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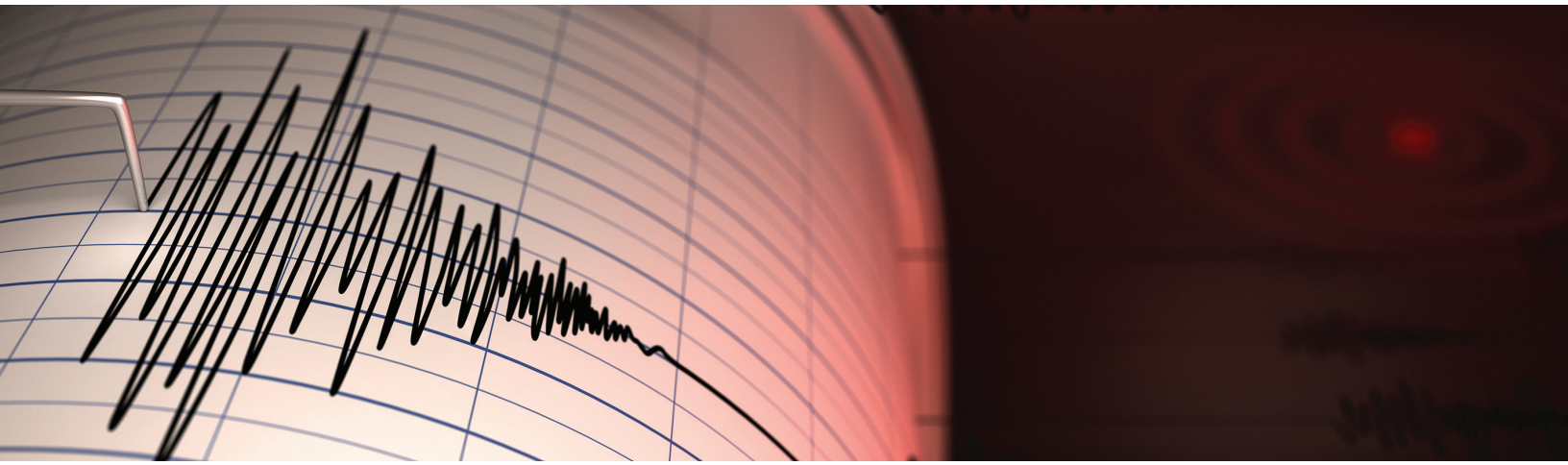

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Diversifying into Insurance Risk Premia

Traditionally, natural catastrophe risk from events such as hurricanes and earthquakes has been underwritten and largely retained by insurance and reinsurance companies. The traditional approach has been a transfer of the risk from the generally smaller balance sheets of primary insurance companies to the larger, more global balance sheets of reinsurers. Over recent decades, this has been changing. In pursuit of capital efficiency and better solvency, the insurance industry has been offloading these risks and the associated premiums to increasingly receptive capital markets, via various types of Insurance-Linked Securities (ILS).

In this paper, we describe the characteristics of ILS and their usefulness to institutional investors. We show that adding a particular type of ILS, Industry Loss Warranties (ILWs), to typical endowment, pension and insurance portfolios would have led to an improvement in risk-adjusted returns and resilience to tail market scenarios while conforming to the usual constraints and regulatory requirements faced by these investors. We also explain why ILWs may present some unique advantages among all ILS types.

Executive Summary

- Today's institutional investors face some common challenges: the current credit cycle has experienced a very long extension; sovereign spreads are generally tight but have become volatile in some countries; balance sheet tail risks are increasing; and the search for yield has driven investors into more illiquid alternative asset classes.
- Traditionally, natural catastrophe risk has been the domain of the insurance and reinsurance industries. In recent decades, however, the capital markets have begun taking on a greater role in natural catastrophe risk in the form of ILS.
- We believe Insurance-Linked Securities (ILS) provide genuine diversification from traditional asset classes and offer attractive risk-adjusted returns.
- In our view, the rapid growth of the ILS market reflects the potential benefits they bring to both sides of the equation: freeing up solvency capital for insurers while providing a diversified source of return for investors.
- We focus on one particular type of ILS, so-called Industry Loss Warranties (ILWs), which are short-duration, small ticket-size, privately negotiated contracts that are based on standardized indices rather than specific indemnities. They offer portfolio construction agility and ease of deployment for institutional investors.
- We show that adding ILWs to models of typical endowment and pension portfolios would have improved their balance sheet efficiency and reduced their exposure to credit cycles and sovereign spreads while conforming to their objectives and constraints.
- We also explain why we think ILWs may be a viable choice for insurance investors: their transparency and easy-to-understand nature make it easy to incorporate them into an insurance capital model and have their use approved by the regulator. In particular, they provide a strong source of long-term solvency stability improvement.

Today's institutional investors face some common challenges. It is widely believed that we are in the late stages of a credit cycle that has experienced a long extension mainly due to post-crisis quantitative easing policies. Sovereign spreads are at a low level, but can and have become volatile in some countries. Global equity markets have become more unpredictable. Thus investment managers with a conventional allocation structure are exposed to the tail risk coming from the lack of diversification between the major asset classes—credit, sovereign bonds and equities. Institutional investors who are subject to duration, capital and quality constraints in particular have increasingly deployed capital into illiquid alternative investments. How these assets will behave in a stressed market scenario is uncertain.

Against this backdrop, we would like to discuss the merits of a relatively new asset class, Insurance-Linked Securities (ILS). These are used to transfer insurance risk from an entity, such as a (re)insurer, to capital market investors. Their values are linked to non-financial risks such as natural perils or longevity/mortality. Insurers and reinsurers often sell these products to the capital markets to free up their own capital resources to write additional business, to meet their solvency objectives, and to make their balance sheet more efficient from a regulatory and solvency perspective—this last point being particularly pronounced in stress-test-based regimes such as Solvency II.

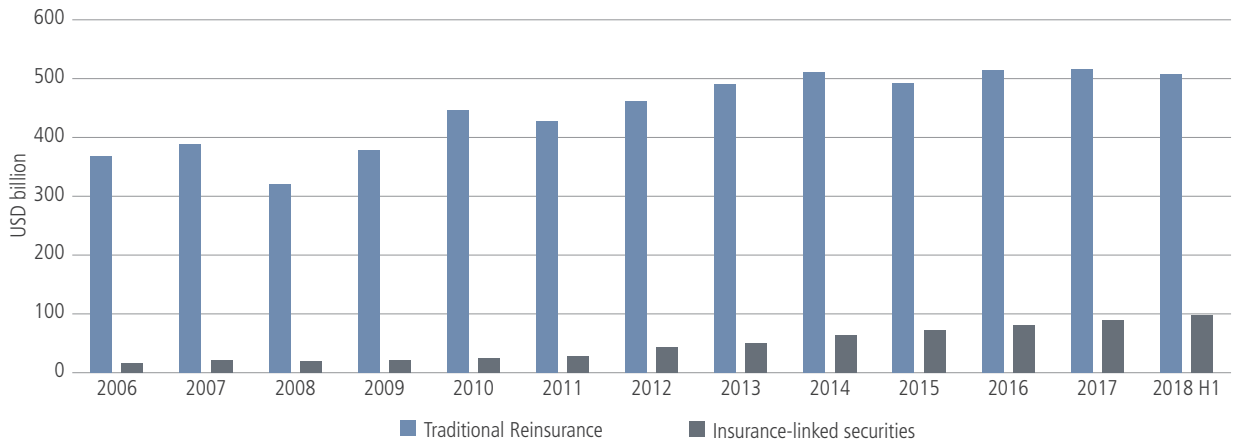
Generally, ILS products come in the form of natural catastrophe bonds ("CAT bonds"), sidecars, quota shares and industry loss warranties. There are also insurance risk transfer contracts that are not securitized, such as longevity swaps. In this paper, we briefly describe the history and diversification benefits of the Insurance-Linked Securities ILS asset class before elaborating on Industry Loss Warranties (ILWs) and their unique characteristics when placed in institutional investment portfolios.

Introduction to ILS

During the 1980s and '90s, several unprecedented industry-insured loss events such as Hurricane Hugo and Hurricane Andrew caused severe capital drain in the traditional reinsurance market. Both insurance regulators and credit rating agencies urged insurers to find ways to transfer some of their risk exposure. As a response, various types of innovative insurance risk transfer product were introduced into the financial market. The first Industry Loss Warranty contract covering property catastrophe risks originated in the London markets in the late 1980s. In the mid-1990s, AIG, St Paul Re, Hannover Re and USAA developed innovative bond-type structures that allowed investors direct access to the returns from natural catastrophe insurance.

The ILS market has grown fivefold since 2006. By the first half of 2018 the market was worth almost $100 billion, some 16% of the industry's total reinsurance capital (Figure 1).

FIGURE 1. THE GROWING MARKET IN INSURANCE-LINKED SECURITIES
Size of the ILS and total reinsurance market, 2006–2018



Source: Aon Securities, Inc.

The impetus for that growth is manifold. As the number of sponsors and deals grew from a small base, the market became more institutionalized and deal origination became more efficient. ILS product design became more customizable and that made it easier for investors with no prior experience to enter the field. Because (re)insurers face tighter regulatory solvency requirements, they have less capacity for exposure to catastrophe risk, and that creates a potential "solvency risk premium" for investors who are not subject to the same solvency regime.

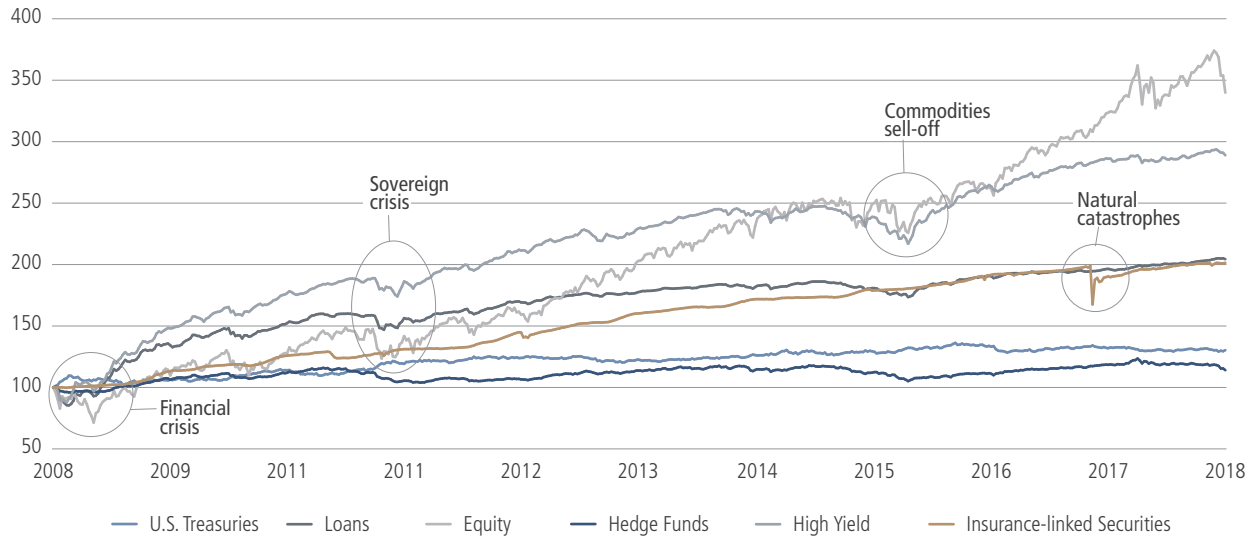
As Figure 2 shows, an ILS investment, represented by the Swiss Re Cat Bond Total Return Index, not only delivered an annualized return in excess of 7% between 2008 and 2018, but has done so entirely unaffected by events such as the 2008–09 financial crisis, the 2011 sovereign debt crisis or the 2015 oil and emerging-markets sell-off.

This is not to say that ILS contracts are foolproof. Natural catastrophe events do occur. The volatility in 2017 reflected concerns about the $100 billion of insured losses incurred that year due to events such as Hurricane Harvey, Hurricane Irma, Hurricane Maria and California wildfires. A successful ILS investment team would be expected to adjust geographical and categorical exposures, and apply hedging strategies to mitigate the extent of drawdown under such circumstances.

Nonetheless, ILS are by their very nature uncorrelated with financial markets. No recession ever caused an earthquake, and an Atlantic hurricane is unlikely to trigger a sell-off in the S&P500 Index. For investors with portfolios dominated by financial market risks, we believe ILS are a robust source of diversification.

FIGURE 2. ILS PERFORMANCE VERSUS OTHER ASSET CLASSES 2008–2018

Cumulative returns, 2008–2018



Correlation between ILS and Major Financial Indices, 2008–2018.

	Insurance-Linked Securities	High Yield	Hedge Funds	Equity	Loans	U.S. Treasuries
Insurance-Linked Securities	1.00					
High Yield	0.03	1.00				
Hedge Funds	0.04	0.58	1.00			
Equity	0.03	0.55	0.67	1.00		
Loans	0.04	0.86	0.49	0.44	1.00	
U.S. Treasuries	-0.05	-0.25	-0.31	-0.43	-0.34	1.00

Source: Bloomberg. As of October 2018. Indices used: Swiss Re Cat Bond Total Return Index, Bloomberg Barclays US Corporate High Yield Total Return Index Value Unhedged USD, Hedge Fund Research HFRX Global Hedge Fund Index, S&P 500 Total Return Index, Markit iBoxx USD Liquid Leveraged Loans Total Return Index, Bloomberg Barclays U.S. Treasury Total Return Unhedged USD. See index definitions at the end of this paper. **Past performance is no guarantee of future results.** Indexes are unmanaged and are not available for direct investment.

Types of ILS

Since the inception of ILS, several different risk transfer products have become available to investors:

Reinsurance Sidecars and Quota Share

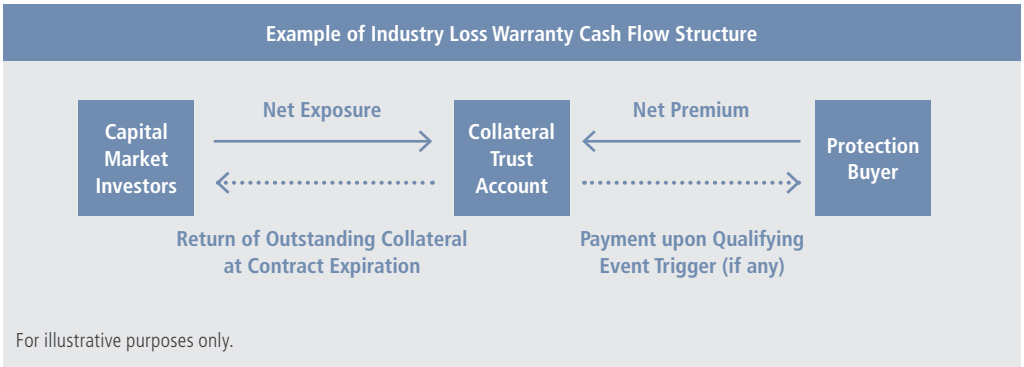
Reinsurance sidecars, or special purpose vehicles (SPV), are financial structures designed to allow third-party investors to access, on a pro rata basis, the risk and returns of a single reinsurer's portfolio. These structures are generally fully collateralized and terminate after a certain period. Quota share agreements allow for similar access, but without the need for an SPV.

Catastrophe Bonds

Catastrophe bonds are 144A securities that are structured as floating-rate principal-at-risk notes, with maturities of three to five years. A CAT bond's trigger mechanism defines the type of event that would result in a loss of principal. This trigger is mostly defined based on the actual insured loss to the issuer, industry losses or parametric data (such as wind speed). The coupon paid to investors is based on the spread paid by the sponsors and the interest on collateral. When the bond matures, the investors receive the outstanding principal amount minus any payments to the sponsor from triggering events.

Industry Loss Warranties

ILWs are smaller ticket size (usually around $10m), privately negotiated contracts with short duration and bespoke terms. Each ILW is fully collateralized, and is composed of a **net exposure** paid by the investor and a **net premium** from the protection buyer. The moneys from both parties are kept in a dedicated trust that, for the life of the agreement, holds Treasury, money market funds or other low-risk assets. The sum is paid out to the insurer in the event of a qualifying loss, or to the investor at expiration, net of any qualifying losses.



For illustrative purposes only.

Insured losses are determined independently with reference to an industry index. ILWs will state a **territory** within which the qualifying insured losses occur (ranging from a single U.S. state to worldwide, but with the majority covering all U.S. states and territories); a **term** to expiration (mostly 180 days, but ranging from days to years); and the **perils** covered (hurricane, earthquake, etc).

Benefits of ILWs

One of the key aspects of ILWs is that the structure is based on industry-wide losses rather than the portfolios of specific perils that are used in more traditional reinsurance. That reduces the risk of adverse selection because neither the investor nor the protection buyer has an information advantage over the other.

ILW deals are privately negotiated, making the deal structures customizable and generally more straightforward. This flexibility allows investors to build custom portfolios and to actively manage these portfolios around shorter-term environmental conditions. Thus institutional investors may assess their risk/return characteristics and incorporate them into their risk management framework.

ILW contracts are generally small in size (usually $10 million per contract, versus $150 million for a typical CAT bond issuance), relatively numerous (hundreds are written every year, against a few dozen CAT bonds), and they have short maturities and reasonable liquidity. These features make them easier to deploy as part of a sizable institutional mandate with tailored objectives and timelines, as well as ease of entry, exit and exposure adjustment needed at times of perceived incoming losses or after an insured-loss event.

Case Studies

In the final section of this paper, we use examples of an endowment fund and a defined benefit pension scheme to show how the addition of ILWs might help them better achieve their objectives, while respecting their constraints and requirements. We also examine a hypothetical case where a life insurer CIO faces a decision whether to allocate to an ILS sub-portfolio and which type of ILS investments to use.

	CASE STUDY 1 Endowment Fund	CASE STUDY 2 DB Pension Scheme	CASE STUDY 3 Life Insurer
Asset Allocation	Growth-oriented	Balanced	Balanced
Objectives	Diversify return; reduce drawdown and forced-selling risk	Coverage ratio growth without increase in risk exposure or volatility	Decide which type of ILS to invest in and how to onboard it

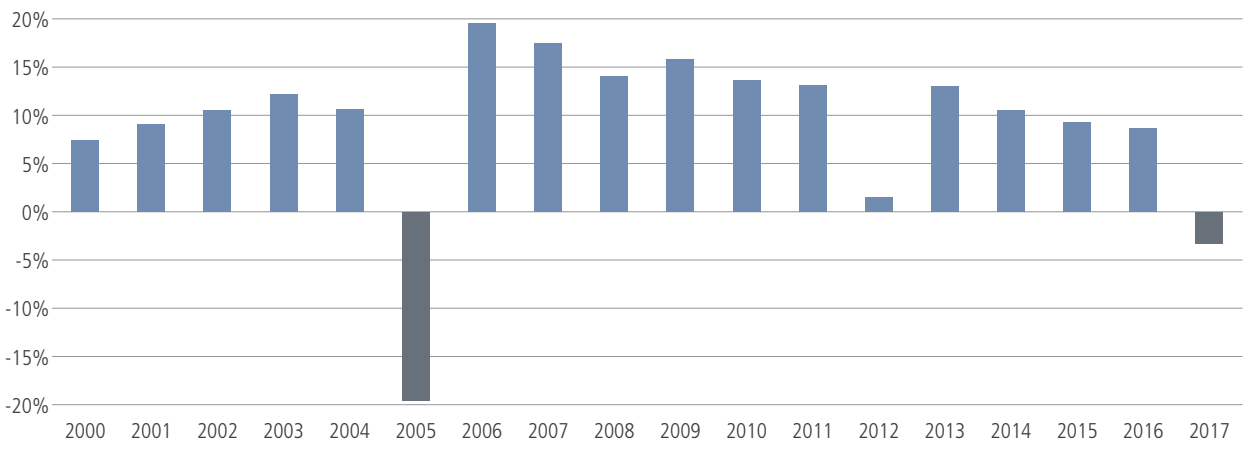
To support our hypothetical backtests, we modeled what we consider to be a typical, diversified ILW portfolio consisting of 11 underlying contracts, shown in figure 3. We referred to a widely used investable index as our starting point for selection, which we refined by constraining the portfolio to U.S. exposures, but representing all the major regions and the full range of perils, in proportions similar to the broad market. The resulting portfolio is exposed to different peril, territory and industry loss triggers—from a contract that triggers for a $5 billion or greater industry hurricane loss in New England and New Jersey (Contract 3), to a contract that triggers when an earthquake loss in the U.S. is greater than or equal to $30 billion (Contract 2). In practice, such a portfolio can be tailored to an investor's preferences.

Although we can estimate the probability of a given contract being triggered using various natural catastrophe pricing models, the ultimate return on capital for each contract is determined based on market pricing and the occurence of contract triggering events.

The yearly market price for each contract is based on the current market price and the Guy Carpenter Regional Property Catastrophe Rate-on-Line Index. This index represents the historical pricing of natural catastrophe reinsurance since 1990. Combining the current market price and Guy Carpenter Index allows us to estimate the historical market price for each contract. The returns for each contract can then be calculated based on that estimated market price of the contract and the net exposure, which determine the amount of capital required for the contract. The impact on each contract from historical events, such as Hurricane Katrina and Hurricane Sandy, is determined using a third-party catastrophe model and any losses are reflected in the presented returns. More specifically, if and when an event triggers a contract, all or part of the collateral is claimed by and paid to the counterparty, and is no longer available to the investor at the expiration of the contract. The amount of capital at risk is limited and expressly described in the ILW contract. While often binary, there may be use of payout functions based on event severity or other negotiated factors.

Figure 3 shows the yearly performance of our hypothetical backtested model portfolio between 2000 and 2017. Large events corresponding to negative returns include Hurricane Katrina (2005), Hurricane Wilma (2005) and Hurricane Irma (2017). While Hurricane Sandy (2012) was a large event, the diversification of the portfolio protected against a negative return.

FIGURE 3. CALENDAR-YEAR RETURNS TO A HYPOTHETICAL BACKTESTED MODEL ILW PORTFOLIO



Hypothetical Portfolio constituents

Contract	Limit ($m)	Name
1	10	Florida Hurricane $30bn and California Earthquake $35bn
2	10	U.S. Earthquake $30bn
3	15	New England and New Jersey $5bn
4	10	U.S. All Natural Perils $30 bn x $30bn
5	25	CA Earthquake $35bn
6	7.5	U.S. Hurricane and U.S. Earthquake $60bn
7	10	Florida Hurricane $25bn
8	15	Florida Hurricane between $15bn and $25bn
9	10	U.S. Earthquake $30bn
10	15	U.S. Hurricane $30bn
11	10	U.S. Earthquake $15bn

Source: Neuberger Berman analysis of market prices and Guy Carpenter Regional Property Catastrophe Rate-On-Line Index. The weight of each contract is determined by its total limit. When a contract triggers, it registers a total loss and produces no further returns for the remaining months of the year in which it was triggered. The portfolio is re-set at the start of each year. For illustrative purposes only. Based on a hypothetical backtested model between 2000 and 2017. Please see important disclosures at the end of this paper.

Case Study 1: Endowment Fund

An **Endowment Fund** usually has the objective to make consistent annual payouts while protecting its real value against inflation. It typically has a relatively liberal risk appetite and a correspondingly high target return.

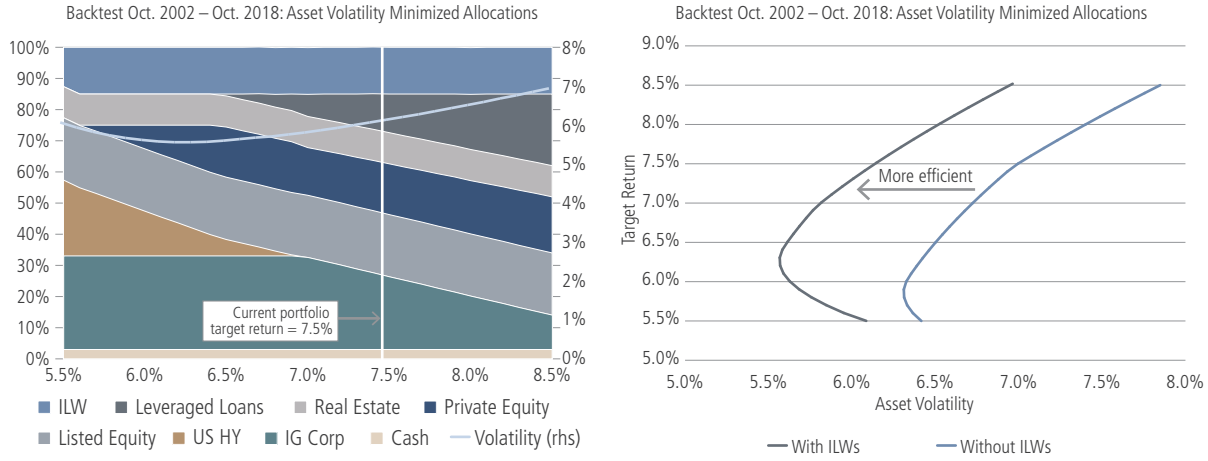
We assume a growth-oriented asset allocation: 25% listed equities, 25% private equity, 25% real estate, 8% investment-grade credit, 8% high yield, 8% leveraged loans and 1% cash. The management team is concerned that these assets may represent an overly concentrated risk profile in a market downturn, in which case the fund might be forced to sell assets to meet its annual payout requirement. On the other hand, safer assets such as Treasuries or a bigger allocation to investment grade credit might not meet its long-term target return of 7.5%. The fund wishes to diversify its sources of return to protect its downside, but maintain the return potential as much as it can.

We first perform a portfolio optimization to determine an ideal asset allocation based on historical experience, with the expected returns reflecting our long-term forward-looking assumptions. Our optimized portfolio has an allocation cap of 30% per sub-portfolio, except for

listed equities, which are capped at 80%; total illiquid assets, capped at 50%; cash, capped at 3%; and ILWs, which are capped at 15% of the overall portfolio. We then compared the efficient frontier of this optimized portfolio with that of the current allocation.

The volatility-minimized allocations are shown below. We can see that the ILWs, due to their near-zero correlation with other financial assets, are favored up to their allocation cap of 15% at all target return levels. We also tested Conditional VaR-95 minimized allocations and a different historical period of Oct. 2008 to Oct. 2018; the results looked similar to what is shown, given the relative simplicity of the allocation structure and portfolio constraints.

FIGURE 4. DIVERSIFICATION: ILWs HIT THEIR ALLOCATION CAP IN A VOLATILITY-OPTIMIZED PORTFOLIO AT ALL LEVELS OF TARGET RETURN



Source: Bloomberg, Neuberger Berman analysis. The charts show results for a portfolio optimized for target return versus volatility, with allocation caps of 30% for each sub-portfolio, except for listed equities (capped at 80%), total illiquid assets (50%), cash (3%) and ILWs (capped at 15% of the overall portfolio). For illustrative purposes only. Based on a hypothetical backtested model between October 2002 and October 2018. Please see important disclosures at the end of this paper.

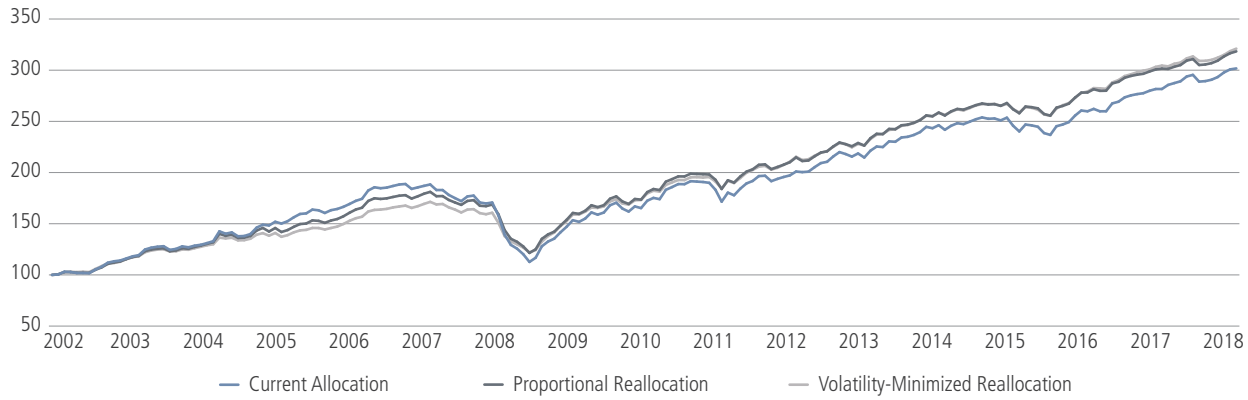
Because an endowment fund is likely to make only small changes to any one of its separate asset buckets at a time, not least because some of the buckets are very illiquid, we went on to compare three cases: 1) The current allocation; 2) The volatility-minimized portfolio that results from the current target return of 7.5%, with 15% in ILWs; and (3) Re-allocating 15% to ILWs by reducing the allocation to each of the current asset buckets, proportionately, rather than making the big changes to particular buckets that are implied by volatility minimization. Figure 5 shows the results.

FIGURE 5. TWO WAYS TO ALLOCATE 15% OF AN EXISTING PORTFOLIO TO ILWs

Portfolio allocations and risk-return characteristics, October 2002 – October 2018

	Current Portfolio Allocation	Proportional Reallocation from Existing Buckets to a 15% ILW Allocation	Volatility-Minimization Allocation
Asset Allocation			
Cash	1%	1%	3%
IG	8%	7%	23%
HY	8%	7%	0%
Listed Equity	25%	21%	20%
Private Equity	25%	21%	16%
Real Estate	25%	21%	10%
Leveraged Loans	8%	7%	13%
ILW	0%	15%	15%
Risk & Return Characteristics			
Target Return	7.50%	7.60%	7.50%
Volatility	8.40%	7.20%	6.20%
Max Drawdown	-40.30%	-32.90%	-28.80%
Conditional VaR-95	-5.70%	-4.60%	-3.80%
Equity and Credit Risk	–	Reduced	Reduced

Cumulative returns of the three allocations, October 2002 – October 2018



Source: Bloomberg, Neuberger Berman analysis. Conditional Var-95 represents the average loss experienced in the worst 1-in-20 scenario. For illustrative purposes only. Based on a hypothetical backtested model between October 2002 and October 2018. Please see important disclosures at the end of this paper.

Case Study 2: DB Pension Scheme

In general, as **Defined-Benefit (DB) pension schemes** mature, asset allocation moves away from equities to bonds and other asset classes. A mature DB scheme with a coverage ratio close to 100% would theoretically have little risk appetite—its primary objective would be cash flow matching. However, few schemes have this luxury; they tend to be maturing, but also burdened with a coverage ratio below 100%. Funds in this situation require higher returns than bonds can generate, but cannot afford to be overly exposed to equity market downturns.

The solution to this dilemma on the asset side of the balance sheet is to seek diversified returns while minimizing the risks being taken against the duration, inflation and longevity assumptions embedded in the scheme's liabilities. Since 1997, bonds, equities and cash allocations have reduced to varying degrees while allocations to other assets, such as real estate and other alternatives, have increased from 4% to 25% across worldwide pension schemes, according to the 2018 Global Pension Asset Study from consultancy Willis Towers Watson.

Our hypothetical DB pension scheme is invested 10% in global equities, 10% in private equity, 10% in real estate, 25% in investment grade corporate bonds, 10% in high yield, 20% in taxable municipal bonds and 15% in U.S. Treasuries. Its current coverage ratio is 83%, with liabilities fairly evenly distributed. The scheme's assets must match the duration of its liabilities within +/-2 years before the use of any derivatives or leverage.

Suppose the trustees' objective is to enhance the coverage ratio to above 100% within 10 – 15 years' time. They believe that a target return of 5.5% p.a. and some changes to the Strategic Asset Allocation are necessary for this to be feasible, but they cannot introduce any more market risk into the portfolio.

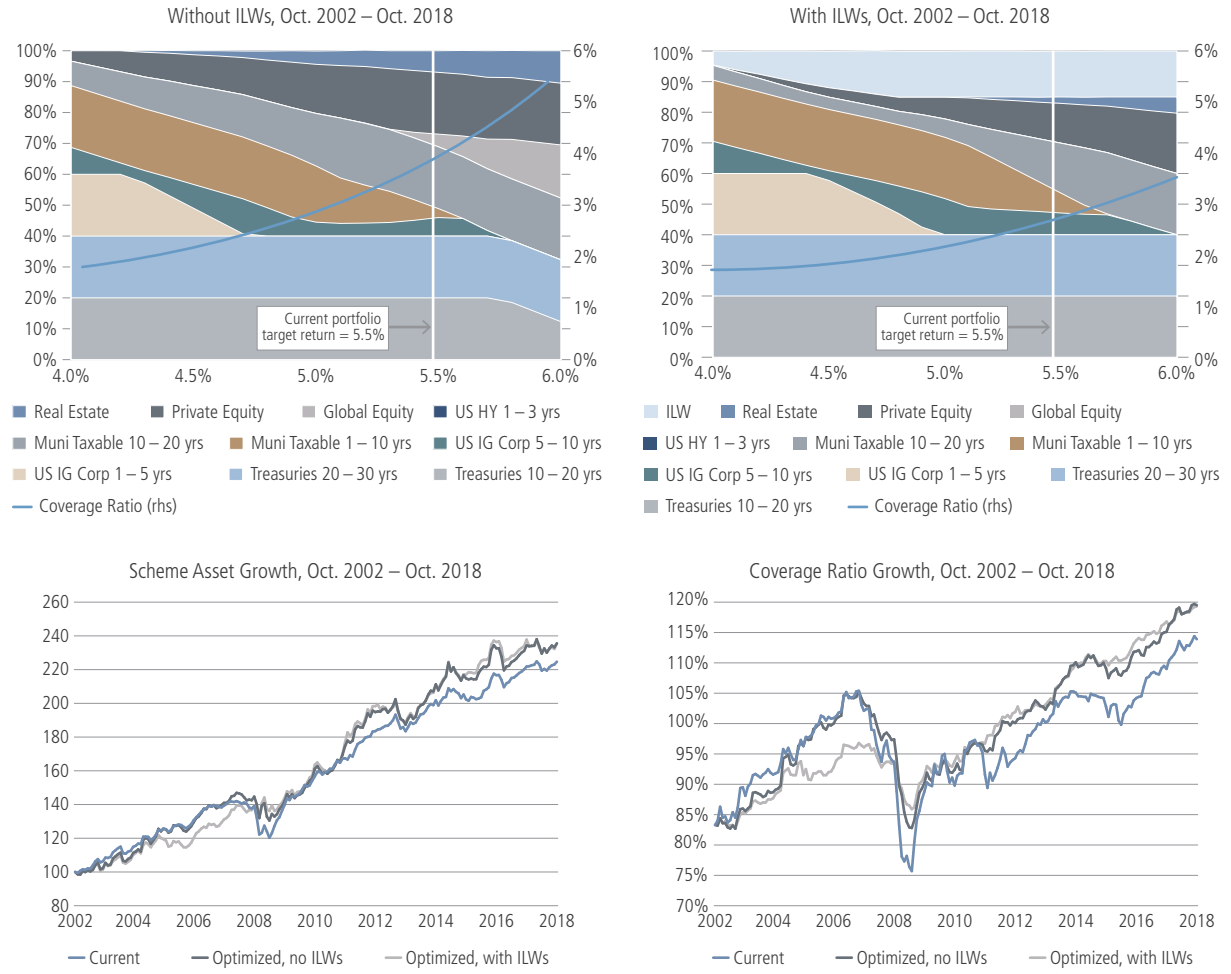
The top two charts in figure 6 show two coverage-ratio-volatility-optimized asset allocations for different levels of target return: one with and one without the use of ILWs. Asset class expected returns used are based on our long-term forward-looking assumptions. A 20% cap is placed on each sub-portfolio of assets in the analysis, except for ILWs, which are subject to a cap of 15%. The upward-sloping line shows the volatility of the scheme's coverage ratio at different levels of target return, while the vertical line is drawn at the trustees' desired target return.

It can be seen that, when they are included, ILWs are favored up to their allocation cap of 15% at all target return levels higher than 4.5%. At the desired level of target return, 5.5%, the 15% allocation to ILWs comes mostly at the expense of growth assets and alternative fixed income in the portfolio, which means that the allocation still matches the duration of the scheme's liabilities within the permitted range. The shallower slope of the coverage ratio volatility line indicates how effective adding ILWs to the optimization is with regard to this objective.

The bottom two charts in figure 6 show the asset growth and coverage ratio evolution for the pension scheme, given its current asset allocation, the allocation optimized for minimal coverage ratio volatility but without ILWs, and the optimized allocation that includes ILWs. It can be seen that the evolution of the coverage ratio growth is much smoother when ILWs are included in the asset portfolio, illustrating the pronounced benefits of having this uncorrelated strategy as a minor allocation.

From an operational point of view, an ILW fund will offer liquidity somewhere between listed equities and private equities—quarterly redemptions and subscriptions are the norm—and therefore the inclusion of an ILW allocation is unlikely to change substantially the general liquidity profile of a typical pension fund. The bond-like cash flows from the ILWs may even help a scheme enhance its cash flow scheduling capabilities.

FIGURE 6. PORTFOLIOS OPTIMIZED FOR MINIMAL PENSION COVERAGE RATIO VOLATILITY



Source: Bloomberg, Neuberger Berman analysis. The top charts show results for portfolios optimized for target return versus coverage ratio volatility, the first without ILWs and with all asset class allocations capped at 20%, and the second with ILWs added to the optimization, but capped at 15%. For the bottom charts, we assume that sponsor contributions and outgoings cancel each other out, so that the results reflect only investment-related changes in assets. The current allocation is 10% global equities, 10% private equity, 10% real estate, 25% investment grade corporate bonds, 10% high yield, 20% taxable municipal bonds and 15% U.S. Treasuries. For illustrative purposes only. Based on a hypothetical backtested model between October 2002 and October 2018. Please see important disclosures at the end of the paper.

Case Study 3: Life Insurer

Finally, the CIO of a **life insurer,** part of a global bancassurer, sees a recent push from the Group Board for a more diversified asset allocation: the life entity currently holds an allocation dominated by domestic sovereign bonds (60%) which, under Solvency II, are highly capital-efficient, but which in reality cause a lot of movement in the insurer's solvency position. In fact, a recent, sudden capital drain has stalled the Group's dividend payments to all entities.

The CIO is considering making a small allocation of up to 5% to ILS, having been persuaded of the asset class's diversification and yield benefits. However, she still has to decide which categories of ILS to invest in, and to take into consideration that this asset class is unfamiliar to most of her investment and risk team; catastrophe risks are not considered in the Internal Model of the life company; and the regulator may have concerns about headline risk and block the application.

Several considerations inform the CIO's decision:

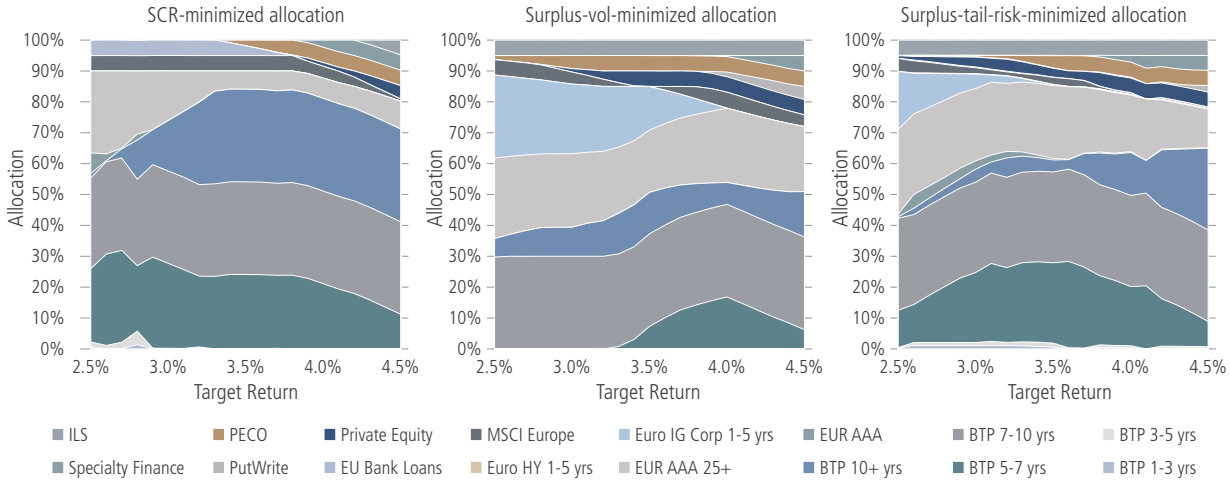
1. **Liquidity, transparency and flexibility.** The insurer wants to have a flexible deployment schedule and a relatively liquid and transparent profile. The ILS portfolio profile should allow for a small degree of tailoring.
2. **SCR calculation.** Under the Solvency II Standard Formula, there are no standardized U.S. peril definitions or solvency capital requirement (SCR) calibrations. The life company's Internal Model does not include risks arising from U.S. perils. Therefore it needs to find an "easy" catastrophe risk model to use.
3. **Regulatory approval.** Onboarding a new strategy will absorb significant time and effort, and therefore the CIO will need to be confident that the models, and the ILS asset class or sub-asset class chosen, will be acceptable when presented to the insurance regulator.
4. **Headline risk and claims risk.** The life company will have to explain clearly to the regulator and its policyholders why it has decided to take on these new risks, and confirm whether and how it is still meeting the Prudent Person's Principle. This includes ensuring the development of potential claims is not too long, so as to avoid unpleasant surprises to the annual P&L statement.

Given these considerations, we believe there are a number of reasons why ILWs may be the most suitable type of ILS investment, detailed in the table below. A prudent approach may be to build an ILW-majority portfolio complemented with selective allocations to other ILS.

	Industry Loss Warranty	Cat Bonds	Sidecars
1. Liquidity, transparency and flexibility	– Although privately negotiated, with short durations and more contracts around, effective liquidity is good – High transparency – Easier to structure as a diversified portfolio	– Relatively liquid – Primary issuance only for certain slots during a year – Issue sizes are larger	– Less liquid than CAT bonds – Low transparency
2. Ease of SCR calculation	– Relatively easy to calibrate since all based on worldwide/U.S. standardized indices	– Relatively easy if based on standardized indices – Otherwise, indemnity cover types have region-specific risk types that are difficult to calibrate	– Low transparency of deals may lead to difficulty in SCR estimation
3. Likelihood of getting insurance regulator's approval for investment	– More likely, because the geographical distribution and peril categories are more transparent and there is little adverse selection risk	– Easier for those with standardized geographical distribution and peril categories – Adverse selection risks exist for indemnity cover types	– Adverse selection risk and settlement risk are quite high for investors unfamiliar with these types of deals
4. Headline risk and settlement risk	– Low because of high transparency and short claims development period	– Generally low as the asset class becomes more mainstream – Longer claims development period	– High because of deal complexity – Long claims development period

Having made the operational case for ILWs, how do they perform against the insurance company's investment and risk-management criteria? In figure 7, we show three allocations, using ILWs, optimized for the Solvency II solvency capital requirement, minimized surplus volatility and minimized surplus tail risk (defined as CVar-95). Asset class expected returns used are based on our long-term forward-looking assumptions. ILWs and other alternatives are capped at 5%.

FIGURE 7. INSURANCE PORTFOLIOS OPTIMIZED IN THREE WAYS, USING ILWs



Impact on risk and return characteristics, Oct. 2008 – Oct. 2018

		Alternative allocation plans					
	Current Allocation	SCR Minimized	Change	Surplus Volatility Minimized	Change	Surplus Tail Risk Minimized	Change
Surplus							
Surplus Return	10.00%	11.60%	1.50%	14.40%	4.40%	14.10%	4.10%
Surplus Volatility	61.00%	85.10%	24.10%	49.90%	-11.10%	56.90%	-4.10%
Surplus Maxd Drawdown	-56.50%	-68.10%	-11.50%	-59.90%	-3.40%	-50.60%	5.90%
Surplus VaR-95	-18.40%	-23.20%	-4.80%	-16.60%	1.80%	-18.90%	-0.40%
Surplus CVaR-95	-29.00%	-30.50%	-1.50%	-25.90%	3.10%	-23.90%	5.10%
Solvency							
Solvency Volatility	72.10%	94.90%	22.90%	55.70%	-16.40%	65.00%	-7.00%
A/L Ratio Annual Growth	1.20%	1.50%	0.30%	2.10%	0.90%	2.10%	0.80%
Average SCR	7.20%	4.50%	-2.70%	7.90%	0.60%	5.80%	-1.40%
Return on SCR	34.10%	66.40%	32.20%	43.70%	9.50%	57.80%	23.70%
Solvency Sharpe Ratio	0.14	0.12	-0.02	0.26	0.12	0.22	0.08

Source: Bloomberg and NB calculations. ILWs and other alternative investments are capped at 5% in all three portfolios. The current allocation shown in the table is 15% in Sovereign 1-3, 3-5, 5-7 and 7-10 each; 15% in Sovereign 10+; 7.5% in AAA covered bonds and covered 25+yrs each; 5% in investment grade corporate bonds; 5% in high yield; 10% in equities. Traditional bonds and equities are capped at 30%; alternative assets are capped at 5%. The total equity allocation and the total alternatives allocation are kept between 5% and 20% for the life entity and 5% and 15% for the property & casualty entity. The average rating of the life entity's fixed income holdings >=BBB; that of the P&C entity >=A-. The asset-liability duration gap of both entities is kept within +/-2.5 years (scaled to assets). In the backtest and the statistics, underwriting effects are ignored in order to isolate the portfolio optimization impacts. The Solvency Sharpe ratio is the surplus annualized growth rate divided by solvency volatility. For illustrative purposes only. Based on a hypothetical backtested model between October 2008 and October 2018. Please see important disclosures at the end of this paper.

It can be observed that, when we optimize for minimal surplus volatility and minimal surplus tail risk, ILWs are favored up to their cap of 5% at all levels of target return. When we optimize for solvency capital requirement, however, ILWs only receive an allocation at higher levels of target return because ILS strategies are not exempt from the Solvency II solvency capital requirement, as government bonds are. On the other hand, it is hard to find anything that is less correlated with traditional market returns than ILS strategies, and as such they can be very valuable in mitigating actual solvency volatility and tail risks to solvency. These statements are illustrated by the capital and solvency data shown in the table in figure 7.

A useful takeaway is that it is important to differentiate between allocation strategies that lead to an inflated but vulnerable solvency ratio, and strategies that can genuinely help improve long-term solvency ratio stability and growth. In our view, ILWs tick the latter box nicely.

Concluding remarks

In summary, we argue that ILS are intuitively and empirically a genuine source of diversification against the financial risks that dominate investment portfolios.

The history of ILS payouts indicates that the risks of ILS are more than fairly compensated. The risk premiums come from not only natural catastrophe risk transfer, but also from the incentive that insurers have to free up capital quickly for new underwriting, while conforming with regulatory solvency requirements. Typical institutional investors should have the resources to weather through underwriting cycles to reap such long-term premiums.

Within the broad category of ILS, we believe ILWs have unique advantages, because they have shorter duration, are more numerous and come with more transparent and less complex deal structures than catastrophe bonds and sidecars. These characteristics facilitate the onboarding into a diversified and customized institutional portfolio.

As illustrated by the case studies, adding ILWs to typical institutional portfolios has the potential to improve risk-adjusted returns and resilience to tail market events while still conforming to the usual constraints in duration, capital and quality.

HYPOTHETICAL BACKTESTED PERFORMANCE DISCLOSURES

The hypothetical performance results included in this material are for backtested model portfolios and are shown for illustrative purposes only. Neuberger Berman calculated the hypothetical results by running a model portfolio on a backtested basis using the methodology described herein. The results do not represent the performance of any Neuberger Berman managed account or product and do not reflect the fees and expenses associated with managing a portfolio. If such fees and expense were reflected, returns referenced would be lower. The model portfolio may not be appropriate for any investor. The model may change in the future due to market events and risks in the insurance industry.

There may be material differences between the hypothetical backtested performance results and actual results achieved by actual accounts. Backtested model performance is hypothetical and does not represent the performance of actual accounts. Hypothetical performance has certain inherent limitations. Unlike actual investment performance, hypothetical results do not represent actual trading and accordingly the performance results may have under- or over-compensated for the impact, if any, that certain economic or other market factors, such as lack of liquidity or price fluctuations, might have had on the investment decision-making process or results if assets were actually being managed. Hypothetical performance may also not accurately reflect the impact, if any, of other material economic and market factors, or the impact of financial risk and the ability to withstand losses. Hypothetical performance results are also subject to the fact that they are generally designed with the benefit of hindsight. As a result, the backtested models theoretically may be changed from time to time to obtain more favorable performance results. In addition, the results are based, in part, on hypothetical assumptions. Certain of the assumptions have been made for modeling purposes and may not have been realized in the actual management of accounts. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the hypothetical results have been stated or fully considered. Changes in the model assumptions may have a material impact on the hypothetical returns presented. There are frequently material differences between hypothetical performance results and actual results achieved by any investment strategy. Neuberger Berman did not manage any accounts in this manner reflected in the models during the backtested time periods shown.

DEFINITIONS

Industry Loss Warranties ("ILWs") are private investment contracts enabling the transfer of catastrophe risk from the protection buyer to the protection seller. The term "industry loss" refers to the fact that the triggers for the contracts are typically based not on the losses of a specific insurance company but rather on insured losses across the insurance industry as reported by a third-party, independent reporting agent. ILWs are typically fully cash-collateralized by both parties, reducing credit risk. ILWs are short-term instruments, typically 180 days to 365 days in duration, and are self-liquidating. In addition, as they are privately negotiated instruments, ILWs allow for greater customization of risk and return profiles.

Catastrophe Bonds are typically 144A securities structured as floating-rate principal-at-risk notes of 3- to 5-year maturity, and designed to transfer reinsurance risk to the capital markets. A central feature of a catastrophe bond is its trigger mechanism, which defines the type of event that would cause a principal reduction 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 are indemnity-based, approximately a quarter index-based and the rest in parametric form.

Reinsurance **Quota Shares** are financial arrangements (typically called "sidecars" when utilizing special purpose vehicles) established to allow third-party investors to take on a pro-rata exposure to the risk and returns of a reinsurer's portfolio or a specialized portfolio with risks selected by the reinsurer. Unlike traditional reinsurance, reinsurance quota shares are usually fully collateralized and of limited duration, typically from one to three years. The terms and risk-return profiles of sidecars vary widely.

Sharpe Ratio is the ratio of excess return (over the risk-free rate, i.e., cash or Treasury bills) to risk (measured by volatility). A higher Sharpe ratio means a better risk/return trade-off.

INDEX DEFINITIONS

The **Swiss Re Cat Bond Total Return Index** tracks the total return of a representative basket of the global catastrophe bond market, excluding life and health catastrophe bonds.

The **Bloomberg Barclays US Corporate High Yield Total Return Index Value Unhedged USD** measures the total return of a more liquid component of the USD-denominated high-yield fixed-rate bond market.

The **Guy Carpenter Global Property Rate-on-Line Index** is an index of global property catastrophe reinsurance Rate-on-Line movements, on brokered excess of loss placements, covering all major global catastrophe reinsurance markets. It has been maintained by Guy Carpenter since 1990 and is updated following renewals on January 1 each year by calculating the year-on-year change in rate-on-line across the same renewal base.

The **HFRX Global Hedge Fund Index** is designed to be representative of the overall composition of the hedge fund universe. It is comprised of all eligible hedge fund strategies, including but not limited to convertible arbitrage, distressed securities, equity hedge, equity market neutral, event driven, macro, merger arbitrage, and relative value arbitrage. The strategies are asset-weighted based on the distribution of assets in the hedge fund industry.

The **Markit iBoxx USD Liquid Leveraged Loans Total Return Index** measures the total return of the approximately 100 of the most liquid, tradable USD-denominated leveraged loans.

The **Bloomberg Barclays U.S. Treasury Total Return Unhedged USD** measures the total return of USD-denominated, fixed-rate U.S. Treasury bonds with a maturity longer than one year.

Correlation with Other Asset Classes. Catastrophic events are unpredictable and it is entirely possible that major losses will occur at or about the same time as other components of an investor's portfolio are also declining in value. In addition, the amount of global capital investing in insurance-related risks may be impacted to some extent by interest rates and other events affected traditional asset classes within the broader capital markets.

Reliability of Valuations. Investments that are illiquid (including ILWs), not traded or for which no value can be readily determined, generally will be assigned value based on pricing models, dealer quotes or independent appraisals, or such other factors, as applicable. Such valuations may not be indicative of what actual fair market value would be in an active, liquid or established market.

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