparisons of Smallest Claim Amounts in Two Hetrogeneous Portfolios

Abedin Haidari
Shahid Beheshti University, Iran

Suppose $X_{\lambda_1},,X_{\lambda_n}$ is a set of Weibull random variables with shape parameter $\alpha > 0$, scale parameter $\lambda_i > 0$ for $i = 1, ..., n$ and $I_{p_1}, ..., I_{p_n}$ are independent Bernoulli random variables, independent of the X_{λ_i} 's, with $E(I_{pi}) = p_i, i = 1, ..., n$. Let $Y_i = X_{\lambda_i} I_{p_i}$, for $i = 1, ..., n$. In particular, in actuarial science, it corresponds to the claim amount in a portfolio of risks. In this talk, under certain conditions, we discuss stochastic comparisons between the smallest claim amounts in the sense of the usual stochastic, mean excess, covex and dispersive orders. Finally, we obtain the results concerning the dispersive order between the smallest claim amounts and find a lower and upper bound for the coefficient of variation. The results established here extend some well-known results in the literature.

Keywords: Usual Stochastic Order; Stop-Loss Order; Dispersive Order; Convex order; Smallest Claim Amount; Weibull Distribution; Valu-at-Risk.

This is a joint work with Ghobad Barmalzan (Shahid Beheshti University) and Amir T. Payandeh Najafabadi (Shahid Beheshti University).

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Behavioral Considerations in Actuarial Analysis with an Innovative Win-Win Model Applied to Individuals Investment Insurance

Saleh Hatami
Amirkabir University of Technology, Iran

Neglecting the qualitative aspect of risk in actuarial analysis on one hand and lack of validation about the subjective value of premium determination in insurance companies on the other hand, were two incentives to do some researches on this subject.

By using behavioral finance in actuarial calculations as a solution to these two issues , it has been derived an innovative win-win model with integration of these two literatures (behavioral economics and actuarial analysis), which works to optimize the premium amount and making more attractive deals (wining of insurance companies); also the model can help to make better policies to control many individual biases that make the clients to behave riskier than their condition allows (wining of the two sides of an insurance contract).

The paper structure is quite normal. it begins with an introduction that is trying to prepare the readers mind for a brand new integration in two literatures and it has three literature reviews, inside, each of which explicates the risk concept with a specific perspective, then comes the model and after that we have a final and necessary review about the option contracts vs. investment insurance, and of course the conclusion in the end.

Keywords: Behavioral Finance, Insurance Policy, Premium, Actuarial Analysis, Hedging, Investment Insurance, Behavioral Economics

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Artificial Boundary Method for American Call Option Pricing under the Jump-Diffusion Model

S. Mohammad Mahdi Kazemi
Amirkabir University of Technology, Iran

This talk proposes an artificial boundary method for partial-integro differential equations (PIDEs) to compute American call option prices when the stock price follows a diffusion process with jump components. The idea is to reduce the infinite computational domain to a finite one by introducing an artificial boundary in a proper outer problem and then applying the Fourier transform approach to derive a transparent boundary condition. We then develop a CrankNicolson scheme to solve the PIDE with the artificial boundary condition. With a finite computational domain, the optimal exercise boundary can be determined efficiently. The results show that the new treatment is very efficient and gives better accuracy than the normal finite difference method.

Keywords: American option, artificial boundary, jump-diffusion model, finite difference method.

This is a joint work with Mehdi Dehghan (Amirkabir University of Technology), Ali Foroush Bastani (IASBS).

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Moving Least Squares with Application to Finance

Afsaneh Khademi
Islamic Azad University, Iran

In this talk, a meshless method based on moving least squares (MLS) approximation is applied to obtain numerical solution of Asian option price. we use a discretization scheme over the time variable and MLS method are used to the spatial approximation. One of the advantage of this method is easily applicable to nonlinear problems, due to the lack of dependence on a mesh in comparable with other numerical method. The accuracy and efficiency of the proposed method are acceptable for price of Asian option.

Keywords: Asian option pricing, Moving least squares method, Meshless methods

This is a joint work with Majid Amirfakhrian (Islamic Azad University).

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Minimum Empirical Value at Risk Portfolio Computation

Somayyeh Lotfi
University of Guilan, Iran

Value at Risk (VaR) has become a popular risk measure used by both regulated banks as well as investment practitioners. A common approach to solve minimum VaR portfolio optimization problem is to solve the corresponding Empirical VaR (EVaR) minimization problem obtained by using Monte Carlo simulation approch. This formulation result in a mixed integer programming (MIP) which is a quite complex optimization problem. In this study, we first propose a new model for obtaining the portfolio of minimum EVaR, then using some numerical examples we compare the quality of solutions of two models, highlighting some of new models benefits.

Keywords: Empirical Value at Risk, Non-Convex, Mixed Integer Programming

This is a joint work with Maziar Salahi (University of Guilan).

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On Structural Models for Credit Risk based on Regime-Switching Lévy Processes

Hadi Mohagheghi
IASBS, Iran

In this talk, we study a switching Levy process counterpart of Mertons structural model for credit risk valuation of financial entities. In these models, the default event depends on the total value of the firms assets modeled by a regime switching diffusion with synchronous jumps which allows the firms asset jumps along with a change in the regime. We are able to compute default probabilities as well as pricing of defaultable bonds when the recovery rate depends on the state of the economy.

Keywords: Credit Risk, Regime-Switching Diffusion, Default Probability, Defaultable Bond.

This is a joint work with A. Foroush Bastani (IASBS).

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Real Option Pricing and Optimal Investment Timing Under Regime-Switching Diffusions

Shahram Mohammadi
IASBS, Iran

Discounted cash flow analysis for valuation of companies or investment projects based on the fundamental net present value concept has been amongst the most commonly used tool in finance for decades with certain restrictive limitations. Valuation methodologies based on real options theory has offered a variety of new ways to address these limitations by providing the possibility of flexibility and opportunities for growth. On the other hand, the use of regime-switching models is a new trend in finance allowing the modelers to give interpretable explanations for many economic phenomena. In line with the work of [A. Bensoussan, Z. Yan and G. Yin, *Threshold- Type Policies for Real Options Using Regime-Switching Models*, SIAM J. Fin. Math., 2012, 3, 667-689] which has modeled the impact of macroeconomic conditions on irreversible investments under a regime switching model by rigorously justifying the existence and uniqueness of optimal threshold-type policies, in this work we make precise the impact of regime-switching dynamics on the valuation process by showing that a delay will occur in expected investment timing due to regime-shifts.

Keywords: Real Options, Regime-Switching Diffusion, Threshold-Type Policy, Irreversible Investments.

This is a joint work with A. Foroush Bastani (IASBS).

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Using Kernel based Collocation Methods to Solve Variational Inequalities with Applications in Option Pricing

Mojtaba Moradipour
Shahid Beheshti University, Iran

Under the standard Black-Scholes model, the value of an American option solves a free boundary problem which is equivalent to a parabolic variational inequality problem. We use positive definite kernels to discretize the variational inequality problem in spatial direction and achieve a sequence of linear complementarity problems (LCPs) in a finite dimensional Euclidean space. We use special kind of kernels to achieve LCPs with positive definite coefficient matrices and then we prove some existence and uniqueness theorems to the solutions of LCPs. Finally we use direct and iterative methods successfully to solve the LCPs. Illustrative examples are included to demonstrate the validity and applicability of the new techniques.

Keywords: American options, Positive definite kernels, Variational inequalities, Linear complementarity problems.

This is a joint work with S.A. Yousefi (Shahid Beheshti University).

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Numerical Approximation of the Early Exercise Boundary of American Put Options by Runge-Kutta-Pouzet Methods

Khadijeh Nedaiasl
IASBS, Iran

The early exercise boundary $B(t)$ of an American put option with strike price K and maturity T, satisfies the integral equation

$$K-B(t) = p(B(t),t)+\int_0^t [rKe^{-r(t-s)}\mathcal{N}(-d_2(B(t),t-s,B(s)))-\delta B(t)e^{-\delta(t-s)}\mathcal{N}(-d_1(B(t),t-s,B(s)))]ds,$$

in which $p(B(t),t)$ represents the corresponding European put option price and $\mathcal{N}(.)$ is the standard cumulative normal distribution function. In the literature of integral equations, this equation could be formulated as the general form

$$x(t) = \varphi(t,x(t)) + \int_0^t k(t,s,x(t),x(s))ds, \quad t \in [0,T],$$

which is called an *implicit Volterra integral equation*. The existence and uniqueness issues of the early exercise boundary has been addressed in several studies by fixed point theorems or probabilistic approaches. Some researchers have also used the quadrature based numerical techniques as well as iterative methods to solve this equation. In this study, we apply high order Runge-Kutta methods of Pouzet type to approximate $B(t)$. We will demonstrate the effectiveness of this approach by presenting some numerical experiments and compare them with some competing approaches.

Keywords: American Put Option, Early Exercise Boundary, Integral Equation, Runge-Kutta Methods.

This is a joint work with A. Foroush Bastani (IASBS).

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Numerical Method to Estimate Life Insurance Under Stochastic Mortality

Abodolsadeh Neisy
Allameh Tabataba'i University, Iran

In this talk, we present a model for life insurance under stochastic mortality in an incomplete market. For this purpose. First, we describe the term life insurance policy and present the financial market in which the issuer of this contract invests and obtain the hedging strategy for the issuer of the life insurance.

Keywords: Stochastic mortality; pricing; life insurance; Sharpe ratio; non-linear partial differential equations; market price of risk; equivalent martingale measures.

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Hedging of Defaultable Securities through an Extension of Itô's Formula

Ramin Okhrati
University of Southampton, UK

Hedging of defaultable claims plays an important role in credit risk modeling. In particular, the problem is challenging when the underlying asset value process is a pure jump one. In this case, many regularity problems arise because the smoothness of the applied functions might fail. We discuss that how the risk of defaultable claims can be managed by locally risk minimizing approach and through an extension of Itô's formula for finite variation Lévy processes. The extended formula is applicable when the underlying function is continuous and admits weak derivatives. Then we apply this extended version in a structural setup, in order to find hedging strategies for defaultable claims. Finally, we discuss that how the procedure can be applied to hedge defaultable claims when the underlying asset values are observed discretely on some specific dates.

Keywords: Hedging strategies, Defaultable claims, Itô's formula, Finite variation Léevy process, Weak derivative

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On the Estimation Methods for Risk Measurement

Hassan Omidi Firouzi
Paris-Sorbonne, France

Banks can use either the internal models-based approach or the standardized approach to assess and report the risk of the trading book for future periods to regulators. In this joint paper, we focus on internal models- based approach. We examine both statistical and financial properties of relevant estimation methods for computing Value at Risk (VaR) and Expected Shortfall (ES) for banks at both desk level and bank-wide level. We focus on a benchmark method for estimation and we study statistical and financial properties of the method. We provide numerical results for different hypothetical portfolios.

This is a joint work with Jean-Paul Laurent.

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An Optimal Multilevel Reinsurance Strategy

Ali Panahi
Shahid Beheshti University, Iran

The usual stop-loss reinsurance strategy categorizes risk of insurance company into two different levels. This article generalized such classification to $m(> 2)$ levels, say multilevel reinsurance strategy. To obtain such multilevel reinsurance strategy, this article starts from a given reinsurance strategy (such as stop-loss or quota-share strategies) that acts on $[0, \infty)$. In the first step, it cuts down an interval $[0, \infty)$ into two intervals $[0, M_i)$ and $[M_i, \infty)$. Functional form of the new reinsurance strategy has been defined on an interval $[M_i, \infty)$ while on an interval $[0, \infty)$ the old reinsurance strategy does not change. To determine such functional form on $[M_i, \infty)$, this article employs the conditional tail expectation (CTE). This extension procedure can be repeated to obtain an $m(> 2)$ multilevel reinsurance strategy. Finally, unknown parameters of the multilevel reinsurance strategy have been estimated using the Bayesian estimation methods. A simulation study has been conducted to show practical implementation of our findings.

Keywords: Reinsurance strategy; Stop loss; Optimization; Conditional tail expectation; Bayesian method.

This is a joint work with Amir T. Payandeh Najafabadi (Shahid Beheshti University) and Hirbod Assa (University of Liverpool, UK).

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Approximating the Extrema's Distributions of Lévy Processes

Amir T. Payandeh
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Suppose X_t is a one-dimensional and real-valued Lévy process started from $X_{0=0}$, which **(1)** its nonnegative jumps measure ν satisfying $\int_{\mathbb{R}} \min\{1, x^2\}\nu(dx) < \infty$ and **(2)** its stopping time $\tau(q)$ is *either* a geometric *or* an exponential distribution with parameter q independent of X_t and $\tau(0) = \infty$. This article employs the Wiener-Hopf Factorization (WHF) to find in $L^{p^*}(\mathbb{R})$; (where $1/p^* + 1/p = 1$ and $1 < p \leq 2$ approximation for the extrema's distributions of X_t. Estimation bounds, for such approximate method, along with two approximation procedures and several well examples are explored.

Keywords: Lévy processes; Positive definite function; Extrema's distributions; Fourier transform; Hilbert transform.

This is a joint work with Dan Z. Kucerovsky (University of New Brunswick, Canada).

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Optimal Approximations for Optimal Portfolio Selection Problems based on the Stochastic Differential Equation Driven by a Birnbuam Sunders Stochastic Process

Azadeh Rajabzadeh
Shahid Bahonar University of Kerman, Iran

In this talk, we consider multiperiod portfolio selection problems in a type market where a basket of 1 riskfree with constant rate and m riskfree securities with stochastic return traded continuously. For this market, we assume that the price process evolves according to a stochastic differential equation as in geometric Brownian motion stochastic process when the source of variation replaced by a Birnbuam Sunders stochastic process. This set-up could be used in a problem concerns a decision maker who invests some amount of money that increase stochastically (the initial wealth or provision) in order to be able to fulfil a series of future consumptions or payment obligations. Second, we consider the portfolio selection problem of a decision maker who invests money at predetermined points in time and we assume that the value of invests is increased stochastically in time and the investigator want to obtain a target capital at the end of the time period under consideration. Several optimality criteria based on some risk measure are presented. For both selection problems, we propose accurate approximations based on the concept of comonotonicity, as studied in Dhaene et al. (2005).

This is a joint work with M. Rezapour (Shahid Bahonar University of Kerman) and A. Jamalizadeh (Shahid Bahonar University of Kerman).

Reference

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Stochastic Exponential of a COGARCH with a Levy Process and Option Pricing

Mohsen Rezapour
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Using the volatility, which measures an asset's risk, of financial assets changes stochastically over time have been considered in the finance literature by many authors. Continuous time models have been elevated to great importance in the modelling of time series data, in response to the successful options pricing model of Black and Scholes (1973), among other things. Continuous time series models with stochastic volatility are used for modeling option pricing, asset allocation, risk return tradeoff, and term structure theory. Since in the context of high frequency data, the underlying process of asset prices, exchange rates, indices, or interest rates is often irregularly spaced and stochastic jumps and jump risk premia can also capture additional variation in the conditional distribution of returns, continuous time series models can obtain a more accurate analysis for financial data.

The "COGARCH" model as a continuous-time analogue to the discrete time GARCH stochastic volatility model of Engle and Bollerslev by a single source of variation was introduced in Kluppelberg, Lindner, and Maller (2004). The proposed COGARCH model arisen from a pure jump Levy process. Therefore, consider a new stochastic volatility model with another source of variation may conclude more heuristic analysis. Here, we consider COGARCH option pricing model including another source of variation, in which the underlying stock price process is taken as a stochastic exponential of a COGARCH model with another Levy process as a new source of variation. The risk-neutral dynamics of this model is proposed and the option pricing is considered by two methods that are partial integro differential equation and Monte Carlo Markov chain. As a prominent example, we compute European option prices in the Variance-Gamma COGARCH model.

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Optimal Linear Relativity Premium Using Both Number of Reported Claims and Steady-State Distribution

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A bonus-malus system plays a very important role in actuarial mathematics through determining its relativity premium, which is extensively used in automobile insurance. There are many ways including Bayesian estimator and ordinary linear estimator to calculate the relativity premium. There is no doubt that Bayesian estimator is the most accurate esti- mator; however, it is undesirable for commercial purposes for its rather irregular pattern. This paper aims to introduce an optimal linear estimator for relativity premium, which has a simple pattern and is obtained under the balanced loss function such that the result is close to Bayesian methods. In bonus-malus system, the relativity premium calculating based on steady-state distribution or claim number distribution. This paper approximate relativity premium close to estimators based on steady-state distribution or claim number distribution coincidently.

Keywords: Bonus-malus system, relativity premium, Bayesian estimator, balanced loss function, optimal linear estimator.

This is a joint work with Amir T. Payandeh (Shahid Beheshti University).

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The Fair Pricing of Variable Annuities with Guaranteed Minimum Withdrawal Benefit

Azadeh Salehi
Allameh Tabataba'i University, Iran

Recently, life insurance industry has grown significantly by offering an enormous variety of life insurance products. Variable annuities with Guaranteed Minimum Withdrawal Benefit (GMWB) provide the tax-deferred feature of variable annuities as well as the guaranteed minimum payment that promises to return the entire initial investment. In this paper, the modeling of the variable annuities with GMWB has been studied. We also approximate the value of the variable annuities riders and explore the effects of various modelling parameters on the value of the contract.

Keywords: Variable annuities; GMWB; life insurance; insurance fee.

This is a joint work with Ali Safdari-Vaighani (Allameh Tabataba'i University).

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Is Default Risk Priced in Equity Options?

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Ryerson University, Canada

What is the impact of default risk on equity option pricing? We study this question in detail by empirically examining to what extent the firm-specific default risk matters in pricing individual equity options. Since credit default swaps (CDS) are similar to put options in that both offer a low cost and effective protection against downside risk, we use CDS spread as credit risk proxy to investigate the effects of default risk on put option pricing. Recent financial crisis showed that for many financial firms equity options experienced high implied volatility (IV) when the underlying CDS spreads went up. By examining an exhaustive sample of US-listed firms with both CDS and put options data available over the period from 2002 to 2010, and studying the primary determinants of option IVs cross-sectionally and over time, the findings show that default risk is a significant factor in the prices of equity options. Moreover, the impact of default risk remains significant after controlling for firm-specific and macroeconomic factors. This study relates to recent literature that explains how default risk can get injected from the fixed income market to the equity options market and why default risk is important in the pricing of equity options and implied volatility.

Keywords: Option Pricing, Default Risk, Implied Volatility, CDS Spreads, Volatility Skew
Category: Financial Risk Management and Asset Pricing

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The Concept of Comonotonicity in Actuarial Science and Finance: Theory and Application

Ali Sarzaeem
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In an insurance context, one is often interested in the distribution function of a sum of random variables. Such a sum appears when considering the aggregate claims of an insurance portfolio over a certain reference period. It also appears when considering discounted payments related to a single policy or a portfolio at different future points in time. The assumption of mutual independence between the components of the sum is very convenient from a computational point of view but sometimes not realistic.

I will describe approximation for sums of random variables when the distribution of the terms are known but the stochastic dependence structure between them is unknown or too cumbersome to work with. Then, I will describe some applications of the concepts.

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Malliavin Calculus Monte-carlo Approach in Financial Mathematics

Mahdieh Tahmasebi
Tarbiat Modares University, Iran

In this Lecture, we give a brief introduction of Malliavin Calculus and apply these ideas to solve two fundumental problems in Finance. One is to solve numerically a stochastic control portfolio problem by obtaining a presentation for conditional expectations and the other is to evaluate the price of contingent claims in Heston model by two methods Monte-carlo methods and Malliavin approach and of course compare each other in some examples.

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Optimal Portfolio Allocation and Consumption Decisions under Higher Moments

Saman Vahabi
IASBS, Iran

In this talk, we have solved a continuous-time, consumption investment problem when the risky asset is driven by a pure jump process with non-trivial and tractable higher moments. We obtain the optimal portfolio allocation and consumption decision problem for an investor having CRRA utility in both of her objectives. We also study sensitivity of the investment in the risky asset to higher moments.

Keywords: Pure-jump processes, Optimal allocation, Higher moments, Consumption decisions.

This is a joint work with A. Foroush Bastani (IASBS).

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معرفی و محاسبه احتمال ورشکستگی مدل فرآیند سرمایه کلاسیک تعمیم یافته تصحیح شده

سروش امیرحشچی
دانشگاه شهید بهشتی

یکی ازمهمترین نگرانی های شرکت های مالی دردوران فعالیت خودمسأله‌ی ورشکستگی است. در محاسبه‌ی احتمال ورشکستگی، ابتدا مدلی را که قادر به توصیف فرایند سرمایه‌ی شرکت است را معرفی و سپس احتمال ورشکستگی را با توجه به مدل معرفی شده بدست می آورند. تاکنون مدل های متعددی جهت توصیف فرایند سرمایه معرفی شده است. اما می توان گفت مدل های معرفی شده بدلیل فرض های در نظر گرفته شده دارای بیان نادقیقی از شرایط واقعی هستند. در این سخنرانی با استفاده از مدل فرایند سرمایه کلاسیک و نسخه‌ی تعمیم یافته‌ی آن مدل جدیدی را معرفی میکنیم که بازتاب بهتری از حقایق نسبت به مد لهای پیشین داشته، بنابراین مدلی کاراتر و نتایج دقیقتری را به دنبال خواهد داشت. در این سخنرانی همچنین به محاسبه ی احتمال ورشکستگی از طریق شبیه سازی در یک بررسی موردی پرداخته و یک کاربرد از مدل معرفی شده را بیان خواهیم کرد.

این سخنرانی براساس کار مشترکی با امیر تیمور پاینده (دانشگاه شهید بهشتی) و آرمان رستمی (دانشگاه شهید بهشتی) می باشد.

کلمات کلیدی: احتمال ورشکستگی، مدل فرایند ریسک کلاسیک، مدل فرایند ریسک کلاسیک تعمیم یافته اصلاح شده، فرایند پواسن، شبیه سازی.

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سنجش ریسک اعتباری مشتریان بانک با رویکرد ترکیبی تکنیک های داده‌کاوی

محمد تقی پور
دانشگاه آزاد اسلامی

ریسک اعتباری یکی از مهمترین ریسک هایی است که نهادهای پولی و مالی را تحت تأثیر قرار می دهد. بانک‌ها درصدد اعطای تسهیلات خود به مشتریانی هستند که ضمن برخورداری از ریسک پایین بتوانند بازده متناسب با سود تسهیلات اعطایی را داشته باشند. این امر زمانی محقق می گردد که بانک ها قادر به شناسایی مشتریان اعتباری خود اعم از حقیقی و حقوقی بوده و بتوانندآنها را براساس توانایی و تمایل نسبت به بازپرداخت کامل و به موقع تعهدات با استقاده از معیارهای مالی و غیر مالی مناسب، طبقه بندی نمایند هدف اصلی این پژوهش بررسی عوامل مؤثر در سنجش اعتبار مشتریان بانک با رویکرد ترکیبی داده‌کاوی جهت بهبود تصمیم گیری می باشد. بدین منظور اطلاعات و داده های مالی و کیفی مشتریان شامل نمونه ۱۰۰۰تایی از سایت معتبر دانشگاه UCI گرفته شده و ۲۴ متغیر توضیح دهنده مورد استفاده قرار گرفت. جهت نیل به هدف تحقیق از تکنیک های درخت تصمیم والگوریتم بیزساده وترکیب آن به پیش بینی ریسک عدم باز پرداخت تسهیلات اعطایی توسط بانک می پردازد و علاوه برآن عوامل موثر در اعتبار سنجی مشتریان را از این منظر رتبه‌بندی می کنیم. در این بین نتایج نشان می دهد بیز ساده عملکرد بهتری نسبت به درخت تصمیم در پیش بینی تسهیلات اعتباری به مشتریان داشته است.

این سخنرانی براساس کار مشترکی با مجتبی صالحی (دانشگاه پیام نور واحد مشهد) و مهرناز باقری (موسسه غیرانتفاعی آبا، آبیک قزوین) می باشد.

کلمات کلیدی: ریسک اعتباری، داده کاوی، درخت تصمیم، الگوریتم بیز ساده

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بررسی استراتژیهای مختلف سرمایه گذاری صندوقهای بیمه با مشارکت معین

حسن داداشی
دانشگاه تحصیلات تکمیلی علوم پایه زنجان

در کشورهای با صنعت بیمه توسعه یافته مدیریت صندوق های بیمه بیشتر براساس سهم مشارکت مشخص کارکنان صندوق در مقابل مدل دیگر که سهم سود را برای آنان مشخص می کرده اند می باشد. در این روش هرچند که مدیریت صندوق ریسک کمتری را متحمل می شود ولی با سرمایه گذاری در بازار سهام نیازمند انتخاب سبد بهینه برای ماکزیمم کردن سود کارکنان صندوق در دوران بازنشستگی می باشد.
روش های زیادی در مدیریت سبد این صندوق ها وجود دارد. ازجمله روش میانگین واریانس که شبیه روش نظریه مارکویتز در انتخاب سبد است. روش دوم که روش هدف محور نام دارد، انتخاب یک سبد هدف برای زمان بازنشستگی کارکنان مورد نظر است که مدیریت سبد سعی دارد سبد صندوق در آن زمان به سبد هدف هرچه بیشتر نزدیک باشد. روش سوم که از همه ساده تر است این است که ، بعنوان مثال برای یک دوره سی ساله، برای بیست سال اول در بازار سهام سرمایه گذاری شود و سپس در ده سال آخر بتدریج این سبد به یک سبد با اوراق قرضه تبدیل شود. روش چهارم براساس معیارهای کلی از ماکزیمم سازی تابع مطلوبیت مورد انتظار است. در اینجا دو حالت تابع مطلوبیت نمایی CARA (ریسک گریزی مطلق ثابت) و تابع مطلوبیت لگاریتمی CRRA (ریسک گریزی وابسته ثابت) را مطالعه میکنیم.
در این کار ابتدا بصورت تئوری نشان می دهیم که روش هدف محور در نهایت یک سبد روی مرز کارا، بدست آمده از روش میانگین واریانس، می دهد. یعنی حالتی از روش میانگین واریانس را نتیجه می دهد. همچنین نشان می دهیم که روش هدف محور دارای محاسبات کمتر و خطای کمتر نسبت به روش میانگین واریانس می باشد. شبیه سازی های ما همچنین نشان می دهد که روش سوم بازدهی کمتری را نسبت به روش های دیگر دارد.
با مقایسه روش چهارم با روش میانگین واریانس که یک روش کارا است نشان می دهیم که روش چهارم یک روش ناکارا است و برای مدت زمان کوتاه بهین هگی و کارایی برهم منطبق هستند یعنی تفاوت معنی داری ندارد ولی برای مدت زمان طولانی(مثلا صندوق بازنشستگی) ناکارایی قابل توجه است.همچنین ناکارایی با افزایش زمان سررسید و نسبت شارپ دارایی ریسکی افزایش می یابد و با افزایش ضریب ریسک گریزی کاهش می یابد.
با مقایسه چهار روشی که بکار بردیم نشان می دهیم که روش هدف محور نسبت به روش های دیگر بهتر است زیرا دارای محاسبات کمتر و خطای کمتر نسبت به روش های دیگر دارد و روی مرز کارا می باشد.

این سخنرانی براساس کار مشترکی با مهین شادی (دانشگاه تحصیلات تکمیلی علوم پایه زنجان) می باشد.

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بررسی ضریب حساسیت نرخ فرار سپرده‌های بانکی به تغییرات نرخ ارز با استفاده از مدل های Auto Regressive

مهدی محمدزاده منفرد
بانک آینده

تحقیق پیش‌روی سعی در بررسی تاثیر نوسانات اخیر نرخ ارز به عنوان یکی از متغیرهای اقتصاد کلان بر نرخ فرار سپرده‌های بانکی یکی از بانک‌های خصوصی کشور در شش ماهه اول سال ۹۲ و استخراج ضریب حساسیت سپرده‌های بانکی نسبت به تغییرات مذکور را دارد. با توجه به وجود اثرات خودهمبستگی در متغیرهای مورد مطالعه، مدل‌های خودرگرسیونی به منظور استخراج ضریب حساسیت مورد استفاده قرار گرفت. به منظور تامین فرض اصلی مدل‌های خودرگرسیونی، آزمون ریشه واحد دیکی فولر تجمیعی برای سنجش مانایی به کار گرفته شد و نتایج قابل قبولی برای مانایی متغیرها بدست آمد. همچنین نتایج مدل رگرسیونی تخمینی، ضریب حساسیت ۱.۷۶- را بدست می‌دهد. ضریب فوق بیان می‌دارد که نتایج بدست آمده در تحقیق حاضر منطبق با قانون تقاضاست؛ به این ترتیب که با افزایش قیمت ارز، تقاضا برای ارز کاهش می‌یابد که نشان‌دهنده رفتار عقلایی سرمایه‌گذار ایرانی است. نتایج تحقیق حاضر فرضیه خرید ارز توسط سرمایه‌گذاران ایرانی در بازارهای افزایشی ارز بر اساس انتظارات تورمی شکل گرفته آنها در بازار چند سال گذشته به منظور کسب سود در آینده را رد می‌نماید.

این سخنرانی براساس کار مشترکی با مهران فرهی کیا (بانک آینده) و هیدی یوسفی (بانک آینده) می باشد.

کلید کلیدی: نرخ فرار سپرده، تغییرات نرخ ارز، سری زمانی، مدل های اتو رگرسیو، شبکه بانکی.