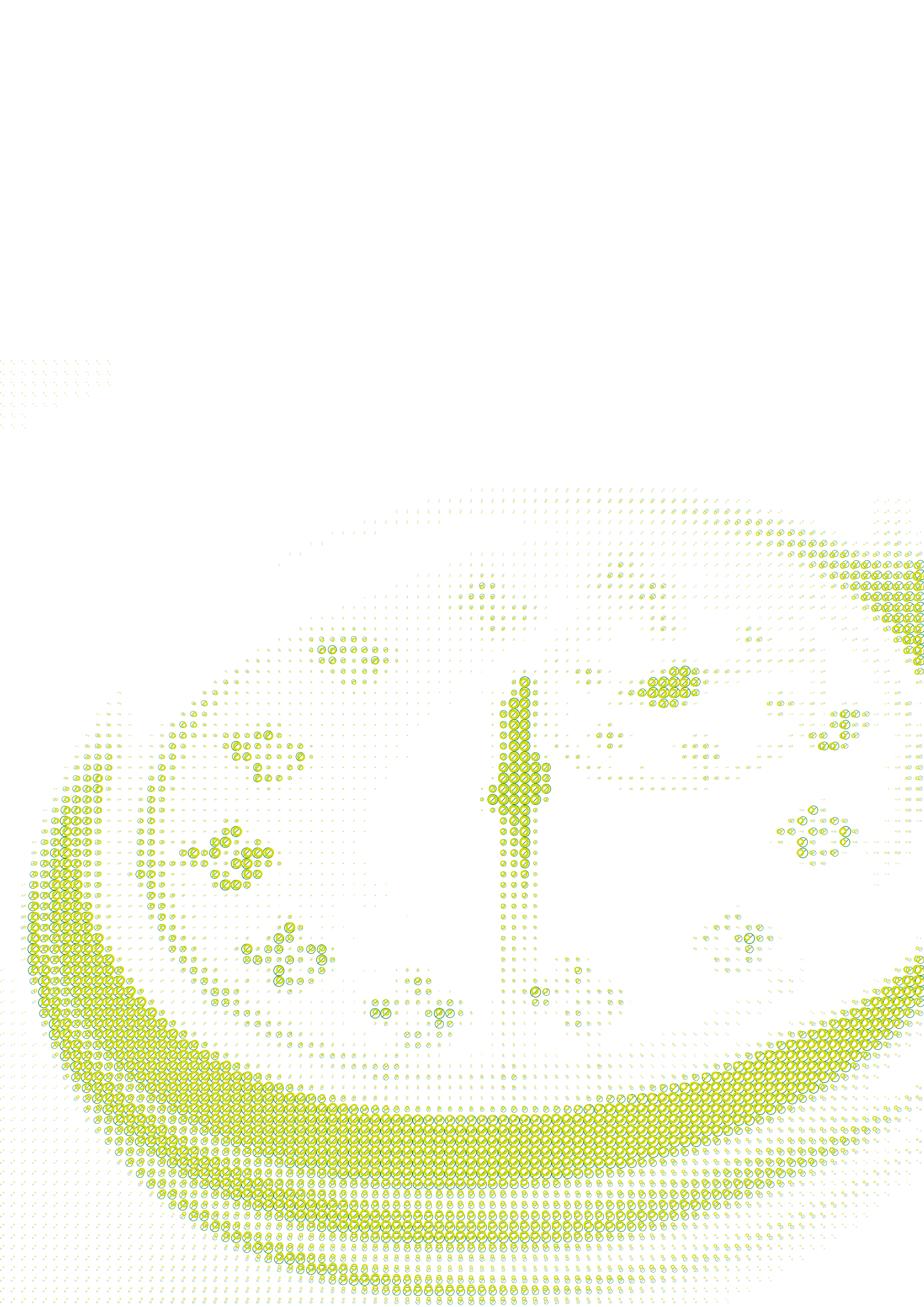
Swiss Re

The fundamentals of insurance-linked securities

Transforming insurance risk into transparent and tradable capital market products

Since its inception in 1996, the market for insurance-linked securities (ILS) has witnessed robust growth worldwide. Re/insurers, governments and corporations continue to access capital market solutions to finance growth, manage capital and transfer risk related to extreme events.
Swiss Re is a pioneer in the development of transparent and tradable insurance-linked securities.



Foreword

Swiss Re, as an industry leader in managing risk, is constantly developing innovative solutions to help insurers, corporations and governments mitigate the impact of catastrophic events. As a pioneer in transferring insurance risk to capital markets, we leverage our global expertise to give our clients options to manage their risks.

ILS products are a strong component of our re/insurance client offerings. We combine Swiss Re's strong origination and distribution platforms with our unmatched appetite to assume basis and execution risks. We continue to drive the insurance-linked securities market as sponsor and underwriter.

In recent years, the market has continued to strengthen with the entry of new sponsors and investors, but the underlying rationale for ILS remains. Sponsors continue to value the fully collateralised, multi-year capacity of an alternative market. Investors continue to see relative value in a diversifying asset class with superior returns. The market is also broadening: US peak perils are being complemented with additional diversifying catastrophe perils, and securitisation is extending further beyond natural catastrophe, particularly into the life space.

At Swiss Re, we are excited about the future growth of the ILS sector. We look forward to continuing our leadership in the development of a market for transparent and tradable insurance-linked securities, to help our clients manage their risk.

Sponsors value the fully collateralised, multi-year capacity from an alternative market. Investors continue to see relative value in a diversifying asset class with superior returns.

In 1992, Hurricane Andrew caused USD 17 billion of industry losses in Florida. In the preceding years, insurers struggled to evaluate the impact of increased population densities and a rapid concentration of insured values in disaster-prone areas. The increasing severity and frequency of events like storms, earthquakes or floods drove up the costs of disaster relief and reconstruction.

The losses were more than twice the figure insurance risk managers expected, and several insurers were ultimately forced to file for bankruptcy. In the wake of this experience, many insurers and reinsurers were unwilling or unable to offer the same level of coverage. With capacity constrained in traditional markets, the securitisation of insurance risks was an innovation developed in response to this need. Insurance-linked securities (ILS), specifically catastrophe (cat) bonds, emerged as an attractive source of capacity for the industry and a diversifying asset for investors.

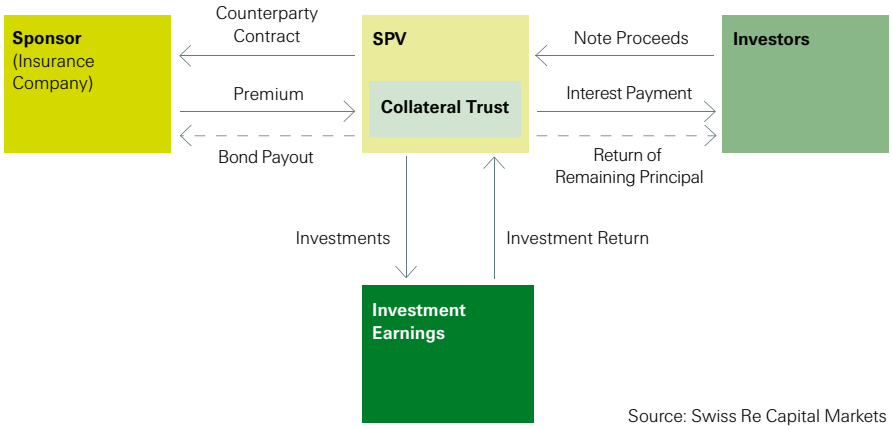
The case for ILS strengthened in the wake of the heavy hurricane season of 2005, when Hurricanes Katrina, Rita, Wilma, Ophelia and Dennis contributed to a record USD 80 billion in insured losses. Once again, re/insurers approached the broader capital markets in response to capacity constraints in the traditional reinsurance market. Consequently, 32 sponsors issued USD 8.5 billion of cat bonds in 2007, the year with the largest amount of newly issued ILS capacity.

A further testament to the strength of the market was its performance during the financial crisis. The ILS sector withstood much of the pressure in the capital markets during this period, proving that the true foundation of the ILS market remains intact. Sponsors with increased awareness of credit exposure value the collateralised, multi-year capacity from an alternative source, while investors are attracted to this non-correlated asset class with superior returns.

Structure of insurance-linked securities

Cat bonds are bonds whose coupon and principal payments depend on the non-occurrence of a predefined catastrophic event, the performance of an insurance portfolio or the value of an index of natural catastrophe risks. Institutions ranging from governments to multi-national corporations, through to regional and global insurers, have used cat bonds to hedge their risks. From the perspective of the sponsoring institution, cat bonds function like fully-collateralised, multi-year reinsurance contracts.

Figure 1
Catastrophe bond payment structure



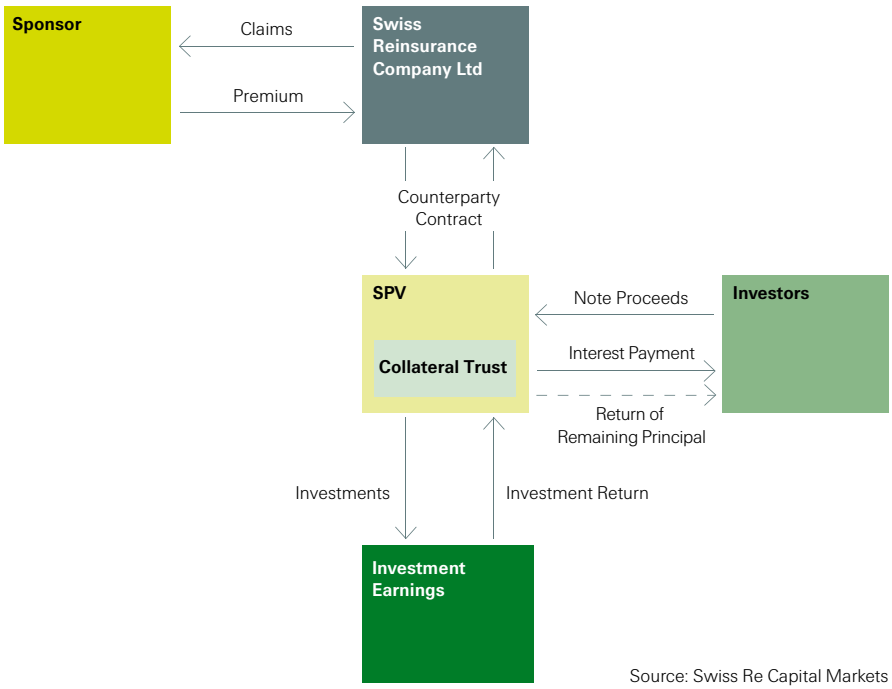
Source: Swiss Re Capital Markets

Consider a simple structure that provides collateralised capital to cover losses from a natural catastrophe (Figure 1). The transaction illustrated involves three parties: the ceding company (or sponsor), the special purpose vehicle (or issuer), and the investors [1] (large institutional buyers). The special purpose vehicle (SPV) is typically structured as a Cayman Islands, Bermuda, or Ireland exempt company whose common shares are held by a charitable trust. This structure shelters the SPV from a potential bankruptcy of a sponsor. Investors purchase securities from the issuer and the issuer simultaneously enters into a reinsurance or derivative contract with the ceding company. The proceeds from the cat bond are invested in high quality securities, such as US Treasury Money Market Funds, and held in a collateral trust. Investment returns from this account plus the risk premium paid by the ceding company jointly constitute the coupon payment under the notes.

Cat bonds commonly have a term of one to four years. If no qualifying event or trigger occurs during the risk period, the SPV returns the principal or initial investment, to investors with the final coupon payment. If a covered natural catastrophe does occur, the SPV pays the ceding company according to the terms of the reinsurance contract and pays the balance to investors.

The simple cat bond transaction structure depicted in Figure 1 can be modified in a variety of ways. As depicted in Figure 2, a reinsurer may act as an intermediary between the ceding company and the SPV. If so, the reinsurer may absorb basis risk before retroceding to the SPV (basis risk is the mismatch between losses to the reinsured portfolio and the recovery provided by the cat bond). In this case, should a catastrophe occur, an insurer would collect reinsurance recoverables based on its own insured losses while the SPV would pay out based on a particular trigger mechanism.

Figure 2
Swiss Re as transformer



Source: Swiss Re Capital Markets

1 To date, the majority of cat bonds have been sold to investors pursuant to Rule 144A. Securities Act of 1933, as amended (the "Securities Act") provides a safe harbor from the registration requirements of the Securities Act of 1933 for certain private resales of minimum USD 500 000 units of restricted securities to QIBs (qualified institutional buyers), which generally are large institutional investors that own at least USD 100 mn in investable assets. When a broker or dealer is selling securities in reliance on Rule 144A, it is subject to the condition that it may not make offers to persons other than those it reasonably believes to be QIBs.

Cat bonds offer a range of collateral solutions to both minimise credit risk and provide adequate returns to investors.

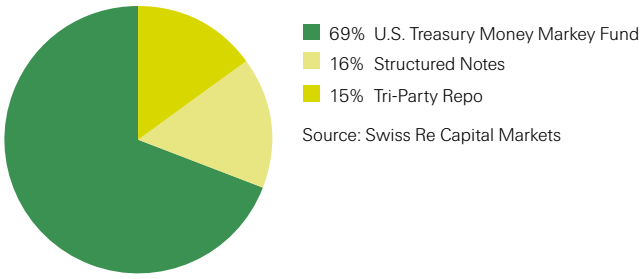
Collateral account solutions

A typical transaction begins as the SPV deposits the initial funds from investors in a collateral trust account with restrictions on investments and withdrawals. Cat bonds provide a range of collateral solutions to both minimise credit risk and to provide adequate returns to investors. In general, investors and sponsors prefer collateral solutions with minimal credit risk.

The significance of the collateral structures was highlighted during the recent credit crisis when Lehman Brothers declared bankruptcy. Originally, the typical cat bond structure used a Total Return Swap (TRS) by which a counterparty guaranteed the liquidity and performance of a collateral account. Investors and sponsors relied on the combined creditworthiness of both the TRS provider and the collateral. Lehman Brothers was the TRS counterparty for 4 of 119 cat bonds outstanding at the time of their bankruptcy. While only a small percentage of the market was affected, the demise of Lehman Brothers forced investors to focus on the underlying assets in those collateral trusts. Thus the four transactions with Lehman Brothers as Swap Counterparty were impacted for a variety of reasons including illiquid collateral account assets, no top-up provision, no concentration limits, long-dated assets (mismatched maturities), a lack of transparency, and a lower-rated swap counterparty. There was temporary disruption in the market while investors and sponsors re-examined their view of the credit risk in the structures.

A key driver in resuming new issue activity after this disruption was the design of new collateral structures. More conservative collateral solutions were introduced to further minimise credit and counterparty risk. In recent years, most new issuance has invested the collateral in US Treasury Money Market Funds due to minimal mark-to-market issues and full Regulation 114[2] compliance. Structured Notes[3] from the International and European Banks for Reconstruction and Development (IBRD and EBRD) have gained popularity as they provide securely invested collateral and LIBOR[4]-based returns. (Figure 3) Other options include Tri-Party Repos, Structured Bank CDs, and Prime Money Market Funds.

Figure 3
Collateral for cat bond new issuance after the financial crisis
(01 January 2009 to 01 June 2011)



Source: Swiss Re Capital Markets

2 This term refers to Regulation 114 of the Insurance Department of the State of New York which established standards for the assets placed in a trust account for reinsurance purposes.
3 Puttable Floating Rate Notes
4 The London Interbank Offered Rate (LIBOR) is a daily reference rate based on the interest rates at which banks borrow unsecured funds from other banks in the London wholesale money market (or interbank lending market).

Types of trigger mechanisms

Cat bond transactions use a variety of trigger mechanisms to determine whether a natural catastrophe qualifies for coverage. These include industry index, pure parametric, parametric index, modelled loss and indemnity. These five types of trigger mechanisms offer varying levels of basis risk to sponsors and transparency to investors. (Figure 4)

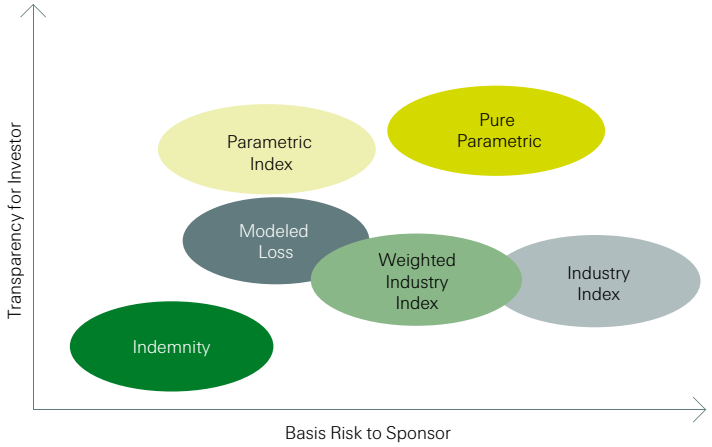
Recent cat bond transactions have featured both PCS and PERILS industry index triggers.

The first cat bonds issued in the late nineties predominantly adopted the use of indemnity triggers. Over time, ceding companies began to increasingly use industry loss, parametric, and modelled loss triggers. Different triggers and structures are able to co-exist in the market, reflecting the various needs of ceding companies and investor preferences. Swiss Re offers sponsors a variety of risk warehousing solutions to provide basis risk protection and enable the use of non-indemnity triggers.

Industry index trigger

Industry index triggers operate on the principle that the ceding company recovers a percentage of total industry losses in excess of a predetermined attachment point, to the extent of the available limit (i.e. the remainder of the principal). Recent cat bonds have used both PCS and PERILS indexing for triggers. Property Claim Services (PCS) investigates reported disasters in the United States and determines the extent of insured losses. PERILS is an insurance industry data and service provider based in Europe. Their development of a European Windstorm Index has enabled several new cat bond issuances.

Figure 4
Illustrative trigger comparison matrix



Source: Swiss Re Capital Markets

Case study: PERILS European Industry Loss Index

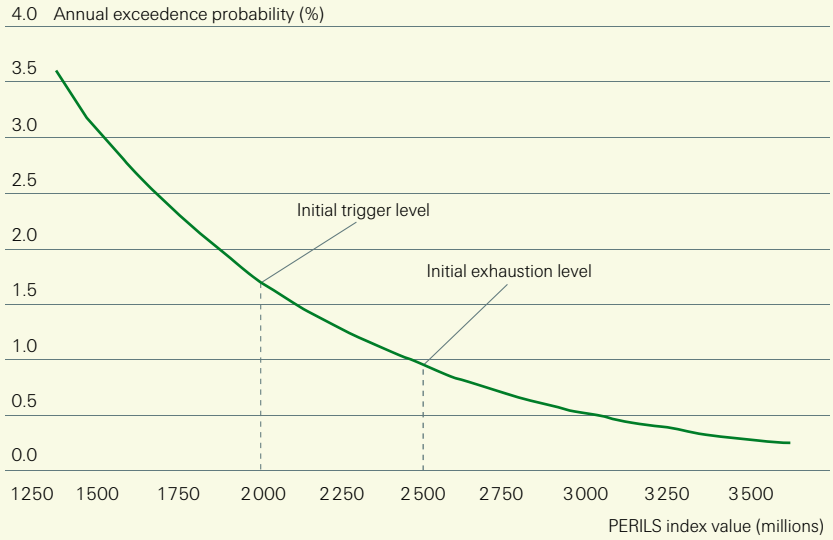
PERILS (Pan-European Risk Insurance Linked Services) is an independent company formed by eight shareholders in the re/insurance industry: AXA, Allianz, Groupama, Guy Carpenter, Munich Re, Partner Re, Swiss Re and Zurich Financial. PERILS aggregates industry-wide exposure and claims data for Europe.

This initiative has two main goals. Firstly, it aims to provide transparent and independent exposure and loss estimates that will stimulate the development of new products and create additional insurance capacity. Secondly, it seeks to improve the modelling and assessment of natural catastrophe risks, as well as underwriting and risk management. The data helps insurers indentify trends, optimise their reinsurance purchasing, and benchmark their risk portfolio against the industry.

The creation of the index has benefitted the European re/insurance, and ILS markets by improving the transparency of industry losses. Standardised, consistent and timely market data has facilitated recent growth in European cat bonds. In 2010, three new PERILS bonds were issued and one new bond closed in early 2011.

A hypothetical Eurowind ILS transaction (Figure 5) illustrates the PERILS index trigger. Investors in this bond would begin to lose one dollar of principal when industry losses, as measured by the PERILS Index, amount to EUR 2.0 bn. The principal is exhausted at EUR 2.5 bn. Any loss amount between the attachment and exhaustion amounts would result in a linear reduction in the principal.

Figure 5
Illustrative PERILS index value loss exceedance probability curve



Source: Swiss Re Capital Markets

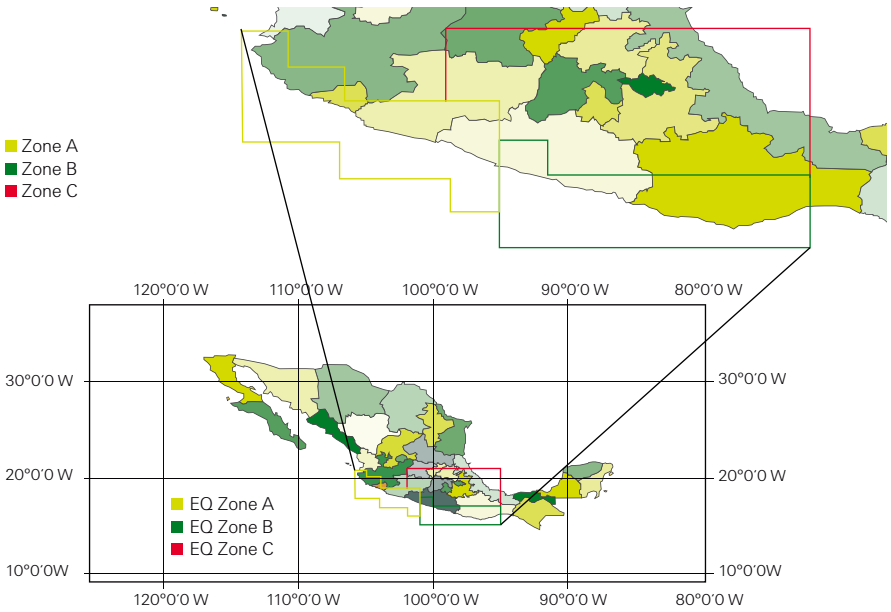
An industry index trigger exposes the ceding company to basis risk to the extent that its actual losses differ from that of the industry as a whole. If the mismatch is substantial, the sponsor may remain exposed to the industry risks it had sought to hedge, or, alternatively, may benefit from a windfall recovery. A weighted industry index can help further customise the industry index and reduce basis risk. By applying weighted calculation factors to various sub-regions of the covered area, the sponsor can obtain coverage that more closely aligns with its own portfolio of risks. Sponsors value the ability to reduce basis risk and enable more efficient risk transfer. A weighted PCS Index is the most frequently adapted solution in the market.

Basing reinsurance protection on an index, rather than a book of business, not only permits the ceding company to protect proprietary information from disclosure to competitors, but also makes the deal more transparent to investors. Index-based deals raise fewer investor concerns about adverse selection (the fear that the sponsor is ceding precisely those risks it deems most problematic), moral hazard (that ceding risk negatively alters the incentives of the sponsor) and unsound underwriting practices. Another advantage of the industry index approach is that an independent party (not involved in the transaction) reports the industry loss figures used in the calculations. As with the indemnity trigger, an industry loss trigger may require an extended development period to determine coverage.

Pure parametric trigger

Pure parametric or physical triggers are even more transparent to investors than industry index triggers. A hypothetical earthquake transaction (Figures 6 and 7) illustrates the use of a pure parametric trigger. The sponsor's recovery depends solely on the location (specific grids in and around Mexico) and the magnitude of earthquake events.

Figure 6
Illustrative parametric trigger locations



Source: Swiss Re Capital Markets

Figure 7
Illustrative earthquake parameters

	Earthquake Zone A	Earthquake Zone B	Earthquake Zone C
Magnitude (M_w)	7.9 or higher	8.0 or higher	7.4 or higher
Depth (km)	200 or lower	200 or lower	200 or lower

From an investor's perspective, this trigger type makes risk assessment completely transparent. Another advantage of a pure parametric trigger over an industry index or indemnity trigger is that the post-event development period is shortened to weeks rather than months. Nonetheless, a pure parametric trigger may leave the ceding company exposed to significant basis risk if, for example, the geographical distribution of its book of business varies from that of the cat bond.

Parametric index trigger

Parametric index triggers are an adaptation of pure parametric triggers. The parametric index simply refines the pure parametric trigger by using a greater number of locations and applying different weights to each location to reflect the ceding company's exposure to events in the area. This formula more accurately tracks losses to the ceding company's portfolio than the formula for a pure parametric trigger. A possible formula to calculate a parametric index for a hurricane might be comprised of:

Figure 8
Illustrative hurricane parametric index formula

Hurricane index formula:

$$\text{Hurricane index value} = K \times \sum_{i=1}^{j} w_i \times \langle v_i - L \rangle^n$$

- K is a constant
- j is the total number of locations
- i is the relevant location
- w_i is the relative weight of location i
- v_i is the calculated peak gust windspeed at location i
- L is a constant representing a threshold peak gust windspeed above which a damage potential exists
- n is a constant

The use of transparent index triggers will help to grow the market for ILS.

The inputs (Figure 8) are the peak gust wind speeds at each of many locations.[5] The formula first calculates numbers that serve as proxies for storm damage at each location. The event index is the sum of these numbers, weighted by predefined location weights, which essentially reflect the ceding company's exposures at each location. While not as simple as a pure parametric trigger, the parametric index trigger is equally transparent. After an event, an investor can enter wind speeds into the formula and calculate the index value, which in turn determines the loss payout.

Modelled loss trigger

Similar to the parametric index, modelled loss triggers have also been used in numerous transactions. After a catastrophe occurs, the physical parameters of the catastrophe are entered into a third-party model to project the expected losses to the ceding company's portfolio. Rather than settling the transaction loss payout based on actual losses, the transaction settles instead on this estimate from the model.

Indemnity trigger

In indemnity deals, triggers are based on the ceding company's own book of business, and resemble conventional risk solutions.They are not subject to basis risk, as the trigger event is linked to the direct loss of the ceding company. The cover provided by the cat bond "attaches" (or becomes effective) only if the ceding company incurs a predetermined level of losses. Above the predetermined level, or attachment point, the ceding company is reimbursed for its actual losses from the covered event(s).

Investors may demand an increased spread for indemnity trigger transactions. They are exposed not only to the natural catastrophe risk, but also to unexpected secondary loss effects. Furthermore, they are subject to the operational risk of the ceding company's underwriting and claims functions. And, rating agencies tend to require additional stress testing due to the operational risk exposure, which may result in a lower rating.

While not as simple as a pure parametric trigger, the parametric index trigger is equally transparent.

5 Since these locations may not correspond with locations where wind speed measurements during a whurricane are collected, wind speeds at some locations may be imputed using other wind speed readings.

Case study: Successor X Ltd.

In February 2011, Swiss Re securitised two additional tranches of protection with Successor X Ltd. It is the most recent issuance in the Successor X programme. This franchise has securitised four takedowns since December 2009. The overall Successor programme has been one of the ILS market's most consistent issuers.

During the structuring process many considerations are taken into account, such as choice of trigger and type of collateral. For the Successor X Ltd. programme the type of triggers were carefully selected in order to minimise any basis risk to Swiss Re. The takedown completed in February 2011 used a modified industry trigger for US hurricanes and a parametric index trigger for California earthquakes. The modified industry trigger uses the Property Claims Service (PCS) as the reporting agency and applies weights by line of business and state against reported industry losses to best reflect the sponsor's exposures. The parametric index uses the physical parameters of an earthquake event reported by the U.S. Geological Survey to determine the payout of the structure. Swiss Re used these two different trigger types to optimise and diversify its triggers to minimise exposure to basis risk after considering Swiss Re's specific risk distribution in the covered regions.

The selection of the collateral structure tried to find a balance between collateral return and minimal credit risk. Therefore the takedown used a Puttable Floating Rate Note issued by the IBRD for one tranche and a US Treasury Money Market Fund for the other. As is common with cat bond structures, the collateral was placed in a segregated collateral account controlled by the cat bond SPV.

This shelf programme has enabled Swiss Re to securitise a diverse range of peak perils at a variety of risk levels. By frequently accessing the capital markets, Swiss Re has sought to stabilise the cost of their reinsurance while acquiring multi-year, collateralised protection.

After large events like Hurricane Katrina, industry capital is stressed, pressuring insurers and reinsurers to increase rates in order to rebuild surplus. As traditional reinsurance capital becomes constrained, firms seek alternative sources of risk transfer.

Cat bonds should be viewed as a complementary risk transfer product. They enable sponsors to access collateralised, multi-year risk protection from a diversified source of capacity. In a complementary role, cat bonds broaden capacity for peak perils. Where pricing is attractive relative to traditional reinsurance, cat bonds can act as a substitute layer in an existing reinsurance tower. Also, with a typical multi-year duration, the sponsor can secure protection across several renewals, partially uncoupling from the pricing cycle and decreasing earnings volatility.

Sponsoring a cat bond has offered insurers, reinsurers, corporations, and governments the flexibility to either purchase less reinsurance protection or to hold less capital. Regularly sponsoring cat bonds may alsyo provide strategic benefits, as consistent issuers may receive more favourable pricing than one-time issuers. Such sponsorship can also strengthen the company's reputation as an innovator and diversify its reinsurance receivables.

Relative pricing

From a sponsor's perspective, conditions in insurance and reinsurance markets have a considerable impact on the attractiveness of cat bonds. The cost of cat bond issuance compared to traditional reinsurance varies according to the reinsurance underwriting cycle. Extreme events, such as Hurricane Katrina, can significantly erode industry capital, limiting supply and pushing the reinsurance pricing cycle from "soft" to "hard" as insurers and reinsurers increase rates in order to rebuild surplus and seek payback for losses.

As the traditional reinsurance capital becomes constrained, firms seek alternative sources of risk financing. Since bonds can be traded in the secondary market daily, risk pricing in the capital markets is more volatile and can react more quickly than the traditional reinsurance market. During a hard market, ILS may be less expensive than reinsurance and an attractive option for sponsors. In contrast, during a soft market, when there is excess capacity in the industry, aggressive competition for business lowers rates and the cost of reinsurance tends to fall. Cat bonds can then appear relatively less attractive to sponsors, who tend to reduce their issuance levels under soft market conditions.

If the timing of the insurance cycle varies by line of catastrophe business, so, too, will the relative cost of securitisation. As the reinsurance market tightens for a specific line of business, the case for securitisation grows more compelling.

Cat bonds to date (Figure 9) have mostly securitised protection for peak perils, the risks that could cause the largest insured industry losses. To understand why, note

that capital charges (the amount of capital a reinsurer must hold per amount of coverage limit provided) are quite low for non-peak perils; a reflection of reinsurers' ability to diversify among many such perils. This low capital charge translates into lower insurance prices, or rates-on-line.

Primary insurers and corporations have greater difficulty diversifying risks than reinsurers. Therefore, some insurers and corporations may view certain risks as peak perils, even if the industry as a whole does not.

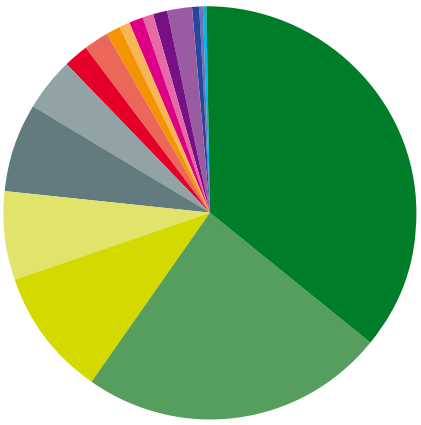
The pricing dynamic reverses for peak perils such as North Atlantic hurricanes, Japanese earthquakes and typhoons, California earthquakes and European windstorms; the capital charges, and therefore rates-on-line, are high. Consequently, for these peak perils, cat bonds and traditional reinsurance may have comparable pricing.

When comparing traditional reinsurance and cat bonds, companies must consider other factors in addition to pricing, including multi-year fixed pricing, systematic claims processing and reduced counterparty risk.

Multi-year term

Another distinction between cat bonds and traditional reinsurance is the fixed cost coverage over a multi-year period typically provided by cat bonds. Because of regulatory and other constraints, for example, primary insurers have in recent years had difficulty raising rates for homeowner's multi-peril coverage as quickly as their cost of capital has changed. One solution could be to hedge this exposure by entering into multi-year reinsurance contracts. However, these are not always available at affordable rates in the traditional market. Alternatively, many cat bonds provide sponsors with more affordable multi-year coverage.

Figure 9
Perils by total risk securitised in millions (as of 05 May 2011)



- 36% Multiperil (USD 12 603 mm)
- 24% US Wind (USD 8 431 mm)
- 10% CA EQ (USD 3 583 mm)
- 7% Extreme Mortality (USD 2 274 mm)
- 7% Euro Wind (USD 2 284 mm)
- 4% JP EQ (USD 1 529 mm)
- 2% Auto (USD 847 mm)
- 2% PNW EQ (USD 600 mm)
- 1% Industrial Accident (USD 405 mm)
- 1% Japan Typhoon (USD 400 mm)
- 1% Mexico EQ (USD 330 mm)
- 1% Credit Reinsurance (USD 305 mm)
- 1% Event Cancellation (USD 256 mm)
- 2% Central US EQ (USD 576 mm)
- 0.4% Health MBR (USD 150 mm)
- 0.3% Taiwan EQ (USD 100 mm)
- 0.3% Mexico Pacific Wind (USD 100 mm)
- 0.1% Mexico Atlantic Wind (USD 50 mm)
- 0.1% Longevity Differential (USD 50 mm)

Source: Swiss Re Capital Markets

Catastrophe bonds are structured to pay promptly, thereby minimizing the loss development period.

Systematic claims procedures

One benefit of cat bonds, which is difficult to value but is nonetheless important to ceding companies, is systematised claims processing. When evaluating cat bonds, rating agencies (and by implication, investors) require that the transaction provides unambiguous payment terms. Whereas traditional reinsurance contracts can give rise to coverage and payment disputes, cat bonds are structured to avoid such disputes and to pay out promptly, thereby minimising the loss development period. This is especially true of non-indemnity based securities. Sponsors value the fact that funds are made available very quickly after a loss event. The use of objective, independent data in a non-indemnity transaction eliminates the information asymmetry between the sponsor and investors.

Credit quality

Catastrophe reinsurance claims for peak perils may coincide with times of industry distress. Therefore, purchasers of catastrophe reinsurance seriously consider counterparty risk and often purchase coverage from several different companies. Cat bonds are structured to minimise counterparty risk. Typically, the SPV invests the collateral for the reinsurance contract in highly-rated investment grade securities, such as US Treasury Money Market Funds. An added benefit is that, contrary to reinsurance, the creditworthiness of the collateral and the ability of the SPV to meet payment obligations is largely uncorrelated with the occurrence of a large natural catastrophe. The recent financial crisis reinforced the need for high quality collateral and reduced counterparty credit exposure.

Cat bonds as a capital alternative

Traditional reinsurance permits an insurer to leverage its balance sheet and underwriting expertise so that it can write more business with a given level of capital, or, similarly, hold less capital in reserve to support a given book of business. Both options enable an insurer to potentially boost its return on equity (or surplus, in the case of a mutual). Since cat bonds can cover multiple perils over multi-year terms and can more readily replenish capital than traditional reinsurance, they are the more attractive surplus alternative. Further, the capital relief provided by a multi-peril cat bond tranche can be much greater than that for a single peril deal. For the same probability of expected loss, ceding companies are therefore willing to pay a higher premium for multi-peril coverage than for single peril coverage.

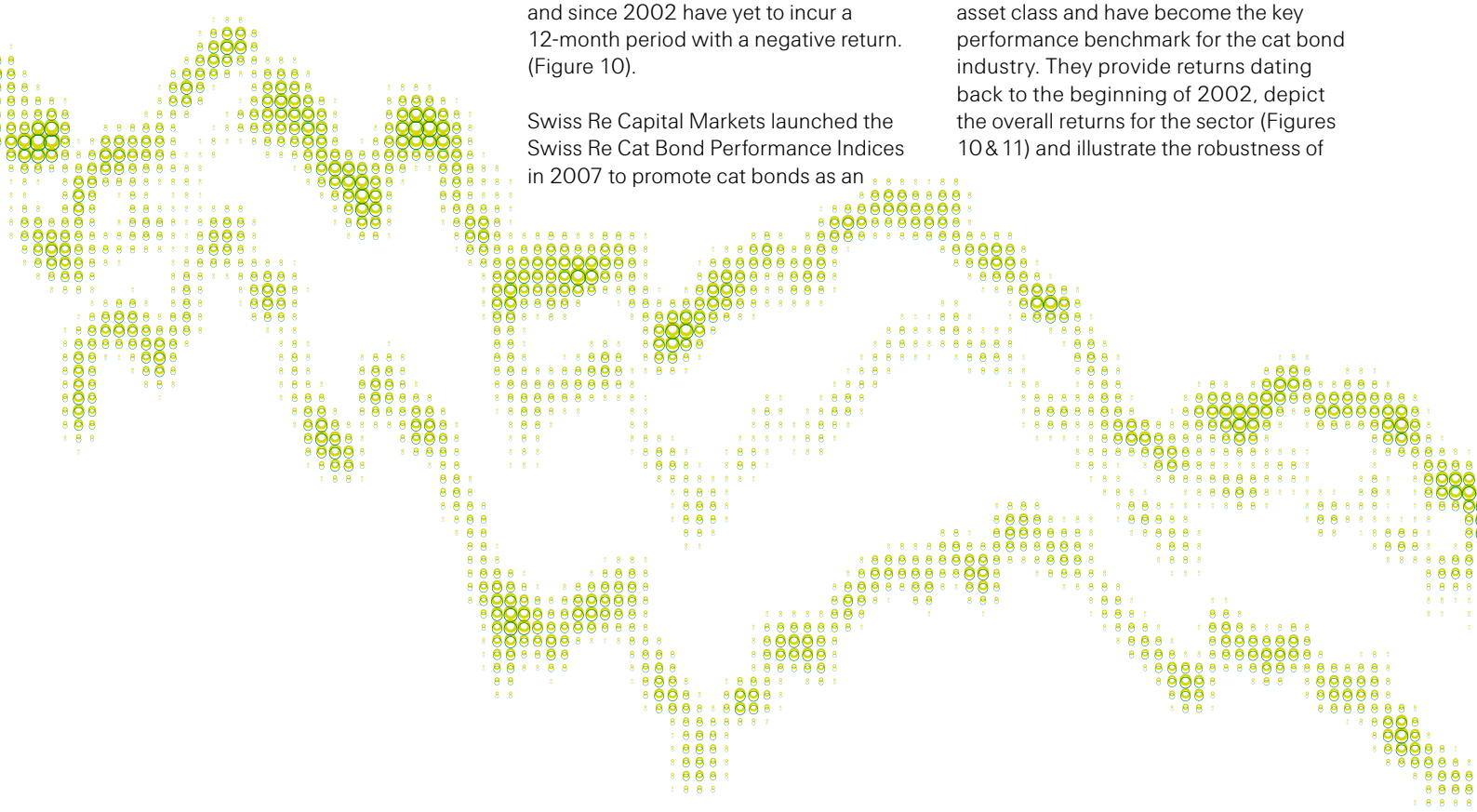
Solvency II

Solvency II is the updated set of regulatory requirements for insurance firms that operate in the European Union. It introduces a number of changes in regulatory capital requirements with broad convergence towards an economic view of capital needs. Basic principles such as the recognition of excess of loss risk transfer, the substance (of risk transfer) over form and the credit quality of the protection provider should prove beneficial to ILS issuance.

Historically, catastrophe bonds have offered investors excellent performance and compare favourably with corporate bonds of similar credit quality and other benchmarks.

Insurance-linked securities offer fixed-income investors the dual advantage of attractive returns and a method to improve their overall portfolio risk profile.[6] Historically, cat bonds have offered investors excellent performance and compare favourably with corporate bonds of similar credit quality and other benchmarks. Cat bonds offer attractive returns over time and since 2002 have yet to incur a 12-month period with a negative return. (Figure 10).

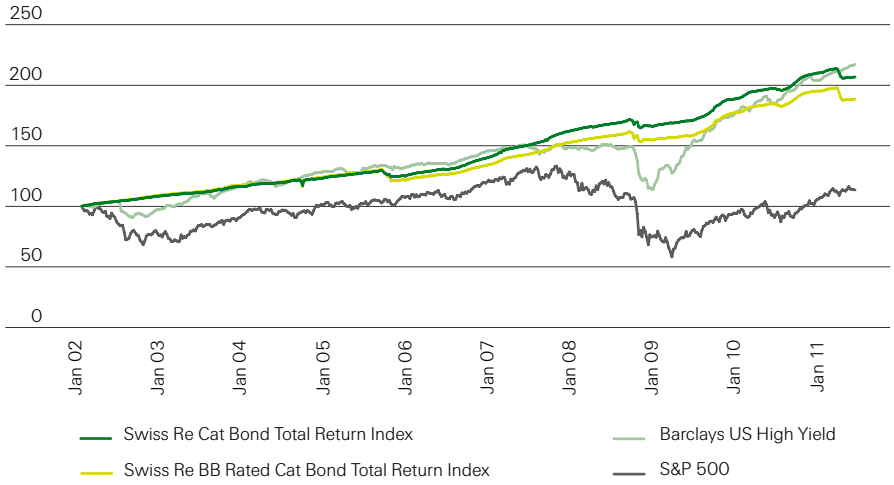
Swiss Re Capital Markets launched the Swiss Re Cat Bond Performance Indices in 2007 to promote cat bonds as an attractive asset class. The Cat Bond Indices are a series of performance indices which are constructed to track the coupon return, price return and total rate of return for cat bonds. They are based on indicative prices supplied by Swiss Re Capital Markets and its affiliates.[7] These indices improved the transparency of cat bond returns, increasing the tradability of the asset class and have become the key performance benchmark for the cat bond industry. They provide returns dating back to the beginning of 2002, depict the overall returns for the sector (Figures 10 & 11) and illustrate the robustness of



6 The numerical results provided in this section were calculated by Swiss Re Capital Markets Corp. using publicly available market data and proprietary data. No authorisation is granted to use or rely on these results for any other purpose.

7 The Swiss Re Cat Bond Performance Indices are the exclusive property of Swiss Re. Swiss Re has contracted with Standard & Poor's to maintain and calculate the indices. S & P Custom Indices calculates the Swiss Re Cat Bond Indices based on Swiss Re bid pricing indications as of 4.00pm New York time every Friday. If Friday is a holiday, the pricing indication will be as of 4.00 pm on the preceding business day. The index values are posted on Bloomberg each week. S & P shall have no liability for any errors or omissions in calculating the indices.

Figure 10
Swiss Re Cat Bond Total Return Indices vs. benchmarks (04 Jan 2011 to 27 May 2011)



Source: Swiss Re Capital Markets

cat bond returns. For more information, please see our publication: Swiss Re Cat Bond Performance Indices – February 2011.

Diversification

Cat bonds provide a source of diversification because the risk on cat bonds is largely uncorrelated with the risk of other asset classes.[8] During periods of economic distress, which typically produce a "flight to quality", correlation among risky financial assets increases. Consequently, benefits of portfolio diversification between financial assets can dissolve when needed most, whereas the diversification potential with cat bonds generally remains. The recent financial crisis offered further support for the low correlation between insurance risk and credit/asset price risk.

To illustrate the diversification benefits of cat bonds, compare the volatility and Sharpe ratios (Figure 12) of the Swiss Re Global Cat Bond Total Return Index with the Barclays Ba High Yield Corporate Index, and the S&P 500.[9] The second

Figure 11
Swiss Re Cat Bond Total Return Indices: Compound annual growth rates

Index	CAGR (1.4.02–5.27.11)
Swiss Re Global Cat Bond Total Return Index	8.04%
Swiss Re Cat Bond Total Return Index (USD)	8.06%
Swiss Re BB Rated Cat Bond Total Return Index	6.99%
Swiss Re US Wind Cat Bond Total Return Index	9.06%

Source: Swiss Re Capital Markets

Figure 12
Comparative volatility and sharpe ratios (04 Jan 2002 to 27 May 2011)

	Swiss Re Global Cat Bond Total Return Index	Barclays Ba US High Yield	S&P 500
Annualized Volatility	2.59%	6.98%	18.70%
Sharpe Ratio	2.33%	0.94%	–0.03%

Source: Swiss Re Capital Markets

8 Corporate bonds are exposed to credit risk (sensitivity to potential default of the issuer). Because cat bond proceeds are invested in a collateral trust account, cat bond holders are largely sheltered from credit risk of the issuer.

9 Calculated by Swiss Re Capital Markets using proprietary data and the Barclays Capital BB Corporate Index.

matrix details the correlation coefficients of the weekly returns for the three indices over the same period. (Figure 13)

Spreads

The correlation between returns on cat bonds and returns on BB corporate bonds is low, since the sources of default risk to cat bonds (natural catastrophes) and to corporate bonds (corporate defaults) are fundamentally independent. In view of their low correlation, the expected return on cat bonds should, in theory, be lower than that of equivalent corporate bonds, since investors should be prepared to pay a premium for the benefit of diversification supplied by cat bonds. Yet the market has often seen the opposite dynamic: Cat bond spreads have exceeded those for corporate bonds of similar credit quality.

In the liquid secondary market, investors have the ability to trade in and out of cat bond positions.

There are several reasons for the excess spreads on cat bonds versus comparable corporate bonds. Firstly, cat bonds offer an incentive to invest because many investors are still unfamiliar with them. Investors committed to the sector are paid a "novelty premium," although this premium is beginning to diminish.

ILS represent a fraction of the overall securitised product volume and investors continue to build buy-side resources to take advantage of this niche market. ILS is only offered to the institutional investor community to the exclusion of retail investors.[10] Secondly, the relatively small market size for cat bonds makes them less attractive for many of the larger scale money managers interested in the sector. Thirdly, cat bonds are subject to a "cliff risk", or the likelihood that the tranche's notional will quickly be exhausted once losses in the portfolio reach the attachment point.

Investors continue to develop a range of cat bond allocation strategies to fit their individual objectives. Diversification within a cat bond portfolio remains a high priority and new cat bond issues that provide diversifying perils often receive favourable pricing from the capital markets. Alternately, as investor demand for peak perils constricts, investors with capacity can take advantage of attractive opportunities. In the liquid secondary market, investors have the ability to trade in and out of cat bond positions based on the seasonality of different natural perils. Example: An investor searching for higher yield could earn a significant premium for holding more "on-risk" bonds during a storm season.

Liquidity

The ILS market is conceived as a tradable product. As noted earlier, during the financial crisis, multi-strategy hedge funds were forced to de-leverage their funds and many of these investors found strong

Figure 13
Correlation coefficients
(04 Jan 2002 to 27 May 2011)

	Swiss Re Global Cat Bond Total Return Index	Barclays Ba US High Yield	S&P 500
Swiss Re Global Cat Bond Total Return Index	1.00	-	-
Barclays Ba US High Yield	0.19	1.00	-
S&P 500	0.14	0.40	1.00

Source: Swiss Re Capital Markets

10 Cat bonds are restricted to Qualified Institutional Investors (QIB), This term primarily refers to institutions that manage at least USD100 mn in securities, including banks, savings and loans institutions, insurance companies, investment companies, employee benefit plans, or an entity owned entirely by qualified investors. Also included are registered broker-dealers owning and investing, on a discretionary basis, USD 10 mn in securities of non-affiliates.

prices for their ILS positions. Following the 2011 Tohoku Japanese Earthquake, secondary trading volume increased as uncertainty prior to the release of data for the parametric index calculation created opportunities for trading desks, opportunistic buyers, and concerned sellers. Cat bond trading activity displays a seasonal pattern surrounding the hurricane, typhoon and European windstorm seasons. The secondary market helps investors exit their positions in these bonds and reduce their exposure to these perils. Trading activity facilitates the migration of these bonds to investors with an appetite for the risk premium paid to holders during these seasons. Investors have consistently found liquidity for their cat bond positions as secondary trading volume at Swiss Re Capital Markets surpassed USD 1 billion in 2010 (Figure 14).

Using ILS to reduce the impact of adverse credit events

Until now, the analysis has focused on risk as measured by return volatility and the Sharpe ratio. However, portfolio managers are also interested in the risk/return characteristics of portfolios under the impact of extreme market movements. During the 2008 credit crisis (Figure 15), cat bonds exhibited stability and high returns relative to comparable investments due to the nature and integrity of the structures.

Figure 14
Swiss Re Capital Markets secondary trading volume
(01 Jan 2009 to 31 May 2011)

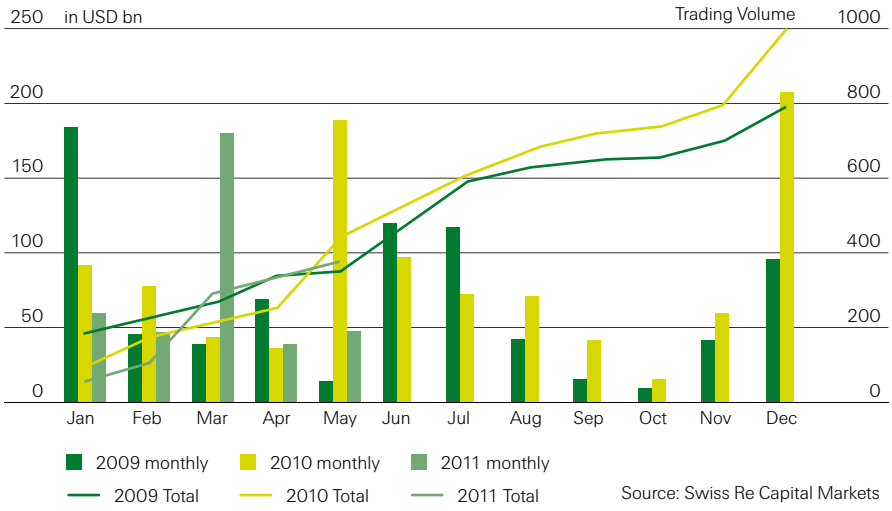
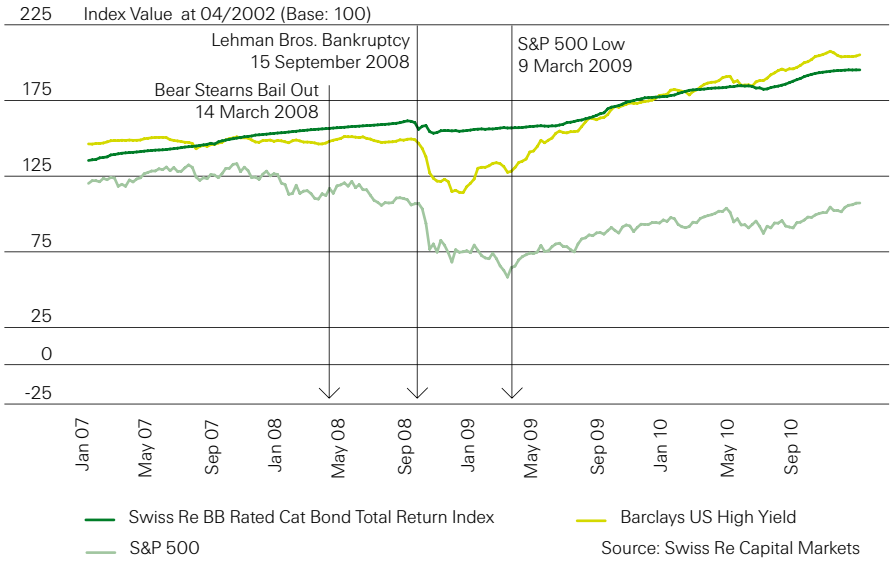


Figure 15
Cat bond performance during a recent period of pronounced market turbulence
(01 Jan 2007 to 31 Dec 2010)



The evaluation of the underlying natural catastrophe risk is prepared by a specialised third-party risk consulting firm. This service has enabled the expansion of the investor base to include a global group of multi-strategy hedge funds and institutional money managers.

Natural catastrophe risk analysis

To evaluate a cat bond and any other ILS, an investor must analyse the underlying risk, amongst other factors. A cat bond offering circular will discuss the underlying risk exposure, including the expected loss estimates and the likelihood of different loss scenarios. An evaluation of the underlying natural catastrophe risk is prepared by a specialised third-party risk consulting firm, such as AIR Worldwide Corporation (AIR), EQECAT, Inc., or Risk Management Solutions (RMS). This service has enabled the expansion of the investor base to include a global group of multi-strategy hedge funds and institutional money managers.

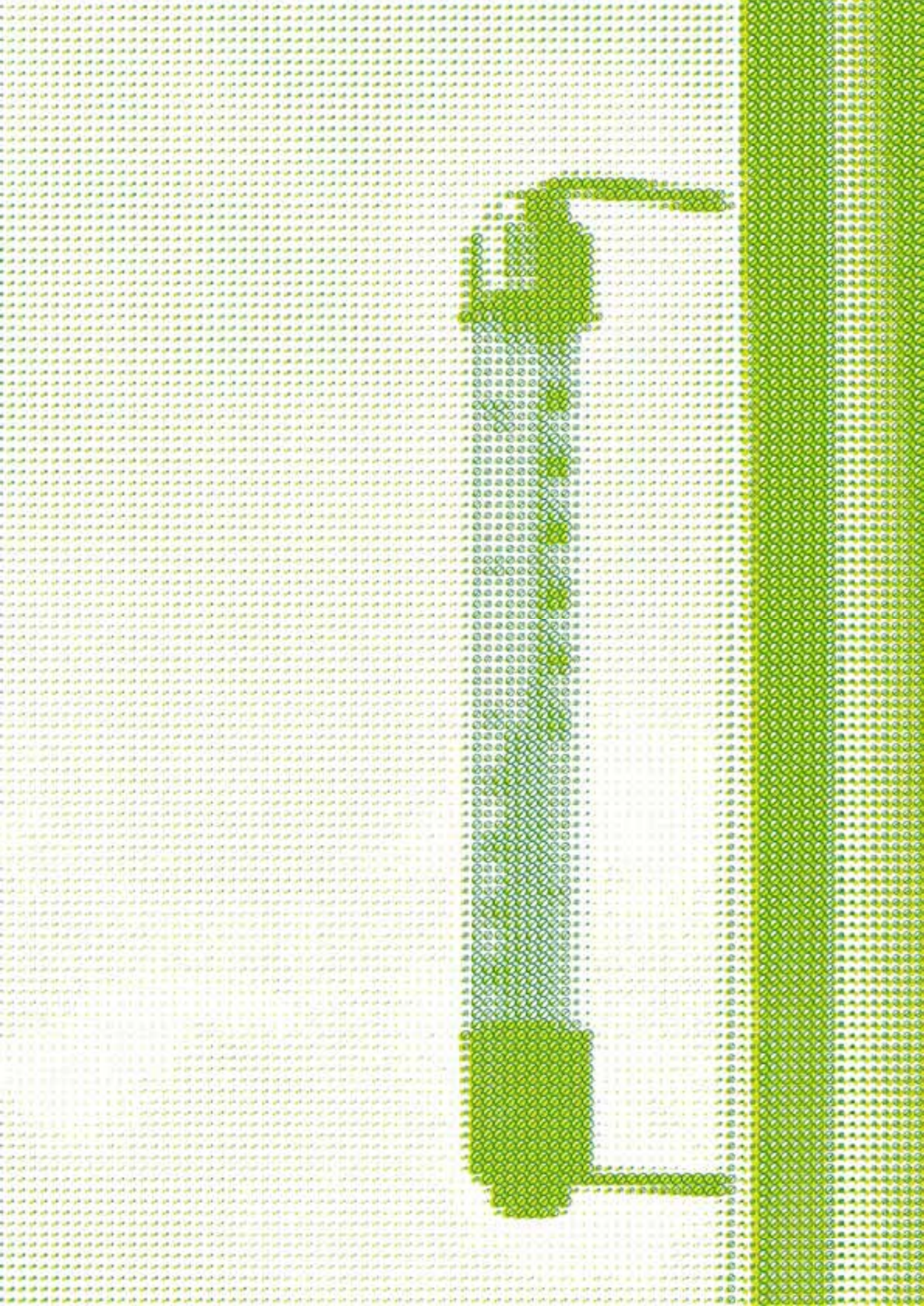
One way to estimate the risk from a natural peril, such as an earthquake or a windstorm, is to simulate a representative set of catastrophic events.

Since the return periods for significant events can be decades or even centuries, there is usually no representative claims experience for a given portfolio of catastrophe risks. It is difficult, moreover, to index past loss events since the geographical distribution and the quality of the insured objects may change considerably over time.

Despite these difficulties, one way to estimate the risk from a natural peril, such as an earthquake or a windstorm, is to simulate a representative set of catastrophic events which might affect a portfolio of risks. The simulation results can be used to construct an "artificial loss experience", based on estimates of the insured losses and the frequency of occurrence for each of the simulated events. This model can then be used to estimate the expected loss to cat bonds.

Natural catastrophe models incorporate the following four elements:

- Hazard
- Vulnerability of the insured properties
- Distribution of the insured values with respect to risk class and location
- Insurance conditions applying to the original cover



Hazard

Hazard refers to how often events of a given intensity can be expected to occur in a particular region, irrespective of the coverage in place. A hazard model is based on historical records of past events and scientific data. For example, over 12 000 earthquakes exceeded Mw 4.0 in 2010 and this robust global stream of data can be used to calibrate the hazard model. Tectonic and palaeoseismic information can be used to improve estimates of recurrence rates. In addition, geological data together with physical and empirical models are used to calculate the attenuation of earthquake waves from a fault rupture and to account for local site effects on seismic energy. For hurricanes or typhoons, wind models characterise the propagation of tropical cyclones and the spatial distribution of wind speeds. Natural and man-made surface roughness created by mountains and large cities are also considered in determining realistic wind intensities in various regions.

A hazard model is based on historical records of past events and scientific data.

When assessing hazards, long-term average recurrence estimates may be inadequate for assessing the risk of a certain event occurring over a short period of time. One reason is that the probability of a specific earthquake fault rupturing in the near future may depend on the time elapsed since the last event. In the case of atmospheric perils such as hurricanes, analysts must consider short-term changes in occurrence probabilities due to changes in climate. Models may therefore take timing into account.

Vulnerability

Vulnerability relates to the degree of destruction that an insured property or a portfolio of insured objects is expected to sustain from an event of a given intensity. Analysis of past catastrophe losses permits quantification of relationships between natural hazard parameters (i.e. earthquake magnitude or hurricane wind speed), specific risk characteristics (i.e. line of business, type of buildings) and the expected damage. The model applies these quantitative measures to portfolios lacking specific loss experience in order to estimate vulnerability.

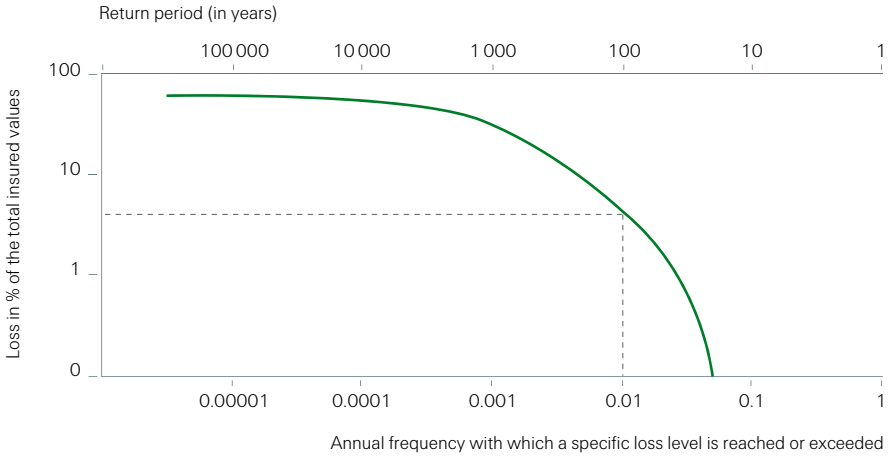
Distribution of insured values

The distribution of insured values with respect to risk characteristics and geographical zones (i.e. counties, towns or even individual sites) is central to the analysis of natural catastrophe risks, as it enables an assessment of which insured values may be affected by a given event. The distribution of insured values also considers site-specific hazard and vulnerability.

Insurance conditions

Insurance conditions, such as deductibles or limits, also greatly influence the total amount of insured loss that may arise from an event. If many of the losses that a natural disaster causes are less than the applicable deductible, the total insured loss would be significantly reduced.

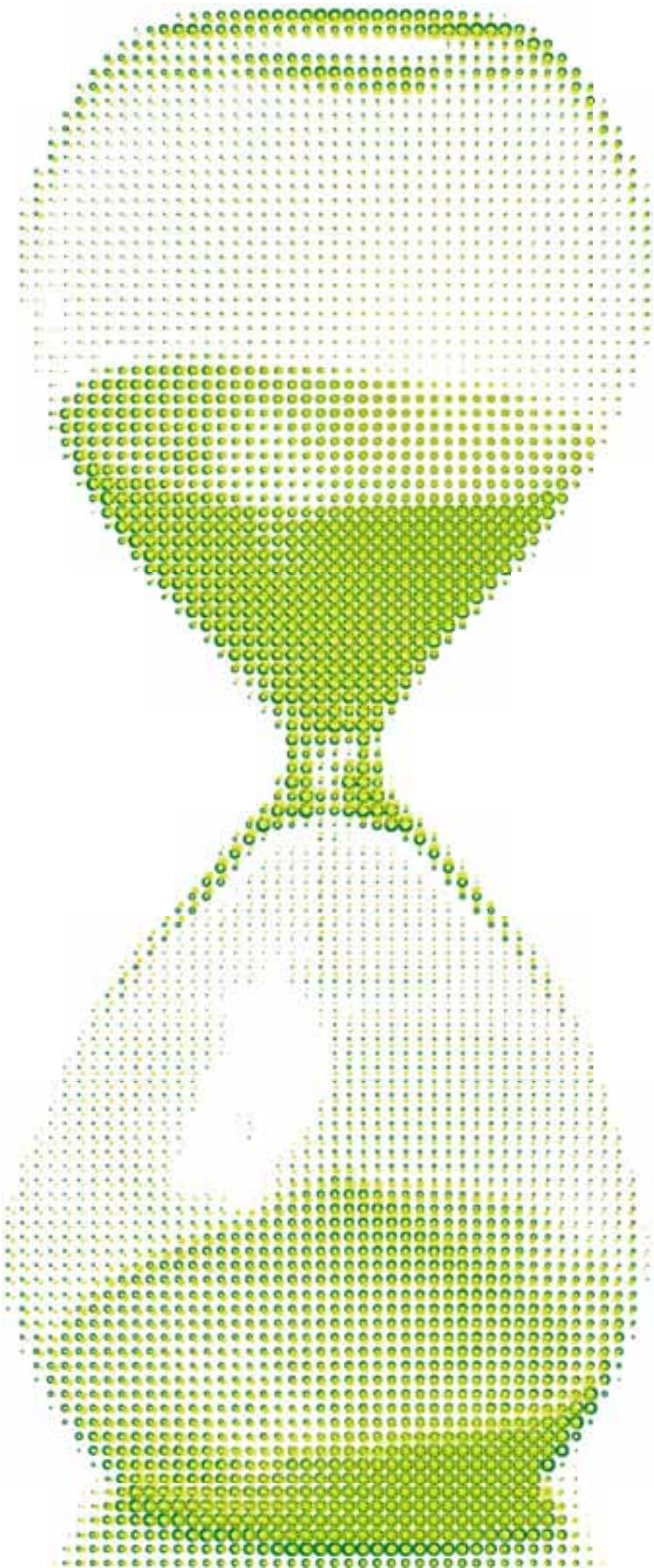
Figure 16
Illustrative Loss Curve



Source: Swiss Re Capital Markets

Natural catastrophe models may incorporate additional factors such as underinsurance (a level of coverage less than actual replacement cost), claims handling practices, moral hazard, and the sharp increases in building costs that may occur in the aftermath of a disaster. Also, depending on the type of loss trigger, some aspects are more relevant than others. For transactions using a parametric index, only the hazard portion of the model is relevant since the intensity of the event translates into a loss via a predetermined mechanism. For transactions based on indemnity or industry index triggers, all four elements must be considered.

Setting up a natural catastrophe model like the one described above involves estimating a wide variety of parameters and requires complex simulations to test for robustness. The probability of each loss level is computed on the basis of the representative set of simulated events and their estimated frequencies of occurrence. The results can be summarised in a "loss frequency" or "exceedance probability" curve (Figure 16), which provides estimates of expected annual losses and the attachment probabilities for different loss levels.



Life and health securitisations offer investors in insurance-linked securities the opportunity to further diversify their risk exposure across additional perils while providing relative value to corporate credit investors.

It is expected that demand for protection against other peak risks, such as pandemics and longevity, will accompany rising demand for natural catastrophe capacity. Total longevity liabilities have been estimated at over USD 17 trillion and total capacity in the insurance sector will be unable to provide sufficient support. This development will require a large amount of underwriting capacity and a portion of that volume will be brought to the financial markets as insurance-linked securities. The past few years have seen several interesting transactions with underlying life & health risks.

Life and health exposures are an additional source of risks available for transfer to the capital markets.

Life and health risks

Life and health exposures are an additional source of risks available for transfer to the capital markets. Unlike property and casualty business, life and health contracts typically have long durations [11] and often include financial options, such as minimum interest rate guarantees. In addition to underwriting risk, life and health insurers may be exposed to risks associated with policyholder behaviour (e.g. lapses, premium amounts and timing) and risks associated with assets set aside to support policyholder liabilities (e.g. interest rate risk, credit risk).

Since life and health insurers' risk profile is fundamentally different from their property and casualty counterparts, their capital needs are distinct and they possess different motivations for accessing the ILS market. The life and health market is similar to the non-life market in the demand for the securitisation of peak risks. However, there is also a greater need for financing and capital structure optimisation.

Life and health securitisations may offer ILS investors the opportunity to further diversify their risk exposure across additional perils while providing the opportunity to find relative value for corporate credit investors.

11 Most health contracts have shorter one-year durations.

Case study: Vita Capital IV Ltd.

In October 2010, Vita Capital IV issued two series of notes (Series III and Series IV) providing Swiss Re with USD 175 million of additional protection against extreme mortality risk. This latest issuance is the most recent in the Vita programme and brought the number of takedowns to seven and total issuance to USD 1.76 billion since the programme was first introduced in December 2003.

Vita Capital IV Class E Series III and Series IV are USD-denominated notes and cover extreme mortality risk in the United States and Japan (Series III) and Canada and Germany (Series IV). The bonds are triggered based on a calculated Mortality Index Value which references publicly available population mortality data.

RMS provided an independent expert analysis in relation to the notes evaluating the risk of elevated mortality (caused, for example, by infectious diseases, terrorism and natural disasters). Both series of notes were collateralised with AAA-rated notes issued by the International Bank for Reconstruction and Development (IBRD) offering a LIBOR-based rate.

Peak life and health risk transactions

This product generally provides economic capital relief to sponsors and is very similar to non-life catastrophe bonds in terms of structure and risk assessment. Existing applications in the life and health space include protection against extreme mortality events, spikes in health care utilisation, and trends in mortality improvements. Similar to non-life catastrophe bonds, the structures are designed to isolate the securitised exposure and minimise the impact of ancillary risks, such as sponsor credit risk or risks associated with collateral held by the special purpose vehicle issuing notes.

Perils subject to these types of transactions generally are not viewed to be correlated with the broader financial markets and could provide additional diversification in an ILS portfolio.

Embedded value transactions

Another application of ILS technology is embedded value (EV) securitisation. EV securitisation refers to the monetisation of expected future profits generated by a defined block of insurance business and is typically used for financing capital management purposes. EV transactions offer multiple potential benefits to sponsors, including:

- Non-recourse financing
- Funding matched to the cash flow profile of the underlying asset (i.e. profits generated by the underlying business)
- Potential for Return on Equity (ROE) enhancement
- Risk transfer

Transactions may include several tranches with each targeting a different risk profile and expected maturity. Typically, transactions are rated by at least one rating agency. Depending on structural features, ratings could be capped at the rating of the transaction sponsor.

The specific risks investors need to consider when evaluating EV transactions will vary depending on individual blocks and individual tranches within each deal. Generally, investors should focus on the following risks in their assessment:

- **Mortality/Morbidity:** Risk of death/health-related claims being greater/less than expected. On certain products, such as life annuities, earlier than expected deaths will result in greater profits whereas they will erode profits on a life insurance block.

- **Lapse:** Risk that more/fewer than expected policies terminate and the resulting impact on profitability. In general, higher than expected lapses will reduce profits on a block of business. However, certain products, such as long-term care (LTC) insurance, are lapse-supported and terminations may increase future profits.

- **Investment performance:** Risk that investment performance is worse than expected. Investment performance will be more critical for products where the key source of profit is spread or the difference between investment income and amounts credited to the policyholders account such as annuities. Investors should understand whether a transaction is adversely affected by mark-to-market losses on the underlying asset portfolio. Typically, settlements are based on book value accounting, exposing investors to investment losses only if and when losses are crystallised or if underlying securities become permanently impaired.

- **Sponsor credit:** Risk that the sponsor's deteriorating credit causes anti-selective lapses, thus eroding the future embedded value.

Embedded value securitisation can be viewed as an alternative or complement to insurance company coporate debt.

An independent risk analysis is usually provided, often detailing the sensitivity of underlying cash flows to various key assumptions. This analysis typically is an important consideration in the ratings process.

EV securitisations can be viewed as an alternative or complement to insurance company corporate debt. With structural features, such as ring-fencing of subject business and ranking compared to senior unsecured creditors, EV securitisations can potentially provide investors with good relative value.

Reserve financing transactions

Financing needs arising from regulatory requirements are particularly acute in the United States, where insurance regulators often require life companies to hold reserves significantly above prudent best estimates. This concept is mostly prevalent for level premium term insurance business (subject to so-called Regulation XXX) and universal life business with secondary guarantees (subject to Actuarial Guideline 38 – also known as Guideline AXXX). Under these transactions, funds raised from capital market investors are held in trust to support regulatory reserve requirements and invested in eligible assets.

Since some L&H ILS transactions historically relied on financial guarantors to obtain favourable execution and the majority of trades were investment-grade, it is not surprising that this sector has been severely impacted by the financial crisis, resulting in very small deal volume since 2007. While the credit crisis has impacted this segment of the market, issuance volume is expected to grow considerably in the future as investment-grade spreads have tightened. Hopefully, the L&H ILS market can provide investors with the ability to further diversify within the ILS asset class.

Case study: Kortis Capital Ltd.

In December 2010, Swiss Re announced the completion of Kortis Capital, an innovative USD 50 million life insurance-linked securitisation. Under the transaction, Swiss Re obtained collateralised protection against the risk of divergence in mortality improvements between two reference populations.

This transaction is the first of its kind and marks an important step in the development of capital markets solutions for longevity risk. It also provides more evidence that the market for life insurance-linked securities is resurging.

Longevity Divergence Index

The risk to investors under the Kortis transaction is captured via the Longevity Divergence Index. The index measures the difference in the rate of mortality improvement between older UK males (ages 75 to 85 inclusive) and middle-aged US males (ages 55 to 65 inclusive).

These two reference populations are closely related to Swiss Re's longevity (UK component) and mortality (US component) lines of business. Furthermore the divergence concept reflects the fact that increasing life expectancies are generally positive for the sponsor.

As a result of the index construction investors in the notes are exposed to systematic increases in life expectancy only to the extent to which it disproportionately affects older UK males. Investors are also exposed to decreasing life expectancies to the extent that mortality rates for middle-aged US males deteriorate at a faster pace than rates for older UK males. Similar to the Vita transactions, mortality rates underlying the indices are based on publicly available population data rather than on data from the sponsor's book of business.

The transaction includes an eight-year risk period, starting on 1 January 2009, and a single measurement period. In other words a principal loss to investors can only occur when data for the full risk period has been captured. Accordingly, and contrary to most cat bonds, investors can expect to receive interest on the full notional for the duration of the transaction. However, the transaction does include a call feature that allows Swiss Re to call the bond in the last two years at a premium.

Risk analysis

The independent expert risk analysis for the transaction was provided by RMS. RMS applied a structural approach to longevity risk by developing a causes of death model, coupled with detailed research into likely drivers of future mortality improvements. These drivers include multiple categories of medical treatment advances and lifestyle trends.

This approach to longevity risk modelling is more transparent than a statistical model and is rapidly gaining acceptance within the pension and annuity markets. It also allowed investors in the Kortis transaction to translate trigger levels into changes in smoking rates, cancer mortality improvements, and other tangible real-world scenarios.

Finding the balance between a manageable risk period for investors and a sufficient duration for sponsors to derive economic benefits has historically been a hurdle. The Kortis structure proved that investor and sponsor needs can be met in an ILS transaction, marking another important step in the convergence of insurance and capital markets.

The ILS market is strong and poised for continued growth. The investor and sponsor base is comprised of stable long-term participants and will continue to generate new interest in the sector.

The ILS market is strong and poised for continued growth. Our investor and sponsor base is comprised of stable long-term partners and we consistently generate new interest in the sector. Over the past few years, the market has continued to strengthen with the entry of new sponsors and investors expanding the market. The broadening of the market beyond peak US perils has been achieved through the development of the PERILS industry loss trigger, continual model refinements, and the converging spread trend among non-US perils. We are hopeful that the market will begin to introduce additional emerging market perils.

Many sponsors have fully integrated ILS into a comprehensive risk transfer program and the ILS market has a stable, consistent flow of new issues. As more transactions feature transparent index triggers, the supply-demand dynamics of the market will be engaged. Increased transparency will attract more "real money" investors and improve liquidity. This will benefit sponsors in the form of more attractive pricing, resulting in elevated new issue volumes.

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* An investment in Insurance Linked Securities involves potentially significant risks for an investor. In summary, these risks include (but are not limited to):

- Investors may lose all or a portion of their investment in Insurance Linked Securities if a natural catastrophe or other event triggers a payment by the issuer of the Insurance Linked Securities under the underlying risk-transfer agreement that the Insurance Linked Securities relate to.
- The maturity of Insurance Linked Securities may be extended without the prior consent of the investor.
- The Insurance Linked Securities may be redeemed before their maturity date (including before any extension of such maturity date by the issuer).
- If the Insurance Linked Securities are redeemed before maturity, the interest rate payable under the Insurance Linked Securities will be reduced.
- Investors have limited recourse to assets of the issuer of the Insurance Linked Securities and no recourse to assets of the counterparties to the underlying risk-transfer agreements to which the Insurance Linked Securities relate.
- If the issuer of the Insurance Linked Securities becomes insolvent, investors may lose some or all of their investment.
- Investors may be required to consolidate the issuer for accounting purposes under certain circumstances.
- An investment in the Insurance Linked Securities may have adverse tax consequences for investors.
- Any claim you have against the issuer in the event of the issuer's insolvency will rank below any claim a counterparty to the underlying risk-transfer agreements, to which the Insurance Linked Securities relate, has against the issuer.
- Enforcement of the security interest granted to a Trustee for the benefit of the investors may be limited.
- The Insurance Linked Securities may not have a secondary market or the secondary market for the Insurance Linked Securities may have limited liquidity; the market price of the Insurance Linked Securities in the secondary market may be highly volatile.
- The Rating Agenc(y)(ies) (if any) may change any rating assigned to the Insurance Linked Securities. Any credit rating given in respect of the Insurance Linked Securities may not reflect the potential impact of all risks related to the Insurance Linked Securities. A credit rating is not a recommendation to buy, sell or hold the Insurance Linked Securities and may be revised or withdrawn by the rating agency at any time.
- The risk factors relating to an investment in Insurance Linked Securities are set out in detail in the offering materials for the relevant Insurance Linked Securities.
- Before entering into any financial transaction, you should ensure that you fully understand the terms, have evaluated the risks and determined that the transaction is appropriate for you in all respects.

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