Natural Event Risk Is a Strong Fundamental Diversifier

By Peter J. DiFiore, PhD, CAIA®, Cedric Drui, CFA®, CAIA®, and Charles Mixon

The search for diversification in investment portfolios has led many investors to consider alternative assets. However, most of the familiar alternatives including private equity, venture capital, timber, or infrastructure are highly illiquid, lack transparency, and have been found to correlate in times of non-normal market stress. The true diversification value of other alternative asset classes, in particular hedge funds and commodities, is questionable. Indeed, the flight to quality during the global financial crisis of 2008–2009 was a painful reminder that correlation among asset classes is not a static measure.

Correlation can and will change rapidly during periods of extreme turmoil, and even more so when liquidity issues come into play. Modern portfolio theory, with a narrow focus on portfolio beta, does not factor in contagion risk and overstates the diversification benefits of high yield bonds, commodities, hedge funds, real estate, and even private equity. By comparison, most insurance-linked securities (ILS) retained their value during the financial crisis, demonstrating the near zero-beta feature of these financial instruments.¹

ILS effectively provide a form of risk transfer, reducing accumulations of low probability, high severity risks away from operating companies, primary insurers, and/or reinsurance companies. Property catastrophe reinsurance specifically focuses on losses tied to the occurrence of extreme but infrequent events such as hurricanes and earthquakes, which generate widespread damage to residential and commercial properties (and therefore losses for insurers). The development of products to securitize these risks gave birth to the ILS asset class.

Natural catastrophe reinsurance is a natural diversifier providing an uncorrelated return stream without the need for complex financial engineering. Furthermore, regulatory capital constraints on market participants, the exotic nature of the risk, and multiple barriers to entry provide for attractive risk premia across wide segments of the market. As described below, a well-constructed portfolio of industry loss warranties provides investors with highly transparent exposure to natural event risk with limited ancillary risks.

**Historical Background**

The business model of reinsurance is capital-intensive and highly regulated. Regulators and rating agencies make their capital requirement determinations based on modeled exposure to both existing losses in the reinsurers’ portfolios that have not yet been paid, and also to potential future losses. In particular, these determinations are driven by peak areas of concentrated risk for reinsurers, which typically involve natural catastrophe exposures.

Low probability, high severity natural catastrophe events pose a systemic, solvency risk to primary insurance companies. Therefore, rating agencies and regulators impose high capital charges on companies accumulating natural event risk above pre-defined stress thresholds. This exogenous force creates demand for risk transfer. The transfer of risk occurs contractually in many forms. Over the past decade, direct capital markets investors have assumed these risks through fixed income instruments and other securities fueling an $80-billion insurance-linked securities market.

Fundamentally, ILS represents the convergence of the world of reinsurance and the capital markets. The need for this alternative form of risk transfer emerged in 1992 in the aftermath of Hurricane Andrew, which depleted the capital base of traditional insurance and reinsurance companies. Hannover Re issued one of the first insurance-linked securities in 1994, allowing investors to earn returns directly tied to the occurrence and severity of extreme natural events, which are inherently uncorrelated to broader economic conditions.

The size of the ILS market has experienced sustained, rapid growth of nearly 20 percent...
In recent years, investor demand for ILS has accelerated due to a search for alternative yield and strong performance of the asset class, especially through the 2008–2009 financial crisis. Figure 1 highlights the low correlation between ILS (using the Swiss Re Cat Bond Total Return Index as proxy) and traditional asset classes since inception of the ILS index in January 2002. Over these 15 years, the correlation between the Swiss Re Cat Bond Total Return Index returns and the S&P 500 Total Return Index is 0.17 compared to 0.68 for both the Barclays U.S. Corp High Yield Total Return and Credit Suisse Hedge Fund indexes.

**Investment Options**

Several options are available to investors who seek to capture the risk-return profile of insurance-linked securities, including engaging in direct reinsurance as well as custom structures called sidecars, quota shares, catastrophe bonds, and industry-loss warranties (see table 1).

**Reinsurance Sidecars and Quota Share**

Reinsurance sidecars are financial structures, typically referred to as special purpose vehicles (SPV) or special purpose insurers (SPI), established to allow third-party investors to take on a pro-rata exposure to the risk and returns of a single traditional reinsurer’s portfolio. Unlike traditional reinsurance, sidecars are usually fully collateralized and of limited duration (typically from one to three years, subject to renewal). The terms and risk-return profiles of sidecars vary widely. Quota share agreements provide investors with similar specific exposure but without the need of an SPV.

**Catastrophe Bonds**

Catastrophe (cat) bonds are 144A securities, structured as floating-rate principal-at-risk notes of three- to five-year maturity, and designed to transfer reinsurance risk to the capital markets. A central feature of a cat bond is its trigger mechanism, which defines the type of event that would cause a loss to the notes.

The trigger mechanism could be based on actual insured losses of the issuer (known as indemnity cover), industry-index losses (aggregating all insured losses in the covered area), or even parametric-data (e.g., wind speed measurements). Today most catastrophe bonds (66 percent of those issued in 2016) are indemnity-based, with the balance being mostly index-based, and a very small number with parametric triggers.

Capital market investors earn a return based on the spread paid by the sponsor and interest on collateral, which together form the coupon paid by the bond. At the maturity date of the bond, investors receive the outstanding principal amount, which is net of any payment to the sponsor to cover the sponsor’s losses resulting from a triggering event.

**Industry Loss Warranties (ILWs)**

ILWs are private investment contracts enabling the transfer of catastrophe risk from the protection buyer to the capital market investor (see figure 2). The term “industry-loss” refers to the fact that the triggers for the contracts are based not on the losses of a specific issuer but rather on covered losses across the insurance industry. Such triggers are analyzed more...
easily than those of a single reinsurer because robust, detailed, and widely accepted models have been developed for such industry-wide risk. Such losses are calculated and reported by an independent reporting agent.

ILWs are typically cash-collateralized by both parties at inception in full, eliminating counterparty credit risk. ILWs are short-term instruments, often less than 180 days in duration, and are self-liquidating. In addition, because they are privately negotiated instruments, ILWs allow customization of risk and return profiles.

ILWs tend to be smaller in size than cat bonds (an average of approximately $10 million per contract compared to an average of $150 million for a typical cat bond issuance) but enjoy much greater market depth, with hundreds of ILWs being sold every year compared to roughly 30 catastrophe bond issuances. The total annual ILW market is roughly equivalent to the annual primary issuance of cat bonds and estimated to be $5 billion–$7 billion per year.

A Detailed Primer on ILWs
The ILW contract form as first traded between reinsurance companies started to appear in the London market in the late 1980s covering property risk (McDonnell 2002). Between 1987 and 1990 a series of major catastrophes led to a collapse in the London-based international insurance market and demand for ILWs increased. Syndicates of Lloyd's were the initial buyers and contract coverages were very broad with low attachment level triggers. Most ILWs at this time were written by a few large international reinsurer companies. Volume and diversity of trigger types grew substantially following Hurricane Andrew in 1992. Since the early 1990s, the level of customization has increased significantly and, as noted above, the market now covers $5 billion to $7 billion of notional size annually traded within a private market.

ILWs are bespoke contracts in which the specific characteristics are agreed upon by both parties in advance. The final form and price of an ILW arises from a negotiation with key variables being the term, the limit, and the trigger. The term of an ILW generally is six months, but can be as short as days around an actual event, known as a “live cat” ILW. Each ILW has a “limit” or notional size that is composed of the premium paid by the buyer and the net exposure or capital at risk from the seller. The limit is funded by both parties into a dedicated collateral trust that, for the life of the agreement, holds U.S. Treasury money market funds or other low market risk assets (which provide risk-free rate flow through). The key characteristics of the trigger are customized and include peril, region, severity, frequency, reporting index, and reporting period.

ILWs have the following several advantages over other ILS instruments:

**Customizability:** Each ILW is individually negotiated, allowing investors to build custom portfolios and match those portfolios with their risk-return appetite as well as to manage the duplication of risks. The ILW’s bespoke nature and short duration allow for active management of the portfolio and the ability to manage around shorter-term environmental considerations.

**Transparency:** The objective third-party calculations of industry losses and the simple nature of the transactions permit a maximum level of transparency for the risks incurred.

**Reduced adverse-selection risk:** Neither party to an ILW contract has an information advantage over the other, because the relevant framework is of industry-wide losses rather than a specific insurance portfolio.

**Short-term tenor:** The short tenor of ILW instruments (six months) enables an assessment of the risk and return available in the investment close to the time when risk is incurred. This compares to a period of years, which is typical for a sidecar or cat bond. The short tenor also minimizes interest-rate risk and minimizes liquidity issues, because the investments automatically turn to cash in a relatively short period.

**Ability to capture the pure natural event risk:** ILWs are triggered only when a pre-defined and included event occurs; some ILS instruments cover all events except those explicitly excluded (nuclear war, etc.). Collateralized reinsurance, particularly in recent years, has expanded terms to include perils such as cyber threats and terrorism, which can also damage the value of the non-correlated nature of ILS.

**Reduced loss-development periods:** Unlike traditional reinsurance, where claims may be litigated and delay final loss determinations for several years, the use of an industry index trigger permits a final resolution of ILW contracts within months after a major event.

**Continuous open market:** Unlike traditional reinsurance, which has designated renewal dates, the ILW market is open for trading throughout the year, which permits active management of an ILW portfolio.

**Historical Event Losses**
ILWs may be structured for any potential type of event and span insured loss levels from $5 billion to $200 billion. However, the largest volume is transacted at catastrophic levels at or above the largest.
Pricing and Risk Management

Compared to more-traditional asset classes (equity, fixed income, and even private equity), the idiosyncrasies of the ILS asset class require a unique set of skills and methods to properly evaluate the risk and return of a potential investment. In order to do so, ILS managers typically will use proprietary tools as well as specialized third-party software to evaluate the probability of low-frequency, high-severity catastrophe risk. These models are well-vetted and utilized widely by those within the ILS world, including rating agencies and regulators.

Table 2: Top 10 Costliest Insurance Market Catastrophes

<table>
<thead>
<tr>
<th>Rank</th>
<th>Date</th>
<th>Peril</th>
<th>Original Dollars (Million)</th>
<th>Inflation Adjusted to 2015 Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug. 2005</td>
<td>Hurricane Katrina</td>
<td>$41,100</td>
<td>$49,047</td>
</tr>
<tr>
<td>2</td>
<td>Sep. 2001</td>
<td>September 11th Events</td>
<td>$18,779</td>
<td>$24,613</td>
</tr>
<tr>
<td>3</td>
<td>Aug. 1992</td>
<td>Hurricane Andrew</td>
<td>$15,500</td>
<td>$24,111</td>
</tr>
<tr>
<td>4</td>
<td>Oct. 2012</td>
<td>Hurricane Sandy</td>
<td>$18,750</td>
<td>$19,563</td>
</tr>
<tr>
<td>5</td>
<td>Jan. 1994</td>
<td>Northridge, CA Earthquake</td>
<td>$12,500</td>
<td>$18,597</td>
</tr>
<tr>
<td>6</td>
<td>Sep. 2008</td>
<td>Hurricane Ike</td>
<td>$12,500</td>
<td>$13,826</td>
</tr>
<tr>
<td>7</td>
<td>Oct. 2005</td>
<td>Hurricane Wilma</td>
<td>$10,300</td>
<td>$12,292</td>
</tr>
<tr>
<td>8</td>
<td>Aug. 2004</td>
<td>Hurricane Charley</td>
<td>$7,475</td>
<td>$9,207</td>
</tr>
<tr>
<td>9</td>
<td>Sep. 2004</td>
<td>Hurricane Ivan</td>
<td>$7,110</td>
<td>$8,758</td>
</tr>
<tr>
<td>10</td>
<td>Apr. 2011</td>
<td>Flooding, hail, and wind</td>
<td>$7,300</td>
<td>$7,757</td>
</tr>
</tbody>
</table>

Source: as reported by the Insurance Information Institute, http://www.iii.org/fact-statistic/catastrophes-us

Table 3: Sample Catastrophe Model Output

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Type</th>
<th>Severity</th>
<th>Location</th>
<th>Industry Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hurricane</td>
<td>Category 4</td>
<td>Miami-Dade County, FL; Gulfport, MS</td>
<td>$32.5 billion</td>
</tr>
<tr>
<td>1</td>
<td>Earthquake</td>
<td>Magnitude 7.5</td>
<td>Oakland, CA</td>
<td>$25.2 billion</td>
</tr>
<tr>
<td>2</td>
<td>Hurricane</td>
<td>Category 1</td>
<td>New York County, NY</td>
<td>$2.9 billion</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>10,000</td>
<td>Hurricane</td>
<td>Category 2</td>
<td>Harris County, TX</td>
<td>$7.2 billion</td>
</tr>
</tbody>
</table>

Table 4: Summary Statistics for ILW Portfolio Analysis

<table>
<thead>
<tr>
<th></th>
<th>60/40 Portfolio</th>
<th>10% ILW allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of years</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Minimum</td>
<td>-14.2%</td>
<td>-10.9%</td>
</tr>
<tr>
<td>Maximum</td>
<td>31.9%</td>
<td>31.2%</td>
</tr>
<tr>
<td>Annualized</td>
<td>10.0%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>10.4%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.67</td>
<td>0.73</td>
</tr>
</tbody>
</table>

The output of this risk analysis is generally in the form of a loss distribution from numerous events precompiled into a stochastic catalog. The probability distribution of these losses can be used to calculate a technical price that is equivalent to the average simulated loss (expected loss2 or EL) plus a risk load, often expressed as a multiple of standard deviation (see Kreps 1990 and Ishaq 2005).

Sample model output based on a 10,000-year simulation is given in table 3.

Adjustments for model biases, non-modeled factors, and short-term seasonal risk considerations also may be applied to arrive at a more complete view of risk.

ILWs As an Attractive Portfolio Addition

To examine the marginal benefit of the inclusion of ILWs within a portfolio, we analyzed a simplified portfolio that added two ILWs to a 60/40 portfolio (i.e., 60 percent invested in equities, as proxied by the S&P 500 and 40 percent invested in bonds, as proxied by 10-year Treasury bonds).

For this illustrative analysis, we created a portfolio of two ILWs, the first of which represented 60 percent of value and triggered upon the occurrence of any U.S. hurricane causing greater than $30 billion in insured loss. The second ILW triggers for any U.S. earthquake that exceeds $15 billion of insured loss.

A re-analysis of all events since 1976 suggests these ILWs would have triggered only during Hurricane Andrew in 1992; the Northridge, California, earthquake in 1994; and Hurricane Katrina in 2005. For our analysis, we applied an independent market price proxy by scaling today's market price (14 percent and 6.5 percent return on capital, respectively) into the past with the Guy Carpenter U.S. property rate on line index.3

The analysis shows that a 10-percent allocation to the portfolio over 40 years generates a 3-percent increase in annualized returns, a 5-percent drop in volatility, and a...
Diversification Considerations

Figure 3 highlights the benefit of adding natural event catastrophe exposure via a portfolio of ILWs to an investor portfolio. Both the annualized return and Sharpe ratio increase relative to the 60/40 portfolio.

While some investors may have concern of drawdown should those two predefined natural events occur, any ILW allocation should be considered in the context of a long-term holding and as a part of a broader, diversified alternative investment program or within an opportunistic sub-portfolio. Furthermore, a more diversified portfolio of ILWs (beyond the two chosen here for the sake of simplicity) with limited intra-contract correlation mitigates the potential for significant event drawdown.

On the other hand, over diversification within ILS may result in erosion of risk-adjusted returns and the accumulation of unknown or poorly understood risks that may expose investors to numerous attritional loss events and significant underperformance with time. Unexpected losses have been common in the reinsurance markets. Attritional losses can however be mitigated by ensuring strict management of risk quantification, close attention to settlement considerations, and, above all else, disciplined pricing of risk-return opportunities. ILWs, due to their “clean,” structural exposure to industry index losses only, offer portfolios strong intrinsic protection against unknown risks, particularly when applied to peril regions with good risk quantification tools as well as quality post-event reporting structures.

Given the diversification benefits from a strategic asset allocation to this asset class, more attention should be paid to maximizing risk-adjusted returns and appropriate sizing within the portfolio.

Conclusions

Insurance-linked securities focused on natural catastrophe risk exposure offer attractive returns that are uncorrelated with traditional investment asset classes. Within the ILS asset class, ILWs offer customizable, highly transparent natural event-linked returns with inherent structural protection from potential counterparty and ancillary risks. ILWs currently provide attractive risk-return attributes in addition to powerful diversification benefits within a wider portfolio.

Peter J. DiFiore, PhD, CAIA®, is a managing director with Cartesian Re Management Co. He earned a BS in chemistry from North Carolina State University and MA and PhD degrees from the Department of Geosciences at Princeton University. Contact him at peter.difiore@cartesianre.com.

Cedric Drui, CFA®, CAIA®, is a managing director with Cartesian Re Management Co. He earned an MS in mathematics and an MS in atmospheric and space sciences from the University of Michigan, and an aerospace engineering degree from the École Nationale Supérieure de l’Aéronautique et de l’Espace. Contact him at cedric.dru@cartesianre.com.

Charles Mixon is a managing director with Cartesian Re Management Co. He earned a BA from Elon University and an MA from Indiana University. Contact him at charles.mixon@cartesianre.com.

Endnotes

1. Some forms of ILS, such as catastrophe bonds, did succumb to brief periods of contagion correlation as investors unable to sell other assets drew liquidity by selling catastrophe bonds that retained a level of underlying value in a move that some dubbed “a rush to the ATM.”

2. Expected loss is the mean value of all losses calculated over a long simulation period, generally reported as a percentage of value in a given year.

3. The Guy Carpenter U.S. Property Rate on Line (ROL) Index is the proprietary index of U.S. property catastrophe reinsurance rate-on-line movements, on brokered excess of loss placements, that has been maintained by Guy Carpenter since 1990. The index covers U.S. property catastrophe renews. It is updated following January 1st renewals and July 1st renewals reflecting the full year, by calculating the change in ROL year on year across the same renewal base. http://www.artemis.bm/indices/regional-property-cat-rate-on-line-index.html.

References


This article does not constitute a recommendation, or an offer to sell or a solicitation of an offer to buy any securities.