Munich Risk and Insurance Days 2023

October 5 – 6, 2023

Venue:
Technical University Munich
Room 0.01.17
Parkring 35 (Business Campus)
85748 Garching/Munich

Organizers:
Prof. Dr. Matthias Scherer,
Dr. Florian Brück, Andrei Craciunescu,
Dr. Corrado De Vecchi, Dominik de Witte,
Bettina Haas, Constantin Siggelkow

Thursday, October 5, 2023	
09:55 – 10:00	Welcome (Matthias Scherer)
10:00 – 10:40	Werner, Ralf: **Analysis of Interest Rate Evolutions by Autoencoders**
10:40 – 11:20	Ramada-Sarasola, Magdalena: **How is technology truly transforming insurance? Navigating the noise to uncover actual value of #tech in the Context of Risk to Capital Journeys**
11:20 – 12:00	Schoutens, Wim: **Sustainable finance and ESG investing : Sense or nonsense**
12:00 – 13:00	Lunch Break
13:00 – 13:40	Graf, Stefan: **The role of inflation in retirement planning – why reducing nominal risk can increase real risk and how to incorporate inflation protection in real-world products**
13:40 – 14:20	De Vecchi, Corrado: **Pricing insurance contracts with an existing portfolio acting as background risk**
14:20 – 15:00	Weber, Stefan: **Robust Portfolio Selection Under Recovery Average Value at Risk**
15:00 – 15:30	Coffee Break
15:30 – 16:10	Müller, Alfred: **Decisions under uncertainty: sufficient conditions for almost stochastic dominance**
16:10 – 16:50	Junike, Gero: **P&L attribution in dynamic time**
16:50 – 17:30	Vanduffel, Steven: **Robust Distortion Risk measures**
17:30 – 17:35	Closing (Matthias Scherer)
18:30	Dinner Neuwirt Garching

Friday, October 6, 2023	
08:55 – 09:00	Welcome (Matthias Scherer)
09:00 – 09:40	Bignozzi, Valeria: **Fair valuation under parameter uncertainty**
09:40 – 10:20	Pfaffel, Oliver: **Risks & Opportunities of Large Language Models in Insurance**
10:20 – 10:40	Coffee Break
10:40 – 11:20	Millossovich, Pietro: **Stress Testing with f-divergences**
11:20 – 12:00	Preischl, Michael: **Demand modelling in private lines non-life insurance**
12:00 – 13:00	Lunch Break
13:00 – 13:40	Stahl, Gerhard: **An Uncertainty-based Risk Management Framework for Climate-Change Risk**
13:40 – 14:20	Kiesel, Rüdiger: **Net-Zero: Fact or Fiction**
14:20 –14:40	Coffee Break
14.40 – 15:20	Liebrich, Felix: **Calibrating reference measures of law-invariant functionals**
15.20 – 16:00	Mai, Jan Frederik: **Pricing contingent convertibles with equity conversion feature in a distressed market environment**
16:00 – 16:05	Closing (Matthias Scherer)
16:05 – 16:30	Coffee

Titles and Abstracts

Bignozzi, Valeria
University Milano-Bicocca
Fair valuation under parameter uncertainty
Current approaches to fair valuation in insurance often follow a two-step approach, combining quadratic hedging with application of a risk measure on the residual liability, to obtain a cost-of-capital margin. In such approaches, the preferences represented by the regulatory risk measure are not reflected in the hedging process. Our first goal is to address this issue by an alternative two-step hedging procedure, based on generalised regression arguments, which leads to portfolios that are neutral with respect to a risk measure, such as Value-at-Risk or the expectile. First, a portfolio of traded assets aimed at replicating the liability is determined by local quadratic hedging. Second, the residual liability is hedged using an alternative objective function. The risk margin is then defined as the cost of the capital required to hedge the residual liability. In the case quantile regression is used in the second step, yearly solvency constraints are naturally satisfied; furthermore, the portfolio is a risk minimiser among all hedging portfolios that satisfy such constraints. Fair valuation requires the knowledge of the (joint) distribution of the liability and of the traded assets, which is often not available in practice and estimated from historical data. Our second goal is then to find the best strategy/risk measure estimator that takes into account the riskiness arising from distribution uncertainty. In particular, focusing on the family of location-scale distributions, we consider elicitable risk measures and different (random) estimators, we study their properties and evaluate their accuracy. The approach is implemented using a fairly general neural network algorithm. Based on joint works with Karim Barigou, Salvatore Scognamiglio and Andreas Tsanakas".

De Vecchi, Corrado
Technische Universität München
Pricing insurance contracts with an existing portfolio acting as background risk
We develop and investigate a premium principle that explicitly takes into account the impact of a new risk on some insurer's existing portfolio. More precisely, we propose the notion of indifference pricing rule for a new risk conditioned on an existing portfolio acting as background risk. This setup is quite natural, but most classical pricing rules disregard the impact of an existing portfolio on the price of a new risk. The resulting premium rule, that in our case explicitly depends on the joint distribution of the new risk and the existing portfolio, is analyzed in detail with respect to its mathematical properties. In order to underline the differences between our approach and the literature on law-invariant premium rules, special attention is given to the indifferent premium behaviour with respect to some well-known dependence concepts. To illustrate the practical relevance of our approach, we consider a portfolio of exchangeable risks and investigate the impact of the portfolio's dimension on the price of a risk to be added. This illustrates the (limits of) diversification benefits under this flexible assumption on the joint distribution of a sequence of risks. Axiomatic and continuity properties of the proposed indifference premium rule are also investigated.

Graf, Stefan
Munich Re

The role of inflation in retirement planning – why reducing nominal risk can increase real risk and how to incorporate inflation protection in real-world products

In order to improve consumers' and advisors' ability to make decisions in retirement planning, they need to understand the return potential and the associated risks of the respective products. Usually, risk-return indicators are based on nominal measures derived from the probability distribution of nominal wealth at the end of the product's term. For consumers, however, real benefits (i.e. the benefits in "today's purchasing power" adjusted for inflation) are more relevant than nominal benefits. We show that real risk-return characteristics can be structurally different from nominal risk-return characteristics. Hence, typically used nominal risk-return indicators can misguide consumers. Under certain circumstances, a product that is less risky than a competing product in nominal terms can be riskier than the competing product in real terms. In this talk we sketch the results of a paper which analyses different aspects of nominal vs. real risk-return characteristics that are relevant for long-term savings processes. Firstly, we derive from economic arguments and existing literature why the return of certain assets, particularly stocks, exhibits a positive "correlation" with inflation over long periods of time. We argue that such long-term effects need to be considered in an analysis of long-term savings processes. Secondly, we introduce a capital market model that implies such a positive correlation over long time horizons and analyse how fundamental (simple) results change, if we focus on real returns. We determine the stock ratio of the utility maximizing portfolio in the famous Merton problem when utility of the inflation-adjusted benefit is considered in this capital market model. We then show how the utility derived from a simple investment in a bond and a stock significantly deviates from the nominal result. Thirdly, we analyse how the real risk-return characteristics of typical retirement savings products deviate from the nominal counterparts. We particularly show that, under certain circumstances, an increase in (nominal) guarantees can increase real risk. Note that here (as in all our analyses), we assume that – as is currently the case in practice – guarantees of typical products are given in nominal terms and bonds with nominal notional values are used as "safe assets". We close the talk with an introduction of (real life) old age provision products that offer some sort of dedicated inflation protection either in the accumulation or decumulation phase.

Junike, Gero
Carl von Ossietzky Universität Oldenburg

P&L attribution in dynamic time

The decomposition of profit and losses into different risk factors (e.g. FX, IR, CS) is a task that is regulatory required, e.g., in the insurance regulation Solvency 2. Three different decompositions are prevalent: one-at-a-time (OAT), sequential updating (SU) and average SU (ASU). In this research, we provide theoretical and empirical insights into the differences of the three decompositions. We discuss axiomatic concepts as well and a unique decomposition principle is identified through nine axioms. This is a joint work with Marcus Christiansen, Solveig Flaig and Hauke Stier.

Kiesel, Rüdiger
University Duisburg-Essen
Net-Zero: Fact or Fiction
Companies flood the public with net-zero promises, but often leave the path to net-zero unexplained or blurred. The quality of the data on carbon emissions is still insufficient and metrics for calculating carbon risks are not precisely defined. In this talk we show the deficiencies in the analysis of carbon risks and develops a methodology to capture net-zero promises and carbon risks probabilistically. As a possible application of the methodology a resilience-based approach to the regulation of financial institutions is being outlined (see the talk by Gerhard Stahl).

Liebrich, Felix
LMU
Calibrating reference measures of law-invariant functionals
A functional on random variables is law invariant with respect to a reference probability (or probabilistically sophisticated) if its value only depends on the distribution of its argument under that measure. In this talk, we take a concrete functional as given and ask (i) if there can be more than one such reference probability, and (ii) how one can infer the reference probability from the functional. While this stance is in contrast to wide parts of the literature that treat the reference probability as given, it is instead more in line with the investigation of probabilistically sophisticated preferences. Concerning question (i), we demonstrate that uniqueness holds for a wide class of functionals unless they are constant or depend only on the essential supremum and essential infimum of the argument. Concerning the calibration, we show how to infer the reference measure as a related supremum or infimum in the space of bounded charges. While it is generally versatile, this approach fails in the important case of the Value-at-Risk. Here, a suitable alternative is presented.

Mai, Jan-Frederik
XAIA Investments
Pricing contingent convertibles with equity conversion feature in a distressed market environment
Many contingent convertible bonds (CoCos) issued since 2014 belong to the additional Tier 1 (AT1) capital of the issuing bank and are thus of a perpetual nature. Within a Black-Scholes setup, under the very conservative assumption that the CoCo trigger is activated by an adverse entity, we are able to derive a closed-form expression for the fair price of such an instrument, provided it has an equity conversion feature (no write-down feature). This formula allows for a quick understanding of the mechanics of such AT1 CoCos, helps to efficiently compute delta-hedge ratios, and it can be implemented easily on a spreadsheet. Furthermore, the closed-form solution may be used as an integral building component of an efficient, semi-analytical pricing formula for AT1 CoCos, when an additional call right for the issuing bank and a reset coupon is present, as typical in the marketplace. Finally, we demonstrate that over the last few years observed CoCo market prices were too high to be explained by our adverse entity assumption, but currently (after the recent Credit Suisse CoCo wipe-out in March 2023) have come down to levels that can be modeled reasonably with our approach. Our approach can therefore be a useful tool to deal with CoCo prices in a market environment with distressed banking sector.

Millossovic, Pietro
Bayes B. School
Stress Testing with f-divergences
We discuss how sensitivity and (reverse and forward) stress testing of a risk management model can be tackled solving an optimisation problem where the f-divergence of an alternative scenario is minimised under some constraints. The special cases of KL- and chi2-divergence are given special attention, and some features of the general f-divergence case are investigated.

Müller, Alfred
University Siegen
Decisions under uncertainty: sufficient conditions for almost stochastic dominance
Decision making under risk involves a ranking of distributions, which is typically based on a method for assigning a real number to a distribution using a risk measure, a premium principle or a context of expected utility. As it is typically difficult to assess a concrete risk measure or utility function it is a well established idea to use stochastic dominance rules in form of stochastic orders to compare distributions. However, it is often equally difficult to completely specify a distribution. Therefore it is an interesting question whether one can derive unambiguous decisions under partial knowledge of the distributions. In this talk we in particular address this question under the condition that we only know the mean and variance of the involved distributions or that we know the marginal distributions but not the copulas in a multivariate context. Under such assumptions we derive sufficient conditions for concepts of almost stochastic dominance that are based on restrictions on marginal utilities. The talk is based on joint work with Marco Scarsini, Ilia Tsetlin and Robert L. Winkler.

Pfaffel, Oliver
Munich Re
Risks & Opportunities of Large Language Models in Insurance
Large Language Models (LLMs) have emerged as powerful tools in the insurance industry, offering a wide range of applications to enhance operational efficiency, customer engagement, and analytic capabilities. This presentation aims to delve into the risks and opportunities associated with the adoption of Large Language Models within insurance. By utilizing LLMs, insurers can automate processes like underwriting and credit assessments, improving accuracy and speed while reducing manual effort. Developing an effective large language model requires careful consideration of various technical dimensions. The selection of appropriate training techniques, languages, data sources, model architectures, and evaluation methodologies is crucial to achieving optimal performance. However, it is important to acknowledge the risks and challenges associated with the application of LLMs. These risks encompass issues such as hallucination, information leakage, adversarial attacks, and harmful outputs. By acknowledging these challenges, insurers can implement safeguards and mitigate potential risks, ensuring responsible and ethical use of LLMs within the insurance context. Lastly, the presentation will showcase results from a text classification task in primary health insurance that demonstrate the superiority of an insurance domain-adapted language model compared to generic alternatives.

Preischl, Michael
Munich Re
Demand modelling in private lines non-life insurance
Pricing is a major topic in actuarial sciences. While it is relatively straightforward to judge if prices are well aligned with the underlying risk, the question of which prices will result in the most profitable business is much harder to answer, as this must take into consideration the buying behaviour of the customer group. Demand modelling is a well-established tool to quantify and predict customer actions and reactions to price changes. In this talk, we will discuss the importance of the modelling setup, touch upon modelling techniques and give applications in private lines non-life insurance. In addition, we will have a look at the legal framework of demand modelling resp. price optimisation and how recent changes in regulation will affect the industry.

Ramada-Sarasola, Magdalena
WTW
How is technology truly transforming insurance? Navigating the noise to uncover actual value of #tech in the Context of Risk to Capital Journeys
From big data and machine learning, to true AI, blockchain and quantum computing – which technologies are delivering their promises? In this keynote Dr. Ramada-Sarasola will navigate through the latest technological advances, how and where they are impacting the insurance value chain today and to which extent we can expect true game changers to surface in the near future. She we discuss concrete use cases including WTW's proprietary layered GBMs, the applicability of quantum mechanics in finance and insurance, as well as her last ten years of research and experimentation with blockchain and insurance. Dr. Magdalena Ramada-Sarasola is a Senior Director at WTW and leads the company's global InsurTech Innovation efforts and blockchain initiatives. She joined the firm in 2005 and has 20+ years of experience in strategy consulting and innovation management. She was among the first to explore and publish about blockchain in the context of insurance, she specializes in the impact of new technologies on our industry and for the past 9 years, she has been exclusively focused on helping large multinational (re)insurers across 4 continents to digitize, innovate and transform.

Schoutens, Wim
KU Leuven
Sustainable finance and ESG investing : Sense or nonsense
We take a critical look at the current trends of sustainable finance and ESG investing. We elaborate on green bonds, sustainable linked bonds and other alternatives. We assess whether statements concerning lower risks and higher returns are true in a constrained setting of sustainable portfolio investments. We elaborate on the extension of the classical portfolio theory and the optimal frontiers from a two dimensional setting (risk and return) into a third ESG dimension. We also touch upon issues of greenwashing. We finally comment on potential systemic risks arising from an enforcement of sustainable investment into the regulation.

Stahl, Gerhard
HDI
An Uncertainty-based Risk Management Framework for Climate-Change Risk
Climate risks are systemic risks and may be clustered according to so-called volatilities, uncertainties, complexities and ambiguities (VUCA) criteria. We analyse climate risk in the VUCA concept and provide a framework that allows to interpret systemic risks as model risk. As climate risks are characterised by deep uncertainties (unknown unknowns) we argue that precautionary and resilient principles should be applied instead of capital-based risk measures (reasonable for known unknows). A prominent example of the proposed principles is the precommitment approach (PCA). Within the PCA subjective probabilities allow to discriminate between tolerable risks and acceptable ones. The amount of determined solvency capital for acceptable risks and estimations of model risk may be aggregated by means of a multiplier approach. This framework is in line with the three Pillar approach of Solvency II, especially with the recovery and resolution plan. Furthermore, it fits smoothly to a hybrid approach of micro and macro prudential supervision.

Vanduffel, Steven
VUB
Robust Distortion Risk measures
The robustness of risk measures to changes in underlying loss distributions (distributional uncertainty) is of crucial importance in making well-informed decisions. In this paper, we quantify, for the class of distortion risk measures with an absolutely continuous distortion function, its robustness to distributional uncertainty by deriving its largest (smallest) value when the underlying loss distribution has a known mean and variance and, furthermore, lies within a ball - specified through the Wasserstein distance - around a reference distribution. We employ the technique of isotonic projections to provide for these distortion risk measures a complete characterisation of sharp bounds on their value, and we obtain quasi-explicit bounds in the case of Value-at-Risk and Range-Value-at-Risk. We extend our results to account for uncertainty in the first two moments and provide applications to portfolio optimisation and to model risk assessment.

Weber, Stefan
University Hannover
Robust Portfolio Selection Under Recovery Average Value at Risk
We study mean-risk optimal portfolio problems where risk is measured by Recovery Average Value at Risk, a prominent example in the class of recovery risk measures. We establish existence results in the situation where the joint distribution of portfolio assets is known as well as in the situation where it is uncertain and only assumed to belong to a set of mixtures of benchmark distributions (mixture uncertainty) or to a cloud around a benchmark distribution (box uncertainty). The comparison with the classical Average Value at Risk shows that portfolio selection under its recovery version enables financial institutions to exert better control on the recovery on liabilities while still allowing for tractable computations. The talk is based on joint work with Cosimo Munari, Justin Plückebaum and Lutz Wilhelmy.

Werner, Ralf
University Augsburg
Analysis of Interest Rate Evolutions by Autoencoders
In this talk, we will discuss an approach by Kondratyev (risk.net June 2018), who has analyzed historical interest rate evolutions by means of an autoencoder. After briefly recalling the main ideas and comparing it to classical approaches, we will especially highlight pros and cons of such a data-driven approach and discuss lessons learned.