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Proceedings of the Researchers' Corner for the 10th Annual Meeting of the Sponsoring Group Reinsurance

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Institut für Versicherungswesen

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und Rechtswissenschaften

Technology
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FOREWORD

The 10th Annual Meeting of the Sponsoring Group Reinsurance was held 7 July 2017, in Niederkassel near Köln. Some 80 representatives of the (re)insurance companies involved in the Sponsoring Group took part in the meeting, together with invited guests. Offered for the third time as part of the Annual Meeting, the Researchers' Corner gave nine members of academic staff at the Cologne Research Centre for Reinsurance an opportunity to deliver short presentations on their individual research projects. Professor Materne also conducted interviews with Messrs Lorenz Kielwein and Frank Baumann. Kielwein reported on the application of mathematical systems theory to processes in change management, and Baumann on his 30 years of experience at Gothaer.

During each of three sessions, three short lectures with posters were held in parallel and discussed afterwards. The heterogeneity of the topics presented by the staff members reflects the dovetailing of research theory with practice.

In the sessions, the following speakers presented in German and English:

Round 1

a) **Fabian Pütz (M.Sc.)**

Alternative Capital and Basic Risk in the Standard Formula (Non-Life) of Solvency II

b) **Manuel Dietmann (M.Sc.)**

SFCR: Findings for Initial Publication

c) **Jan Böggemann (B.Sc.)**

Optimising the Purchase of Optional Reinsurance by an Industrial Insurer

Round 2

a) **Robert Joniec (M.Sc.)**

Actuarial swap

b) **Lucas Kaiser (M.Sc.)**

The Impact of Different Determinants on the Rating of Reinsurance Companies

c) **Lihong Wang (M.Sc., FCII)**

Chinese Automobile Vehicle Recall Insurance

Round 3

a) **Sebastian Hoos (M.Sc., FCII)**

Critical Analysis of the Practical Application of the Definition of an Event

b) **Fabian Lassen (B.A.)**

Employees in the Reinsurance Industry: Germany and the USA.

c) **Kai-Olaf Knocks (M.A., FCII)**

[Autonomous Driving: Evolution or Revolution?

The presentations also featured the work of another member of our staff who unfortunately, for logistical reasons, was able to present his research project in poster form but was not able to deliver a brief lecture.

Poster

d) **Wolfgang Koch (B.A.)**

Public-Private Partnership in Emerging and Developing Countries.

We would like to thank the funding bodies who make this event possible to begin with and provide our scholars an opportunity to conduct their research.

Cologne, January 2018

Prof. Stefan Materne

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Alternative Capital and Basic Risk in the Standard Formula (Non-Life) of Solvency II

Fabian Pütz, M.Sc.



Types of basic risk

Counterparty risk

Claim trigger	Modelling error	Trigger risk	Dynamic basic risk
parametric	x	x	x
Modelled	x	(x)	x
industry index		x	x

- Special requirements for design of the SPV
- ✓ Counterparty default risk (nearly) completely avoided

Basic risk under SII

‘The risk that exists if the position covered by the risk-mitigation technique does not correspond to the risk position (...)’

Necessary consideration in

- solvency balance sheet
- Calculation of the SCR
- ORSA

How to quantify this?

- Concept of materiality for taking basic risk into account
- Taking the ‘basic opportunity’ into account
- Basic risk in trad. reinsurance policies
 - e.g. exclusions of liability
 - definition of the ‘risk position’

Assessment of SII specifications

- ✓ Principle-oriented regulatory content
 - individuality of the respective basic risk
- ❖ Economically inadequate regulatory content
 - e.g. basic risk from currency mismatches
- ❖ Heterogeneous regulatory content
 - e.g. consideration of basic risk in trad. reinsurance
- ❖ Heterogeneous audit requirements
 - e.g. auditing of different confidence levels

Assumptions	
Amount of original claim in local currency	EUR 100
compensation received from reinsurance in foreign currency	USD 112
1st case variant: Constant exchange rate	
Value of the original claim in local currency	EUR 100
Value of compensation (USD 112) based on current exchange rate	EUR 100
Difference in economic value	EUR 0
2nd case variant: Appreciation in local currency	
Value of the original claim in local currency	EUR 100
Value of compensation (USD 112) based on current exchange rate (EUR 1 = USD 1.20)	EUR 93.3
Difference in economic value	EUR - 7.7

Lecture by Fabian Pütz at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

Alternative Capital and Basic Risk in the Standard Formula of Solvency II

The brief presentation presents the contents of the Master's thesis of the same title: 'Alternative Capital und Basisrisiko in der Standardformel von Solvency II'. The aim of the Master's thesis was, specifically, to investigate the extent to which the requirements of Solvency II take adequate account of the specificities of alternative reinsurance structures, based on the example of cat bonds for counterparty default risk (hereinafter referred to as 'counterparty risk') and the baseline underwriting risk under the principle of substance over form.

If the basic construction of a cat bond is considered, a transaction always involves three parties: the risk sponsor, the SPV and the investors. The risk sponsor transfers underwriting risks to a special purpose vehicle by means of a suitably structured reinsurance agreement, which in turn securitises these risks and passes them along to the capital-market investors via a bond issue, which deposits the nominal amount of the bond up front to the collateral and, in accordance with the underwriting course of the covered risk portfolio, can preserve or lose the nominal amount including interest.

Two points in particular are crucial for taking account of counterparty and baseline risk within this transaction. Counterparty risk is determined in particular by the design of the collateral, and the baseline underwriting risk arises as a function of the structure of the reinsurance agreement between the risk sponsor and the SPV. Specifically, the choice of the respective compensation trigger is crucial.

Consideration of counterparty risk will be addressed only briefly here. Basically, it can be noted that the typical configuration of cat bonds with up-front payment of the collateral by investors reduces the solvency capital that must be kept for counterparty risk almost entirely. Counterparty risk is calculated essentially by multiplying the likelihood of default by a loss given default as the expected default amount in the event of default. When calculating this expected default, collateral can be deducted with its market value. If it is assumed that the collateral assets invested can generally be considered to be risk-free according to the standard formula (e.g. European

government bonds or OECD government bonds with a good rating), the resulting loss given default is equal to zero.

If the baseline underwriting risk is considered, it should first be emphasised that these are not financial baseline risks from the capital investment but rather underwriting risks that arise out of the interaction of the original loss by the risk sponsor and the compensation from the reinsurance agreement.

In principle, and speaking generally, the baseline underwriting risk can be characterised as the condition in which, from the point of view of the reinsured party or the risk sponsor, a difference exists between the compensation to be paid to own policyholders and the compensation received from the corresponding underwriting hedging instrument.

Given this general definition, particularly questionable is the extent to which the baseline underwriting risk can exist on a compensation basis in the case of traditional reinsurance agreements. As a matter of principle, the wording of this definition also extends to situations in which the same circumstance governs traditional reinsurance contracts, for example through cover and risk exclusions, deductibles or self-supported layers. In contrast to this general definition, baseline underwriting risk in the market-oriented practical perspective is largely attributed only to index-based compensation triggers; this is why the general definition presented above is rather broad from a market perspective. This discussion will be taken up again later.

Using this market-oriented definition, a distinction is also made in the literature between different sources that give rise to baseline underwriting risk for index-based compensation triggers. On the one hand, this is the baseline risk from modelling errors, which can be paraphrased as the baseline risk 'of the risk itself'. This may lead to a deviation from the compensation paid to own policyholders and the compensation received from the index-based reinsurance agreement if the overriding hazard, such as a storm, is modelled 'wrongly' in terms of its probability or the extent of loss involved. On the other hand, baseline underwriting risk arises from the materialisation of the trigger risk if – despite the assumption that perfect modelling of the overriding risk itself is possible – there can be a difference between the claims payment made and the relief received if the selected reference trigger fails to adequately reflect the loss of the portfolio. In addition to these two sources, in some cases the literature references dynamic baseline risk as a source. In principle, this

does not constitute a separate source of baseline underwriting risk and instead merely expresses that baseline risk may fluctuate over time.

If this baseline underwriting risk within the context of Solvency II is considered in this general introduction, it can generally be said that this must be considered in the solvency balance sheet, in calculating the risk-mitigating effect of the solvency capital that must be kept and in the ORSA process. All in all, the requirements of Solvency II are formulated in a very qualitative way, which ultimately seems appropriate given to the individual nature of the underwriting risk.

Under the requirements of Solvency II, baseline risk must be described as the risk that exists if the position covered by the risk mitigation technique no longer corresponds to the risk position (...). One striking thing in the analysis of this general definition is in substance close to the general definition of baseline underwriting risk stated at the outset and is thus broader than the definition commonly seen in the market.

It is therefore questionable to what extent the baseline underwriting risk must be taken into account in the case of traditional reinsurance contracts on a compensation basis. The requirements and Solvency II make contradictory statements on this point.

On the one hand, the guidance on considering passive reinsurance requires that the content of cover, such as disclaimers, partial placements or franchises, be factored in at a confidence level of 99.5 percent. At the same time, the requirements for consideration of baseline underwriting risk in the solvency balance sheet stipulate that the item of recoverable amounts from reinsurance must be corrected only for contracts that are not formulated on a compensation basis. This results in a certain contradiction in the specifications.

Also questionable is the point from which baseline risk should be regarded as material and hence to be taken into account. Here, too, there is no unambiguous statement to be found in the requirements. A sample case mentioned in which material baseline risk may be lacking is one in which the change in the value of the risk position covered by the risk-mitigation technique must reflect at least 90 percent of the change in value of the risk exposure. More generally, the exposure covered by a risk mitigation technique must be sufficiently similar to the entity's risk exposure

and must reflect the change in value nearly identically when a comprehensive set of risk scenarios is applied.

This scenario bundle **also** comprises scenarios that correspond to a confidence level of 99.5 percent. Conversely, this would mean that there would actually be no other confidence levels for which scenarios have to be tested. This requirement, however, is fundamentally inconsistent with the guidance on consideration of passive reinsurance, which only requires that appropriate coverage, such as disclaimers or franchises, be tested and assessed at a confidence level of 99.5 percent.

Also questionable is the extent to which the characteristics of the baseline underwriting opportunity, i.e. an overcompensation on the part of the risk sponsor, must be taken into account. Because the concept of risk is logically defined as a downside risk in the calculation of the solvency capital requirement, consideration of the characteristics of the baseline opportunity would be considered inconsistent. In contrast, because valuation of the solvency balance sheet must be performed as a fair value balance sheet, consideration of the baseline underwriting opportunity appears to be necessary here.

The last use case of the baseline underwriting risk is the presentation of baseline underwriting risk due to currency mismatches. Here, the specifications of Solvency II state that baseline underwriting risk must be taken into account if there is **no** fixed rate of exchange stipulated in the reinsurance agreement. If this requirement is considered in terms of its economic impact, however, then this sample calculation shows that baseline underwriting risk arises particularly if a fixed exchange rate has been agreed and the foreign currency in which the reinsurance agreement is denominated devalues the compensation paid to its own insured parties against the local currency. This case would result in an economic loss due to currency mismatch. In principle, the specification would have to be formulated in exactly the opposite sense, because if no fixed exchange rate has been agreed, the compensation would have to be converted at the current exchange rate; hence, there is no baseline risk due to currency fluctuations.

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

SFCR: Findings for Initial Publication

Manuel Dietmann M.Sc.

Sticking points identified in the SFCR

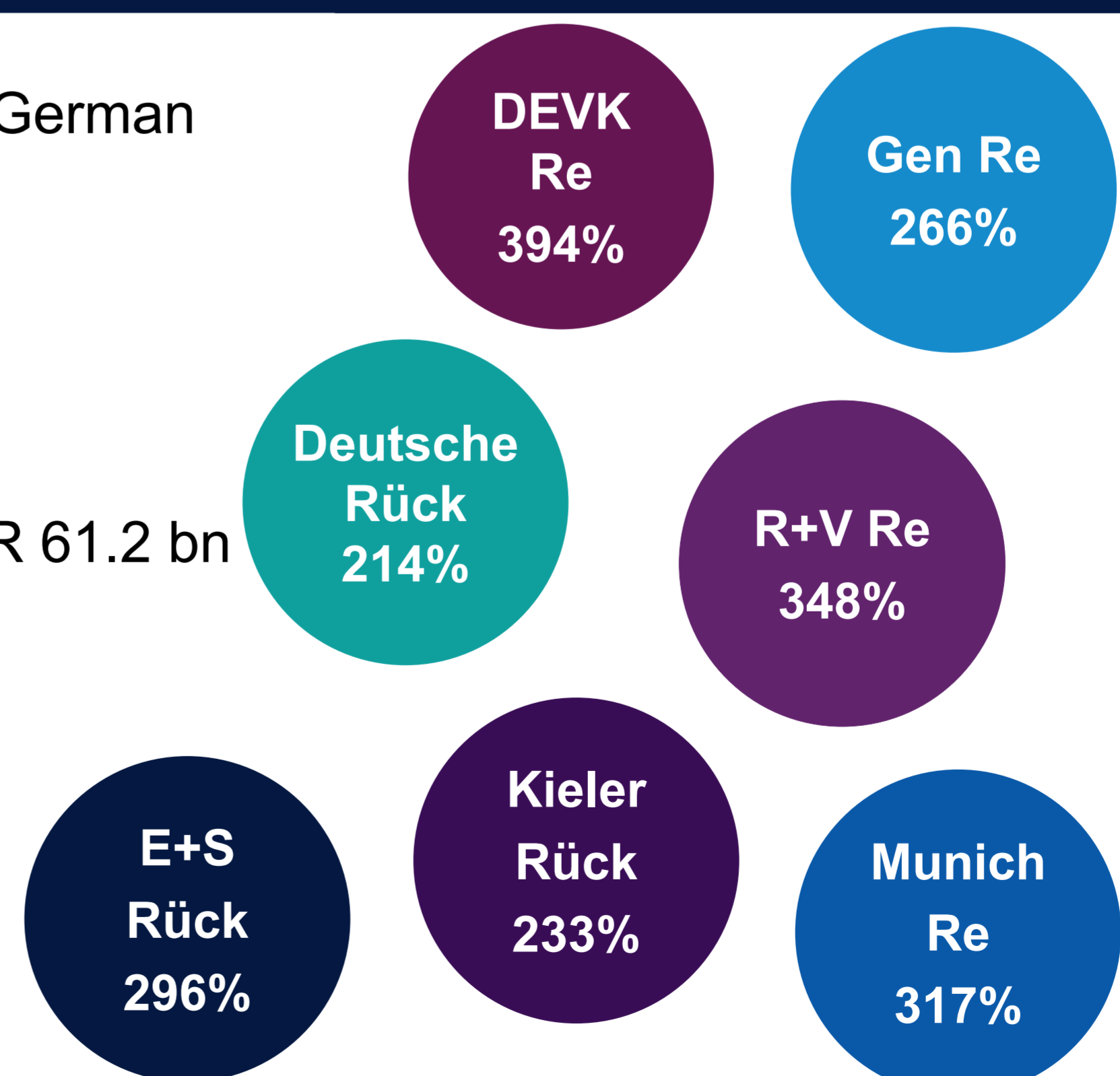
Comprehensive consistent implementation, inter alia with regard to:

Balance – depth of detail – terminology – regulatory references

- A** – Breakdown of actuarial earnings per HGB [German Commercial Code] to the Solvency II divisions
- Breakdown of investment result pursuant to HGB across Solvency II asset classes
- B** – Disclosures on the assessment of the adequacy of the governance system
- Explanation of the relative importance of fixed and variable compensation components
- C** – Different interpretation of the reg. requirements (risk exposure vs. solvency capital requirement)
- Quantitative disclosures on risk exposure
- D** – Depth of detail on the disclosures of actuarial reserves (including comprehensibility)
- Implementation of requirements for alternative valuation methods
- E** – Already well prepared due to the extensive specifications of Day 1 reporting
- Initial request for internal model users to explain the differences to the standard formula

Earnings of the reinsurance industry

- Reporting obligation pursuant to SII for 30 German reinsurers
- Own funds in the amount of EUR 209.4 bn
- Solvency capital requirement (SCR) of EUR 61.2 bn
- Average SCR coverage ratio of 342%
- Surplus cover among all reinsurers
- Market risk material risk driver



Lecture by Manuel Dietmann at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

SFCR: Erkenntnisse zur erstmaligen Veröffentlichung [SFCR: Findings for Initial Publication]

22 May and 3 July 2017 marked the first dates on which German insurance companies were required to file full solvency and financial condition reports (SFCR). Reporting and disclosure requirements are anchored in the third pillar within the scope of Solvency II. Under Solvency II, reporting comprises, in addition to SFCR, the regular supervisory report (RSR), the company's own risk and solvency assessment report (ORSA Report) and the quantitative reporting templates (QRT).

SFCR and RSR follow the same structural breakdown as the mandatory structure laid down in the Annex to Commission Delegated Regulation (EU) 2015/35. Similarly, the requirements for the substance of the report are generally set out in the Commission Delegated Regulation and in some cases are specified by the EIOPA Guidelines (Guidelines on reporting and public disclosure) and the BaFin Information Sheet on Solvency II Reporting. The insurance companies have an obligation to strictly adhere to the requirements. The substantive specifications for SFCR and RSR differ from one another due to the different groups of addressees involved; a different depth of detail in the explanations is required as a result. While the RSR is only sent to the supervisory authority as part of the prudential reporting process, the SFCR is a report subject to public disclosure in order to ensure comparability and transparency. In order to take adequate account of the broad group of addressees, the focus in the case of the SFCR is upon intelligibility.

Already in previous years, insurance companies had an obligation to submit selected chapters to the supervisory authority as part of reporting on the preparatory phase and Day 1 reporting. However, this was only an obligation to report to the supervisory authorities and did not lead to public disclosure. Accordingly, insurance companies were better prepared for Sections D and E, and parts of Section B, than for Sections A and C, which had to be drawn up for the first time.

There were a number of challenges that insurance companies had to overcome when drawing up the full SFCR for the first time. The sticking points identified, in terms of both process and content, are presented below.

At the procedural level, the challenge, early in the reporting process, was to integrate all of the departments acting as subcontractors, and to communicate the internal reporting requirements. If this process did not take place, then the report exhibited overarching inconsistencies – for example, in the terms used, references to regulatory sources, the balance among the individual sections and the level of detail – and these inconsistencies subsequently increased the effort required for quality assurance.

In Section A, 'Business activity and operating result', in addition to general business information, classification within the Group organisation and the main divisions operated, the core information consists particularly of the results of the financial statements in accordance with Solvency II. When implementing the requirements, consistent transfer of data granularity from the German Commercial Code [HGB] to Solvency II proved to be difficult. This relates not only to the breakdown of the underwriting result using commercial-law-based financial statements to the Solvency II business areas but also to the breakdown of the HGB-based investment result to the Solvency II asset classes. This is why not all insurance companies were able to fully implement the regulatory requirements for Section A.

Section B, 'Governance system', essentially contains information on the organisational and operational structure of insurance companies based on Solvency II principles. In addition to information on organisational structure, the contents of the risk-management system, fit & proper, compensation, key functions and outsourcing must be drawn up as well. The sticking points discernible in this section were the disclosures on the rating of the governance system against the backdrop of the type, scope and complexity of the risks inherent in its business operations. Under the requirements of the Solvency II regulations, insurance companies have an obligation to review the governance system for appropriateness on a regular basis. The process used to review the governance system, which should be ensured by an audit plan or similar tools, is not yet fully established across all insurance companies. Some companies have not yet undertaken an explicit assessment. In addition, it was

found that some of the information on the remuneration system was waived full transparency, as the required explanations of the relative significance of fixed and variable shares were not described as required. Specifically, for the vast majority of insurance companies that do not apply IFRS in accounting, the disclosures on compensation entail previously unpublished and very sensitive information.

For Section C, 'Risk profile', insurance companies have an obligation to provide disclosures on risk exposure, risk mitigation, risk concentration and risk sensitivity in order to use this information to provide an understandable explanation of the company-specific risk profile. The wording of the regulatory requirements for this section is relatively imprecise. As a consequence of this, the requirements have been interpreted differently by the companies, with different approaches observed with regard to the filling of the section. Particularly where the disclosures on risk exposure are concerned, a pronounced heterogeneity can be seen in the substantive statements made. While a portion of the insurance companies represented the SCR results for the scope and nature of the quantitative disclosures on risk exposure, another portion enlisted the underlying parameters, such as measures of volume, for explanation. Furthermore, it can also be stated that there is wide variance on the disclosures with regard to sensitivity to risk. In some cases, there were no quantitative disclosures presented in the report with regard to the stress tests and sensitivity analyses carried out.

Section D, 'Valuation for solvency purposes', is intended primarily for a listing of information on the valuation of assets, underwriting reserves and other liabilities. This includes, inter alia, a description of the fundamentals, methods and main assumptions on which the valuation for solvency purposes is based, together with details around the material differences to a commercial-law valuation. Significant differences in depth of detail and comprehensibility were observed, in particular with regard to the notes on the technical provisions. Given the complexity of the topics involved, not all insurance companies have managed to dovetail adequate implementation of the content requirements with comprehensible language. Another topic in which implementation is heterogeneous concerns the disclosures on alternative valuation methods. A separate sub-section requires additional disclosures on assets and liabilities that qualify as alternative valuation methods (Level 3) under the three-tier valuation hierarchy in Solvency II. This section lays out the underlying

assumptions, the uncertainties in valuation, and the regularity with which the adequacy of valuation is subject to review. For the most part, this required information was not placed in the section designated for the purpose.

The content required in Section E, 'Capital management', concerns own funds as well as the solvency capital requirement (SCR) and minimum capital requirement (MCR). For the most part, the insurance companies are already aware of the content to be explained, based on the extensive requirements of Day 1 reporting. Nevertheless, in some cases the reports are not entirely transparent. This was noted in particular with regard to the comments on the equalisation reserve. For the sake of comparability and comprehensibility, at least the key elements of the equalisation reserve should factor into the description as a material constituent of own funds. Not the subject of Day 1 reporting, and hence subject to explanation for the first time for users of internal models, is the presentation of any differences to the standard formula. Where the level of detail and comprehensibility are concerned, different emphases were observed in the statements. For example, there was very little explanation of the differences in aggregation and diversification versus the standard formula.

The solvency ratios of the 30 German reinsurers subject to reporting under Solvency II exhibit a very positive result. With own funds of approximately EUR 209.4 bn and a solvency capital requirement of approx. EUR 61.2 bn, this results in a weighted coverage ratio of 342%. All reinsurance undertakings reported surplus cover as at the balance sheet date. The reinsurance firms generally exhibit a solid capital base that is capable of adequately cushioning any potential negative developments. Market risk was identified as a key risk driver. This is due, on the one hand, to the generally high level of exposure to market risks and, on the other hand, to the function played by many reinsurance companies as a holding company within an insurance group. Given this constellation, investments are taken into account in market risk within the context of calculating the solvency capital requirement.

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Optimizing the Purchase of Optional Reinsurance by an Industrial Insurer

Jan Böggemann, B. Sc.

Framework conditions

- Industrial insurance is in transition, due, among other things, to the low interest-rate environment, excess capacity and hyper-competition
- This results in rising liability risks and insured sums
- Process optimisation presents a point of departure for reducing costs, and thus for increasing competitiveness

Theses

1. There is a difference between the theory and practice of purchasing optional reinsurance
2. With a clearly designed process, the industrial insurer can reduce its costs
3. On average, an industrial insurer can achieve better placement results, thanks to largely central purchasing

What needs to be kept in mind?

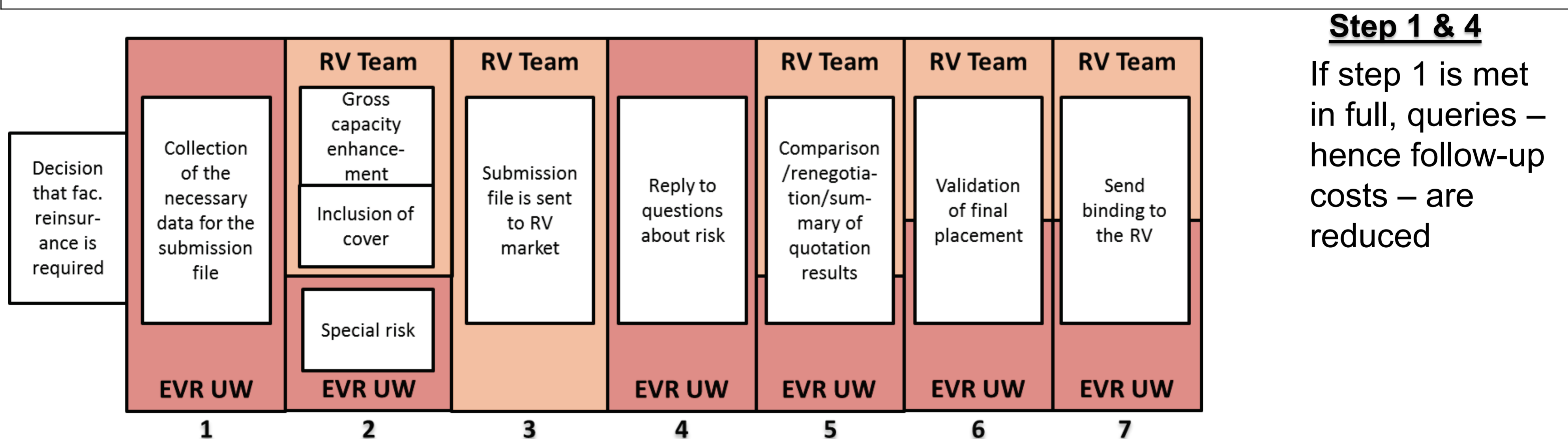
- Specific organisational features
- Internal risk policies
- Design of the treaty, special acceptance solutions possible where necessary

What can be neglected?

- There is no need to distinguish between purchases of an expansion of capacity versus purchases of an expansion of cover

Underwriter of the primary insurer vs. central reinsurance team

- **PI UW** → much better awareness of risk, although the core mission is actuarial analysis
- **RI team** → much better market overview and better process expertise



The diversification factor improves through cooperation between the compulsory and optional department

Involving all purchasing stakeholders as early in the process as possible generates synergy effects that lead to a reduction in cost

Central purchasing leads gives the primary insurer greater negotiating power, and hence better placement results

Lecture by Jan Böggemann at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

Optimising the Purchase of Optional Reinsurance by an Industrial Insurer

The lecture began with an explanation of the market framework conditions for an industrial insurer. The theses of the work were presented on the basis of these conditions, and the circumstances that can be considered or neglected in purchasing were described. The final portion of the lecture was devoted to the processing steps of the work, with closing statements made in relation to the theses presented.

To judge from statements by various board members of industrial insurers, the framework conditions currently entail an environment of low interest rates, excess capacity and hyper-competition. In this regard, the sector is undergoing a radical transition. Low interest rates are making it more difficult to generate solid investment returns. This adds growing importance to underwriting analytics. Further framework conditions present insurance companies with rising liability risks and insured sums.

Process optimisation presents a point of departure for reducing costs, and thus for increasing competitiveness. One process that can be reviewed for its efficiency is the purchase of optional reinsurance by an industrial insurer.

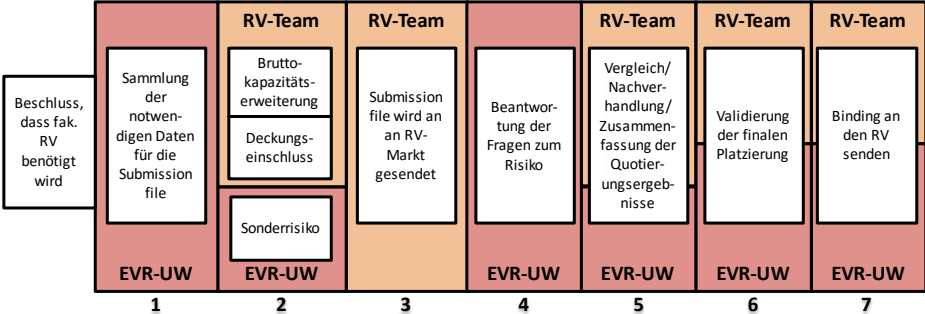
As a result of the work, the following three theses were put forward:

1. There is a difference between the theory and practice of purchasing optional reinsurance
2. With a clearly designed process in place, an industrial insurer can reduce its costs
3. On average, an industrial insurer can achieve better placement results, thanks to largely central purchasing

On the one hand, there are certain circumstances that must be taken into account when purchasing; on the other hand, there are certain circumstances that can safely go overlooked. The individual insurer's organisational specificities and internal risk policies must be observed. These may specify, for instance, that only a certain percentage of a particular risk may be carried, even if the internal limit on net

capacity has not yet been reached. The reasons for this may be, for example, that the existing treaty should not be encumbered because a risk to be taken entails a high potential for damage. This is how an industrial insurer might seek a more favourable solution overall. Likewise, the design of the treaty must be taken into account, together with the extent to which a special acceptance solution is possible there. 'Special acceptance' means shifting the cover of a particular risk from the optional to the compulsory reinsurance policy. There is no need to distinguish between the purchase of an extension in gross capacity and an extension in cover, as the processing steps each involves are essentially identical.

To assess whether the underwriter of the primary insurer or the reinsurance team should perform the processing steps that occur during the purchase of optional reinsurance, the respective strengths of the two parties must be emphasised. The primary insurer's underwriter has considerably better knowledge of the risk involved. Its core mission, however, is underwriting analytics. By contrast, the reinsurance team has a much better overview of the market, along with better process expertise. A clear division of responsibilities is possible once the advantages and drawbacks of both parties are taken into account.



When deciding that optional reinsurance is needed, all parties should be involved in the process at the earliest possible stage, to reduce any information asymmetry between them. Given its proximity to the risk, it is best for the primary insurer's underwriter to compile the data required for the submission file. It should be noted, however, that the submission file should be compiled by the reinsurance team, as it has a better overview of the market and thus knows which information a reinsurer needs during the tendering process. If, for example, Step 1 has been met in full, this may lead to synergies that, in the best case, lead any queries about risk to disappear entirely. In the next step, it turned out that the distribution of the risk should not be based on the magnitude of the risk but on its complexity. Thus, simple upgrades in

gross capacity and inclusions in cover can be performed by the reinsurance team. In the case of special risks such as the reinsurance of off-shore wind farms, this should be performed by the underwriter, working in conjunction with the responsible risk engineer.

In conclusion, the following findings emerge:

1. The diversification factor is improved through cooperation between the compulsory and optional departments, as this bundles information on reinsurance policies.
2. Involving all purchasing stakeholders as early in the process as possible generates synergy effects that can lead to a reduction in cost.
3. Central purchasing leads gives the industrial insurer a greater negotiating power, and hence better placement results.

To be discussed:

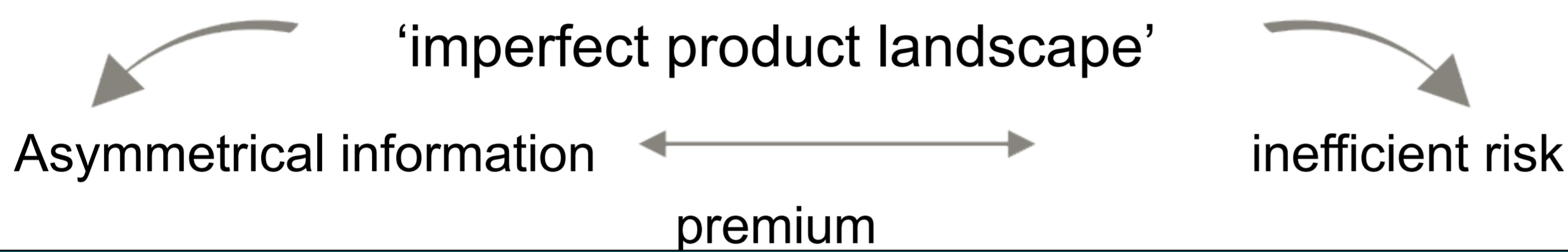
- What is the order of magnitude of enterprise size up to which joint purchase of compulsory and optional reinsurance make sense?
- What impacts does the more volatile optional business have on an industrial insurer's bargaining power?

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Actuarial Swap

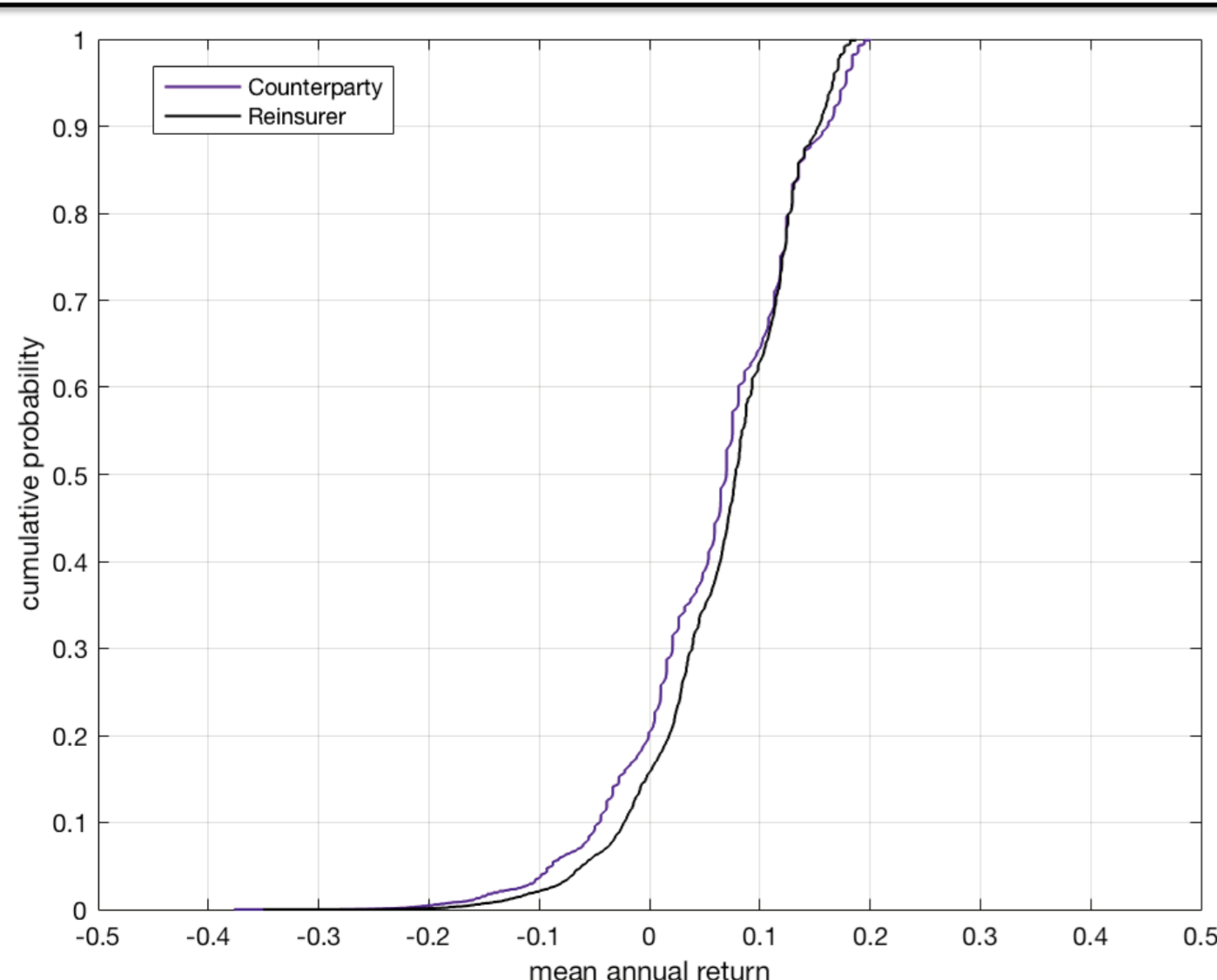
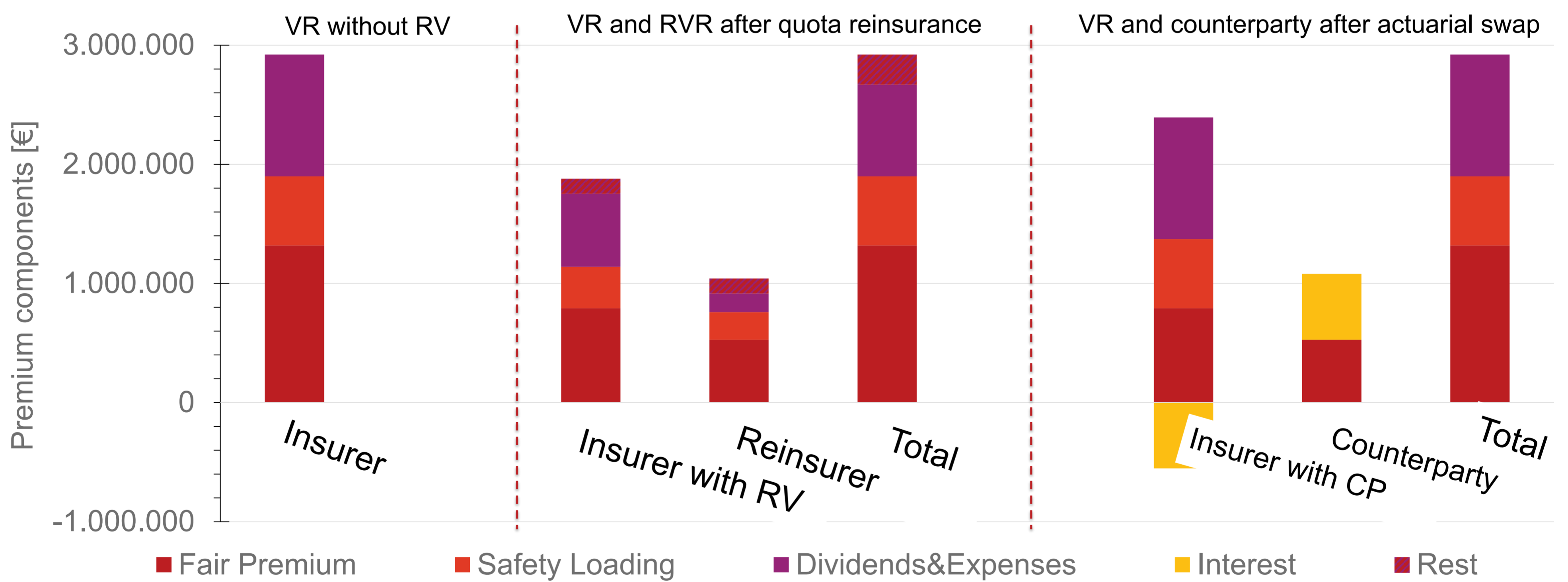
Robert Joniec, M.Sc., FCII

The ART market is not efficient

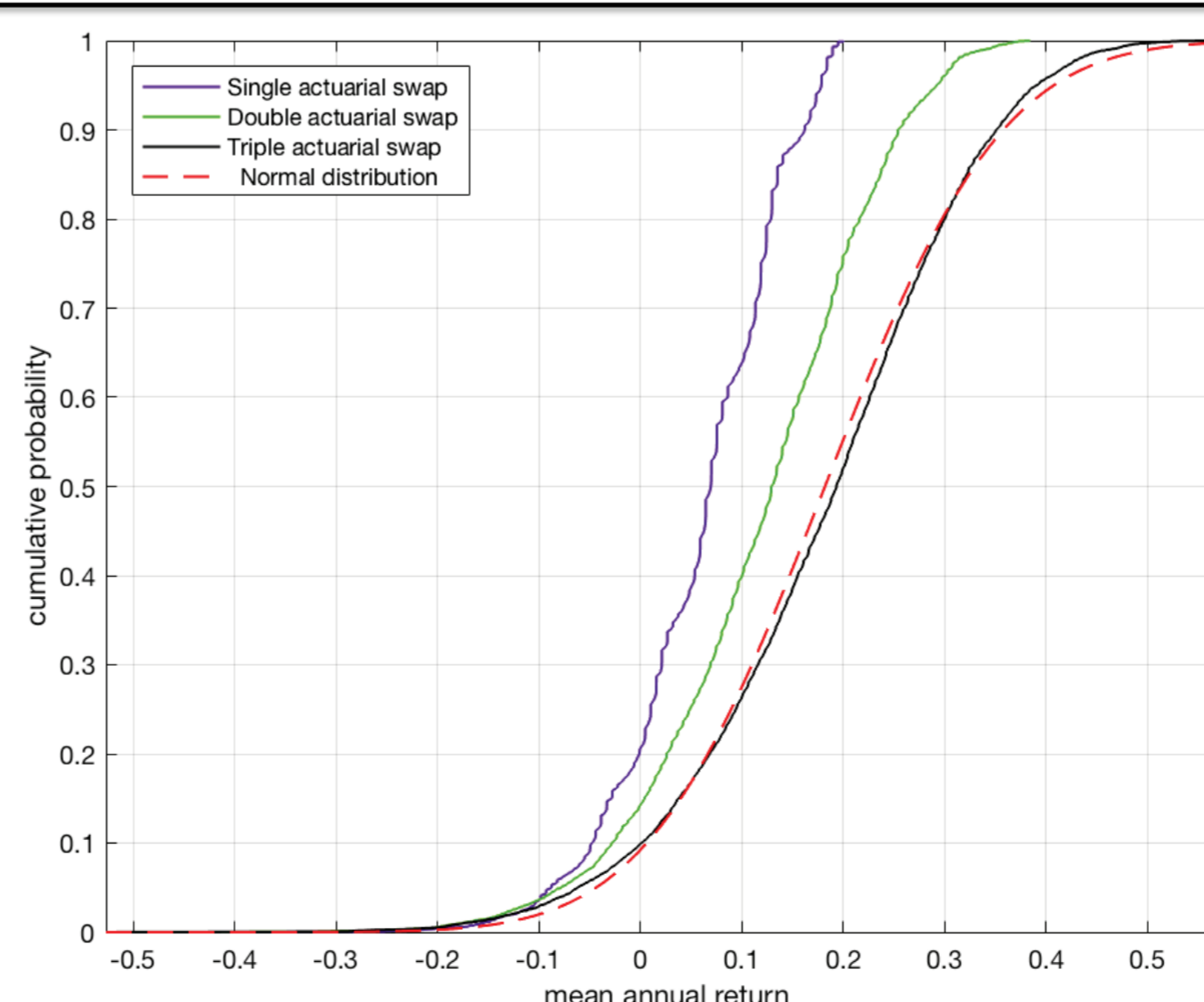


Alternative capital	
Non-proportional	Proportional
Securitization / Collateralized Re / Side Cars	Securitization / Collateralized Re / Side Cars
Insurance Derivatives	Actuarial Swap

- there is no alternative product with the same effect as a quota RV (see solvency bond prototype)
- Traditional avenues and traditional contacts dominate the overall market
- Effects on transactions costs and risk premiums



RoRAC of providers of capacity (deviation due to sliding scale commission in trad. contract)



Diversification effect of multiple actuarial swaps (i.i.d.) within an investment portfolio (RoRAC)

Challenges:

- Marketing
- Market cycle
- Business models
- Differences in theory
- Etc.

Lecture by Robert Joniec at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

Actuarial swap

In what follows, I will provide you with a rough overview of the market for alternative risk transfer and then focus on the actuarial swap to explain this product's structure and effects.

The ART market

The market for alternative risk transfer (ART) can be characterised as inefficient. For several years, of course, there has been doctrinal trend that holds that all markets are more or less inefficient. Although this finding now enters into many decision-making processes, it does not translate into the stagnation of the financial world. There are, however, reasons to assume that transactions costs within the ART market are comparatively high. Although the ART market already represents an alternative to traditional reinsurance and is in competition with it, traditional players are dominant in both segments. Another argument is the imperfect product landscape in the ART market. If an insurer or reinsurer wishes to synthesise non-proportional reinsurance, it may do so with the aid of 'alternative carriers' (securitisation, side cars or collateralised reinsurance) or 'alternative products' (insurance derivatives). 'Synthesising' means that the effect of traditional reinsurance can be replicated with these alternatives. If an insurer or reinsurer intends to synthesise proportional reinsurance, this can only be done with the help of 'alternative-carrier' structures; among other things, these always require the establishment of a special-purpose vehicle (SPV). At this point, it should be noted that, at the 2016 Annual Meeting, Fabian Pütz presented the prototype of a corresponding solvency bond within the scope of his research at the Cologne Research Centre for Reinsurance. Consequently, there is currently no insurance derivative that has the capability to transfer underwriting risk in a proportional manner. This thesis contains two important limitations. First, there are longevity and mortality swaps in the life segment that entirely fall within the definition of an actuarial swap. Second, 'not available' means that such information is not publicly available to every market player, or that the topic has not yet been examined in the academic world – and in this case, both are true.

The concept of the actuarial swap

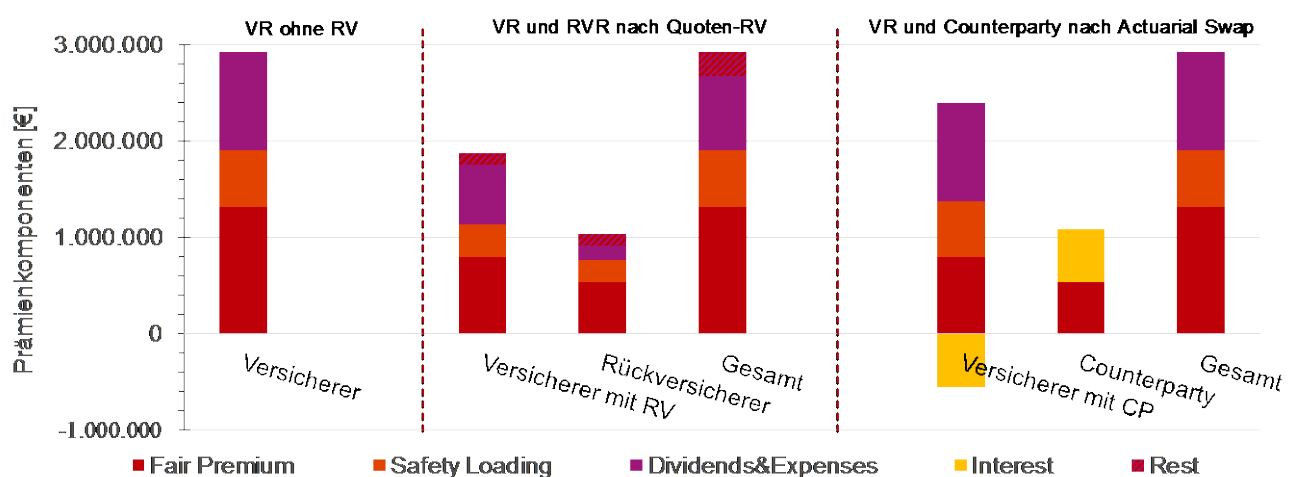
The actuarial swap is an insurance derivative that transfers underwriting risk to a counterparty/investor in a proportional way. The idea is based on the natural parallel between a swap and a standard P&C insurance agreement.

The policyholder pays regular and constant premiums in exchange for irregular and variable claims payments. This principle can also be applied to a portfolio of insurance risks. Since quota-share reinsurance represents a percentage share in the respective payment flows, there are fundamental parallels between a swap and quota-share reinsurance. In the second step, the components of a primary insurance premium were considered in order to implement them in isolation in a derivative. In principle, a premium consists of expected loss, a volatility surcharge and a surcharge for the insurer's expenses and income targets. Within a quota-share reinsurance agreement with an assignment of 40%, 40% of all components are assigned to the reinsurer. The reinsurer pays for 40% of all claims. In addition to this, through the commission, it reimburses the assignor for the costs of canvassing and administering the respective business. Depending on how a commission is calibrated (a variable commission in this case), there may be a residual amount of money that can increase commissions within the scope of profit-sharing, or that the reinsurer may retain as additional profit. In the actuarial swap transaction, the assignor pays just 40% of the expected loss to the counterparty and still receives a refund of 40% of all claims incurred. In addition to the expected loss, the assignor pays a rate of interest that is meant to reflect the cost of capital. For the transaction to provide capital relief in the solvency balance sheet, the counterparty could invest an amount that corresponds to 40% of the SCR of the entire portfolio. A Monte Carlo simulation can test the impact of the agreements on the return on risk-adjusted capital (RoRAC) of the participating parties. Based on the RoRAC, the outcome shows that the impact of the agreements on its statistical distribution is identical. Changes emerge in a comparison of the alternative and traditional solutions through the extended design of the reinsurance agreement with a variable commission and a one-year carry-forward provision. It should be possible to integrate additions like these in equal measure into a swap. Generally speaking, the ISDA agreements provide a standardised and accepted basis for contract design. Finally, RoRAC can also be used to analyse the performance of a portfolio of multiple, actuarial swaps that are identically

distributed and statistically independent of one another. Just like the reinsurer, the investor benefits from diversification effects in its 'insurance portfolio'. Based on these observations, and knowing that, for example, under the Capital Asset Pricing Model (CAPM), only non-diversifiable risks lead to a risk premium that exceeds the risk-free interest rate, which is currently very low, the premium level in the overall market points suggests that structural inefficiencies exist. To this extent, a product such as the actuarial swap can, theoretically, generate added value. In practice, however, there are a number of hurdles to overcome, beginning with matters of understanding and marketing; these hurdles can also lead to failure as a result of different basic understanding in insurance vs. finance, differences in business models, and current levels of premiums or interest rates. This is why continual interaction with market players and experts is an essential part of the research project – and in this regard, we will continue to rely on your interactive feedback in future.

Discussion

- For this swap to be actually attractive to (re)insurers, it must qualify for capital relief in the solvency balance sheet and be otherwise subject to adequate valuation within HGB or IFRS.
- Knowledge of the possibilities in the ART market is still limited to relatively few players. This helps these experts as well as the traditional market continue to generate higher margins.
- One of the challenges will be transparent reporting and predictable managing of such a swap between investor and assignor.
- In the financial world, there are not many investors who have [developed] sufficient expertise to carry out appropriate investment underwriting.



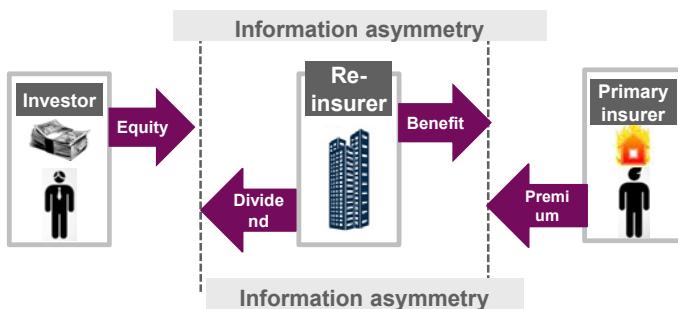
10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

The Impact of Different Determinants on the Rating of Reinsurance Companies

Lucas Kaiser, M.Sc.

Generally, ratings **reduce** mutual **information asymmetries** between the contracting parties through the information provided.

The problem of information asymmetry leads to the growth of Rating agencies



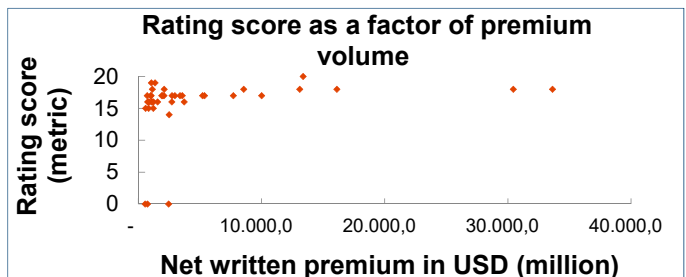
Ratings relate either to financial products (e.g. CatBonds) or entire companies.

Differentiating into product and corporate rating

Product rating	Rating object	Corporate rating
<ul style="list-style-type: none"> The focus is on the insurance product Analysis of product quality Price-performance ratio 	<ul style="list-style-type: none"> Valuation of the insurance company as a whole Financial soundness Qualitative and quantitative criteria 	

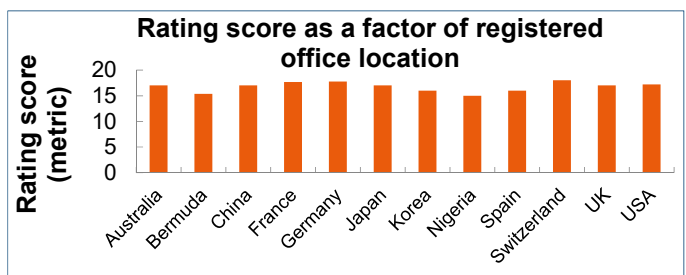
Financial-power ratings are an **important consideration** when selecting a reinsurance company. This reflects financial stability and suggests security.

It can be stated that the determinant of 'premium volume' is insufficient to justify a good rating for financial strength.



It turns out that there is no significant difference per country in terms of rating score.

This could be justified by the fact that the country rating accounts for just a part of a reinsurance company's total financial-power rating.



Further differentiation of reinsurance companies in:

- EU/EEA RV
- Equivalence RV (Bermuda, Japan and Switzerland)
- Third-country RV
 - USA (US-EU Covered Agreement, no equivalence of any kind)

Lecture by Lucas Kaiser at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

The Impact of Different Determinants on the Rating of Reinsurance Companies

The importance of ratings has increased steeply in recent years. For assignors and investors in particular, a reinsurance company's creditworthiness has a key role to play. The project considered whether a reinsurance company's company size as well as its registered office significantly influence the rating result.

Rating agencies serve as information intermediaries between and among market players in the insurance market. The information they provide reduces mutual information asymmetries. Specifically, when purchasing reinsurance cover, an insurance company attaches importance to the financial solidity of the assignee. Primary insurance companies purchase reinsurance protection in order to protect themselves against peak risks, on the one hand, and to reduce the risk capital they must retain on the other. Choosing the wrong assignees can have consequences that threaten a primary insurer's very existence. This is why a reinsurance company with a solid rating is preferred.

For an addressee of reinsurance ratings, the main focus is upon the performance of the reinsurance company rated. Contract fulfilment in the event of a claim is the top priority for a primary insurer. Financially strong reinsurers need to be solidly positioned across all their core processes (underwriting, risk policy, retrocession, etc.).

The question arises as to whether large reinsurers tend to have higher rating scores. The basis for the review is the Standard & Poor's ranking. Each year, Standard & Poor's publishes a list of the top 40 reinsurers in the world, based on booked net premium volume. It can be stated that the determinant 'premium volume' is insufficient to justify high rating scores. As already discussed at the beginning of my remarks, there are other determinants that enter into the rating. Financial strength in particular, is not exclusively a function of premium volume and plays a major role in this regard. The basic conclusion that emerges from this is that large reinsurers do not tend to have better rating scores than their smaller counterparts.

Another criterion that can be enlisted to analyse rating scores is the ‘registered office of the rated reinsurance company’. The Standard & Poor’s rating list clusters rated reinsurers according to the country in which their registered offices are located. It then proceeds to average the scores for each country. It turns out that there is no significant difference per country. This could be justified by the fact that the country rating accounts for just a part of a reinsurance company’s total financial-strength rating.

A score might also be a function of the criterion of ‘reinsurer type’. This criterion refers to the division into EU/EEA reinsurers, equivalence reinsurers and third-country reinsurers. Triggered by the Solvency II Directive ratified in 2016, a restriction on the business activities of third-country reinsurers has entered into force in the EEA.

The approach described above for determining averages of ‘booked net premium’ and ‘registered office’ categories was analogously applied to the ‘reinsurer type’ category. There is a marginal difference across the three sub-categories of EU/EEA reinsurers, equivalence reinsurers and third-country reinsurers. The averages for rating scores are distributed as follows, in descending order: EU/EEA reinsurers exhibit the highest average, followed by equivalence reinsurers and third-country reinsurers. Based on this, it might be concluded that the type of a reinsurance company might affect its rating score. This is the case, however, only if the rating agencies ascribe the lowest default risk to the EU/EEA region.

Finally, US-based third-country reinsurers were considered more closely. Comparing these with the overall share of third-country reinsurers, it emerges that US reinsurers receive a significantly higher average rating score. This may owe to the fact that the US generally has higher regulatory requirements than those in effect in the other third countries, and that the rating agencies award correspondingly better scores as a result.

Reinsurance ratings offer primary insurers a suitable tool for assessing a reinsurer’s financial strength. These ratings increase transparency and reduce the information asymmetries among the two parties to the agreement. Especially in insurance lines

with long-tail business, e.g. liability insurance, the assignors attach great importance to the security of the reinsurer. Rating scores in particular represent a driving factor for decision-making here.

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Chinese Automobile Vehicle Recall Insurance

Lihong Wang, M.Sc, FCII

Date	Legal background
01.09.1993	Product Quality Law
01.01.1994	Law on the Protection of Consumer Rights and Interests
01.10.2004	Provisions for the Administration of Recall of Defective Auto Products
04.06.2004	Measures for the Administration of Information System on Recall of Defective Auto Products
01.07.2010	Tort Law
17.01.2013	Opinions on Several Issues Concerning the Implementation of the Regulations on the Administration of Recall of Defective Auto Products
01.01.2016	Measures for the Implementation of the Regulations on the Administration of the Recall of Defective Auto Products
01.04.2017	Measures for the Administration of Import and Export of Industrial Products

Recall Regulations

General Administration of Quality Supervision, Inspection and Quarantine of P.R. China (AQSIQ)

- AQSIQ is a ministerial administrative organ directly under the State Council of the People's Republic of China, in charge of national quality, metrology, certification and accreditation, standardization, as well as administrative law enforcement.
- Announces *recall* regulations
- Orders recall actions
- Documents recall events
- Coordinates with other ministries (e.g. Ministry of Commerce, Transport and Public Security, etc.)

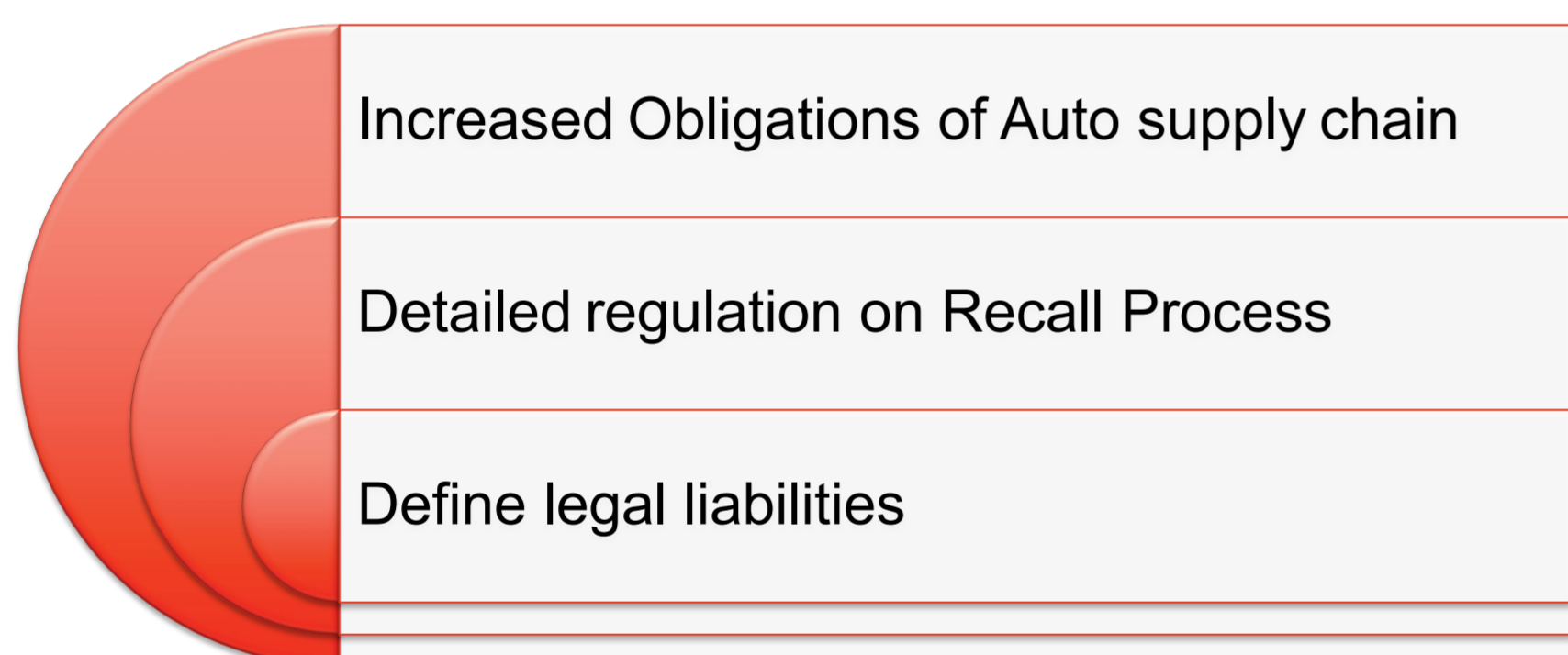
AUTO RECALLS: ANNOUNCEMENT IN CHINA

AUTO RECALLS: AMOUNT OF CARS IN CHINA

Recall Causes (2015)

Component	Announcements	Recalled vehicles
Airbag and Seat Belts	46	2865994
Engine	69	1842671
Steering system	14	313780
Electronical equipment	32	165500
Transmission	8	148165

Source: AQSIQ



Insurance

- Insurers, e.g. Allianz, ACE/Chubb, AIG, Zurich and XL Catlin, are offering this special class of business through various channels.
- However, the loss ratios vary from company to company.
- Rating models and analytical data are largely unavailable.
- Recalls are strongly influenced by political elements and media coverage.

- **Claim experience** → So far, there are few statistics on the repair costs, and insurers have lack of control over service stations.
- **Product liability** → Personal Injury Liability can be long and drawn out, due to ever-changing litigation environment and uncertainty relating to internal political power struggles and economic growth.

Chinese non-Life insurance Segment	Share in %
Property	10.2
Construction & Engineering	1.1
Motor	77.5
Liability	3.8
Others (Surety & Bonds, Marine and Aviation)	7.4

Reinsurance

Product Innovation and Risk Engineering

Huge opportunities for insurers and reinsurers
Risk categorisation is the key
Main Players: SR, MR, GenRe, TransRe, etc.

Risk accumulation

- Complex supply chain (Traceability)
- Cedant risk accumulation (Market loss)
- Worldwide exposure (Add-on effect)

Lecture by Lihong Wang at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

In the following, I would like to present my latest findings in my ongoing research project on the Chinese Automobile Vehicle Recall insurance market. This will be a brief overview of the legal background, regulations and insurance aspects.

China has become the biggest personal car market in the world. Over the last 25 years, there have been significant changes in the legal framework on product liability and product-recall requirements.

Back in 1993 and 1994, laws including the product **Quality Law** and **Laws on the Protection of Consumer Rights and Interests** laid out milestone statutes on this subject by defining defects, recalls and responsibility for recalls for the first time.

In 2004, the **Provisions on the Administration of Recall of Defective Auto Products** created the recall system. However, these provisions have been replaced by other regulations since 2016.

Another milestone was the 2010 **Tort Law of P.R. China**, which defines tortious liability for recall and, most significantly, includes punitive liabilities.

In 2013, a higher level of regulation, which is directly under the State Council, further refined the recall system for defective autos. This became a centralized administrative, rather than “merely” departmental, regulation.

Later, in 2013, overseas recall information was also taken into consideration. The scope of quality and safety-risk information of products expanded from national to international boundaries.

Since 2016, further detailed regulations have come into force. Documentation and implementation of recall systems have been further refined. From 1st April 2017 onwards, **The Measures for the Administration of Risks in Imported and Exported Industrial Products** have included social and traffic accident information as sources

of information, and AQSIQ has introduced the concept of building risk-management systems through risk evaluation, early warning and rapid response.

These laws and regulations define legal liabilities, expand details on recall processes and increase obligations of auto manufacturers and auto supply chain companies.

The State General Administration of Quality Supervision, Inspection and Quarantine of P.R. China (AQSIQ) is a ministerial administrative organ directly under the State Council of the People's Republic of China, in charge of national quality, metrology, certification and accreditation, standardization, as well as administrative law enforcement. This is the main government entity in charge of the recall regulations, announcing recall notices, ordering recall actions, conducting recall investigations, monitoring recall progress and documenting recall events. In practice, AQSIQ coordinates with other ministries (e.g. Ministry of Commerce, Transport and Public Security, etc.)

In 2015 alone, there were approximately 250 recall announcements, involving 5.6 million cars. In 2016, over 11 million cars were recalled, which represents a 103% increase, close to a quarter of all cars manufactured and sold in China in that year. This involved joint ventures, and local and foreign imported car manufacturers. The graphs show a clear trend of more and more cars being affected.

The top five causes of auto recalls, according to the AQSIQ 2015 annual report, have been 1) Airbags and seatbelts, 2) Engine, 3) Steering system, 4) Electronic equipment and 5) Transmission. In the case of electronic equipment, there were 32 announcements, which is relatively high. This was due to the fact that cars are moving from traditional mechanical to more advanced, and consequently, more complicated electronic controlling systems.

In China, the recalls have been increasingly influenced by political factors and media coverage. Other issues should not be ignored and include such issues as insurers having limited statistics on repair, replacement and refund costs and options, as well as limited control on the service stations. Personal injury could be long-tail business due to an evolving litigation system.

Under such increased demand and this stricter legal environment, only a few risk carriers in the market, including Allianz, ACE/Chubb, AIG, Zurich and XL Catlin, are offering this specialty insurance. The insurance covers both manufacturers and component suppliers. The loss ratios vary significantly among insurance companies and have led insurers to revise, adjust and modify insurance coverage, conditions and pricing. Rating models and analytical data are still largely unavailable and incomplete.

Recall insurance covers the cost of getting a defective product back under the control of the manufacturer or merchandiser that would be responsible for possible bodily injury and property damage from its continued use or existence. Typically, these costs include recall costs, pre-recall costs, and increased cost of working after a recall, as well as brand rehabilitation and crisis management, etc.

For the time being, liability insurance is relatively small in the non-life insurance sector (only 3.8%) when compared to the motor insurance (77.5%) and property insurance (10.2%). But the annual growth resulting from higher demand and stricter requirements is much higher compared to other lines of business.

Reinsurers such as Swiss Re, Munich RE, Gen Re, Trans Re, etc., are the major supporters of this class of business, but most importantly also provide certain expertise in underwriting. With such help, insurers are better able to select and price their risks and set terms and conditions. Recall insurance will remain as a high entrance-barrier product. Risk engineering, selection and categorisation remain the key to success.

From a portfolio management perspective, reinsurers should be aware of the increasing complexity in the supply chain (traceability), their risk accumulation and an add-on effect to their existing portfolio from other markets.

This is an ongoing research project and is supported by TH Köln, University of Limerick and Sichuan University.

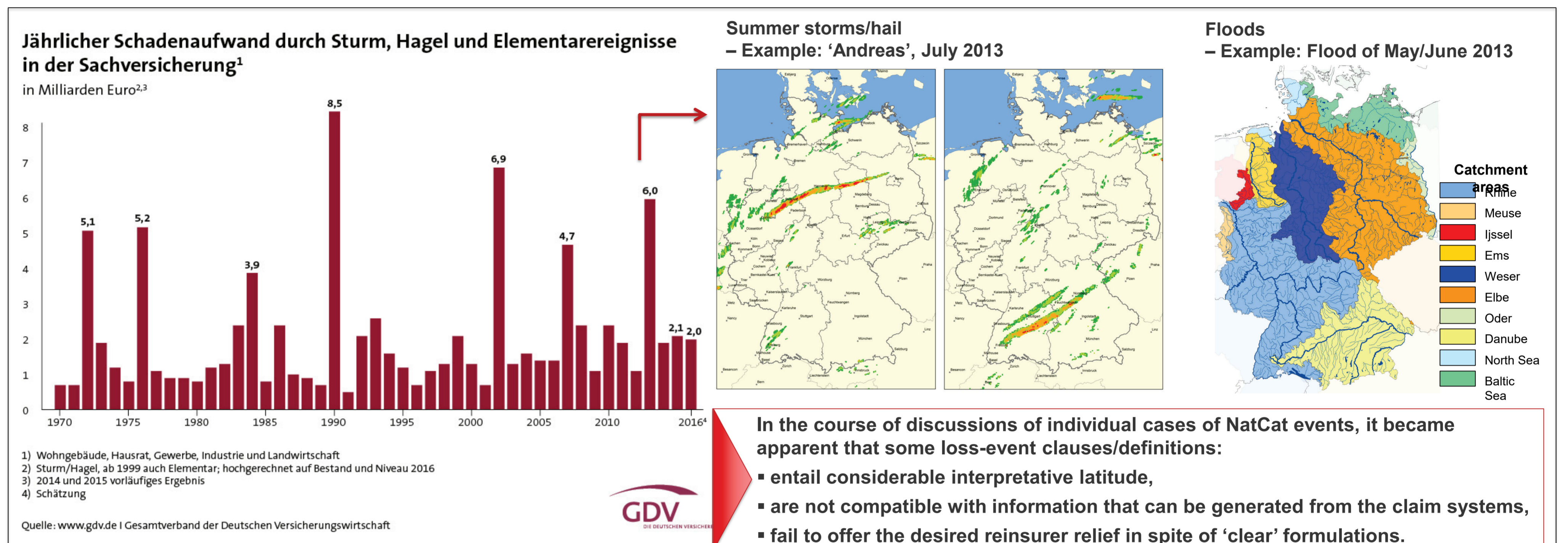
Any suggestions and comments would be welcome.

Please feel free to contact me at Lihong.Wang@th-koeln.de

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Researchers' Corner, 7th July 2017

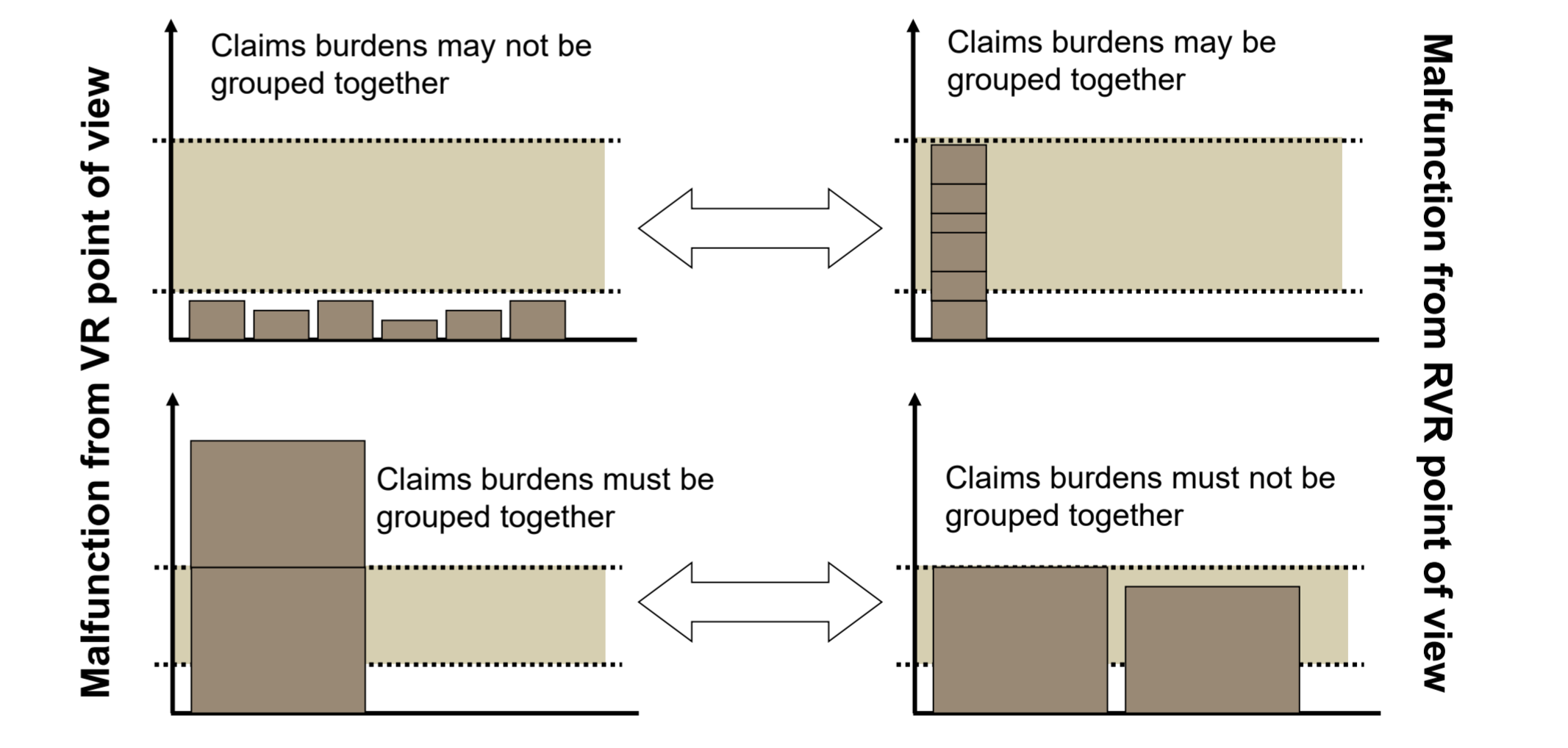
Analysis of the status quo of the definition of 'event' under NatCat XL covers

Sebastian Hoos, M.Sc.

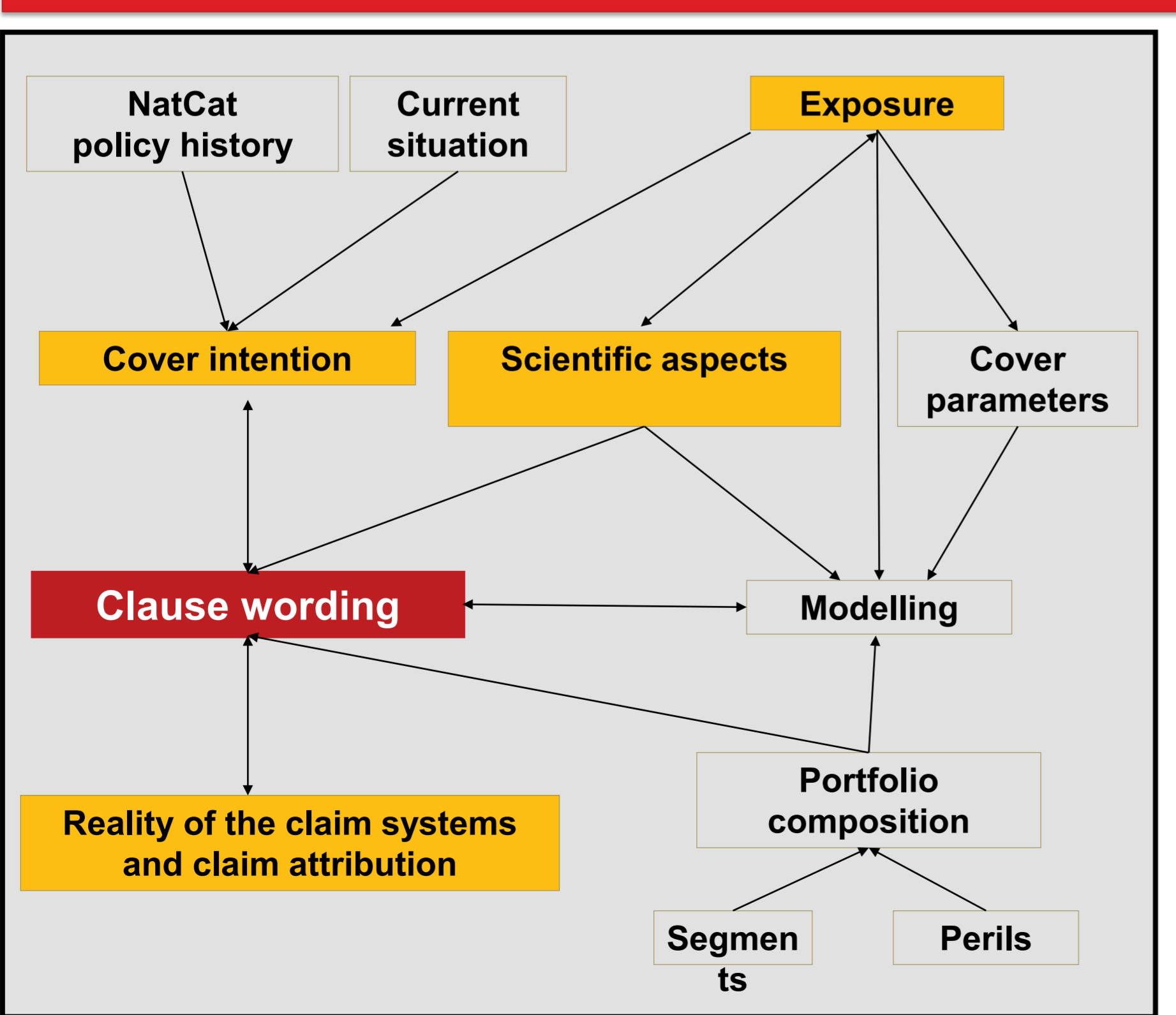


Which individual losses must be aggregated into a 'loss event' in the sense of cumulative excess loss?

1	2	3
Loss event \triangleq natural event \triangleq its period and area	XL event = natural event + period limit	XL event = pure period-based definition
1 Scientific definition of 'event'		3 Pure hours clause
<ul style="list-style-type: none"> A cause defines a loss event. Avoiding fortuities when combining claims to a/several loss event(s). Greatest possible variability: All individual losses through the full duration of the natural event are recorded. Principle suits geophysical models for exposure estimation (usually no time limit). 		<ul style="list-style-type: none"> De facto hours/daily stop loss. Simple filtering of individual losses pertaining to a loss event, as there is no spatial assignment necessary. Several events that are causally separate or of shorter duration can/must be grouped together. Longer-lasting events can/must be broken down. Does exposure estimation suit a (pure) period rule?



The wording of every clause exists in a complex web of relationships and dependencies!



- No natural-hazard event clause is free from 'blurring' and interpretative latitude in the cumulative damage case.
- Specification of the cover intention, however, facilitates/permits interpretation of what was intended when the contract was concluded.
- Each clause wording must meet the requirements of clarity and practicability.
- Without knowledge of the 'NatCat event' in the sense of the model used, there is a risk that the XL will be incorrectly sized and misinterpreted in terms of priority and liability.
- If damage in passive reinsurance can not be attributed to a natural-hazard-based event with sufficient precision, then the step from pure 'hourly events' to stop-loss coverage is very small.

Lecture by Sebastian Hoos at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

Critical Analysis of the Practical Application of the Definition of an Event

1. Introduction

I would like to begin by briefly introducing myself in a few keywords. In 2013, I successfully completed the course of study in Insurance at the Cologne University of Applied Sciences with a Master's degree and a concentration on reinsurance and accounting. During my studies, I worked with Prof. Materne as a member of academic staff. In September 2013, I entered the career world as an assistant to the CEO of Deutsche Rück, Dr. Junke. Since the beginning of 2016, I have been working as a market specialist for the Property/ Casualty treaty business at Deutsche Rück.

It is my pleasure to offer you a brief outline of my project work today in the short amount of time available – and, of course, to respond to your suggestions and questions. We examined the practical application of the definition of an 'event' against a backdrop in which this topic is subject to constant critical discussion in the reinsurance market. In a first step, we asked why the topic has recurrently occupied the market in recent years. This involves the fact that the reinsurance case is not always clearly and unambiguously defined in the underlying reinsurance agreements. This can lead to problems of delimitation. Let us take a look at the common types of agreement for reinsurance of natural hazards.

- Under a storm/natural-hazard insurance ratio, a reinsurer shares a percentage of every claim. In other words, it follows the original trend on a 1:1 basis, so that there are no issues of demarcation involved under this type of contract (simply put, considered in isolation from any event limits in the agreement).
- Under stop-loss, the reinsurer bears liability as soon as the total loss burden from cat events exceeds a specified trigger point in the course of a year. This, too, then, involves a non-controversial mode of action.
- NatCat-XL (also known as XL-per-event or excess-of-loss per event) applies where one and the same event concerns multiple risks at the same

time. Of central importance in the case of Cat-XL, then, is how the event or the case of cumulative loss is defined.

As the market has often shown, the assignor and the reinsurer do not always have the same understanding of which individual claims may be aggregated on the basis of a particular event.

2. **Malfunction**

This can lead to malfunctioning in cover and, concomitant with this, a need for coordination between the two parties. There are two characteristics to this malfunction:

The 1st characteristic concerns priority. To our knowledge, in case of doubt, this level is the most discussed form. This means that the assignor is interested in assigning as many individual losses as possible to a particular event in order to exceed the priority and obtain relief from the reinsurer.

The 2nd characteristic concerns exceeding the ceiling. To our knowledge, this issue has been discussed far less frequently on the market, even though exceeding the ceiling is considerably more substantial in material terms. When the River Elbe flooded in 2002, for instance, it is known that a major German primary insurer had significantly underestimated its exposure and thus ‘imaginatively’ interpreted the flood of the Elbe as 2 events in order to tap the limits twice.

3. **Test criteria**

Against this backdrop, in the project, we tested the standard clauses based on 2 criteria:

1. **Clarity**

- Does the wording reflect the understanding of both parties to the agreement?
- Is the original cover intention of the XL sufficiently clear or guaranteed?
- Are the chosen ‘scientific terms’ unambiguous?

- Are there precedents for a particular interpretation of the clause, e.g. through past settlement practice?

2. **Practicability**

- Even if scientific events are phrased in perfectly clear language, this does not help if the clause is not applicable as a practical matter.
- In other words, are assignors' conventional IT systems also capable of mapping the clause?
- Theoretically, at least, every event as well as every claim has a temporal and spatial signature, that must be 'distinguished' in tandem with one another.
- This means that the location, the time and the cause of the damage must be geocoded and unequivocally ascribed to a geological event.

4. **Case examples**

Enough of the theoretical basics for now. Let us demonstrate the instances of doubt based on some examples.

Sample case: Andreas, 27-28 July 2013

This is a typical summer storm event in which extremely humid, hot summer air abruptly cools. This leads to a large number of local thunderstorms and hail. In late July 2013, another heat wave occurred in Central Europe as a result of advancing subtropical hot air. The highest temperature was measured at 40.2°C in Karlsruhe on 27 July (IMK weather station). On 26 July, an intense thunderstorm system formed over France in connection with the fronts of the ANDREAS low-pressure area; on 27 July, the system reached Belgium and, later, western and northern Germany. Over a swath extending from Gütersloh and through Bielefeld, Hameln, Hanover, Peine, Gifhorn, Wolfsburg, Helmstedt and in the Altmark, a supercell on the south-eastern edge of this system dropped locally extremely large hail, with hailstones 5 to 12 cm in diameter (Sehnde, south-east of Hanover). The front system associated with ANDREAS advanced slowly; on 28 July, another line of thunderstorms formed, this

time over the Rhine rift valley. As it moved eastwards, and especially in the region around Reutlingen and Tübingen, a supercell of this system – one day later and in a completely different region – dropped extremely large hailstones up to 10 cm in diameter.

Now, inevitably, the question arises as to how many events occurred within the meaning of the reinsurance agreement. Let us look at the terms used in common definitions of loss events. Often, although not always, the language used is identical to the wording used in the case of a storm. For example:

- Storm/hail damage originating from the same atmospheric disturbance
- A (storm/hail) event in the meteorological sense
- All individual losses incurred during a contiguous period of 72 hours

Also possible if there is a separate definition of hail:

- ‘A temporally and spatially delimitable hailstorm’

Now let us examine the wording based on our test criteria:

1. „Eine atmosphärische Störung“ oder „Ereignis im meteorologischen Sinne“		
Klarheit	Praktikabilität	
	naturwissenschaftliche Dimension	schadenseitige Dimension
<ul style="list-style-type: none"> • Kein naturwissenschaftlicher Begriff, mögliche naturwissenschaftliche Interpretation als ein Tiefdruckgebiet (TDG) oder eine Großwetterlage (GWL) oder eine (Hagel-) Gewitterzelle oder ein Tornado. • Keine naheliegende naturwissenschaftliche Interpretation gegeben → eher unklar, d. h. klauselintegrierende Erläuterung sinnvoll. 	<ul style="list-style-type: none"> • TDG oder GWL können (in Deutschland) hinreichend genau zeitlich und räumlich eingegrenzt werden (z. B. durch DWD Angabe Beginn- und Ende-Tage über Deutschland). • (Hagel-) Gewitterzelle oder Tornado sind räumlich – wegen sehr kleinräumiger Skala – nur schwierig eingrenzbar; letztlich sind sie aber – aufgrund der „Bodenwirkung“ – gut feststellbar. 	<ul style="list-style-type: none"> • Bei TDG oder GWL: eher „großflächige“ Ausbreitung → eher einfache Zuordnung der Schäden zum Ereignis, im Zweifelsfall durch Abfrage nach Schadentag. • Bei (Hagel-) Gewitterzelle oder Tornado: eher „kleinflächige“ Ausbreitung → eher schwierige Zuordnung der Schäden zum Ereignis, da Schadenort und meteorologische Ereignisfläche miteinander verschnitten werden müssen.

What does this mean: An atmospheric disturbance, or an event in the meteorological sense? This is not a clear scientific term! Thus, the wording is unclear! The following interpretations are possible and can also lead to a different impact of XL. We have a large number of small-area thunderstorm cells in different locations along a large-scale storm front:

- if I interpret an atmospheric disturbance as TDG or large-scale weather pattern, then it is 1 event.
- If I interpret the atmospheric disturbance as a hailstorm cell, then we are dealing with 2 events.

It is now possible to determine whether there may possibly be a precedent from settlement practice in the past that would simplify the interpretation. Or does the cover intention of the agreement specify a possible interpretation:

- In the present case, this is more of a comprehensive-cover portfolio, and the structure of the XL is more likely to be for frequency cover, with a priority in the low % range of the underlying premium. This would tend to support the interpretation of 2 events.
- Or is the XL set up more for a building-based portfolio, one designed to protect against major events (winter storms) with a comparatively higher priority and a longer ceiling? Often, the xy-year 'winter storm' loss (of the property portfolio) forms the benchmark. In the present case, this would tend to favour condensing the two hailstorms into a single event.

2. „Ein zeitlich und räumlich abgrenzbarer Hagelschlag“		
Klarheit	Praktikabilität	
	naturwissenschaftliche Dimension	schadenseitige Dimension
<ul style="list-style-type: none"> • Hagelschlag“ ist kein definierter Begriff, eine mögliche Interpretation wäre Hagelschlag = Hagelzug = Hagelgewitterzelle • Naheliegende Interpretation ist Hagelgewitterzelle → eher unklar, d. h. klauselintegrierende Erläuterung sinnvoll. 	(Hagel-) Gewitterzellen sind räumlich – wegen sehr kleinräumiger Skala – nur schwierig eingrenzbar; letztlich sind sie aber – aufgrund der „Bodenwirkung“ – gut feststellbar.	Eher „kleinflächige“ Ausbreitung → eher schwierige Zuordnung der Schäden zum Ereignis, da Schadenort und meteorologische Ereignisfläche miteinander verschnitten werden müssen.

Agreed: let us say that, in the present case, the wording 'temporally and spatially delimitable hailstorm' has been clearly articulated and that the sample case consists of two events.

The next question thus asks whether the wording of the clauses is sufficiently practicable. The assignor is now required to aggregate damage on a regionalised basis. In the case of 'large-scale' natural-hazard events (winter storms, for instance),

this is relatively easy to do. Here, it usually suffices to query the date of loss from the system. In the case of hail, as a relatively small-area event, the area affected by the meteorological event must be assigned as well! This means that the polygon of the hailstorm must be blended with the geocoded locations of the damage on the date of the hailstorm. Let's say the hailstorm crossed over East Westphalia from 3:09 p.m. until 5:44 p.m. Now, using geocoded data, I need to map my loss data to that precise time and the affected region. This is more easily conceivable in the case of buildings. But what about mobile units (cars)? We all have a certain image of an insurance field service. In case of doubt, what the field agent will write in the notice of claim as to when the dented car belonging to one of his or her best customers was in a particular location is obvious. I deliberately exaggerate the scenario to highlight the problem involved. A 100% correct attribution of a loss to an event is virtually impossible.

3. „Alle Einzelschäden, die während einer zusammenhängenden Periode von 72 Stunden entstanden sind“

Klarheit	Praktikabilität	
	naturwissenschaftliche Dimension	schadenseitige Dimension
<ul style="list-style-type: none"> • Abgestellt wird ausschließlich auf Zeitraum. • Absolut klare Beschreibung, welche Einzelschäden zu einem Schadenereignis zusammenzufassen sind! 	Lediglich Bezug auf Gefahr, daher unproblematisch bzw. nicht vorhanden.	Ausschließlich Zuordnung zu Zeitraum → einfache Zuordnung der Schäden zum Ereignis, da keine Verschneidung von Schadenort und meteorologischer Ereignisfläche nötig ist.

The definition specifying 'all individual losses incurred during a contiguous period of 72 hours' is clear and hardly poses any problems in terms of attributions of damage.

Sample case: flooding

In the case of the hazard of flooding, the issue of delimitation is a bit more pronounced than I can deal with in view of the time available here. The different characteristic forms of flooding alone call for certain kinds of interpretations and specifications. Floods essentially differ in form between rather large river flooding, on the one hand, and local, storm-induced flooding as a result of backflow or heavy rainfall. It is also necessary to question what the triggering moment is. In other words, when does an event begin? With the preparatory rain of TDG A, or rather with the triggering rain of TDG B? Moreover, the wording of clauses for flooding is often quite unclear.

2. „ Ein örtlich zusammenhängendes Überflutungsgebiet“		
Klarheit	Praktikabilität	
	naturwissenschaftliche Dimension	schadenseitige Dimension
<ul style="list-style-type: none"> • Allgemein „verständliche“ Regelung → eigentlich gute Klarheit, aber Begriff des „örtlichen Zusammenhangs“ nicht eindeutig definiert. • Soweit nicht kleinste Unterbrechungen neues Überflutungsgebiet begründen sollen, ist klauselintegrierende Erläuterung sinnvoll. 	Zeitliche und räumliche Eingrenzung hydrologisch möglich.	Örtlich zusammenhängende Überflutungsgebiete sind – bei „wortgenauer“ Anwendung – identifizierbar.

The term ‘contiguous flood area’ calls for a ‘clear’ spatial context. Do interruptions in a flooding area automatically establish a new area of flooding?

3. „ Ein und dasselbe Hochwasser, in einem oder mehreren Gewässern innerhalb eines Einzugsgebietes eines Hauptgewässers einschließlich aller seiner Nebengewässer“		
Klarheit	Praktikabilität	
	naturwissenschaftliche Dimension	schadenseitige Dimension
<ul style="list-style-type: none"> • Was genau als Hauptgewässer zu verstehen ist, ist unklar; sind die großen Flüsse (Elbe, Weser, Oder, Donau, Ems, Rhein, etc.) nicht betroffen, gibt es je nach betrachteter räumlicher Skala viele Interpretationsmöglichkeiten. • Keine naheliegende Interpretation (z. B. klare Benennung der Hauptgewässer) gegeben → eher unklar, d. h. klauselintegrierende Erläuterung sinnvoll. 	Zeitliche und räumliche Eingrenzung hydrologisch möglich.	Eher „großflächige“ Ausbreitung → bei Definition der großen Flüsse (Elbe, Weser, Oder, Donau, Ems, Rhein, etc.) als „Hauptgewässer“ gute Eingrenzung möglich.

5. Conclusion

The cases presented here clearly show why interpretation of the term 'event' is a topic for recurrent discussion on the reinsurance market.

1. The wording used thus presents wide interpretative latitude.
2. Some clauses do not match up with the assignors' claims systems.
3. In some cases, the desired relief to reinsurers failed to materialise, despite the 'clear' clauses used.

Without knowledge of the 'event' in the sense of the model used, there is a risk that the XL will be incorrectly sized and misinterpreted in terms of priority and liability. Deriving from this is the inevitable question as to what alternatives exist, and what motivation speaks in favour of choosing a certain clause. This becomes clearest if you first consider the possible extreme forms.

1) 'Genuine' scientific definition of an event

A natural-hazard event is 100% responsible for defining the loss event that itself most closely corresponds to the purpose of cumulative XL cover and is thus the most appropriate. To the best of my knowledge, this is virtually non-existent in the market, probably due to a lack of practicability. Particularly noteworthy in this connection are the issues described with regard to delimiting localised events that occur simultaneously, and the difficulty of circumscribing areas of flooding.

3) Exclusive reliance on period rules

The other extreme consists of 'pure' time rules, e.g. taking the form: 'All insured losses caused by the elements and occurring within a xxx-hour period'. Then we have a factual hourly or daily stop-loss that creates clarity for all contracting parties and is practicable as well. This approach represents a departure from the notion of the source of the loss, however. In particular, it is necessary to examine how period rules fit with estimates of exposure in the individual models.

2) Mixed form:

Thus, in practice, one tends to encounter mixed forms of 1 and 3, some of which tend more in one or the other direction. In other words, there is an overarching definition of

the event, regardless of how clear that definition may be. This is often followed by specifications per individual hazard in conjunction with a (fixed or maximally interpretable) period of time.

6. In closing

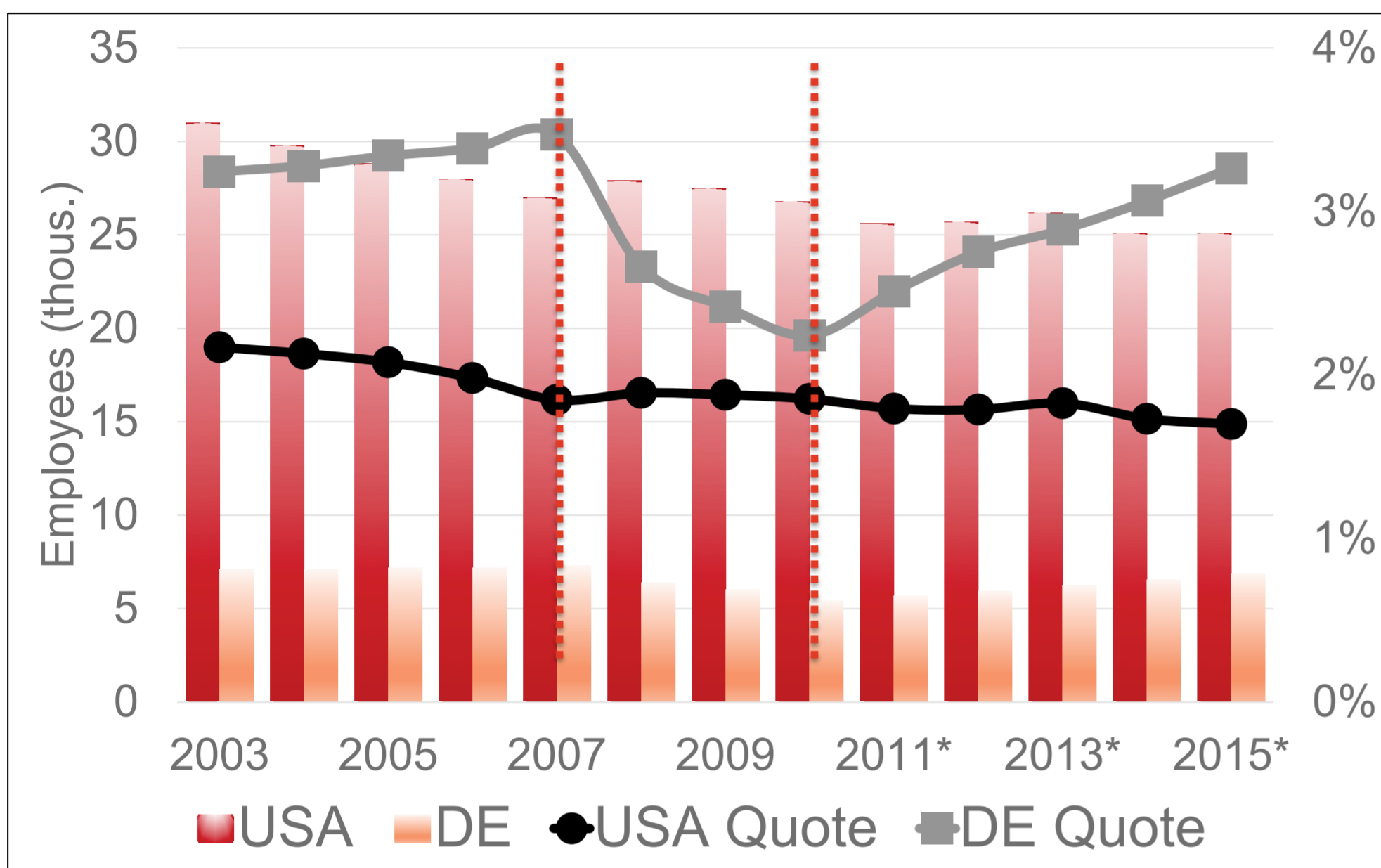
Finally, I would like to point out that the topic of this project was not about legal hair-splitting. Instead, the purpose of the project was to help identify the various dependencies, correlations and associated instances of doubt (in some cases deliberately exaggerated) that can and do arise. The results of the project can serve as a basis for a critical examination of clauses individual to assignors, to permit needed adaptations and the greatest possible consensus between contracting parties prior to the loss event. On the other hand, it is also conceivable that some clauses have deliberately been formulated in vague terms in order to permit a certain margin of interpretation where necessary.

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Employees in the Reinsurance Industry: Germany and the USA

Fabian Lassen, B.A.

Employees in the reinsurance industry



DE (2015)	USA (2015)
Approx. 7,000	Approx. 25,000
Tendency slightly rising	Stagnant

Possible reasons for this development

- Financial crisis from 2007?
- Why DE, not USA?
- Jobs added by EVr, then job cuts?
- Jobs cut by RVr, then added?
- Additional reasons?

Number of insurance employees in Germany 2007 – 2015 (thous.)

DE	2007	2010	2015
EVr	203.1	235.4	204.2
RVr	7.3	5.4	6.9

*DE determined by extrapolation

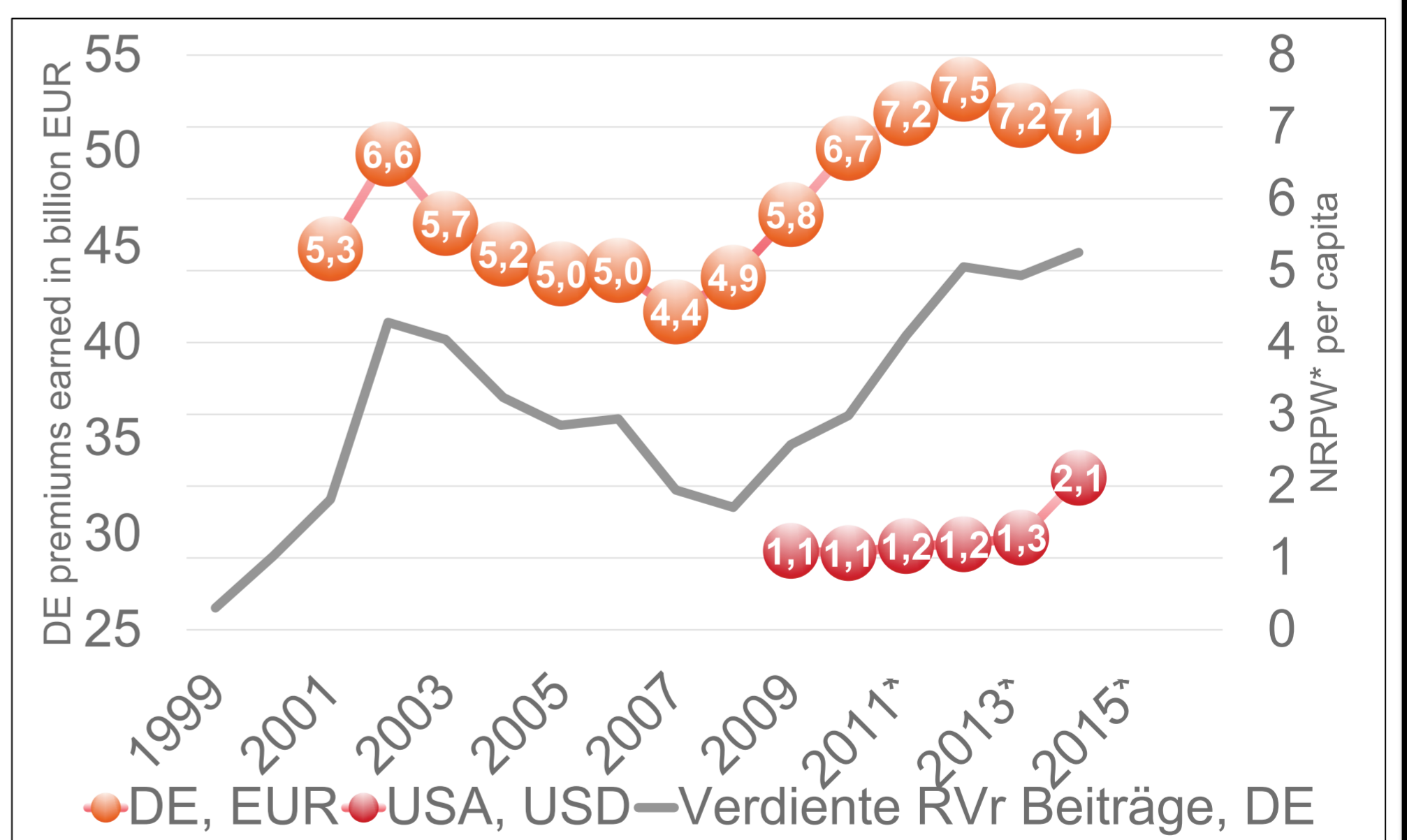
Source: GDV, iii

The ratio represents the share of employees in reinsurance relative to the total number of employees in the insurance industry of the respective country.

Net reinsurance premium written per capita

Possible reasons for the difference

- More proportional reinsurance in D Less optional reinsurance in D



*Net Reinsurance Premium Written

Source: GDV, iii

Net reinsurance premium written per capita

Year	MR	SR	HR
2012	3.04	2.04	6.18
2013	3.17	2.19	6.76
2014	3.13	2.49	6.75
2015	2.59	2.48	5.54

Source: Standard & Poor's, Global Reinsurance Highlights 2013-2016

Additional ideas for the investigation

- Comparison of cost ratios
- Reinsurers with strong travel activity vs. reinsurers with numerous TGs/NLs
- Profitability of Sind RVr with only one location vs. RVr numerous locations
- Efficiency of local NLs in case of obligatory capitalisation (e.g. Germany, China, etc.)

Lecture by Fabian Lassen at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

'Employees in the Reinsurance Industry: A Comparison between Germany and the USA'

People in the reinsurance sector, often bump into one another unexpectedly. One reason for this is the low number of employees in the reinsurance industry. With only around 7,000 employees throughout Germany, the likelihood of running into one another is higher than in other sectors. This information forms the basis of the work presented here, which is currently still in the developmental stage and can therefore be advanced by practical ideas.

The work is divided into three parts. The first part compares the two countries, Germany and the USA, with regard to the number of employees in the reinsurance field and examines the trends. The second part then proceeds to compare the net per-capita reinsurance premium volume of the two countries. With this in mind, the reinsurers Munich Re, Swiss Re and Hannover Re are presented. In the last part, ideas for the further research are identified and will be discussed afterwards.

In addition to a presentation of the absolute number of employees in Germany and the USA, these figures were also associated with the total number of employees in the insurance industry of the respective country. The rate calculated for the USA was consistently around 2%. In Germany, by contrast, it stood at about 3%. The German curve in particular is very interesting to consider, as it exhibits greater deflections. These can be divided into three phases. In the first phase, from 2003 to 2007, the rate rose slightly. From 2007, the rate fell before rising again from 2010. A reason for this development could be seen in the financial crisis in 2007. However, the question then arises as to why the crisis had a greater influence in Germany than in the USA. If the figures from which the quota for Germany is derived are considered, it can be stated that, in the first period from 2007 to 2010, primary insurers added positions while reinsurers eliminated them. From 2010, the trend was the exact opposite. This helps explain the resulting curve, but not the reasons underlying it.

The second part addresses the net reinsurance premium per capita in the two countries. In this case, however, the charts are not quite comparable, as the German fig-

ures are shown in euros and the US figures in US dollars. Nonetheless, a tendency can be recognized here which shows that reinsurance premiums written per capita in Germany exceed those in the USA. The difference could be due to the fact that, in Germany, perhaps more proportional reinsurance and less optional reinsurance is drawn up. And that, as a result, more of the business conducted is not as personnel-heavy. At this stage, however, this can only be considered as a presumption.

The next step is to move away from the country perspective and towards a comparison of reinsurers. Munich and Swiss Re as well as Hannover Re are compared with one another. Here we see that Hannover Re writes significantly more business per capita when compared with its competitors. One reason for this might be that both Munich Re and Swiss Re view themselves as service reinsurers and thus require more employees in the area of research and development than Hannover Re does. The slump in the net reinsurance premium written per capita from 2014 to 2015 at Munich Re and Hannover Re can be explained by fluctuations in exchange rate.

This comparison of companies gave rise to ideas for further investigation:

- Comparison between reinsurers with pronounced travel activity and reinsurers with numerous subsidiaries and branches
- Profitability of reinsurers with just one location versus that of reinsurers with numerous locations
- Efficiency of local branches in cases of compulsory capitalisation

This brings me to the end of my remarks; I would be very happy if it led to a stimulating discussion or feedback; thank you for your attention.

Suggestions by participants:

- The collapse in the number of employees in reinsurance in Germany in 2007 could be due to the takeover of Frankona Rückversicherungs-AG by Swiss Re.
- In lieu of net reinsurance premium written, a comparison could also be conducted between gross reinsurance premium and the reinsurers' EBITDA.
- The differences in the reinsurance markets of the USA and Germany could be pointed out, such as the larger number of smaller reinsurers and the greater market dynamics due to the larger brokerage power.

- It would be interesting to add another country, the UK in particular, as there are also many smaller players here.
- As a recommendation for further investigation, it is expedient to pay attention to which employees are included in the statistics.

Fabian Lassen, Bachelor of Arts, is a member of academic staff at the Cologne Research Centre for Reinsurance (Director Prof. Stefan Materne)

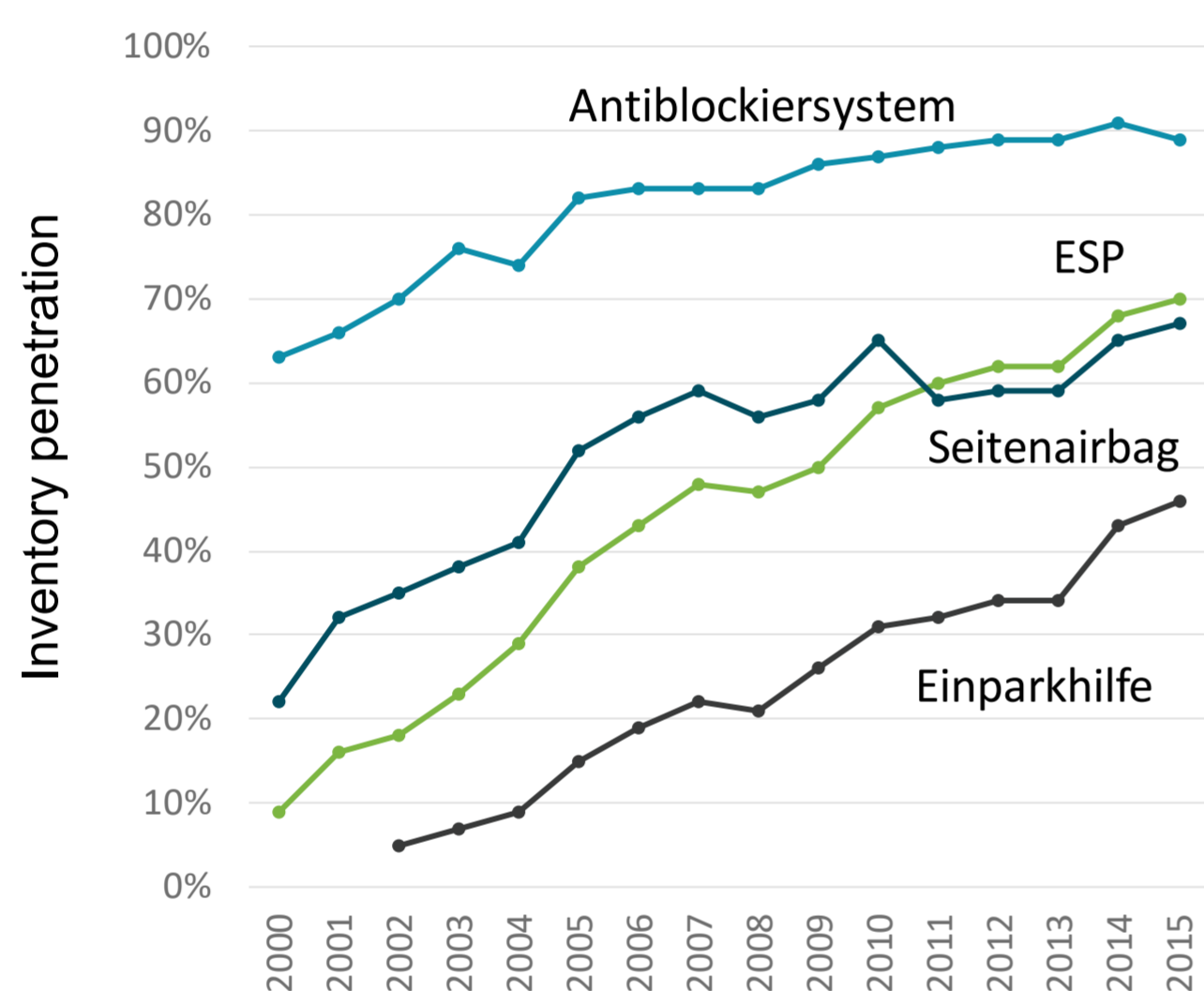
10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Autonomous Driving: Evolution or Revolution?

Kai-Olaf Knocks, M.A., FCII

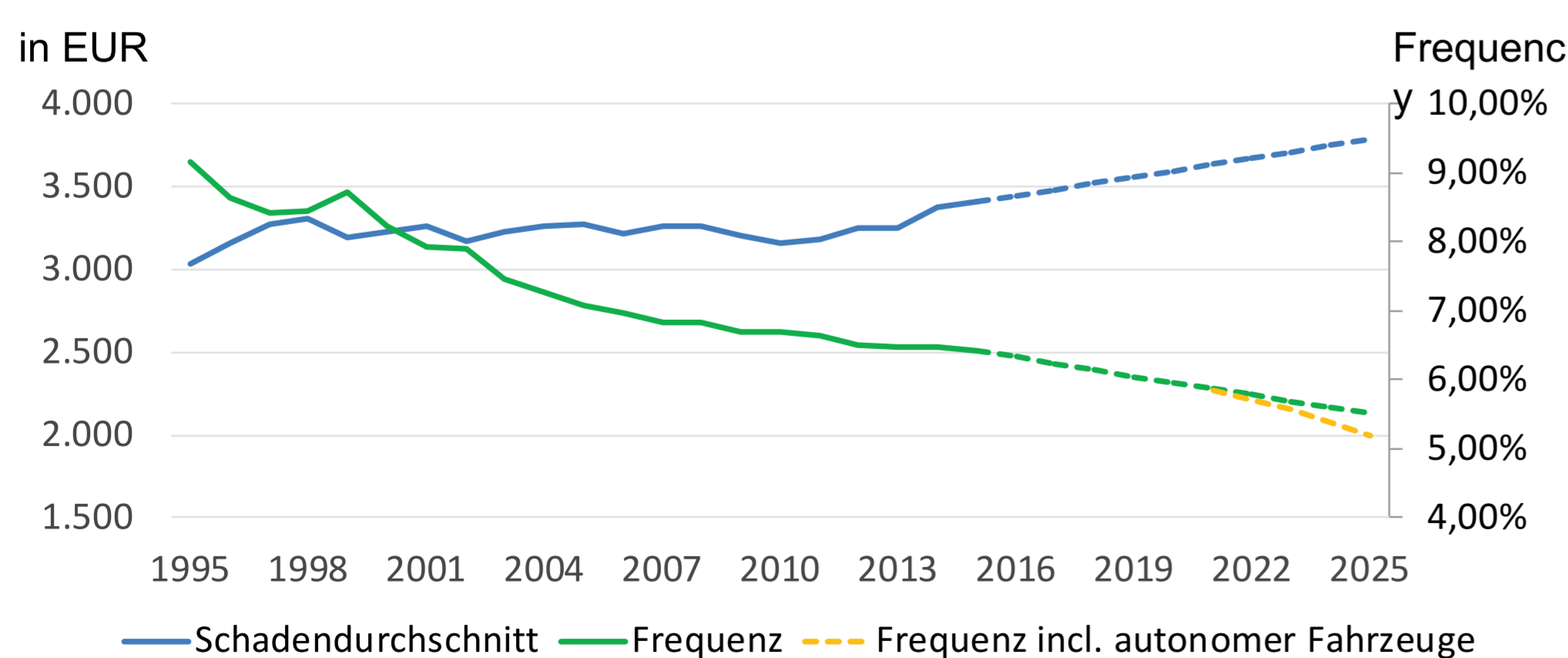
Importance of the motor-vehicle market

- Motor vehicles constitute the largest segment in German non-life/accident insurance (EUR 25.9 bn in 2016)
- considerable significance for reinsurance
- Will autonomous driving soon render motor-vehicle insurance obsolete?



Assumed impact on claims requirements:

- **Average loss** plus 1% p.a. due to
 - 1) increasing costs for personal injury
 - 2) inflation + rising material costs due to an increase in additional technology
- **Claims frequency** has been falling steadily since 1999 – autonomous driving will significantly strengthen this trend over the medium term



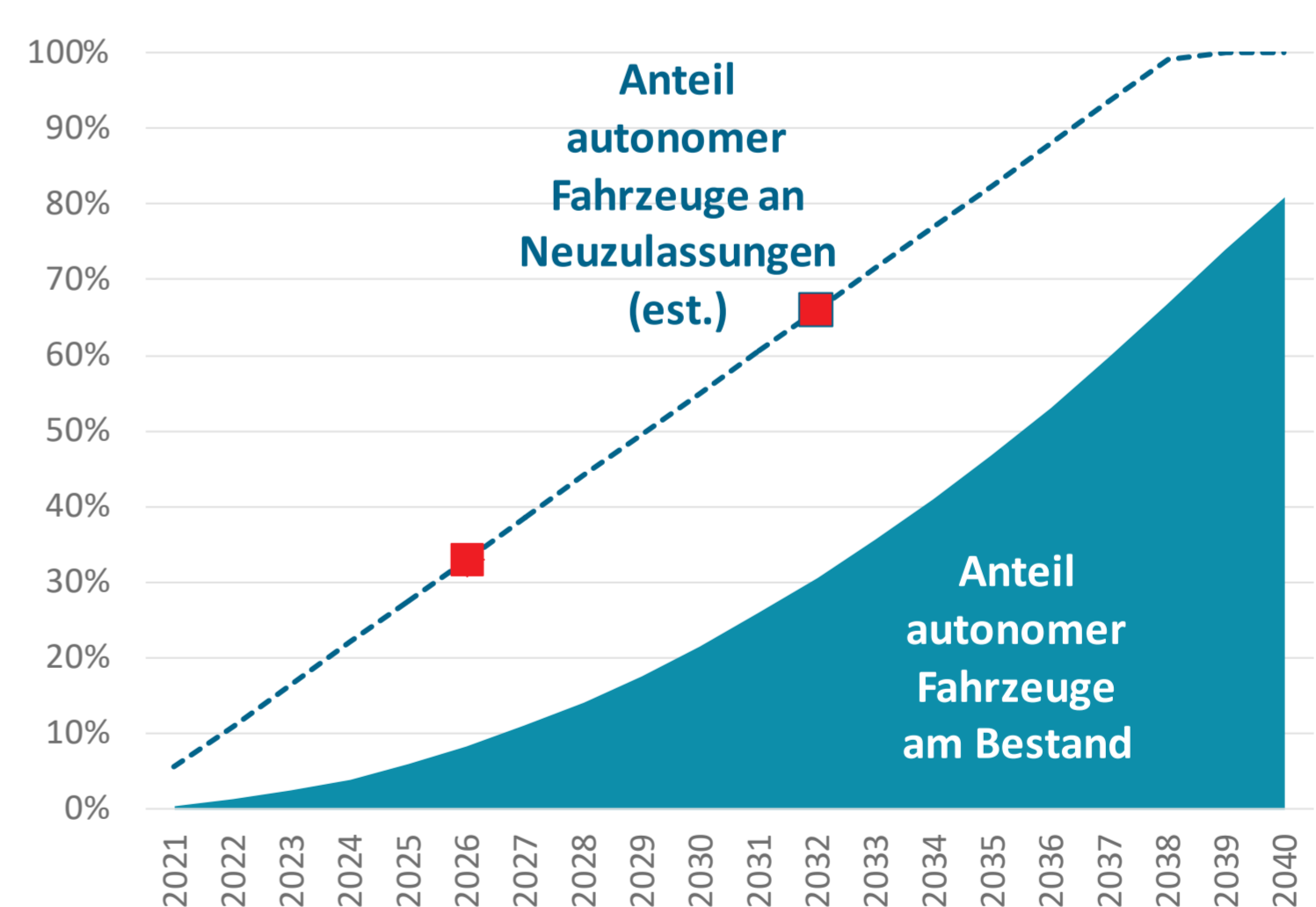
These two assumptions result in a reduction in claims requirements in KH of about 10% by the year 2025

The smartphone revolution



Is the smartphone revolution transferable to autonomous driving?

- Significantly higher acquisition costs
- Necessary infrastructure
- Legal framework conditions
- Soft facts: 'My car is my castle'
- Constantly increasing average age of cars



Additional challenges / risks:

- cyber as a new (cumulative) risk
- autonomous vs. non-autonomous vehicles
- Interaction of KH and product liability
- Hull cover: Further increase in the encumbrance due to natural hazards
- Falling premium volume – rising volatility

Lecture by Kai-Olaf Knocks at the Annual Meeting of the Sponsoring Group Reinsurance on 7 July 2017

‘Autonomous Driving: Evolution or Revolution of the Motor-Vehicle (Re-)Insurance Market?’

Importance of the motor-vehicle market

Motor-vehicle insurance remains the largest segment in German non-life/accidence insurance, with a premium volume of EUR 25.9 billion in 2016. Due not only to the volume but also the high coverage amounts of up to EUR 100 m – with a small slice of the portfolio even offering unlimited coverage amounts – the motor-vehicle line also has major importance for the reinsurance sector.

However, an increasing number of voices in the market are predicting the imminent end of motor-vehicle insurance. Studies show that nearly 90% of all accidents are the result of human error. Autonomous driving could thus lead to a considerable reduction in the frequency of claims. The significant decline in claims payments would also lead to a collapse in premium volume for this segment.

The speed of the transformation

But how quickly can such a development take place? The so-called ‘smartphone revolution’ is often cited as an example of a rapid, disruptive market development brought on by technological progress. Ten years ago, Apple introduced its first iPhone to the market and revolutionised the entire mobile-telephony industry. Many market players – and the market leader at the time in particular – were essentially overwhelmed by technological progress. But does this development also actually apply to the market for motor-vehicle insurance? There are several significant differences between a smartphone and a motor vehicle that actually do emerge upon closer inspection. The differences begin with the considerably higher acquisition costs of a car. Moreover, a great deal of investment in across-the-board autonomous driving will still be required to ensure networking of vehicles with each other. Added to this are the necessary changes in legal framework conditions. First legislation in this connection was passed in early May of this year. However, the new law requires drivers to retain capability of taking control of the vehicle. So what the law permits is not autonomous but rather automated driving, and initially for a limited period of two years. ‘Soft facts’ can also play a role in this regard. Many car owners like to drive themselves and do not want to (completely) surrender

control. Likely the most important reason, however, is the ever-increasing average age of cars, which is currently at around 9.3 years, and this significantly exceeds the service life of a mobile phone.

That the period of transformation in the motor-vehicle market will be considerably longer is suggested when one considers new technologies and their spread in vehicle stock. Taking the evolution of ESP as an example, it turns out that the current inventory penetration of 70% has been some 20 years in coming. There are currently around 45 million cars in Germany, while the number of new vehicles is holding relatively steady at around 3 million per year. These data can be used to extrapolate a possible scenario for the penetration of autonomous vehicles. The most recent current estimate by a major German car manufacturer comes from BMW and forecasts a capability for series production of self-driving vehicles by 2021. The scenario analysis also requires an assumption about the share of autonomous vehicles among all new vehicles. The point of departure assumed in the present sample calculation was 5% in 2021. This share increases on a linear basis in the years that follow, to 1/3 after five years and 2/3 after ten years. After 15 years, it is assumed that a 100% share of vehicles will be self-driving. Based on these assumptions, the share of autonomous vehicles among all vehicles can be expected to stand at approx. 20% in the year 2030. Even under an extreme scenario – with every new vehicle sold self-driving from 2021 – it would take until 2035 to penetrate the entire stock of motor vehicles.

The impact that these trends will have on insurance claims requirements needs to be presented on the basis of the original scenario calculation. The assumption made here is an annual increase of plus one percent in average claims. This trend has been observable in recent years and can be attributed to increasing costs of personal injury and to rising material costs due to the rise in additional technology (sensors, for example). By contrast, the frequency of claims has fallen steadily since 1999. Autonomous driving will significantly increase this trend in the medium term. As already pointed out, according to a study by TU Berlin, 86% of all traffic accidents are the result of human error. The scenario calculation optimistically assumes that the successive yet slowly increasing proportion of autonomous vehicles on the roads will lead to 90% fewer accidents. These assumptions about average claim and frequency of claims would thus lead to a reduction of approx. 10% in the claims requirement for motor-vehicle liability insurance by 2025.

Additional challenges/risks:

What the scenario described above fails to consider, however, are the effects of additional new risks. Above all, cyber risk will also inevitably be introduced as a result of increasing networking of vehicles in the motor-vehicle sector. It also remains to be seen how the autonomous vehicles will interact with what in some cases are irrational-behaving, non-autonomous vehicles still on the road. Another major issue involves delimiting manufacturer and owner liability, and this will lead to a shift away from motor-vehicle liability and towards product liability insurance. In the area of hull insurance, the continuing increase in the burden of natural hazards will negatively impact claims requirements. Finally – and particularly from the perspective of reinsurers – the falling premium volume will lead to increasing volatility.

Conclusion

The mobility approach of our society is certain to change in the coming years. Where the motor-vehicle (re)insurance market is concerned, though, the development we can expect to see will be more evolutionary than revolutionary.¹

Points for discussion after the lecture

- To what extent does car-sharing affect the development of the car market?
- What might a development in hull insurance look like?
- Can autonomous driving actually reduce the frequency of claims so steeply?

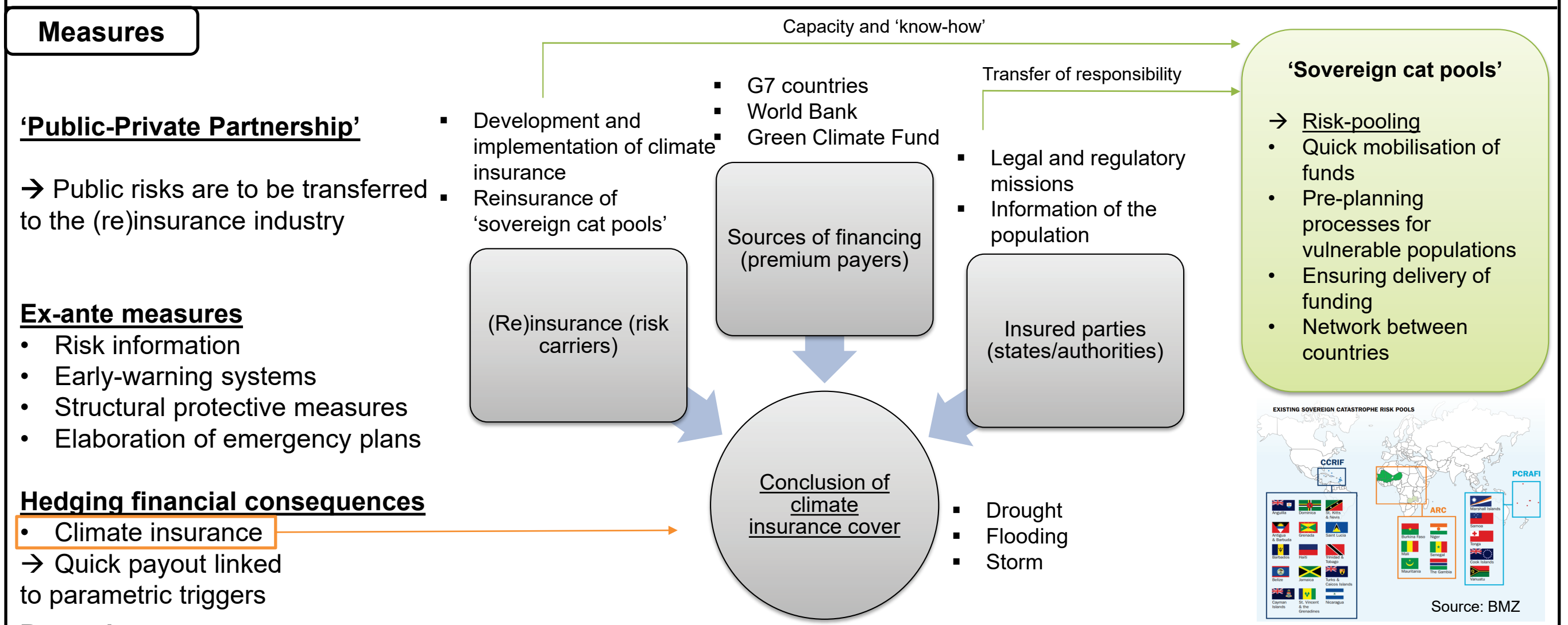
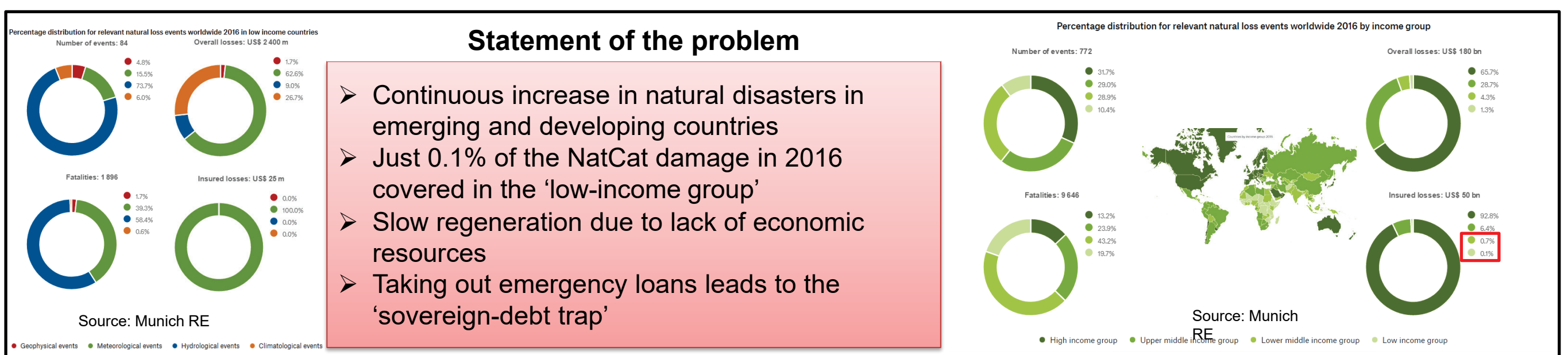
¹ GDV has since published a study that arrives at a similar conclusion: GDV-THEMENSCHWERPUNKT – Automatisiertes Fahren – Auswirkungen auf den Schadenaufwand bis 2035.

<http://www.gdv.de/wp-content/uploads/2017/06/gdv-studie-2017-automatisiertes-fahren-auswirkungen-auf-den-schadenaufwand-bis-2035.pdf>

10th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 7th July 2017

Public-Private Partnership
in Emerging and Developing Countries

Wolfgang Koch, B.A.



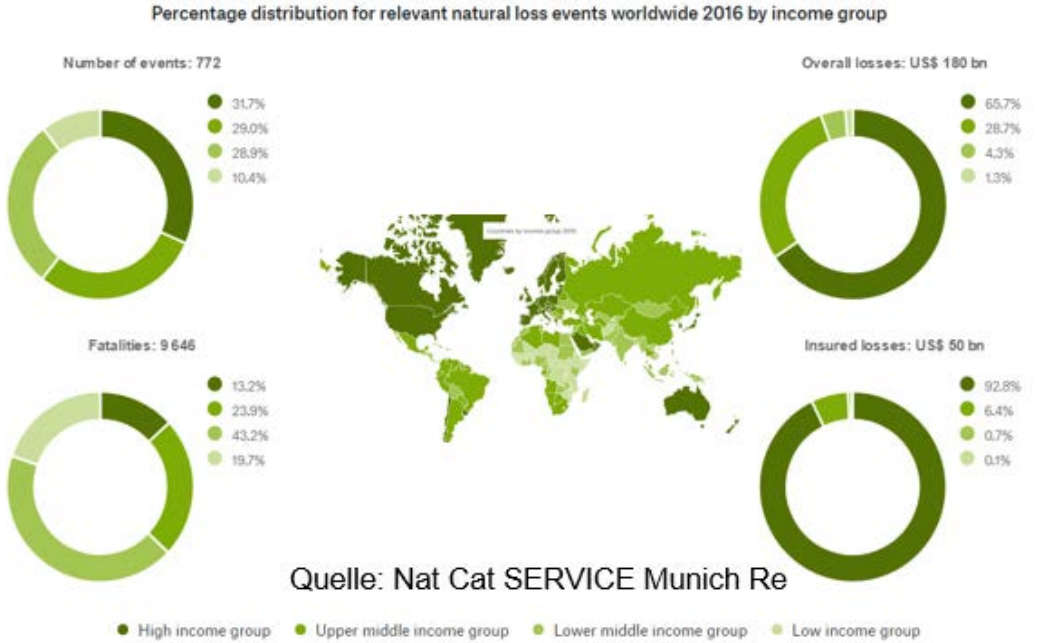
Threats	Opportunities	Successes
<p>Public:</p> <ul style="list-style-type: none"> Damage event occurs without exceeding the trigger point ('basic risk') Damage > insurance benefit Less flexibility compared to emergency loans <p>Reinsurance:</p> <ul style="list-style-type: none"> Danger of 'moral hazard' Conflict of goals between political goals and business goals Inability to pay the premium 	<p>Public:</p> <ul style="list-style-type: none"> Plannability of payments in the event of a disaster Creating 'resilience' in the event of crisis Way out of the 'sovereign-debt trap' Prevention leads to premium reduction <p>Reinsurance:</p> <ul style="list-style-type: none"> Development of a new business field Planning security with a long contract life Compulsory climate insurance possible in countries with a stable legal system 	<ul style="list-style-type: none"> Formation of sovereign cat pools advanced Moral hazard can be contained with the aid of ex-ante measures and deductibles Insurance premium has been paid each year to date Sovereign cat pools operate with the aid of reinsurers' capacity and expertise <p>With the support of reinsurers, an additional 400 million people in emerging and developing countries can be insured against natural disasters by 2020</p>

Lecture by Wolfgang Koch at the Annual Meeting of the Sponsoring Group Re-insurance on 7 July 2017

‘Public-Private Partnership: Support of Emerging and Developing Countries’

Insurance and developing countries? At the micro level, with per-capita income in developing countries averaging USD 2 a day, this constellation seems indeed difficult to imagine. At the macro level, cooperative efforts by states, financiers and insurance companies makes the formation of so-called ‘sovereign cat pools’ and ‘climate insurance’ possible – and even necessary!

Climate change and the natural disasters in which it results, extreme weather conditions and the creeping rise of water levels pose a major challenge for humanity. Global damage due to natural disasters, totalling USD 175 billion in 2016, primarily affects emerging and developing economies. The lack of ex-ante measures and risk information initially leads to relatively higher fatalities figures (1,900 deaths from 80 loss events in the ‘low-income group’) than in industrialised countries (1,273 deaths from 245 loss events in the ‘high-income group’). Aggravating this problem are the factors of the comparatively large insurance gap and the resultant, slower economic recovery. A mere 0.1% of the USD 50 billion in insured losses due to nature in 2016 were insured in the low-income group. Emerging and developing countries are particularly affected by hydrological and meteorological disasters.



What can be done to solve this problem? Initially, states, financiers and insurance companies can work together to take steps to address (structural) loss. Contingency plans can be drawn up and early-warning systems for risk information installed. (Re)insurers also assist these states through their collective expertise and best-practice measures.

In this context, successful 'sovereign cat pools' have already been created in many regions and include ARC, CCRIF or PCRAFI. Among other things, these entities pool risks around the ex-ante measures mentioned above. This gives participating countries a unified network through which they can conclude insurance protection. This includes rapid mobilisation of funds and pre-planning processes for the groups at risk. Brought about by political commitment, sovereign cat pools are responsible for implementing financing and emergency plans from the ex-ante phase in the event of a claim. Loss events are then covered by so-called 'climate insurance'. Well-known financiers of the climate insurance are, for example, the G7 countries, the World Bank and the Green Climate Fund.

For damage brought on by drought, storms or flooding, risk transfer is improved through sovereign cat pools, as risk diversification occurs across several countries with different risk profiles. By creating (less expensive) standard products based on the needs of the respective countries and structuring a portfolio of diversified country risks, Sovereign Cat Pools can offer significantly larger transactions that are attractive to international reinsurance and capital markets.

Insurance cover for premiums commensurate with risk also creates an incentive to actually implement the preventive measures mentioned a moment ago. This incentive is not created in advance by purely international aid such as food assistance. Lower risk translates into lower insurance premiums for states; this makes insurance cover affordable to emerging and developing economies as a result. Cat bonds offer a particularly advantageous climate-insurance solution for emerging and developing economies. By linking claims payments to parametric triggers and thus rapid availability of liquidity, sovereign debt does not increase in the wake of a disaster; this helps prevent suppression of growth in emerging and developing economies. This means there are no high opportunity costs for ex-post financing downstream (loans, donations, etc.). Traditional insurance solutions fail to achieve a benefit such as this. Furthermore, financing through cat bonds does not require direct state access to the capital market or the development of a local primary insurance market – a significant advantage for emerging and developing economies, as their access to the capital market is often limited.

Public-private partnerships are typically characterised by long-term, contractually secured planning security. Climate insurance has thus tapped a relatively new business area that, at least in hard market phases, can at least limit a shortage of reinsurance. The creation of sovereign cat pools can primarily cushion the impact of short-term, economic shocks in developing countries, creating resilience as a result. Formation of international, compulsory insurance solutions, however, cannot be expected in countries subject for the most part to unstable legal systems and low income levels. And where do the risks lie? To begin with, 'adverse selection' poses a risk for climate insurance. Insufficient information on the part of insurers thus leads to risks (e.g. territories) insured for the same price despite their qualitative differences. This inadequate information can be contained through extensive use of the collected experience and statistics on natural disasters. Adverse selection is also limited by premiums that are commensurate with risk and the associated incentive to implement risk-mitigating measures before a loss occurs.

Furthermore, use of parametric triggers largely limits all forms of 'moral hazard'. This applies in particular to external moral hazards (caused by damage to third parties during repair) as well as to the ex-post moral hazard (caused by the policyholder subsequent to the occurrence of loss). When the trigger is activated, reinsurers pay damages in the amount previously agreed in the contract. Accordingly, the benefit amount is not subject to manipulation by third parties after the occurrence of the loss and is independent of any extensive use on the policyholders' part. The ex-ante moral hazard (caused by policyholders prior to the loss) may also be limited by the effect of the risk-adequate premium, which creates incentives for policyholders to implement preventive measures.

For the public, however, the baseline risk and the risk of underinsurance remain. If a parametric index is used as a trigger, baseline risk is at least lower than with a purely parametric trigger, but it cannot be completely ruled out.

The confidentiality of privatisation contracts makes it difficult to make statements about the profitability to date of the public private partnership; to date, however, it has been possible (in terms of ARC), without exception, to pay insurance premiums through the support of the financiers. Worldwide reinsurance cover of ARC has a capacity of USD 55 million.

In summary, it can be said that emerging and developing economies do not have the resilience required to bear the consequences of natural disaster fully and independently through ex-post funding. Through their structure, the sovereign cat pools described create necessary incentives with which to implement preventive measures and give the states in the insurance pool the possibility to offer diversified country risks for significantly larger transactions as a means of providing the countries with insurance cover. This helps develop an independent resilience against the economic 'shocks' caused by natural disasters on the part of states within the pool. Resort to subsequent financing should be had only in the event of emergency and underinsurance.

Public-private partnerships present states and (re)insurance companies alike with a multitude of opportunities. Shortly after the conclusion of climate insurance and the founding of ARC, the first loss event (drought) was already settled in 2015. 1.3 million people in Niger, Mauritania and Senegal received insurance benefits totalling USD 26 million. As a result, some 500,000 head of livestock were rescued. All in all, between now and 2020 ARC is set to insure fully 150 million people against climate risks. The aim of the entire climate-insurance initiative ('InsuResilience') is to increase the number of people insured against climate risks in developing economies from around 100 million in 2015 to 400 million by 2020; this target is expected to be achieved.

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