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Alternative Risk Transfer and Insurance-Linked Securities:

Trends, Challenges and New Market Opportunities

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Management Summary

Due to their relatively high yields and low return correlations with traditional asset classes, insurance-linked securities (ILS) are often described as an attractive investment opportunity. Yet, the investor base for ILS is largely dominated by a few specialized investment managers. The aim of this paper is to analyze advantages and disadvantages, the current market development and the decision-making processes that drive the demand for this aspiring asset class. To reach this aim, we first review the existing knowledge on ILS instruments and markets, then present results of a new international survey among ILS investors and finally, based on the results of the first and second step, derive implications for the future development of ILS.

The key findings of our study can be summarized as follows: To date, transaction costs along with lacking experience/knowledge and regulatory uncertainty are the most significant impediments to ILS market expansion. Skin in the game is necessary to attract investors; we show that a 5 to 10% sponsor investment leads to large increases in the willingness to invest. We observe that investors do not consider ratings as necessary and that having no rating is better than having a bad rating. Overall, the ILS market is likely to grow substantially over the next years; the survey participants expect its volume to double by 2019. In this context, we discuss the role of new instruments such as protected cell companies and new types of risks such as cyber risk, high frequency risks or run-off risks.

Highlights

- Top-ten ILS trends (page 51)
- Potential impediments to ILS growth (page 70)
- New empirical results (page 90)
- Trends in ILS returns (page 129)
- New market opportunities (page 131)

1 Introduction

Insurance-linked securities (ILS), i.e., financial instruments that carry insurance risk, are one of the fastest growing investment opportunities in the last two decades.[1] Yet, despite the steady growth, the absolute volume of catastrophe (cat) bonds and ILS in general is still relatively small, and far below its potential implied by overall insurance premiums and reinsurance capacity (see, e.g., Cummins and Weiss, 2009). Furthermore, before the financial crisis in 2008, ILS grew slowly compared to other securitizations such as asset-backed securities (ABS). This is surprising given the fact that ILS, in contrast to ABS, are less susceptible to moral hazard: a substantial fraction of the insurance risk remains with the sponsor, resulting in an alignment of interest with investors (World Economic Forum, 2008). But why are ILS not yet realizing their full potential?

There are two sides that could hamper the growth of ILS. On the one hand, the sponsors, i.e., reinsurers, insurers or other market participants supplying[2] the risk might not be willing to securitize their liabilities. On the other hand, the investors, acting as the demand side, could be skeptical about buying such instruments.

The main focus of this study is concerned with the investors' perspective.[3] It is often said that investors like the low correlation of ILS with traditional asset classes such as equity and fixed income whilst earning relatively high investment returns (Swiss Re, 2011). However, so far only investors from the insurance industry have been comprehensively asked about the potential advantages of ILS and their concerns regarding the asset class.[4] This study addresses these issues by systematically investigating the concerns of various types of institutional investors and deriving the resulting key impediments to further market growth.

Research Question 1: Investigate investors' concerns about ILS and the resulting impediments to further growth of this asset class.

---

1 Cat bonds set a new outstanding market volume record of more than USD 20bn in 2014 (Munich Re, 2014b).

2 The majority ILS sponsors are (re)insurers. However, a sponsor can also be any other party who is interested in transferring risks to a third party. Prominent examples include FIFA® which issued a cat bond to protect itself against acts of terrorism and natural disasters during the World Cup 2006, the Walt Disney Corporation which acted as a sponsor to protect its theme park in Japan against earthquake-related losses or Universal Studios which protected its movie productions against earthquake events in the California area (Kunreuther and Michel-Kerjan, 2009).

3 In Section 3.3 we take a brief look at the sponsors' perspective in a separate survey.

4 See Braun et al. (2013).

A second aspect of this study is to analyze the recent market development of ILS, especially the evolution of their risk premiums. An interesting point made in this context by Andrew Mawdsley[5] is that "in other asset markets such as high yielding corporate bonds, there has been very dramatic spread compression. Equally so, we have seen spread compression in ILS and therefore, we wonder whether this is due to a truly increased understanding of the risk, a perception that it has declined, or is it simply driven by the market's search for yield."

Spreads on cat bonds have traditionally been larger than on comparable corporate bonds. One explanation for the higher yields that has been brought forward in the early days of the market is that investors receive a "novelty premium" (see, e.g., Bantwal and Kunreuther, 2000). Hence, it is natural that the spreads have tightened as investors became more familiar with the asset class. However, it could also be argued that spreads will stay at certain levels due to investors' fear of large downside risk.[6] Research in equity capital markets showed that investors expect to receive a premium for potentially large losses, i.e., "downside" or "cliff" risk (see Ang et al., 2008).[7] Since catastrophic events embody exactly such large downside events, investors will expect a similar premium in ILS investments. If that is the case, the securitization of alternative risks, which are not so much exposed to catastrophes (high frequency / low severity risks), could be an interesting new investment opportunity that addresses this concern regarding ILS. Moreover, before the financial crisis many market participants saw no counterparty risk in ILS. However, with the bankruptcy of Lehman Brothers and the resulting technical default of four catastrophe bonds, counterparty risk became an important factor for investors and new structures have been developed to reduce it to a minimum. Thus, the risk landscape of ILS is subject to dynamic changes over time.

Research Question 2: Pricing of ILS - Which risk premiums are priced and how do they develop over time?

---

5 Andrew Mawdsley is the Head of Financial Stability and Information Unit within the European Insurance and Occupational Pensions Authority (EIOPA).

6 Carayannopoulos and Perez (2015) shows that catastrophe bonds are only uncorrelated with the market in non-crisis periods.

7 In line with these thoughts Ibragimov, Jaffee, and Walden (2008) explain why insurance providers choose not to offer insurance for catastrophic risks and not to participate in reinsurance markets, even though there is enough capacity to reach full risk sharing through diversification in a reinsurance market. They call this phenomenon "non-diversification traps" in catastrophe insurance markets.

On the supply side, ILS are mostly intended to protect insurers (and reinsurers) against peak events such as large-scale natural disasters, which are difficult to diversify. Nevertheless, ILS could also be deployed for "non-peak events" that generally lead to much smaller capital charges (Swiss Re 2011). This is because the meaning of the term "non-peak event" depends on the perspective, i.e., whether an insurer or a reinsurer is securitizing a part of its books. While reinsurers are able to diversify many types of insurance risks through their worldwide activities, local or regional disasters may severely threaten smaller primary insurers.

Moreover, ILS have the potential of creating new market opportunities by providing capacity in many other fields of risk transfer. Those include the securitization of cyber risk or run-off business. ILS are not only able to provide the necessary capital in case of large losses through, e.g., cyberattacks but also offer investors an additional investment opportunity which exhibits very low correlations with the overall economy, the occurrence of natural disasters, and the mortality of individuals.

Research Question 3: Based on the existing risk landscape and investors' concerns regarding ILS, what might new market opportunities look like?

To answer these three research questions, we first review the existing knowledge on ILS instruments, markets, and challenges (Section 2). In this context we analyze current market trends as described in recent studies and also integrate theoretical and empirical results from academic papers. We then present our own empirical contribution, i.e., the results of two questionnaires which were conducted among institutional investors (Section 3.2), insurers, and consultants (Section 3.3). We also integrate results from several expert interviews in Sections 2 and 3.[8] Finally, based on the results of the first and second step we derive implications and ideas for the future development of ILS (Section 4). Finally, we conclude in Section 5.

[8] The experts are ILS fund managers including Dr. Rainer N. Grünig from Plenum Investments Ltd, Dirk Lohmann from Secquaero Advisors AG, and Tim Tetlow from ILS Capital Management Ltd.

2 Existing Knowledge on ART and ILS

2.1 Instruments

ILS are defined as financial instruments whose values are predominantly driven by insurance risk. Consequently, they differ from traditional equity and debt securities issued by insurers because they are designed to offer a pure-play on the underlying risk types. The instruments discussed in this study are cat bonds (including cat bonds "light"), ILWs, collateralized reinsurance, sidecars, embedded value securitizations, XXX / AXXX securitizations, contingent capital, and insurance futures, options, and swaps (see Cummins and Weiss, 2009; Wu and Soanes, 2007).

In line with the major risk types in the insurance industry, the ILS market currently comprises two main segments: property-casualty (P&C) as well as life/health-related instruments. In contrast to the former, which are used to transfer risk, most of the latter currently serve as financing tools to relieve capital or monetize future cash flows (Swiss Re, 2009; Krutov, 2010). Extreme mortality bonds and longevity derivatives are exceptions and can help typical ILS investors to further diversify their portfolios since catastrophe and biometric risks are generally uncorrelated (Swiss Re, 2011). Yet, there are rare cases in which correlations could arise, the reason being that natural disasters such as severe earthquakes or hurricanes in densely populated areas (especially in developing countries) may increase the rate of mortality through direct casualties and subsequent pandemics.

An overview of the different products is provided in Tables 1 and 2. Further details will be discussed in the following subchapters.

ART vs. ILS: What is covered in this study?

Throughout the study, we use a broad definition of ILS as financial instruments whose values are driven by insurance loss events. In a narrow sense, ILS need to be "securitized" meaning that *(1)* a **special purpose vehicle** (SPV) is created *(2)* which then **issues securities** either as pass-through securities (i.e., the investor receives a pro rata share of any cash-flow) or as multi-class collateralized obligations (i.e., different tranches are created). The securities can be rated and are sold publicly or placed privately (Singer, 2001).

We also differentiate between "alternative risk transfer" (ART) and "insurance-linked securities" (ILS). Apart from ILS, ART also includes unsecuritized instruments such as multi-year and multi-peril products, which more closely resemble traditional reinsurance contracts. The collateral in alternative risk transfer transactions can be deposited in a (modified) Regulation 114 trust (Aon Benfield Analytics, 2014).

Although our focus lies on ILS, we selectively include additional instruments from the field of ART such as collateralized reinsurance in order to fully describe the relevant trends and topics in the field. As we will discuss below, there is an increasing convergence between the different market segments.

Table 1: Main Characteristics of Property / Casualty Instruments

	Cat bond	ILW	Collateralized reinsurance	Sidecars	Cat swaps	Cat futures and options	Contingent capital	Weather derivatives
Definition	Bond which transfers the risk of peak events, such as hurricanes or earthquakes, to a third party; coupon and principal payments are linked to the occurrence of catastrophes	Contractual agreement that calls for the seller to pay the buyer on specified type of losses, as measured by indices and / or incurred losses above a threshold	Privately structured contracts which insure a portfolio of specific insurance policies against losses caused by predefined peril(s)	Financial structures which cover a specific portfolio of insurance policies. Instead of covering an already existing book of business, sidecars raise capital before defining a specific insurance portfolio	Agreements between two parties to exchange contingent payments (usually not collateralized); two types: event-linked as well as pure risk swaps	Standardized exchange-traded contracts to pay or receive payments at a specified time, with the value of the payments being a function of a "cat index"	Securitization transaction similar to a put option, which allows an insurer to issue capital (e.g., common stock, hybrid capital, or debt) at a predetermined strike price following the occurrence of a predefined event	Derivative financial instruments whose payout depends on the value of a weather-related index (or event). By definition weather derivatives are not insurance contracts.
Time horizon	Multi-year	One-year	One-year	Multi-year	Rarely multi-year	Less than one year	Often multi-year	Less than one year
Standardization	Standardized elements but overall customized	Standardized	Highly customized	Moderate	High for event-linked, low for pure risk swaps	High	Low	Exchange-traded and some OTC products standardized; other OTC products customized
Liquidity	Medium, liquid secondary market in many cases	Very low	None	None	Low for event-linked, none for pure risk swaps	Market is currently non-existent (in general exchange trading would allow high liquidity)	Low	Medium for some standard OTC contracts. High for exchange-traded products
Type of Trigger	Indemnity Industry Loss Index Parametric Modeled Loss	Indemnity and loss index	Indemnity	Indemnity	Index (event-linked swap) or indemnity (pure risk swap)	Index-based	Typically indemnity	In general index (often based on heating or cooling degree days)
Single vs. Multi-Trigger	Typically single trigger	Double trigger	Typically single trigger	Can be single-trigger or multi-trigger	Typically single trigger	Single trigger	Typically single trigger	Single-trigger
Basis risk	Present if index-based or parametric trigger	May be significant (mainly index-based)	No	No	Present if index-based	May be significant, depending on the index	Low	May be significant (index-based)
Moral hazard	May be an issue in case of indemnity trigger. Can be mitigated through index-based or parametric trigger	Low	May be present	Low (indemnity based but in general quota-share reinsurance)	May be an issue in case of indemnity trigger	Low	Possible (but unlikely due to relation with company value)	Low as trigger is index-based
Transparency	High if index-based or parametric trigger	High	Low	Low	High for event-linked swap (index-based)	High	High	High
Counterparty risk	Low as capital is usually invested in high quality securities held by trustee	Yes, unless limit is collateralized	Low, full collateralization	No	Yes, unless additional collateralization agreement	Low, only if exchange defaults	Yes	Minimal if traded on exchange. Present if traded OTC and not collateralized

Source: Adapted from Cummins and Barrieu (2013), Swiss Re (2009) and own information

Table 2: Main characteristics Life / Health Instruments

	Longevity bonds	Extreme mortality bonds	Embedded value (EV) securitization	XXX / AXXX reserve securitization	Survivor forwards and Mortality forwards	Longevity swaps	Life settlements
Definition	Bonds which securitize longevity risk and address the fact that a cohort lives longer than expected	Bonds which securitize mortality risk and address the issue that a cohort dies prematurely	Transactions where insurance companies monetize future profits emerging from a block of business; often involves a seasoned closed block of life insurance business in run-off	Securitizations which life insurance companies and reinsurers use to fund redundant reserves via capital markets	Derivatives whose underlying is an uncertain t-year survival or mortality rate. Mortality forwards are the natural counterpart of survivor forwards.	Derivatives that allow two counterparties to exchange future cash flows linked to a fixed swap rate as well as realized survival rates. They are essentially a portfolio of survivor forwards with staggered maturities	Life insurance policies sold to investors in secondary or tertiary market. Investor continues to pay premiums on the contract and collects death benefit payment when the original policyholder passes away
Time horizon	Long-term (in general 8 to 20 years. Beyond 20 years possible).	Multi-year (but not as long-term as other life-related securitizations, until now the longest maturity covered 5 years)	Long-term (often >30 years)	Long-term (most transactions cover 10 to 20 years)	Long-term	Long-term	Long-term (depends on the remaining life expectancy of the insured)
Standardization	Low	Standardized elements but overall customized	No	Moderate	High	High	Low
Liquidity	Very low	Low	No liquidity (private deals)	No liquidity (private deals)	Very low	Low	Medium (Tertiary Market)
Type of Trigger	Index of survival rates (customization for individual sponsor possible)	Index of mortality rates (customization for individual sponsor possible)	No trigger	No trigger	Index of survival or mortality rates	Index of survival rates	N.a.
Single vs. Multi-Trigger	Single trigger (in general)	Single trigger (in general)	No trigger	No trigger	Single trigger	Single trigger	N.a.
Basis risk	Depends on the index composition	Depends on the index composition	No	No	Depends on the index composition	Depends on the index composition	N.a.
Moral hazard	Low	Low	No	No	No	No	N.a.
Transparency	High	High	Low	Low	High	High	May be a problem when investing via funds
Counterparty risk	Depends on the structure	Low as capital is usually invested in high-quality securities held by trustee	High	Low	Present (typically uncollateralized)	Present (typically uncollateralized)	Depends on the rating of the insurance company that issued the policy

Source: Adapted from Cummins and Barrieu (2013), Willkie, Farr & Gallagher LLP (2014), Swiss Re (2009) and own information

2.1.1 Property / Casualty Risk

2.1.1.1 Catastrophe Bonds

Cat bonds are the most prominent form of insurance-linked security to date (Barrieu and Albertini, 2009; Cummins and Barrieu, 2013; Braun, 2015). The goal of this instrument is to transfer the risk of peak events, such as hurricanes or earthquakes, to a third party in the capital market. That is, if a predefined event occurs, the principal is at risk of being lost completely or partially and the coupon payment is only accrued up to the time of default.[9]

Motivation to Invest in Cat Bonds (Investor Perspective)

The main reason due to which investors are attracted to cat bonds are their (historically) relatively high returns, which exhibit both a low volatility and a low correlation with traditional asset classes. Hence, it is possible to achieve considerable portfolio diversification effects, while receiving an attractive risk premium (Swiss Re, 2011). Recently, however, spreads in the cat bond market have tightened significantly. This development is, among other reasons, caused by a large inflow of new capital that is looking for alternative sources of yield in the prevailing low interest rate environment (Munich Re, 2014a). Furthermore, the so-called "novelty premium" that investors demanded for this asset class in the early years of the market has constantly decreased (and might have already disappeared), since cat bonds grew more popular and market participants became familiar with their characteristics. In addition, the secondary market, although not as active as the stock or government bond market, continues to mature and further reduces risk spreads through the provision of liquidity (Munich Re, 2014b).

Motivation to Issue Cat Bonds (Sponsor Perspective)

Sponsors (in most cases insurers and reinsurers) are attracted by cat bonds for several reasons. First of all, compared to the reinsurance industry, capital markets exhibit a much larger risk-bearing capacity and are thus well-suited to absorb the losses of large-scale catastrophic events.[10] Secondly, while traditional reinsurance is

[9] Apart from these principal-at-risk structures, there have also been transactions that exhibit risky coupons but guarantee the repayment of the full principal. An example is the first tranche of the USAA hurricane bond issued in 1997 (Cox and Pedersen, 2000). However, such structures are not common anymore.

[10] Cat bonds allow sponsors to obtain reinsurance protection from a new pool of capital which is fully collateralized and separate from traditional reinsurers (Swiss Re, 2012).

generally renewed every year, cat bonds provide multi-year protection[11] at a fixed price. This can be particularly advantageous when approaching a "hard market".[12] Thirdly, cat bonds exhibit clear contractual agreements, whereas traditional reinsurance can be prone to coverage disputes (Swiss Re, 2011).[13] Especially index-based and parametric transactions leave very little room for disagreement and provide fast payouts shortly after a predefined event (Krutov, 2010). Fourthly, the collateral account of an SPV typically consists of dedicated money market funds that exclusively invest in highly-rated short-term notes such as U.S. T-Bills. This minimizes both interest rate and credit risk in the structures. Before the financial crisis of 2008, cat bonds exhibited less restrictive collateral provisions combined with a total return swap (TRS). However, after the collapse of Lehman Brothers as a TRS counterparty and the subsequent distress of four cat bonds,[14] market participants were forced to revisit the issues of collateral quality and counterparty default risk (Tower Watson, 2010). As a consequence, the TRS feature has now been eliminated and the post-crisis structures require very safe collateral solutions such as the aforementioned money market funds, tri-party repos, or structured notes (see Section 2.2.1 for more details). It is thus no longer possible to used cat bond collateral accounts as a dumping ground for supposedly low-risk structured finance deals. Finally, due to the recent spread tightening, cat bond coverage is now offered at highly competitive prices relative to traditional reinsurance and retrocession deals. Table 3 summarizes the motivation to invest and to sponsor cat bonds.

[11] Most cat bonds have a maturity of three to four years.

[12] The reinsurance cycle is characterized by "hard" and "soft" markets. Hard markets typically appear after extreme events where (re)insurers increase prices to recapitalize their companies and to compensate experienced losses (Swiss Re, 2011).

[13] Note, however, that a very recent development among investors of cat bonds is to allow more flexibility (i.e., variable reset) in payment and coverage, giving rise to potential disputes in the future. We will discuss the issue of variable reset later in this study. It also should be mentioned here that from the buyer perspective the coverage disputes can be disadvantageous (reinsurer is not willing to pay) or advantageous (reinsurer pays although coverage is questionable in order to invest in future relationship with the buyer).

[14] Notably, Ajax Re, Carillon Ltd A-1, Newton Re 2008 A-1, and Willow Re B.

Table 3: Motivation for cat bond investing and sponsoring

Motivation to invest	Motivation to sponsor
- Correlation / Diversification - High yields (but decreasing in recent times, potentially due to the disappearance of a novelty and an illiquidity premium)	- The capital market exhibits a much larger risk-bearing capacity than the reinsurance industry - Multi-year protection at a fixed premium (traditional reinsurance requires annual renewals subject to hard and soft markets) - Clear contractual agreement, especially for index-based products - Reduced credit risk ("risk-free" investment of collateral) - Costs of protection are currently quite low (tightening of spreads)

Typical Structure of a Cat Bond

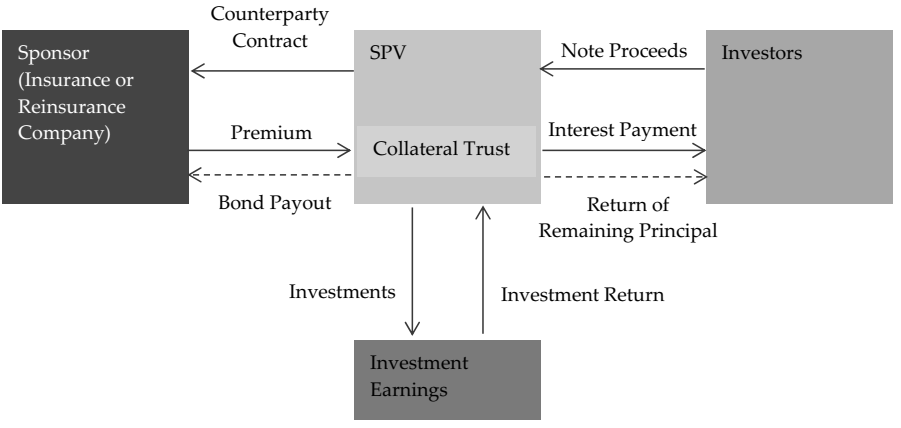
Cat bond transactions are set up around a special purpose vehicle (SPV). The SPV is an independent company which issues the actual securities and is immune to the potential distress of the sponsor (bankruptcy remote). It manages a collateral fund of highly-rated securities that generate investment returns. Both the sponsor's "reinsurance" premium[15] to the SPV and the investment returns in the collateral trust are used as steady interest payments to the investor. Figure 1 illustrates the typical structure of a cat bond.

If no predefined event occurs, investors receive the principal payment in full at maturity. Otherwise, the transaction is terminated and the collateral account is liquidated to compensate the sponsor. In this case, investors lose all or part of their principal. Hence, the exact definition of the trigger event is crucial for the payoffs of a cat bond. The following six trigger types have been used in past transactions:

- Indemnity
- Industry loss index
- Weighted industry index
- Modeled loss
- Pure parametric
- Parametric index

[15] Depending on the trigger type of a cat bond, the sponsor either enters into a reinsurance contract according to IFRS 4 or in a derivative contract according to IFRS 9 / IAS 39.

Figure 1: Structure of a cat bond



Each of these mechanisms is based on a preset threshold value that needs to be breached by an underlying reference variable. In case of the first four triggers, the threshold is commonly called attachment point. When the underlying insurance losses exceed the attachment point, a payout is made to the sponsor and the investor will not retrieve the full principal at maturity.[16] The **indemnity trigger** is ceteris paribus most favorable from the sponsor's perspective as it references his actual losses. Cat bonds with indemnity triggers are free of basis risk[17] and are usually considered as reinsurance instruments under IFRS 4.[18]

Another important trigger type references an insurance **industry loss index** by a third-party such as Property Claims Services (PCS) in the U.S. or PERILS in Europe. These providers collect loss information from insurance companies who write property and casualty business in the affected regions. Since the index providers are independent of the sponsor, the industry loss trigger mitigates potential moral hazard issues. Nevertheless, there is usually no perfect transparency for investors, as the index is based on self-reported data from the insurance industry and often calculated according to proprietary rules. Industry loss triggers may be associated

[16] Both binary and proportional payouts to the sponsor are possible (see, e.g., Cummins and Weiss, 2009).

[17] "Basis risk is the mismatch between losses to the reinsured portfolio and the recovery provided by the cat bond." (Swiss Re, 2011)

[18] Depending on the features of an ILS instrument, it is either recognized as a reinsurance contract (IFRS 4) or as a financial derivative (IFRS 9 in combination with IAS 39). This distinction is important from an accounting, tax, and regulatory point of view as reinsurance contracts are part of the technical provisions and consequently the insurance result. Financial derivatives, in contrast, do not affect the insurance result (World Economic Forum, 2008).

with substantial basis risk for the sponsor as many insurers cover different geographic areas that are more or less affected by a specific natural disaster. Thus, the sponsor's own loss can significantly differ from that of the industry as a whole. To overcome this problem, it is possible to reference a **weighted industry index** which tries to replicate the geographical distribution of the sponsor's underwriting portfolio and thus reduces basis risk.

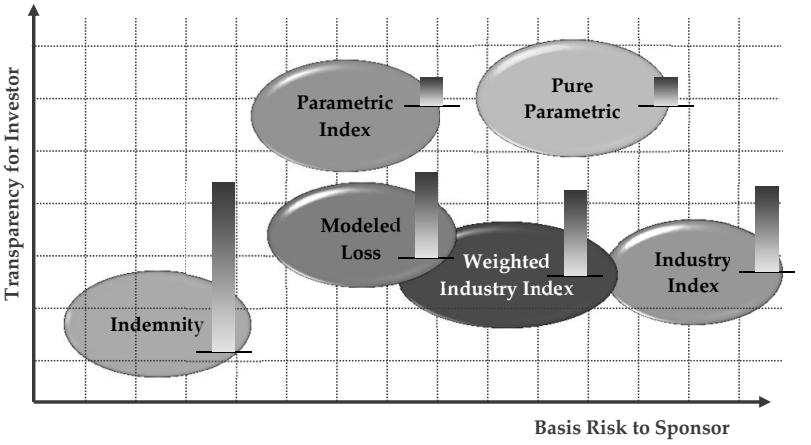
In case of a **modeled loss** trigger, both the loss model and the insurer's reference portfolio are held in escrow. If a catastrophe occurs, its actual parameters are entered into the model and the losses suffered on the insurance portfolio are simulated. Due to the fact that the estimation is made for the sponsor's own portfolio, modeled loss triggers reduce basis risk. At the same time, transparency is higher than for indemnity triggers, since the both the model and the reference portfolio are determined at the outset of the transaction and the loss estimation process cannot be influenced by the sponsor.

The highest transparency for investors and the highest basis risk for sponsors are associated with **pure parametric triggers**, which reference the physical characteristics of the actual event instead of the insured losses. For a hurricane, this could be maximum wind speed, radius, or its category on the Saffir-Simspon scale.[19] Investors are thus able to precisely follow the trigger parameters and sponsors benefit from a quick settlement after the event. A **parametric index trigger** essentially combines readings from several measurement stations in order to reduce basis risk. Hence, sponsors are able to better match their book of business by overweighing geographical regions where they are more active and underweighing regions where they are less active.

Each trigger type is associated a different degree of transparency and basis risk as shown in Figure 2. In terms of structuring costs (see the green bars next to the ovals), indemnity triggers are the most expensive and pure parametric triggers the least expensive. The lion's share of cat bond structuring costs comes from legal fees (Willis Capital Markets & Advisory, 2013).

[19] Note that maximum sustained wind speed and radius are two key factors determining the destructive power of a hurricane.

Figure 2: Cat bond triggers sorted by transparency for investor and basis risk for sponsor including structuring costs



Source: Own representation. Extension based on Swiss Re Capital Markets (2011) and World Economic Forum (2008).

Another important characteristic of cat bond structures beyond their trigger type is their form of registration. Most cat bonds are listed under Rule 144A of the SEC as a "safe harbor" which allows the SPV to privately offer its shares to qualified institutional investors (QIBs) managing USD 100 million or more. This improves the liquidity of cat bonds while avoiding the regulatory challenges if cat bonds were publicly offered (Swiss Re, 2011).[20] Table 4 summarizes the main characteristics of cat bonds.

[20] In general cat bonds are issued through Rule 144A offerings, which are available only to large institutional investors and are not subject to SEC's registration and disclosure requirements. Consequently, many of the usual investor protections that are common to most traditional investment vehicles are not applied. Specifically, cat bond issuers are not required to file a registration statement or periodic reports with the SEC. Although general prohibitions against securities fraud apply to Rule 144A offerings, the lack of public disclosure impedes obtaining information by investors (FINRA, 2014).

Table 4: Main characteristics, advantages, and disadvantages of cat bonds

Characteristics	
- Transfer the risk of peak events, such as hurricanes or earthquakes, to investors in the capital markets - Multi-year contracts - Liquid secondary market in most cases - Fully collateralized	
Advantage	**Disadvantage**
No basis risk if indemnity trigger	Basis risk in case of index trigger
Multi-year coverage (lock in cost of coverage)	Traditional reinsurance market continues to soften (making traditional reinsurance more competitive)
Fully collateralized	In general only for larger volumes (>USD 100m)
Low correlation with financial markets	When triggered no immediate renewal as with traditional reinsurance

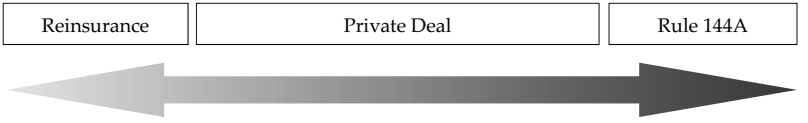
Excursion

Private Catastrophe Bonds ("cat bond light")

Private cat bonds, also known as "cat bond light" or "regulation D", are a recent development using innovative legal documentation to create "private" instruments. Advantages include lower structuring costs, less time consumption and higher flexibility than cat bonds and, at the same time, higher liquidity and wider distribution than collateralized reinsurance (InsuranceLinked, 2014).

According to the US Securities Act of 1933, securities need to be registered with the SEC. Several requirements have to be met, but there are two separate exceptions to this rule. These two exceptions are known as "safe harbors". The first one is Rule 144A for public bonds, under which conventional cat bonds (i.e., public bonds) fall, and the second one is Section 4(a)(2), under which "cat bonds light" (i.e., private bonds) fall (InsuranceLinked, 2014). Loss calculations in cat bonds light are, similar to traditional reinsurance, typically negotiated directly between sponsor and investor by signing confidentiality agreements in return for data access. Thus, some of the work done by risk modelers and legal service providers are excluded in such private deals and internalized by the investor.

Excursion: Cat bond vs. cat bond light vs. collateralized reinsurance



	Collateralized Reinsurance		Catastrophe bond	
	Direct or fronted reinsurance	Contract with cell company which issues notes	Cat bond light	Cat bond
Number of Investors	1 at a time	1 at a time	1 to 5	typically 20 to 40
Term	Largely single year	Largely single year	Multi-year possible	Largely multi-year
Upfront costs and time	Low	Relatively low	Can be significant	Significant
Risk/return profile	Varies, but bias to high risk / high return	Varies, but bias to high risk / high return	Preference is 2% EL with up to 5% EL possible	Preference is 2% EL with up to 5% EL possible
Flexibility after inception	Some	Some	Little	Little
Relationship	Transactional, but strategic possible	Transactional, but strategic possible	Transactional	Transactional
Comments	Higher spread but no fixed costs	Higher spread with limited fixed costs	Expense savings can prove illusory	Lower spreads in exchange for higher up-front costs

Source: Willis Capital Markets and Advisory (2012).

Note: EL = Expected loss.

2.1.1.2 Industry Loss Warranties (ILWs)

Another important instrument that covers natural catastrophes is the industry loss warranty (ILW). ILWs already appeared in the 1980s, whereas cat bonds were first introduced at the beginning of the 1990s (Krutov, 2010). There are several differences between a cat bond and an ILW.

First and foremost, the vast majority of ILWs have a double-trigger mechanism. That is, an ILW is triggered if an index measuring total losses of the insurance industry exceeds a predefined level (industry index trigger) and if the actual loss of the insurer passes a threshold (indemnity trigger). The advantage for the investor is higher transparency while the sponsor can possibly recognize the ILW as a reinsurance instrument from a regulatory perspective (Cummins and Barrieu, 2014). However, the threshold for the index trigger is usually set a much higher level than that of the indemnity trigger. Thus, despite their indemnity trigger, ILWs are usually associated with a considerable degree of basis risk (Gatzert and Kellner, 2011). Second, ILWs cover between USD 1 million and USD 250 million in losses whereas cat bonds require USD 100 million (World Economic Forum, 2008). Third, ILWs rarely exceed one year of coverage and thus are not multi-year products such as cat bonds. Finally, ILWs are so-called unfunded transactions, i.e., unlike in a cat bond deal, the protection seller does not need to post the full risk capital as collateral at the outset. As a corollary, however, counterparty risk becomes an issue because the protection seller could default exactly in the situation when a compensation payment under the contract is due. Table 5 summarizes the main aspects of ILWs.

Table 5: Main characteristics, advantages, and disadvantages of ILWs

Characteristics	
- Contractual agreements that call for the protection seller to compensate the protection buyer in case of a trigger event - In general double-trigger mechanism (industry index and indemnity based) - Smaller volume (USD 1m to 250 m) than cat bonds - Yearly coverage	
Advantage	**Disadvantage**
Low sum insured starting at USD 1 million (whereas cat bonds need at least USD 100 million of cover)	Reliance on loss indices (higher basis risk than pure indemnity triggers)
Fast execution	Private transactions (no secondary market)
No up-front commitment of full risk capital by protection seller (unfunded transaction)	Counterparty risk unless limit is collateralized

2.1.1.3 Collateralized Reinsurance (CRe)

An instrument that has gained much traction in recent years is collateralized reinsurance (CRe). CRe agreements are privately structured deals which reinsure a portfolio of specific insurance policies against losses caused by a predefined peril (Aon, 2013). Technically, CRe does not differ from traditional reinsurance except that collateral is provided up-front. The collateral covers the full potential claim obligation and enables unrated entities such as hedge funds or dedicated cat bond funds to take on catastrophe risk exposure (Fermat Capital Management, 2014).[21] Similar to traditional reinsurance, CRe contracts are typically closed with one-year maturities (Krutov, 2010). In contrast to cat bonds, however, they are not tradable. Being customized according to the counterparties' needs, CRe provides a high degree of flexibility both in terms of structural characteristics and underlying insurance risks. Hence, it allows ILS investors to further diversify their portfolios, which are often primarily exposed to U.S. hurricane risk in the form of cat bonds (Risk.net, 2014a).

From an investor's perspective, the biggest disadvantage of such a product is the necessity of profound underwriting expertise to understand the associated insurance risk(s). Apart from illiquidity and the necessary expertise to deal with the complexity of this instrument, the transaction volume can be critical as well, leaving only large and sophisticated investors for these instruments (Risk.net, 2014a). These drawbacks, however, are compensated by the fact that CRe agreements are attractive for the protection buyer and offer the protection seller higher spreads than cat bonds (Willis Capital Markets & Advisory, 2013). Table 6 summarizes the key characteristics of CRe.

[21] In rare cases, ILWs have been categorized as a type of CRe (see, e.g., Aon 2013). For the sake of clarity we explicitly differentiate between CRe and ILWs based on the characteristics discussed in this section.

Table 6: Main characteristics, advantages, and disadvantages of collateralized reinsurance

Characteristics	
- Privately structured contracts which insure a portfolio of specific insurance policies against losses caused by predefined peril(s) - One year contracts - Not traded - Allow non-insurers can enter the insurance market	
Advantage	**Disadvantage**
High Flexibility	No liquidity
Indemnity based (in general). Hence, no basis risk for the protection buyer	Asymmetric information between protection buyer and seller (investor)
Fully collateralized	Up-front commitment of full risk capital by protection seller needed (funded transaction)

2.1.1.4 Sidecars

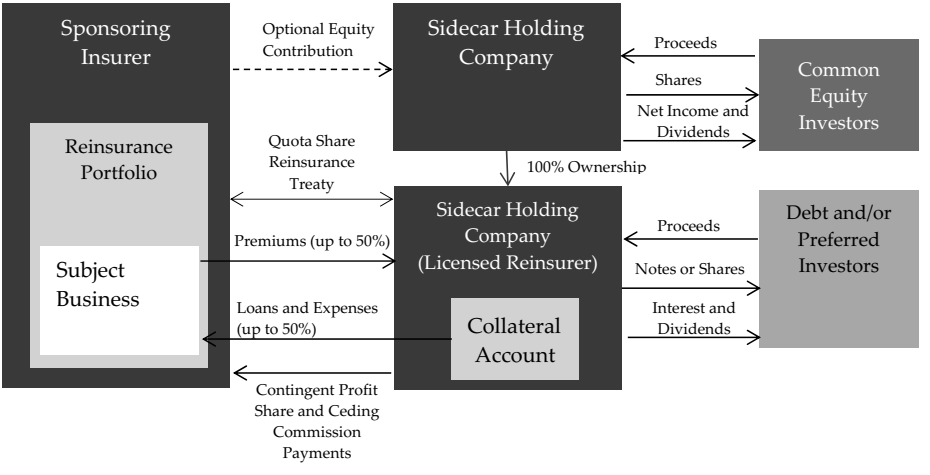
Similar to CRe, sidecars are financial structures which cover a specific portfolio of insurance policies. Sidecars are also (in most cases) fully collateralized and earn a return on that portfolio of policies. In contrast to CRe, sidecars raise capital **before** defining a specific insurance portfolio instead of covering an already existing book of business (Fermat Capital Management, 2014). They have typically been used during "hard markets" with high spreads whereas sidecar activity tended to be reduced during "soft markets" (World Economic Forum, 2008). In the aftermath of Hurricane Katrina, e.g., sidecars became widespread to take on additional capacity for claim obligations. More recently, however, sidecar activity continued to increase despite the softening market (Willis Capital Markets & Advisory, 2014). Sidecars usually rely on quota-share reinsurance instead of the excess-of-loss reinsurance mechanism inherent in cat bonds and ILWs (Wu and Soanes, 2007; Clear Path, 2014).[22]

Another critical difference between sidecars and cat bonds are the "equity-like" returns of sidecars. While cat bonds pay fixed coupons, sidecars pay a higher or lower return depending on received claims. In this context, it is worth mentioning

[22] Quota-share reinsurance means that a specific percentage of all claims is covered by the sidecar structure whereas excess-of-loss reinsurance (often abbreviated XL-reinsurance) fully pays those claims that exceed the threshold (or attachment point). Thus, excess-of-loss reinsurance is useful for peak events.

that sidecars can be either "equity-only" or "leveraged" and accordingly investors are offered debt or equity securities (Krutov, 2010). The debt tranches are comparable to cat bonds. Leveraged sidecars were the more common type before the financial crisis in 2008. However, debt financing became exceptionally expensive after the financial crisis and since then equity-only sidecars are the preferred structure (Krutov, 2010). Typically, sidecars are offered by reinsurers to investors. Investors, though, seem to be skeptical towards sidecar structures due to a potential conflict of interest (Willis Capital Markets & Advisory, 2013). That is, as mentioned above, while defining the insurance portfolio, reinsurers might have an incentive to transfer "bad" risks into the sidecar rather than holding on to that book of business with their own capital base. Another criticism about sidecar structures in the past is their high fees compared to other alternative risk transfer structures. Table 7 summarizes the main characteristics of sidecars. The following schematic (Figure 3) shows the structure of a leveraged sidecar instrument as it might reappear in the future:

Figure 3: Scheme of a (leveraged) sidecar structure



Source: Wu and Soanes (2007).

Table 7: Main characteristics, advantages, and disadvantages of sidecars

Characteristics	
- Financial structures which cover a specific portfolio of insurance policies. In contrast to CRe, sidecars raise capital before defining a specific insurance portfolio instead of covering an already existing book of business - Usually sponsored by reinsurance companies - Often Used during "hard" markets - Embedded quota-share reinsurance	
Advantage	**Disadvantage**
Multi-year coverage	High transaction cost
No basis risk	No liquidity
Lower disclosure requirements in contrast to other ILS vehicles due to a stronger focus of investor's due diligence on management than on portfolio (World Economic Forum, 2008).	
Reinstatement in subsequent season is standard (World Economic Forum, 2008).	

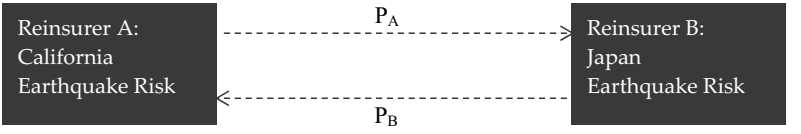
2.1.1.5 Catastrophe Swaps

In contrast to the instruments discussed so far, catastrophe swaps (cat swaps) are (typically uncollateralized) agreements under which the counterparties exchange contingent payments (Cummins, 2008). There are two types of cat swaps: "pure risk swaps" between (re)insurance companies and financial derivatives often called event-linked swaps that can also be entered by non-(re)insurers.

In a pure risk swap, two (re)insurance companies exchange uncorrelated catastrophe risk exposures from their existing books in order to improve portfolio diversification and potentially reduce regulatory capital requirements (Braun, 2011). Thereby, firms whose business is locally concentrated in an area which is susceptible to a particular type of natural disaster can replace a portion of their core risk with another type of peril that they may not be able to access directly. These contracts are usually set up such that the present values of the two swap sides exactly balance and there are no up-front payments between the counterparties. Instead, money is only exchanged in case of a qualifying event. This requires an alignment of the triggers as well as

precise risk modeling in order to match expected losses through the configuration of the terms and conditions of the contract. Figure 4 shows an example in which two reinsurers exchange earthquake risks from the U.S. and Japan.[23]

Figure 4: Example of a "pure risk" cat swap



P_A = contingent payment for Japan earthquake
P_B = contingent payment for California earthquake

Non-insurance investors interested in an unfunded access to catastrophe risk can enter a cat swap in the form of a financial derivative (event-linked swap). Under such a contract, the protection buyer (fixed payer) agrees to make periodic premium payments to the protection seller (floating payer) in exchange for a predetermined binary compensation payment contingent on the occurrence of a trigger event in the covered territory (Braun, 2011). If, during the term of the contract, a final loss estimate for a reference peril reaches the event threshold (attachment level), it results in an immediate payoff to the protection buyer and the subsequent termination of the contract. Event-linked cat swaps are highly standardized and therefore exhibit relatively low transaction costs. In May 2009, the International Swaps and Derivatives Association (ISDA) released a documentation template for transactions referencing US windstorm events. The goal of these definitions for key terms is to reduce uncertainty, improve liquidity and transparency, and encourage growth in the market. Due to the fact that the instrument is usually uncollateralized, the protection seller does not need to invest the full risk capital at the outset. At the same time, however, counterparty risk is a concern for both sides to the transaction. Table 8 summarizes the aforementioned aspects.

[23] It is also possible exchange different perils such as hurricane risk and earthquake risk in one contract.

Table 8: Main characteristics, advantages, and disadvantages of cat swaps

Characteristics	
- Agreement between two parties to exchange contingent payments - Usually not collateralized - Two types: pure risk swaps and event-linked swaps	
Advantage	**Disadvantage**
Highly customized (pure risk cat swap) Highly standardized (event-linked swap)	No accounting and regulatory acceptance as reinsurance for event-linked swap
Low transaction costs (event-linked swap)	Basis risk in event-linked swap (index-based trigger)
No up-front commitment of full risk capital by protection seller (unfunded transaction)	Counterparty risk in the absence of an additional collateral agreement

2.1.1.6 Catastrophe Futures and Options

Catastrophe futures and options are exchange-traded insurance derivatives and, as such, highly standardized. The contracts stipulate payments at specific points in time, which typically depend on the value of a loss index (Cummins and Weiss, 2009). Thus, unlike traditional futures or options, catastrophe derivatives cannot be settled through physical delivery because the underlying is not a traded asset (Krutov, 2010). The buyer (seller) of a catastrophe futures contract enters a long (short) position in the underlying loss index. At the outset, both parties need to make an initial margin payment. Subsequently, the exchange regularly marks the futures contract to market and issues margin calls to the counterparties, depending on the direction of the value changes. Cat options, in contrast, provide the buyer with a nonlinear payoff profile. If the underlying loss index of a call-type catastrophe option, e.g., is below the threshold, the contract is worth zero. Above the threshold, its value increases linearly with the value of the index. Table 9 summarizes the main aspects of cat futures and options.

In 1992, the Chicago Board of Trade (CBOT) began offering exchange-traded catastrophe futures and options based on the Insurance Services Offices (ISO) catastrophe index. However, due to a lack of interest, these instruments were soon discontinued (World Economic Forum, 2008). Despite the failure of this first attempt, CBOT issued another series of contracts in September of 1995 using Property Claim

Services (PCS) indices. Yet, these options were also discontinued in 2000 (Cummins and Weiss, 2009).

From 2007 to 2011, the Insurance Futures Exchange (IFEX) offered cat futures traded on the Chicago Climate Futures Exchange (CCFE) but these were delisted as well after IFEX, as a subsidiary of Climate Exchange plc, was acquired by Intercontinental Exchange (ICE) (CCFE, 2012). Similarly, EUREX offered U.S. hurricane futures in 2012 for the contract risk period 2013 (EUREX, 2012). Again, these hurricane futures were discontinued in 2014 (EUREX, 2014).

Other exchanges offering standardized catastrophe options were the Chicago Mercantile Exchange (CME) and the New York Mercantile Exchange (NYMEX). These options settled according to the CME Hurricane Index and Gallagher Re's Re-Ex index, respectively (Cummins, 2008). These instruments did not succeed, either.

Potential reasons for the repeated failure of this ILS market segment are discussed by Hoyt and McCullough (1999) as well as Bouriaux and Tomas III (2014). According to experts interviewed for this study, the low regulatory and accounting acceptance led to a one-sided market with no one to buy protection. Without more favorable regulation, it was not possible to manage the technical result with these instruments.

Table 9: Main characteristics, advantages, and disadvantages of cat futures and options

Characteristics	
- Standardized exchange-traded contracts to pay or receive payments at a specified time - Underlying is generally an insurance loss index - Futures feature a linear, options a nonlinear payoff in the underlying index - Limited success so far (all attempts were discontinued after a few years)	
Advantage	**Disadvantage**
Fast execution and settlement	High basis risk
Low counterparty risk	Lack of accounting and regulatory acceptance
High standardization	

2.1.1.7 *Contingent Capital*

Although not exclusive to the insurance industry but still worth mentioning in this context is contingent capital offered as bonds, also known as Contingent Convertible (CoCo) bonds. Technically, these instruments are structured with a put option in addition to a traditional bond. If a trigger event occurs, e.g., if the stock price of the (re)insurance company drops below a certain level, it may convert the bond principal into equity to strengthen its capital base (Cummins and Weiss, 2009). The conversion rate can be fixed, variable or variable with a floor. Alternatively, a trigger event could simply result in a write-down of the bond principal (Credit Suisse, 2014). CoCo-bonds are actively traded in the secondary market.

CoCo-bonds and cat bonds have the same ultimate purposes, that is, the avoidance of the (re)insurer's insolvency after a catastrophic event. An important difference between both instruments is the extent to which the (re-)insurer may influence the outcome. While a cat bond is triggered solely by the catastrophic event that lies beyond the control of the sponsor, the value of CoCo-bonds is also driven by management decisions affecting the performance of the insurance company. Table 10 summarizes the main aspects of contingent capital.

Table 10: Main characteristics, advantages, and disadvantages of contingent capital

Characteristics	
- Securitization transaction similar to a down-and-out put option, which allows an insurer to issue capital (e.g., common stock, hybrid capital, or debt) at a predetermined strike price following the occurrence of a defined event - Securitization including contingent put option - Debt capital is converted into equity (or debt) if trigger event occurs	
Advantage	**Disadvantage**
Hedges the equity capital of the sponsor	Potential contagion effects if trigger event erodes trust in the insurer/industry
Secondary market provides liquidity	Counterparty risk in case new equity capital is issued

2.1.1.8 *Weather Derivatives*

Weather derivatives do not directly securitize insurance risk. Hence, they are not ILS in the narrow sense. These instruments are mainly bought by utility companies to hedge against extreme weather conditions, e.g., certain temperature levels (World Economic Forum, 2008). Other market participants include agricultural businesses, construction companies, and retailers (World Economic Forum, 2008). For insurers, these derivative products might contain too much basis risk to be useful for hedging purposes. Table 11 summarizes the key characteristics of weather derivatives.

Table 11: Main characteristics, advantages, and disadvantages of weather derivatives

Characteristics	
- Derivative financial instruments whose payout depends on the value of a weather-related index (or event) - By definition weather derivatives are not contracts of insurance	
Advantage	**Disadvantage**
High transparency	High basis risk (parametric triggers)
High degree of standardization	Less relevant for insurers

2.1.2 *Life / Health Risks*

2.1.2.1 *Longevity Bonds*

A rather controversial product among the general public has been the longevity bond. In a nutshell, investors benefit if retirees and life annuity policyholders die sooner than expected.[24] The general idea is that the bond principal depends on realized survival rates in a reference population: if those are higher than expected, then investors do not receive the full principal repayment. The survival rates are typically reported in form of a longevity index, which may give rise to basis risk. Several indices have been discontinued in the past and today the only available options are provided by the Life & Longevity Markets Association and Deutsche Börse Group for different cohorts (Deutsche Börse Group, 2014).

[24] Although the concept of longevity bonds is not new, successful issuances at the beginning of this decade resulted in some critique against the respective parties as they are buying insurance against the fact that the population "lives too long". Longevity bonds are thus sometimes referred to as "death derivatives" (Bloomberg, 2011).

Until 2010, offerings for longevity bonds were rather unsuccessful and did not create enough demand. Together with the European Investment Bank (EIB), BNP Paribas structured the first longevity bond in 2004 but because of the unfamiliar structure and scarce demand the bond did not reach the market (Krutov, 2010). In 2010, however, Swiss Re succeeded in issuing a longevity bond. This success might be attributable to the introduction of a structure which closely resembles that of a typical cat bond and is thus quite familiar to the ILS investor base. An important disadvantage of longevity bonds (in contrast to swaps) from the investor perspective is their very long time to maturity during which the capital is tied up (Bank for International Settlements, 2013). Since longevity improvements materialize over decades rather than years, short-term longevity bonds are of no value to the sponsor.

A greater awareness of longevity as a risk factor worth hedging, a changing regulatory environment for insurers and pension funds, and reduced basis risk through better indices might have the potential to improve the demand for longevity bonds in the future. Apart from dedicated ILS funds seeking to diversify their portfolios, life insurers with a net exposure in mortality risk are a natural investor group for longevity bonds (Krutov, 2010). Table 12 summarizes the main aspects with regard to longevity bonds.

Table 12: Main characteristics, advantages, and disadvantages of longevity bonds

Characteristics	
- Bonds which securitize longevity risk - Addresses the issue that a cohort lives longer than expected	
Advantage	**Disadvantage**
Long-term hedge for the sponsor	Up-front investment of the investor tied up for a very long time
Diversifying asset for ILS investors	Currently no active secondary market
Low model risk: in contrast to natural disasters, longevity improvements are actuarially better predictable	Basis risk (degree depends on composition of underlying index)

2.1.2.2 *Extreme Mortality Bonds*

Mortality risk means the adverse financial impact of higher-than-expected mortality rates. This risk is securitized in extreme mortality bonds which are triggered by a mortality index. Investors in such instruments suffer losses when realized mortality in a defined population over a specific timeframe exceeds projected mortality. Jumps in mortality rates, i.e., sudden sharp increases of the number of deaths in a population are mainly driven by terrorist attacks, wars,[25] or pandemics (Krutov, 2010). Life insurance products such as term life contracts pay in the event of a policyholder's death. Hence life insurers are prone to extreme mortality events.

The first extreme mortality bond, Vita Capital (sponsored by Swiss Re) was issued in 2003 and matured in 2007 (Krutov, 2010). In contrast to the first longevity bond, Swiss Re's extreme mortality bond met a strong investor demand. Since then, some innovations have taken place. For example, tranching a sponsor's mortality risk into different layers and complementing mortality bonds with financial guarantees ("wrapping") improved ratings and broadened the investor base. Table 13 summarizes the key aspects of extreme mortality bonds.

Table 13: Main characteristics, advantages, and disadvantages of mortality bonds

Characteristics	
- Bonds which securitize mortality risk - Address the issue that a cohort dies prematurely	
Advantage	**Disadvantage**
Multi-year hedge	Basis risk (degree depends on composition of underlying index)
Fully collateralized	Currently still low liquidity

[25] Many insurers exclude war-related claims. Thus, wars are a lesser concern for the securitization of mortality risk than pandemics or terrorism attacks (Millimian, 2013). Here, it becomes obvious that the legal framework for mortality risk must be clear-cut

2.1.2.3 *Embedded Value Securitization*

Embedded value (EV) securitization, sometimes also known as value-in-force (VIF) securitization,[26] refers to transactions where an insurance company monetizes future profits from an **existing** book of life insurance business (Wu and Soanes, 2007; Krutov, 2010). Thus, the insurer receives immediate access to future cash flows which would otherwise materialize over time. Especially in an M&A context, if a life insurer is being acquired, the buyer can consider EV securitization to fund the acquisition. Also, an insurer can securitize part of his EV for capital relief purposes or for an "acceleration" of its balance sheet, that is, to increase liquidity (Wu and Soanes, 2007). The risks for which an investor is compensated include the differences between projected and realized mortality / longevity, lapse rate, and investment returns. Often, EV securitizations are done with life insurance businesses in run-off (Wu and Soanes, 2007) and can thus be easily distinguished from future new business. A concrete example is the complete securitization of New Barclays Life, which was undertaken in November 2003. Table 14 summarizes the aspects of EV securitization.

Table 14: Main characteristics, advantages, and disadvantages of EV securitization

Characteristics	
- Transactions where insurer monetize future profits emerging from a block of business - Often involves a seasoned closed block of life insurance business in run-off	
Advantage	**Disadvantage**
Monetize future cash flows	Investor has to accept risk in mortality / longevity rate, lapse rate, and investment returns
Additional source of financing in M&A context	
Fund new business strains	

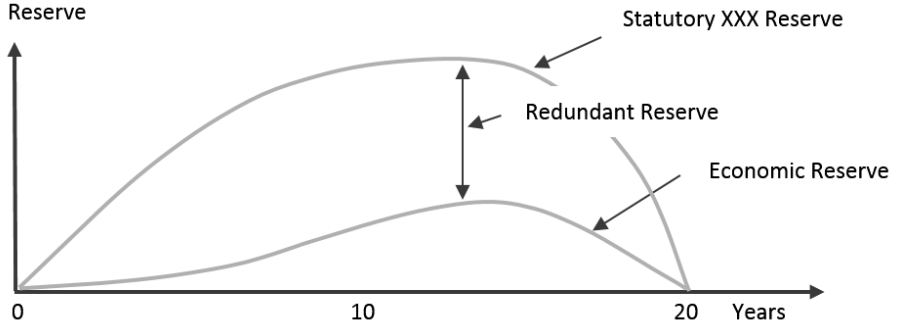
[26] Although both terms are sometimes used synonymously, there is an important difference between the two. The VIF describes the present value of the expected future cash flows of the existing business. In contrast, the EV consists of the VIF and the insurer's adjusted net asset value (see Krutov, 2010). Thus, the EV represents the entire economic value of a life insurer excluding future new business.

2.1.2.4 *XXX / AXXX Reserve Securitization*

Within the U.S. regulatory framework set out by the National Association of Insurance Commissioners (NAIC), the 'Valuation of Life Policies Regulation', known as regulation XXX (or Triple-X) requires a conservative reserving approach for term life insurance policies with long-term premium guarantees. Similarly, Actuarial Guideline XXXVIII (known as Regulation AXXX and sometimes referred to as AG38) defines a conservative reserving approach for universal life with secondary guarantee (ULSG) products. Both regulation XXX and regulation AXXX result in a significant gap between economic and statutory reserves. This is attributable to the fact that the economic reserves do not include a safety margin as do statutory reserves, but rather estimate the required reserves under assumptions which are based on best estimates (Krutov, 2010).

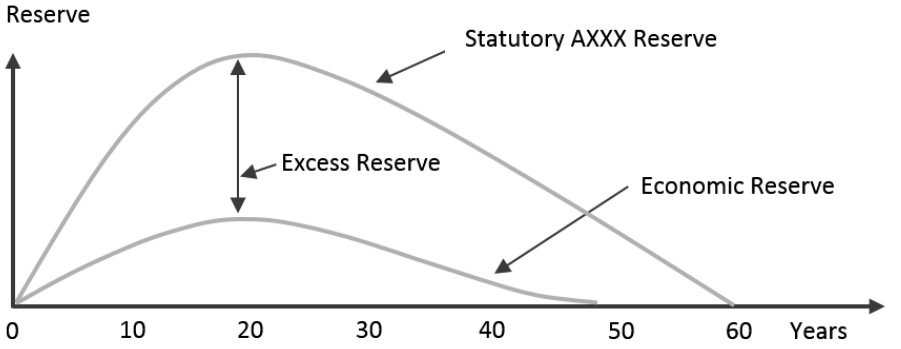
The main objective of XXX / AXXX securitizations is to fund the redundant reserves and to alleviate the capital strain at a locked-in cost (Wu and Soanes, 2007). As shown in Figures 5 and 6, the redundant reserves are significant and may even be a large multiple of the economic reserve. They have been a challenge for the U.S. insurance industry since the introduction of the XXX / AXXX regulation in January 2000 (S&P, 2012).

Figure 5: Redundant reserves due to regulation XXX



Illustrations of XXX redundant reserves based on a 20-year term policy issued to a male non-smoker, aged 45.
Source: Wu and Soanes (2006)

Figure 6: Redundant reserves due to regulation AXXX



Illustrations of AXXX redundant reserves reflecting one year of production for hypothetical portfolio of universal life secondary guarantee business.
Source: Wu and Soanes (2006)

The securitization of AXXX reserves is more difficult than that of XXX reserves due to the higher uncertainty of universal life insurance products in terms of mortality, lapsation, investment, and other factors (Krutov, 2010). The redundant reserve is invested in a Regulation 114 trust and investors of XXX / AXXX securitization receive payments from the investment returns and additional cash flows from the ceding insurer under the reinsurance contract.

Traditional reinsurance solutions and Letters of Credit (LOC) can be an alternative way to reduce capital strain. However, both solutions are short-term in nature and do not provide capital relief for 20 or 30 years (Krutov, 2010). Hence, rating agencies see them with skepticism (Wu and Soanes, 2007; S&P, 2012).

According to S&P (2012) the likelihood of losses for investors (until now) in these structures is remote. That is, for XXX transactions mortality would need to be increased in excess of 150% p.a. to result in losses for investors. For AXXX transactions to result in losses, a low interest rate environment (as currently present), lapses and significantly different mortality rates from estimates would be necessary.

Because of some controversy between regulatory bodies and the insurance industry, it will be interesting to see how XXX / AXXX securitization will develop. Specifically, some regulators are displeased with the assets used to fund these reserves, including surplus notes or LOC's, calling them "inadmissible" (Risk.net, 2014b). With the 'Rector Report' a new initiative seems to be undertaken to standardize XXX / AXXX

transactions. Most importantly, a floor reserve established by actuarial methods is proposed which would be below XXX / AXXX reserve levels (Risk.net, 2014b). Only cash and specific securities prescribed by NAIC would be allowed to cover this floor reserve. Beyond the floor reserve, other assets can fund reserves including LOCs.

However, the ultimate goal of U.S. regulators is considered to be a principle-based regulation as can be seen in section 20 of NAIC's new valuation manual regarding reserves (Risk.net, 2014b).[27] In contrast to a rule-based regulation (i.e., most of U.S. insurance regulation) a principle-based regulation might lead to other models for the calculation of redundant reserves. The models then depend on the underlying principles. For example, in the new regulatory frameworks Solvency II and Swiss Solvency Test (SST) a risk margin is added to the best estimate of the liabilities. This risk margin can either come from a standard regulatory model or from a company specific internal model.

The question is how the U.S. will deal with the redundant reserves from a regulatory perspective and whether the regulations XXX / AXXX will persist in their current form. Table 15 summarizes the aspects of XXX / AXXX reserves securitization.

Table 15: Main characteristics, advantages, and disadvantages of XXX / AXXX reserve securitization

Characteristics	
- Securitizations which life insurance companies and reinsurers use to fund redundant reserves via capital markets	
Advantage	**Disadvantage**
More efficient use of capital	Need assumptions about mortality, lapsation, investment, expense levels etc.
Collateralized	Limited secondary market (instruments might need to be held until maturity of 15 to 30 years)

[27] Note that even within the U.S. regulatory body this is a very controversial discussion. With Europe moving towards a principle-based regulation, we assume that the U.S. will follow at least to some extent in the same direction.

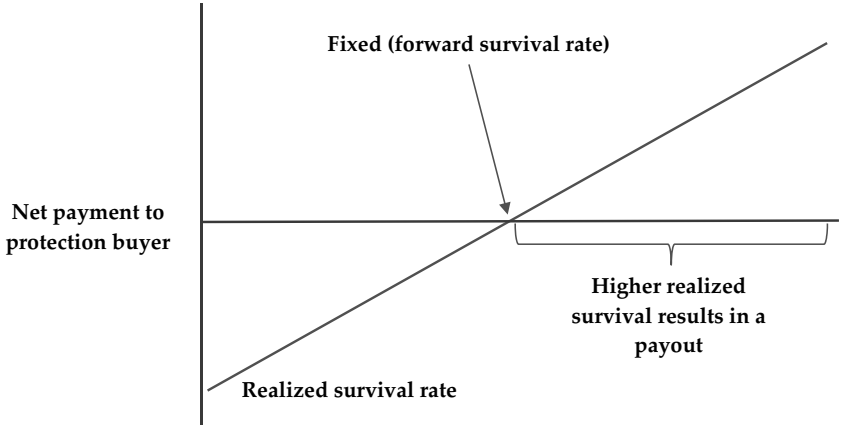
2.1.2.5 *Survivor Forwards and Mortality Forwards*

Survivor forwards (also called "S-forwards") are derivatives whose underlying is an uncertain t-year survival rate. They have been developed by J.P. Morgan's Life Metrics team and are now promoted by the Life & Longevity Markets Association (LLMA), a consortium of banks and insurance companies that share the goal of creating a liquid market for longevity and mortality risk.[28] The longevity protection buyer in a survivor forward enters a long longevity position at a survival rate which is fixed at inception of the contract. Both counterparties agree to exchange cash flows based on the difference of this fixed rate and the realized rate at a specific future time. The contract payoffs follow the typical forward pattern. If, at maturity, the realized survival rate exceeds the forward rate that has been fixed at inception of the contract, the protection buyer receives a payment. This payment can be used to compensate for additional liabilities that arise due to greater-than-expected longevity improvements. However, if the realized survival rate at maturity is lower than the forward rate, the protection buyer needs to make a payment to the protection seller. Figure 7 illustrates this payoff profile. Hence, survivor forwards can be used to manage or actively take exposure to longevity risk. They are the basic building blocks for more complex longevity swap transactions. Typical buyers of survivor forwards are insurance companies with annuity business or pension funds.

Similar to survivor forwards, mortality forwards are derivatives whose underlying is an uncertain t-year mortality rate. In line with the actuarial variable for mortality rates, they are also called "q-forwards". Mortality forwards are the natural counterpart of survivor forwards. Consequently, they can be used to manage or actively take exposure to mortality risk. The mortality protection buyer enters a long mortality position at the forward rate fixed at inception and the counterparties agree to exchange cash flows based on the difference of the forward rate and the realized mortality rate at a specific future time. If the realized mortality rate at maturity is higher than the forward rate, then the protection buyer receives a payment from the protection seller, which he can use to compensate for additional liabilities on his mortality risk portfolio. Lower-than-expected mortality, in contrast, results in a payment from the buyer to the seller of the contract. Typical buyers of mortality forwards are insurance companies with life insurance business or death benefit funds. Both survivor and mortality forwards are subject to basis risk, if the reference population differs considerably from the lives in the portfolio of the hedger.

[28] The current LLMA members are Aviva, AXA, Deutsche Bank, J.P. Morgan, Morgan Stanley, Prudential and Swiss Re (see www,llma.org).

Figure 7: Payoff profile mechanics for mortality forwards



Source: LLMA

Table 16: Main characteristics, advantages, and disadvantages of survivor forwards and mortality forwards

Characteristics	
- Derivatives which can be used to hedge or take on exposure to longevity (S-forward) and mortality risk (q-forward)	
Advantages	**Disadvantages**
Simple and standardized contracts	Still very humble market activity. Difficult to close out positions
Unfunded transactions: No up-front payment needed	May need additional collateral agreement to mitigate counterparty credit risk
	Basis risk if reference population differs from the lives in the hedger's portfolio

2.1.2.6 Longevity Swaps

Longevity swaps are derivatives that allow two counterparties to exchange future cash flow streams linked to a fixed swap rate as well as realized survival rates. They are essentially a portfolio of survivor forwards with staggered maturities and can thus be used to hedge against longevity risk. Each survivor forward corresponds to one payment date under the swap contract. The fixed rate payer assumes a long longevity position, thereby benefiting from higher-than-expected survival rates. As

in the forward case, opposing payments are netted off, i.e., if the realized survival rate on the payment date is larger (smaller) than the longevity swap rate, the protection buyer (seller) receives a payment from the protection seller (buyer). Figure 8 illustrates this structure. A natural way to employ longevity swaps is the exchange of longevity and mortality risk between life insurers and pension funds. Up to date, longevity swap transactions have been particularly popular in the United Kingdom. Table 17 provides some representative transaction examples.

Figure 8: Structure of a Longevity Swap

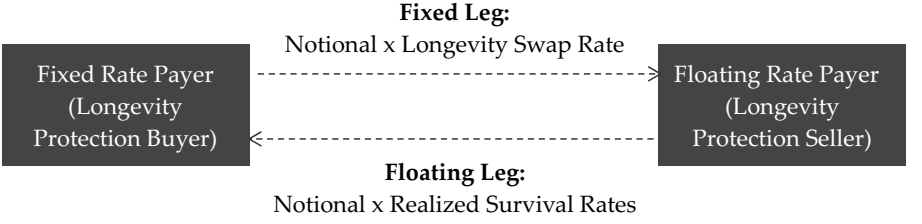


Table 17: Longevity Swap Transaction Examples

Date	Counterparty 1	Counterparty 2	Notional
February 2008	Lucida	J.P. Morgan	148'000'000 USD
October 2008	Canada Life (UK)	J.P. Morgan	844'000'000 USD
December 2008	Australian Insurer	Swiss Re	352'000'000 USD
February 2009	Abbey Life	Pacific Life Re	2'162'000'000 USD
March 2009	Norwich Union	Partner Re and UBS	686'000'000 USD
May 2009	Babcock International	Credit Suisse	764'000'000 USD
July 2009	RSA Pension Fund	Goldman/Rothesay Life	3'099'000'000 USD
November 2009	CDC Pension Fund	Goldman /Rothesay Life	400'000'000 GBP
December 2009	County of Berkshire	Swiss Re/Windsor Life	750'000'000 GBP
February 2010	BMW	Deutsche Bank/Abbey Life	3'000'000'000 GBP
June 2010	British Airways	Goldman /Rothesay Life	1'300'000'000 GBP
January 2011	Pall	J.P. Morgan	70'000'000 GBP
August 2011	ITV	Credit Suisse	1'700'000'000 GBP
November 2011	Rolls Royce	Deutsche Bank	3'000'000'000 GBP
December 2011	Pilkington	L&G	1'000'000'000 GBP
December 2011	British Airways	Goldman /Rothesay Life	1'300'000'000 GBP
May 2012	Akzo Nobel	Swiss Re	1'400'000'000 GBP

Source: Swiss Re, Mercer

Table 18: Main characteristics, advantages, and disadvantages of longevity swaps

Characteristics	
- Derivatives which can be used to hedge or take on exposure to longevity risk.	
Advantages	**Disadvantages**
Standardized contracts	Humble market activity. Difficult to close out positions
Unfunded transactions: No up-front payment needed	May need additional collateral agreement to mitigate counterparty credit risk
Familiar format mimicking classical swaps from the fixed income area	Basis risk if reference population differs from the lives in the hedger's portfolio

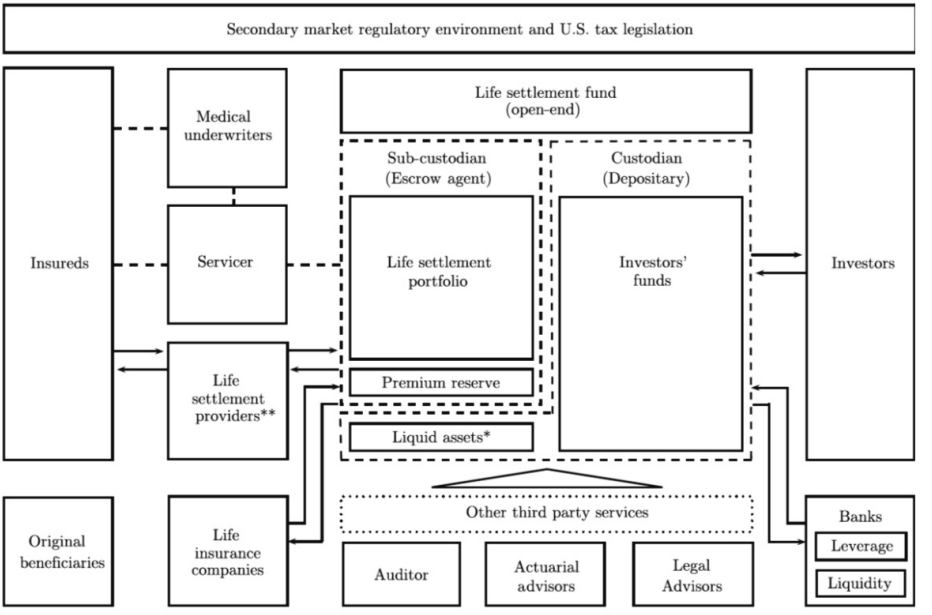
2.1.2.7 Life Settlements

Throughout the last two decades, secondary markets for life insurance contracts have developed in several countries such as the United Kingdom, Germany, and the United States. To date, the largest trading activity takes place in the U.S., where life insurance policies of individuals above the age of 65 with substandard life expectancies (commonly between 2 and 12 years) are purchased. These so-called senior life settlements mainly include lifelong contracts with a death benefit payment such as universal or whole life insurance. Universal life policies are by far the largest segment, since, in contrast to whole life contracts with constant-level premiums, they offer flexible payments as long as the cash value (policyholder's reserve) remains positive. After the completion of a life settlement transaction, the investor typically continues to pay the premiums on the contract until the original policyholder passes away and he can collect the death benefit payment. Hence, while the size of the cash inflow, i.e., the face value of the policy, is known at the outset of a deal, its timing is random. The sooner after the transaction date the insured dies, the higher the return for the investor, since only few premiums have to be paid and the death benefit payment is received early. Those investors, who do not want to hold a policy until it matures, may decide to sell it on in the tertiary market.

Figure 9 depicts the life settlement transaction process. Due to the complexity of the acquisitions, the considerable legal documentation requirements, and the necessary actuarial as well as portfolio management know-how, life settlement investors typically access the asset class via open-end or closed-end funds. The funds, in turn, source their policies from life settlement companies or providers, which may rely on

insurance brokers to establish contact with policyholders willing to sell. By selling his contract to a life settlement provider, the insured can achieve a price above the surrender value. The offer of the provider is based on the difference between the present value of the expected future premium payments and the present value of the expected death benefits. Consequently, the most important pricing determinant is the life expectancy of the original policyholder, which is estimated by specialized medical underwriters. The return for the investor crucially depends on the accuracy of these estimates. Due to the large primary market, the U.S. life settlement industry has a great potential. As reported by *The Deal Pipeline*, the total face value of all completed transactions increased to USD 2.57 billion in 2013. In addition, the Life Insurance Settlement Association (LISA) reports that the asset class is continuing to recover from a downturn in the years 2009 and 2010. Increased volumes were reported by professionals in every segment of the industry and Conning & Co. predict an average annual deal volume of approximately $3 billion between 2014 and 2023. Unfortunately, a more rapid market expansion may be hampered by the fact that the industry is still plagued by a large degree of asymmetric information between investors and fund managers. This causes a misalignment of incentives, which, in certain cases may result in inflated portfolio valuations or even fraud cases (see Braun et al., 2015).

Figure 9: Life Settlement Transaction Process



Source: Braun et al. (2012)

Table 19: Main characteristics, advantages, and disadvantages of life settlements

Characteristics	
- Life insurance policies of senior U.S. citizens traded in the secondary market. This asset class allows investors to take high-yielding longevity risk exposure.	
Advantage	**Disadvantage**
High two-digit rates of return combined with considerable diversification potential of biometric risk	Asymmetric information gives rise to valuation and fraud risks
Active tertiary market through which policies can be sold to other investors	High transaction costs due to non-standardized deals

2.2 Market Development and Trends

In the following we discuss the major trends and developments in the ILS market. As already indicated in Section 2.1 the ILS market is dynamic in its development. At least ten important trends will be proposed in this Section (see Table 20).

Table 20: Top ten ILS trends

- Trend 1: The market will grow ILS has reached critical mass making it a true alternative for traditional reinsurance in terms of cost efficiency, geographical areas, and types of perils.
- Trend 2: The spreads will remain at low levels Demand for ILS (inflow of alternative capital) and other factors (lower interest rates, reduced novelty premium, liquidity, technology) lead to further decrease of spreads.
- Trend 3: New investors (alternative capital) and new sponsors (state entities) Increasing use of alternative capital, i.e., capital inflows from non-specialized institutional investors (i.e., pension funds, hedge funds) seeking uncorrelated returns and relatively high yields in a low interest rate environment. New sponsors come from the government side.
- Trend 4: New structures Increasing range of investors and different risk appetites induce new ILS structures (cat bond light, aggregate loss bonds, hybrid cat bonds); also: more ILS funds who manage different risks.
- Trend 5: Convergence of ILS and traditional reinsurance Increasing use of indemnity-based triggers and variable reset make ILS more and more look like traditional reinsurance solutions.
- Trend 6: Higher liquidity, lower transaction costs Increasing secondary market for ILS and price competition between ILS and traditional reinsurance.
- Trend 7: New types of risk other than cat risk will attract attention Cat risk is dominant at the moment due to the lack of other risks being securitized, but many market participants also expect the market to open for new types of risk in the coming years.
- Trend 8: Internationalization of risks Catch-up of European and Japanese wind perils. In addition, secondary perils such as flood events will be of greater importance (example Sandy), either as a separate risk category or in combination with the corresponding primary wind perils.
- Trend 9: Technological progress Technological progress regarding loss modelling, satellite imaging, and precision / customization of loss indices increase the measurement accuracy of perils.
- Trend 10: Partial increase in life securitization Longevity-induced pension gaps, stronger focus on the management of biometric risk, and inadequate regulatory reserves might trigger more life securitization.

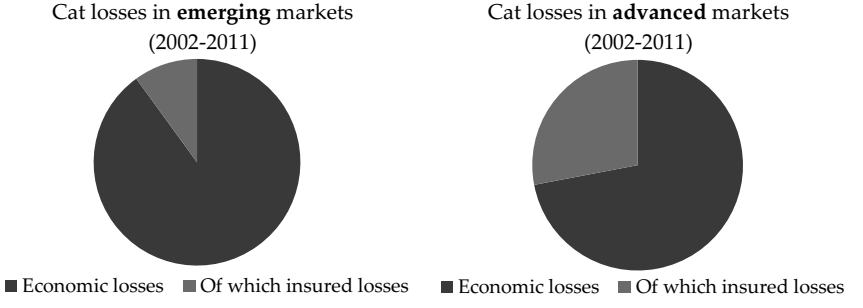
Later, in the empirical part, we will add the following five aspects to the discussion. First, transaction costs – along with lacking experience / knowledge – are still the most significant impediments to ILS market expansion in general. Second, skin in the game is necessary to attract investors; we show that a 5 to 10% sponsor investment (of the total investment size) leads to large increases in the willingness to invest. Third, we observe that having no rating is better than having a bad rating and also document the increasing use of unrated ILS. Fourth, investors prefer bundled risk. This might be surprising because ILS is geographically very specific (e.g., hurricanes in Florida) and very specific in which type of risk (e.g., cat risk). Fifth, we expect a substantial expansion of ILS over the next years. In this context we discuss the role of new instruments such as traded protected cells, and new types of risks. Investors expect the market to double in the next five years.

In the following, we describe the market development with respect to products as well as with respect to the investor and sponsor base. In this context, we will more fully explain the ten trends outlined in the table above. In addition to general market information, we include the results of expert interviews in this part.

2.2.1 Products

The market will grow. According to estimates by Guy Carpenter (2014), the global limit of the property catastrophe reinsurance market in 2014 is approximately USD 300bn where USD 48 billion (or 16%) of that amount has been transferred to the ILS market. These USD 48 billion can be further split into USD 19 billion (or approximately 6% of the global property catastrophe limit) in cat bonds and about 10% in collateralized reinsurance, ILWs, and sidecars. Although, this means that roughly 84% of catastrophe-risk could technically still be transferred through ILS, the capacity in the long-term is limited, at least as long as ILS are primarily employed to cede peak risks. Nevertheless, the difference between 48 billion and 300 billion illustrates that the ILS market still has room for expansion, especially when these instruments become more attractive relative to traditional reinsurance (e.g. because of lower transaction costs, reduced novelty premium, higher liquidity). Moreover, it is also expected that the global maximum volume of the property catastrophe reinsurance market will grow in the next years, because of increasing climate risk, new regulatory capital requirements for insurers that make risk transfer more attractive, better technology to accurately measure perils, and the increasing concentration of insured values in disaster-prone areas. In addition, with a stronger penetration of insurance in the emerging markets, the difference between economic losses and insured losses will be reduced. Figure 10 shows the difference of economic and insured losses between advanced and emerging markets. In the following we discuss some of these trends in more detail.

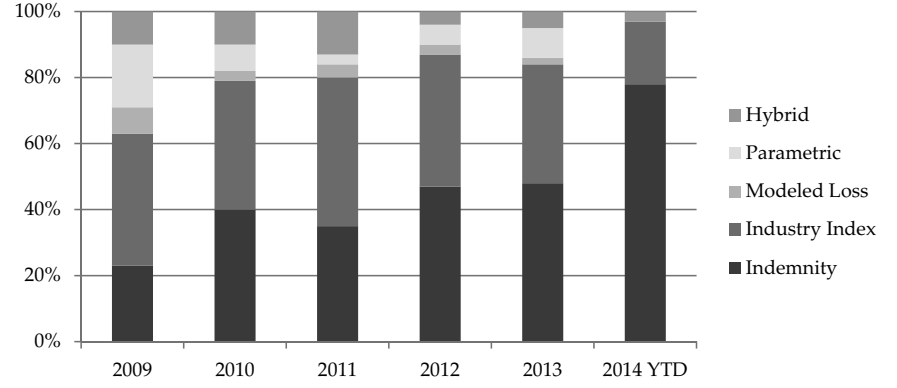
Figure 10: Difference in economic and insured losses (advanced vs. emerging markets)



Source: Guy Carpenter (2014)

A trend currently observable in the ILS market and especially in the cat bond market is a **shift towards indemnity based triggers** which can be interpreted as a general convergence between ILS and traditional reinsurance. Before 2012, index-based triggers dominated the market. New issuances, however, now show a higher percentage of indemnity-based triggers, mainly attributable to accounting and regulatory conditions (Munich Re, 2014; Figure 11). The positive regulatory treatment in favor of sponsors seems to outweigh the disadvantage of higher complexity for investors.

Figure 11: Market share of triggers of new issuance in the ILS market (Q2/2014)



Source: Munich Re (2014b) - ILS Market Update Q2 2014. Excluding private placements and mortality transactions

Figure 12 provides a breakdown of the trigger types that are used in outstanding transactions. Based on the aforementioned trend as well as the current trigger distribution in the market, one can expect that parametric and modeled loss triggers will eventually disappear, while indemnity triggers will become even more important in the future.

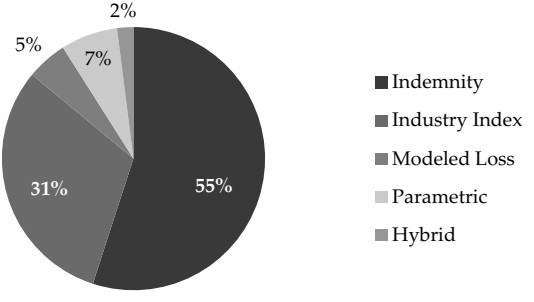
One potential explanation for this development could be the low interest rate environment that strengthens the market power of sponsors who offer (slightly) higher returns than other investment opportunities. Thus, sponsors can impose more beneficial conditions (including indemnity triggers) from their perspective which investors have to accept if they want to earn the ILS spread.[29] Apart from that, particularly the main group of long-standing cat bond investors has grown relatively

[29] Note that we also ask in our study below whether investors invest in ILS due to a lack of other investment opportunities. This is not the case on average and suggests that investors could withdraw if they feel uncomfortable with indemnity triggers.

comfortable with indemnity triggers and instead focuses on a detailed assessment of the ceding entity. In other words, the rejection of transactions solely on grounds of moral hazard seems to have become obsolete. This is further underlined by the fact that recent empirical research does not find evidence for a markup in the spread of indemnity transactions (see Braun, 2015).

Regarding parametric triggers, experts highlight (besides the regulatory treatment) that the payout profile of the bonds is typically binary. Although it cannot be said that, in general, a binary payout profile is detrimental, such structures are very unlikely to replicate the actual claims profile of the sponsor. One expert said that some indices only report once per year, making them less transparent than indemnity triggers with reduced payout periods. Furthermore, the disadvantage of long payout periods given by indemnity triggers is put into perspective by one expert saying that the market "quickly forms an opinion about the claims environment." Thus, selling a cat bond is often possible, irrespective of the actual payout period. Another expert highlights the advantage of indemnity triggers for both the sponsor and the investor side when managed by funds. While sponsors reinsure their actual claims profile, investors receive a portfolio of bundled risks which have been actuarially screened by the fund, thus knowing the exact risk profile of their investment. Of course, this depends on the fund since an actuarial screening is not necessarily the case for each fund. Despite the potential advantage of indemnity triggers, one expert argues that the emergence of indemnity triggers is mainly attributable to the strong market power of sponsors who offer a product that is in heavy demand by investors. Thus, sponsors can set terms which are more beneficial to them.

Figure 12: Trigger breakdown of ILS (outstanding instruments; June 2014)

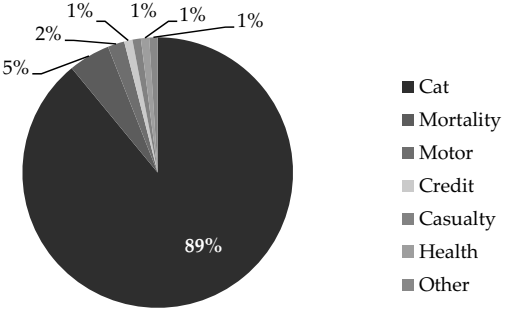


Source: Swiss Re (2014) – Insurance-Linked Securities market update Q2 2014

Another development that we observe among ILS issuances is the ongoing **strong focus on cat risk**. Although the ILS market always favored cat risk, averaging 89% of all issuances during the period 1994-2013 (Figure 13), cat risk seems to become even more dominant due to the lack of previous securitizations of other risks, i.e., motor, credit and casualty (Figure 14). Market participants, however, believe that the market would generally welcome other investment opportunities when they become available.

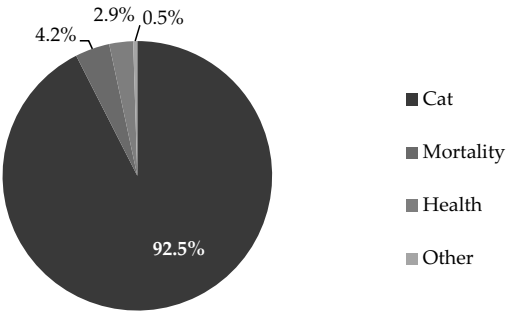
Experts emphasize the innovative non-cat risk transactions which have already been seen, such as AXA's securitization of their motor insurance portfolio (AXA, 2005). Regarding the future securitization of terrorism risk or cyber risk, the opinions of our experts diverge. While some argue that terrorism risk or cyber risk is a peak risk which can be well securitized and possibly offer a high risk compensation, others argue that the central value proposition of ILS is the uncorrelated nature with the market and with terrorism risk or cyber risk there is in fact a high correlation with the market. In our opinion this is a question of scale. Whether due to terrorism, cyberattacks or natural catastrophes, such securitizations might still experience some correlation with the market if these extreme events are large-scale. A central issue with cyber risk, though, is pricing since the actual losses are difficult to determine even after the event has happened. Another expert highlights the necessity of different risks for diversification purposes to control the tail risk prevalent in ILS. This makes cyber or terrorism exposure still interesting for securitization.

Figure 13: Total ILS bond issuances 1994 - 2013 (USD 59.2 billion)



Source: Clear Path (2014). These figures exclude life embedded value and XXX / AXXX reserve securitizations issued prior to 2008 as these relied predominantly upon credit enhancements provided by financial guarantors and were predominantly sold to ABS investor and not as principal at risk insurance-linked investments.

Figure 14: ILS bonds outstanding as of 31.12.2013 (USD 20.6 billion)

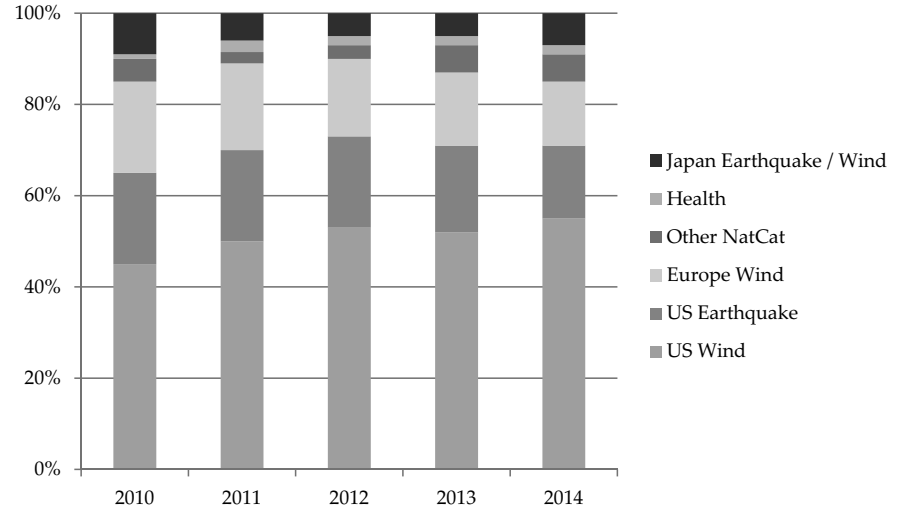


Source: Clear Path (2014). These figures exclude life embedded value and XXX / AXXX reserve securitizations issued prior to 2008 as these relied predominantly upon credit enhancements provided by financial guarantors and were predominantly sold to ABS investor and not as principal at risk insurance-linked investments.

Within the cat bond market itself, we find that U.S. wind perils constantly represent about 50% of the total volume (Figure 15). With the ongoing improvements in index construction such as index weighting and geographical refinement on the one hand, and a higher acceptance of indemnity triggers among investors on the other hand, we might expect a **stronger internationalization** of cat risks. Furthermore, in light of climate change and rising sea levels, secondary perils such as flood events might become more important in the spectrum of natural catastrophes (Munich Re, 2014c). However, as noted by Michel-Kerjan and Morlaye (2008), climate change will also increase the intensity of hurricanes and other wind perils. Thus, it remains to be seen which effect will be more severe. Yet, it can be expected that the overall level of insured losses will increase.

The experts interviewed for this study acknowledge that there will be a higher degree of internationalization. This is not only beneficial for diversification purposes but also for regions where insurance coverage is low. If Chinese perils were securitized, a huge market would develop. Also reinsuring policies from micro-insurance may stimulate economic growth in developing countries. Another expert, though, cautions that some regions are very traditional in their reinsurance approach and that specific cultural differences might hamper the development of ILS there.

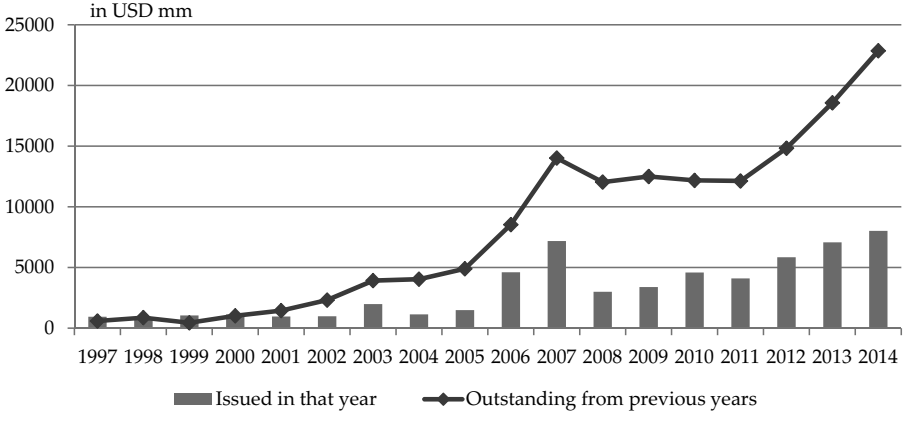
Figure 15: Outstanding cat bonds by peril



Source: Munich Re (2014b) - ILS Market Update Q2 2014

We see an ongoing market expansion. In absolute terms, cat bonds reached their highest all-time level in 2014 with a total market volume of USD 22.9 billion, and in terms of new issuances, a return to pre-crisis levels (Figure 16). Since 1997, cat bonds reached a total cumulative capacity of USD 58.5 billion.

Figure 16: Yearly issuance and outstanding catastrophe bonds (property only in USD million)

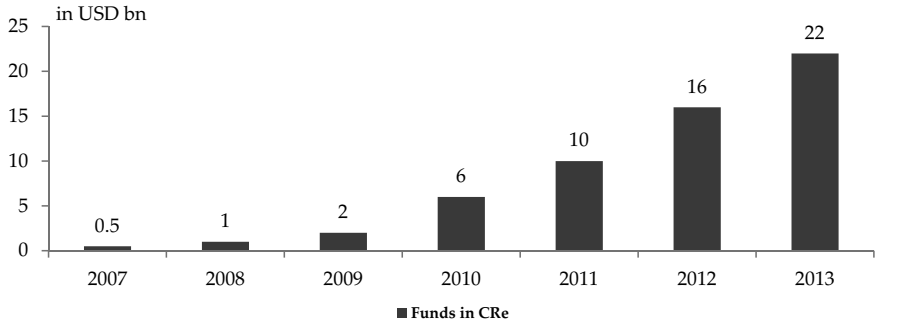


Source: Adapted from Guy Carpenter (2014)

The view of a growing ILS market is also confirmed in our expert interviews. According to an expert, ILS together with all other alternative risk transfer instruments might even replace the traditional reinsurance industry. To some extent, this is already the case in the context of peak events.[30] The competitive pressure due to the low spread levels of ILS also explains the ongoing consolidation of reinsurers who need to be prepared against the challenges posed by ILS. Despite these severe challenges, another expert does not expect a replacement of traditional reinsurance due to the intricacy of writing long-tail risk using ILS. The latter are (in general) fully collateralized until all claims have been paid. This is a competitive advantage for reinsurers who can model losses from long-tail risks without (full) collateralization. Other experts confirm this view and stress that long payout periods are not appreciated by the capital market. In addition, it has been highlighted that client access and the client relationship between cedent and reinsurer are major competitive advantages. Trust should thus be seen as a key success factor for traditional reinsurers and gaining trust is more difficult for an anonymous capital market.

Beyond cat bonds, we observe a tremendous growth in collateralized reinsurance, although estimates are difficult to verify due to the private nature of these deals. Funds provided to CRe reached approximately USD 22bn which is comparable to the market volume of cat bonds. However, it should be noted that CRe reached this level within a few years based on a market volume of less than USD 1 bn in 2007 (Figure 17) compared to the decade long development of cat bonds since the mid-90's.

Figure 17: Growth in collateralized reinsurance (2007 – 2013, in USD billion)



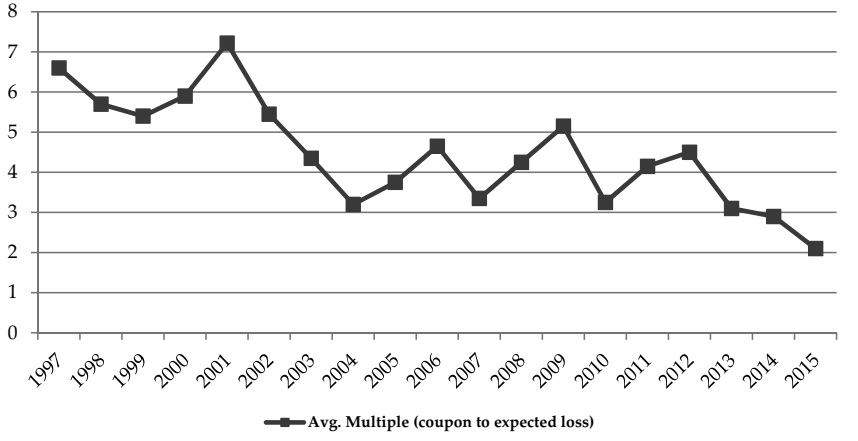
Source: Hannover Re (2013)

[30] According to the expert more than two thirds of the reinsurance capacity for peak events is already covered by ILS, such as cat bonds.

Furthermore, we see a sharp **decrease in cat bond spreads** (or coupons respectively) relative to the expected loss of cat bonds since 2012 (Figure 18). Spreads of new issuances at the beginning of 2014 reached historic lows while expected losses remain high. Some market participants claim that a floor level has been reached regarding spread development in relation to expected loss (Swiss Re, 2014). Based on the current yields one could conclude that the **novelty premiums** cat bonds used to offer for being unknown instruments have (almost) disappeared.

Regarding the yields in the ILS market (especially for catastrophe risk), our experts are at odds with each other. While some do not see any space for even lower yields, suggesting a floor has been reached, others argue that yields might continue to decrease. However, yields should be seen in relation to the expected loss and some experts anticipate multiples moving towards 1.5 or potentially even lower (which would imply a very low risk compensation for catastrophe risk). Depending on the different perspectives of our experts, it could be argued that either the yields continue to decrease and expected losses remain constant or that yields remain constant but expected losses increase.

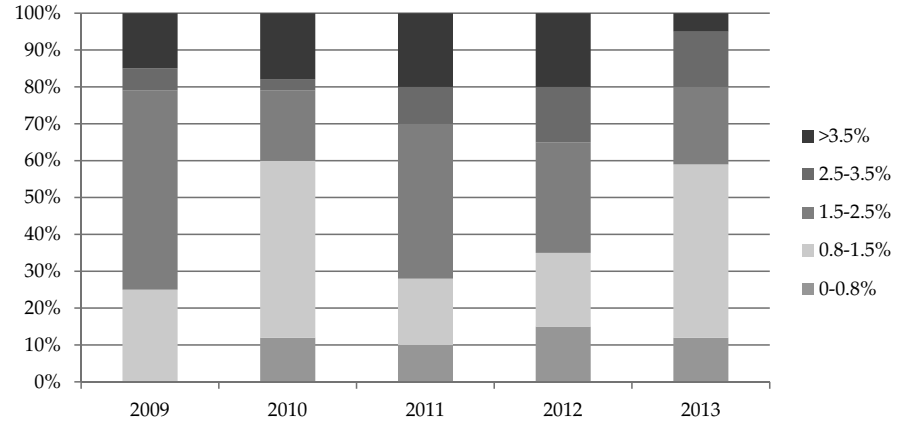
Figure 18: Cat bonds and ILS average coupon to expected loss by year



Source: Artemis (2014) Deal Directory

Taking a closer look at the expected loss ranges in the non-life business (Figure 19), we observe that the highest layer beyond 3.5% is decreasing and layers between 0% and 2.5% attract more interest, suggesting that investors will prefer structures that reference **lower risk layers** in the future.

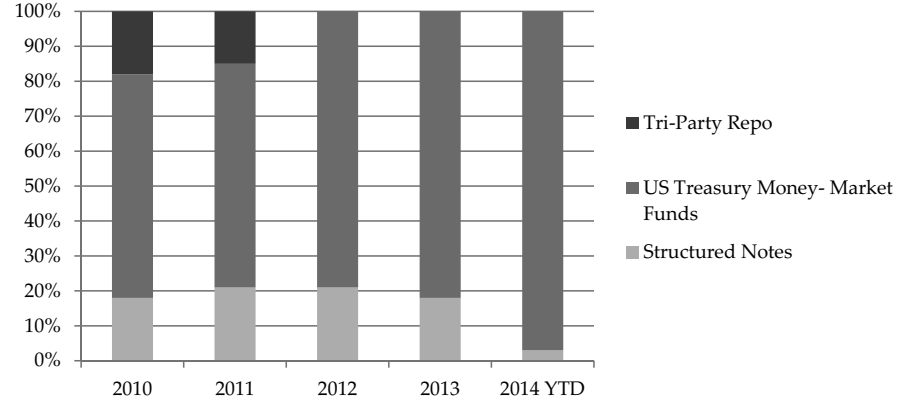
Figure 19: Expected loss ranges



Source: Munich Re (2014a)

With respect to the collateral of cat bonds we also observe a clear trend. Both Structured Notes as well as Tri-Party Repo are being repressed and U.S. Treasury Money-Market Funds remain the **main type of collateralization** (Figure 20).

Figure 20: Collateral solutions Used by outstanding cat bond transactions (as of 30June 2014)



Source: Swiss Re (2014)

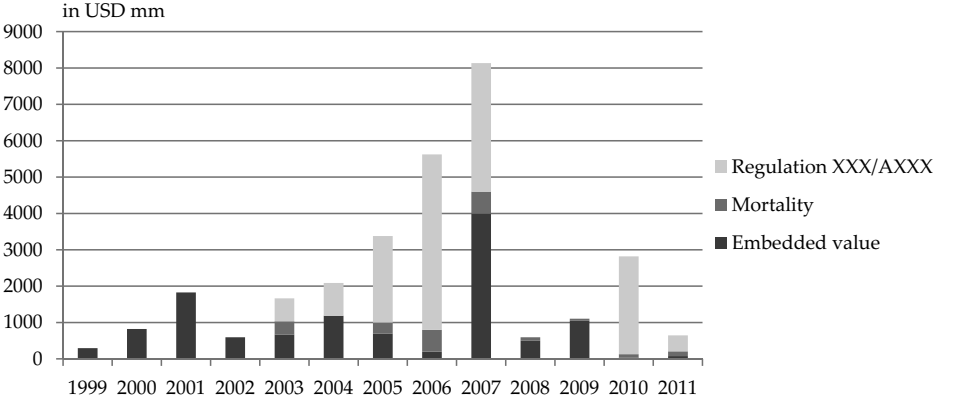
Looking at new issuances in the life insurance securitization market we see a much greater impact of the financial crisis than on the property / casualty side. We also see

that in life securitization there is no constant growth pattern for embedded value securitization, mortality bonds or Regulation XXX / AXXX securitization (Figure 21).

The development of life insurance securitization could be seen as ambiguous. On the one hand, new regulatory frameworks such as Solvency II will place a stronger focus on risk-based economic reserves rather than statutory reserves. In addition, the demand for life insurance in general has decreased due to the low interest rate environment. These trends oppose a strong growth of XXX, AXXX, and other life insurance securitizations. On the other hand, an increase in EV securitizations could be promoted by the growing middle class in emerging markets which accelerates life insurance business, meaning that marketing fees need to be paid today.

One expert says that the stagnating life insurance market could motivate some managers to monetize their life insurance business. Thus, embedded value transactions could increase as long as the low interest rate environment prevails, although the question of how the new funds are invested remains. Another promising field for life insurance and the corresponding securitization is a growing middle class in emerging markets who are seeking ways to maintain and increase their newly gained wealth. In addition, if countries such as China or India decided to transfer their longevity / mortality risk to the capital markets through a state-sponsored solution, this could have huge effects on life securitization. If, however, more regulatory authorities introduce risk-based capital standards, the securitization of reserves (e.g., XXX / AXXX securitization) might become largely redundant.

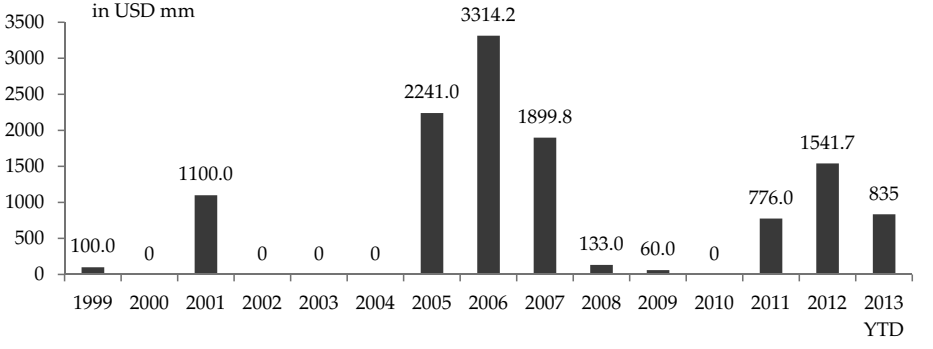
Figure 21: New issuance of life securitization (EV, mortality, regulation XXX / AXXX) from 1999- 2011



Source: Lorson and Wagner (2012)

Sidecars are primarily issued in the aftermath of large catastrophes to generate additional capacity. The highest volume was recorded in 2005 / 2006 after Hurricane Katrina (Figure 22).

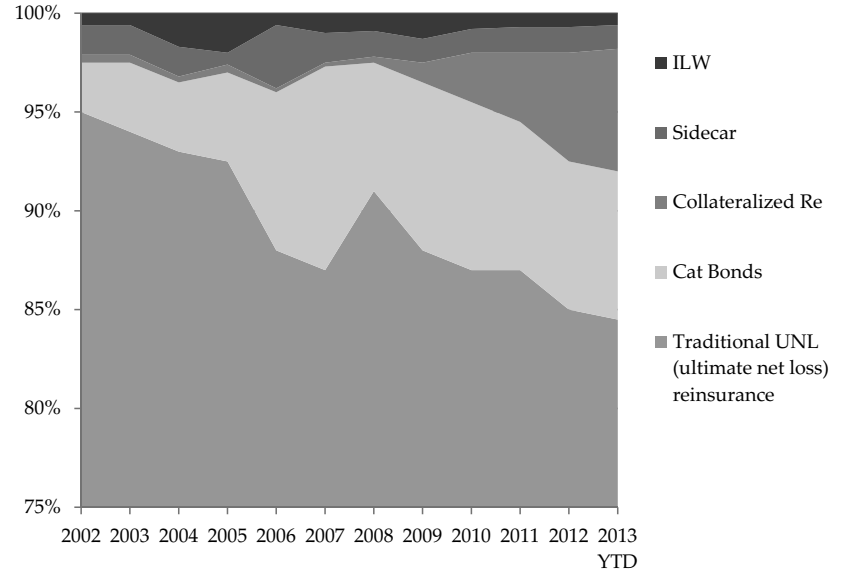
Figure 22: Sidecar issuance between September 1999 and June 2013



Source: Adapted from Aon Benfield (2013)

As seen in Figure 23, one of the fastest growing ILS instruments is **collateralized reinsurance**. While in 2008, collateralized reinsurance amounted to less than 1% of all reinsurance solutions, it exceeded 5% by mid-2013. The flexibility of collateralized reinsurance and the ongoing low interest environment might further enhance the development of this ILS market segment.

Figure 23: Form of transaction

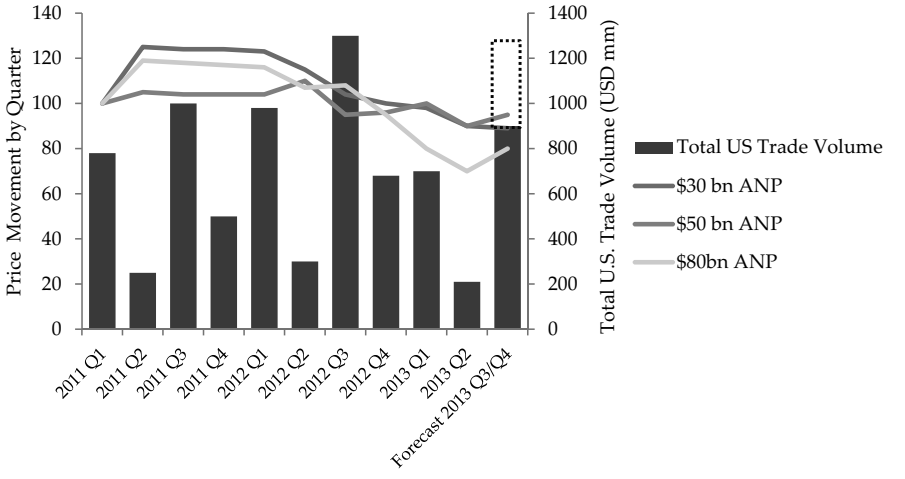


Source: Aon Benfield Securities (2013)

Due to the private nature of ILWs it is difficult to quantify the overall market volume. The World Economic Forum estimated the market size of ILWs (and cat swaps) at approximately USD 10 bn.[31] in 2008. According to more recent estimates by Aon Benfield Securities (2013), the transaction volume (ILWs only) for 2012 was USD 3.2 billion and the predicted U.S. volume for the year 2013 is about USD 1.8 billion (Figure 24). These figures suggest that ILWs are currently decreasing in importance. This might be attributable to the fact that cat bonds are becoming more flexible while including less basis risk.

[31] Note that the World Economic Forum estimated the combined market volume for ILWs and cat swaps at USD 10 bn. Thus, it is not clear what allocation of this figure refers to ILWs or cat swaps, respectively.

Figure 24: Total U.S. ILW trade volume and price movement since 2011



Source: Aon Benfield Securities (2013), ANP=All Natural Perils.

This is also in line with the overall product development in the ILS universe where market participants expect in the future (Aon Benfield Securities, 2013):

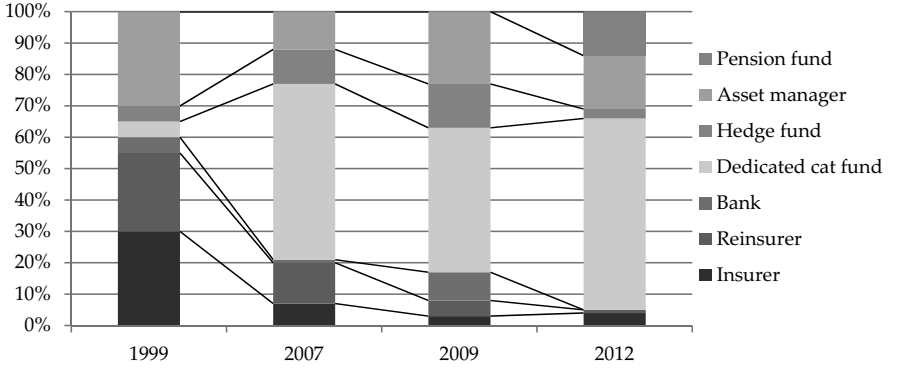
- an increase of indemnity based triggers
- an inclusion of complex and non-modeled risks
- more flexible transaction structures

The future of ILS depends on how investors and sponsors view its merits in terms of flexibility, reduced basis risk, and appropriate risk compensation. Expansion of ILS to specialized industries, such as Marine & Aviation insurance, is viewed with skepticism among market participants due to the lack of extensive capital needs (Clear Path, 2014). Nevertheless, this kind of expansion is possible. Further expansion into specialized industries will require some kind of innovation. An example is Residential Re 2014-1, which was the first cat bond covering meteor strikes (Swiss Re, 2014).

2.2.2 *Investors and Sponsors*

There is a continuously changing field of investors for ILS. During the early stage of the market, primary insurers and reinsurers themselves were investors in this asset class. Dedicated cat funds soon took over and now cover more than half of the entire ILS market volume. By the end of 2012, dedicated cat funds constituted 61% of the market. Aside from (re)insurers, hedge funds and banks represent the primary investor base for ILS (Figure 25).

Figure 25: Development of investor base in catastrophe risk (1999 - 2012)



Source: Adapted from Swiss Re (2009) and Swiss Re (2013) (as of 31.12.2012).

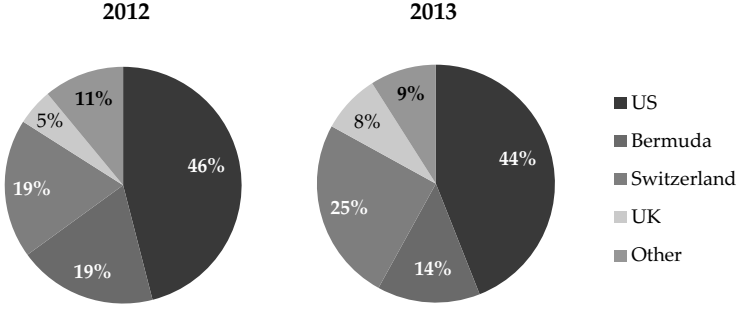
However, **new participants** have been recently entering the market. Notably, pension funds already form 14% of the investor base. Furthermore, it must be noted that pension funds are the primary investors in dedicated cat funds (Clear Path, 2014) and thus the overall largest investors in ILS. Given the low interest rate environment and the enormous USD 30 trillion capacity of pensions funds (Guy Carpenter, 2014), these investors might start to dominate the market and further enhance their expertise through dedicated ILS teams.

Arguments for investing in ILS depend on the type of investor considered. While pension funds might be attracted by the low correlation, other institutional investors such as hedge funds might see ILS as a "pure play investment." We thus believe that while the pension funds are here to stay, some of the hedge funds might disappear after negative experiences. The shift towards new investors is often denoted "alternative capital".

Similar to the current domination of dedicated funds, we observe a major geographic concentration of investors in the United States. In contrast, the percentage of investors in Bermuda has dropped from 19% to 14%, in favor of mostly Swiss investors who increased their market share by 6 percentage points from 19% to 25%. Furthermore, although on a low level, investors in the U.K. also significantly increased their market share from 5% to 8% (see Figure 26).

According to our experts, inflows of alternative capital will continue, especially from pension funds, although ILS constitute a very small portion of their entire asset allocation. One observation made in the past by an ILS expert was that hedge funds are tactical asset allocators who tend to directly compare ILS with corporate bonds. Depending on the relative valuation between both investment opportunities, hedge funds can almost entirely disappear when they perceive the risk-return profile of corporate bonds to be more attractive. Another expert also highlights the regional differences in ILS. Dedicated funds in the U.S. and Switzerland are already investing significant amounts from retail investors, whereas other countries still have a great potential in this regard.

Figure 26: Investors by country (2012 and 2013)

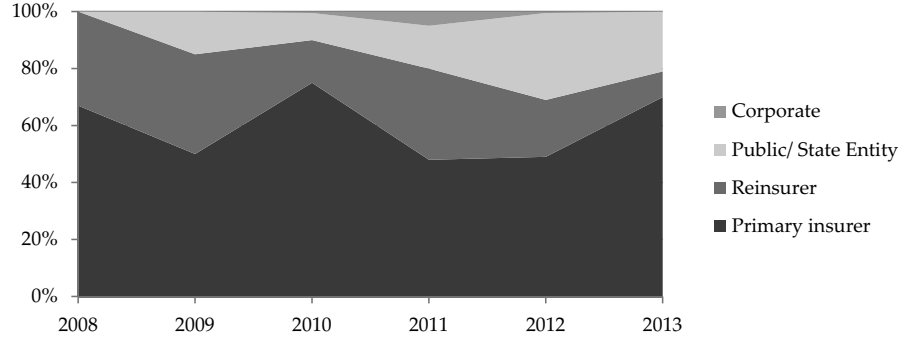


Source: Aon Benfield (2013) as of June 2013.

Figure 27 illustrates the type of sponsors offering risks to investors. The largest volume comes from primary insurers. Together with reinsurers, the two constitute the majority of risk sponsors. In 2011, corporate entities (i.e., Electricité de France, a French utility company) decided to briefly be active in the ILS market but have not

returned since (Munich Re, 2012). Beginning in 2008 **public / state entities entered the market** to transfer their risks directly to capital markets. We interpret this as a trend which will continue and will influence the ILS market in the future. In fact, in 2012 their transferred risk represented 35% of total ILS issuance. It will be interesting to see how state-sponsored risks develop in the future. Clearly, ILS have the potential to close a large part of the gap between insured losses and economic losses (Clear Path, 2014). An advantage of state-sponsored risk transfer could also be a higher rating when compared with private transactions.[32]

Figure 27: ILS Issuance split into sponsor types



Source: Munich Re (2014a)

[32] Theoretically, the public, i.e., the tax payer, already bears the risk of damages to state-owned property. Hence, transferring risk to investors while providing some kind of guarantee might be beneficial for both parties.

2.3 Challenges for Market Development

There are several challenges for both investors and sponsors which might hinder the future growth of ILS. Table 21 contains a brief summary of each these challenges, including a current trend and a rationale. Some of the impediments are central to our empirical study as they set forth the issues we want to empirically quantify in terms of their intensity among institutional investors. For example, we will show in Section 3.2 how the lack of standardization is seen as an impediment in comparison to other challenges. Thus, the aspects presented here can be interpreted as hypotheses to be rejected or confirmed in the empirical Section 3.2.

Table 21: Potential impediments to ILS growth

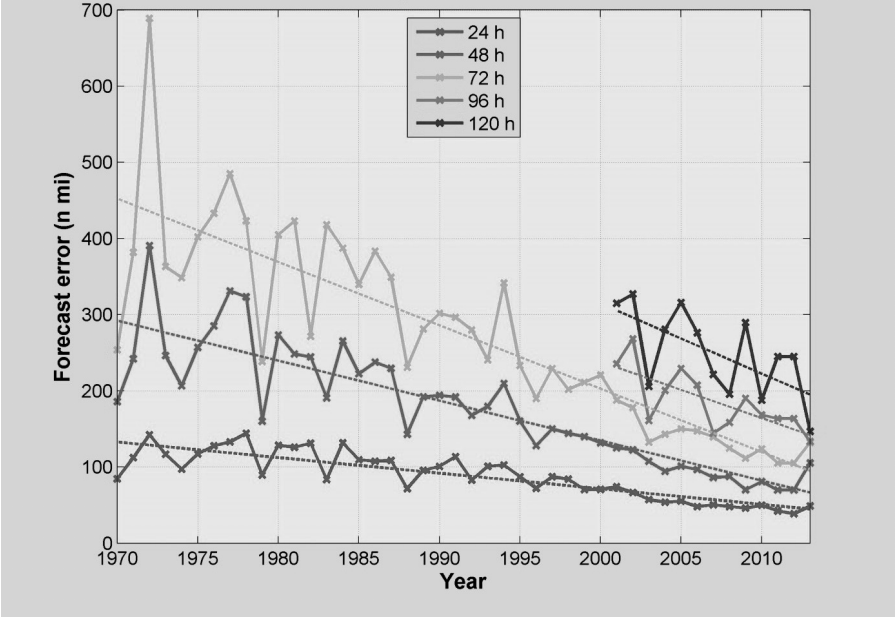
	Trend	Rationale
Impediments for investors		
Standardization	Decreases	Increasing use of indemnity triggers reduces standardization
Limited secondary market (Liquidity)	Constant	Secondary markets still developing; cat options and futures have failed so far
Long payout periods	Constant	With increasing indemnity triggers it takes more time to estimate actual losses; technology will help to decrease the payout periods
Valuation complexity	Constant	Higher expertise among investors and data availability reduce complexity but new structures, variable resets, etc. increases complexity
Transaction costs	Constant	Structuring ILS is still expensive; increasing use of indemnity triggers (more expensive); cheaper new structures
Data quality and transparency	Constant	Data on ILS is scarce; most ILS are private deals or are issued through the non-transparent SEC Rule 144a; technology will help to improve the data base
Downside risk aversion	Decreases	Quest for yield reduces investors' risk aversion
Importance of ratings	Decreases	Number of ratings in ILS is decreasing. Many investors seem to classify ILS as alternative investments instead of fixed income
Impediments for sponsors		
Basis risk	Decreases	Increased use of indemnity triggers; improvement in technology (reduced basis risk also for indices)
Relevance of accounting and regulatory treatment	Increases	Introduction of IFRS / Solvency II / (XXX / AXXX regulation)
Scope of ILS instruments	Increases	Increasing scope of instruments to transfer the sponsor's risk spectrum
Renewal	Constant	Triggered instruments take significant time to be renewed (in contrast to traditional reinsurance)

2.3.1 *For Investors*

As noted by the World Economic Forum (2008) "investors value liquid markets with objective and transparent triggers, standardized documentation and short settlement periods." Currently the only fairly active secondary ILS market exists for cat bonds. However, even the liquidity of cat bonds is not comparable to traditional asset classes such as common stocks, since the investor base is limited by SEC Rule 144A.

The **objectivity and transparency of triggers** seems to deteriorate rather than to improve from the investor's perspective despite the **technological progress** that is made with regard to parametric indices. From the sponsor's perspective this is a positive development as it reduces basis risk. Figure 28 illustrates how the forecast errors (expressed in nautical miles) associated with different forecast periods for hurricanes and tropical storms in the Atlantic Basin decreased over time.[33]

Figure 28: Official annual average track errors from U.S. National Hurricane Center (NHC) (Atlantic Basin Tropical Storms and Hurricanes)



Source: National Hurricane Center (2015)

[33] Note, however, that this does not allow us to draw conclusions about the severity of a storm or the damage it causes.

All of our experts agree that indemnity triggers are the future for ILS. In their opinion, the best case scenario of an index is that it perfectly proxies indemnities, which would then again raise the question why indemnities are not used directly. Furthermore, one of our experts emphasizes that as long as the ILS market is demand driven, i.e., investors are seeking ILS and sponsors can set the terms, there will be no initiative from the sponsor's side to revive index triggers. However, indices based on improved technology might gain in importance in some developing / emerging countries.

Closely related to the issue of triggers is overall **standardization**. Standardization is needed for several reasons. First standardization reduces legal risks.[34] Second, transaction costs decrease. Third, overall transparency increases. Transparency, in turn, is crucial to lowering the bar for investors to get acquainted with this relatively new investment opportunity. The less standardized and transparent an asset class, the fewer investors are attracted by it.

According to our experts, transaction costs have significantly declined as the ILS market has matured, especially for cat bonds. Another significant reduction in transaction costs can be achieved through "cat bond lights". This is a result of the proprietary risk assessment by the investor identical to a traditional reinsurer, which implicitly excludes professional loss modelers from the structuring process and thus reduces costs. Another expert suggests that competition will lead to a decrease in transaction costs in the near future, especially with regard to legal work and trustee user fees. Regarding the impediment of lacking transparency one expert says it is difficult to resolve this issue due to the sponsor's fear of providing too much information and thus giving competitors the possibility to reverse-engineer the sponsor's portfolios and take over their business.

There is disagreement about how much **insurance expertise** or understanding of the underwriting business is required to invest in ILS. Some argue that the development of a specific expertise is not needed, since most investors allocate only a small percentage of their funds to ILS (Krutov, 2010). In addition, by taking on the exposure through sidecars or dedicated ILS funds, investors benefit from the expertise of underwriting teams. Thus, it is more about evaluating the underwriting team than developing an own insurance expertise. Others argue that a significant expertise, perhaps even a team of experts from the insurance industry is required to

[34] The lion's share of structuring costs is attributable to legal fees (Willis Capital Markets & Advisory, 2013).

make informed ILS investment decisions (World Economic Forum, 2008). In light of the financial crisis, many investors now want to evaluate assets themselves to understand the full spectrum of risks they are taking on. The truth about the importance of insurance expertise might lie in between these two contrasting views.

According to our experts, insurance expertise will be of even greater importance in the future due to the increasing valuation complexity of ILS. Aggregate structures, new types of risk, and variable resets are some of the many challenges which make an investment decisions more complex in the future.

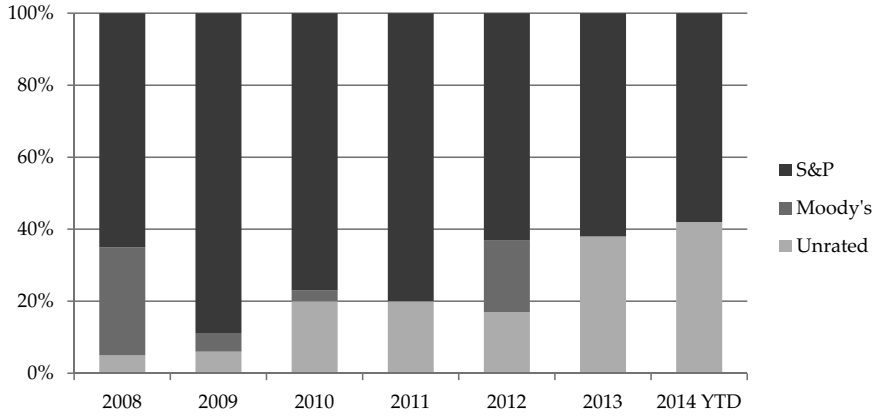
An additional short-coming for investors accepting indemnity triggers is the prolonged **payout period** because it takes significantly more time to derive the actual losses by the sponsor.

However, as already mentioned, our experts do not fully agree on whether longer payout periods for indemnity triggers are really disadvantageous. The reason is that, at least in the case of cat bonds, the (secondary) market offers a price at which investors can sell their investment irrespective of the payout period. Furthermore, the longer payout period is also compensated with a minor "extension premium."

Another important issue is how **ratings** will affect the future of ILS. In general, particularly fixed income investors rely on ratings for investment evaluation and due diligence purposes. Most investors require a certain minimum rating to consider investing in the first place. However, rating agencies have imposed rating caps for ILS due to uncertainty in risk modelling and unambiguous payment terms (World Economic Forum, 2008).

In Figure 29, we can observe a strong increase in unrated transactions since 2009. More than 40% of all transactions in 2014 have not been rated. The only rating agency that actually evaluated ILS transactions in the recent past is S&P. Hence, ILS investors (and / or sponsors) seem to have become less focused on ratings.

Figure 29: Rated vs. non-rated transactions in newly issued ILS transactions



Source: Munich Re (2014b)

Even more surprising is the fact that one would have expected a shattered trust in rating agencies after the financial crisis, yet 90% of all newly issued transactions in 2009 were rated. One explanation for the decreasing number of rated transactions could be that ratings have become less important in the due diligence process. Another explanation could be that investors continue to specialize in ILS and thus have their own expertise to evaluate these instruments making external rating agencies unnecessary.

Lane and Beckwith (2014) argue that dedicated ILS fund managers have an actuarial background and are able to assess insurance risk on their own. Moreover, waiving a rating simply reduces costs and there is a growing understanding that rating agencies replicate the assessment of the risk modelers since credit risk is of minor importance in most ILS transactions.

According to our experts, ratings are indeed becoming less important to investors. One of the reasons not yet mentioned is that many investors categorize their allocation to ILS and especially cat bonds to the "alternative investment" instead of the "fixed income" category. This can even be necessary due to regulatory investment limits as generally applicable for pension funds and insurance companies. In Denmark, for example, 10% of the assets of a pension fund can be invested in alternative funds such as dedicated ILS funds. In France only 5% can be invested in bonds that are issued by a special purpose vehicle (OECD, 2014). Thus, direct competitors of ILS are high yield corporate bonds, alternative investments

without an investment-grade rating, and other instruments that are issued by a special purpose vehicle (e.g., asset-backed securities). Furthermore, due to the rating caps that are supposed to account for the "jump-to-default" risk inherent in many ILS, an investment-grade rating is very difficult to achieve. Hence, it is also acknowledged that if bond structures in the ILS spectrum were classified as fixed income, the market potential of ILS would further increase.

Another more recent issue for investors is the development of **annual resets**. The standard approach before 2013 was the "fixed reset", meaning that sponsor and investor agreed upon a constant expected loss estimate and a stable attachment probability for the cat bond (or ILS in general). Put differently, the risk level and the risk spread remained constant until the bond's maturity. At the beginning of 2013, however, "variable resets" emerged for the first time. In the presence of a variable reset the sponsor can move the risk layer at his own discretion, if his portfolio changes due to new business, M&A or a shift in the regional distribution focus. In such a case, the size of the risk layer covered by the bond remains constant, but the expected loss and the attachment point change. If the sponsor decides to variably reset the cat bond layer, the investor receives a higher spread which is stipulated according to a predefined formula.[35]

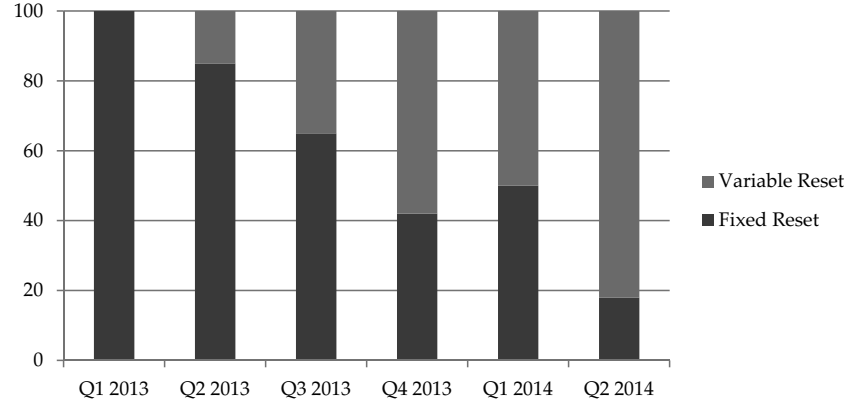
The sponsor's advantage in case of a variable reset is that no coverage gaps or overlaps occur (Munich Re, 2014b). Figure 30 shows that this more flexible structure (from a cedent's perspective) has recently gained a lot of traction in the ILS market and is now the most dominant structure with approximately 80% of all issues in Q2/2014.

The greater convergence of the structural features of ILS and traditional reinsurance, including variable resets, is something our experts also observe and expect to continue. However, this development may also involve drawbacks such as the legal risks associated with less extensive and rather abstract terms and conditions, which are common in the reinsurance industry. The possibility of legal disputes generally has a dissuasive effect on capital market investors, as it may considerably delay contract settlement. This higher variability is even more pronounced in direct deals where the number of investors per deal is smaller than for cat bonds. Another expert also mentions the interesting convergence of ILS and reinsurance in terms of

[35] The formula is usually defined as follows (Munich Re, 2014b): updated risk spread = initial risk spread x (updated expected loss – initial expected loss).

"leveraged structures" which we prefer to call "decollateralized structures."[36] That is, sponsors might accept structures that are only partly collateralized to sustain the most likely losses in case of an event. Larger losses would need to be compensated by additional payments from the investor similar to a "margin call." Obviously, such a transaction would be more risky for sponsors but still is more in line with traditional reinsurance.

Figure 30: ILS issuance split: Fixed vs. variable reset



Source: Munich Re (2014b). Excluding private placements and mortality transactions.

The last issue for investors that we want to address are their **liquidity** concerns. Liquidity is most needed when none is available, e.g. during an economic crisis and catastrophic events. So far, the majority of ILS market segments are highly illiquid. However, some broker-dealers make a market in cat bonds by regularly disclosing indicative bid-ask spreads (Albertini, 2009). Using a few selected transactions in the secondary market, Table 22 illustrates the impact of the interaction between catastrophic events, liquidity, data quality and transparency on cat bond pricing. It also shows that cat bonds are not only subject to downside risk but also volatility in general. This can be seen in the Successor XV-F4 transaction which decreased in value by ca. 75% and recovered by 150% within one and a half months.

Our experts mention that the liquidity of ILS currently differs for the sell side and the buy side. Cat bonds in particular can be traded promptly if someone decides to sell.

[36] We denominate such structures as "decollateralized" instead of "leveraged" structures to avoid confusion between the lower rate of collateralization and equity/debt instruments.

In contrast, if one decides to buy a cat bond it can be difficult to find a seller without accepting severe price effects.

Table 22: Superstorm Sandy's impact on selected cat bond secondary prices

Transaction	Peril(s)	Trigger	Price (10/19/2012)	Price (11/16/2012)	Price (12/31/2012)
Successor XV-F4	U.S. Hurricane	Industry Index	98.01	25.00	75.00
Long Point Re III 2012	Northeast U.S. Hurricane	Indemnity	100.73	92.50	100.22
East Lane Re IV B	Northeast All Natural Perils	Indemnity	103.48	75.00	98.47
Mystic Re III B	U.S Hurricane, U.S. Earthquake	Indemnity	107.19	90.00	99.81

Source: Aon Benfield Securities (2013)

2.3.2 For Sponsors

Basis risk is the core concern for sponsors because it affects accounting treatment, ratings, regulatory requirements (i.e., capital requirements) and of course their operating result.

From an **accounting perspective** ILS are either classified as a financial instrument or as a reinsurance contract. IAS 39 which is now completely replaced by IFRS 9 specifies the accounting treatment of financial instruments. IFRS 4 applies to (re)insurance contracts and determines when an instrument qualifies as reinsurance and thus can be accounted for in the technical provisions. The accounting treatment largely depends on the presence of an indemnity trigger. It is not sufficient that a contract is used *"to mitigate an underlying risk exposure. For example, if the holder uses a derivative to hedge an underlying non-financial variable that is correlated with cash flows from an asset of the entity, the derivative is not an insurance contract because payment is not conditional on whether the holder is adversely affected by a reduction in the cash flows from the asset."* (IFRS 4, B14). Thus, a correlation of the underlying of an ILS transaction with the sponsor's losses alone is not sufficient for recognition as an insurance contract. In fact, IFRS 4 specifically addresses several instruments discussed in this study which are not recognized as insurance contracts.

Another impediment to sponsors is the **limited scope of ILS instruments**. Risks other than catastrophe risk in the non-life sector have not gained much volume in the past. However, with new instruments being offered and higher flexibility being possible in private deals (i.e., collateralized reinsurance) sponsors are more and more able to transfer other risk components from their balance sheet.

An issue that becomes highly relevant at second glance is the **renewal possibility** after an event has happened. That is, as soon as an instrument is triggered the sponsor is not covered against subsequent perils which might happen shortly after the initial trigger event. Usually, traditional reinsurance can renew the coverage shortly after an event and the sponsor would be thus protected against subsequent perils. Yet, ILS requires a more complex structuring process due to legal arrangements and the necessary placement among investors who are willing to bear the risk. Such a situation could be further complicated if there is financial market turmoil during which most investors tend to be hesitant to bear further risks. In the near future we do not expect a change in the renewal characteristics of ILS.

According to IFRS 4, insurance contracts **are**:

> B18 (k)
> **Catastrophe bonds** that provide for reduced payments of principal, interest or both, if a **specified event adversely affects the issuer of the bond** (unless the specified event does not create significant insurance risk, for example if the event is a change in an interest rate or foreign exchange rate).
>
> B18 (l)
> **Insurance swaps** and other contracts that require a payment based on changes in climatic, geological or other physical variables that are specific to a party to the contract.

According to IFRS 4, insurance contracts **are not**:

> B19 (g)
> Contracts that require a payment **based on a climatic, geological or other physical variable** that is not specific to a party to the contract (commonly described as **weather derivatives**).
>
> B19 (h)
> **Catastrophe bonds** that provide for reduced payments of principal, interest or both, **based on a climatic, geological or other physical variable** that is not specific to a party to the contract.

These accounting rules clearly outline the difference between physical variables and adverse consequences for the issuer which underlines the importance of the trigger. Furthermore, the accounting recognition is intertwined with regulatory aspects and specifically the capital requirements of insurers. As stated by CEIOPS (2009), if ILS instruments are "recognized as reinsurance contracts by IFRS, they can be part of the technical provisions of the insurer." Thus, if ILS is recognized in the technical provisions, the capital requirements in the Solvency II regime are reduced.[37]

[37] Note that these regulations are subject to changes. This study describes the current state the accounting and regulatory framework, to the best of our knowledge.

2.4 Academic Work

In this Section, we summarize the theoretical and empirical literature on ILS. In academic work, the convergence of the capital markets and (re)insurance sectors has been described as one of the key economic developments of insurance markets in the past decade (Cummins and Weiss, 2009). We focus on catastrophe risk instruments, because they are not only the most important ILS category in practice, but also the ones which have spawned the vast majority of academic research in recent years. We begin by reviewing those strands of the literature that deal with catastrophe risk markets in general before looking more closely at papers that focus on potential pricing approaches for catastrophe bonds and derivatives.

2.4.1 Academic Work on Catastrophe Risk

In light of the increasing number and severity of natural disasters as well as the importance of reliable approaches for the valuation and management of ILS portfolios, catastrophe risk has become an area of major interest for both academics and industry practitioners. Quite a few papers in this field aim at explaining the growth trajectory of the market for alternative risk transfer. To a much lesser extent, the literature has dealt with the issue of basis risk, which arises when a loss index and the losses of the hedging company are not perfectly stochastically dependent. Furthermore, some authors have identified reasons for the failure of certain market segments and suggested potential remedies. Finally, the catastrophe risk literature is closely related to work on weather or climate-related risks. Unfortunately, an empirical evaluation of many theoretical concepts is still outstanding. Table 23 provides an overview of influential articles on catastrophic risk.

Cummins and Weiss (2009) provide a comprehensive overview of alternative risk transfer instruments and their evolution since the late 1990s. They conclude that the convergence of insurance and financial markets has been accelerated by the strong growth in insured values, the reinsurance underwriting cycle, the advent of enterprise risk management, the latest advances in the theory of finance, technological progress, as well as regulatory, accounting and tax-related aspects. Furthermore, Froot (2001) points out that the relatively low level of catastrophe risk coverage acquired by most insurers is at odds with classical risk theory. He then reviews catastrophe bond transactions to explore reasons for this phenomenon and derives eight potential explanations of which he stresses capital market imperfections

and the market power of reinsurance companies to be the most likely ones. Similarly, Ibragimov et al. (2007) set up a model of the catastrophe risk market that explains why institutions decide not to sell insurance and reinsurance, although there is enough risk-bearing capacity to achieve complete diversification. They call this outcome a "nondiversification trap" and explain that it may arise when distributions exhibit heavy left tails and companies operate under limited liability. Cummins and Trainar (2009) analyze strengths and weaknesses of reinsurance and securitization. Their results demonstrate that traditional reinsurance is well-suited for the management of small, uncorrelated risks and to promote the information exchange between buyers and sellers of protection. Yet, for increasing loss sizes and correlations, the cost of capital may become very large, thus rendering reinsurance solutions inefficient. In such situations, it is possible to draw on securitization as a complement that allows for regulatory arbitrage and the collateralization of low-frequency high severity risks. Finally, according to Lakdawalla and Zanjani (2011), the fact that catastrophe bonds are fully collateralized impedes market penetration, despite the instrument's lower frictional cost compared to traditional reinsurance. They show, however, that catastrophe bonds mitigate market inefficiencies and improve welfare in the presence of contracting constraints or correlated risks.

Literature that focuses on the role of basis risk in alternative risk transfer solutions is still rather scarce. Doherty and Richter (2002) assume the perspective of an insurer who can purchase index-linked protection and a gap insurance contract that fully or partially covers the difference between the firm's losses and the index-linked payoff. The results, which strongly depend on the transaction costs of both instruments, illustrate that it is possible to realize efficiency gains through the combination of the index hedge with gap insurance. Basis risk is also analyzed by Cummins et al. (2004) who run an AIR windstorm model to assess the suitability of cat index options for the hedging of insured losses caused by hurricanes in Florida. Their findings suggest that large insurers can protect themselves quite well, using contracts linked to statewide or intrastate indices. Small insurers, in contrast, face a considerable degree of basis risk when employing index-linked instruments. Zeng (2005) determines the most important efficiency drivers of index-based risk transfer instruments and uses them to construct an index-based hedge that is as effective as a classical excess-of-loss reinsurance contract. Moreover, Gatzert and Kellner (2011) analyze the consequences of basis risk for the solvency situation of insurance companies that protect themselves against natural disaster losses by means of industry loss warranties. They improve on earlier studies by providing for non-linear dependencies between high-

risk and low-risk assets, the loss of the insurance company as well as the industry-wide loss index. In doing so, they are able to demonstrate that the dependence characteristics are of paramount importance with regard to the firm's basis risk and capital charges.

Even though there are many designs for catastrophe risk transfer products, their volumes are still small compared to the traditional reinsurance and retrocession markets and the demand level suggested by risk theory (see, e.g., Mutenga and Staikouras, 2007). There are multiple explanations for the gap between theoretical and true catastrophe insurance demand (see, e.g., Froot, 2001). Kousky and Cooke (2012) aim at explaining the decision not to buy catastrophe insurance when fat tails, micro correlations, and tail dependence are present. They infer that catastrophic loss characteristics require insurers to hold enormous levels of equity capital that drive up premiums to a level at which it is not rational for individuals to purchase catastrophe insurance policies. Their results indicate that, in addition to the behavioral biases and information search costs often offered as an explanation for the low catastrophe insurance demand, the high costs of premiums caused by catastrophe risk characteristics are another important factor in this market. One segment of the catastrophe risk markets that has been particularly unsuccessful are exchange-traded insurance derivatives. Bouriaux and Tomas III (2014) discuss reasons for the repeated failure of cat futures and options to attract a sufficient degree of interest from capital market investors. In their opinion, basis and liquidity risk in combination with product design issues, a steep learning curve, regulatory inconsistencies, and disadvantageous margining systems could be the major issues from the perspective of the hedging and investing entities. In contrast, industry loss triggers and the length of loss development period commonly blamed might not really matter that much. They conclude that futures and options exchanges should be in a position to easily correct these shortcomings.

Finally, the literature on catastrophes risks is strongly interconnected with work on weather or climate-related risks (see, e.g., Michel-Kerjan and Morlaye, 2008) and risk mitigation (see, e.g., Kunreuther and Michel-Kerjan, 2009, Zanjani, 2002). One very specific topic is the design of the U.S. flood insurance program. For example, Michel-Kerjan and Kousky (2010) provide a detailed analysis of the operation of the National Flood Insurance Program (NFIP) in Florida. In their analysis of 7.5 million policies, they identify, among other characteristics of flood insurance buyers, types of contracts (deductibles and coverage levels) and determinants of claims payments.

For example, they show that homes with more floors, elevated buildings, and buildings with basements have lower claims. Moreover, buildings in high-risk areas (SFHA) have higher claims and communities with more risk mitigation (CRS) have lower claims.

Also covered in the recent literature are the government's role as reinsurer of catastrophe risks (Bruggeman, Faure, and Fiore, 2010) and industry response and policy frictions in the context of catastrophic risk (Castellano, 2010). Many authors argue that an effective flood insurance program should include some elements organized by the government and some organized by the private insurance sector. In the context of more general natural disasters, Chang and Berdiev (2013) provide an analysis of the relationship between natural disasters, political risk, and insurance market development in a panel of 39 countries over the period 1984–2009. They find that occurrences of natural disasters and deaths caused by natural disasters lead to greater total insurance consumption, including life and non-life insurance. They also note that countries with lower levels of political risk have higher insurance consumption. The authors emphasize that natural disasters, political risk, and their interaction are important determinants of insurance market development. Cheng and Weiss (2012) analyze property–liability insurance insolvencies during the period of 1994 to 2008 and find hurricane risk exposure has a significant impact on the U.S. market. Through the identification of hurricane exposure as a new variable that explains insolvencies and the unreliability of usually applied risk-based capital ratios, this study reveals the need to revise existing solvency surveillance systems, with catastrophe risk exposure playing a potentially important role in such revisions.

Climate change will affect the insurance industry in many ways. In an effort to investigate the relationship between weather events and incurred losses, Scheel et al. (2013) develop a Bayesian hierarchical statistical approach to explain and predict insurance losses due to weather events for Norway. Their results are useful not only for insurance pricing but also for developing strategies to limit the effects of weather events through preventive actions. Ranger and Surminski (2013) assess the impact of climate change on non-life insurance demand in the BRICS economies. In considering how climate change may influence the expansionary trend of non-life insurance in the period up to 2030, the authors suggest five pathways of influence: wealth; willingness to pay for insurance; policy and regulation; changes in the supply of insurance; and new opportunities associated with adaptation and mitigation. They conclude that the influence of climate change on insurance demand up to 2030 is

likely to be small but not insignificant. Okhrin et al. (2013) offer another look at weather risk. The authors consider the viability of private crop insurance in China. A major obstacle for the implementation of crop insurance is the systemic risk inherent to crop failures. The authors attempt to determine the spatial dependence of weather events in different regions in China and the associated joint losses of hypothetical crop insurance written on these weather events.

Table 23: Influential papers on Catastrophe Risk

Paper	Main Message
1. Kunreuther, H.C., and E. Michel-Kerjan (2009), The Development of New Catastrophe Risk Markets, *Annual Review of Resource Economics*, 1(1), 119-137.	The large-scale disasters that have occurred since 2001 foretell a new era of catastrophes. Insurance-linked financial instruments and long-term insurance contracts are proposed to complement traditional insurance and reinsurance.
2. Ibragimov, R., Jaffee, D., and Walden, J. (2008), Nondiversification Traps in Catastrophe Insurance Markets, *Review* of *Financial Studies* 22(3), 959-993.	Model for markets for catastrophic risk which explains why insurance providers may choose not to offer insurance for catastrophic risks and not to participate in reinsurance markets, even though there is enough market capacity to reach full risk sharing through diversification in a reinsurance market ("nondiversification trap"). Nondiversification traps may arise when risk distributions have heavy left tails and insurance providers have limited liability. When they are present, there may be a coordination role for a centralized agency to ensure risk sharing.
3. Cummins, J.D., and Weiss, M.A. (2009), Convergence of Insurance and Financial Markets: Hybrid and Securitized Risk-Transfer Solutions, Journal of Risk and Insurance, 76(3), 493-545.	Increased frequency and severity of insurance claims has led to the development of new insurance products (ILS) linking traditional reinsurance and elements from financial products. The provided survey shows that the importance of ILS and other new forms will continue to increase.
4. Cummins, J., Lalonde, D., and Phillips, R. (2004). The basis risk of catastrophic-loss index securities. Journal of Financial Economics, 71(1), 77–111.	Uses a windstorm simulation model to analyze the effectiveness of catastrophic-loss index options in hedging hurricane losses for Florida insurers. The results suggest that insurers in the two largest size quartiles can hedge losses almost as effectively using contracts based on four intrastate indices as they can use contracts that settle on their own losses. Many insurers in the third-largest quartile can hedge effectively using the intrastate indices, but most insurers in the smallest quartile would encounter basis risk. Hedging using a statewide loss index is effective only for the largest insurers.

5. Carayannopoulos, P. and Perez, M.F. (2015). Diversification through Catastrophe Bonds: Lessons from the Subprime Financial Crisis. Geneva Papers, 40(1), 1-28.	Show that catastrophe bonds are only uncorrelated with the market in non-crisis period. Improved structures for new CAT bonds issued since 2009 have been positively received by the market.
6. Doherty, N. A. and Richter, A. (2002). Moral Hazard, Basis Risk, and Gap Insurance. Journal of Risk and Insurance, 69(1), 9–24.	Analyzes a decision maker (e.g., a primary insurer) who can purchase an index hedge and a (re)insurance contract that covers the gap between actual losses and the index-linked payout, or part of this gap. The results show that combining insurance with an index hedge extends the possibility set and leads to efficiency gains. The results depend on the transaction costs associated with both instruments. In particular, the authors show that if the index product is without transaction costs, at least some index-linked coverage is always purchased, so long as there is positive correlation between the index and the actual losses. It is also shown that the index hedge would always be supplemented by a positive amount of gap insurance.

2.4.2 Academic Work on the Pricing of Catastrophe Bonds

A continuously growing amount of scholarly research focuses on the valuation of catastrophe bonds (see Braun, 2012, 2015). As shown in Table 24, the types of models that have been suggested in this regard can be assigned to one of four categories: actuarial, econometric, risk-neutral, and utility-based.

Most extant work is concerned with the development of models based on option pricing theory. In an early article, Loubergé et al. (1999) apply the classical Black and Scholes (1973) assumptions to cat bonds before turning to a compound Poisson process in combination with a simple binomial interest rate model. Another option-theoretic model for cat bonds, relying on a compound Poisson process, is presented by Baryshnikov et al. (2001). Lee and Yu (2002) additionally contemplate default risk, moral hazard, and basis risk in a structural credit model with stochastic interest rates as in Cox et al. (1985). Similarly, Vaugirard (2003a,b, 2004) introduces a barrier option framework for cat bonds based on the assumptions that interest rates adhere to a Vasicek (1977) model and that the underlying physical index can be adequately described by a jump-diffusion process. Burnecki and Kukla (2003) employ a Cox process to value zero-coupon and coupon cat bonds, Lee and Yu (2007) apply

insights from their earlier work on cat bonds to reinsurance contracts, and Pérez-Fructuoso (2008) develop a continuous-time model for transactions with index triggers, taking into account both reported losses and incurred but not reported losses. Moreover, Reshetar (2008) considers the risk-neutral pricing of insurance-linked securities that combine both natural disaster and extreme mortality risk, Härdle and López Cabrera (2010) examine the calibration of a cat bond for Mexican earthquakes, and Hainaut (2010) suggests a valuation method with a claim arrival process that is subject to stochastic seasonality. The approach of Wu and Chung (2010) for the pricing of catastrophe bonds is based on a doubly stochastic Poisson process, while additionally incorporating stochastic interest rates and counterparty default risk represented by a Cox et al. (1985) and a Jarrow and Yu (2001) model, respectively. Jarrow (2010), in contrast, draws on reduced-form modeling methodology from the credit derivatives markets to develop an arbitrage-free closed-form solution for the price of a cat bond. Nowak and Romaniuk (2013) derive a general cat bond pricing formula, which can be applied for different payoff functions and interest rate dynamics and Ma and Ma (2013) draw on the work of Lee and Yu (2002) to present another contingent claims model for cat bond pricing with compound nonhomogeneous Poisson losses and stochastic interest rates, which they fit to Property Claim Services (PCS) loss data from 1985 to 2010. Finally, Gatzert et al. (2015) demonstrate how information from the cat bond market can be used to infer arbitrage-free and market-consistent prices for industry loss warranties.

Another strand of the cat bond pricing literature rests on the insight that insurance markets are generally incomplete, implying that it is not possible to replicate all contingent claims with available financial instruments. Consequently, even if arbitrage opportunities are ruled out, a single unique equivalent martingale measure does not exist (see, e.g., Harrison and Kreps, 1979). To overcome this problem, these authors resort to equilibrium theory. Cox and Pedersen (2000), for example, derive an approach for cat bond valuation in an incomplete markets setting, employing time separable utility. Moreover, Froot and Posner (2000, 2002) develop an equilibrium model for the pricing of multiple event risks under parameter uncertainty. In contrast to that, Young (2004) computes indifference prices for cat bonds based on exponential utility investor preferences, and Egami and Young (2008) extend their work to tranched deals. An incomplete markets approach is also adopted by Zimbidis et al. (2007), who analyze cat bonds for Greek earthquake risk with dynamic interest rates. In addition, Dieckmann (2011) proposes a consumption-based

model for cat bonds with an external habit process as in Campbell and Cochrane (1999). Finally, Zhu (2011) explains stylized facts with regard to the cat bond spread by means of an intertemporal equilibrium framework.

Apart from the aforementioned modeling-oriented literature on catastrophe bonds, there have been advances in applied research in recent years. An early empirical study is authored by Lane (2000), who fits a power function with two parameters, the probability of first loss and the conditional expected loss, to a small sample of cat bonds from 1999. Lane and Mahul (2008), in contrast, assume a linear relationship between the expected loss and the cat bond spread. Examining primary market data for about 250 cat bond tranches that have been issued between 1997 and early 2008, they illustrate the impact of the underlying peril and the reinsurance cycle. Subsequently, they estimate their model with small cross sections of indicative secondary market prices at two different points in time: the second quarter of 2006 and the first quarter of 2008. Similarly, Dieckmann (2009) considers secondary market data for a cross section of 61 deals before and after the occurrence of Hurricane Katrina in August 2005, aiming to identify significant spread drivers as well as the effect of mega-events on the pricing relation. The impact of the 2005 hurricane season on cat bond spreads is also examined by Ahrens et al. (2009), who draw on the treed Bayesian estimation technique to test the model of Lane (2000) based on 199 observations that were collected between March 2003 and July 2008. Furthermore, Gatumel and Guégan (2009) aggregate market maker quotes for a small number of cat bond tranches into an index time series, which they employ to study the spread behavior in the secondary market from January 2004 to April 2009. Apart from that, they fit three pricing models to their data and assess the evolution of the respective parameters over time. Another analysis of the primary market is provided by Papachristou (2009), who explores factors that affect the cat risk premium. For this purpose he applies a generalized additive model to 192 bonds launched between January 2003 and July 2008. Moreover, Bodoff and Gan (2009) rely on a sample of 115 transactions issued before 2008 to devise a tractable pricing approach for cat bonds in the primary market, incorporating expected loss, covered territory, and reference peril. The fit of different models that have been brought forward in the literature is compared by Jaeger et al. (2010) and Galeotti et al. (2013). In doing so, the former adopt both cat bond and industry loss warranty prices as of August 31, 2009, while the latter use primary market spreads for 176 cat bond transactions between 1999 and 2009. The most sophisticated secondary market study to date has been conducted by Gürtler et al. (2015), who assess the impact of financial market turmoil and large

natural disasters on cat bond spreads by means of panel data methodology. Finally, Braun (2015) analyzes a comprehensive sample of primary market data, derives an econometric pricing model, and demonstrates its superiority compared to extant approaches based on a battery of in-sample and out-of-sample tests.

Table 24: Literature on Different Pricing Approaches for Catastrophe Bonds

Actuarial	Econometric	Risk-Neutral	Utility-Based
Kreps (1999) Lane (2000) Major & Kreps (2002) Lane (2004) Linear Model Polynomial Model Fermat Capital Jaeger et al. (2010)	Lane & Mahul (2008) Lei et al. (2008) Ahrens et al. (2009) Gatumel & Guégan (2009) Papachristou (2009) Bodoff & Gan (2009) Galeotti et al. (2013) Braun (2015) Gürtler et al. (2015)	Loubergé et al. (1999) Cox & Pedersen (2000) Baryshnikov et al. (2001) Lee & Yu (2002) Burnecki & Kukla (2003) Vaugirard (2003a,b, 2004) Wang (2004) Pérez-Fructuoso (2008) Reshetar (2008) Härdle & López Cabrera (2010) Hainaut (2010) Wu & Chung (2010) Jarrow (2010) Nowak & Romaniuk (2013) Ma & Ma (2013)	Cox & Pedersen (2000) Froot & Posner (2000, 2002) Young (2004) Egami & Young (2008) Zimbidis et al. (2007) Dieckmann (2009) Dieckmann (2011) Zhu (2011)

2.4.3 *Academic Work on the Pricing of Other Cat Risk Instruments*

Apart from catastrophe bonds, quite a few authors have suggested pricing models for catastrophe options, futures and swaps. While this strand of the literature already encompasses some interesting analyses and approaches, many open questions still remain. We begin by considering utility-based work in the context of catastrophe derivatives. Embrechts and Meister (1997) provide a generic discussion of catastrophe futures pricing in a utility maximization context. Furthermore, Aase (1999) treats catastrophe risk as systematic and resorts to a partial equilibrium framework with constant absolute risk aversion to derive pricing formulae for cat futures, caps, call options, and spreads. Christensen and Schmidli (2000) introduce an exponential utility model for cat futures which includes loss reporting lags. Finally, amending his earlier work on cat derivatives pricing by employing a Markov model for the dynamics of the underlying, Aase (2001) proposes a competitive equilibrium approach which assumes constant relative risk aversion of the representative agent.

As in the catastrophe bond literature, the majority of papers on the pricing of cat derivatives focus on preference-free no-arbitrage frameworks. Cummins and Geman (1994, 1995) value cat futures and call spreads with an Asian option approach, assuming a jump-diffusion process with constant jump amplitude for the claim dynamics. Besides, Chang et al. (1996) develop a cat option model based on a stochastic time change linked to insurance futures transactions. This setup allows them to convert a compound Poisson into a pure diffusion process for which risk-neutral valuation is readily applicable and a parsimonious closed formula can be derived. Similarly, by means of stochastic time change and Laplace transform, Geman and Yor (1997) present a semi-analytical solution for the price of cat options on a loss index that follows a jump-diffusion process. Bakshi and Madan (2002) provide a closed-form solution for PCS cat option prices based on the assumption that losses follow a mean-reverting Markov process with one-sided jumps. A compound doubly stochastic Poisson process (Cox process) is used by Dassios and Jang (2003) to model stop-loss reinsurance contracts and cat derivatives. Muermann (2003) assumes a compound Poisson loss process and values cat derivatives relative to observed premiums of insurance contracts on the same underlying risks. Moreover, in his model for options on a PCS index, Schmidli (2003) distinguishes between catastrophe occurrence and loss development period, which are governed by a compound Poisson process and a Geometric Brownian Motion, respectively. In addition, Cox et al. (2004) consider the valuation of double trigger catastrophe put

options when losses are generated by a compound Poisson process and Jaimungal and Wang (2006) generalize their work by incorporating stochastic interest rates. Biagini et al. (2008) use a Fourier transform to derive an analytical solution for the price of an option with catastrophe occurrence and loss development period. Muermann (2008) applies a cat call option model based on a compound Poisson process for the underlying loss index to extract the market price of insurance risk from quotes of traded cat derivatives. Furthermore, Chang et al. (2008, 2010) generalize their concept from the mid-1990s from a complete market continuous-time to an incomplete market discrete-time framework to price Asian-style cat options with a doubly-binomial model. They additionally consider stochastic Poisson intensities described by a mean-reverting Ornstein–Uhlenbeck process and reduce the computational effort through a stochastic time change from calendar to claim time. Catastrophe futures and options are also priced by Wu and Chung (2010) who employ a doubly stochastic Poisson process with Ornstein–Uhlenbeck intensity in combination with a Cox et al. (1985) model for the term structure and the framework of Jarrow and Yu (2001) for counterparty default.

More recent work is provided by Braun (2011), who analyzes catastrophe swaps, a financial instrument that has attracted little academic attention to date. He presents a two-stage contingent claims pricing approach that distinguishes between the main risk drivers ex-ante as well as during the loss reestimation phase and additionally incorporates counterparty default risk. Finally, Chang et al. (2011) derive a pricing formula for catastrophe equity put options, which allow the issuer to sell new shares at a predetermined price in case catastrophe losses exceed a certain threshold. The authors assume that catastrophic events follow a Markov modulated Poisson process (MMPP). Catastrophe equity put options are also considered by Villegas et al, (2012) who focus on the pricing of various ART solutions, including multi-trigger products and insurance-linked securities. As an alternative to complex and customized derivative and actuarial pricing strategies involving strong assumptions about the distribution of important risk factors, the authors suggest the use of optimization-based methods computing upper and lower price bounds that rely on market data and expert information. Their approach is especially advantageous in situations where data on risk factors is scarce and the product's structure is too complex to derive analytical solutions.

3 New Empirical Study

3.1 Methodology

The aim of our market survey is to analyze advantages and disadvantages of ILS, the current market development, and the decision-making processes that drive the demand for this asset class. We conduct two separate surveys and, in addition, we reconcile the survey answers with expert interviews after the survey evaluation. The first, extensive market survey targets institutional investors (Section 3.2).[38] The second, complementary survey targets insurers and consultants, addressing their perspective as sponsors and potential private investors. One focus topic of the study is sidecar investments.[39] Participation in this survey was anonymous. The market survey with respect to institutional investors was organized in five sections (the complete questionnaire is given in Appendix A):

A. General Questions (e.g., company size, business model)
B. Assessment of ILS (e.g., assessment of potential impediments, ratings)
C. Focus Topic Sidecars (e.g., concerns to invest in sidecars)
D. Risk-return, correlation and other characteristics of ILS
E. Outlook (e.g., expectation on market expansion)

Questions in the survey were created using the existing literature in the ILS field. Braun et al. (2013) conducted a survey to analyze the decision process for cat bond investments among insurers and reinsurers. The World Economic Forum (2008) identified potential impediments through focus groups, where the majority of participants also stemmed from the insurance industry. In contrast, this study looks at the full spectrum of potential investors for ILS, including pension funds, hedge funds, foundations etc.

In early April 2014, 398 questionnaires were mailed to investors for whom we could collect postal addresses. We then sent out a reminder e-mail to each investor which included an online survey link. Finally, we sent 1374 emails with the online survey link to hedge funds that had e-mail addresses published by the CISDM database.[40] All interested investors could participate in the online survey between April 1 and

[38] Note that we address all institutional investors whether they may or may not have any experience with ILS.
[39] We focus on sidecars, because Krutov (2010) argues that sidecars offer the same advantages as other ILS to investors and, in addition, have advantages that are specific to sidecars; they might be easier to enter, might not require extensive expertise and have a clearly limited lifespan.
[40] This list excludes hedge fund contacts we identified on our own.

June 23, 2014.[41] 19 individuals participated in the online survey but did not complete it. 32 participants completed the entire survey online. Additionally, 5 participants completed the survey offline returning it by post. Based on 1,772 addressed investors and 56 participants (i.e., 32 online, 5 offline, and 19 partially responding), the response rate to our survey is 3.2%.

In the presentation of the study results, we separate ILS funds from other institutional investors due to potential conflicts of interest that ILS funds are exposed to by their very nature. That is, the business model of an ILS fund is to promote the asset class and to attract further capital rather than alienating prospective investors. One the one hand, it is important to include ILS funds in such a study because of their market expertise and, on the other hand, it is crucial to disentangle the concerns of the broad institutional investor base from those of the specialized ILS funds. Interestingly, as we will see in the results, the two perspectives are very much consistent.

The second survey regarding insurers and consultants was conducted on February 24, 2015 in Hamburg, Germany. The survey was held during a conference with 41 participants from the insurance and consulting industry. The survey addresses the issues of familiarity with the ILS topic in general, the future exposure of the own company (insurance / consulting) towards ILS, the potential for different risks to be securitized, and the willingness to invest in ILS as a private investor.

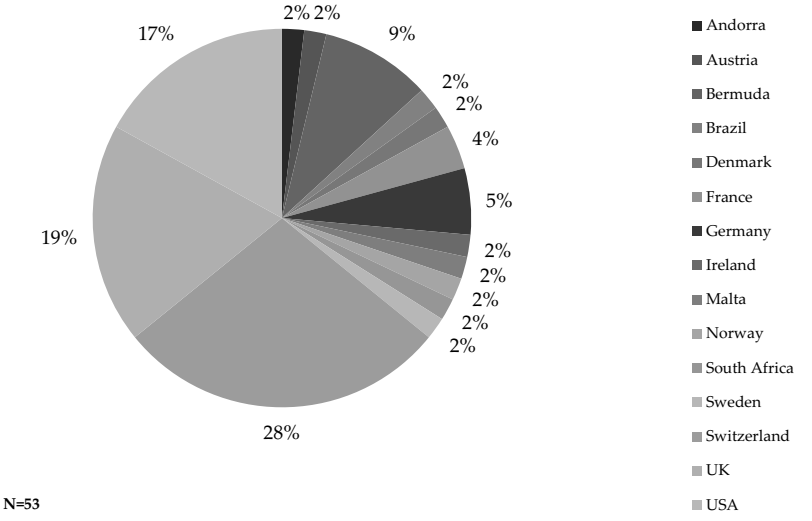
[41] We also asked survey participants to forward the e-mail to institutional investors they considered interested in the ILS topic to increase the number of survey participants.

3.2 Results

3.2.1 General Questions

Respondents to our survey come from 15 countries (Figure 31). The majority of participants is based in Switzerland (28%), followed by the U.K. (19%), the U.S. (17%), and Bermuda (9%). Hence, our sample is dominated by those countries that host large parts of the global ILS investor base and can be considered to be a well-balanced representation of the overall market (see Figure 26 in section 2.2.2).

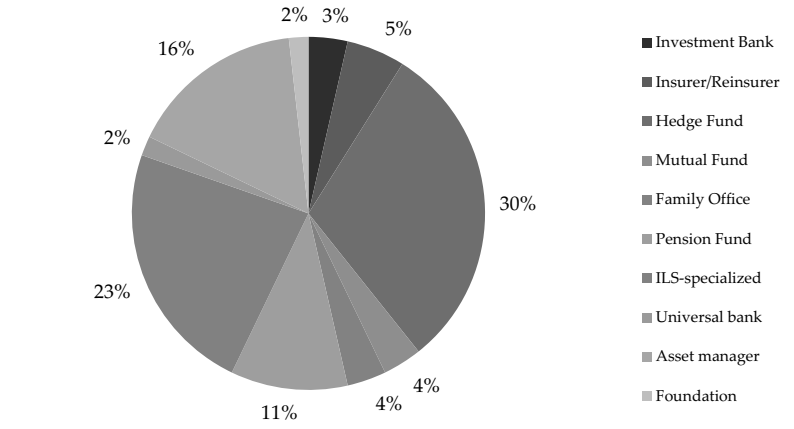
Figure 31: Headquarter of investor



N=53

Four investor types stand out in our survey. These are hedge funds (30%), dedicated ILS funds (23%), asset managers (16%), and pension funds (11%). According to Munich Re (2014a), pension funds have allocated substantial amounts of capital to the ILS asset class since 2012. In 2012, pension funds owned 14% of the ILS volume (see Figure 22 in Section 2.2.2). Other investor groups include mutual funds, family offices, banks, and foundations.

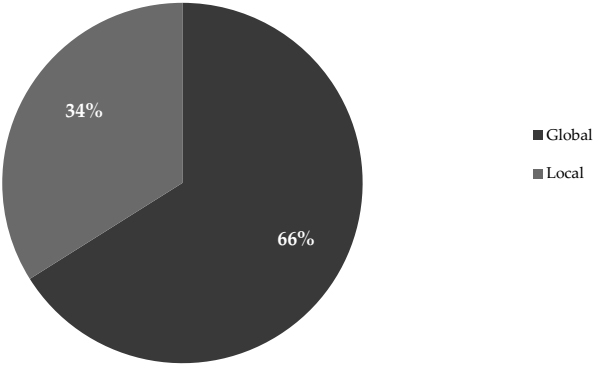
Figure 32: Business model



N=56

Furthermore, 66% of the participating investors consider themselves as global players, whereas 34% see themselves as rather locally oriented (Figure 30). This information is relevant for sponsors, since it might be necessary to draw on several local distribution channels to reach up to one third of the potential institutional investor base for their ILS transactions.

Figure 33: Global player

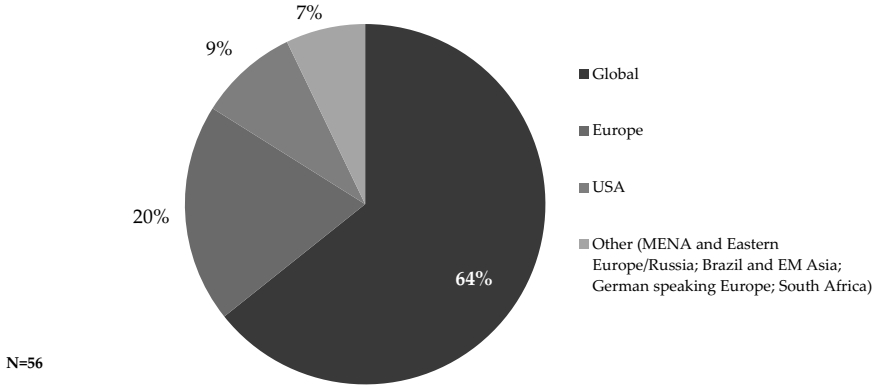


N=56

The self-image of the survey participants is also corroborated by the investment region they are active in. Two thirds invest globally, 20% invest mainly in Europe,

9% mainly in the U.S., and 7% indicate that their investment focus lies on other regions. The latter include Brazil, Russia, South Africa and emerging markets in Asia. These regions are all currently mainly disregarded by the ILS market. However, some of these countries, as well as China and India, exhibit a growing insurance penetration and additional capital might help to reduce insurance prices via more intensive competition in the reinsurance market. Investors from developed countries might still demand an additional compensation for elevated political risk but one point is particularly advantageous: Natural disaster risks from the BRICS[42] countries are theoretically unrelated, since their sources are located in the northern and southern hemispheres, different climatic regions, and on different continents. Thus, they would offer valuable diversification properties for ILS portfolios.

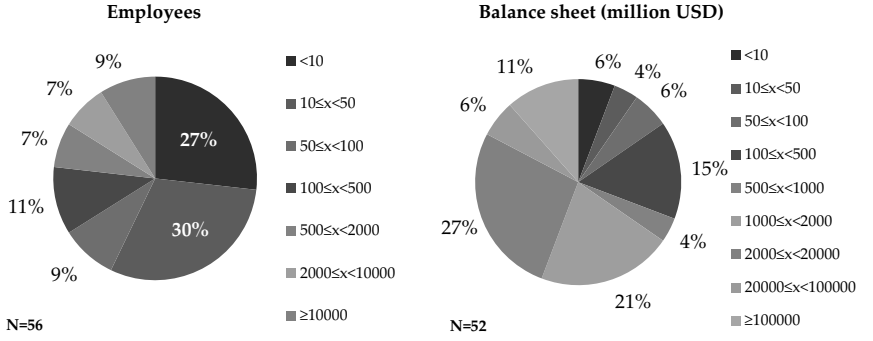
Figure 34: Investment region



There is also a great dispersion in size over the sample of investors (Figure 35), both in terms of number of employees and balance sheet size. More than half of the companies do not have more than 50 employees which can be explained by the strong representation of dedicated ILS funds and hedge funds. Yet, more than two thirds of the investors in our sample reported more than USD 1 billion in total assets (balance sheet size).

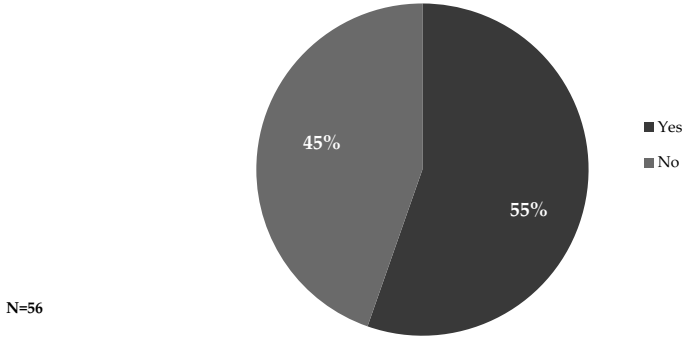
[42] Note that BRICS is a common acronym for Brazil, Russia, India, China, and South Africa.

Figure 35: Size of investors



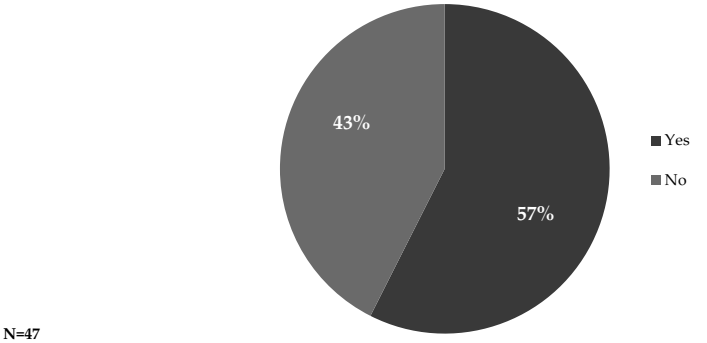
It should also be noted that 55% of the total investor base in our sample are allowed to short sell positions, indicating a high flexibility in their investment styles (Figure 36). Considering that 30% of the entire sample consists of hedge funds, this comes as no surprise. Internal regulation regarding short selling among ILS funds, in contrast, is rather mixed with about 60% of them being able to short sell whilst 40% are not.

Figure 36: Allowance of short-selling



Our sample is also well-balanced between investors who have already invested in ILS and those who have not (Figure 37). Thus, this study also addresses the concerns and expectations of investors who do not (yet) exhibit an in-depth knowledge of the asset class. The corresponding results should be particularly interesting for sponsors, because they indicate aspects that need to be addressed so that new market participants can be attracted.

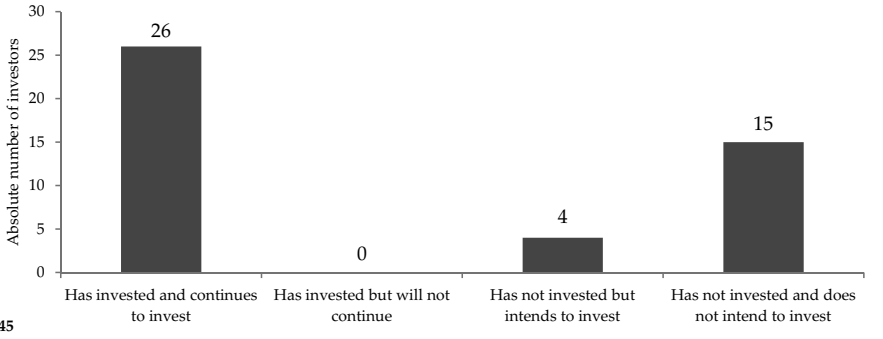
Figure 37: Experience with ILS (invested in ILS in the past or currently invested)



None of our participants who are / were invested in ILS intend to stop doing so. This is certainly a first indicator suggesting further growth of this asset class in the future. More importantly, it may indicate that once investors are exposed to ILS, their overall satisfaction seems to be sufficient to not abandon the asset class.[43] In addition, four participants are considering an ILS engagement in the near future. Based on our sample, this would hypothetically increase the investor base in ILS by approximately 15% (= four new investors based on 27 actual investors) under the assumption that these four institutions are representative for the entire market (Figure 38). Finally, 15 potential investors or 33.3% of the respondents neither have invested nor would consider investing in ILS in the future. The majority of these participants are hedge funds and pension funds. Because hedge funds are often focused on one asset class only, they may easily ignore the ILS asset class. Pension funds, in contrast, might be too unfamiliar with ILS in general.

[43] Note, however, that there may be a certain non-response bias, since those investors with negative ILS experiences may not have participated in this study.

Figure 38: ILS investment decisions



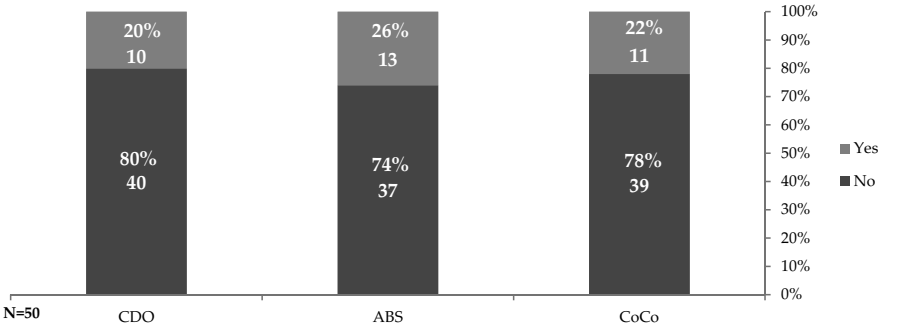
N=45

To understand how much experience investors in our sample have regarding structured products other than ILS, we wanted to know whether they ever invested in collateralized debt obligations (CDO), asset-backed securities (ABS), or contingent convertible bonds (CoCo-bonds). Depending on the instrument, at least 74% answered that they have never invested in such products (Figure 39). Specifically, 80% never invested in CDOs, 74% never invested in ABS, and 78% never invested in CoCo-bonds.[44]

With very few exceptions, most respondents who previously held one structured product also invested in the other ones. Interestingly, all 10 investors who purchased CDOs have either invested in ILS or are at least considering an investment. These investors might be comfortable with the tail risk inherent in ILS, which is also a significant pricing factor in CDOs (see also Longstaff and Rajan, 2008). In contrast, those who only held ABS positions in the past state that they have never invested in ILS and have no plans to do so in the future (three out of four investors). A potential explanation could be that these investors focus on a specific type of structured finance security. Similarly, those who invested in ABS could have developed reservations against securitization in general because of negative experiences during the financial crisis in 2008.

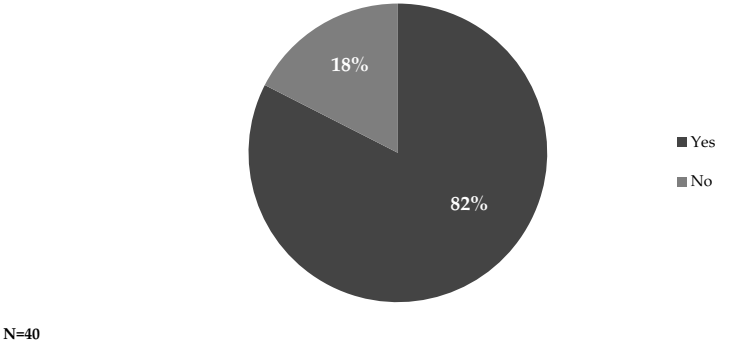
[44] Note that the absolute number of respondents in Figure 39 varies because some respondents chose not to answer all categories.

Figure 39: Invested in structured products other than ILS (# and %)



To learn more about the investment process of the respondents, we also wanted to know whether they have a due diligence process in place before making any investments. In this regard, only 18% responded with no.

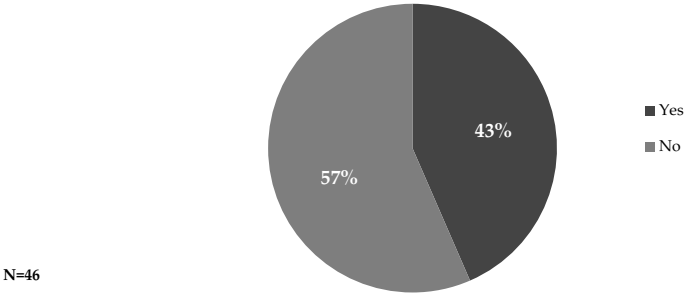
Figure 40: Due diligence



3.2.2 Assessment of ILS

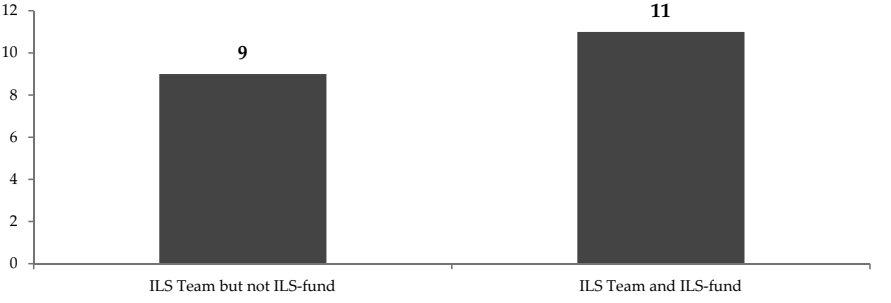
Our survey shows that 43% of the investors in our sample already have a specialized ILS team (Figure 41). This is primarily because ILS funds, by their very nature, require such a team. The following figures discuss ILS teams in more detail.

Figure 41: ILS team



N=46

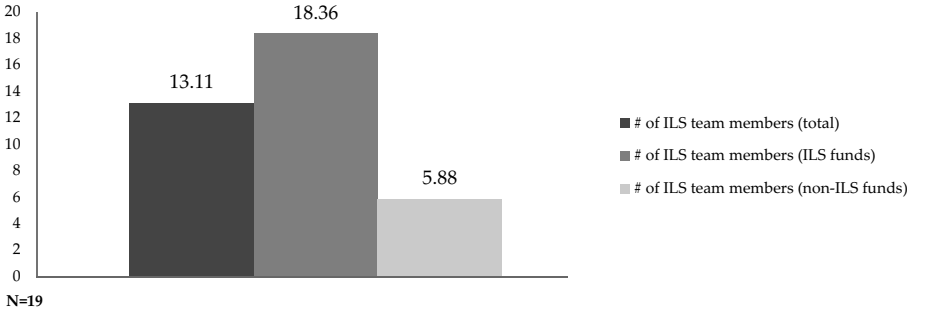
Figure 42: ILS team distribution



N=20

In Figure 42, we take a closer look at the 20 respondents who do have an ILS team. Interestingly, nine of them are not ILS funds. Figure 43 shows that their ILS teams comprise on average slightly less than six members, whereas the average team at the 11 ILS funds comprises 18 members. Therefore, ILS funds should have a clear competitive advantage with regard to sophisticated ILS investment decisions.

Figure 43: Number of ILS team members

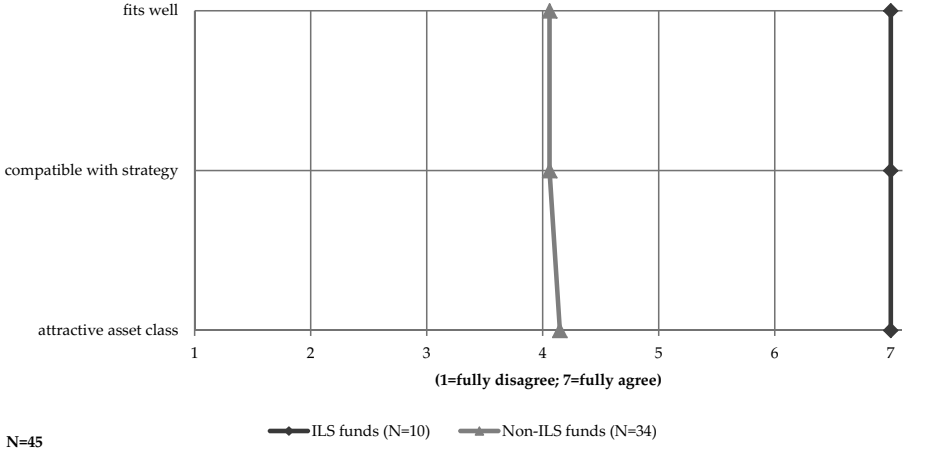


N=19

We are also interested in the experience of the ILS teams. Most teams were established in 2006, suggesting eight years of professional experience in ILS. We also observe that the first teams in our sample were established in 1997 by an ILS fund and in 1999 by a non-ILS fund. Thus, their experience dates back all the way into the early days of the market.

Furthermore, we asked the investors how well ILS fit their portfolio. That is, to which extent this asset class suits their current investment strategy and how attractive they find it in general (see Figure 44). As mentioned above, we differentiate between ILS funds and non-ILS funds. Unsurprisingly, ILS funds are very positive about the asset class. The broader investor base, however, seems to be rather undecided in their overall opinion.

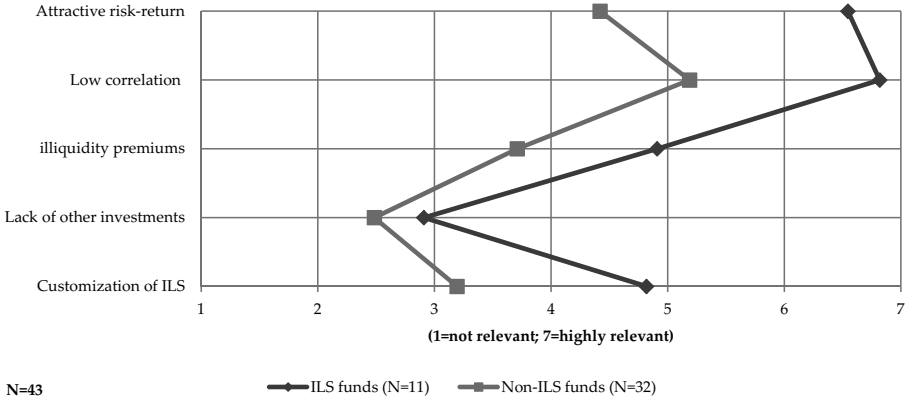
Figure 44: Fit of ILS in institutional portfolio



N=45

We now turn to Figure 45. Clearly, the low correlation of ILS with other asset classes, which seems to be the key aspect when considering an ILS investment, receives a favorable assessment by investors in general (both ILS and non-ILS funds). It is even considered to be more relevant than the expected return. Attractive returns are the second most important reason for investing in ILS, although the broad investor base emphasizes this aspect less than ILS funds. Moreover, while harvesting illiquidity premiums and customizing ILS products is considered relevant to ILS funds, the broader investor base is much less interested in the customization of ILS and seems to be more or less indifferent to earning illiquidity premiums. Both investor types agree that they would not turn to ILS merely due to a lack of other investment opportunities. In light of the current low interest rate environment, this is an interesting answer. However, it might be partly driven by the relatively small ILS market volume, implying that large institutional investors can only allocate a minor amount of their capital to this asset class anyway.

Figure 45: Investing in ILS



Turning to the potential concerns with regard ILS, we observe significant differences in the answers of ILS funds and the broader investor base (see Figure 46). While the direction of each effect is consistent for the two groups, the concerns of non-ILS funds compared to ILS funds are much more pronounced (they are shifted to the right by a factor of two). A second important observation is that neither group is highly concerned about the aspects that were included in our survey.

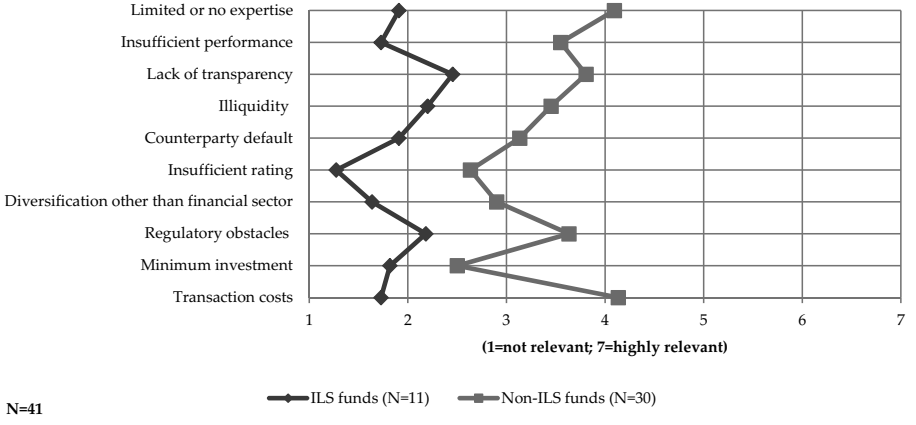
The greatest disagreement between non-ILS funds and ILS funds can be observed with regard to transaction costs. In fact, while ILS funds consider transaction costs to

be virtually irrelevant, non-ILS funds take them into account. Potential explanations could be that ILS funds are able to achieve better execution pricing or that they can pass on some of the transaction costs to their own investors. For non-ILS funds, the minimum investment seems to be the least of their concerns. Interestingly, the most severe ILS-fund concern is the lack of transparency. For non-ILS funds this is merely the third largest concern. Furthermore, both groups are not at all concerned about insufficient ratings of ILS.

There are two possible explanations for this result. First, most investors (82%, see Figure 40) have an intensive own due diligence process in place so that ratings are no longer that important in the decision making process. Second, investors might actually include ratings in their due diligence process but not give these ratings much weight. Specifically, they might be aware of potentially large losses as indicated by non-investment grade ratings, but still feel sufficiently compensated through higher returns and thus be willing to bear the risk.

Our questionnaire allowed investors to indicate additional concerns regarding ILS that were not included in our questionnaire. In this context, only "mispricing" was mentioned by one investor. While this could indeed be a greater concern among institutional ILS investors, it may also be seen as a problem of over-the-counter markets for exotic risk in general. Overall, we find that investors' concerns with regard to ILS are on a moderate level, with their own limited expertise, the lack of transparency, regulatory obstacles, and transaction costs standing out.

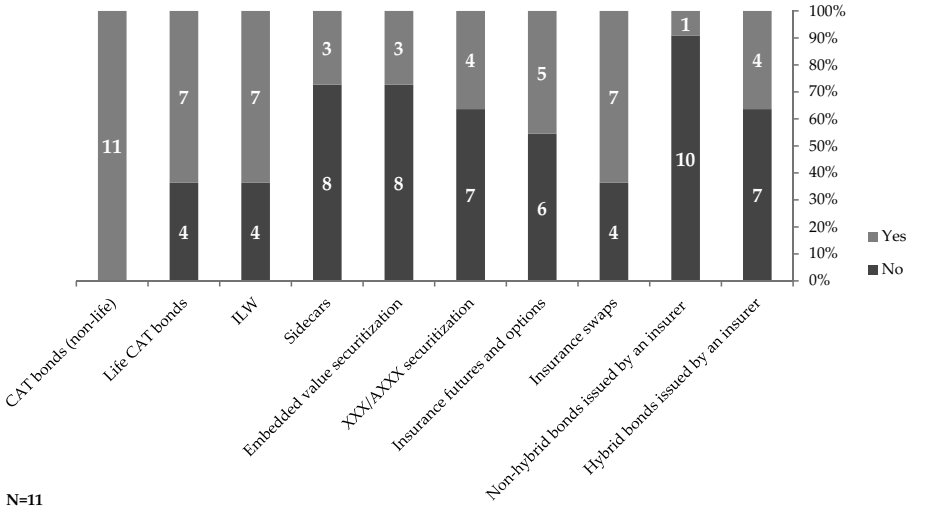
Figure 46: Concerns to invest in ILS



N=41

We were also interested in the specific ILS instruments that investors hold. Again, we distinguish the responses of ILS fund managers (Figure 47) and the broad investor base (Figure 48). Non-life cat bonds are the dominant ILS instrument among all ILS-fund managers, whereas the least popular alternative are regular bonds issued by insurance companies as well as sidecars and embedded value securities.

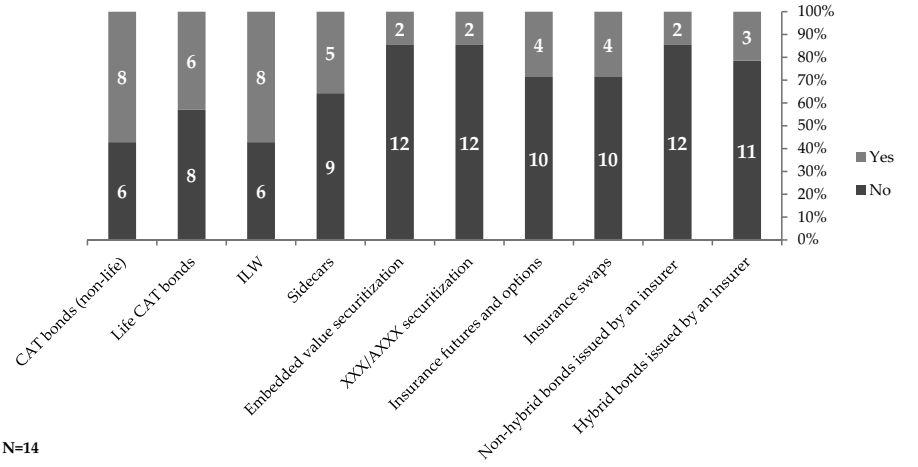
Figure 47: ILS Investors are invested in (ILS funds)



N=11

The broader investor base is also mostly attracted to (non-life) cat bonds with 8 out 14 (approximately 57%) of the respondents being currently invested in cat bonds. However, an identical number of investors are also currently invested in ILWs. In addition, compared to the ILS fund managers, a higher percentage of the broader institutional investor community is invested in sidecars (55.6% vs. 37.5%). It should also be noted that at least one investor is engaged in each of the different ILS investment opportunities (Figure 48).

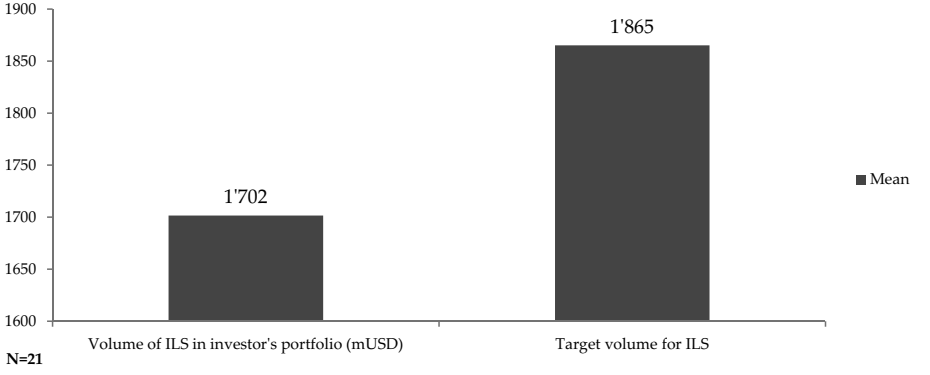
Figure 48: ILS Investors are invested in (non-ILS funds)



N=14

Looking at Figure 49, we see that the average ILS portfolio volume of all respondents currently amounts to USD 1.7bn and it is planned to increase this figure by more than 9.5% in the near future to an average of almost USD 1.9bn.

Figure 49: Average ILS portfolio volume and target volume (in mUSD)

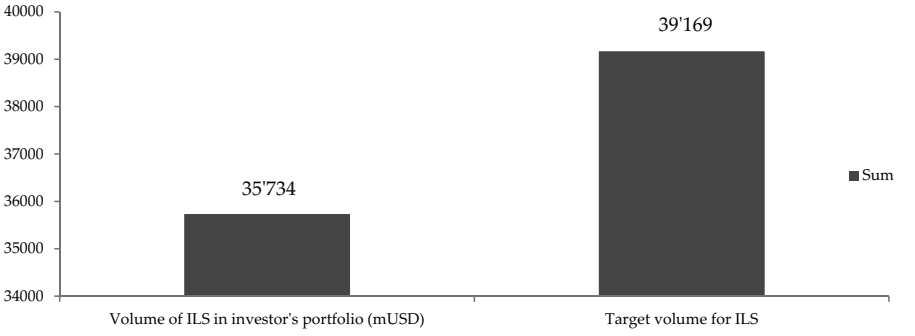


N=21

Figure 50 shows that the overall volume of ILS positions in our sample amounts to more than USD 35bn, i.e., almost double the size of the entire cat bond market as recently estimated by Guy Carpenter (2014).[45]

[45] However, some institutional investors in our sample might be invested through the ILS funds among the survey respondents. Thus, double counting of the investment volume might, to some extent, be an issue. If we completely exclude ILS funds from this analysis, then the total volume decreases to about USD 7bn. Hence, the bulk of ILS investments are captured by the ILS funds and double counting should not matter that much.

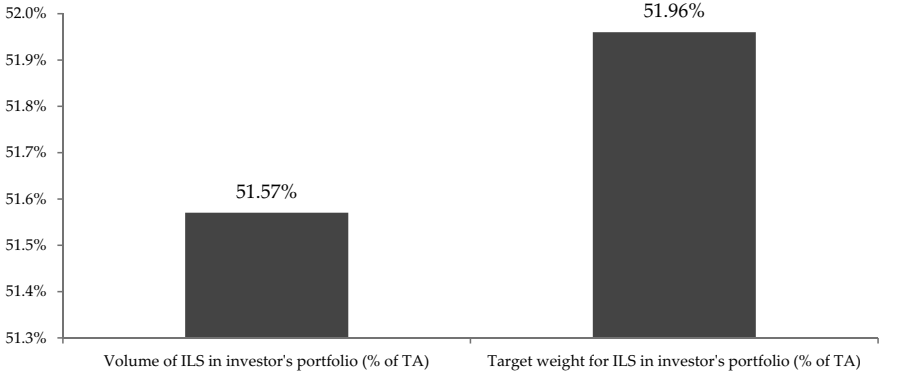
Figure 50: Total ILS portfolio volume and target volume (in mUSD)



N=21

The largest part of the expected increase in ILS target volumes is attributable to the fact that ILS funds already exhibit target weights of 100% and intend to expand their assets under management. The remainder is associated with smaller increases in the allocations by non-ILS funds.

Figure 51: Percentage of ILS in portfolio and target percentage

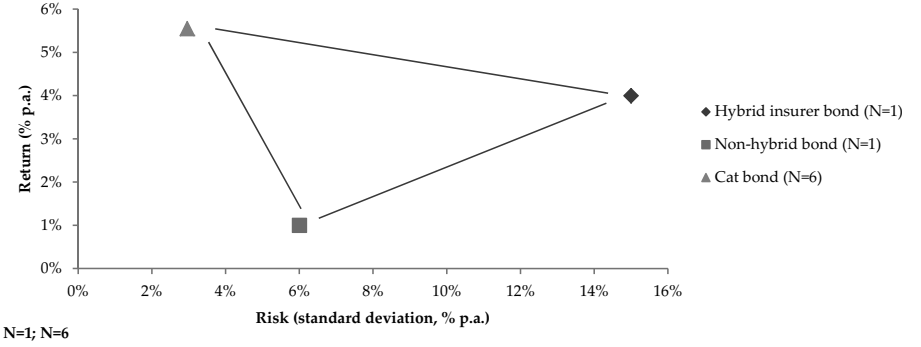


N=17

An interesting question for traditional institutional investors is how ILS behave in a mean-variance framework (Figure 52). It is worth noting that a key characteristic of most ILS is their inherent tail risk (e.g., due to catastrophe losses). We asked investors which return and variance (i.e., standard deviation) they expect from three different investments – a CoCo-bond, a regular bond, and a cat bond. All results can be considered as reasonable although it should be noted that only one participant

expressed expectations for all three instruments. Six participants indicated risk and return expectations regarding cat bonds, the average of which is 5.55% p.a. Similarly, the average standard deviation expected by the respondents amounts to 2.96% p.a. This result is in line with historic risk and return figures of cat bonds.

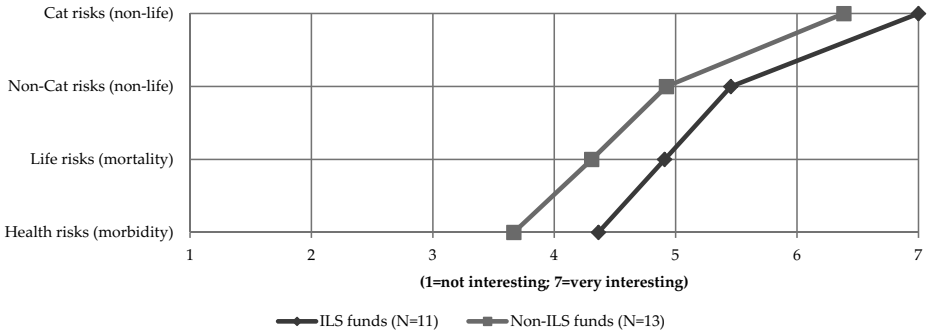
Figure 52: Risk-return expectations



N=1; N=6

Besides catastrophe risk, we inquired about other types of insurance risk that could be of interest to institutional investors, specifically with regard to the diversification of ILS portfolios. The preferences of ILS funds and the broader investor base are very much aligned and differ only by a slight margin (Figure 53). As a benchmark it can be seen that catastrophe risk (in the non-life sector) is the most interesting insurance risk for investors, explaining to some extent the prominent role of cat bonds within the ILS universe. The second most interesting type of insurance risk is non-cat property-casualty rather than biometric risk. That is, investors are also interested in high frequency, low severity risk (such as motor insurance or run-off business). As explained above, sponsors do not experience strong capital requirements for non-peak events to date. Especially for large primary insurers, non-cat risks are quite accurately predictable and can be well diversified. Nevertheless, if securitizations of non-cat risks would offer cheaper coverage than traditional reinsurance, both primary insurers and ILS investors stood to benefit.

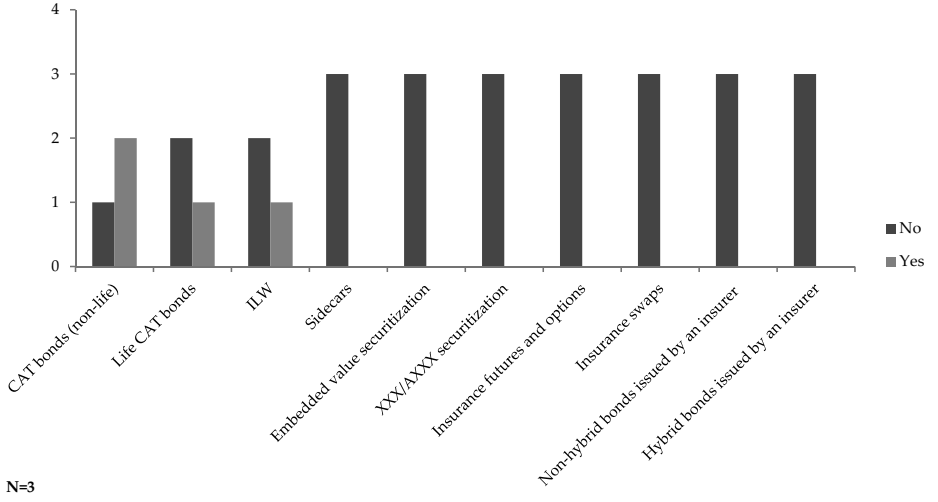
Figure 53: Interesting insurance risks



N=24

To address the future of ILS, we investigate potential investors which have not yet been active in the ILS-market. The number of these investors in our sample is scarce. Only three survey participants are not yet active in the market but plan to invest in the near future (Figure 54). Out of all potential types of ILS, only three were of interest to these respondents. One of them plans to invest in cat bonds, another one investor intends to invest in extreme mortality (life cat) bonds, and the third one is interested in cat bonds and ILW.

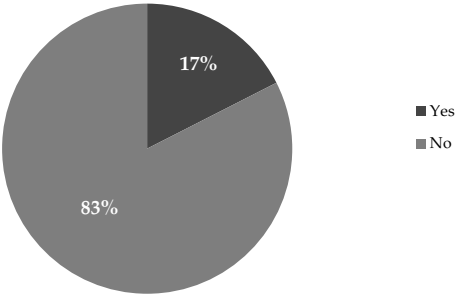
Figure 54: Investors not yet active in ILS: In which ILS does your company plan to invest?



N=3

In light of the due diligence process among many institutional investors (see also Figure 40) we confronted the full sample with the question of whether an ILS instrument requires a rating. Surprisingly, 83% of the 40 respondents indicated that a rating is unnecessary (Figure 55). Those who indicated that a rating is needed were pension funds, hedge funds, banks, and one insurance company. Hence, the majority are investors who do not have the resources to evaluate ILS investments on their own and might instead want to rely on the opinion of a specialized third party such as a rating agency. The insurer, in contrast, might want to rely on the rating to reduce the return that investors demand for taking on the insurance risk.

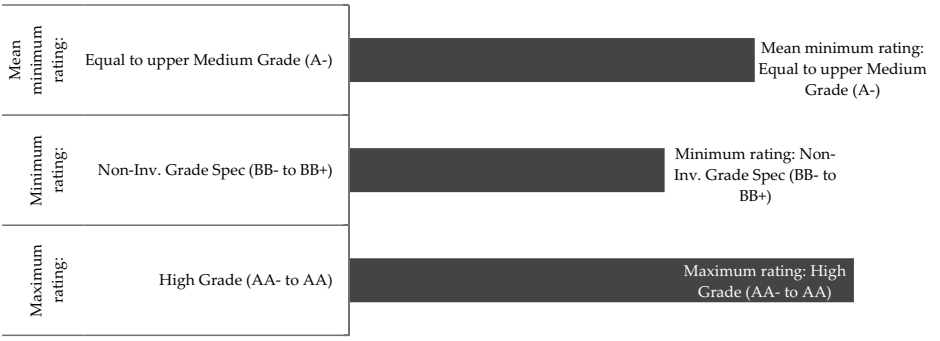
Figure 55: Does an ILS investment need a rating?



N=40

Furthermore, we asked the 17% of respondents who do require a rating for the lowest category at which they would still invest in ILS (Figure 56). On average, the minimum S&P rating is **A-** which is significantly higher than the average rating of cat rated bonds. Even the lowest minimum rating of **BB-** is still above the rating of many cat bonds. At the top some investors require ILS to hold a high grade rating which is one level below AAA. Life related bonds used to be rated in that upper range, yet, since the financial crisis these investment are seen much more critical by rating agencies.

Figure 56: Minimum rating to invest in ILS (of those requiring a rating)



N=7

We were also interested in the maximum percentage of the total asset allocation that the 83% of the respondents who do not require a rating are willing to invest in ILS. The average answer is 62.1%. However, this figure also includes ILS funds that naturally tend to have a target weight of around 100%. Excluding ILS funds from this statistic, we find that investors are willing to allocate, on average, 38.7% of their total assets to ILS. This is a fairly high figure given the fact that the current percentage allocation to ILS is in the lower single digits.

Figure 57: Maximum investment amount in ILS (in % of total assets of those not requiring a rating and not being ILS funds)

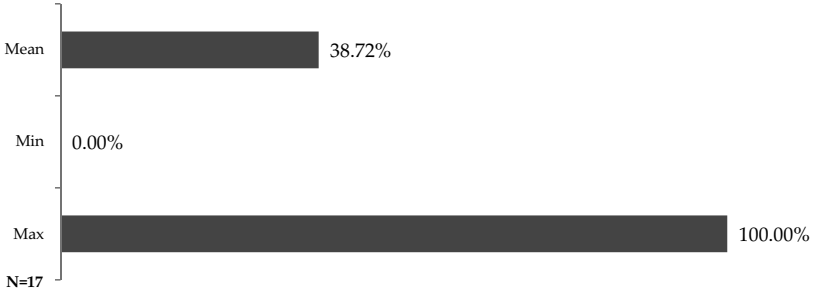
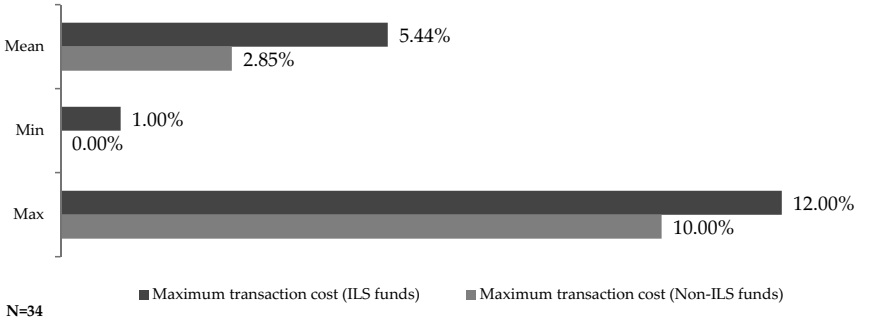


Figure 58 provides more details with regard to transaction costs. On average, non-ILS funds are prepared to spend up to 2.85% of the invested volume on transaction costs. For ILS funds, this figure is much higher (5.44%). The maximum transaction costs that ILS funds are willing to bear are more than double the mean transaction costs (5.44% mean vs. 12% maximum). For non-ILS fund investors, the maximum equals more than three times the mean (2.85% mean vs. 10% maximum).

Figure 58: Maximum transaction cost in relation to the invested volume



In addition, we asked investors who are already invested in ILS about their future ILS portfolio (Figure 59). More specifically, we asked how their ILS allocation will change over the next 12 and 36 months. The majority of respondents (=25) indicated that their allocation to ILS will not change in the future. This also includes ILS funds which already have reached the maximum ILS allocation of 100%. Nine participants said that their ILS allocation will increase by almost 20% in the next 12 months and 10 participants expect to increase their allocation by more than 90% over the next 36 months. While a 90% increase might be seen as dramatic, it should be noted that the current allocation of some participants is low. Moreover, at the current outstanding ILS volume, even small increases in the ILS portfolio weights of large institutional investors such pension funds with hundreds of billions of asset under management would exert a considerable influence on the market.

Figure 59: ILS in portfolios for those who are already invested (growth potential in % from today's point of view)

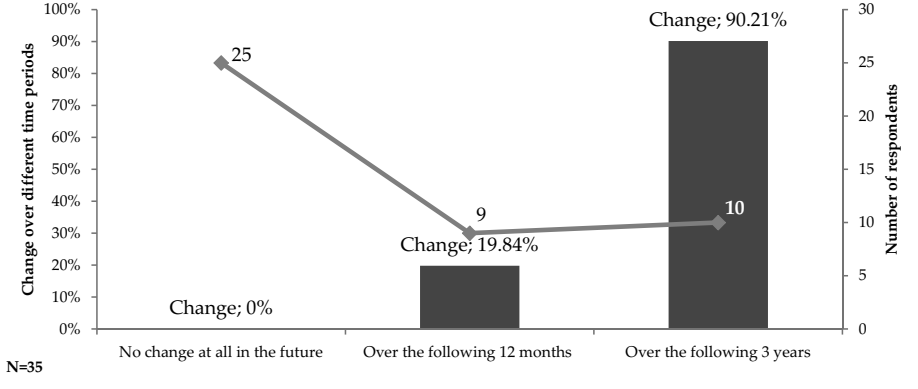
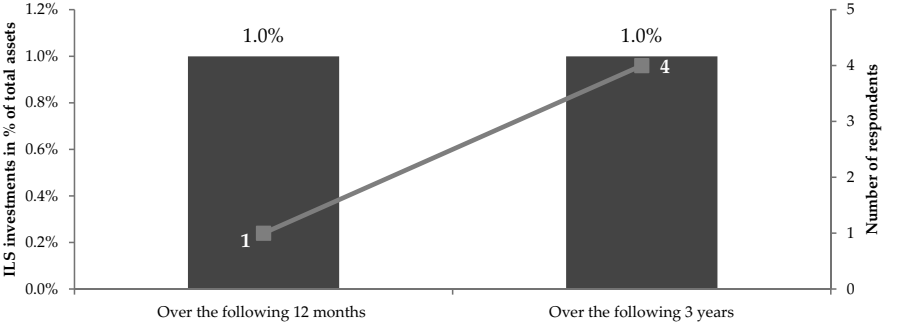


Figure 60 looks at investors who are currently not invested in ILS but intend to do so over the next 12 and 36 months. We see that, over the next 36 months, 4 survey participants intend to allocate 1% of their total assets to ILS. Over the next 12 months, in contrast, only one respondent intends to invest 1% of his total portfolio. Based on these findings, we assume that prospective ILS investors prefer to plan their future allocation over the medium term (i.e., 3 years) rather than the short term (12 months).

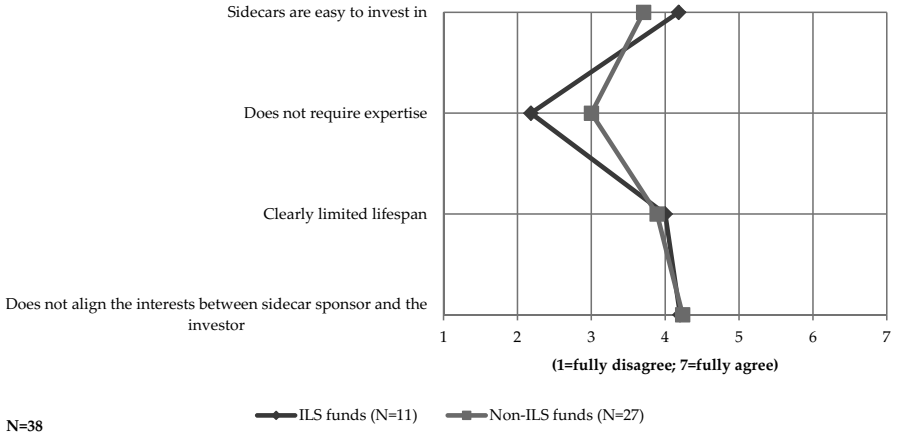
Figure 60: ILS in portfolios for those who have not yet invested but intend to do so (in % of total assets)



3.2.3 Focus Topic Sidecars

In Figure 61, we focus on sidecars as another tool to securitize insurance risks. We take a closer look at sidecars, because Krutov (2010) argues that they offer the following very specific advantages to investors: (a) they might be easier to access than other ILS, (b) they might not require extensive ILS expertise, and (c) they have a clearly limited lifespan. Evaluating these hypotheses by means of our sample of investors, we do not find evidence to support them. First and foremost, Krutov (2010) assumes that investors do not require insurance expertise to invest in sidecars. Our survey participants disagree on this point. Interestingly, ILS funds even strongly disagree with this notion while non-ILS funds mildly disagree. While ILS funds are more or less indifferent about the "easiness" of investing in sidecars, non-ILS funds show a slight tendency to disagree about the ease of investing in sidecars. Both investor groups are indifferent about the limited lifespan and the conflict of interest between sidecar sponsor and investor.

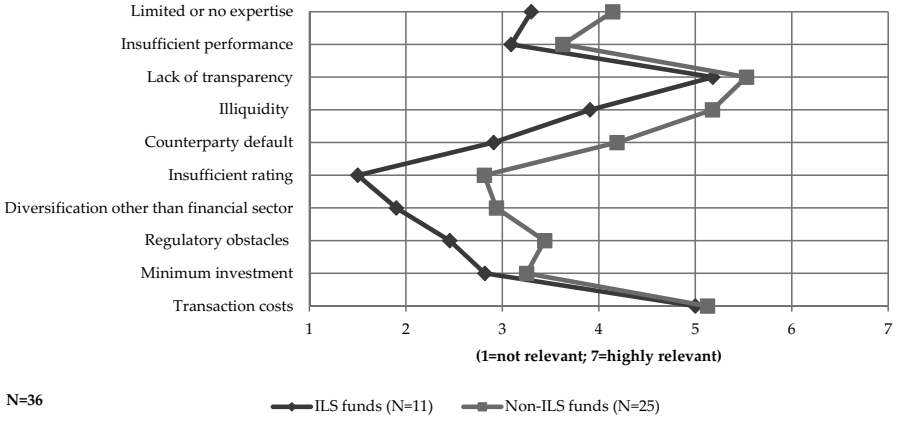
Figure 61: Statements on sidecars



To contrast concerns about sidecars with concerns about ILS in general, we use the same questionnaire items found in Figure 46 (Concerns to invest in ILS) in Figure 62. The most prominent difference between ILS and sidecars are the transaction costs. While ILS funds consider the transaction costs for ILS in general to be almost irrelevant (Figure 46 shows a value of 1.73 on a scale from 1 to 7), they consider the transaction costs associated with sidecars to be highly relevant (Figure 62 shows a value of 5 on a scale from 1 to 7). The same is true for non-ILS funds.

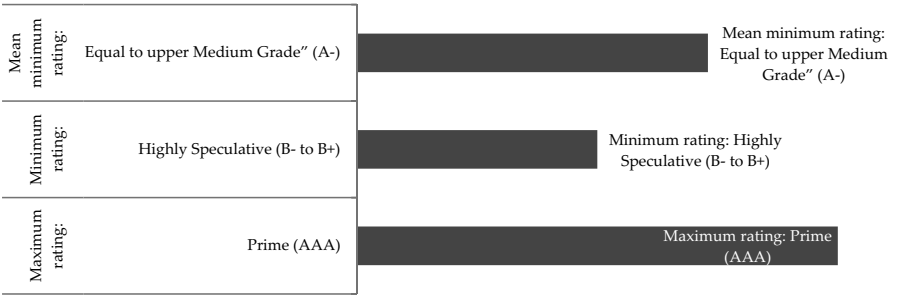
Another important perceptual difference between sidecars and ILS relates to transparency. Both ILS and non-ILS funds consider the lack of transparency to be the biggest issue with regard to sidecars (see Figure 62). For ILS in general, on the contrary, the lack of transparency was perceived to be much less important (2.5 and 3.8 on a scale from 1 to 7 for ILS funds and non-ILS funds, respectively; see Figure 46). Furthermore, illiquidity and counterparty default risk of sidecars are major concerns for non-ILS funds. However, both groups do not seem to be concerned about the ratings of sidecar investments.

Figure 62: Concerns to invest in sidecars



We asked participants if they believe that sidecars require a rating (Figure 63). The results look very similar to our results on ILS in general (Figure 56) with a slightly higher variance around the mean. The mean rating in Figures 56 and 63 is identical (i.e., **A-**), whereas the minimum rating in Figure 63 is one level lower (i.e., **B-**) and the maximum rating is one level higher (i.e., **AAA**) than in Figure 56.

Figure 63: Minimum S&P-rating to invest in sidecars (of those requiring a rating)



With regard to the question of how much an investor who does not require a rating for sidecars would be willing to allocate to these vehicles, we find much more conservative numbers than for the overall ILS spectrum (Figure 64). That is, on average, investors would allocate 7.6% of their total assets to sidecars (compared to 62.1% for ILS in general). This is in line with the concerns of ILS funds regarding this investment type. Even the maximum investment allocation, which is 100% for ILS in general, amounts to only 50% of the total assets for sidecars.

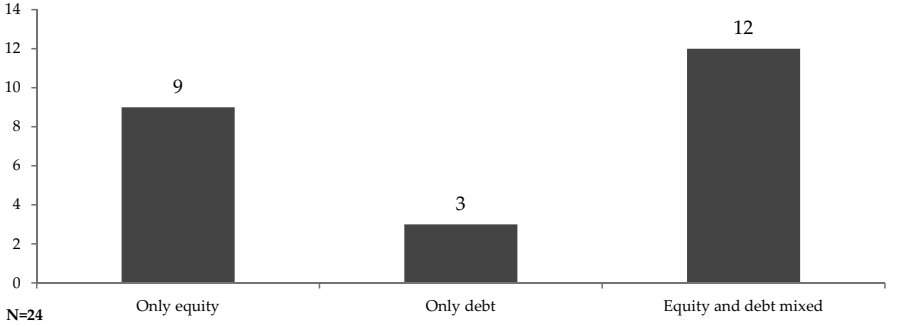
Figure 64: Maximum investment amount in sidecars (of those not requiring a rating)

In contrast, those institutional investors who require a rating for sidecar investments are willing to commit larger percentages of their portfolios (Figure 65). More specifically, the mean allocation of this group amounts to 10.6% and the maximum investment is now at 100%. Because many investors indicate that sidecars do not need a rating, it is difficult to infer that adding a rating would increase the allocation to sidecars by a certain percentage.

Figure 65: Maximum investment amount in sidecars (of those requiring a rating)

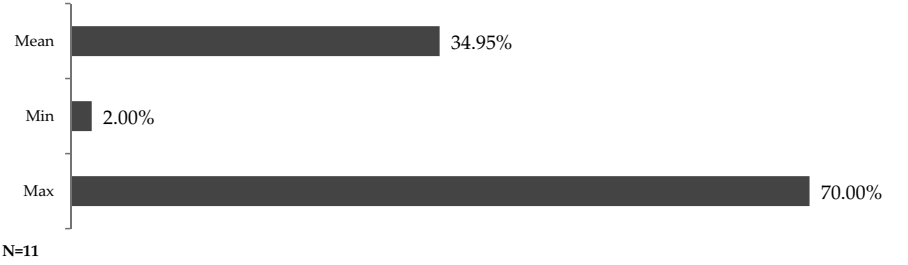
Another interesting point deals with the structure of sidecars which usually comes in the form of mixed equity and debt instruments. This is also reflected in Figure 66 where almost half of all respondents prefer a mixed structure. The second largest group prefers higher-risk equity-only structures.

Figure 66: Preferred capital structure of a sidecar



Taking a closer look at those investors who prefer sidecars with a mixed capital structure, we see that, on average, they prefer leveraged structures with a debt to capital ratio of almost 2 to 1 (or 34.95% of equity). Some investors even prefer highly leveraged structures that are difficult to achieve in the aftermath of the financial crisis of merely 2% in equity. At the other end of the spectrum, some investors prefer an equity dominated structure with a debt to capital ratio of 3 to 7 (or 70% of equity).

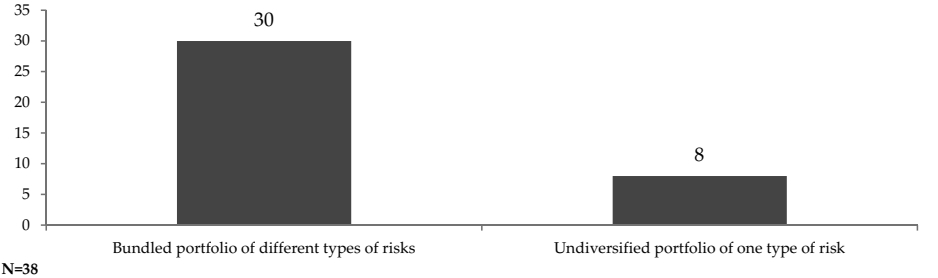
Figure 67: Equity (in % of total capital) in sidecar of those who prefer a mixed capital structure



Turning to Figure 68, we observe that institutional investors tend to prefer bundled instead of undiversified risk in sidecars. This is a surprising result. First, ILS investments generally cover very specific types of risk (e.g. cat risk, life risk). Second, they generally cover very specific geographic regions (e.g. Florida, California, Japan). Third, ILS sponsors may attract specific types of underwriting business. Fourth, investors can, at least theoretically, form their own diversified ILS portfolio. Nevertheless, our findings suggest that pre-diversified portfolios are preferred in sidecar transactions. Although portfolio diversification is a core competency of

dedicated ILS funds, half of the ILS funds in our sample indicated that even they prefer bundled risks (Figure 68).

Figure 68: Preferred capital structure of a sidecar

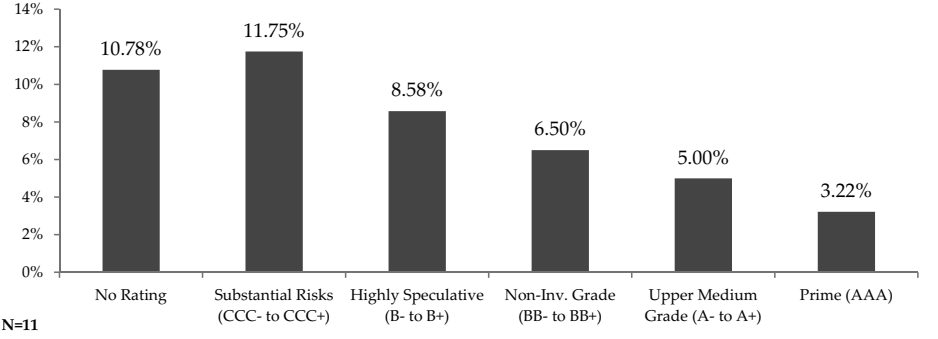


N=38

3.2.4 Risk-Return, Correlation and other Characteristics of ILS

Figure 69 summarizes the return expectations of ILS investors by rating category. Despite the current low interest rate environment, we still observe a relatively high return requirement of 3.2% p.a. for the largely theoretical case of a AAA-rated instrument. A possible explanation is that structured products with an excellent rating are now investigated much more carefully than before the financial crisis. We also see that investors expect a lower return from unrated ILS (10.8% p.a.) than from ILS with a CCC rating (11.8% p.a.). Thus, from the sponsor's perspective, it may make sense to refrain from a rating of certain ILS transactions altogether.

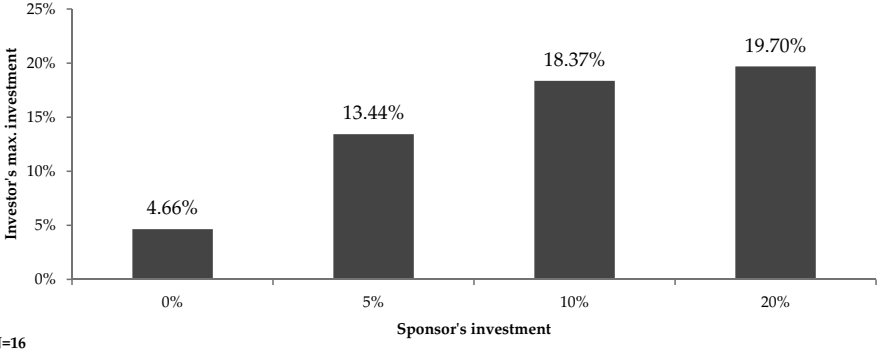
Figure 69: Return (% p.a.) net of transaction costs expected from ILS



N=11

Another important question for both investors and sponsors addresses the issue of the sponsor's own investment as a loss buffer and a signal to the investor (Figure 70). While, without retention by the sponsor, the maximum allocation of investors is merely 4.66%, this figure jumps to 13.4% if the sponsor himself invests 5% into the structure. It increases again by almost five percentage points to 18.4% when the sponsor invests 10%. When the sponsor investment reaches 20%, however, the investors' maximum allocation flattens out at 19.7%. It is thus not reasonable for sponsors to retain more than 10% of the transaction volume on their own books.

Figure 70: Investor's maximum investment by sponsor investment

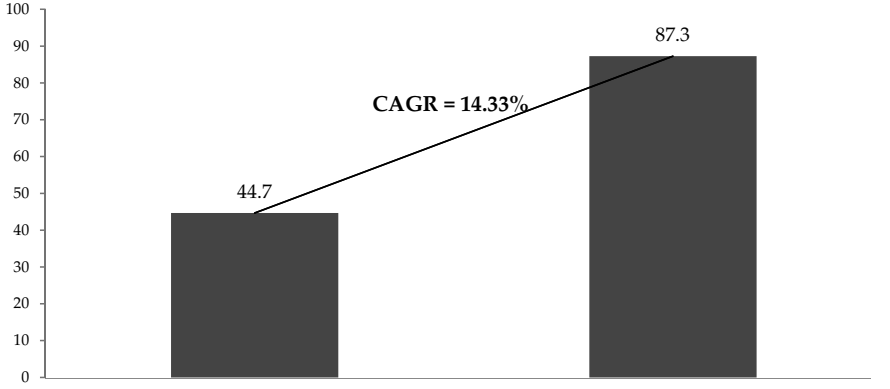


N=16

3.2.5 Outlook

In the previous figures (especially Figure 50), we already dealt with the question of how the ILS market might develop based on the participants' ILS allocation. However, we also asked them for an estimate of the current total ILS market volume and how it might develop over the next five years (Figure 71). The overall consensus is that the ILS market will continue to grow at a compound annual growth rate (CAGR) of 14.33%. This number is almost twice as much as the number we derive from Figure 59.[46] Our participants estimate the current ILS market at USD 44.7bn and suggest it will grow to a volume of USD 87.3bn by the year 2019. Investors thus expect the market to double in the next five years.

Figure 71: ILS outlook (in bn USD)

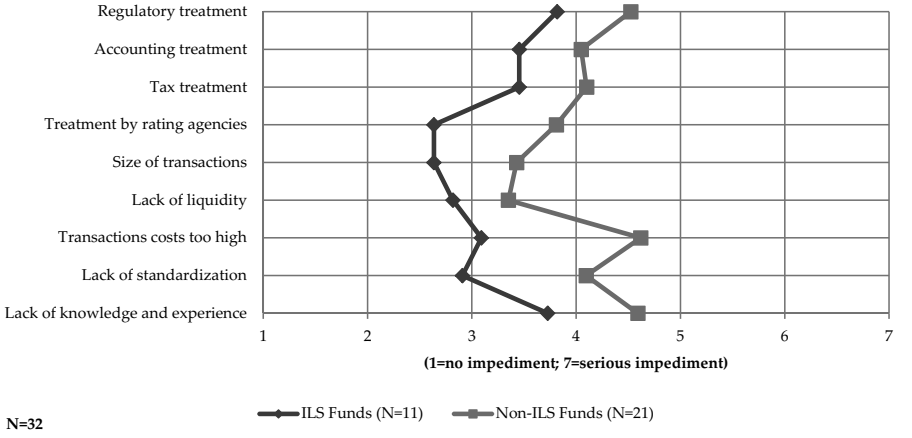


N=28

Our last question addresses the impediments to an ILS market expansion. This question required the respondents to adopt a holistic perspective. For the broader investor group, the biggest issues are the regulatory treatment of ILS, a lack of knowledge and experience in the capital markets, and high transaction costs. ILS funds are predominantly concerned about the first two points as well (Figure 72).

[46] That is, 25x0% +10*90.2%, results in a CAGR of $(1.257)^{1/3}$-1 = 7.9%.

Figure 72: Impediments to ILS market expansion



3.3 Survey among Insurers and Consultants

In a second survey, we asked 41 participants from the insurance industry and several consultants interested in the challenges of the insurance industry how they assess the market for ILS in the future. First, we wanted to know how insurers and consultants assess their own knowledge about ILS. More than 50% of the participants do not consider themselves as having a "good" knowledge about ILS, despite their exposure to the insurance industry (Figure 73).

Figure 73: Good knowledge about ILS

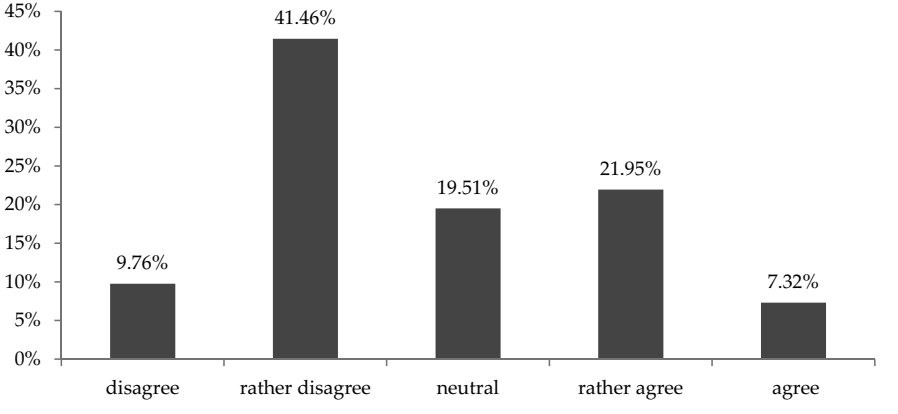
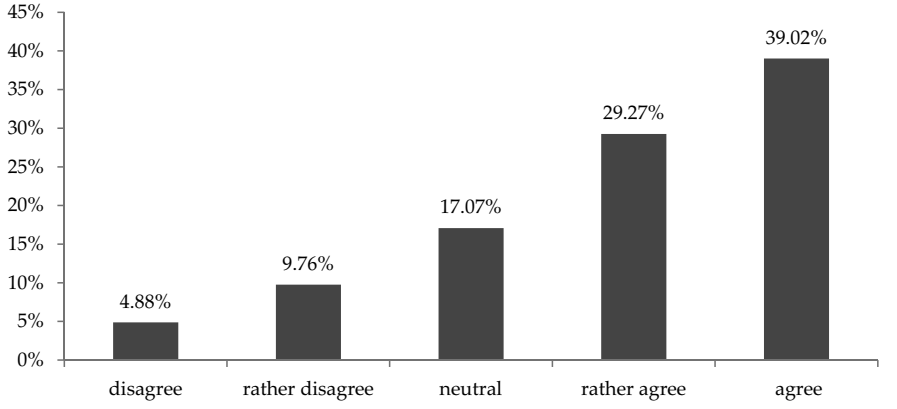


Figure 74 reveals that 68.29% of the survey participants believe that they will have to deal more extensively with ILS within the next five years. Only a minority of 14.64% think that their company will not have to deal more extensively with ILS in the next five years.

Figure 74: Future exposure of ILS within own company (insurer / consultants)



Regarding the types of risks which could be securitized we asked where the participants see the greatest growth potential within the next five years. Consistent with the past development, catastrophe risk exhibits the biggest growth potential, followed by run-off insurance risks and life insurance risks. Securitizing single large risks such as the Costa Concordia incident or the Deepwater Horizon disaster are seen as less promising. The lowest potential is attributed to frequency risk within the non-life sector (e.g., motor insurance).

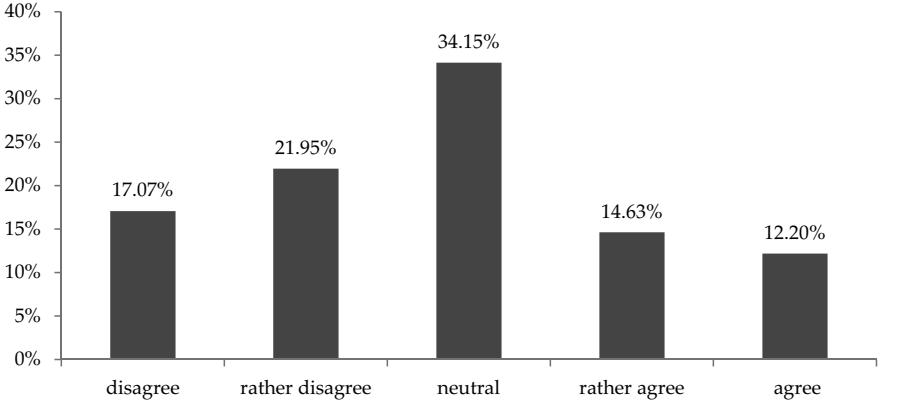
Table 25: Ranking of risks to be securitized

Risks	Ranking (Grade)	Valuation
Life	2.97	☆☆☆
Natural catastrophes	2.26	☆☆☆☆☆
Frequency risk (Non-life)	3.49	☆
Run-off	2.94	☆☆☆☆
Single large risks (e.g., Deepwater Horizon)	3.34	☆☆

Another question we asked the participants in light of the growing presence of ILS funds open to retail investors was how they feel about an investment in ILS. 39.02% of the participants were not willing to invest in ILS despite being active in the insurance industry in some way. 34.15% were not sure whether to invest or not and 26.83% said that they would invest or tend to invest in ILS.

Interestingly, those who state that their knowledge about ILS is good or rather good exhibit a higher propensity to invest (i.e., 3.6 on a scale from 1=disagree to 5=agree) than those who have some knowledge about ILS (i.e., 2.3 on a scale from 1 to 5) and those who have less or no knowledge about ILS (i.e., 2.4 on a scale from 1 to 5).

Figure 75: Willingness to invest (as private investor)



3.4 Main Insights from the Empirical Study

The key findings of the empirical part can be summarized as follows:

1. The most significant impediments to ILS market expansion in general are transaction costs, a lack of experience / knowledge with regard to the asset class as well as regulatory uncertainty.

2. Skin in the game is necessary to attract investors; we show that a 5 to 10% sponsor investment leads to large increases in the willingness to invest.

3. Ratings of ILS transactions are found to be of minor importance to investors. However, having no rating is better than having a bad rating.

4. Investors prefer bundled risk. This might be surprising because ILS are very specific in terms of insured risk (e.g., cat risk), peril (e.g., hurricanes) and geographic region (e.g., Florida).

5. Overall, we expect a substantial expansion of the ILS market over the next years; the survey participants expect the market to double by 2019.

4 Implications and Potential New Market Solutions

Based on the results of Sections 2 and 3, we now derive five implications that can be expected to drive the future development of the ILS asset class (Section 4.1) and discuss two potential market opportunities (Section 4.2).

4.1 Implications

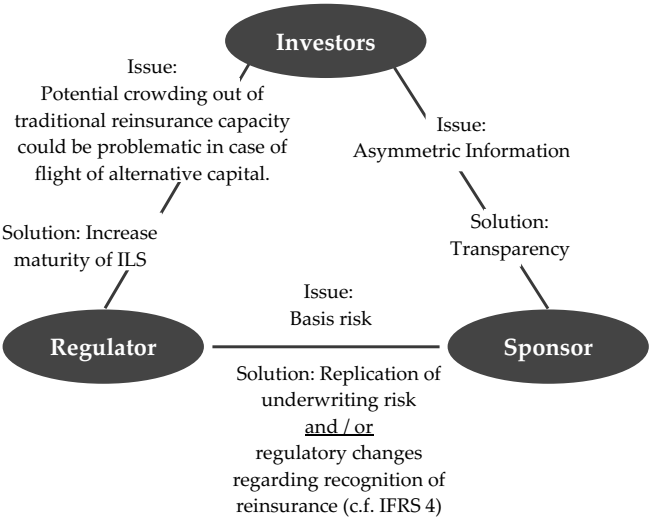
4.1.1 Improving Transparency and Transaction Costs

Based on both our literature review and our empirical results we suggest two key measures for a successful expansion of the ILS market. First, ILS instruments must become more standardized and, in turn, transparent. However, as discussed above, higher standardization results in higher basis risk. Furthermore, sponsors are reluctant to make detailed underwriting information available to the public or potential investors. Thus, investors, sponsors, and regulators ultimately need to find common ground with regard to transparency and standardization (see Figure 76 for an excerpt of issues and potential solutions).

One possible solution is the double-trigger mechanism (as already present in ILWs), comprising both indemnity and index triggers. This trigger design allows investors to focus on an objective index (industry loss or parametric) while the sponsor reports proprietary loss figures. For the contract to pay off, both indices would need to exceed a certain threshold. Hence, based on carefully chosen trigger levels, such a solution has the potential to increase transparency, mitigate basis risk, and achieve regulatory acceptance for capital relief. Apart from that, further improvements in the design of industry loss indices could help to promote standardization. The better these objective indices can replicate losses on a specific insurance portfolio, the less need sponsors would feel for rather intransparent indemnity-based transactions.

In addition to greater transparency, transaction costs need to be reduced to broaden the investor base. Depending on the trigger type, structuring ILS deals requires a lot of resources. If ILS became more standardized, transaction costs could be reduced. Again, this could be achieved by means of double-trigger solutions or improved loss indices. Both alternatives should exhibit some potential to attract a wider range of investors and to further establish ILS in the capital markets.

Figure 76: Interests between investors, sponsors, and regulators



4.1.2 Need for Exchange Traded Instruments

Another crucial factor for investors is the time between their investment decision and the availability of an asset. Offers for equity, bonds, real estate, hedge funds, or commodities are usually immediately available. In the ILS market, however, this is only partially possible through dedicated funds. Thus, the time that is needed to establish an ILS position must be minimized for the asset class to be more appealing to institutional investors. In this regard, it seems beneficial that customization, which requires an extensive amount of time, has not been identified as a key attraction of ILS (see Figure 45). The time to market could be dramatically shortened by means of exchange-traded products, which unfortunately have not succeeded yet as seen on CBOT, CME, EUREX or IFEX.

4.1.3 Role of New Risk-based Capital Standards (Solvency II)

The introduction of new risk-based capital standards is an important driver of ILS supply, because it may change the instruments' suitability for the purpose of capital relief. Hence, the introduction of Solvency II in the European Union can be expected to have a considerable impact on the ILS market. The latest draft of Solvency II generally recognizes ILS as financial instruments that provide insurance risk

mitigation (Aon Benfield, 2010). However, to achieve a (partial) reduction in regulatory capital under the new standards, insurers will need to demonstrate that basis risk in a transaction is brought to a minimum.

> "...When an insurance risk mitigation technique includes basis risk (for example as might happen where payments are made according to external indicators rather than directly related to losses) the insurance risk mitigation instruments should only be allowed in the calculation of the Solvency Capital Requirements with the standard formula if the undertaking can demonstrate that the basis risk is either not material compared to the mitigation effect or if the risk is material that the basis risk can be appropriately reflected in the SCR".

Source: Quantitative Impact Study 5 (2010), SCR.13.8, p. 274

Furthermore, the third pillar of Solvency II aims at market discipline through disclosure requirements. In this regard, insurers could decide to increasingly rely on securitization instead of traditional reinsurance, because the former is associated with a higher degree of transparency for outside stakeholders (Gorge, 2009). Another aspect of Solvency II (in combination with IFRS) is that the prudent reserve strategy which many insurers followed in the past will be replaced by risk-based provisioning. This new economic perspective might be associated with a higher degree of reserving risk that could be tackled by means of ILS (Gorge, 2009).

In life-insurance securitization, we might see more embedded value securitizations as Solvency II does not allow insurers to recognize the present value of future profits (PVFP) in their capital calculations, thus encouraging them to securitize it (Linklaters, 2008).

Although non-peak risks (such as motor insurance) are of lesser importance for insurers in the Solvency II framework, their securitization could be demand-driven (i.e., by investors) rather than supply-driven (i.e., by insurers). Market opportunities regarding non-peak events are discussed in greater detail in Section 4.2. Table 26 summarizes the Solvency II draft provisions.

Table 26: Summary of Solvency II draft provisions using a Special Purpose Vehicle (SPV)

Requirements	Details
Mandatory Conditions for Recognized Risk Transfer	- The risk transfer contract must meet the definition of a Special Purpose Vehicle (SPV) - The risk transfer contract between the sponsor and the SPV must have a clear aggregate limit - Claims of investors are subordinated to claims of the sponsor - The SPV must at all times have assets that are equal to or greater than the sum of the aggregate limit - Investment risk should be minimized
Effective Risk Transfer	- The amount of risk transfer will determine the extent to which the sponsor can obtain recognition for the technical and Solvency Capital Ratio (SCR) calculations - In determining the use of the loss trigger, basis risk should be kept to a minimum - If a material level of basis risk exists, the sponsor is likely to receive only partial recognition for internal risk analysis or, worse, no allowance at all
Offshore Special Purpose Vehicles	- If a sponsor and SPV are domiciled in different countries, there needs to be a dialogue between their respective regulators - A member state will not be permitted to give more favorable treatment to an offshore SPV than it gives one domiciled in that member state - Obligations of the SPV are to be fully funded

Source: Aon Benfield (2010)

Another consequence of Solvency II is the preferential treatment of risks transferred to SPVs within EU jurisdiction (such as Ireland or Luxembourg) rather than transferring it to an SPV outside EU jurisdiction. This is because EIOPA needs to evaluate the "regulatory equivalence" of the risk transfer if the SPV is located outside EU jurisdiction (Aon Benfield, 2010).

Furthermore, regulators of the Solvency II regime will take a close look at the SPV's collateral which needs to be of suitable quality, duration and liquidity. However, this seems to be one of the major lessons of the financial crisis and is already put in place through U.S. treasury bills and money market funds (Aon Benfield, 2010).

Note that financial regulation is subject to change on a regular basis. This study describes the accounting and regulatory framework at the time of writing. Since Solvency II is not yet introduced, the recognition of ILS (and alternative risk transfer in general) as a risk mitigation technique is still subject to the regulator's final decision.

4.1.4 Correlation Property

Based on our sample, we see that those investors who entered the ILS market tend to stay. Moreover, the average institutional investor expects the market to double in the near future. However, there are some concerns which are seen as critical for the future of ILS:

1. No big losses have been seen so far. Cat bonds, e.g., securitize event risk with reoccurrence periods of 100 years or more. Hence, the two decades in which the ILS market has existed are far too short for a genuine historical experience with regard to the underlying risk.
2. Interest rate levels might rise again, which could drive many investors back to traditional asset classes and reduce ILS market size.
3. The low-correlation property of ILS still needs to be tested in the context of severe events. Do ILS still exhibit a low correlation if a severe catastrophe hits an economically important region (e.g., the San Francisco Bay Area)?

Obviously, the current market volume in ILS is too small to be systemically relevant in provoking a financial crisis as subprime loans and their respective asset-backed

securities did in 2007 / 2008. However, the analogy is not without foundation and with increasing market volume and the continued entry of pension, hedge, and mutual funds in ILS, contagion effects might play a larger role in the future. Although some cat bonds investors suffered due to insufficient collateral solutions during the financial crisis, the effect on the overall market was marginal and the asset class as a whole performed quite well.

Much more critical are situations where institutional investors are forced to liquidate cat bonds to meet margin calls as multi-strategy hedge funds did during the financial crisis (Twelve Capital, 2010). If such fire sales were to take place at an even larger scale than during the financial crisis, ILS would probably begin to correlate with the broader capital markets. However, it is very difficult to assess how severe an event would have to be for such a scenario to occur.

4.1.5 Trends in ILS Returns

In Table 27 we summarize the most important risk premiums inherent in ILS returns and how we expect them to develop through 2020. Overall, we conclude that spreads are likely to stay at rather low levels. Reasons comprise less liquidity risk due to increased trading activity, a reduced novelty premium due to higher awareness of ILS among institutional investors, minimized credit risk because of improved collateral solutions after the financial crisis, and a higher geographic diversification of perils. Nevertheless, some spread components might increase. Notably, the growing use of indemnity triggers and variable resets could result in increasing risk compensation. Furthermore, while the reinsurance cycle is currently in a soft market, climate change could cause another hard market and drive up non-life ILS spreads (see Table 27).

Table 27: Trends in ILS returns

Price Element	Trend 2020	Explanation
Risk-free rate	Remains on low level	Low interest rate environment
Insurance Risk	Remains constant	No trend in expected losses
Liquidity Risk	Decreases	More liquid secondary market (sell side)
Novelty Premium	At a minimum	Investors become more familiar
Credit risk	At a minimum	Improved collateralized structures
Geographic concentration risk	Decreases	Increasing geographic diversification possible
Structuring risk	Increases	Increasing use of indemnity triggers and variable reset
Reinsurance cycle	Shift to hard market possible	ILS pricing follows traditional reinsurance pricing. Currently "soft market" but climate change or a severe event could result in another "hard market".

4.2 Potential New Market Opportunities

4.2.1 New Types of Risk

In general, we expect to see a market expansion for insurance-linked securities in the next years. There are still large areas of risk which have not yet been considered for securitization. In this Section, we discuss some potential new types of risk that could be a topic for securitization in the next years. Among these are:

- Run-off business
- Cyber risk
- Political risk
- Microinsurance
- Liability insurance

A new field which might be attractive for investors seeking uncorrelated returns is run-off business. Insurance-linked run-off securities could securitize a specified portfolio of insurance policies, which is in run-off. Run-off denotes discontinued business, i.e., business for which there are still obligations from previous years, but for which no new premiums are written. Other terms for this concept are legacy business or inactive business. The most prominent examples are asbestos claims for contracts which were written in the 1960s. Those still require substantial reserves in the balance sheets of insurers. An advantage of these products might be that they are neither correlated with traditional investments (equity, bonds) nor ILS instruments that refer to catastrophe or life / health risks. Eling and Pankoke (2013) estimate the run-off market volume to be EUR 103.5 billion for Germany, Switzerland and Austria in 2013. PWC (2013) estimates run-off business to exceed EUR 220 billion in Europe. Globally, non-life run-off business is estimated at USD 550 billion according to Endres (2011). Overall, there are large amounts of run-off business which insurers are keen on shifting off their balance sheets for capital relief reasons. Note that run-off securitization has been practiced in life insurance securitization providing precedents for non-life securitization (Wu and Soanes, 2007).

Cyber security will be a big challenge for risk management in the future. Similar to catastrophe risk, cyber risk exposure might in some circumstances be characterized by peak events. Thus, at first sight, securitization could be an important (alternative) method of providing cyber risk coverage. In contrast to catastrophe risk, cyber risk is hardly diversifiable by itself as cyberattacks can have an impact worldwide. Thus, returns on “cyber-bonds” could be higher than for cat bonds. Furthermore, it is

crucial to differentiate between the intensities of cyber risk to address the issue of insurability. That is, while there can be cyberattacks impacting specific or several companies, there are also large scale events, which can decouple the public from any cyber activity including payment activity. One example is the disconnection of almost the entire continent of Africa in March 2013 due to severed deep-sea cables preventing not only connection to the internet but also the execution of any financial operations (Biener et al., 2015). Although the number of data breaches in the U.S. dropped from 662 in 2010 to 419 in 2011, there is an upwards trend (see Figure 77).

Figure 77: Data breaches 2005-2013, by number of breaches and records

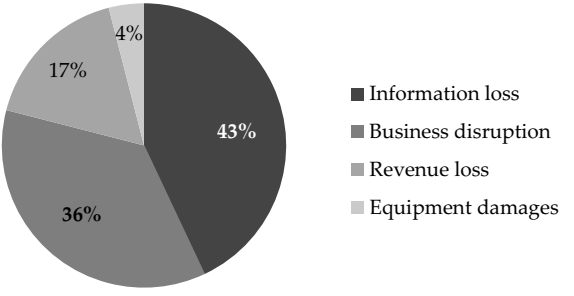
Source: Identity Theft Resource Center

More significant are the consequences of these data breaches (Figure 78). In 2013, 17% of the data breaches involved revenue loss. The largest percentage (43%) of data breaches result in information loss, making it difficult to assign a dollar value. 36% of data breaches cause business disruption allowing for a more accurate estimate of loss. In conclusion, while cyber risk can be a new market opportunity for insurance securitization, it is important to find an adequate trigger (and trigger event) to efficiently protect against cyber risk.

There is no consensus among our experts regarding the future securitization of terrorism risk or cyber risk. While some argue that terrorism risk or cyber risk is a peak risk which can be well securitized and possibly receive high risk compensation, others argue that the central value proposition of ILS is its uncorrelated nature with the market and with terrorism risk or cyber risk there is in fact high correlation with the market. In our opinion, this is a question of scale. Whether due to terrorism, cyberattacks or natural catastrophes, such securitizations might experience some

correlation with the market if the underlying events are extremely large-scale. A central problem for the development of cyber risk securities is certainly risk modelling and pricing. In addition, even the trigger mechanism would pose a considerable challenge, since actual losses after an event are typically difficult to determine.

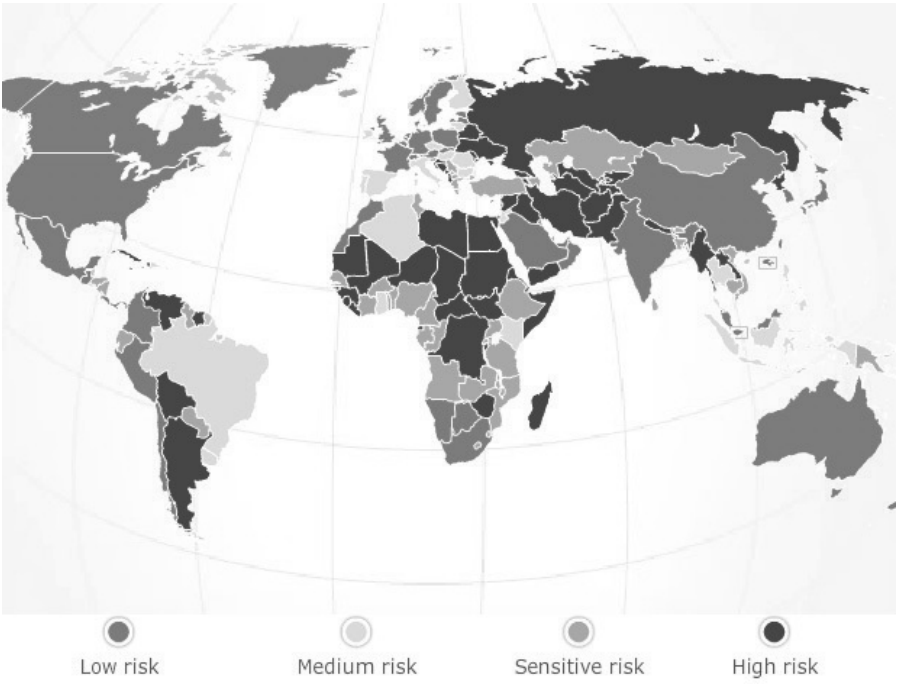
Figure 78: Data breaches by damage category and percentage of all breaches



Source: 2013 Cost of Cyber Crime: United States, Ponemon Institute.

Another area of interest could be instruments that securitize political risk. Political risk is of increasing importance given the high number of global conflicts. Large commercial projects like the Southstream oil pipelines illustrate the increasing relevance of such events also for insurance. Political risk is becoming increasingly relevant and measurable (refer to the country risk map shown in Figure 79).

Figure 79: Country Risk Map



Sources: Euler Hermes' country risk ratings as of 19/03/2015.

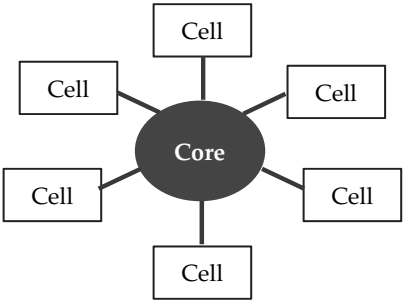
Market participants have recently become interested in microinsurance as a potential topic for securitization. Microinsurance is as a financial arrangement intended to protect low-income people against specific perils in exchange for regular premium payments proportionate to the likelihood and cost of the risk involved (see Churchill, 2007). The microinsurance industry has seen strong growth in recent years, with average annual growth rates of approximately 10 per cent. Industry practitioners, however, estimate that only 5 per cent of the potential market is covered, and that there is a high degree of variability in terms of risk and geographical coverage, leaving large segments of the world's poor with limited or no access to insurance (see Biener and Eling, 2012). While a standalone microinsurance policy typically is not large enough for securitization, one might think of larger microinsurance programs run by governments where ILS instruments could be used for risk transfer. Examples of such larger programs can be found especially in health insurance, for example in China (New Rural Cooperative Medical Care System) or the Philipplines (PhilHealth, i.e. the Philippine Health Insurance Corporation).

Finally, securitization might be increasingly used for liability insurance, man-made disasters and large single risks in the commercial area. While there have been first securitizations of man-made disaster risk, this market offers additional potential. For example, one might imagine British Petroleum (BP) issuing a cat bond which makes a payment to cover liability claims from a man-made catastrophe such as Deepwater Horizon. Various industrial accidents (Costa Concordia, rail road liability, fracking) could be discussed in this context. One reason why liability has not yet been securitized is its long-tail nature (the length of time between premium and claims payment). To date, most securitizations focus on short-tail business, meaning that the loss amount can be estimated after a short period of time. Although liability risk does not have short-tail characteristics, one might (at least partially) hedge against it with short-term or medium-term instruments, whose payoff can be used to cover property losses or set aside for future liability losses.

4.2.2 New Types of Structures

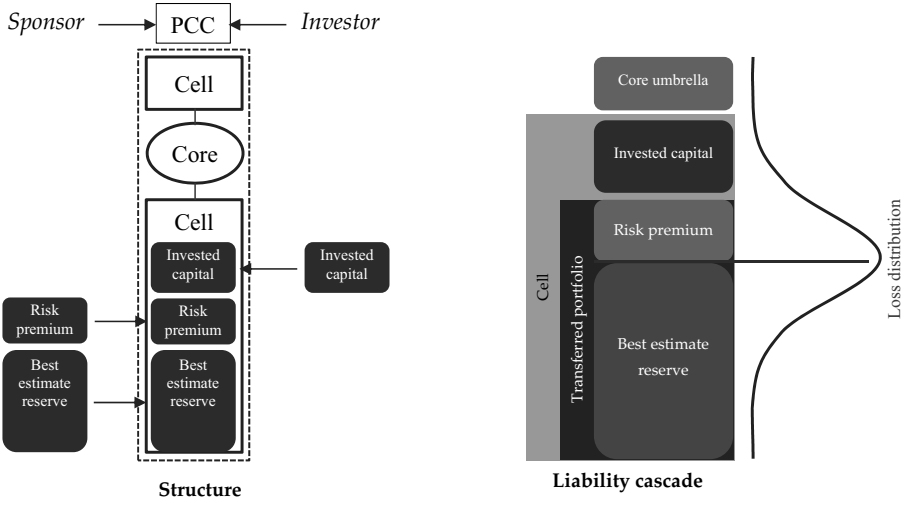
As already discussed in this study and confirmed by the survey participants, a major disadvantage of ILS are the high transaction costs including legal fees and administration costs which require a minimum lot size for economic viability. A structure which is becoming more and more popular among sponsors are Protected Cell Companies (PCC). PCCs are regulated in Bermuda, Barbados, Gibraltar, Malta, the Isle of Man, and several states in the U.S. The central aspect of PCCs is that assets and liabilities of each cell are segregated from each other and also from the sponsor's assets and liabilities. A PCC operates through two components. The first component is a non-cellular part (also known as the core) and the second component is an unlimited number of cells (see Figure 80).

Figure 80: Structure of a Protected Cell Company (PCC)



A key advantage of this structure is that the legal and administrative costs (including claims management) for a single core can be shared among the core's cells, making the structure very cost-efficient. Forming a cell is a straightforward and standardized procedure. Cells are highly flexible and can contain specific business line risks from one country or a heterogeneous portfolio of different lines of business from different countries. Another advantage for investors is the flexible duration of the investment. It is possible to sell the shares before the final claims settlement at a predefined price. Within a cell, the investor provides capital while the sponsor provides a risk premium and a reserve according to best estimates. The entire cell then consists of the best estimates reserve, the risk premium, and the invested capital (Figure 81).

Figure 81: Structure and liability cascade of a PCC



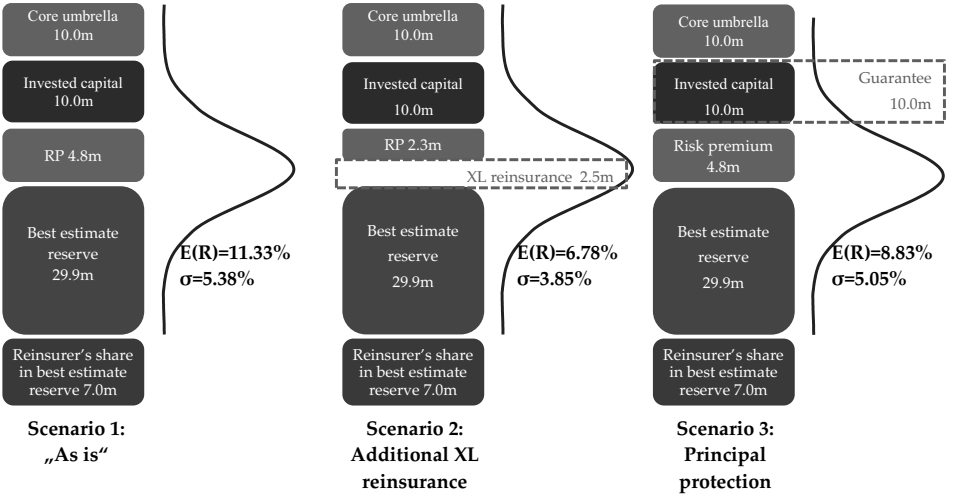
In order to understand how different structures within a PCC can affect the risk-return relationship, we analyze a hypothetical motor insurance portfolio in three different scenarios (Figure 82).[47] The first scenario is called status quo. The second adds a reinsurance contract to the structure, and the third one guarantees the full repayment of the principal. In all three scenarios a share of 7.0m of the best estimates reserve of 36.6m is covered by a reinsurance contract, resulting in a net reserve of 29.9m. Furthermore, in the first scenario 2.4m of the 4.9m risk premium are released in the first three years and the cell earns 1.2m from investing the net reserves, the risk premium, and the provided capital. Another 0.2m is necessary to cover administrative costs, regulatory and statutory filings. Based on a net profit of 3.4m over three years, the expected return for the investor is 11.33% with a volatility of 5.38%. The volatility is based on reinsurance default risk, investment risk, and EIOPA's reserve risk calibration.

In the second scenario the sponsor pays an additional excess-of-loss reinsurance covers which reduces the reserve volatility (downside only) before capital consumption. The reinsurance premium of 2.5m is paid out of the risk premium upfront and thus reduces the risk premium which is released in the first three years

[47] We would like to thank DARAG Deutsche Versicherungs- und Rückversicherungs-AG for providing us with the risk scenarios.

to 1.1m. Due to the upfront reinsurance fee the cell only earns 1.13m in investment income and thus the expected return is 6.78% with a reduced volatility of 3.85% as a result of the reinsurance cover. In the third scenario, the sponsor guarantees the full principal. In this case, 1.6m of the risk premium is released in the first three years and the expected return is 8.83% with a volatility of 5.05%.

Figure 82: Risk-return scenarios



5 Conclusion

More than 20 years have passed since the first cat bond was issued and the financial industry started to discuss ILS as an alternative risk transfer instrument. The aim of this study was to determine where the industry stands today. To do so, we first reviewed the existing literature and provided insights from a group of experts. Although ILS have already become relatively widespread, the lack of knowledge about these instruments is still seen as one of the main impediments to continued market expansion. Second, we provided an empirical contribution by surveying investors and sponsors. In addition to the lack of knowledge, our survey emphasizes that transaction costs and regulatory uncertainty are the most significant impediments to ILS market expansion. Based on these results, we then derived implications and ideas for the future development of ILS.

Apart from the aforementioned findings, it was possible to show that skin in the game is necessary to attract investors and to reduce moral hazard. Our empirical results indicate that a 5 to 10% sponsor investment leads to large increases in the willingness to invest. We also observe that investors do not consider ratings as necessary and that having no rating is better than having a bad rating. Overall, the ILS market is likely to grow substantially over the next years; the survey participants expect its volume to double by 2019.

The recognition of ILS as a risk transfer instrument in new risk-based capital standards (e.g. Solvency II) and accounting standards (e.g. IFRS 4) will play a key role for the future of the ILS market. On the investor side, we highlight the importance of transparency and standardization. We also show that a higher liquidity, e.g., through exchange traded instruments, would be beneficial to attract a broader audience of potential investors. Another key result of the study is that that there are large areas of risk which have not yet been considered for securitization. Among these are run-off business, cyber risk, political risk, microinsurance, and liability insurance. Each of these fields is associated with arguments for and against securitization. Yet, due to ongoing changes in the business environment, one or several of these risk types might become an attractive opportunity for securitization. Finally, we discussed the role of new structures such as the protected cell company.

Given the current low interest rate environment and the corresponding quest for yield, ILS - more than ever before - exhibit attractive properties for institutional

investors, including relatively high expected returns, low volatility, and low correlation to traditional asset classes. The growing number of ILS investment funds indicates that investor appetite for the asset class is continuously increasing. Thus, it is safe to state that these instruments have firmly established themselves as a permanent alternative in the risk transfer domain. If the market manages to improve on some of the critical aspects mentioned in this study its future perspectives look bright.

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Appendix A: Questionnaire

Insurance-Linked Securities –
Determinants of the Investment Decision

Institute of Insurance Economics
University of St.Gallen

Due to their relatively high yields and low return correlations with traditional asset classes, insurance-linked securities (ILS) have repeatedly been described as an appealing investment opportunity (see, e.g. Cummins and Weiss, 2009; Braun et al., 2013). Yet, the investor base for this kind of asset is largely dominated by few specialized investment managers. The aim of this international survey is to analyze advantages and disadvantages, the current market development and the decision-making processes that drive the demand for this aspiring asset class. Your participation is entirely anonymous. If you provide your (email) address you will receive all study results and an invitation to a congress where the results are discussed with experts in the field.

ILS are financial instruments (other than traditional equity and debt issued by insurers) which carry insurance risk and thus provide alternative ways to participate in this type of risk, i.e., cat bonds, ILWs, sidecars, embedded value securitizations, XXX/AXXX securitizations, contingent capital, and insurance futures, options, and swaps (see Cummins and Weiss, 2009; Wu and Soanes, 2007; in the Appendix definitions of all instruments are given). The questionnaire is organized in five sections.

A. General Questions

A-1. In which country is your company based (headquarters)?

_____

A-2. What is the business model of your company?

Investment Bank	❍	Insurer / Reinsurer	❍
Hedge Fund	❍	Mutual Fund	❍
Family Office	❍	Pension Fund	❍
Sovereign Wealth Fund	❍	Private Equity Fund	❍
Dedicated Fund (i.e., ILS-specialized)	❍	Other (please specify)	_____

A-3. Would you describe your company as a global player?

Yes ❍ No ❍

A-4. Where is the geographic investment focus of your company?

Global	❍	Europe	❍
USA	❍	Other (please specify)	_____

A-5. How many employees work in your company?

_____

A-6. Please provide an approximation of your company's balance sheet size (i.e., total assets).

Approx. _____ Currency _____

A-7. Does your investment process allow short-selling?

Yes ❍ No ❍

B. Assessment of Insurance-Linked Securities

B-1. Has your company conducted any ILS investments in the past or is it currently invested in ILS?

Yes ❍ No ❍

B-2. Does your company intend to invest in ILS in the future?

Yes ❍ No ❍

B-3. Has your company invested into one or more of the following types of securitizations? (multiple answers possible)			
Mortality / Longevity Bonds	❍	Collateralized Debt Obligations (CDOs)	❍
Asset-Backed-Securities (ABS)	❍	Contingent Convertible Bonds (CoCo)	❍

B-4. Please indicate if your company requires an internal Due Diligence for ILS in the investment process?			
Company specific 'Due Diligence'	❍	None	❍

B-5. Does a dedicated ILS investment team exist within your company?				
Yes	❍	No	❍	
If yes, how many members: _____ persons;				established in which year: _____

B-6. Please evaluate the fit of ILS in your portfolio according to the following statements:	Fully disagree						Fully agree
[1] ILS fits well in our asset portfolio.	❍	❍	❍	❍	❍	❍	❍
[2] ILS is compatible with our strategic investment goals.	❍	❍	❍	❍	❍	❍	❍
[3] ILS is an attractive asset class.	❍	❍	❍	❍	❍	❍	❍

B-7. From your perspective, what are the major arguments for investing in ILS?	Not relevant						Highly relevant
[1] Attractive risk-return profile	❍	❍	❍	❍	❍	❍	❍
[2] Low correlation with traditional investments	❍	❍	❍	❍	❍	❍	❍
[3] Participation in illiquidity premiums	❍	❍	❍	❍	❍	❍	❍
[4] Lack of other investment opportunities	❍	❍	❍	❍	❍	❍	❍
[5] Customization of ILS products	❍	❍	❍	❍	❍	❍	❍
[6] Other (please specify):_____	❍	❍	❍	❍	❍	❍	❍

B-8. From your perspective, what are your concerns to invest in ILS?	Not relevant						Highly relevant
[1] Limited or no expertise	❍	❍	❍	❍	❍	❍	❍
[2] Insufficient performance	❍	❍	❍	❍	❍	❍	❍
[3] Lack of transparency / information	❍	❍	❍	❍	❍	❍	❍
[4] Illiquidity	❍	❍	❍	❍	❍	❍	❍
[5] Counterparty default	❍	❍	❍	❍	❍	❍	❍
[6] Insufficient rating	❍	❍	❍	❍	❍	❍	❍
[7] Need for diversification other than financial sector	❍	❍	❍	❍	❍	❍	❍
[8] (Internal / External) Regulatory obstacles	❍	❍	❍	❍	❍	❍	❍
[9] Size of minimum investment	❍	❍	❍	❍	❍	❍	❍
[10] High administration / transaction costs	❍	❍	❍	❍	❍	❍	❍
[11] Other (please specify):_____	❍	❍	❍	❍	❍	❍	❍

If you stated that your company <u>has invested or is currently invested in</u> ILS investments and <u>will continue to do so in the future</u>.
Please provide further details with regard to the following questions:

B-9. Please indicate in which ILS your company invests in. (Multiple answers allowed)			
CAT bonds (non-life)	❍	Life CAT bonds	❍
Industry Loss Warranties (ILW)	❍	Sidecars	❍
Embedded value securitization	❍	XXX/AXXX securitization	❍
Insurance futures and options	❍	Insurance swaps	❍
Non-hybrid bonds issued by an insurer	❍	Hybrid bonds issued by an insurer	❍
Other (please specify) ❍	_____		

B-10.What is the current volume of ILS investments in your asset portfolio?			
in USD:	_____	in % of total assets:	_____

B-11. Please provide your targeted volume and portfolio weight for ILS investments?								
in USD: _____					in % of total assets: _____			
B-12 What are your risk (=standard deviation of returns in % p.a.) and return (in % p.a.) expectations for an investment in:								
[1] Hybrid Bond issued by an insurer	Risk: _____%				Return: _____%			
[2] Non-hybrid bonds issued by an insurer	Risk: _____%				Return: _____%			
[3] Cat Bond	Risk: _____%				Return: _____%			
B-13. Which insurance risks are of particular interest to you?								
	not interesting						very interesting	
[1] Cat risks (non-life)	❍	❍	❍	❍	❍	❍	❍	
[2] Non-Cat risks (non-life)	❍	❍	❍	❍	❍	❍	❍	
[3] Life risks (mortality)	❍	❍	❍	❍	❍	❍	❍	
[4] Health risks (morbidity)	❍	❍	❍	❍	❍	❍	❍	
[5] Other (please specify):	❍	❍	❍	❍	❍	❍	❍	

If you stated that your company has not conducted ILS investments to date but is planning to do so in the future.
Please provide further details with regard to the following points:

B-14. Please indicate in which ILS your company plans to invest in (multiple answers allowed).			
CAT bonds (non-life)	❍	Life CAT bonds	❍
Industry Loss Warranties (ILW)	❍	Sidecars	❍
Embedded value securitization	❍	XXX/AXXX securitization	❍
Insurance futures and options	❍	Insurance swaps	❍
Non-hybrid bonds issued by an insurer	❍	Hybrid bonds issued by an insurer	❍
Other (please specify): ❍ _____			
B-15. Please provide your targeted volume and portfolio weight for ILS investments?			
in USD: _____		in % of total assets: _____	

If you stated that your company has conducted ILS investments but will not continue to do so in the future.
Please provide further details with regard to the following points:

B-16. What is the current volume of ILS investments in your asset portfolio?	
in USD: _____	in % of total assets: _____
B-17. Please briefly explain the main reasons due to which your company will not continue its ILS investments.	

The following questions deal with ratings, cost structure, and market expectations for ILS investments:

B-18. In your opinion, does an ILS investment need a rating to be invested in?	
Yes ❍	No ❍
B-19. If you stated that an ILS investment needs a rating. At which S&P-rating would you start to consider investing in ILS in general (i.e., the minimum investment rating)? (One answer only)	
Equal to "In Default" (D) ❍	Equal to "Extremely Speculative" (C and CC) ❍
Equal to "Substantial Risks" (CCC- to CCC+) ❍	Equal to "Highly Speculative" (B- to B+) ❍
Equal to "Non-Inv. Grade Spec." (BB- to BB+) ❍	Equal to "Lower Medium Grade" (BBB- to BBB+) ❍
Equal to "Upper Medium Grade" (A- to A+) ❍	Equal to "High Grade" (AA- to AA+) ❍
Equal to "Prime" (AAA) ❍	

B-20. If you stated that an ILS investment does not need a rating. What is the maximum amount (in % of total assets) you would be willing to invest in ILS without a rating?
_____%
B-21.What is the maximum transaction cost you would be willing to accept in terms of invested volume?
_____%

B-22. What percentage of your total assets will consist of ILS over the following time periods from today's point of view?	
No change at all in the future	❍
Over the following 12 months	_____%
Over the following 3 years	_____%

C. Sidecars

C-1. Please indicate to what extent you agree with the following statements?									
	Fully disagree						Fully agree	Do not know
[1] Sidecars are easy to invest in.	❍	❍	❍	❍	❍	❍	❍	❍
[2] Investing in sidecars does not require expertise in reinsurance underwriting.	❍	❍	❍	❍	❍	❍	❍	❍
[3] Sidecars have a clearly limited lifespan.	❍	❍	❍	❍	❍	❍	❍	❍
[4] Excess-of-loss reinsurance does not align the interests between sidecar sponsor and the investor.	❍	❍	❍	❍	❍	❍	❍	❍

C-2. From your perspective, what are your concerns to invest in sidecars?								
	Not relevant					Highly relevant		Do not know
[1] Limited or no expertise	❍	❍	❍	❍	❍	❍	❍	❍
[2] Insufficient performance	❍	❍	❍	❍	❍	❍	❍	❍
[3] Lack of transparency / information	❍	❍	❍	❍	❍	❍	❍	❍
[4] Illiquidity	❍	❍	❍	❍	❍	❍	❍	❍
[5] Counterparty default	❍	❍	❍	❍	❍	❍	❍	❍
[6] Insufficient rating	❍	❍	❍	❍	❍	❍	❍	❍
[7] Need for diversification other than financial sector	❍	❍	❍	❍	❍	❍	❍	❍
[8] (Internal / External) Regulatory obstacles	❍	❍	❍	❍	❍	❍	❍	❍
[9] Size of minimum investment	❍	❍	❍	❍	❍	❍	❍	❍
[10] High administration / transaction costs	❍	❍	❍	❍	❍	❍	❍	❍
[11] Other (please specify):_____	❍	❍	❍	❍	❍	❍	❍	❍

C-3. What would be the minimum S&P-rating that your due diligence would request for such a sidecar investment?	
No Rating ❍	Equal to "In Default" (D) ❍
Equal to "Extremely Speculative" (C and CC) ❍	Equal to "Substantial Risks" (CCC- to CCC+) ❍
Equal to "Highly Speculative" (B- to B+) ❍	Equal to "Non-Inv. Grade Spec." (BB- to BB+) ❍
Equal to "Lower Medium Grade" (BBB- to BBB+) ❍	Equal to "Upper Medium Grade" (A- to A+) ❍
Equal to "High Grade" (AA- to AA+) ❍	Equal to "Prime" (AAA) ❍

C-4. What would be the maximum amount your company would invest in sidecars (in % of total assets) given your above mentioned minimum rating?
_____%

C-5. Please indicate your preferred capital structure of a sidecar:		
Only equity ❍	Only debt ❍	Equity and debt mixed ❍

C-6. If you stated in C-6. "Equity and debt mixed" as preferred capital structure, how much equity (in %) should the sidecar contain with respect to the total sidecar capital?
_____%

D. Risk-return, correlation and other characteristics of ILS

D-1. Which kind of packaging do you prefer the insurance risks to be dealt in?

Bundled portfolio of different types of risks ❍ Undiversified portfolio of one type of risk ❍

D-2.What return (% p.a.) net of transaction costs do you expect from an ILS investment that possesses an S&P-rating of:

No Rating: _____%p.a. Equal to "Substantial Risks" (CCC- to CCC+): _____%p.a.

Equal to "Highly Speculative" (B- to B+): _____%p.a. Equal to "Non-Inv. Grade" (BB- to BB+): _____%p.a.

Equal to "Upper Medium Grade" (A- to A+):_____%p.a. Equal to "Prime" (AAA): _____%p.a.

D-3. Please indicate to what extent you agree with the following statements:

	Fully disagree						Fully agree	do not know
[1] Pricing information for the ILS asset class is readily available.	❍	❍	❍	❍	❍	❍	❍	❍
[2] Historical performance figures for the ILS asset class are readily available.	❍	❍	❍	❍	❍	❍	❍	❍
[3] Loss experience/data for the ILS asset class is readily available.	❍	❍	❍	❍	❍	❍	❍	❍

D-4. All else equal what would be the maximum fraction of your total assets (in %) you would be willing to invest in ILS if the sponsor himself is invested in the same instrument (i.e., has "skin in the game")?

Sponsor's own investment:	Your maximum investment:
0%	_____%
5%	_____%
10%	_____%
20%	_____%

E. Outlook

E-1. How do you evaluate the ILS market development?

What do you estimate is the current ILS market volume? Approx. _____ billion USD

What do you estimate will be the ILS market volume in five years? Approx. _____ billion USD

E-2. How do you evaluate the following impediments to ILS market Expansion?

	No impediment						Serious impediment
[1] Regulatory treatment	❍	❍	❍	❍	❍	❍	❍
[2] Accounting treatment	❍	❍	❍	❍	❍	❍	❍
[3] Tax treatment	❍	❍	❍	❍	❍	❍	❍
[4] Treatment by rating agencies	❍	❍	❍	❍	❍	❍	❍
[5] Size of transactions	❍	❍	❍	❍	❍	❍	❍
[6] Lack of liquidity	❍	❍	❍	❍	❍	❍	❍
[7] Transactions costs too high	❍	❍	❍	❍	❍	❍	❍
[8] Lack of standardization	❍	❍	❍	❍	❍	❍	❍
[9] Lack of knowledge and experience	❍	❍	❍	❍	❍	❍	❍
[10] Other (please specify):_____	❍	❍	❍	❍	❍	❍	❍

E-3. Please feel free to provide any further comments.

Please provide your e-mail address if you would like to receive a copy of the final study: _____

Appendix B: Definitions

Alternative risk transfer (ART): Alternative techniques to transfer insurance risk away from a risk bearing entity to a third party including capital market investors. ART is not necessarily securitized.

Basis risk: Difference in outcome between an index loss as the underlying basis for an ILS instrument and a specific portfolio of losses (imperfect hedging).

Cat bonds: Bond which transfer the risk of peak events, such as hurricanes or earthquakes, to a third party; coupon and principal payments are linked to the occurrence of catastrophes.

(Catastrophe) Contingent Capital: Securitization transaction similar to a put option, which allows an insurer to issue capital (e.g., common stock, hybrid capital, or debt) at a predetermined strike price following the occurrence of a defined catastrophic event. For example, if the insurer's stock price falls below the strike price following a hurricane of specified magnitude, the insurer would have the option of issuing shares at the agreed upon strike to replenish its capital; see Cummins/Weiss, 2009.

Catastrophe options and futures: Catastrophe futures are standardized exchange-traded contracts to pay or receive payments at a specified time, with the value of the payments being a function of a cat index. Options involve the right to buy (call) or sell (put) an underlying asset at a predetermined price; see Cummins and Weiss, 2009.

Collateralized Reinsurance: Privately structured contracts which insure a portfolio of specific insurance policies against losses caused by (a) predefined peril(s).

Embedded Value Securitization: Transactions where insurance companies monetize future profits emerging from a block of business; often involves a seasoned closed block of life insurance business in run-off; see Wu and Soanes, 2007.

Industry Loss Warranties (ILW): Contractual agreements that call for the seller to pay the buyers on specified type of losses incurred by the buyer if the industry, as measured by indices, incurred losses above a threshold; see Wu and Soanes, 2007.

Insurance-linked securities (ILS): In a broad sense: Financial instruments that carry insurance risk. In a narrow sense: Financial instruments using a special purpose vehicle which issues securities either as pass-through securities (i.e., the investor receives a pro rata share of any cash-flow) or as multi-class collateralized obligations (i.e., different tranches are created). The securities can be rated and are sold publicly or placed privately (Singer, 2001).

Insurance swaps (Longevity / mortality, catastrophe): The insurer agrees to pay a series of fixed premium payments to a counterparty in exchange for floating or variable payments triggered by the occurrence of a specified insured event; see Cummins and Weiss, 2009.

Life settlements: Life insurance policies that are sold to investors in the secondary or tertiary market. The investor continues to pay the premiums on the contract and collects the death benefit payment when the original policyholder passes away.

Sidecar: Financial structures which cover a specific portfolio of insurance policies. In contrast to CRe, sidecars raise capital before defining a specific insurance portfolio instead of covering an already existing book of business.

Special Purpose Vehicle (SPV): Subsidiary of the sponsor company with completely separate balance sheet created to eliminate counterparty risk in ILS transactions. The proceeds from the investors' purchase are kept within the institution and invested in safe collateral until the maturity of the ILS.

XXX / AXXX reserve security: Regulation XXX went into effect for U.S. life insurance and reinsurance companies in 2000. Regulation XXX defines reserving methodology for companies that underwrite guaranteed term life policies in the U.S. AXXX, also known as Actuarial Guideline 38 (AG 38). The statutory reserve formula under Regulation XXX and AG 38 created redundant statutory reserve requirements for life companies. The difference between statutory reserves and economic reserves (based on best estimate actuarial assumptions) are the redundant reserves. XXX and AXXX securitizations are attempts by life insurance companies and reinsurers to fund redundant reserves via capital markets; see Wu and Soanes, 2007.

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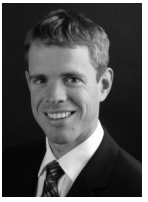

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Abstract

Due to their relatively high yields and low return correlations with traditional asset classes, insurance-linked securities (ILS) are often described as an attractive investment opportunity. Yet, the investor base for ILS is largely dominated by a few specialized investment managers. The aim of this study is to analyze advantages and disadvantages, the current market development and the decision-making processes that drive the demand for this aspiring asset class. To reach this aim, we first review the existing knowledge on ILS instruments and markets, then present results of a new international survey among ILS investors and finally, based on the results of the first and second step, derive implications for the future development of ILS.

A few highlights in this book

- Top-ten ILS trends (page 51)
- Potential impediments to ILS growth (page 70)
- New empirical results (page 91)
- Trends in ILS returns (page 129)
- New market opportunities (page 131)

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