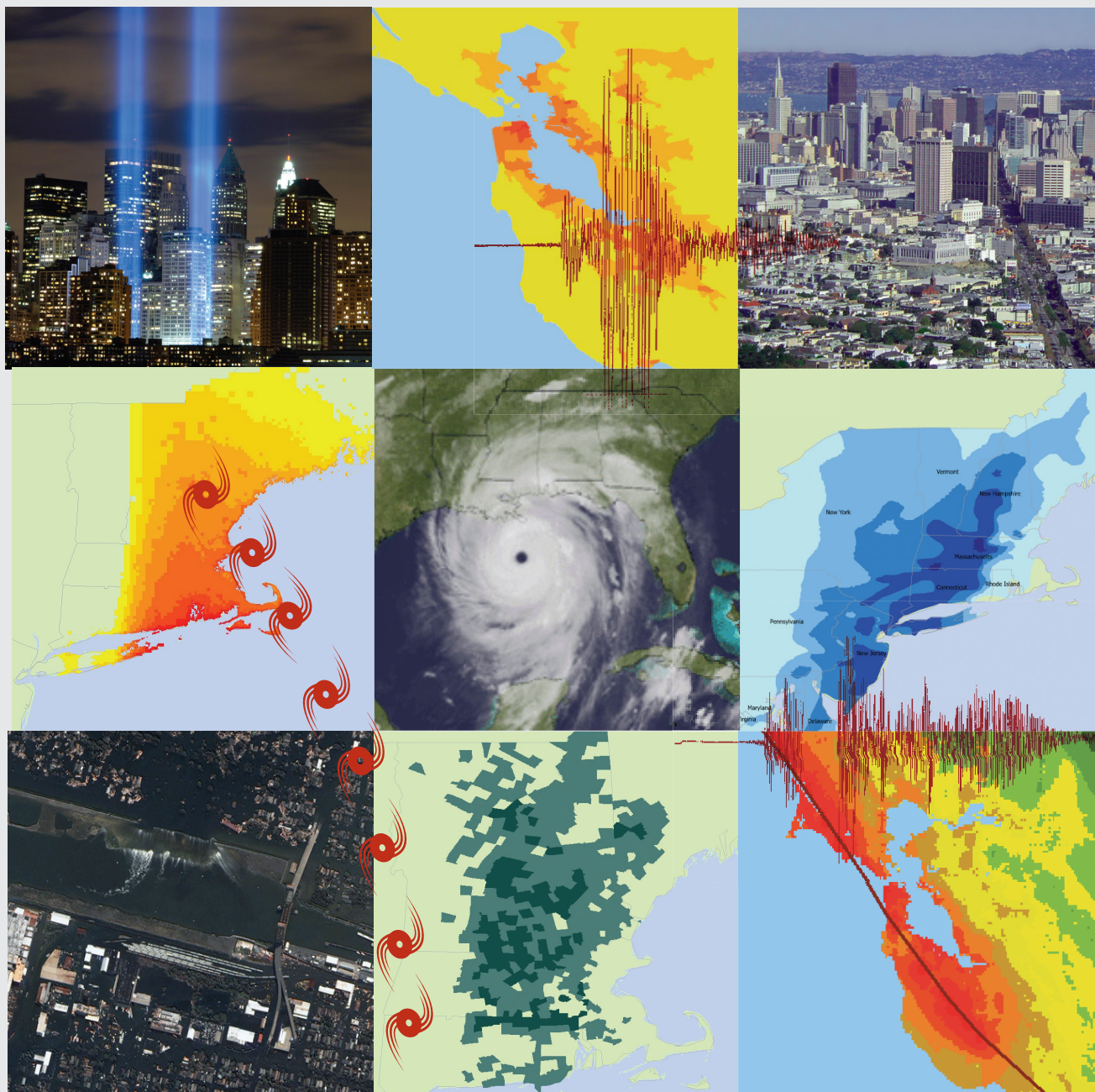


CAT BONDS DEMYSTIFIED

RMS GUIDE TO THE ASSET CLASS



INTRODUCTION

Catastrophe (cat) bonds have attracted investor interest as one of the few asset classes not correlated to the global financial markets.

Cat bonds were first issued in the aftermath of Hurricane Andrew and the Northridge Earthquake in the mid-1990s and the market has grown robustly since. They are the best-known example of a broader class of insurance-linked securities (ILS).

Cat bonds are the most suitable ILS instrument for novice investors because they are 1) rated and 2) freely tradable by qualified investors. They are also an effective way to enhance the risk-return profile of an investment portfolio.

In the current low interest rate environment, the value of cash is being eroded by inflation and

government bonds offer 'return-free risk.' Investors looking for viable uncorrelated alternatives to equities who typically turn to investments in infrastructure or agricultural land will find that catastrophe bonds fit well into an alternative strategy. Relative to other alternative investments, cat bonds offer both low correlation to the market and higher yields for the same level of risk, as can be seen in the Table 1.

Many institutional investors are already successfully including ILS in their portfolios, either through outsourcing to dedicated funds or investing directly.

This guide explores the main features and considerations of a cat bond investment, including different investment routes and key questions asked by new investors in the space.

Table 1:
Comparison of historical returns
and volatility since 2002

Index	Historical Annual Returns	Volatility
Swiss Re Cat Bond Total Return Index	7.98%	2.97%
Dow Jones Credit Suisse Hedge Fund Index	6.38%	5.91%
S&P 500 Index	1.06%	16.24%
Dow Jones Corporate Bond Index	1.19%	6.70%
Private Equity Total Return Index	-2.26%	30.23%

WHAT ARE CAT BONDS?

Cat bonds are a standardized method of transferring insurance risk to the capital markets. The proceeds from the sale of the bond are invested in near risk-free assets to generate money market returns, which combined with an insurance company's premium, allow the bond to pay a substantial spread over money market returns as a quarterly coupon to the investor. If no insurance events occur the investor enjoys the enhanced coupon for the term of the bond, typically three years, and receives the principal back at maturity. If one of the designated events occurs, all or part of the principal is transferred to the insurance company, the investor's coupon payments cease or are reduced, and at maturity there is either zero, or a reduced amount of principal repaid.

It is helpful at this point to delve more deeply into cat bond structures, to explore the key features of any cat bond that need to be understood by a potential investor.

Mechanics of a cat bond

The basic structure of a cat bond (Figure 1) includes five key elements:

1. The sponsoring (ceding) insurance company establishes a special purpose vehicle in a tax efficient jurisdiction.
2. The SPV establishes a reinsurance agreement with the sponsoring insurance company
3. The SPV issues a note to investors; this note has default provisions that mirror the terms of the reinsurance agreement
4. The proceeds from the note sale are managed in a segregated collateral account to generate money market returns
5. If no trigger events occur during the risk period, the SPV returns the principal to investors with the final coupon payment.

Figure 1:
Structure of a cat bond transaction



Cat bond risk

Those who invest in cat bonds are subject to two distinct sources of risk, the first being the insurance risk that the cat bond assumes; the second is the credit risk associated with the collateral account. Investors need to be sure that the constraints on the collateral account provide sufficient protection so that they can be

reasonably sure of the return of their principal absent an insurance event. Most current cat bonds restrict collateral account investment to U.S. Treasury Money Market Funds, but other common solutions include specially issued puttable Structured Notes from the International and European Banks for Reconstruction and Development (IBRD and EBRD), and Tri-Party Repos.

Lessons Learned – The Lehman Brothers Bankruptcy

The significance of the collateral structures has been brought to light by the Lehman collapse. Originally the typical cat bond structure used a Total Return Swap (TRS) by which the counterparty guaranteed that the SPV will receive a return equivalent to LIBOR on its investments in the collateral account. Lehman Brothers was the TRS counterparty for 4 of 119 live cat bonds in the market at the time of its demise; while only a small number of bonds was affected, this caused the market to focus on the safety of underlying assets and design new, more conservative collateral structures that decreased the counterparty risk even further.

TRIGGER TYPES

Turning now to the insurance risk inherent in a cat bond, we will discuss how the triggering events that would cause a reduction in the principal of the cat bond are defined.

The three trigger types commonly used in the cat bond market—indemnity, industry loss, and parametric—are described below. A fourth type, modeled loss, is essentially an expansion of the parametric concept and uses a model in place of an index function.

Indemnity

For an indemnity trigger, the triggering event is the actual loss incurred by the sponsoring insurer following the occurrence of a specified catastrophe event, in a specified geographic region, for a specified line of business.

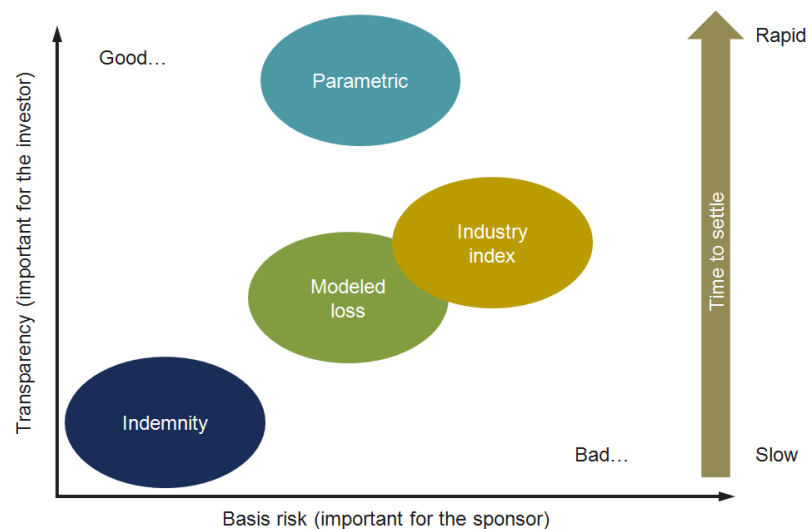
For example, a bond might be structured to trigger if the sponsoring insurer's residential property losses from a single hurricane in the U.S. state of Georgia exceed \$25 million, in the time period from April 1, 2012 to March 31, 2015.

A bond of this type requires extensive legal definitions of the key terms, such as the book of business, recognition of loss, and what constitutes a hurricane.

Indemnity transactions and other risk transfer mechanisms triggered by direct insurance or reinsurance losses have a clear benefit to the sponsor of the transaction. Because the sponsor's specific loss experience is used as the trigger, the funds recovered from the catastrophe bond will match the underlying claims very closely, minimizing the sponsor's basis risk (the difference between incurred losses and the bond payout).

However, these risk transfer mechanisms make the underlying risk less transparent to investors, as they cannot access detailed information on every policy or judge the quality of the sponsoring insurance company's underwriting or loss adjusting. Also, indemnity transactions can take a significant amount of time to settle following a catastrophe event, as the insurer must first assess and tally all claims, which can take a significant time. In some cases the bond will extend beyond the scheduled maturity to allow the sponsoring insurer total all claims, especially if an event has occurred near the end of the bond's risk period. This extension period can be detrimental to investors, as their funds are locked up at significantly lower rates than during the risk period.

Figure 2:
Comparison of trigger types



Industry Loss

In the U.S. and Europe, the main accepted providers of insurance industry loss estimates are Property Claims Services (PCS) and PERILS, respectively. Both firms undertake to provide estimates of the total loss experienced by the insurance industry after a major catastrophe. Cat bonds based on industry loss operate under the assumption that the sponsoring company's portfolio is aligned with the industry and therefore the sponsor recovers a percentage of total industry losses.

Industry loss-based structures are essentially a 'pooled indemnity' solution—the indemnity loss experiences of many companies are used to determine the industry loss estimate. Industry loss triggers are more transparent than pure indemnity transactions as first industry loss estimates from modelling companies are usually available within a couple of weeks after the event. It can, however, take more time for the official loss amount to be released. As for the risk of the bond being extended, it is roughly at the same level as for a pure indemnity bond, and higher than for a parametric trigger.

Parametric

A parametric transaction uses the physical characteristics of a

catastrophe event as the trigger. For example, a pure parametric bond might trigger if an earthquake with a magnitude greater than 7.1 occurs within a 50-km radius of Tokyo. Most parametric transactions are based on an index of the event parameters whereby appropriate weights are applied to measurements from a larger area, which is designed to match the actual losses expected for the sponsoring insurer's business.

Because event parameters are available shortly after an event occurs, parametric transactions are settled much more rapidly than other trigger types and the risk of bond extension is reduced. However, since parametric triggers make no reference to insured loss, there is a likelihood that the sponsor will not receive the precise loss amount experienced from an event. To mitigate this risk, the indices used in the bond trigger are often finely tuned to the sponsoring insurer's exposure. Parametric triggers have proven popular with investors as the trigger is very transparent—the probability of a region experiencing 100 mph winds can be easier to understand than the probability of a particular insurer incurring \$1 billion of losses.

There is no consensus as to which is the optimal trigger type, and the balance of issuance swings depending on whether investor demand or issuer supply is the key market driver.

What is an index formula?

In order to determine whether a parametric bond has been triggered by a cat event or not, the parameters of the event (typically wind speed or earthquake ground motion) are entered into an index formula.

Let's take windstorm as an example: immediately after an event, the calculation agent will use this formula to apply pre-defined weights (w_i – those are set at the time of issuance in line with the distribution of the sponsor's exposure) to the wind speed measurements (v_i) at each of n recording stations.

$$I = f(w, v)$$

If the index value calculated in this process is above the pre-defined trigger level threshold, the bond is triggered. If the value is above the exhaustion threshold, the bond is exhausted.

MARKET OVERVIEW

Why Do Insurers Choose Cat Bonds?

Traditionally insurers have turned to the reinsurance market to offset risks that exceeded their own carrying capacity. Primary insurers are often strongly geographically concentrated, typically limited by national or state boundaries; this offers reinsurers the possibility of gaining diversification benefits by reinsuring primaries on a global basis. Since these diversification benefits will accrue most strongly to reinsurers who are able to diversify across multiple countries and lines of businesses, the reinsurance industry has become strongly concentrated with the biggest five reinsurers (Munich Re, Swiss Re, Berkshire Hathaway, Hannover Re and the Society of Lloyds) underwriting over 50% of worldwide premiums.

At the same time, insured losses from catastrophes have been rising faster than inflation for several decades. This means that very large catastrophes have the possibility of generating losses that exceed the reasonable carrying capacity of the reinsurance industry. The global reinsurance industry has current capital levels of approximately \$400 billion, after peaking at \$470 billion at the end of 2010. To put these numbers into perspective, the largest historical hurricane losses, which occurred in 1926, would if repeated today cause losses of approximately \$125 billion greater than 25% of the reinsurance industry's capital base, although some of this loss would be retained by primary insurers. Given that there have only been rigorous, scientific hurricane observations since the beginning of the last century, there is no reason to expect that the 1926 hurricane losses could not be exceeded; indeed RMS models suggest that hurricanes with the potential to cause loss at the \$200 billion level have a 1-in-125 year probability of occurrence (0.8%). Primary insurers looking to hedge their tail risk are aware of the fact that just when they need this coverage the

most, in the aftermath of a major catastrophe, there is a possibility that the entire insurance industry will be heavily affected and it can't be guaranteed that their reinsurer won't run into payment difficulties.

Another concern for primary insurers is the volatility of reinsurance pricing. Reinsurance losses are inherently unpredictable, but given the relative rarity of catastrophes, the industry typically experiences several years of low losses followed by years with high losses (see "What Affects Prices on p. 8). Cat bonds allow insurers to deal efficiently with both the problem of reinsurance credit risk and with the volatility of reinsurance pricing. The funds resulting from the sale of the cat bond are held in a segregated account that is managed in order to minimize credit risk. As a result the likelihood of an inability to pay claims after a catastrophe is considered very low.

Since cat bond deals are typically three years or longer, insurers can use these instruments to lock in reinsurance rates.

Given the advantages of cat bonds, then, why isn't issuance of these instruments higher? Primarily for two reasons: first, the costs of cat bond issuance are significantly higher than for a traditional reinsurance contract, and are not economically viable for small principal amounts. Second, the number of investors willing to buy cat bonds is still limited, mostly due to lack of familiarity with catastrophe risk.

Spreads and Returns

Given the lack of correlation between cat bonds and other asset classes the expected return on cat bonds should, in theory, be lower than the return of corporate bonds with similar credit quality. However, the market has often seen the opposite: cat bond spreads have generally exceeded those for corporate bonds with equivalent ratings. Investors in cat bonds appear to earn both a liquidity and a 'novelty'

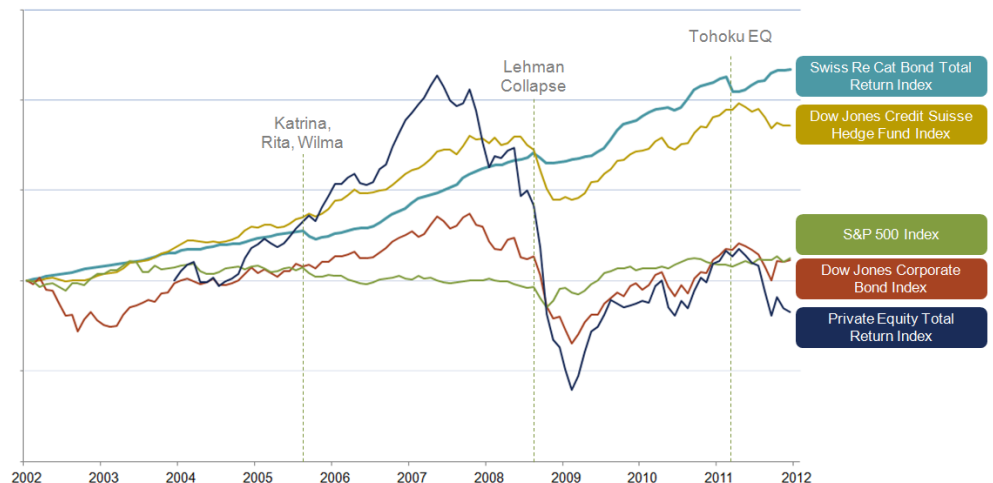
premium for taking insurance risk. The returns are typically in the range of 5-15% above LIBOR, with the average spread for bonds issued in 2011 of 8.85%. The spreads are usually higher for cat bonds bringing peak perils to market (especially hurricanes in the U.S.), and slightly lower for non-peak perils (for example, earthquakes in Turkey) since investors are keen to diversify within their insurance exposure and are willing to accept lower spreads for those perils. This implies that market prices are determined by dedicated insurance funds not by already well diversified investors who would not want to reduce their returns from an already diversifying investment.

Although cat bonds are inherently risky, making it possible for the notional amount to be quickly exhausted once the triggering event occurred, they have historically offered excellent returns. The market performed well even in years with multiple cat event occurrences—there has not been a single 12-month period to date where cat bonds incurred a negative return. Interestingly, historical experience suggests that one key to success in this asset class is the avoidance of a small number of poorly structured bonds.

In 2011 the overall cat bond market returned only 1%, and although 2011 was marked by higher than average insurance losses there were no events extreme enough to trigger the majority of cat bonds. Even the Tohoku Earthquake, while certainly large enough to trigger many cat bonds, had its epicenter located sufficiently far from Tokyo so that most Japanese earthquake bonds, which were designed to cover losses in Tokyo, did not trigger. Yet in spite of the epicenter of the event being away from where most cat bond exposure was located, three bonds were affected, from which one incurred a total loss; if investors had avoided these bonds their returns would have been several percentage points higher than the market.

Even though past cat bond performance cannot be used as an indicator of future performance, the class compares very favorably with other traditional and alternative asset classes, which can be seen by looking at the past performance of the Swiss Re Cat Bond Total Return Index, a benchmark commonly used in the ILS industry. This index, as well others in the Swiss Re Cat Bond series is based on secondary market data and tracks the price, coupon and total rate of return for cat bonds since 2002.

Figure 3:
Performance of the Swiss Re Cat
Bond Total Return Index compared
to other asset classes.



Secondary market

Cat bonds can be traded through an active secondary market. Several intermediaries support the market by bringing the buyers and sellers together as well as by providing indicative bid and offer spreads on all traded catastrophe bonds.

While the secondary market has yet to be fully developed, as deals are normally made on a matched trade basis, indicative bids provided by the intermediaries are very useful when performing ILS portfolio valuation.

What affects prices?

The pricing of insurance linked securities will largely depend on reinsurance pricing, and reinsurance pricing is mainly dictated by the frequency and severity of natural catastrophes. It is not dependent on events in financial markets: a financial crisis will not trigger an earthquake and an earthquake will typically not cause a financial crisis. There are though indirect linkages between the financial markets and the cat bond market which the investor needs to monitor. At times when the overall market is experiencing tight liquidity, investors may use cat bonds as a source of liquidity: this happened in the immediate aftermath of the Lehman collapse in September 2008. Conversely, if reinsurers suffer capital writedowns as a result of losses on their investment book, both reinsurance rates and the spreads on newly issued cat bonds will tend to increase which will put downwards pressure on the prices of already issued cat bonds.

The reinsurance market is cyclical, which has a major effect on bond spreads. The occurrence of a major cat event will significantly erode the amount of capital available in the insurance industry, which can lead to a hard market of low supply and high reinsurance prices. During a hard market, cat bonds may be less expensive than reinsurance and an attractive option for sponsors, leading to increased volumes of bond issuance. In contrast, during a soft market, reinsurance prices decline and given

the costs of issuing a cat bond, sponsors might opt to seek protection through traditional reinsurance and retrocession. A soft market will continue until the next catastrophe when the capital becomes a constraint again and the cycle resets.

The fixed bond spread is determined at the time of issuance and chosen to provide appropriate compensation for the risk assumed by investors; i.e., it is dependent on the expected loss of a bond. The spread will also be influenced by the point of time in the reinsurance cycle: spreads tend to be higher in a hard market and lower in soft market, mirroring what happens in the traditional reinsurance space.

In addition to this, cat bond secondary market prices fluctuate throughout the year. Those movements are influenced by a variety of factors such as shifts in the aggregate supply and demand of the market (for example, prices in the secondary market can be depressed by an influx of new, well priced cat bonds), but specifically because natural perils, particularly hurricanes, have distinct seasonal exposure patterns which are reflected in the secondary market pricing. It is often the case that prices fall in anticipation of a hurricane season, especially if forecasts predict above-average activity, and rise when U.S. wind bonds come off risk as the season closes.

Market participants

The ILS investor base is continuously expanding, attracting more global capital every year. While dedicated ILS fund managers remain the largest investor group (absorbing approximately 70% of new issuance), the asset class has recently attracted a large pool of institutional investors, money managers and pension funds increasingly drawn to ILS because of the market's returns during the financial crisis and its liquidity profile. The Eurozone sovereign debt crisis has in particular made investors from different market segments turn their attention to ILS. The convergence market has seen a remarkable \$3 to 4 billion of new fund inflows at the beginning of 2012.

ASSESSMENT OF CATASTROPHE RISK

The metrics that are most commonly used when discussing risk associated with a catastrophe bond are the expected loss (EL) and attachment and exhaustion probabilities. At the portfolio level investors examine the return period losses, or the likelihood of exceeding different loss thresholds. These metrics are calculated through the use of catastrophe modeling software, available from companies like RMS. Models are essential to the evaluation of cat bonds or any other ILS, as there is usually no systematic claims experience for extreme events with such a low probability of occurrence and an actuarial approach relying on historical data is inappropriate. In order to assess the likelihood that a given contract will trigger, models use a simulated set of

thousands of possible catastrophe events that could occur in a given area and affect a given portfolio of risk. Based on the loss estimates for each of those stochastic (simulated hypothetical) events and its probability of occurrence, a set of metrics including the expected loss and the exceedance probability curve (illustrating a range of return periods and corresponding losses) is calculated.

The evaluation of the underlying catastrophe risk is always carried out by a modeling company as part of the cat bond preparation process, and the results are published in the cat bond offering circular and the pricing supplement.

HOW DO I INVEST IN ILS?

As with any other asset class, exposure to cat bonds can be gained through an engagement with a dedicated ILS fund, direct investment, or a combination of the two.

Dedicated ILS funds

There are a number of dedicated ILS funds in the ILS market that accept mandates from institutional investors. They tend to be located in global financial and insurance centers like the U.K., Switzerland, Bermuda, and the U.S. The advantage of investing through a dedicated fund is instant diversification: by choosing a pooled solution, investors gain access to a share of a large ILS portfolio that they would not be able to take on quickly on their own. The other advantage is expertise: dedicated ILS funds have market experience in performing due diligence on new investments and typically use ILS portfolio modeling and monitoring software that allows them to assess each individual investment as well as overall portfolio risk.

The typical fee structure ranges from a base of 1-2% of assets managed plus performance fees of 10-15%.

Direct investment

Many investors choose to invest directly. As with other asset classes, the advantage of direct investment is the ability to maintain full control of the portfolio and the investment strategy. The approach to diversification is an important factor: the level of diversification a dedicated ILS fund will seek is often much higher than that needed for a small allocation of cat bonds in a portfolio of alternatives.

It is often the case that institutional investors initially enter the space by engaging with a specialized investor but at the same time start developing in house expertise and eventually bring all or a portion of the portfolio in house.

CONCLUSIONS

The market for cat bonds and other ILS has been attracting more institutional investors over the years. Leading ILS fund managers report new waves of institutional capital being drawn to this space, eager to take advantage of the market's diversification potential and possibilities of excellent return. Despite the evident increased interest, catastrophe bonds remain a niche asset class that has not yet found a way into most mainstream portfolios.

For investors with an appetite for a more interesting risk-return profile, being an early adapter of a new alternative asset class like ILS is an attractive option, especially while catastrophe bond spreads are high compared to other asset classes.

All sources indicate that the market is set for continuous growth – there is a steady supply of new offerings and additionally, the upcoming implementation of Solvency II regulations for the insurance industry will likely result in increased issuance by European sponsors.

Contact RMS

To receive more information or to arrange a meeting to discuss how RMS could support your investments in cat bonds, please contact any of the individuals listed below:

Robert Stone
Senior Director, US East Coast
+1 201 912 8643
robert.stone@rms.com

Peter Nakada
Managing Director, US East Coast
+1 201 912 8644
peter.nakada@rms.com

Marta Abramska
Manager, RiskMarkets, London
+44 207 444 7736
marta.abramska@rms.com

John Stroughair
VP, RiskMarkets, London
+ 44 207 444 7834
john.stroughair@rms.com