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Proceedings of the Researchers' Corner for the 12th Annual Meeting of the Sponsoring Group Reinsurance 2019

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und Rechtswissenschaften

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Foreword

The 12th Annual Meeting of the Sponsoring Group Reinsurance [Förderkreis Rückversicherung] was held 5th July 2019 in Niederkassel, near Cologne. Some 80 representatives of the (re)insurance companies involved in the Sponsoring Group took part in the meeting, along with guests. Offered for the fifth time as part of the Annual Meeting, the Researchers' Corner gave eight members of academic staff at the Cologne Research Centre for Reinsurance an opportunity to deliver a presentation on their respective current research projects.

In three sessions – each featuring 2-3 parallel lectures with posters – the most important results of the scientific studies by the Cologne Research Centre for Reinsurance were presented and discussed. The heterogeneity of the topics presented by academic staff reflects the dovetailing of Cologne Research Centre with reinsurance practice.

Session 1

- a) Manuel Dietmann (M.Sc.): The increasing importance of the risk-management function in insurance companies
- b) Robert Joniec (M.Sc., FCII, cand. PhD): How is the reinsurance cycle doing?
- c) Wolfgang Koch (M.Sc., FCII): Information asymmetries between reinsurance brokers and assignors

Session 2

- a) Jörg Dirks (M.Sc., FCII): Unmanned aircraft – Evolution of the market for aviation (re-)insurance
- b) Fabian Lassen (M.Sc., FCII): Reducing volatility through use of an insurance swap
- c) Fabian Pütz (M.Sc., cand. PhD): Transferring cat risks from emerging markets from a macroeconomic perspective

Session 3

- a) Kai-Olaf Knocks (M.A., FCII): The ILS market in 2019 – discouragement or wait-and-see?
- b) Lihong Wang (M.Sc., FCII, cand. PhD): China InsurTech development

With the publication series, 'Proceedings of the Researchers' Corner', the Cologne Research Centre for Reinsurance meets the desire for publication of the research results of our scholars together with the accompanying posters and discussions. The titles are reproduced in keeping with the above agenda of the Researchers' Corner for the 12th Annual Meeting of the Sponsoring Group Reinsurance.



As part of the event, Prof. Materne also conducted an interview with Mr Ingo Wichelhaus (Senior Director, Mount Street) on the topic of risk management and portfolio management. Particular attention was devoted to the broad spectrum of risk for financing in the shipping sector.

We would like to thank the sponsors who made both this event and the research of the scholars possible.

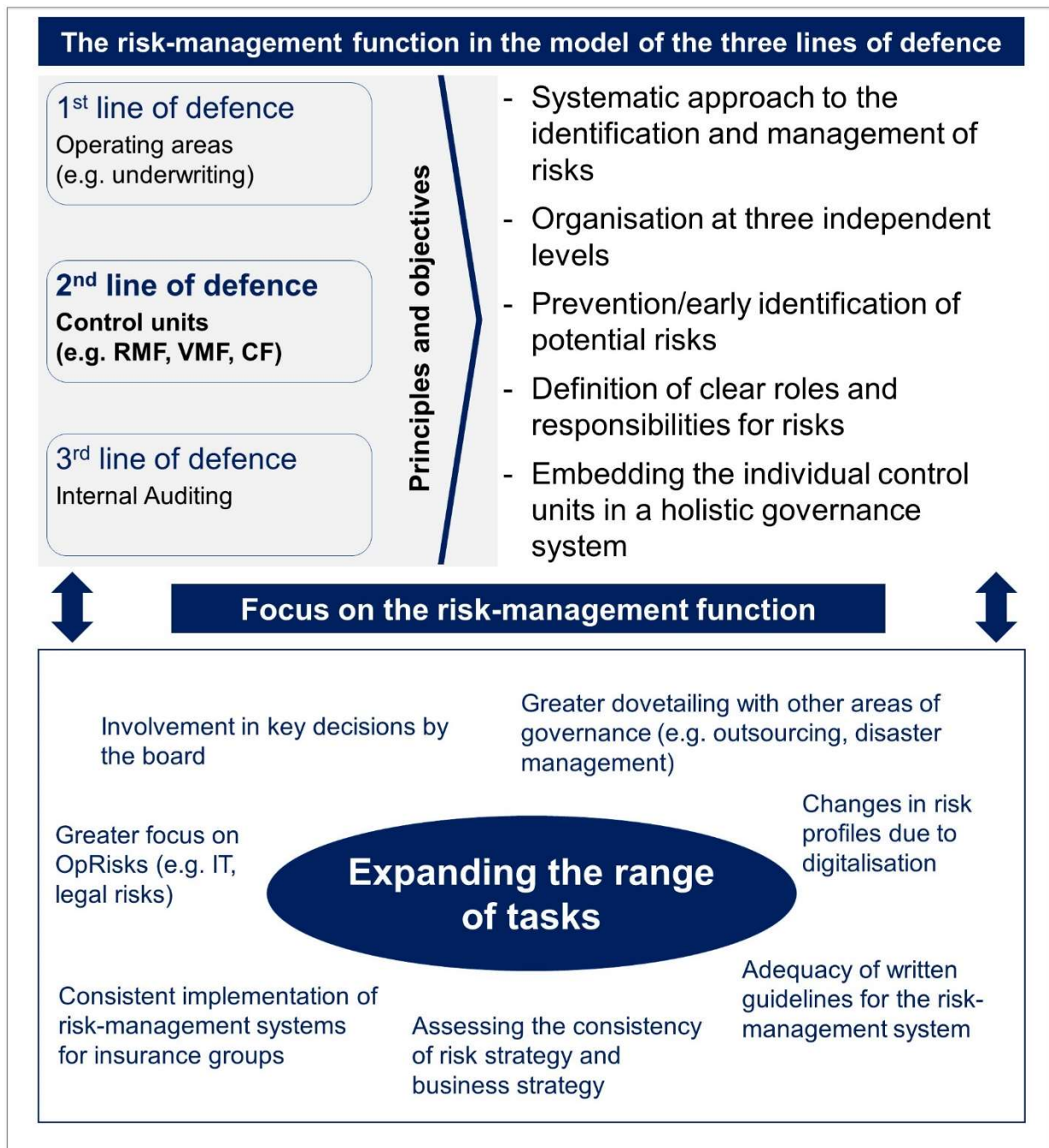
Cologne, August 2019

Prof. Stefan Materne

12th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 5th July 2019

The Increasing Importance of the Risk-Management Function in Insurance Companies

Manuel Dietmann, M.Sc.



12th Annual Meeting of the Sponsoring Group Reinsurance Researchers' Corner, 5th July 2019

The Increasing Importance of the Risk-Management Function in insurance companies

Manuel Dietmann, M.Sc.

Manuel Dietmann has been a part-time member of academic staff at the Cologne Research Centre for Reinsurance at the Cologne University of Applied Sciences since 2012. After successfully completing his Master's degree in Insurance, he has been working full-time at KPMG since 2014. His work there involves advising insurance companies, concentrating on risk management, governance systems and reporting.



The model of the three lines of defence permits structured separation of and interaction among operating activities versus control functions, thereby forming the basis for a functioning control and monitoring system for insurance companies and banks. In essence this promotes a systematic approach for the identification and handling of risks at three independent levels below the board level. The properties and missions of the individual lines of defence are as follows:

The **first line of defence** applies to the operating divisions. Among other things, this includes activities relating to the structure of risks, such as underwriting (structure of insurance risks) or capital investment management (structure of market risks). At this level, the so-called risk managers or risk owners are responsible for identifying, assessing, managing and monitoring the risks in their respective areas. This is done, for example, within the framework of the internal control system (ICS), which identifies risks within its own processes and establishes suitable controls as risk-mitigation measures.

The control units of the **second line of defence** are responsible for the independent and process-integrated monitoring of the operating divisions. At a minimum, the control units in insurance companies include the key functions required by regulation: namely the risk-management function, the actuarial function and the compliance function. Among other things, the tasks of the control units include establishing the processes and a uniform methodology for risk management; monitoring compliance

with the specifications, guidelines and control standards of the first line of defence; as well as cross-divisional monitoring of the overall risk profile and reporting to the board.

The **third line of defence**, as an objective and independent audit and advisory entity, is Internal Audit, which must be established as the fourth key function of insurance companies, in accordance with regulatory requirements. Internal Audit provides advice to the board of directors and applies a risk-based approach to the task of ensuring the adequacy and effectiveness of the entire governance system. Consequently, Internal Audit examines the first and second lines of defence independently of the process and downstream.

Effective implementation of the model of the three lines of defence requires proper observance of the separation of functions. According to this principle, and as a function of the company's own individual risk profile, activities in connection with the structuring of risks and the monitoring of risks must be adequately separated. Linking the lines of defence in conjunction with the consistent design of risk-management processes enhances efficiency within the organisation. With a unified methodology in place across companies for the assessment and monitoring of risk, processes can be optimised throughout the entire governance system.

The risk-management function plays a central role within the model of the three lines of defence. As the entity in charge of operational implementation of risk management, the risk-management function plays a significant role in promoting implementation of the risk-management system. A large number of regulatory requirements led to an expansion of the range of tasks associated with the risk-management function. These are not additional regulatory requirements beyond the relevant requirements of the German Insurance Supervision Act (VAG) and Commission Delegated Regulation (DVO); rather, they are mainly requirements that were not fully implemented during the first step of implementation of Solvency II. With the publication of Circular 2/2017 (VA) – Minimum Requirements under Supervisory Law on the System of Governance of Insurance Undertakings (MaGo), the supervisory authority has bundled its expectations for the configuration of essential areas of way the business of insurance companies is organised. This circular specifies the interpretation of the requirements for the business organisation in the VAG and in the DVO.

These measures have increased companies' awareness and hence their obligation to adequately implement this requirement. Using two selected examples, the expansion of the range of tasks and the directly related increasing importance of the risk-management function in the company are presented below.

Integrating the risk-management function into key decisions of the board of directors is a regulatory requirement of the DVO – which, however, was in part observed by the companies only through the specification of MaGo. As current market

observations reveal, the state of implementation of decision-making processes is heterogeneous. According to this requirement, the board of directors must take due account of information from risk management when making decisions of its own. Accordingly, in order to assess the impact of the decision from a risk perspective, the risk-management function must be involved in all material decisions taken by the board of directors. In the first step, the individual company should specify which decisions can be deemed material. These might be decisions to purchase or sell a company, or to modify the reinsurance strategy. Companies need to consider the processes that will apply in the effort to involve the risk-management function. In practice, the following two approaches in particular are observable.

Involvement of the risk-management function can be mapped, for example, by means of a pronounced committee structure within the company. Under this scenario, decisions are prepared for the board of directors in the various committees (e.g. Underwriting Committee or Investment Committee). The participation of the risk-management function in these committees ensures acknowledgement of the risks involved.

Another avenue for involvement in processes involves adapting the documentation submitted to the board. Accordingly, the form for a board resolution can be expanded to include so-called 'capture criteria' for involvement of the risk-management function. This will lead to a systematic review of material facts prior to submission of the documentation, which requires a risk assessment by the risk-management function.

The second example relates to a stronger focus by companies on operational risks that affect all divisions of the companies, thus giving them central importance for the companies. Here, too, MaGo explicitly states for the first time that operational risks include IT risks, among other things, that must be considered within the framework of risk management. As IT risks are growing increasingly significant in the wake of digitalisation of business models and process automation, in future these risks must be integrated even more effectively into the risk-management process. An observable consequence of this is the expansion of risk management to include IT specialists in the effort to adequately assess the risk potential due, for example, to a cyber-attack or server failure. Furthermore, insurance companies have an obligation to establish a process by which at least the internal damage events that result from operational risks are recorded and evaluated. In the event of material internal damage events, the risk-management function and the board of directors also need to be notified immediately.

Given the growing importance of the second line of defence, many market stakeholders are involved in the further development of the control functions, and the risk-management function in particular. As the sample presentation with the expansion of the range of tasks shows, in future the risk-management function will

play a central role within the organisational structures of insurance companies. On the one hand, this is a regulatory requirement in view of an effective and appropriate system of governance. And on the other hand, it is a necessary prerequisite for adequately mapping changes in a sustainable system of governance.

Discussion

- What impacts can digitalisation have on risk management or on the risk-management function?

Through process automation, for example: nowadays, worksteps that were once mainly performed manually are being replaced by automated solutions. Assessment and the control measures deployed need to be updated within the framework of the ICS. This, in turn, calls for a deep grasp of what it is that triggers automation (e.g. the use of bots) in the effort to arrive at a proper assessment of the risks involved.

- In the wake of the enormously complex implementation of Solvency II, have insurance companies been able to implement all the requirements?

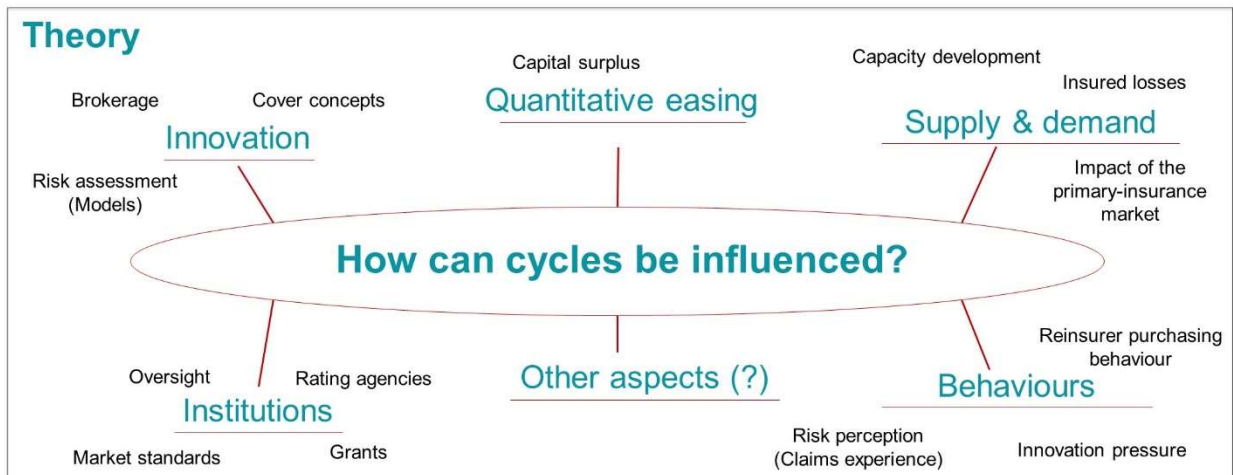
Most of the companies are in a position to meet the requirements. Companies have since entered a phase of stabilisation and optimisation. The existing challenges to companies are diverse – for example, for small and medium-sized insurance companies to shorten deadlines by 2 weeks in 2020 for QRTs and narrative reports (SFCR and RSR).

Please contact Manuel Dietmann (manuel.dietmann@th-koeln.de) with any questions or comments.

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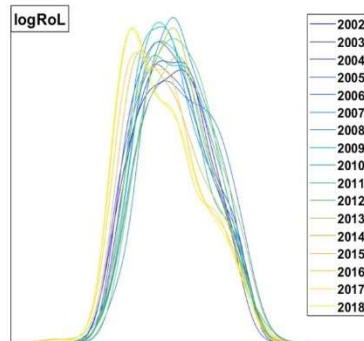
How is the Reinsurance Cycle Doing?

Robert Joniec, M.Sc. / FCII / cand. PhD

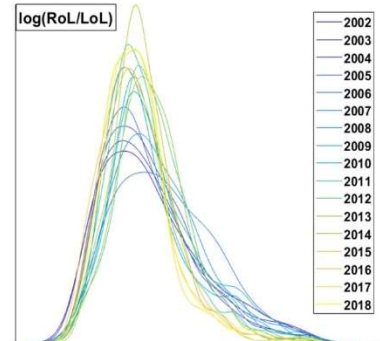


Data analysis

- North American disaster claims excesses
- 7000 contracts between 2002 and 2018
- Actuarial variables considered:
 - Modelled damage, standard deviation, attachment, limit, probability of entry and exit, insured risks, total annual limit requested (per company), total annual claims (modelled, per company)
- Economic variables considered:
 - Taxes, risk-free interest, capital costs, insured losses, overcapacity

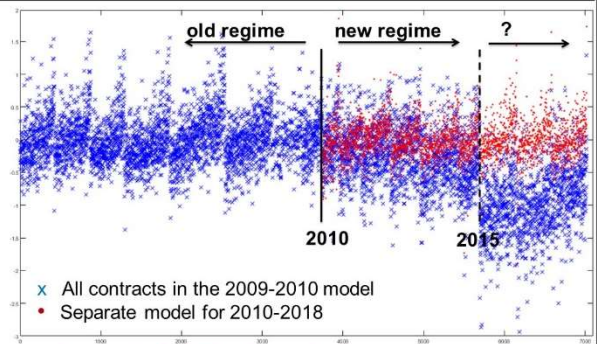
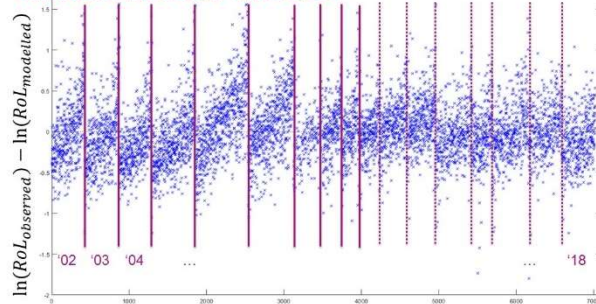


Distribution of the log(Rate on Line).



Distribution of logMultiples (=Rate on Line / Loss on Line), per contract year.

Mixed linear model



2002-2009: EL^+ , $Annual\ EL^-$, $Attachment^-$, $Annual\ Limit^+$, $Attachment\ Probability^+$, EQ^+ , $Fire^-$, $Cat\ losses(last\ 2y)^+$, FFR^+ , CoC^- , $Secondary^+$, $Capital\ Charge^+$, $Net\ Supply^+$
2010-2018: EL^+ , $Annual\ EL^-$, $Attachment^-$, $Annual\ Limit^+$, $Windstorm^-$, EQ^- , $Cat\ losses(last\ 2y)^+$, FFR^- , $Taxes^-$, $Net\ Supply^-$
 EL: Expected loss, EQ: Earthquake, FFR: Federal funds rate, CoC: Cost of capital

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How is the Reinsurance Cycle Doing?

Robert Joniec, M.Sc. / FCII / cand. PhD



Robert Joniec has been a part-time member of academic staff at the Cologne Research Centre for Reinsurance since 2017. In addition, he is a PhD student at the University of Limerick and is investigating the influence of alternative risk transfer on the market for reinsurance. His main occupation is as a member of the Strategic Advisory EMEA Team at Guy Carpenter & Company GmbH.

This year's research topic, 'How is the reinsurance cycle doing?', is the continuation of last year's investigation into the factors that influence the price of risk transfer. In a multi-year review of influences on price, the question arises as to whether cycles exist, and how the influencing factors selected affect them.

A dataset of some 7,000 North American natural disaster claims excesses brokered by reinsurance broker Guy Carpenter between 2002 and 2018 were investigated during the past year. Actuarial and economic variables were considered, including, for example, the expected damage of the subscribed policy, the standard deviation of the modelled damage, the probabilities of entry and exit of the layer, the level of the federal funds rate, as well as the average capital costs and effective taxes for insurance companies in the North American market. One of the first observations of the data that have been collected and largely adjusted is in line with expectations. On average, the rates on lines (RoL) have fallen over the years: more specifically, the relatively high RoLs have dropped, while medium and low RoLs seem to have remained rather stable. This can also be determined on the basis of the multiples (ratio between the premium paid and the damage expected). These results are interesting to begin with, but they do not offer any indication of could have caused prices (in RoL or multiples) to drop over the 17-year period observed.

A mixed linear model was used to identify a relationship between the variables selected and the reinsurance cycle. The model is a regression analysis that makes it possible to observe recurring contracts and to group them according to selected criteria (e.g. by company). Because additional explanations of methodology were

omitted in the presentation due to time constraints, the study methodology is a 'black box', and the results are discussed directly below.

The usual evaluation and thus the first important findings of a regression can be found in a residual plot. In a residual plot, the height of each point is calculated based on the difference between the actual RoL and the RoL predicted by the model. This makes it possible to evaluate the accuracy of the model graphically. In a residual plot in which residuals residues were sorted chronologically by contract year (the first coordinate of the X-axis thus corresponds to a contract from 2002, the last to a contract from 2018; see poster at page 13), a pattern that repeats itself every year emerges. Each contract year was also sorted in descending order by multiples. Thus, the first residual is the model accuracy of the contract from 2002 with the lowest multiple. The last 2002 residual describes the model accuracy of the contract from 2002 with the highest multiple. The last point in the residual plot is thus the 2018 contract with the highest multiple. So the pattern that emerges means that the simulated model is less well-suited for low and high multiples than for medium-range multiples (regardless of whether RoLs or multiples are modelled). It also turns out that the pattern is clearer in earlier years than it is in later years. One possible reason for this owes to the change in market conditions, i.e. a change in how and whether certain factors have an influence on price. The hypothesis is thus that, around the year 2009, there was a structural change in the influences on the reinsurance market. This is verified in three steps. First off, a separate model (Model 2) is now trained using only data from contracts between 2002-2009, rather than use all the data, as before. Model 2 is then applied to all contract years and the residuals considered. It is striking that Model 2, as expected, largely replicates the results of Model 1 (the basic model) for the years 2002-2009. However, residuals exhibit a downward trend from contract year 2010 onwards. This downward trend is interrupted by a sudden downward shift, followed by slow upward movement, from the 2015 contract year onwards. In the last step, a third model (Model 3) is trained using data from 2010-2018. Applying Model 3 to data between 2010-2018 provides a 'normal' result that reflects the pattern that was observed initially. Compared to the result from Model 1, this is clearer and more concentrated in the direction of the X axis (meaning it is also more accurate). The model coefficients that demonstrate whether actuarial or economic (independent) variables exist in a certain relationship with the RoL (dependent variable) are different in some respects for the three models. Actuarial variables are largely significant and correlated equally, but to varying degrees. Significant differences are noticeable in the economic variables.

Model 2 (2002-2009)¹: *EL⁺, Annual EL⁻, Attachment, Annual Limit⁺, Attachment Probability⁺, EQ⁺, Fire⁻, Cat losses (last 2y)⁻, FFR⁺, CoC⁻, Secondary⁺, Capital Charge⁺, Net Supply⁺*

Model 3 (2010-2018)¹: *EL⁺, Annual EL⁻, Attachment, Annual Limit⁺, Windstorm⁻, EQ⁻, Cat losses (last 2y)⁺, FFR⁻, Taxes⁻, Net Supply⁻*

The combination of the residual plots and the coefficients of the three models confirms the hypothesis that pricing and hence also market dynamics and a possible cycle have changed. Model 1 can be discarded as it cannot map this change. Returning to the question of how the reinsurance cycle is doing, the following can be stated:

- Economic variables play a role for the years 2002-2009 and 2010-2018, but there are differences.
- There are actuarial variables that remain unchanged and change only in terms of the strength of the influence. They have no influence on (the formation of) cycles.
- (1) Insured losses, (2) whether a contract covers a risk that has led to high insured losses in the past year, and (3) a measure of the capitalisation of the reinsurance market are significant influencing factors. These suggest a cycle within the scope of the 'capital constraint' theory.
- There are also conflicting results in the changes in the coefficients of the current models (insured losses vs. capitalisation).
- The question arises whether an additional, separate model should be used from 2015 onwards.
- It does not seem to make sense to use another model for the period 2015-2018, as reinsurance contracts are renewed annually. There are just three observation times that severely limit the validity of the findings.

¹ (Annual) EL: Expected loss (total of all purchased cover), EQ: Earthquakes, FFR: Federal funds rate, CoC: Cost of capital, Cat losses (last 2y): Total insured NatCat losses of the previous two years, Secondary: One of the risks insured was the second-largest loss source on the market in the previous year.

Discussion

- Can the findings from the study of the North American cat market be transferred to the global reinsurance market? A study of the global reinsurance market would be interesting.

There is a very high barrier due to the way reinsurance works. Because contracts are renewable annually, there are 17 observation times for the period 2002-2018. A great many things that could influence the market occur, however, between renewal dates such as 1 January of a particular year (see factors). In this dynamic and complex construct, individual events must then be considered in isolation as best as possible. This already presents a challenge in the US market for the specified period. At the global level, this seems nearly impossible, given the very wide variety of influences from different regions. Nevertheless, because this is a market in the classic sense, findings from the North American market should certainly be transferable in principle, i.e. can also be applied to other regions or to the global reinsurance market.

- Is there even such a thing as the reinsurance cycle that has been suggested?

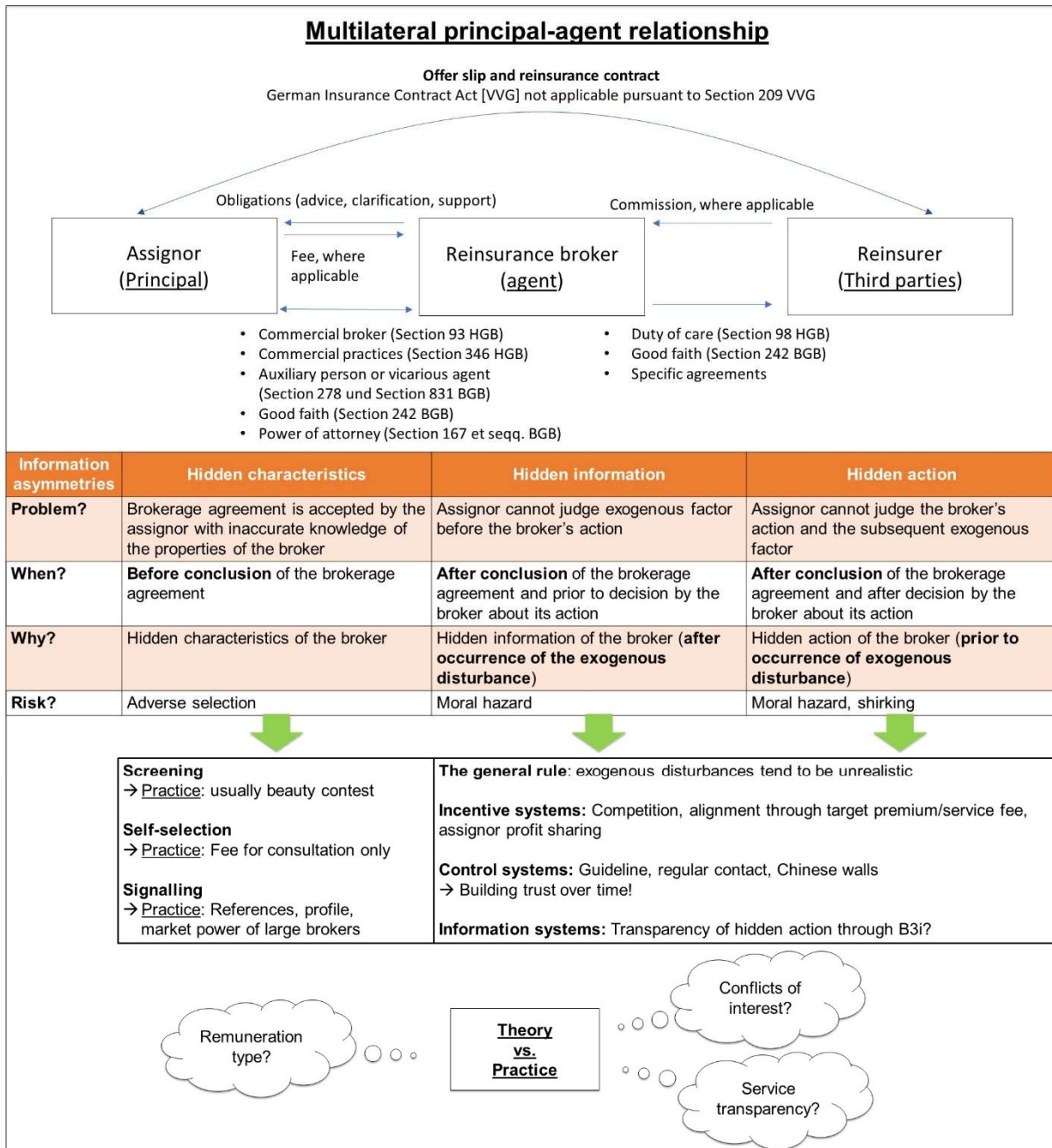
There is a good basis in the literature that deals with the origins and effects of cycles in the insurance sector, including the reinsurance cycle. This was the underlying motivation for asking how the reinsurance cycle has developed over the eventful 17 years.

Please contact Robert Joniec (robert.joniec@th-koeln.de) with any questions or comments.

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Information Asymmetries between Reinsurance Brokers and Assignors

Wolfgang Koch, M.Sc. / FCII



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Information Asymmetries between Reinsurance Brokers and Assignors

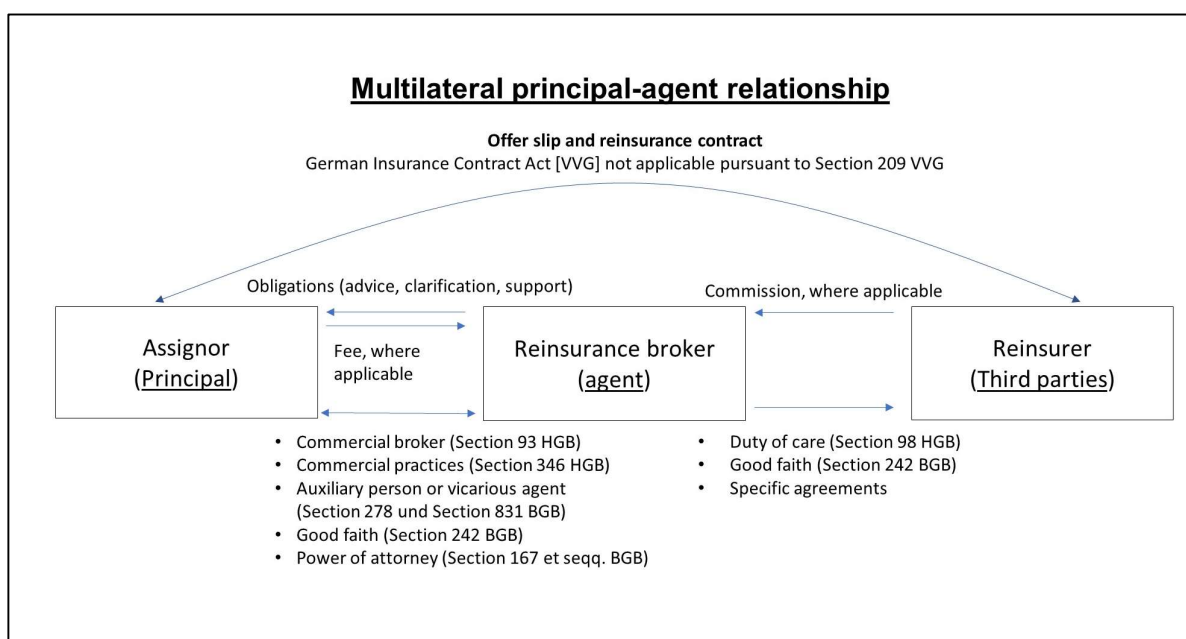
Wolfgang Koch, M.Sc. / FCII

Wolfgang Koch has been a member of academic staff at the Cologne Research Centre for Reinsurance at the Cologne University of Applied Sciences since 2016. He is also Executive Assistant to the Chief Executive Officer at Deutsche Rückversicherung AG.



The information asymmetries between reinsurance brokers and assignors were first theoretically derived with the aid of the principal-agent theory. Subsequently, the information asymmetries and solution strategies of the problems that resulted were discussed in expert interviews. These expert interviews were conducted exclusively with reinsurance brokers.

The principal-agent relationship between reinsurance brokers and assignors is structured as follows:



In the model presented, the assignor is the 'principal', i.e. the ordering party, and the reinsurance broker is the 'agent', i.e. the contractor. Under the principal-agent problem, the agent has a knowledge edge over the principal in fulfilling his task, knowledge which he or she – within a legal framework – does not share with the principal. The agent refrains from sharing this knowledge, as this gives him or her a personal advantage. In this constellation, the reinsurer is represented as a 'third party'. As this thus means that there are more than two parties involved in the transaction, this is known as a 'multilateral principal-agent relationship'. The German Insurance Contract Act [Versicherungsvertragsgesetz (VVG)] is not applicable under Section 209 VVG. Consequently, the legal framework of the contractual relationship arises particularly out of the German Commercial Code (HGB) and German Civil Code (BGB).

Three manifestations of information asymmetries are discussed in greater detail below: **Hidden Characteristics**, **Hidden Information** and **Hidden Action**.

In the case of **hidden characteristics**, an assignor accepts a brokerage agreement without knowing about the properties of the reinsurance broker, for example his or her performance capability or the quality of that broker's work. Hence, this information asymmetry has arisen even before the brokerage agreement is concluded. Because the broker's hidden characteristics become apparent only after the agreement has been concluded an adverse selection may result. To avoid hidden characteristics, three possible theoretical solutions were discussed in the context of the expert interviews:

- In the case of 'screening', the assignor could theoretically obtain information about the characteristics of the reinsurance broker by means of tests, profile queries, etc. During the interviews, this approach was confirmed in practice through 'beauty contests'. Beauty contests are also carried out in Germany until a basis of trust has been established.
- In the case of 'self-selection', the reinsurance broker would receive at least two different agreement offers. The assignor might draw conclusions about the broker's intentions or motivations on the basis of the decision in favour of a respective agreement. The preliminary consideration that the performance motivation of the reinsurance broker could be determined by his or her choice between the two remuneration models – commission and fee – could not be confirmed in practice. A fee is paid much less frequently, for example for modelling or advice by the reinsurance broker, and can serve to diversify the earnings structure of the reinsurance broker.
- During 'signalling', the reinsurance broker actively approaches the assignor in the effort to convince the assignor of his or her profile. The interviews confirmed the importance of the personal profile in the manageably-sized

reinsurance market. In this context, the large reinsurance brokers stressed that the assignor considers the market power of large brokers to be a very positive signal.

Hidden information and **hidden action** can arise after the brokerage agreement has been concluded. In both cases, information asymmetry is influenced by exogenous factors that the assignor cannot assess. Exogenous factors can arise, for instance, through climate change, low-interest phases or advances in digitalisation. In other words, these are events over which neither party can exert influence but that nevertheless have an impact on the transaction. The principal-agent theory assumes that only the reinsurance broker can observe the effects of exogenous factors, and that he or she does not share this information with the assignor.

In the case of hidden action, the reinsurance broker has already taken action, e.g. made a placement, and the exogenous factor that could necessitate a correction of the placement occurs only later on. The theory refers to the failure to make a correction as 'shirking'; the disincentive is commonly referred to as a 'moral hazard'.

In the case of hidden information, the sequence is reversed: the exogenous factor occurs prior to placement, and the reinsurance broker, acting for his or her personal benefit, does not share this information with the assignor. Accordingly, the assignor cannot fully assess the placement made by the reinsurance broker.

The following theoretical solution approaches developed in this connection were discussed in the expert interviews:

- Generally speaking, it should be noted that the expert interviews were unanimous in observing that a scenario in which exogenous factors are known only to the reinsurance broker but not to the assignor's reinsurance department is not a realistic one.
- In theory, hidden action and hidden information can be eliminated through incentive systems with the interests of the two parties thus aligned. Although the reinsurance market is manageable, in the interviews the brokers highlighted competition as an incentive system that ultimately leads to a comparable market price for the assignor. The reconciliation of interests by means of a target premium that assignors can specify also represents a practical method. After all, a service fee is also customary under which the reinsurance broker refunds the commission in exchange for a fee.
- The introduction of control systems is another possible solution in principal-agent theory. Guidelines as well as regular – often daily – contact during placement were underscored in the interviews as a measure that could be taken. Chinese Walls within the company also constitute an appropriate form

of control among the large brokerages. Building trust between assignors and reinsurance brokers is crucial.

The following statements that emerged from the expert interviews give rise to further discussion:

- Remuneration type: In the interviews, the incentive – conceivable under the brokerage model of remuneration – to place contracts at the highest possible reinsurance premiums could be refuted through resort to the argument of long-term customer relationships in a manageable reinsurance market.
- Conflicts of interest through ‘portfolio management’: Also conceivable are placements that are made not only in the interest of the individual assignor, but in which the reinsurance broker takes its entire portfolio into consideration and maintains the business relationship with the reinsurer.
- Service transparency: The reinsurance broker creates transparency. However, ‘soft facts’ such as a statement about the image or strategic orientation of a assignor might not necessarily be passed along from the reinsurance broker to the reinsurer.

Discussion

- To what extent can the B3i approach provide transparency?

It is difficult to make an up-to-date statement about this, as the first applications for the reinsurance market (catastrophe excess of loss) are not expected to be launched until early 2020.

It is conceivable that, as an information system, in future the B3i blockchain approach can provide even more transparency in placement.

- The following scenario: in a particular account, a particular reinsurer – Munich Re, for example – would actually be the best reinsurer for a particular assignor. However, the reinsurance broker would prefer to place the cover with a Bermuda-based reinsurer, for example, as Munich Re might run the risk that they would rather connect directly in a few years’ time, and the Bermuda-based reinsurer views the reinsurance broker as an important distribution channel. Could this scenario result in failure to select the optimal solution for the assignor?

As such, the scenario does not reflect the practical experience of reinsurance brokers. If an assignor wishes to place directly, this effort enjoys the support of the reinsurance broker. In the event, a corresponding transfer of knowledge from the broker via the market, for example a company's appetite for risk, is then passed along to the assignor.

The assignors on hand stated that one should inform oneself and not necessarily make oneself dependent upon the reinsurance broker's opinion.

- So where does the broker's added value lie to begin with?

Work is outsourced to the reinsurance broker, and this broker creates transparency. However, the assignor must be aware of certain key figures if he wants to be able to judge the reinsurance broker's work.

The reinsurance broker also creates transparency through the market price.

Please contact Wolfgang Koch (wolfgang.koch@th-koeln.de) with any questions or comments.

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Unmanned Aircraft – Evolution of the Market for Aviation (Re-)Insurance

Jörg Dirks, M.Sc. / FCII

Unmanned aircraft – also known as 'drones' – are aircraft that can be operated autonomously by a computer, or remotely from the ground, without having a crew on board

Terms:

- Unmanned Aerial Vehicle (UAV) / or System (UAS)
- Remotely Piloted Aircraft System (RPA / RPAS)
- Unmanned Combat Air Vehicle (UCAV)

The use is decisive...

• **Model airplanes:**

Use for sports or leisure activities
(Section 1 (2) No 9 German Aviation Act [LuftVG])

• **Unmanned Aerial Vehicles (UAVs):**

Commercial use (e.g. image recordings with the aim of sale/pursuant to Section 1 (2) No 1 LuftVG)

Dynamic growth market in the aviation sector

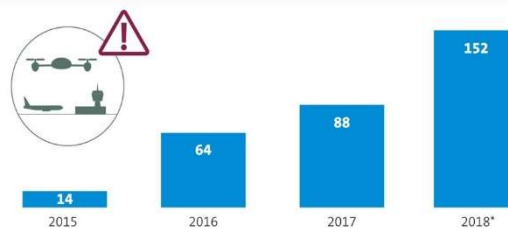
- 2025: approx. 10% of the global aviation fleet will be unmanned
- Effective regulatory framework conditions required
- International uniform standards for the operation of drones and clear liability rules (e.g. EASA Q2 2019)
- Development of the market for drones and technologies must continue to be monitored

Aviation reinsurance:

- Coverage of comprehensive and liability risks
- No observation for the cover of military drones
- Reinsurance forms np & prop / mandatory & optional
- Clash cover / cumulative across lines (e.g. for UAVs/business interruption/cyber & terror)
- Growing premium volume for commercial UAVs

Behinderungen des Luftverkehrs durch Drohnen nehmen zu

Zahl der gemeldeten Drohnensichtungen im deutschen Luftraum



Quelle: DFS Deutsche Flugsicherung.

*Stand: 30. November 2018

Kommerzielle Drohnen starten durch

Prognostizierte Entwicklung des weltweiten Marktes für kommerzielle Drohnen



© Statista.com

Quelle: Tractica

statista

Comparison of regulations / Germany vs. USA



Legal framework in Germany

- Labelling requirement for all drones weighing 0.25 kg or more
- Permission requirement for aeroplane models and drones over 5 kg
- Proof of knowledge from a weight of 2 kg
 - Certificate after examination, minimum age: 16 years
- Prohibition on operating over certain areas
 - out of sight/over 100 metres
 - in controlled airspace
- Insurance obligation (Section 43 LuftVG)

Legal framework in the USA

- Registration requirement for all drones weighing 0.25 kg or more
- Failure to register: fine of up to \$250,000
- Fly only within view and in daylight
- Maximum altitude around 400 ft. (approx. 121.92 metres)
- Minimum age of pilot: 16 years & Remote Pilot Certificate (for commercial use) Designated No Drone Zones
- No obligation to insure

12th Annual Meeting of the Sponsoring Group Reinsurance Researchers' Corner, 5th July 2019

Unmanned Aircraft – Evolution of the Market for Aviation (Re-)Insurance

Jörg Dirks, M.Sc. / FCII



Jörg Dirks has been a part-time member of academic staff at the Cologne Research Centre for Reinsurance at the Cologne University of Applied Sciences since 2018 and is engaged in research on the topic of Unmanned aircraft – Evolution of the market for aviation (re-)insurance. The focus here is particular upon the resulting opportunities and challenges for the reinsurance industry in the coverage of unmanned aircraft that are used for commercial purposes. Jörg Dirks is employed full-

time at Hannover Re as an underwriter for aerospace reinsurance and supervises the Asian region there.

Unmanned aerial vehicles (UAV) offer great potential for the environment and are increasingly conquering the airspace. Drones simplify certain operations in private and commercial applications alike. Amazon is experimenting with package deliveries by drone; the German water-rescue association DLRG uses drones in difficult search and rescue missions; and insurers themselves deploy drones in some cases to provide initial damage assessments in the wake of natural disasters.

A 'drone' is an unmanned aircraft. Unmanned aircrafts are aircrafts that can be operated autonomously by a computer, or remotely from the ground, without having a crew on board.

Aviation law distinguishes between unmanned aviation systems and model aircraft. According to Section 1 of the German Aviation Act, unmanned aviation systems are exclusively devices that are used commercially. Model aircrafts, on the other hand, are private, i.e. devices used for sport or leisure activities. The use involved decides which of these designations applies.

In German and/or colloquially, the term 'Drohne' ['drone'] is synonymous with an unmanned aircraft. The terms 'unmanned aerial vehicle', 'unmanned aerial system' or 'remotely piloted aircraft system' are used in English-speaking regions. Significant

differences between the various designations lie in the technological performance profiles involved. In what follows, the colloquial term 'drone' is used.

The areas of application for drones will continue to grow in future. For primary insurers and reinsurance firms, this growing market presents an opportunity not only to generate additional premium income but also to diversify their own portfolios, particularly in the fields of primary insurance and reinsurance in the aviation sector. Primary insurers and reinsurers also act as users, if drones are used to assess insurance claims, and as providers in the development of special insurance solutions for unmanned aircraft.

Worldwide, developed and emerging economies are relying increasingly on the use of high-performance, unmanned flight systems as a complement to manned aviation. The aviation industry estimates that around 10% of the global aviation fleet will be unmanned by the year 2025.

According to a report by the German air traffic control authorities, impediments to air traffic caused by drones in German airspace have increased approximately tenfold within three years (from 14 reports in 2015 to 152 reports in 2018). On the basis of these reports, the general trends in the market for drones and the rapidly developing technologies must continue to be monitored, particularly by the insurance industry.

Only by constantly taking market conditions into account can both the primary and the reinsurance industry continue to evolve in terms of product innovation for the cover of drones (e.g. for commercially used drones) and offer special forms of cover.

According to an analysis by Statista, the projected trend in the global market for commercial drones is set to continue to grow. Statista's assumption is reinforced not only by the aviation industry (such as in market forecasts by Airbus and Boeing) but also by market analyses issued by international aviation associations. These entities see great potentials for growth in this technology. According to Statista, global sales of commercial drones stood at approx. 246,000 in 2018 and are expected to grow to approximately 2.6 million commercial drones by 2025. This corresponds to an estimated approximately 12.6 billion US dollars in revenue worldwide. As drone technology and equipment are also evolving, revenue can grow further as well.

Uniform and clearly worded regulations are thus necessary for the use of drones. In order to tap opportunities for the emerging technology of drones while enhancing airspace safety at the same time, the Federal Ministry of Transport and Digital Infrastructure (BMVI) in Germany has promulgated a new regulation for unmanned aircraft, one that is intended to enhance both general safety and privacy protections. This Drone Regulation governs the use of drones in Germany. Comparable

regulations in effect in other countries are in identical in some cases, or even stated in greater detail.

Cover for comprehensive and liability risks is currently offered in the aviation (re)insurance market. In the case of aviation reinsurance, this cover is insured through the classic forms of proportional and non-proportional reinsurance, and through mandatory and optional contracts. There is currently no known cover for military drones in the reinsurance sector. For aviation reinsurance, in particular, a cumulation across several lines is not negligible (e.g. in the case of comprehensive and liability cover, business interruptions, cover against cyber and terrorist attacks).

In future, primary and reinsurance companies will continue to face the question of how drones are assessed by the various aviation authorities all over the world. In Europe, the US and the UK (e.g. through ICAO, EASA, FAA and CAA), there are clear rules in place that govern air traffic for drones (for commercially used drones in particular) and thus also permit clear assignment of drones to the aviation insurance line. In Asian countries (such as Japan or India), on the other hand, because drones are currently not viewed as stand-alone aircraft, they are more likely to be situated in the general liability-insurance market (e.g. liability for third-party damages) than in the market for aviation-related liability insurance.

If the new Drone Regulation promulgated by the BMVI is compared with other international aviation ordinances for drones (e.g. USA), both similarities and differences emerge. A common feature is the obligation to label and register drones weighing 0.25 kg or more, a minimum age of 16 for pilots to use commercial drones weighing 2 kg or more, and prohibitions on operating them in certain areas (e.g. marked 'No Drone Zones' in the USA).

In Germany, under Section 43 of the German Aviation Act, the owner of an aircraft (drones included) has an obligation to maintain liability insurance cover of his or her liability for damages in an amount to be determined by statutory decree. Liability insurance is governed by the provisions of the German Insurance Contract Act that apply for compulsory insurance. The statutory provision of Section 114 of the German Insurance Contract Act does not apply.

This provision currently creates a legal unique selling point in Germany. For the insurance sector in particular. If the use of drones continues to increase in future, and if, ideally, international standards for their use are established, this type of risk will also be of interest to the primary and reinsurance sectors.

Discussion

- For the evolution of an insurance market – regardless of the line involved – what is important is how claims evolve, as these are an expression of exposure. Is there any experiences with damage claims at this point in time?

As there are currently no known major claims due to commercial drones, it is not possible at this point in time to take a comprehensive view on the basis of claims experience. However, the analyses and assumptions of the aviation industry and aviation associations speak of exponential growth in technology. Aviation reinsurance thus needs to address this issue in order to evaluate possible claims, and to be able to take these influences into account during product innovation.

- There are activities and efforts by start-ups to minimise or eliminate the risk of collisions or flyovers of zones that are off-limits to drones. Therefore, there may be no claims against commercial drones in future.

While targeted damage-prevention measures may minimise claims, the complete elimination of claims is considered unlikely. Comparing the aviation industry with the automotive industry and the telematics discussion involved there, certain synergies can also be derived for drones. But for reasons of human error, for instance, claims can continue to arise that the primary and reinsurance sectors must consider. Nevertheless, damage-prevention measures for all lines can also lead to evolution in the insurance market such that insurance products must be adapted and optimised.

- What is your perspective on the issue with Amazon? Could the use of drones in the near future be realistic? Will we soon have to expect thousands of drones around us?

Increased use of drones is possible with the help of a uniform standard, but this must nevertheless be organised and regulated. If we compare the drone regulations of Germany and America, there are many similarities, but there are differences in the obligation to carry insurance for liability claims.

Taking Amazon or DHL as an example, the routes for drones that are used commercially for transport purposes can be defined in advance to permit orderly control of air traffic. The use of commercial drones, e.g. For deliveries of parcels by Amazon or DHL, is considered realistic in future and is also currently being investigated very closely by Amazon and DHL.

Please contact Jörg Dirks (joerg.dirks@th-koeln.de) with any questions or comments.

12th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 5th July 2019

Reducing Volatility through Use of an Insurance Swap

Fabian Lassen, M.Sc. / FCII

1. Background of the actuarial swap

- A multi-dimensional diversification effect across across the region and the risk class can be achieved and the efficiency of the risk portfolio enhanced.
- Swap of actuarial **payment flows** with comparable expected probability of occurrence and amount

2. Claims expenditure

Period	VU A (flooding)	VU B (hail)
1	-3,137,826	-3,649,671
2	0	-1,349,531
3	0	-2,869,477
4	-13,526,247	-5,115,622
5	-773,421	0
6	0	-4,353,065
7	-2,929,940	0
8	0	-8,064,172
9	-542,372	0
10	0	0
Total	-20,909,806	-25,401,538
SD	3,981,962	2,626,805

3. Correlation & capping of payment flows

Loss amount **26.3%**

Loss occurrence **-40.8%**

VU B relieves VU A	max. 2,475,554
VU A relieves VU B	max. 1,478,585

4. Swap of claims with limitation

Period	B takes over from A	A takes over from B
1	2,475,554	1,478,585
2	0	1,349,531
3	0	1,478,585
4	2,475,554	1,478,585
5	773,421	0
6	0	1,478,585
7	2,475,554	0
8	0	1,478,585
9	542,372	0
10	0	0
Total	8,742,455	8,742,455

5. Claims expense after swap

Period	VU A	VU B
1	-2,140,857	-4,646,640
2	-1,349,531	0
3	-1,478,585	-1,390,892
4	-12,529,278	-6,112,591
5	0	-773,421
6	-1,478,585	-2,874,480
7	-454,386	-2,475,554
8	-1,478,585	-6,585,587
9	0	-542,372
10	0	0
Total	-20,909,806	-25,401,538
SD	3,555,705	2,345,615

-10.7% (SD reduction for VU A)

-10.7% (SD reduction for VU B)

6. Summary

- A multi-year maturity seems necessary to achieve the desired effects over the long term
- Adjustments based on claims experience
- In practice, the amount of claims payments due to a natural event is only known after a few weeks
- Relief from the swap presented above would only occur late
- Optimisation through:
 - Estimation
 - Evasion to non-indemnity trigger
- The challenge is to identify hazards that exhibit the same probability of occurrence and a comparable level of expected loss.
- Analysis of correlations between different hazards and regions is necessary required to locate suitable combinations of hazards
- How do the parties involved react to one-sided increases in volatility?

12th Annual Meeting of the Sponsoring Group Reinsurance Researchers' Corner, 5th July 2019

Reducing Volatility through Use of an Insurance Swap

Fabian Lassen, M.Sc. / FCII

Fabian Lassen has been a member of academic staff at the Cologne Research Centre for Reinsurance at the Cologne University of Applied Sciences since 2015. As an underwriter in non-life reinsurance at R+V Versicherung, he is also responsible for the markets of Denmark and Switzerland.



Combining two different portfolios of independent insurers can achieve a multi-dimensional diversification effect across the region and the risk class in question. If two parties swap actuarial payment flows of comparable probability and amount, the volatility of these payment flows can be reduced, and earnings planning can be improved. This will not affect existing reinsurance programmes. The method of operation is presented on the basis of insurance company A (VU A) and insurance company B (VU B).

VU A covers the risk of flooding/inundation in a particular region. VU B, on the other hand, offers insurance cover against hail in another region. Assuming that both portfolios have a constant structure of risk in their region and in their covered risk, claims spanning the last ten periods were considered (see Item 2 of the poster on page 31). VU A had to pay out approximately 20.91 million monetary units (GE) during this period and had a standard deviation (SD) of approximately 3.98 million GE for these payments. VU B, on the other hand, paid out more, with approx. 25.40 GE, but showed a lower SD of 2.63 million GE.

The correlation between the two portfolios with regard to the claims amount is 26.3% and minus 40.8% with regard to the occurrence of loss (see Item 3 of the poster on page 31). These facts could make these portfolios suitable for achieving the above-mentioned effect for purposes of improving earnings planning.

Before swapping payment flows, the basic rule is established that neither partner should be financially disadvantaged during or beyond the period of the cooperation. This means that after several periods have elapsed, neither insurer will be subject to any additional charges as a result of the swap, and neither will pay a greater total amount. For this reason, a maximum relief per claim is defined. VU B provides VU A with a maximum of 2.48 million GE in relief; conversely, VU B receives a maximum

of 1.48 million GE in relief from VU A. These limits were determined on the basis of claims experience with the aim of offsetting the mutual payment flows after the completion of ten periods (see total under Item 4 of the poster on page 31).

The result can be seen in Item 5 of the poster. After ten periods, both insurers pay out the same total as they would have if there had been no swap. However, the SD is reduced by minus 10.7% for both. This clarifies the positive effect of the cooperation, and both insurance companies can plan their earnings more effectively.

Although concepts like this are already in use in the field, they tend to be aimed at risks with a very high return period. In practice, the concept presented here only works on a long-term basis. This is why a multi-year term seems required in order to permit a balancing over time. As portfolios and the risk situation are constantly changing, adjustments also need to be made over time. The challenge is to identify appropriate risks with equal probability of occurrence and comparable losses.

Discussion

- If a portfolio develops less well than expected, the contract and thus the concept could fail.

To prevent this, a good basis of trust between the parties is necessary first. This way, short-term negative developments can be offset in the long term by means of adjustments.

From this point of view, it also seems necessary that the return period of the risk to be taken into account should not be too high. A certain frequency in events leads to more frequent swaps, with payment flows equalising more quickly as a result.

In case of doubt, the concept could naturally fail on this point as well.

- Such a swap can become a problem on the reputation side if an insurer only operates in one market and suddenly has to explain a major claim from an entirely different market. In practice, this could discourage some insurers from using this approach.

Depending on the form and amount of the payments involved, this scenario seems entirely possible. The volume of the payment flows could be limited, however, such that any payments made would only be in very small amounts.

- The data quality that this requires could be difficult to achieve in practice. The question also arises as to whether exposures can be compared with each other over time, and whether the parties actually swap the same probabilities of claims over time.

Indeed, it may be difficult to obtain data of sufficient quality. This renders the search for suitable portfolios more difficult. However, a pragmatic approach to risks with a low return period can aid a swap of claims from portfolios that do not completely match up. Making use of suitable adjustments can offset possible undesirable developments. As a result, such a concept can be introduced even in the event that available data are somewhat sparse.

- How can the example be optimised?

Rather than use static values, future payment flows could be modelled. This way, different developments and scenarios could also be simulated. These, in turn, could be used to test and verify suitable adjustment methods.

More than two parties could also cooperate under a concept such as this. The diversification effect could increase here, but complexity increases as well.

Please contact Fabian Lassen (fabian_janbert.lassen@th-koeln.de) with any questions or comments.

Transferring Cat Risks from Emerging Markets from a Macroeconomic Perspective

Fabian Pütz, M.Sc. / cand. PhD

Characteristics of emerging markets

I. Concentration of unprotected capital values

- ❖ Increasing importance of production capital in the secondary sector
- ❖ Location in exposed regions and lack of structural protection

Consequences:

- Over-proportional vulnerability to disaster events
- Negative impact on economic growth and sovereign debt

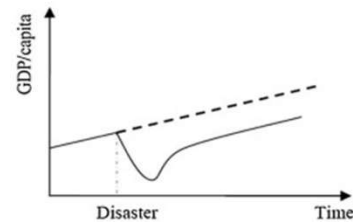
II. Lack of societal-social progress

- ❖ Per-capita income still low, and inequality in distribution of wealth
- ❖ Insufficient access to education, energy and health care

→ low private-sector coverage of risks

III. Limited fiscal leeway

- ❖ Short-term reallocation of budgets required
- ❖ Access to refinancing opportunities in the capital market difficult or expensive



Efficient financing of disaster risks

'When risks associated with a public investment are publicly borne, the total cost of risk-bearing is insignificant and, therefore, the government should ignore uncertainty in evaluating public investments'

Risk premium of a government investment is passed on to a large number of taxpayers and tends towards zero (Arrow-Lind theorem)

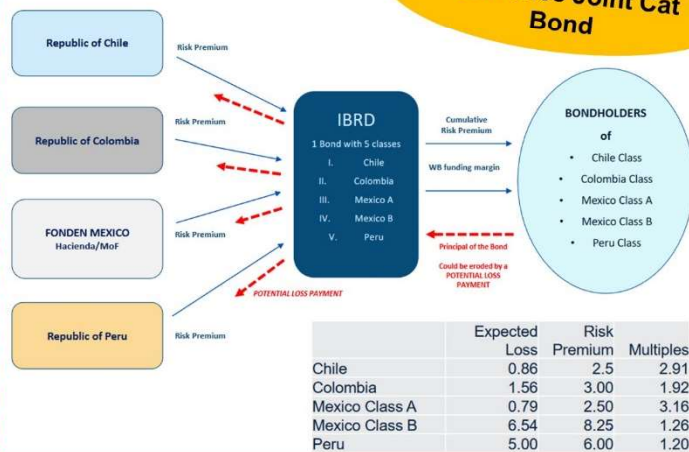
Any form of ex-ante risk transfer is inefficient from a risk-neutral perspective, because

Exp. economic premiums > Exp. economic insurance benefit

Benefits of ex-ante financing through cat bonds

- ❖ Availability of high capacities necessary for hedging at the state level
- ❖ Minimising the default risk through securitisation in collateral
- ❖ 'Simpler' formulation of parametric indices at state level
- ❖ Fast and transparent availability of liquidity

Pacific Alliance Countries Joint Cat Bond



12th Annual Meeting of the Sponsoring Group Reinsurance Researchers' Corner, 5th July 2019

Transferring Cat Risks from Emerging Markets from a Macroeconomic Perspective

Fabian Pütz, M.Sc. / cand. PhD



Fabian Pütz has been a member of academic staff at the Cologne Research Centre for Reinsurance at the Cologne University of Applied Sciences since 2014. He is also a Research Assistant and PhD student at the University of Limerick and is involved in research into automated vehicles and their impact on the insurance industry. He is full-time Controller and Team Leader Technical Accounting at Echo Re.

Firstly, the characteristics are presented that fundamentally lead to the increased vulnerability of emerging markets with regard to the (economic) damage resulting from natural disasters.

Building upon this, a presentation is made as to how risks from natural disasters can be hedged as efficiently as possible from an economic point of view using instruments of ex-ante risk transfer.

With regard to the characteristics of emerging markets described below, which basically lead to increased vulnerability to (economic) damage from natural disaster events, it bears pointing out that emerging markets are fundamentally a very inhomogeneous group of countries. Given particularly the differences around the size and economic/fiscal strength of these countries, the characteristics described below can only be applied to very differing degrees to individual countries. The following analysis is therefore to be regarded as qualitative rather than universal:

The concentration of unprotected capital values results, for instance, from the transition of the economic structure as it shifts from the dominance of the primary sector to a greater significance for the secondary sector. This leads to the creation of production capital and a more capital-intensive economy. Despite the build-up of a more capital-intensive economy, frequent administrative delays in these countries mean that assets are hedged against natural-disaster risks through resilient infrastructure and structural protection. This is particularly noteworthy, as emerging

markets are often located in exposed regions (particularly coastal regions or earthquake-prone regions in Latin America or Asia) and thus per se have greater exposure to natural disasters.

A (holdover) **lack of societal-social progress** means that disaster risks due to low insurance penetration are privately covered only to a limited extent. In the event of a disaster, this increases state-level responsibility for disaster financing. A particular driver for still-insufficient private cover of risk is that a growing but still comparatively low per-capita income is primarily devoted to satisfying needs such as access to education, energy and health care (the lower needs according to Maslow's hierarchy of needs).

However, the increased responsibility for state-level financing of risk generally encounters the **limited fiscal leeway** to which emerging markets are subject. Often, this limited fiscal leeway is the result of continued difficulty of access to the external capital market, and of a lack of scope for a short-term increase in tax revenues. Where disaster events are financed by reallocating long-term investment budgets into short-term intervention budgets, this tends to lead to high opportunity costs.

All in all – and contrary to the general trend of decreasing vulnerability to natural disasters (as measured, for example, by fatalities) as per capita income increases – in emerging markets, the aspects described above have the effect of temporarily amplifying the economic damage observed relative to gross domestic product. Due to the fact that the state carries greater responsibility for financing after a disaster event, while the fiscal room for manoeuvre usually remains limited and the reallocation of budgets causes high friction costs, there is a tendency to have a negative impact on both economic growth and sovereign debt.

The trend towards increased economic vulnerability to natural disasters raises the question of how the economic risk of these events can be covered as efficiently as possible. A simplified consideration of the 'Arrow-Lind Theorem' for the evaluation of public investment projects holds that investment decisions must in principle be assessed in a risk-neutral manner. This risk-neutral assessment neglects the individual's appetite for risk. The Arrow-Lind theorem presupposes, among other things, that the investment risk is shared across a large number of taxpayers/risk bearers within the community (negligible absolute risk), and that total investment volume is distributed across a large number of (independent) projects. Based on this, it can be observed that forms of ex-ante risk transfer (e.g. traditional reinsurance or alternative capital market solutions) would in principle have to be regarded as inefficient due to additional cost and risk premiums if the investment could also be financed retrospectively using tax revenues without significant friction costs. Due to the characteristics of emerging markets, however, it has been concluded that these countries may face significant friction costs, or that limited fiscal leeway may render retrospective financing considerably more difficult. Moreover, the prerequisites of the

Arrow-Lind theorem imply that although the risk that materialises does not constitute a systematic risk (distributing the entire investment budget across a large number of investment projects), the comparatively high economic damage in relation to gross domestic product tends to contradict this prerequisite. Overall, this means that, particularly in the case of emerging markets, the ex-ante transfer of risk can certainly be considered to be the (most) efficient variation of risk financing, leading in particular to increased stability and resilience of the state budget and thus permitting long-term financial planning. Furthermore, risk-appropriate pricing of insurance premiums generally leads to an incentive function for further preventive measures (e.g. infrastructural and structural protection).

With regard to financing through cat bonds, it should be noted that these generally have positive characteristics that favour the efficiency of these risk-financing instruments at the (semi-) public level. The availability of sufficient capacity through enlistment of the capital market; minimisation of default risk through securitisation of collateral; and, in particular, the rapid availability of liquidity where parametric triggers are in use (minimisation of friction costs) are particularly worthy of highlighting in this connection.

Due not least to the Paris climate targets and the resulting idea of responding to climate change with steps to increase resilience to climate risks on the part of countries in need (e.g. the InsuResilience Programme), but also thanks to increased service offers by institutions such as the World Bank, this topic is receiving increased attention overall and can thus help drive increased demand for risk-transfer solutions in the short and medium terms. This is evident, for instance, in the increasing number of issued capital-market transactions, such as the cat bond issued in early 2018 by the Pacific Alliance Countries of Chile, Colombia, Mexico and Peru, which have jointly hedged against damage from earthquake events within their own tranches with a total capacity of some USD 1.36 bn.

Discussion

- Are the characteristics described also applicable, for example, to China as an emerging economy?

Due to its size and fiscal power, China can certainly be seen as a special case. Here, the size of the country already leads to a balancing of risk across individual provinces in the event of natural hazards with regional effects; this renders the individual events less relevant in relation to economic strength.

- To what extent are the qualitative findings applicable to (developing) economies that are smaller and that lag even further behind?

These countries are often still heavily dependent on short-term assistance from the international community in the event of a disaster. Moreover, often still-insufficient satisfaction of primary needs in these countries means that fiscal resources tend not to be available for prospective risk financing in the absence of funding from international development-assistance organisations.

Please contact Fabian Pütz (fabian.puetz@th-koeln.de) with any questions or comments.

**12th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 5th July 2019**

**The ILS Market in 2019 –
Discouragement or Wait-and-See?**

Kai-Olaf Knocks, M.A. / FCII

Renewal 2018

- HIM events in 2017 in particular caused claims of \$ 143 bn
- It is estimated that the ILS market accounted for approximately 25 to 30% of insured US hurricane claims
- Not many investors then withdrew their capital – the majority kept their investments in ILS constant or even increased them in view of prospects of rising premiums
- Profitable stock-exchange year 2017 compensated ILS losses



Source: WillisTowersWatson



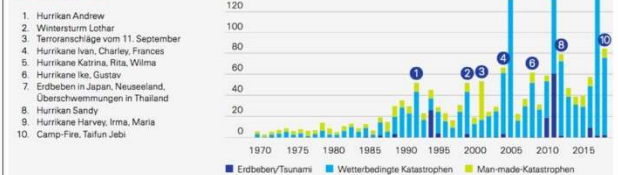
Source: Aon

Renewal 2019

For 2019, many investors acted much more cautiously:

- With \$76 bn in claims expenditures from natural disasters, 2018 marked the fourth-highest value ever recorded
- 2017/2018: highest NatCat claims expenditures ever recorded for a two-year period (\$219 bn)
- Further additions to reserves for 2017 HIM events in 2018
- Collateral multiple clause/collateral trapping
- High share of claims due to secondary risks
- Widening of spreads for high-yield corporate bonds
- Losses in other asset classes in 2018

Abbildung 3
Versicherte Katastrophenschäden, 1970–2018, in USD Milliarden zu Preisen von 2018



Source: sigma 2/2019

Outlook

- Professional ILS investors are likely to continue to provide capacity
- ILS is still a (nearly) uncorrelated asset class, and that makes it attractive
- Massive liquidity still available
- Further growth in ILS capacity, however, will depend more on price trends

12th Annual Meeting of the Sponsoring Group Reinsurance Researchers' Corner, 5th July 2019

The ILS Market in 2019 – Discouragement or Wait-and-See?

Kai-Olaf Knocks, M.A. / FCII

Kai-Olaf Knocks has been a part-time member of academic staff at the Cologne Research Centre for Reinsurance since 2008. Since 2010, he has been working full-time as Client Relationship Manager at SCOR Rückversicherung Deutschland.



Renewal 2018

The market for ILS has experienced robust growth in recent years, and many market stakeholders/observers have been waiting for a real test of the market. This test then arrived in 2017, in the form of the HIM events that led to \$143 billion in damage. It is estimated that the ILS market accounted for approximately 25-30% of insured US hurricane claims. Many market stakeholders were eager to hear the investors' reactions, but very few withdrew their capital as a result. The majority kept it constant, and many even increased it. There were essentially three decisive reasons for it: The first reason was the prospect of a hardening of the market and thus of rising rates. This was also confirmed by a survey conducted by WillisTowersWatson, in which 48% of all respondents said they wanted to increase their investments with an eye to increasing premiums. The second reason was that although the losses due to HIM events were very high, they were fundamentally within the expected scope – they did not come as a surprise. The third reason was the profitable year 2017 on the stock exchange, i.e. the losses from ILS could be offset with income from other classes of asset. As a result, the market continued to grow and reached a volume of \$97 bn at the end of 2018 (2017: \$ 89 bn). However, considering the size of the market after the third quarter of 2018, the value stood even higher, at \$99 bn. This is already an indicator of the development of the market during the 2019 renewal.

Renewal 2019

Many investors were much more cautious for 2019, and the capacity provided by ILS fell slightly. This could be attributed to the recurrence of natural disasters in 2018, which, after all, constitute the fourth-highest value at all, with claims expenditures of \$76 bn. Considered over the last 10-15 years, however, this figure is only slightly

above average; consequently, this cannot be the only reason for investors' increased caution.

If the years 2017 and 2018 are taken together, they generated the highest NatCat claims expenditures ever recorded for a two-year period at all (\$219 bn). Added to this were further additions to reserves for the 2017 HIM events during 2018. Moreover, due to the collateral multiple clauses, because many investors had to provide a multiple of the claims expenditures as collateral, this capital was not available for new investments.

2018 was also characterised by a high proportion of losses brought on by secondary risks. Because losses due to forest fires in particular were not expected at this level (\$18 bn), the models used had not taken them into account.

In addition, other asset classes became more attractive again – e.g. the widening of the spreads on high-yield corporate bonds. Overall, however, 2018 was a negative year for the stock exchange; as a result, the losses from ILS – in contrast to 2017 – could not be offset by other income.

Outlook

Professional ILS investors are likely to continue to provide capacity. ILS is still a (nearly) uncorrelated asset class, and that makes it very attractive for many investors. In addition, there is still massive liquidity in the market that needs to be invested. However, further growth in ILS capacity is likely to depend more on price trends than it has in the past.

Discussion

- Actual volume of the ILS market:

this is difficult to measure, as collateralised reinsurance in particular, in contrast to cat bonds, is generally not published.

- Impact of the interest-rate environment on trends in the ILS market:

As already pointed out in the lecture, the massive amount of capital available has contributed to the development of the market.

- What characteristics would damage events have to have in order to deter investors?

The years 2017 and 2018 showed that it does not necessarily have to be a very high loss, and that even comparatively lower loss amounts that were nevertheless not within the scope of the expected, can have an impact. As already pointed out in the lecture, however, there are also other factors that contribute significantly to the development of the market.

- 'Maturity' of ILS investors:

this seems to be approaching the appetite for risk of a (re)insurer.

Please contact Kai-Olaf Knocks (kai-olaf.knocks@th-koeln.de) with any questions or comments.

12th Annual Meeting of the Sponsoring Group Reinsurance
Researchers' Corner, 5th July 2019

China InsurTech Development

Lihong Wang, M.Sc. / FCII / cand. PhD

Introduction

InsurTech is the ecosystem of focused, innovation-based companies (often startups) that generate value for clients and/or insurance incumbents by disrupting or solving problems across the insurance value chain through the engagement of technology by following a lean and user-centric approach (The InsurTech Book, 2019).

With more than 1 billion smartphones and tablet devices, 900 million users of WeChat and over 750 million internet users, China is embracing and advancing in the InsurTech innovation. Leading insurers and startups are using new technologies to connect with and serve customers.

InsurTech Strategies

Three fundamental InsurTech strategies of the Chinese insurance companies are:

Enable

- To use AI, Cloud Technology, fraud detection & intelligent claims handling to enhance workforce capabilities.

Integrate

- To create an ecosystem in its own value chain and also benefit the social integration.

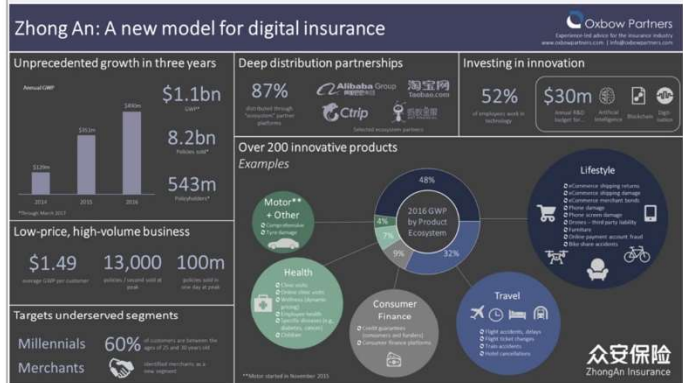
Commerce

- To sell technology products to other industries and profit from its investment in InsurTech.

The Chinese insurance market has developed at a speedy pace over the last two decades. While technology becomes part of people's everyday life, traditional insurers (incumbents) and start-ups supported by tech-firms (such as Alibaba, Baidu, and Tencent) are engaging to connect directly and to serve their clients more effectively. Critical tools for InsurTech include **big data, cloud computing, artificial intelligence (AI), blockchain, and the Internet of Things (IoT)**.

Case Study

Ping An Group (Traditional) 中国平安 PINGAN 保险·银行·投资	Zhong An (Start-up) 众安保险
At the early stage, Ping An <u>digitizes</u> its auto, health, and life insurance business by building online portals that promote digital offering.	Zhong An is a <u>digital</u> insurer founded by Ant Financial, Ping An and Tencent. The insurer uses data & new technologies at every stage of its operation.
Through Ping An's various <u>apps</u> (health care, real estate, loyalty reward program), Ping An is able to reach out to 400 million users.	From using data to analyse customers' needs & <u>develop</u> products according, to engaging AI and blockchain to <u>settle claims</u> online & reduce fraud.
Collecting <u>customers and consumers data</u> , Ping An is marketing and cross selling its whole range of financial services.	Through <u>Cloud Computing</u> , the company is able to operate at a relatively low cost. The advantage is a driving force of Zhong An's rapid growth over the last six years.



Source: Oxbow Partners, <https://www.oxbowpartners.com/2017/zhong-an/>

(Digital) Opportunities and Challenges for Insurers

InsurTech enables Chinese insurers to engage directly with customers, per online and self-service mechanism, similar to the banking and retail sectors. Insurers can collect and analyse customers needs and gain insights that can be using in underwriting and marketing. However, reputational risks, cyber risks, and software flaws can expose insurers to serious consequences in the digital age.

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China InsurTech Development

Lihong Wang, M.Sc. / FCII / cand. PhD



Since 2010, Lihong Wang has been a part-time research assistant at the Cologne Research Centre for Reinsurance. Currently, her main job is working as a “claims consultant” at R+V Re, where she also started her career in 2012. From 2012 until 2017 she worked as an underwriter for R+V Re. Moreover, Lihong Wang is pursuing a PhD study at the University of Limerick, Ireland, on the subject of automotive recall insurance in China.

This year's research project focuses on InsurTech Development in China. Following an overview of the scale of the InsurTech potential in China, and an introduction to the strategies and tools of Chinese insurance companies, two examples of insurance companies engaging InsurTech will be illustrated and explained in detail. After that, the challenges and opportunities they are facing will be pointed out.

InsurTech is a crossword of insurance and technology. By definition, according to the InsurTech Book 2019, InsurTech is the ecosystem of focused, innovation-based companies (often start-ups) that generate value for clients and insurance incumbents by disrupting or solving problems through the engagement of technology by following a lean and user-centric approach.

Why is InsurTech a hot topic? As a background, China is an underdeveloped insurance market with only 4% of insurance penetration and a relatively low insurance density. The answer lies in considering China's over 1 billion smartphones and tablet devices, 900 million users of WeChat and over 750 million internet users. China embraces a fast, relatively transparent platform for information exchange in this commercial arena. China has the highest FinTech adaptation rate in the world and a widely-used mobile payment system across the country. Previous research projects showed the slowdown of the Chinese economies in 2016 but a rising middle class in China (in 2018) that include people between 25 to 35 years old, well-educated, young, well-travelled and open-minded online shoppers and shop-owners. It is a logical transition into the InsurTech movement due in no small amount of this force.

How do insurers engage technologies in their operations? They usually have three strategies in a different stage of InsurTech deployment.

Firstly, technologies enable human beings or machines to work fast, more efficiently and intelligently in processing information. InsurTech is to improve risk analysis, underwriting and claims handling. Secondly, they integrate insurance into a value chain creation and communicate with clients and third parties by using designated apps or platforms. Last but not least, they sell some of the technological products to other industries and profit from their early investment. Products such as facial recognition are sought-after by the health care and travel sectors.

Chinese insurers are investing and working on InsurTech projects on their own or working with technology firms (such as Alibaba, Baidu and Tencent), creating tools and using platforms to connect and serve their clients more effectively. Useful tools include Big data, Cloud Computing, Artificial Intelligence, Blockchain, and Internet of Things. Blockchain is keenly discussed and explored by some insurers, reinsurers and related third-party firms in China, as to be used as an information ledger or system to upload and share information instantly.

To explain different approaches, in the following you are provided a comparison of two insurers, Ping An versus Zhong An in the InsurTech implementation:

Ping An as a traditional insurer, the second biggest life and non-life market; Zhong An as a start-up digital insurer, founded by Ping An, Alibaba and Tencent in 2013.

At the early stage, Ping An started with the digitalisation of its business and processes and creating online portals at step one in the early 2000s. It then further developed various apps for shopping rewards, banking, health care, real estate through which Ping An can reach out to 400 million users. Now they harness data for marketing and cross-selling of their other financial products.

Differently, Zhong An as a digital insurer has been engaging in technology and data in every stage of their operation. They use behavioural and psychological questionnaires and other data to analyse customers' needs and develop products and services in a short period. For example, when customers post life events and location-based photos, Zhong An can suggest insurance products adequately. It can identify moments when customers can use an insurance product and process insurance sales efficiently. It settles claims online and via apps while using two-dimensional codes, facial recognition software and smart photos to combat fraud. More importantly, Zhong An uses cloud computing and machine learning, which give it cost-efficiency and advantage to proliferate in the last six years since the formation. Through their digital partners, Zhong An is now selling more than 200 insurance products.

Some interesting data of Zhong An as a different business model according to Oxbow Partners in 2017:

- Until March 2017, Zhong An had 1.16 billion US Dollars Gross Written Premium sold 8.2b policies to 543 million policyholders.
- It creates and delivers innovative products in Lifestyle, Travel, Financial, Health and Motor.
- They have microinsurance products that have low prices – per customer 1.5 USD premium.
- However, the policy volume is high – Zhong An issued 13,000 policies per second and 100m insurance policies per day at peak times.
- 60% of the new middle class are millennials (25 to 30 years old); their targets are also online shop owners. These are the typical rising middle class in China.
- Prominent partners are shopping platforms (Alibaba, Taobao), travel website (Ctrip), financial planning site (Ant Financial).
- 52% of their employees have worked in the technology sector, and they invest more than 30m USD annually in the research of AI, Blockchain and data analysis.

In 2018, they generated 1.6 billion US Dollars annual gross written premium from 460 million policyholders. Also, they have significant initiatives to use blockchain to transform the country's social pension insurance system and private insurance operations.

This is an example of how InsurTech is developing at a fast pace and with transformative innovations in China. It suits Chinese needs and helps the new middle class to have a better financial future. For insurers and reinsurers, it poses enormous opportunities and significant challenges. It enables insurers to connect with their customers directly and efficiently; it gives insurers opportunities to design products that are being needed by the people quickly and effectively. InsurTech emphasises convenience, community, collaboration, curation and communication. However, it amplifies the value creation and risk accumulation in tier-one and tier-two cities. The regulation is tightening regarding customer data protection and data security. Consumers' sensitivity in pricing and need of consulting services also block InsurTech's way into more sophisticated products, such as life insurance. In general, InsurTech creates a brand-new risk landscape in terms of cyber exposure, reputational risk and trust issues. It challenges insurers' business model.

Discussion

- Is Zhong An profitable?

According to media reports, Zhong An is currently losing money for investors. However, we need to remember that this company is only six years old and has very high research and development costs. On the other side, Amazon is also not particularly profitable, yet Amazon's market value is very high.

- Is InsurTech all about Spot Insurance: pay as you go?

InsurTech companies offer annual policy and policy on demand (so-called spot insurance). Contrary to most insurance companies, the motor is a small part of Zhong An's insurance portfolio. The major part is lifestyle insurance products, such as shopping return, furniture insurance, drone insurance, and flight delay insurance. As mentioned earlier, the premium per policy is tiny. That was the reason why Zhong An had only easy, cheap and standard products. On the other hand, it is probably the future of insurance, so-called pay as you go, instead of a super policy covering everything that we might not always need.

- Does Zhong An regulate claims online?

Yes, most of their products can be claimed and paid out using apps and platforms as their products are mostly standard and straightforward. For example, in case of a flight delay insurance, once they see the flights have been delayed over an hour, they pay out immediately. Zhong An pays even before the passengers are contacted by the airlines for the delay or before cancellation because all the data is processed digitally and using AI at the insurer. In an aspect, these InsurTech companies are genuinely advanced.

Would you like to comment or ask any questions? Please feel free to contact Lihong Wang (Lihong.wang@th-koeln.de).

Sponsoring Group Reinsurance

The Cologne Research Centre for Reinsurance is fully financed by third-party funds provided from the Sponsoring Group Reinsurance, in which there are currently 94 companies involved. These are risk carriers (with an approx. 85% market share worldwide) as well as transferors and reinsurance-oriented service providers.

Sponsoring Group Reinsurance



Current as at: 2019

The Cologne Research Centre for Reinsurance ensures bidirectional knowledge transfer between theory and practice, in particular to the Society for the Promotion of Reinsurance. It accomplishes this, firstly, via ongoing, bilateral project cooperation and the exchange of views with the respective experts in the field; and secondly, via the two major scientific events held each year.

We want to thank the Sponsoring Group Reinsurance, the University leadership and administration, the Institute of Insurance Studies (ivwKöln) and the employees of the Cologne Research Centre for Reinsurance for all their support for research projects and events.

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