Mathematical Finance
Finance mathématique
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CAROLE BERNARD, University of Waterloo
Optimal Investment under State-Dependent Constraints

Bernard and Boyle (2010) derive the lowest cost strategy (also called "cost-efficient" strategy) that achieves a given wealth distribution. An optimal strategy for a profit seeking investor with law-invariant preferences is necessarily cost-efficient and is almost surely unique. In the specific case of a Black and Scholes market, the optimal strategy is always path-independent and non-decreasing with the stock price. Assuming now that investors still want to achieve a given distribution at a fixed horizon but have additional state-dependent constraints, we show how to construct an optimal strategy. In the case of the Black and Scholes market, we show that such optimal strategy is not necessarily non-decreasing in the stock price, may be path-dependent and is not unique anymore.

Joint work with Steven Vanduffel (Vrije Universiteir Brussels).

CHRISTOPH FREI, University of Alberta
A financial market with interacting investors: does an equilibrium exist?

While trading on a financial market, the agents we consider take the performance of their peers into account. By maximizing individual utility subject to investment constraints, the agents may ruin each other even unintentionally so that no equilibrium can exist. However, when the agents are willing to waive little expected utility, an approximated equilibrium can be established. The study of the associated backward stochastic differential equation (BSDE) reveals the mathematical reason for the absence of an equilibrium. Presenting an illustrative counterexample, we explain why such multidimensional quadratic BSDEs may not have solutions despite bounded terminal conditions and in contrast to the one-dimensional case.

The talk is based on joint work with Gonçalo dos Reis (TU Berlin).

CODY HYNDMAN, Concordia University
Existence and Uniqueness for nonlinear FBSDEs related to quadratic term-strucutre models

We consider existence and uniqueness results for some nonlinear forward-backward stochastic differential equations (FBSDEs) related to quadratic term-structure models of interest rates. The forward component of the FBSDE is a Gaussian diffusion or an affine diffusion. We also investigate the case of FBSDEs related to affine term-structure models where the forward component of the FBSDE is a Wishart process.

ALEXEY KUZNETSOV, York University
A Wiener-Hopf Monte-Carlo simulation technique for Levy processes

We develop a completely new and straightforward method for simulating the joint law of the position and running maximum at a fixed time of a general Levy process with a view to application in insurance and financial mathematics. Although different, our method takes lessons from Carr's so-called 'Canadization' technique as well as Doney's method of stochastic bounds for Levy processes. We rely fundamentally on the Wiener-Hopf decomposition for Levy processes as well as taking advantage of recent developments in factorization techniques. We illustrate our Wiener-Hopf Monte-Carlo method on a number of different processes. Moreover, we illustrate the robustness of working with a Wiener-Hopf decomposition with two extensions. The first extension shows that if one can successfully simulate for a given Levy processes then one can successfully simulate for

any independent sum of the latter process and a compound Poisson process. The second extension illustrates how one may produce a straightforward approximation for simulating the two sided exit problem.

This is joint work with A.E. Kyprianou, J.C. Pardo and K. van Schaik.

NADIA MASSOUD, York University

Hedge Funds in M&A Deals: Is there Exploitation of Private Information?

This paper investigates recent allegations regarding the misuse of private insider information by hedge funds prior to the public announcement of M&A deals. We analyze this issue by using a unique and comprehensive dataset which allows us to analyze the trading pattern of hedge funds around corporate mergers and acquisitions in both the equity and derivatives markets. In general, our results are consistent with hedge funds, with short- term investment horizons (henceforth, short-term hedge funds) taking advantage of private information and engaging in trading based on such information. We show that short-term hedge funds holdings of a target's shares in the quarter prior to the M&A announcement date are positively related to the profitability of the deal as measured by the target premium. In addition, we also find that the target price run-up before the deal announcement date is significantly greater for deals with greater short term hedge fund holdings. We also find evidence consistent with informed abnormal short selling and put buying in the corresponding acquirer's stock prior to M&A announcements. This is particularly evident when hedge funds take larger stakes in target firms. In addition, we show that such a strategy is potentially very profitable. We consider alternative explanations for such short term hedge fund holdings in target firms; however our results seem inconsistent with these alternative explanations but rather, seem to be consistent with trading based on insider information. Overall, our results have important implications regarding the recent policy debate on hedge fund regulation.

DON MCLEISH, University of Waterloo

Transform-Based Simulations and Option Pricing

When we are given only a transform of a distribution or an option, such as a characteristic function or Laplace transform, it is usually very difficult to conduct simulations. Possible approaches such as numerical inversion of the transforms are computationally very expensive since they are needed essentially for each simulated value. In this paper we explore and compare several alternatives, including simulations directly based on the characteristic function and those which use a saddlepoint approximation obtained from the Laplace transform. We apply these methods to problems in finance including the pricing of options in the Heston stochastic volatility model.

TOM SALISBURY, York University

Optimal utilization of variable annuity guarantees

Variable Annuities contain numerous living and death benefits which have attracted recent attention within the literature on finance and insurance. One established fact coming from this research is that many widely available products sold in the U.S. were underpriced, likely because the insurance company wasn't hedging properly and/or using actuarial (as opposed to financial) techniques for pricing. Indeed, the popularity as well as the liability created by these products were partially responsible for the financial difficulties experienced by numerous insurance companies during the 2008/2009 crisis. This pricing and hedging literature continues to grow.

A question which has attracted less scholarly and research attention, but is equally important, is how exactly consumers who hold these guaranteed should best manage them. In the U.S. market alone there are over $1 trillion worth of these guarantees held by individual investors, so this is a question financial advisors are increasingly being asked. The optimal policy for a consumer seeking to maximize lifetime utility with these products – in an incomplete market – isn't necessarily a policy that induces the maximum liability to the issuer. In other words, the hedging strategy (for the issuer) isn't the symmetric opposite of the dynamic utilization strategy (for the buyer). I will discuss some results in this direction, obtained with Huaxiong Huang and Moshe Milevsky.

MARTIN SCHWEIZER, York University
ean-variance problems in mathematical finance

We give an overview of classical and new results on mean-variance hedging and mean-variance portfolio choice. The former is the problem of finding a best approximation (in the mean-square error sense) to a given financial payoff by means of a self-financing dynamic portfolio strategy. The later is the problem of finding via trading a financial position with minimal risk and maximal return. We give precise mathematical formulations (for all the terms used above) and present classical results as well as some recent developments. The overall goal is to reach a general mathematical audience rather than the specialists in the field. The talk is based on joint work with several collaborators.

ANATOLIY SWISHCHUK, University of Calgary
Variance and volatility swaps in energy markets

This talk is devoted to the pricing of variance and volatility swaps in energy market. We found explicit variance swap formula and closed form volatility swap formula (using Brockhaus-Long approximation) for energy asset with stochastic volatility that follows continuous-time GARCH (1,1) model (mean-reverting) (or Pilipović one-factor model). Numerical example is presented for AECO Natural Gas Index (1 May 1998-30 April 1999)

AERAMBAMOORTHY THAVANESWARAN, University of Manitoba
Fuzzy Sets Approach in Mathematical Finance

In the time series literature, usually point estimates of the parameters are used to obtain the minimum mean square error forecasts. For example, the forecast of the $(n+1)^{th}$ observation based on $y_1, \ldots, y_n$ from $y_{n+1} - \hat{\mu} = \hat{\phi}(y_n - \hat{\mu})$ does not take into account the parameter variability. Fuzzy forecasts are shown to be better than the MMSE forecasts. Accurate estimates of volatility parameters are needed in option pricing. Generalized Autoregressive Conditional Heteroscedastic (GARCH) models and Random Coefficient Autoregressive (RCA) models have been used for volatility modelling. Option pricing using fuzzy estimates are discussed. An improved option pricing formula for Black-Scholes model with fuzzy volatility is also discussed in some detail.