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The Freiburg-Strasbourg research group on
Financial and Actuarial Mathematics

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Invitation to our 6th workshop at FRIAS, 14th/15th of November 2019
In honour of Yuri Kabanov (FRIAS senior fellow)

14th of November

10:15–11:00	Laura Ballotta **Risk management of climate impact for tourism operators: An empirical analysis on ski resorts**
11:00–11:45	Nicole Bäuerle **Portfolio optimization in fractional and Rough Heston models**
12:00–14:00	Lunch at FRIAS
14:00–14:45	Anna Maria Gambaro **Time consistent optimal asset allocation for iife insurance funds under Solvency II**
14:45–15:30	Griselda Deelstra **On barrier option pricing by Erlangization in a regime-switching model with jumps**
15.30–16.00	break
16:00-16:45	Pietro Millossovich **On the optimal design of participating life insurance contracts**
16:45–17:30	An Chen **On the optimal combination of annuities and tontines**
19:00	Conference Dinner

Date and Location: November 14–15, 2019
FRIAS, Alberstr. 9, 79104 Freiburg, Groer Seminarraum

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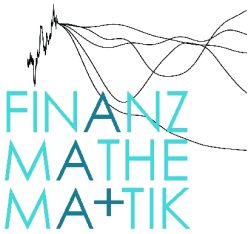

15th of November

10:15–11:00	Emmanuel Lepinette **Arbitrage and pricing without martingale probability measure in discrete-time**
11:00–11:45	Thilo Meyer-Brandis **Systemic Risk Measures: Random Capital Allocation and Fair Risk Allocation**
12:00–14:00	Lunch at the Mensa
14:00–14:45	Francesca Biagini **Reduced-form framework under model uncertainty**
14:45–15:30	Yuri Kabanov **On ruin problems with investment**
16:00–16:45	Monique Jeanblanc **Generalisation of the Cox model**

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Laura Ballotta

Risk management of climate impact for tourism operators: An empirical analysis on ski resorts

The aim of this paper is to analyze the performance of hedging strategies based on snow and temperature options developed by ski operators to protect their profitability under adverse changes in climatic conditions. The setup is based on a joint non-parametric model for snow and temperature aimed at providing a modelling support for the assessment of the impact of these weather variables on the number of visitors at the ski resort. The analysis is carried out considering the case of Austrian Alps, and examines: i) the ability of the proposed approach to provide a realistic representation of the true data-generating process; ii) the variability reduction in the Profit and Loss of the ski operator offered by the suggested strategies; and iii) the tradeoff between the budget earmarked for hedging and profitability protection.
This is joint work with G. Fusai, I. Kyriakou, N. Papapostolou and P. Pouliasis.

Nicole Büerle

Portfolio optimization in fractional and Rough Heston models

We consider a fractional version of the Heston volatility model which is inspired by Guennoun et al. (2018). Within this model we treat portfolio optimization problems for power utility functions. Using a suitable representation of the fractional part, followed by a reasonable approximation we show that it is possible to cast the problem into the classical stochastic control framework. This approach is generic for fractional processes. We derive explicit solutions and obtain as a by-product the Laplace transform of the integrated volatility. In order to get rid of some undesirable features we introduce a new model for the rough path scenario which is based on the Marchaud fractional derivative. We provide a numerical study to underline our results.

Francesca Biagini

Reduced-form framework under model uncertainty

In this talk we introduce a sublinear conditional expectation with respect to a family of possibly nondominated probability measures on a progressively enlarged filtration. In this way, we extend the classic reduced-form setting for credit and insurance markets to the case under model uncertainty, when we consider a family of priors possibly mutually singular to each other. Furthermore, we study the superhedging approach in continuous time for payment streams under model uncertainty, and establish several equivalent versions of dynamic robust superhedging duality. These results close the gap between robust framework for financial market, which is recently studied in an intensive way, and the one for credit and insurance markets, which is limited in the present literature only to some very specific cases. This is joint work with Yinglin Zhang.

An Chen

On the optimal combination of annuities and tontines

Tontines, retirement products constructed in such a way that the longevity risk is shared in a pool of policyholders, have recently gained vast attention from researchers and practitioners. Typically, these products are cheaper than annuities, but do not provide stable payments to policyholders. This raises the question whether, from the policyholders' viewpoint, the advantages of annuities and tontines can be combined to form a retirement plan which is cheaper than an annuity and carries less risk than a tontine. In this article, we analyze and compare three approaches of combining annuities and tontines in an expected utility framework: The "tonuity" introduced in Chen, Hieber and Klein (2019), a product very similar to the tonuity which we call "antine" and a portfolio consisting of an annuity and a tontine. We show that the payoffs of a tonuity or an antine can be replicated by a portfolio consisting of an annuity and a tontine. Consequently, policyholders achieve higher expected utility levels when choosing the portfolio over the novel retirement products tonuity and antine.
This is joint work with Manuel Rach and Thorsten Sehner.

Griselda Deelstra

On barrier option pricing by Erlangization in a regime-switching model with jumps

We consider the risk-neutral pricing of vanilla, digital and down-and-out call options when the underlying asset price evolves like the exponential of a Markov-modulated Brownian motion (MMBM) with two-sided phase-type jumps. The price of such options is intimately related to the first passage properties of the MMBM. To analyse these first passages, we randomize the time horizon using Erlang distributions with suitable parameters and apply matrixanalytic methods. This provides us with closed form approximations of the options prices, with a very high precision, as shown by several numerical illustrations.
This is joint work with Guy Latouche, Matthieu Simon.

Anna Maria Gambaro

Time consistent optimal asset allocation for life insurance funds under Solvency II

In this paper, we propose a dynamic consistent optimization problem for a portfolio of life insurance policies, in the Solvency II directive framework. In [Asanga et al., 2014], the authors use Solvency indicators to and the optimal asset allocation of non-life insurance funds, minimising the Solvency Capital Requirement (SCR), in a one-period static model. [Christiansen and Niemeyer, 2014] propose a dynamic formulation of the SCR, using the dynamic value at risk (VaR). However, the dynamic-VaR is not a time consistent risk measure (see for instance, [Acciaio and Penner, 2010]). For non-life insurance funds and in case of a single liability cash-flow at maturity, [Devolder e.a, 2017] analyse the time-consistent dynamic formulation of the SCR using the iterated-VaR and the iterated conditional tail expectation. However, the iterated formulation of the SCR has some important drawbacks. [Devolder and Lebegue, 2017] show that using iterated risk measures, the SCR becomes quite expensive for long term liabilities and it may explode in some circumstances. Moreover, the iterated-SCR is not compliant with the Solvency II directive, in fact, it does not answer to the regulator request: how much is the capital to be held by insurance to meet his obligations over the following year?

We extend the literature in various directions. Firstly, we consider the framework of life insurance liabilities with multiple cash-flows. Secondly, starting from the static definition of the SCR in [Christiansen and Niemeyer, 2014], we propose a dynamic version of the SCR, that is time consistent, in agreement with the regulators directive and that encompass the drawbacks of the iterated formulation. Moreover, following the work of [Shapiro, 2009] on dynamic risk averse stochastic programming problems, we formulate a time consistent asset allocation problem based on the SCR minimization.

Finally, we apply the optimization problem to the case study of with-profit life insurance funds, which is analysed in [Gambaro et al., 2018] from the market-consistent valuation perspective.

Monique Jeanblanc

Generalisation of the Cox model

In that presentation, we will show how, using a Cox model one can produce default times which do not avoid a given sequence of stopping times.

Emmanuel Lepinette

Arbitrage and pricing without martingale probability measure in discrete-time.

We study a no-arbitrage condition, we call Absence of Immediate Arbitrage (AIP), in discrete-time. This one is weaker than the classical NA condition, equivalent to the existence of a risk-neutral probability measure. Nevertheless, AIP condition may be sufficient to characterize the super-hedging prices of a European or American contingent claim, even with respect to a risk-measure. Moreover, AIP condition is naturally observed in the real markets. At last, the dual technique we use may be also useful for incomplete markets. This presentation corresponds to several recent joint work with the co-authors J. Baptiste, L. Carassus and J. Zhao.

Thilo Meyer-Brandis

Systemic Risk Measures: Random Capital Allocation and Fair Risk Allocation.

We introduce a general class of systemic risk measures that are determined in terms of sufficient, possibly random capital allocation to individual banks before aggregation of their risks. We then focus on the question how to allocate the corresponding total systemic risk among institutions in a fair way. We show that the dual problem of the minimization problem that identifies the systemic risk measure provides a valuation of the random capital allocation which is fair both from the point of view of the society/regulator and from the individual financial institutions. This leads to a new systemic equilibrium concept that we denote by Systemic Optimal Risk Transfer. The case where risk is aggerated via exponential utilities allows for explicit computation and is treated in details.

Pietro Millossovich

On the optimal design of participating life insurance contracts

We study how policyholders and equityholders contribute to the formation of a life insurance company issuing participating contracts. The structure of these contracts is stylized and features a guaranteed rate of return and a terminal bonus, as in the pioneering model by Briys and de Varenne (1994). Policyholders aim at maximizing their preferences by choosing the leverage ratio and the guaranteed level, while being subject to regulatory constraints of fair valuation and solvency. We provide conditions under which non trivial contracts exist and analyze their properties, particular discussing the role of systematic longevity and financial risk.
This is joint work with A. R. Bacinello and C. Corsato.