

DGVFM-Workshop für Nachwuchsmathematiker*innen
Wissenschaftszentrum Schloss Reisenburg
13. bis 15. November 2024

Mittwoch, 13.11.2024

Anreise ab 14:00 Uhr möglich

15:00 – 16:00 Uhr

Kaffee und Kuchen

16:00 – 16:30 Uhr

Begrüßung und Einführung,
Vorstellung der Teilnehmerinnen und Teilnehmer

16:30 – 17:00 Uhr

Prof. An Chen
„Informationen zur Aktuarsausbildung (DAV)“

17:00 – 18:15 Uhr

Prof. Dr. Hansjörg Albrecher (Universität de Lausanne)
**“Pooling of Nat-Cat losses and the challenges of
climate change for insurers”**

18:30 Uhr

Abendessen

Donnerstag, 14.11.2024

08:30 - 09:15 Uhr

Frühstück

09:30 - 10:45 Uhr

Prof. Dr. Jan-Philipp Schmidt (TH Köln)
**“Dynamic pricing in the insurance industry: A supply
and demand-oriented approach”**

10:45 – 12:00 Uhr

Prof. Dr. Manuel Rach (Universität St. Gallen)
**„Unit-linked decumulation of wealth during
retirement: A utility-based analysis“**

12:30 – 13:30 Uhr

Mittagessen

14:00 – 15:15 Uhr

Prof. Dr. Luitgard Veraart (London School of Economics and
Political Science)
**“Systemic risk in markets with multiple central
counterparties”**



DGVFM

Deutsche Gesellschaft für
Versicherungs- und Finanzmathematik e.V.

15:15 – 15.45 Uhr

Kaffeepause

15:45 – 17:00 Uhr

Dr. Dorothee Riemann (Gen Re)
„Cat XL reinsurance – How to price for a catastrophe cover?“

18:30 Uhr

Abendessen

Freitag, 15.11.2024

08:30 - 09:15 Uhr

Frühstück

09:30 – 10:45 Uhr

Constantin Papaspyratos (Bund der Versicherten)
“The supervisory and contractual aspects of occupational disability insurance in Germany”

10:45 – 11:30 Uhr

Prof. Dr. An Chen (Universität Ulm)
“Valuation and Design of Sustainability-Linked Bonds”

11:30 – 12:15 Uhr

Prof. Dr. Jörn Saß (RPTU Kaiserslautern-Landau)
“Compression of insurance portfolios for simulating a life insurer’s balance sheet”

12:15 – 12:30 Uhr

Abschlussrunde, Evaluation

12:30 Uhr

Mittagessen

14:00 Uhr

Ende der Veranstaltung



Vorträge / Referent*innen

Prof. Dr. Hansjörg Albrecher (Universität de Lausanne)

Pooling of Nat-Cat losses and the challenges of climate change for insurers

Weather-related and catastrophe insurance losses typically exhibit strong spatial dependence, particularly at the local level. However, if the considered region is large enough, there may be sufficient diversification, which is essential for the insurability of related risks. In this talk we discuss how mathematical techniques can help to study this question. Looking into real as well as simulated historical loss data for flood and storm events, we investigate the aggregation properties within a province, a country, as well as Europe and we look into consequences for solvency capital requirements of insurers. We also discuss challenges of climate change on the physical risks of insurance companies in this context.

Prof. Dr. Jan-Philipp Schmidt (TH Köln)

Dynamic pricing in the insurance industry: A supply and demand-oriented approach

In the insurance sector, risk has traditionally been the main factor in pricing. This presentation expands this perspective by integrating the dynamics of supply and demand on insurance markets. It illustrates how considering these market mechanisms can develop effective pricing strategies that are not solely based on risk assessments but also enhance competitiveness in a changing market environment. By analyzing the interactions between market conditions and pricing, new insights are gained into optimizing pricing strategies in the insurance industry.

Prof. Dr. Manuel Rach (Universität St. Gallen)

Unit-linked decumulation of wealth during retirement: A utility-based analysis

In a dynamic hybrid life insurance product, policyholders accumulate savings in a dynamically adjusting combination of a traditional life insurance (earning a constant guaranteed interest rate and a potential surplus participation) and an investment in funds. We design and analyze a policyholder's perspective on a dynamic hybrid annuity, an innovative retirement plan which converts the idea from dynamic hybrid products to the decumulation phase, resulting in a special type of unit-linked retirement benefits. An analysis under expected utility reveals that this dynamic hybrid annuity can be preferable to simpler forms of traditional or unit-linked decumulation.

Prof. Dr. Luitgard Veraart (London School of Economics and Political Science)

Systemic risk in markets with multiple central counterparties

We provide a framework for modeling risk and quantifying payment shortfalls in cleared markets with multiple central counterparties (CCPs). Building on the stylized fact that clearing membership is shared among CCPs, we develop a modeling framework that captures the interconnectedness of CCPs and clearing members. We illustrate stress transmission mechanisms using simple examples as well

as empirical evidence based on calibrated data. Furthermore, we show how stress mitigation tools such as variation margin gains haircutting by one CCP can have spillover effects on other CCPs. The framework can be used to enhance CCP stress-testing, which currently relies on the "Cover 2" standard requiring CCPs to be able to withstand the default of their two largest clearing members. We show that who these two clearing members are can be significantly affected if one considers higher-order effects arising from interconnectedness through shared clearing membership. Looking at the full network of CCPs and shared clearing members is, therefore, important from a financial stability perspective.

This is joint work with Iñaki Aldasoro.

Dr. Dorothee Riemann (Gen Re)

Cat XL reinsurance – How to price for a catastrophe cover?

Insurance companies can buy reinsurance to transfer part of their insured risk to a reinsurer. In return, the reinsurer receives a premium for assuming the risk. How exactly the risk is shared between the insurer and reinsurer is defined by the form of reinsurance. One such form is a Cat XL, which stands for "catastrophe excess of loss". Cat XL reinsurance plays a crucial role in the management of extreme risks. By purchasing this type of cover, an insurance company protects itself against catastrophic events where multiple claims arise from a single event. Standard examples of such an event are natural disasters or major accidents.

We discuss the basics of reinsurance and the general approach to pricing. We then use a fictitious example to construct, step by step, a price for a Cat XL cover in the context of life insurance. Finally, we give an outlook on model extensions and discuss various pricing challenges.

Constantin Papaspyratos (Bund der Versicherten)

The supervisory and contractual aspects of occupational disability insurance in Germany

In international comparison, the German occupational disability insurance is considered the most „high-performance“ private insurance product for securing the workforce. The uniqueness of the policies offered in Germany is based on the strict legislative prescription. This leads to the insurance coverage being significantly different from comparable policies in the insurance markets in other countries. We discuss the peculiarities of this insurance coverage and which legal regulations and court rulings life insurance companies must observe. We reconsider the regulatory requirements actuaries must comply, what consumers need to consider when they apply for insurance coverage and practical problem statements the policy holders must take into account if they claim a pension from the contract.

Prof. Dr. An Chen (Universität Ulm)

Valuation and design of sustainability-linked bonds (based on a work of An Chen, Maria Hinken und Gunter Löffler)

Sustainability-linked bonds (SLBs) offer coupon payments that increase if key performance indicators do not reach sustainability performance targets. In both a risk-neutral and a consumption-based



pricing framework, we find that fair issue yields of SLBs, and hence their financing costs, are non-monotonic in the ambition of the sustainability targets. Thus—contrary to common perceptions—more ambitious targets do not necessarily indicate a higher sustainability quality; rather, an opportunistic issuer may set more ambitious targets in order to lower financing costs. We also show that an issuer that chooses higher penalty payments may do so in order to better exploit investor preferences for sustainable assets.

Prof. Dr. Jörn Saß (RPTU Kaiserslautern-Landau)

Compression of insurance portfolios for simulating a life insurer's balance sheet

We introduce a stochastic asset-liability management model for a life insurance company and present a procedure for generating a compressed contract portfolio that respects the given biometric structure. The balance sheet model is in line with the principles of double-entry bookkeeping as required in accounting. We prove the consistency of the balance sheet equations and focus on the incorporation of new business, i.e. the addition of new contracts in each period. Efficient simulations are retained by integrating new policies into existing cohorts according to contract-related criteria. In extensive Monte Carlo simulation studies for different scenarios regarding the business form of today's life insurers, we utilize these to analyze the long-term behavior and the stability of the components of the balance sheet for different asset-liability approaches and interest rate scenarios. Finally, we investigate the robustness of two prominent investment strategies against crashes in the capital markets, which lead to extreme liquidity shocks and thus threaten the insurer's financial health. We discuss the relevance of the results based on possible simulation errors and model parameters.