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Default contagion with domino effect

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ABSTRACT

I will introduce a structural framework to model dependent defaults, with a particular interest in their contagion. In our model, to describe the contagion, the default level of each firm is assumed to be affected every time a default of another firm occurs. A default of a firm brings about a prescribed constant jump to the default level of other firms. One default can therefore cause other defaults, but each of the second order default may trigger third order ones, and so on. This gives a structural framework to Bayesian network type dependence of joint default probability.

(Joint work with Hai-Ha Pham)

Forward performance processes in EVE correlation models

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ABSTRACT

We consider the problem of optimal portfolio selection in an incomplete market. The incompleteness stems from the presence of multidimensional Brownian factors not characterized by the stock dynamics. An essential quantity in this framework is the correlation matrix ρ between the Brownian motions W_t driving the stocks and the Brownian motions B_t generating the extra factors. For a general correlation structure it is very hard to calculate the optimal portfolio both analytically and numerically. Moreover, in a noisy market with a large number of stocks, it is especially challenging to estimate these correlation matrices. To deal with both of these challenges, we introduce a new Eigenvalue Equality (EVE) class of correlation matrices. In this framework, for power utility functions we construct a large class of forward performance processes (FPPs) as well as solve the Merton problem. For Markovian factors, doing the former requires solving an associated non-linear parabolic partial differential equations (PDEs) posed in the “wrong” time direction, and thereby we establish on domains an explicit form of the generalized Widder’s theorem of Nadtochiy and Tehranchi. For the non-Markovian case, such as rough volatility, we provide a probabilistic representation of both FPPs and classical value functions.

Liquidity in competitive dealer markets

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ABSTRACT

We consider competitive dealers whose business model is to service their clients' orders for some asset at competitive prices while managing their inventory risk through asset transfers to the end user market. In the end user market, asset prices are given exogenously, but transfers are subject to search costs that impede trading in this market. We formulate the dealers' inventory management problem by a quadratic tracking problem imposing quadratic costs on the transfer rate. Assuming all agents are price-takers we then compute explicitly the equilibrium prices at which the clients' demand maximizes the dealers' risk adjusted expected proceeds. We also describe how the clients will optimize their quadratic expected utility and analyze when they benefit from the dealers' presence. Finally, we also look at the advantage of a large trader who internalizes her impact on asset pricing when devising her strategy.

This is joint work with Ibrahim Ekren and Johannes Muhle-Karbe.

Proactive and reactive investments via Meyer- σ -fields

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ABSTRACT

In many financial optimization problems jumps due to exogenous shocks play a crucial role. In models with transaction costs, for instance, also jumps due to endogenous controls must be accounted for and their interplay with exogenous shocks becomes a delicate issue. Most notably, it is important to specify what an economic agent knows when about an impending exogenous shock and how and when she can act upon this information.

We propose to use Meyer- σ -fields as a flexible tool to model information flow and illustrate the possibilities of this approach by an in-depth study of irreversible investment with inventory risk. In an explicitly worked out case study with compound Poisson processes, we find optimality of *ladlag* controls whose jumps from the left reflect the agent's reaction to her signals and whose jumps from the right her reaction to the fully revealed shock. As signal quality varies the optimal policies are found to interpolate from the classical predictable controls operating without signals to optional ones that fully account for any exogenous shock as it happens.

Sentiment analysis for online reviews with regularized text logistic regression

YING CHEN

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ABSTRACT

With the increasing user-generated reviews and feedback posted in online review platforms, it becomes essential for executives and managers to build an efficient classifier to capture general sentiment of reviews based on the unstructured text information. We propose regularized text logistic regression method that, besides providing good classification accuracy, can identify a set of essential features so as to provide rapid and valuable suggestions for sentiment analysis and operational improvement. We demonstrate the performance of the proposed method along with two real text data on restaurants and hotels and compare the classification performance with several alternatives. This is a joint work with Peng Liu and Chung Piaw Teo.

Optimal liquidation in spite of increasing prices

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ABSTRACT

A large investor seeks to liquidate a financial asset position in finite time while she anticipates a general drift of market prices, which can be upwards or downwards. Depending on her initial market impact, the optimal liquidation strategy comprises an initial block buy or sale, followed by continuous selling and/or buying – possibly entering a short position – and finally leaving the market with a final block buy or sale to clear her position. Due to the non-zero drift, solution methods based on convex analysis are out of reach. We solve this optimal liquidation problem in two steps. Classical calculus of variations provides a candidate for the free boundary surface that separates buy and sell regions and moreover yields local optimality near said boundary. Using this local optimality result, we can extend the variational inequality to the whole state space and thereby get global optimality.

Mean field games with singular controls and optimal portfolio liquidation: Existence of equilibria

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ABSTRACT

The presentation establishes the existence of a class of strategic interacted mean field games with singular controls, which arises naturally in mean field games of optimal portfolio liquidation with both active and passive orders. A relaxed solution approach is used. We prove the existence by first establishing the existence of the corresponding mean field games with regular controls and then taking approximation.

Crowd wisdom and prediction markets

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ABSTRACT

Thanks to digital innovation, the concept of crowd wisdom, which aims at gathering information (e.g. Wikipedia) and making a prediction (e.g. using prediction markets) from a group's aggregated inputs, has been widely appreciated. An innovative survey design, based on a Bayesian learning framework, called the Bayesian truth serum (BTS), was proposed previously to reduce the bias in the simple majority rule, so as to get a consistent estimator, by asking additional survey questions. A natural question is whether we can extend the BTS framework to prediction markets (not just polls). To do so, this paper proposes two estimators, one based on a prediction market alone and the other based on both the market and a poll question. We show that both estimators are consistent within the BTS framework, under different sets of regularity conditions. Numerical results are given to illustrate the convergence of different estimators. This is a joint work with Min Dai and Steven Kou.

Economic meaning of bitcoin mining

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ABSTRACT

Although Bitcoin mining activities are widely discussed in the media, as miners attempt to profit from transaction fees, there are few academic papers studying the transaction fees. We proposed a model for Bitcoin transaction fees from the miners' perspective. The model is rich enough to incorporate both inventory and demand levels. The model is calibrated to the empirical data and dynamics of the average transaction fees are discussed. The model is made possible by significantly extending the classical Hotelling model for exhaustible natural resources, via the addition of both feedback supply and an S-shaped stochastic demand function.

Speculative trade and market newcomers

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ABSTRACT

In financial markets, investors' expectations vary with their experience according to empirical evidence. When short-selling is limited, heterogeneous expectations lead to speculative price bubbles according to existing theoretical economic models. Surprisingly, this previous theoretical literature did not allow for persistent differences in traders' experience and, instead, relied on alternative and somewhat fragile assumptions on belief heterogeneity. This is notwithstanding that an experience gap can more convincingly persist in the real world, as young traders constantly enter financial markets and also many countries have inflows of immigrants. In this paper, we introduce and employ dispersed timing of market entry as the only source of belief heterogeneity in a standard tractable theoretical framework for studying bubbles. In our model, market newcomers are less experienced, because they just start learning when they enter the market. Depending on the traders' beliefs, newcomers can be either more or less optimistic than incumbent traders. Bubbles occur when newcomers are more optimistic.

Timer options: expiry floats with realized variance

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ABSTRACT

Timer options are barrier style options in the volatility space. A typical timer option is similar to its European vanilla counterpart, except that expiry floats with realized variance. The finite maturity timer option expires either when the accumulated realized variance of the underlying asset has reached a pre-specified level or on the mandated expiration date, whichever comes earlier. The challenge in the pricing procedure is the incorporation of the barrier feature in terms of the accumulated realized variance instead of the usual knock-out feature of hitting a barrier by the underlying asset price. When there is no mandated expiration date, the pricing procedure requires the determination of the joint distribution of the random expiration time and the stock price at expiration. For finite maturity timer option with mandated expiry, we derive an alternative analytic integral representation of the price function of the timer option under the 3/2-model of stochastic volatility. Pricing properties of the timer options are also explored.

Non-concave portfolio optimization without the concavification principle

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ABSTRACT

The problems of non-concave portfolio optimization appear in many areas of finance and economics, such as in behavior economics, incentive schemes, and goal problems. Almost all of existing literature solves these problems using the concavification principle. We provide a general framework for numerically solving non-concave portfolio optimization problems, where the concavification principle may not hold and the utility functions can be discontinuous. In particular, we find that adding portfolio constraints, which makes the concavification principle invalid, can significantly affect economic insights in the existing literature. Theoretically, we show that a monotone, stable, and consistent finite difference scheme is still convergent under the general framework. This work is jointly with Min Dai, Steven Kou, and Xiangwei Wan.

Optimal investment and consumption with fixed and proportional transaction costs

MAX REPPEN

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ABSTRACT

We consider the classical optimal investment and consumption problem with infinite horizon, studied in the presence of both proportional and fixed costs with general utility functions. In this context, we outline general results for possibly discontinuous viscosity solutions of the dynamic programming equation, and then discuss asymptotic and numerical methods for these problems.

Models of interaction through hitting times in systemic risk and the supercooled Stefan problem

MYKHAYLO SHKOLNIKOV

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ABSTRACT

I will discuss a natural bare-bones model for default cascades occurring in the study of systemic risk. In the large system limit the model leads to the physical solution of the supercooled Stefan problem, originally proposed to describe the freezing of a supercooled liquid. Motivated by this observation, we study the latter and, in particular, describe in detail the structure of the unique physical solution. Based on joint work with Francois Delarue and Sergey Nadtochiy.

Trading, market impact and nonlinear systems

RONNIE SIRCAR

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ABSTRACT

We discuss problems where impact from optimal or equilibrium trading leads to challenging nonlinear systems and fixed point problems. These may arise from

- i Oligopolies with a small number of influential players, such as oil markets.
- ii Optimal execution where trading speed is penalized.
- iii Portfolio selection to maximize expected utility.
- iv Market impact from a significant group of portfolio optimizers in a market with clearing conditions.

The problems are addressed with computational and analytical methods, and specification of a terminal time and terminal condition has strong influence on resulting strategies. Analogous issues arise in some examples from sports.

FBSDEs with discontinuous coefficients

LUDOVIC TANGPI

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ABSTRACT

In this talk, we consider well-posedness of systems of forward and backward stochastic differential equations when (at least some of) the coefficients are merely assumed to be measurable. Since such systems cannot be tackled with classical fixed point theory, we devise new methods based on “domination arguments” and Malliavin calculus techniques. The talk is based on joint works with K. Bahlali and O. Menoukeu-Pamen.

Multi-dimensional optimal trade execution under stochastic resilience

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ABSTRACT

We provide a general framework for analyzing linear-quadratic multi-dimensional portfolio liquidation problems with instantaneous and persistent price impact and stochastic resilience. We show that the value function can be described by a multi-dimensional backward stochastic Riccati differential equations (BSRDE) with a singular terminal condition in one component. We prove the existence of a solution to the BSRDE system and characterise both the value function and the optimal strategy in terms of that solution. We prove that the solution to the liquidation problem can be approximated by the solutions to a sequence of unconstrained problems with increasing penalisation of open positions at the terminal time. Our proof is based on a much finer a priori estimate for the approximating BSRDE systems, from which we infer the convergence of the optimal trading strategies for the unconstrained models to an admissible liquidation strategy for the original problem.

Adaptive log-linear zero-inflated generalized Poisson autoregressive model with applications to crime counts data

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ABSTRACT

We propose a new model for time series of counts, ALG (Adaptive log-Linear zero-inflated Generalised poisson integer-valued GARCH), to describe the dynamics of count series with features of autocorrelation, heteroscedasticity, over-dispersion and excessive number of zero observations. The proposed ALG model is able to flexibly capture the characteristics of the nonlinear responses and simultaneously incorporate the influence of exogenous variables in a unified modelling framework. Moreover, the ALG model enables to handle stochastic structural breaks with time-varying parameters. The parameters are adaptively estimated under local homogeneity with an adaptive Markov Chain Monte Carlo (MCMC) sampling procedure. We investigate the finite sample performance of the ALG model under both homogeneous and inhomogeneous situations with practically oriented simulations. We conduct the empirical analysis on the crimes incidents categorized as “malicious damage to property”, “liquor offences” and “arson” in Byron, New South Wales, Australia. The ALG model delivers a nice forecasting accuracy of the stochastic intensity of the time series of counts. It shows that the temperature effect is not significant for “malicious damage to property”, while is important on “liquor offences” and “arson” crimes, meanwhile the impact on “liquor offences” becomes larger at the year 2016-2017 and is stable for “arson” over year 2007-2017.

The economics of asset securitization

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ABSTRACT

We develop an equilibrium model of asset securitization with heterogeneous beliefs among the issuer and investors. Both the price and the volume of each tranche are determined analytically by the underlying asset quality in equilibrium. The embedded credit risk of the senior tranche is consistent with its observed high yields. The equity tranche has a credit risk profile at its issuance that leads to a rich pattern of retention of both the equity and the senior tranches. Moreover, the optimal senior tranche size is positively associated with the asset quality, but the optimal equity tranche size has a negative relation with the asset quality. Finally, the tranche structure is time-varying and virtually dominates the path-through structure due to the correlated residual risks among tranches and the diversification discount property in securitization. The model implications are consistent with well-documented empirical facts in the asset securitization literature.

Portfolio diversification and model uncertainty: a robust dynamic mean-variance approach

CHAO ZHOU

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ABSTRACT

This talk is concerned with multi-asset mean-variance portfolio selection problem under model uncertainty. We develop a continuous time framework for taking into account ambiguity aversion about both expected rate of return and correlation matrix of stocks, and for studying the effects on portfolio diversification.

We prove a separation principle for the associated robust control problem formulated as a mean-field type differential game, which allows to reduce the determination of the optimal dynamic strategy to the parametric computation of the minimal risk premium function. Our results provide a justification for under-diversification, as documented in empirical studies, and that we explicitly quantify in terms of correlation and Sharpe ratio ambiguity parameters. In particular, we show that an investor with a poor confidence in the expected return estimation does not hold any risky asset, and on the other hand, trades only one risky asset when the level of ambiguity on correlation matrix is large. This extends to the continuous-time setting the results obtained by Garlappi, Uppal and Wang (2007), and Liu and Zeng (2017) in a one-period model.

Based on joint work with Huy  n Pham (Paris Diderot) and Xiaoli Wei (Paris Diderot).