Swiss Re New Markets

Insurance-Linked Securities

Insurance-Linked Securities

Contents

Introduction

In the past two years approximately $2 billion in worldwide insurance and reinsurance capacity has been created through the issuance of capital market instruments including:

- over-the-counter swaps
- exchange-traded and over-the-counter options
- private placement bonds

Although still small in comparison to 1997 worldwide reinsurance industry premiums of $125 billion, this new class of "insurance-linked" securities (ILSs) has broken new ground in the insurance and financial markets. By bridging the insurance and capital markets, ILSs are creating a range of attractive investment opportunities previously unavailable to those outside of the insurance industry. The securities also constitute a potential new source of competitively priced insurance coverage, especially at times when such coverage is in short supply. Insurance and capital market participants who recognize the potential of these securities and position themselves accordingly will help shape the market's development and will stand to profit the most from it.

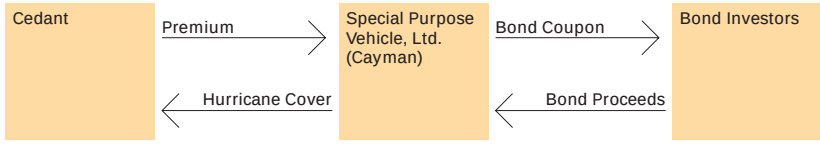
This report explores the prospects for insurance-linked securities by focusing on two key questions. First, how might the structures of these instruments evolve over the next several years? A careful review of the ILS deals to date holds some clues. Second, how important will insurance-linked securities be to the insurance and reinsurance markets? Ultimately, the success of these securities will depend on not just their level of issuance, but on the extent to which they improve the efficiency of insurance and reinsurance markets.

The plan of the report is as follows: First, we consider how insurance-linked securities work and describe some deals that have already come to market. Next, we explain how these securities facilitate a mutually beneficial transfer of risk, allowing issuers to tap into new sources of funds and investors to diversify their portfolios and boost risk-adjusted returns. We then examine the modeling and quantification of catastrophe risk, both processes vital to the pricing of insurance-linked securities. Finally, we offer some insights into how the market for these securities might develop in coming years.

How Insurance-linked securities work

The majority of ILS transactions to date have involved catastrophe bonds, commonly called "cat bonds," whose coupon and principal payments depend on the performance of a pool or index of natural catastrophe risk. Insurance-linked securities such as cat bonds can be structured to hedge the risks of many types of institutions, ranging from global corporations to local insurers, from whose perspective the securities behave like a reinsurance contract.

Figure 1:
Catastrophe bond payment structure

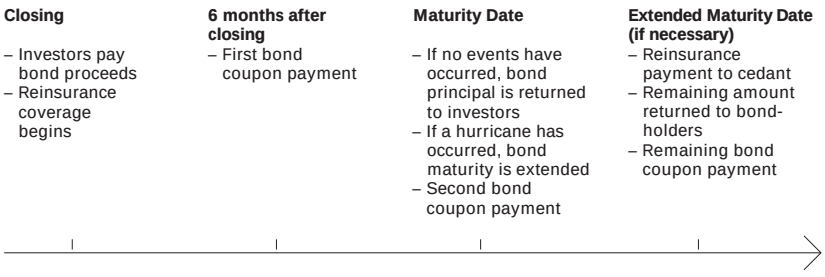


Consider, by way of example, a simple one-year structure collateralized by a bond issue that provides capital to cover losses in the event of a hurricane (Figure 1). The illustrated transaction involves three parties: investors, the cedant and the issuer. Investors purchase bonds from the issuer, a special purpose reinsurance vehicle (SPV) that simultaneously enters into a reinsurance contract with the cedant. The SPV is typically structured as an independent charitably-owned trust that is licensed as a reinsurer in an offshore location such as the Cayman Islands or Bermuda. Its sole purpose is to engage in the business relating to the securitization. This exclusive focus on a single transaction minimizes the risk to which the SPV exposes its counterparties.[1] Thus, the SPV resembles a single-parent captive that is created to serve the reinsurance needs of its parent.

Figure 2 depicts the timing of cash flows in a typical transaction. The funds provided by the bond investors are initially deposited in a trust account with restrictions on how its assets are invested and when they can be withdrawn. The investment earnings on this initial deposit as well as the premium the cedant pays for insurance coverage are periodically (often, semi-annually) paid to investors as a bond coupon. In the typical structure, there is a possible extension period following the maturity date, called the "loss development period," during which the amount of losses payable under the cover is determined. If there have been no qualifying events during the year, the principal amount is returned to the bond investors with their final coupon payment. If there has been an event, the amount due the cedant under the coverage definition is paid at the end of the loss development period and any balance of the funds goes back to investors as a return of principal.

[1] Bermuda allows reinsurance companies to apply for protected cell status that permits the segregation of contracts.

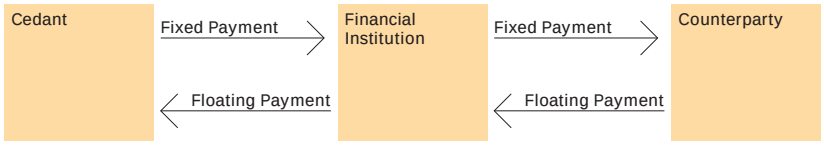
Figure 2:
Catastrophe bond cash flow timing



The simple structure depicted in Figure 1 can be modified. Often, there is a reinsurance company acting as an intermediary between the cedant and the SPV. This reinsurer can retain some risk before retroceding to the SPV. An insurance company may, for example, recover based on its own losses, while the reinsurer enters into a contract with the SPV based on an index of losses. In another variation, a bond issue can have one or more classes that are guaranteed to return to investors some percentage of principal, a feature known as defeasance. These bonds can be structured so that investors receive the guaranteed portion of the principal at the regular maturity date if no catastrophic loss occurs. If a loss does occur, the full principal is repaid but at a later date. This delayed repayment is funded by zero coupon securities that the issuer purchases at the maturity date using the guaranteed portion of the bond proceeds.

Cat bond structures involve an offshore issuer, management agents and trustees; as well as other parties. An alternative way to transfer catastrophe risk is through a swap transaction, in which a series of fixed, predefined payments is exchanged for a series of floating payments whose values depend on the occurrence of an insured event. The swap, by design, offers benefits to both sides, permitting a cedant to lay off insurance risk to a counterparty better equipped to manage it. The cedant can enter into the swap directly with counterparties or through a financial intermediary (Figure 3). In some jurisdictions, the counterparties need not be insurers. New York State insurance regulators ruled in the summer of 1998 that insurance-linked swaps whose payments are not based on the cedant's actual losses are financial contracts and can therefore be entered into by non-insurers.

Figure 3:
Cat swap payment structure



Three transactions executed over the past 18 months – an index bond, a physical trigger bond, and a physical trigger swap – illustrate how deals can be structured so that their payouts are based on indices rather than actual losses. Basing a deal on an index rather than a book of business allows the cedant to protect proprietary information from disclosure to competitors and makes the deal more transparent to investors. Index-based deals also raise fewer investor concerns about adverse selection (the fear that an insurer is trying to cede precisely those risks that it privately deems the most problematic), moral hazard (the problem that ceding risk might alter the behavioral incentives of the primary insurer) and unsound underwriting practices. These advantages must be weighed against the advantages of indemnity-based deals, which are based on a book of business. Indemnity-based deals resemble other risk management techniques already in place and are not subject to basis risk, the risk of a mismatch between a firm's book of business and the index to which a particular transaction is linked. If the mismatch in an index deal is substantial, the cedant might remain exposed to the risks against which it sought to hedge. To date, index-based transactions have comprised 20 percent of the market, as measured by risk capital raised.

Industry index bond

In a transaction completed July 16, 1997, a SPV named SR Earthquake Fund, Ltd. simultaneously issued $137 million notes and entered into a $112.2 million contract with Swiss Re based on an industry-wide index of California earthquake losses. The index was based on the largest insured loss from a single earthquake over the two-year risk period, as determined by PCS (Property Claim Services), a leading provider of loss estimates for the insurance industry.

In response to the varying risk appetites among investors, the bond issue was divided into four classes, or "tranches". The first two classes (A-1 and A-2) are the first insurance-linked notes ever to be rated investment grade (Baa3 by Moody's and BBB- by Fitch) based on their expected loss as measured by a catastrophe loss probability model. Only 60% of the bond principal is at risk; the remainder is invested in Treasury notes maturing before the end of the two-year risk period. A-1 pays a fixed interest rate of 8.645%; A-2 has a floating rate equal to 3 month LIBOR plus 255 basis points (hundredths of a percent). Class B notes (rated Ba1 by Moody's and BB by Fitch), which have 100% of principal at risk, pay a fixed interest rate of 10.493%. If a qualifying earthquake occurs in California during the risk period, these three classes suffer loss of principal because the issuer would have to pay funds to Swiss Re for their coverage. The resulting loss to bondholders would depend on the level of insured losses, as estimated by PCS (Table 1). Class C notes (not rated), whose coupon is 11.952%, entail greater risk. They lose all principal if the largest California earthquake exceeds $12.0 billion of insured losses.

Table 1:
Payout schedule for SR Earthquake Fund issue

PCS estimated insured losses from largest earthquake	Classes A-1, A-2 Principal Loss*	Class B Principal Loss*	Class C Principal Loss*	Annual probability of loss this magnitude
$12.0 Billion or greater	0%	0%	100%	2.40%
$18.5 Billion or greater	20%	33%	100%	1.00%
$21.0 Billion or greater	40%	66%	100%	0.76%
$24.0 Billion or greater	60%	100%	100%	0.52%

* as % of original principal

The annual expected principal loss is 0.46% to Class A-1 and Class A-2 note holders, 0.76% to Class B note holders, and 2.40% to Class C note holders[1]. The maximum losses to the $62 million of Class A-1 and A-2 notes provide $37.2 million of coverage to Swiss Re. In addition, the $60 million of Class B notes and $14.7 million of Class C notes provide further coverage to Swiss Re in those amounts.

The use of the PCS loss index benefited both the reinsured and the note holders. Because Swiss Re writes residential and commercial earthquake coverage that closely mirrors the California market, using the PCS loss index exposed Swiss Re's capital to minimal basis risk. In exchange for that risk, the company was able to limit the amount of information it disclosed about its book while minimizing any potential adverse selection and moral hazard issues for investors. The parties to the transaction were comfortable using this index over the two-year period. If the risk period were significantly longer, however, the issuer would have sought a mechanism that would allow the effective coverage to vary in response to changes in general conditions and its own exposure to the California insurance market.

Another issue especially relevant to earthquake bonds is the development period. Before the Northridge earthquake in 1994, many industry participants would have estimated the period between the occurrence of a natural disaster and the bulk of the loss claims at six months for earthquakes and slightly less for hurricanes. Northridge, however, was very different. The original PCS estimate for claims was $7.2 billion after six months and did not develop to the full insurance loss estimate of $12.5 billion until twenty months after the event.

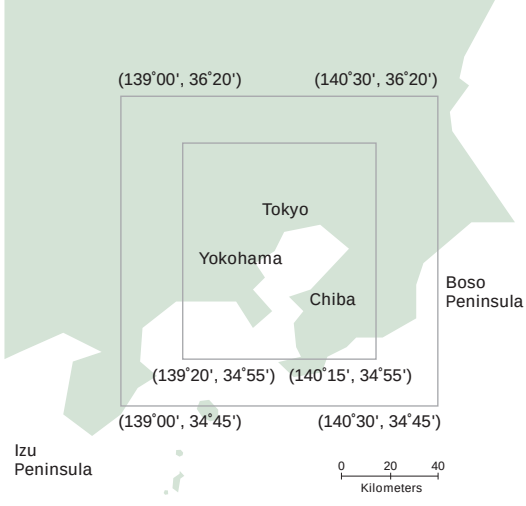
[1] Expected principal loss is defined as the average of all possible outcomes, weighted by their respective probabilities.

Reinsurers accept the trickling in of claims over time; investors, however, have collateralized the potential loss payout and would like the flexibility to reallocate their principal to other assets once the risk period is over. (Investors receive the full premium only during the risk period; during the development period, they receive interest rates pegged at either the LIBOR rate or at LIBOR plus a nominal spread.) Once the principal is returned to investors, however, it cannot be retrieved. To strike a balance between returning principal too soon (before all losses have been accounted for) and holding it too long (which would reduce the return to investors), a stratified extension period was developed that has been used as a standard for payouts on several subsequent index transactions. Over the development period, which is one year at maximum, the latest estimate of insured losses is periodically compared to an increasing benchmark level. If losses build steadily, the trust account keeps the money on deposit. If the losses stabilize below predetermined trigger levels, additional principal is returned to investors.

Physical trigger bond

Tokio Marine, a major writer of Japanese earthquake policies, faced different challenges when purchasing coverage for its earthquake exposure. The company wanted to lock in reinsurance capacity at a fixed price over ten years, which would facilitate an increase in its underwriting activity. Because the company planned to amortize its issuance costs over the life of the deal, the long risk period also reduced the prospective annual cost of the transaction. (Issuance costs are a one-time expense as compared to the annual costs of reinsurance, such as brokerage fees.) Determining which policies to model for an indemnity transaction would have been difficult because Tokio Marine's book

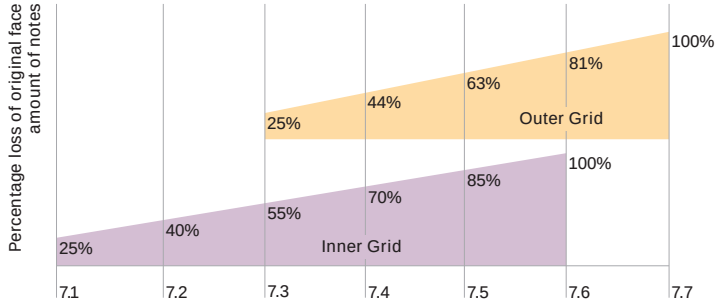
Figure 4:
Parametric Re inner and outer grids



of business was expected to change over time. Another difficulty was the absence of a generally accepted reporter of loss estimates in Japan. (More generally, the lack of industry loss reporting outside the U.S. makes it difficult to arrange index transactions based on non-U.S. risk.) Finally, even if a reporter of loss estimates did exist, the prospect of the insurance environment changing over the course of a decade created additional uncertainty.

To overcome these obstacles, a first-of-its-kind transaction finalized on November 19, 1997 was structured on the basis of a true physical index. The potential losses in the transaction, which involves a bond issuance by Parametric Re, Ltd. (a Cayman Island SPV), are based on the magnitude of earthquakes in and around Tokyo. The reinsurance cover, written by Parametric Re, was contingent on the magnitude of earthquake activity in the region as measured by the Japan Meteorological Agency (JMA). An earthquake registering a JMA Magnitude of 7.1, for example, would have a recovery of 25% if the earthquake were to occur in the inner grid but zero were it to occur in the outer grid (Figure 5). The bonds issued by Parametric Re were divided into two classes, units and notes. Notes with a face value of $80 million were fully exposed to earthquake risk (rated Ba2 by Moody's and BB by Duff and Phelp's). Units worth $20 million risk (rated Baa3 by Moody's and BBB- by Duff and Phelp's) were comprised $10 million of defeasance certificates unexposed to earthquake risk and $10 million of notes exposed to earthquake risk.

Figure 5:
Parametric Re loss trigger



A major advantage of the magnitude trigger is that it permits standardization: a single trigger can be used in multiple transactions. If other companies issue magnitude trigger bonds based on the same index, investors will be able to reuse their analyses of the original transaction. Traditional indemnity-based transactions, by contrast, require investors to analyze each company's book of business. Transactions based on a magnitude trigger also offer investors greater certainty and objectivity. Moreover, because payouts depend on a quickly determined, well-defined standard rather than the settlement of actual claims, investors can receive their funds more quickly.

Physical trigger swap

On April 1, 1998, Mitsui Marine arranged coverage through a swap transaction based on the same earthquake parameters as the Parametric Re bond offering. The insurer wanted to develop an alternative source of reinsurance capacity for a portion of its Japanese earthquake exposure. Because the amount of coverage it sought was $30 million, and because of timing constraints, a swap was determined to be the best alternative. As a general rule swap executions involve fewer intermediaries and less documentation, usually resulting in quicker, more cost-effective transactions.

Periodically, Mitsui Marine pays a premium, which is in turn paid to counterparties. Because the notional amount of a swap is not always on deposit with a bank, the deal can expose the cedant to credit risk, just as would be the case for a reinsurance contract. To reduce this risk, the counterparties can be required to pledge collateral.

Natural catastrophe risk analysis[2]

A basic prerequisite for the securitization of insurance risk is a reliable estimate of expected losses and the likelihood of different loss outcomes. For a peril such as fire, estimates of the expected losses to a portfolio of insured objects are usually based on claims statistics from past years. Historical losses are indexed to current price levels and adjusted to reflect changes in the amount of exposed values. This method is often inapplicable, however, to natural catastrophes. Because 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 because the geographical distribution and the quality of the insured objects may change considerably over time. Complicating matters further, many catastrophe-prone areas in the United States have experienced rapid increases in population.

One way to develop estimates of the risk from earthquakes or windstorms despite these difficulties is to simulate a representative set of events that might affect a portfolio of risks. For each of the simulated events, insured losses and the frequency of occurrence are estimated. The simulation results are then used to construct an "artificial loss experience," which substitutes for an actual history of losses. The simulations take into account four elements:

- hazard
- vulnerability of the insured properties
- distribution of the insured values with respect to location and risk class
- insurance conditions applying to the original cover.

Hazard refers to how often earthquakes or windstorms 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 information specifying the perils. Regarding earthquakes, tectonic and palaeoseismic information can be used to improve estimates of recurrence rates. Moreover, the attenuation of earthquake waves from a fault rupture has to be modeled and geological data are needed to consider local site effects amplifying or damping the amount of ground shaking. Regarding storms, wind models characterizing the propagation of hurricanes and the spatial distribution of wind speed have to be compiled. After a tropical cyclone has made landfall, natural surface roughness from mountains or manmade roughness created by large cities have to be considered to avoid overestimating wind intensities.

Long-term average recurrence estimates might be inadequate for assessing the risk of a certain event occurring over a short period of time such as a few months. One reason is that the probability of a specific earthquake fault rupturing in the near future depends 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.

[2] For a fuller treatment of this subject, see the Swiss Re publication *Natural Hazard and Event Loss.*

Vulnerability relates to the degree of destruction that an insured property or a portfolio of insured objects is expected to sustain from an earthquake or windstorm of a given intensity. Analysis of past catastrophe losses permits the quantification of relationships between natural hazard parameters (e.g., earthquake magnitude or hurricane wind speed), specific risk characteristics (e.g., line of business, type of buildings) and the expected damage. These relationships can then be applied to portfolios lacking specific loss experience.

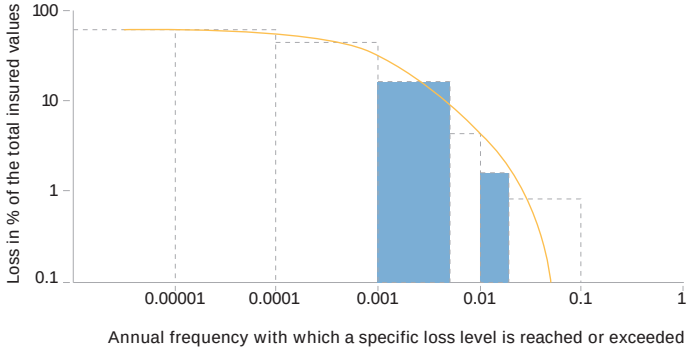
The *distribution of insured values* with respect to risk characteristics and geographical zones (e.g., counties, towns or even individual sites) is central to the analysis of natural catastrophe risks. This information allows one to assess what values are affected by a given event and to consider aspects of site-specific hazard and vulnerability.

The total amount of insured loss arising from an event is also heavily influenced by the *insurance conditions* – like deductibles or limits – that apply to the original cover. If many of the losses that a natural disaster causes are less than the deductible, the total insured loss is significantly reduced.

Finally, additional factors such as underinsurance (a level of coverage less than actual replacement costs), claims handling practices, moral hazard, and the sharp increases in building costs that occur in the wake of a disaster should carefully be considered.

Setting up such a natural catastrophe model involves estimating a wide variety of parameters based on incomplete data and knowledge. Given the level of uncertainty inherent in such an exercise, a thorough analysis requires simulations based on many alternative parameter estimates to test for robustness. These simulations, because of their complexity, can only be carried out with the help of computer programs. Based on the representative set of simulated events and their estimated occurrence frequencies, the probability of each loss level is computed. This is summarized in a "loss frequency" or "exceedance probability" curve. These curves provide estimates of expected annual losses as well as the probabilities of attachment for different reinsurance layers.

Figure 6:
Loss frequency curve



The loss frequency curve in Figure 6, for example, provides the following information:

- a loss amounting to 0.8% or more of the total portfolio values should be expected about once every ten years (annual frequency 0.1)

- a loss ratio of 20% or more will occur on average once every 140 years (annual frequency 0.007)

- some degree of damage can be expected to occur every five years.

Swiss Re and a few other reinsurance companies first developed natural catastrophe risk assessment programs in the 1980s. Reinsurers bear a significant share of insured catastrophe losses and therefore have a vital interest in understanding the risks. More recently, a few specialized catastrophe consulting firms have begun providing similar tools to the insurance industry. Several large corporations with heavy risk concentrations have also developed their own models.

Insurance-linked securities offer several potential benefits to issuers, including attractive pricing (whether now or in the future), additional reinsurance capacity, credit enhancement, and greater leverage. We discuss each of these in turn.

Pricing

Insurance-linked securities can provide a viable alternative to traditional reinsurance, although the cost advantage will vary throughout the insurance underwriting cycle. In some periods, such as after a major disaster, industry capital may be in short supply, pressuring insurers and reinsurers to boost premiums to rebuild surplus. At other times, when there is excess capacity in the industry, insurers might aggressively compete for business by lowering their rates. The status of the cycle is thus a major determinant of the attractiveness of ILSs. If, moreover, the timing of the insurance cycle varies by line of business, so too will the potential cost savings associated with securitization. The tighter the market for a particular line of reinsurance business becomes, the more compelling will be the case for securitization in that line of business.

Standardization and transparency also affect pricing. As the market matures, some types of contracts will become easier to standardize, bundle, and explain to investors. Standardization simplifies issuance and reduces transaction costs. As investors grow comfortable with particular ILS structures, moreover, they will require less explanation for each particular deal. The more transparent the securities are, the lower the premium issuers will need to pay. The yield spread between ILSs and Treasury securities should therefore narrow over time, just as they have for other financial instruments such as mortgage-backed securities.

The maturation of the ILS market should also improve its liquidity. If there is no secondary market for a particular instrument, it will attract only a limited clientele; namely, investors prepared to buy and hold until maturity. Issuers will therefore have to pay a liquidity premium above and beyond the risk premium. Once a more active secondary market for the securities develops, ILSs will become more attractive to a broad range of investors, who will therefore require a lower rate of return to hold them.

A final point for potential issuers to note is that in weighing the costs of securitization, what matters is not just today's cost of reinsurance, but also tomorrow's cost. Assembling the data and documentation needed to issue ILSs typically requires several months. If the reinsurance market firms up, such as after a major catastrophe, issuers will face considerable a delay in making their initial entrance into the ILS market because many others will be trying to do the same. Firms with prior experience at issuing ILSs will have a much easier time accessing the market. Thus, even if issuing ILSs is somewhat more expensive than conventional reinsurance, the transaction might ultimately prove cost effective because it affords the issuer the opportunity to enter the ILS market more readily in the future.

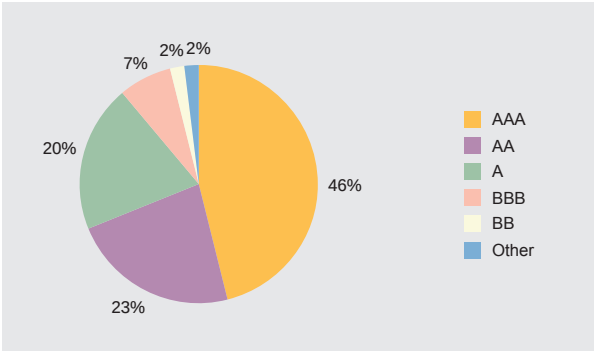
Other considerations

Capacity. Another advantage ILSs offer issuers is that they provide additional reinsurance capacity. Some very large insurers, for example, feel that the catastrophe reinsurance market lacks the capacity to provide them adequate protection against major events. Their response is to hold a substantial buffer of extra capital in lieu of reinsurance. Other firms face a separate concern: when the market tightens, reinsurance contract attachment levels rise in response, effectively providing less coverage. In this context, the ILS market has begun to offer additional reinsurance capacity in the late 1990s, just as the Bermuda market began to do in the late 1980s and early 1990s.

Credit quality. Purchasers of reinsurance seriously consider counterparty risk because the situations in which the coverage is most needed are often times of industry distress. This is why insurers generally purchase reinsurance from several companies simultaneously. Reinsurance capacity varies in credit quality. According to a tabulation by Standard & Poor's, less than half of the global reinsurance contracts written in 1996 were by AAA-rated reinsurers; more than a quarter of contracts were issued by firms rated A or below (Figure 7). ILSs can be structured to minimize counterparty risk. When issuing catastrophe bonds, for example, a firm can specify that the principal be invested in highly rated investment grade securities to be held as collateral in a SPV. Arrangements such as this may provide greater credit quality than conventional reinsurance.

Figure 7:
1996 market share of global reinsurance industry by rating category.

Source: Standard and Poor's Global Reinsurance Highlights 1997



Leverage. One of the traditional uses of reinsurance is to permit a direct insurer to leverage its balance sheet and its underwriting expertise so that it can underwrite more risk with a given level of capital. A mature ILS market might offer some direct insurers even greater latitude to employ leverage. An insurer could, for example, pursue a strategy of underwriting a certain type of policy – be it homeowners, auto, or term life – in large volumes, packaging these policies, and selling them to an intermediary. This strategy might appeal to firms whose competitive advantage in marketing and processing applications enables them to earn a satisfactory return on underwriting. Indeed, a mature ILS market might stimulate the formation of such firms.

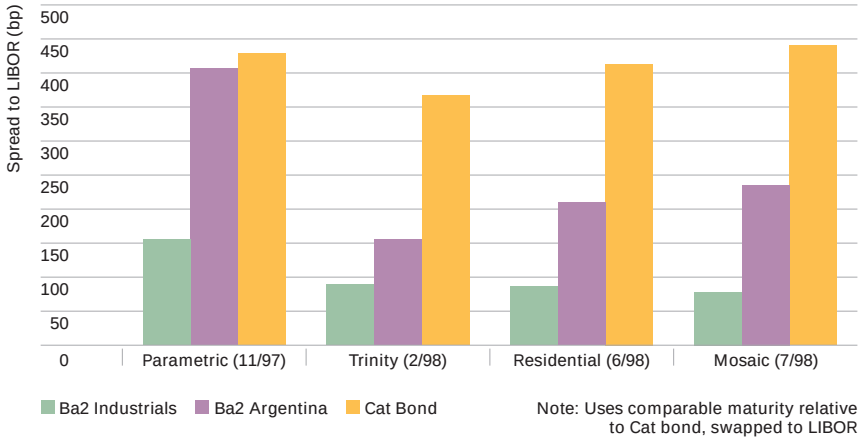
Finally, there are *strategic reasons* for some firms to issue ILSs. A company's risk manager, or credit rating agency, may be uncomfortable with its level of exposure to a particular peril. In response to such concerns, an additional layer above traditional reinsurance can provide an extra margin of safety. Early participation in the market will signal to investors and policyholders that a company is proactive, innovative, and willing to assume a leadership role. If, moreover, the ILS market evolves so that there are profitable niches for various participants, the first firms to issue the securities will be in the best position to learn how the process works and to determine what role they might play in the market.

Insurance-linked securities can offer investors attractive returns while providing a way of reducing the overall risk of their portfolios.

Market yields*

Insurance-linked securities offer investors the opportunity to earn high expected returns for several reasons. In their early stages of development, ILSs will be priced to yield a "newness premium." Catastrophe bonds with a given credit rating, for example, have yielded a spread over LIBOR that is higher than that of other comparably rated fixed income securities (Figure 8). If the securities become more accepted by investors, the newness premium would disappear or at least shrink, causing the securities to appreciate in value.

Figure 8:
Comparative pricing at issue



Even after the market has matured, investors will still have opportunities to earn high returns. Experts who can discern which ILS issues are undervalued will be able to profit from their specialized knowledge. Profitable opportunities will also arise when a tight reinsurance market causes the industry to conserve its scarce capital by pricing coverage at abnormally high levels. In such high rate environments, issuers will be willing to compensate investors more generously than under normal market conditions, raising the expected return to investing in ILSs.

* For indicative pricing and information on specific ILSs on the Bloomberg platform, type SRNM ‹GO›.

Diversification opportunities

Because, as empirical analyses have shown, the occurrence of insurance-related events is uncorrelated with the returns to stocks and bonds, investing in ILSs reduces the overall risk of a diversified portfolio. Indeed, if ILSs represent a limited share of an investor's overall holdings, their inclusion reduces portfolio risk by almost as much as the purchase of a risk-free security. Thus, an ILS need only earn an expected return slightly above the risk-free rate to improve the risk-return profile of a portfolio.

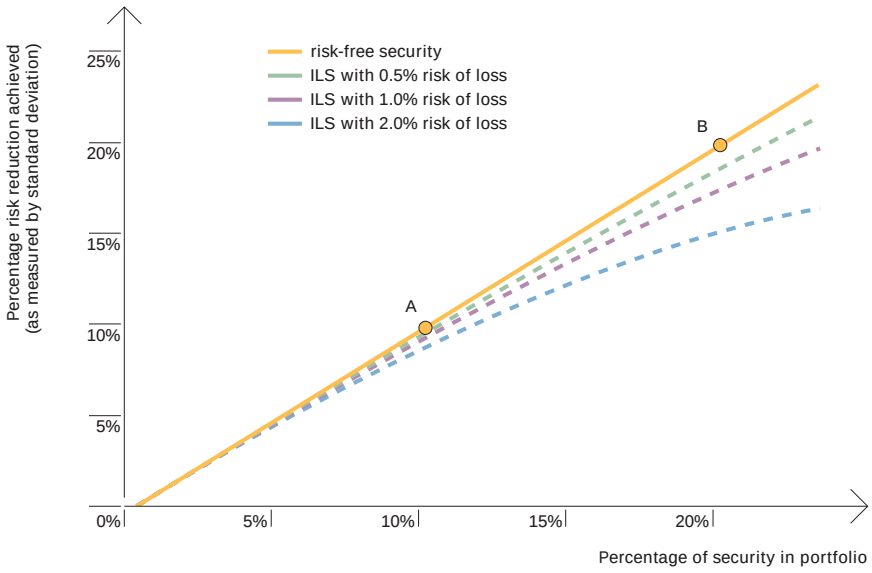
To demonstrate this point, consider a hypothetical ILS structure that pays an agreed-upon yield if no catastrophe occurs but suffers a total loss of principal in the event of a catastrophe, whose probability can be estimated. The greater the probability of catastrophe, the higher the variance of returns to the security.[3] This probability therefore determines the extent to which holding the security reduces overall portfolio risk.

To illustrate, let us compare four securities: a risk-free security (such as a Treasury bill) and three ILSs whose percentage probabilities of total loss of principal are, respectively, 0.5, 1.0, and 2.0. How effectively does each security reduce risk when added to a portfolio of risky assets?

As is well established in the finance literature, adding a risk-free security to a risky portfolio causes a linear reduction in the risk of that portfolio, as measured by the standard deviation of returns (Table 2, solid line). Thus, a ten percent allocation to a risk-free security reduces portfolio risk by ten percent (point A), a twenty percent allocation reduces portfolio risk by twenty percent (point B), and so forth. As Table 2 shows, each of the three ILSs provides nearly as much portfolio risk reduction as does the risk-free asset for allocations of ten percent or less. For larger allocations, however, the risk reduction facilitated by these securities is substantially weaker. Because ILSs are still a new and unfamiliar asset class, we will concentrate on cases in which investors allocate less than ten percent of their portfolios to them.

[3] More formally, if the investor earns a return of r* in the event of no catastrophe and (r*-1) if a catastrophe does occur, then the security has an expected return of $E(r) = q(r^* - 1) + (1 - q)r^* = r^* - q$, where q is the probability of a catastrophe occurring. The security's variance of returns, it can be shown, will equal $Var(r) = q(1-q)$ which, as noted, is an increasing function of q.

Figure 9:
Risk reduction properties of ILSs



One way to express the amount of portfolio risk reduction achieved by investing in an ILS is as a proportion of the portfolio risk reduction realizable through investing the same funds in a risk-free security. Thus, allocating five percent of a portfolio to an ILS securitizing a catastrophe risk whose probability of occurrence is one percent reduces portfolio risk by 97.4 percent as much as would allocating the same funds to a risk-free security (Table 2, Panel A, shaded cell). More generally, for asset allocations of 1 to 10 percent, the three ILSs realize anywhere from 89.0 to 99.7 percent of the risk reduction achievable by investing in a risk-free security.

This, in turn, has implications for the spread above the risk-free rate that an investor will require in order to be indifferent between holding an ILS and a risk-free security. Taking the same example, a 113 basis point (bp) spread would provide a sufficient incentive for investors to allocate five percent of their portfolios to the ILS (Panel B, shaded cell).[4] Of this amount, 100 bp would compensate for the expected loss while 13 bp would compensate for the marginally smaller amount of risk reduction achieved.

[4] This calculation assumes that the portfolio of risky securities earns a risk premium of five percent. The results are very similar for other values of the risk premium.

Table 2:
Risk reduction facilitated by investing in an ILS

Portfolio allocation to ILS (in percent)

Panel A: Reduction achieved relative to a risk-free security			
	Percentage probability of catastrophe		
	.5	1.0	2.0
1	.997	.995	.990
5	.987	.974	.947
10	.972	.945	.890

Panel B: Yield spread above risk-free rate needed to compensate investor for added risk (in basis points)			
	Percentage probability of catastrophe		
	.5	1.0	2.0
1	51	103	205
5	57	113	226
10	64	128	255

Note: Figures in Panel B assume that risky portfolio earns expected return of 5 percent above risk-free rate

These calculations suggest that ILSs pay investors a premium that more than compensates for the risk of loss. For example, Class A securities of the SR Earthquake Fund issue had a risk of loss of less than 1 percent yet paid an annual yield of 255 bp over LIBOR (see pp. 7–8). Thus, investors received a spread above the risk-free rate that was far higher than our calculations indicate. The discrepancy was even greater than this comparison suggests, moreover, because our calculation assumed a total loss of principal in the event of a major earthquake, whereas the security's potential loss was capped at 60 percent.

The difference between the actual and theoretical spread likely reflects several considerations, including newness and liquidity premiums (previously discussed), as well as compensation for model and parameter uncertainty. Model uncertainty reflects our inability to know how faithfully the catastrophe model being used to rate a transaction captures all of its relevant risks. Parameter uncertainty is a concern because even if a model is conceptually perfect, it might still be misestimated owing to insufficient data.

To summarize, investors who substitute ILSs for a portion of their holdings in Treasury securities can achieve a higher expected return on their portfolios for a given level of risk. The high coupons that ILSs pay reflect several distinct factors, which should become less relevant as the market for these securities matures.

One final point to note is that the analysis assumes that an investor buys just a single ILS issue. In actuality, many investors will assemble diversified portfolios of these securities, thereby reducing their risk exposure to any particular event. If buying a single ILS represents an attractive opportunity, owning a diversified portfolio of several such securities would be better still.

Potential non-cat lines of business

The discussion so far has focused on the securitization of catastrophe risks. What other types of insurance risk might be amenable to securitization? To gain some perspective, let us first note some of the qualities that typically characterize asset-backed securitization transactions:

- Historical basis for pricing or quantitative analysis of future income
- Segmentation of business lines
- Regulatory or tax advantage
- General industry motivation to transfer a portion of risk
- Need for capital combined with high cost of capital for general corporate risk

Catastrophe-linked securities satisfy all but the regulatory or tax advantage (same advantage is accomplished by an existing vehicle, reinsurance) although the other characteristics may only be satisfied weakly. One of the stronger motivations is the industry need to handle large, infrequent catastrophes. While other lines of insurance, such as marine and aviation, have been covered through securitizations, the coverage has been small relative to catastrophe coverage obtained in the market.

Another insurance risk that has been securitized in significant size is life insurance. The transactions to date have been motivated by a need for capital to finance acquisitions of existing books of business. Securitization may work well for life insurance because many of the risks that would cause a mismatch between assets and liabilities (policies) are risks that are well understood. The securitization raises money based on the present value of the emerging surplus of the business. Other risks embedded in the surplus include mortality and lapse risk, both of which have a historical basis for analysis. Each transaction differs based on the types of policies included. More of these types of transactions should occur in the future.

Several other lines of business seem well suited for securitization. Workers' compensation and auto insurance are often mentioned because of their historical pricing basis. Mortgage insurance and residual value insurance have both been securitized in the last year. Asbestos and pollution are additional, albeit more challenging, potential lines of business. Although there have been many historical surprises in the loss development of these risks, some of the uncertainty in development patterns has been reduced. Further, the size of future claims in the industry remains quite large, making it an attractive candidate for securitization. Credit insurance, a large European line, is very well suited for securitization because of the existence of capital markets pricing comparables. Finally, securitization may also be attractive for some of the high-severity, low-frequency types of political risks that are now being integrated into coverage.

Although the issuance of insurance-linked securities has begun in earnest, the extent to which the market will grow over the next decade and beyond remains uncertain. We can, however, gain insight into this new market by considering the development of other financial innovations. Especially instructive is the emergence of a market for mortgage-backed securities as well as other asset-backed securities that combine and repackage individual cash flows. Drawing in part on this history, we offer a few observations:

"Early adapters"

Just as the success of a new consumer good often depends upon the acceptance of "early adapters" (trendsetters inclined to try a new product) so too have ILSs had some natural constituencies in the early going: mutual funds, investors with industry knowledge, and hedge funds. The number of participants in these categories seems poised to increase. One such set of investors is yield-conscious bond fund managers. Bond funds, of which there are now thousands, have become a commodity product. Because funds within a given subcategory hold very similar securities, managers seeking to differentiate themselves from their peers actively seek new instruments that provide some pick-up in yield. Insurance-linked securities, in limited quantities, might fit the bill.

Another class of early investors includes firms and individuals with institutional knowledge of insurance markets. The securities offer insurers and reinsurers a simple way of entering a particular market (line of business or region) without building costly infrastructure. Similarly, individuals who have worked in the insurance field, whether as underwriters, actuaries, or security analysts, might open asset management boutiques investing exclusively in these instruments. Finally, hedge funds, which have the flexibility to invest in a wide range of assets, could also take more of an interest in these securities.

Lucrative niches should emerge in the ILS market

A major accomplishment of the mortgage-backed securities (MBS) market is that it reduced the costs of underwriting a mortgage by permitting a more efficient allocation of capital and division of labor through specialization. Before the market developed, banks would typically make mortgage loans, carry them on their books, and service them for the life of the loan. Although they might occasionally swap or sell off a block of loans to another bank, this was a cumbersome activity. Today with the advent of the MBS market, a bank typically makes a loan and then sells it to an agency, such as Fannie Mae or Freddie Mac, which in turn bundles the mortgages, offers credit enhancement, and services the loans.

A similar development may be in store for insurance-linked securities. Today, primary insurers generally sell policies, invest the premiums, service the policies and manage the liability. In coming years, an established market for insurance-linked securities would allow different industry players to assume more focused roles. Some firms can become "virtual insurers," marketing policies by direct mail or phone and then immediately selling off the policies once the sale is made (banks, for example, might find this role attractive).

Other firms might be the securitizers, purchasing policies from a variety of direct insurers, packaging them in ways that appeal to investors (perhaps offering credit enhancements), and then reselling them. Major reinsurers or firms with experience in securitizing assets might be naturals for the role. A third market niche would involve servicing the individual policies – collecting premiums and processing claims, for which a service fee can be collected. Firms with efficient, low-cost back-office capabilities might be especially suited to the role.

Finally, firms that can effectively sell ILSs to clients will stand to earn commissions or placement fees. Investment banks, retail brokers, and reinsurers are candidates for this role. In short, a lesson to be learned from other financial innovations is that there is money to be made by those who successfully specialize in particular securitization-related activities rather than doing everything themselves.

Catalysts for market development

Potential catalysts for market development include the occurrence of a catastrophe, a major stock market downturn, the increased participation of the ratings agencies, and favorable regulatory treatment.

As many observers have noted, a major catastrophe or series of catastrophes could accelerate the market's development. After such an event, some insurers might fail, capital would become scarcer, premiums would rise, and new sources of insurance capacity would be sought. It was just these sorts of shocks that facilitated the growth of the Bermuda market in the late 1980s and early 1990s.

Another type of event that might accelerate the development of the ILS market is a plunge in securities prices, which would have several implications. Insurers and reinsurers would suffer losses on their investments, straining their surpluses and pressuring them to raise premiums in response. Investors, whose expectations have been colored by an extraordinary 15-year bull market in US equities, would grow disillusioned, reduce their equity holdings, and look elsewhere for new investment opportunities.

The involvement of credit rating agencies and regulators can also stimulate the development of the ILS market. As they have begun evaluating deals, the rating agencies have increased the credibility of the securities in the eyes of investors who lack the experience or resources to investigate the details of the security. By assigning ratings to the deals and explaining their evaluation methodologies to the investment community, the rating agencies provide a simple way to compare the risk of different ILSs while inviting comparisons between ILSs and other fixed income securities.

Regulatory reaction to the new securities is important for two reasons. First, if regulators indicate that the risks underlying the securities are adequately disclosed, more investors would feel comfortable owning them. Second, depending on how insurance and banking regulators classify the securities, their owners will receive more or less favorable treatment with respect to taxes and capital requirements. A favorable tax ruling on a particular mortgage-backed structure known as "REMICs" made it a preferred alternative for many issuers and investors in that market.

Deal structure

To win widespread acceptance, the securities must find a proper structure or paradigm. As previously noted, insurance risk can be packaged in a variety of forms. Although each alternative form is merely a different way of dividing the same pool of risk, how the risk is parceled out determines what types of investors will find the securities attractive. Insurance risk packaged as a bond will appeal to a different class of investors than it would if packaged as an option or swap. The choice of structure also has legal, regulatory, and tax consequences.

Because there is no scientific way to determine which financial product design will prove most popular, underwriters will need to experiment with a variety of structures in order to discover which ones appeal most to investors as well as issuers.

Prospects

The potential scale of the ILS market is substantial. Under conservative assumptions, domestic US ILS issuance could reach $10 billion per year within the next decade. The current scale of the US property-casualty market offers a rough sense of the potential markets for ILSs.

For example, in 1997 net written premiums were $45 billion for multiple peril insurance, $129 billion for commercial and personal automobile insurance, $23 billion for workers' compensation, and $60 billion for all other lines. If over the next decade securitizations grew to 5 percent of multiple peril, 2 percent of automobile, 1 percent of workers' compensation, and 2 per cent for all other lines (including the longer tailed liability lines), they would total $6.3 billion assuming no growth in direct premium volumes. Annual premium growth of 3-4 percent over the next ten years would bring this to between $9-10 billion in the US alone, or four to five times the recent $2 billion annual pace of issuance. Thus, while still a relatively small piece of the overall insurance market, it seems quite plausible that ILSs will grow to become an important risk-financing tool.

An interesting question is the extent to which these securities will create new financing possibilities, as opposed to substituting for more traditional insurance and reinsurance financing. If securitization starts to replace traditional insurance financing, insurers and reinsurers will need to either develop expertise in a particular area – be it ILS structuring, risk assessment, or sales and distribution – or face the prospect of declining market share and obsolescence.

For additional information or further inquiries, please contact:

Gail Belonsky, Ph.D.
Director
Swiss Re Financial Products
New York
++01 212 317 5561

Gail heads up the Insurance Securitization group at Swiss Re New Markets. She has been an economic consultant at the New York Stock Exchange and a Vice President in the Mortgage-Backed Securities department at Drexel Burnham Lambert. Gail earned a doctorate in finance from the University of California at Berkeley, a Master of Science from the University of Guelph and a Bachelor of Science from Cornell University.

David S. Laster, Ph.D.
Senior Economist
Swiss Re Economic Research & Consulting
New York
++01 212 317 5587

David earned a Bachelor of Arts in mathematics from Yale University and a doctorate in economics from Columbia University. After completing his doctorate he did research on financial market topics at the Federal Reserve Bank of New York, publishing articles in the *Financial Analysts Journal and the Quarterly Journal of Economics*. David's current areas of research are the demutualization of insurers, integrated risk management, and the securitization of insurance risk.

David Durbin, Ph.D.
Head of Swiss Re Economic
Research & Consulting North America
New York
++01 212 317 5564

David has a doctorate in economics from the City University of New York and has been involved in insurance-related research for 18 years. He has published extensively on economic factors affecting insurance markets and on optimal design of insurance programs, and has testified on insurance issues including profitability and the cost of capital in more than 20 states.

Swiss Re New Markets owes special thanks to Edouard Schmid of Swiss Re's Risk and Reinsurance division for his contributions.

Title: Insurance-Linked Securities

Editor:
Gail Belonsky

Produced by Swiss Re New Markets
Corporate Communications

Graphic design:
Werbebüro Laube,
CH-5426 Lengnau

Photos: Adobe Image Library

To order additional copies of this brochure or a copy of our catalogue of Swiss Re publications, please contact:

Swiss Re Publishing
Mythenquai 50/60
P.O. Box
CH-8022 Zurich
Telephone: +41 1 285 21 21
Fax: +41 1 285 20 23
E-mail: publications@swissre.com
Internet: http://www.swissre.com

MN-MF
4000e, 2/99