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Theme: Cat Bonds

NOVEMBER 2023

Overview

Catastrophe bonds, often referred to as Cat bonds, represent a specialist segment of the fixed income asset class. Their emergence was driven by the need for the insurance industry to effectively transfer catastrophic risk to the capital markets.

The first Cat bond was issued in 1994 in the aftermath of Hurricane Andrew, which caused over U$15bn in insured property losses and led to the insolvency of at least 16 insurance companies. Today the asset class has grown into a U$40bn market. Cat bond issuers are predominantly primary insurers in the US and Japan and reinsurers in Bermuda and Europe.

Cat bonds are a unique form of floating-rate securities that come with minimal interest rate risk. Investors in these bonds receive a premium above the risk-free rate in exchange for assuming event-related risks, particularly those associated with hurricanes, wildfires, floods and earthquakes.

The coupon and, in some cases, a portion of the principal in Cat bonds could be lost if predefined catastrophic events occur and lead to substantial losses for the issuer, although these conditions are typically clearly outlined in the offering documents. Furthermore, over time the premiums paid by issuers have comfortably offset the occasional losses. Over the past 20 years, the Cat bond index has compounded at over 6% p.a. (in dollar terms) with less volatility than US equities or bonds.

Importantly, weather risk behaves differently from market risk, making it rare for Cat bonds to weaken concurrently with losses in stock and bond markets. This underscores the robust diversification benefits of including Cat bonds in multi-asset portfolios.

However, it's important to note that Cat bonds are not entirely immune to the occasional significant sell-off. The largest drawdown on record occurred in 2017 with a nearly 16% drop, primarily driven by substantial insurance losses stemming from three major Atlantic hurricanes - Harvey, Irma and Maria. Nevertheless, the Cat bond index rebounded from this drawdown in less than a year, emphasising its resilience as an asset class.

Yields on Cat bonds are extremely attractive today at approximately 14% p.a. (gross of fees, U$ terms).

In essence, Cat bonds can be summarised as follows:

- **What?**
  Bonds issued by insurance and reinsurance companies
- **Why?**
  Attractive yield with minimal interest rate risk and diversification benefits
- **How?**
  Specialist Cat bond fund managers
- **Holding Period?**
  3yrs+

Delving into some more detail...

Chinese equity markets

The main features of Cat bonds are:

- Bonds issued by insurance and reinsurance companies
- Short dated – with an average maturity typically around 2 years
- Pay a floating rate coupon (so minimal interest rate risk)
- Main risk is an adverse event – primarily hurricanes and earthquakes
- Bonds have pre-defined triggers before any money is lost
- Priced on a weekly basis

"**Catastrophe bonds**, also called **Cat bonds**, are an example of insurance securitization, creating risk-linked securities which transfer a specific set of risks (typically catastrophe and natural disaster risks) from an issuer or sponsor (ceding company) to capital market investors.

In this way, the investors take on the risks of a catastrophe loss or named peril event occurring in return for attractive rates of investment return. Should a qualifying catastrophe or named peril event occur, the investors will lose some or all of the principal they invested and the issuer (usually an insurance or reinsurance company, but sometimes a corporate or sovereign entity) will receive that money to cover their losses."

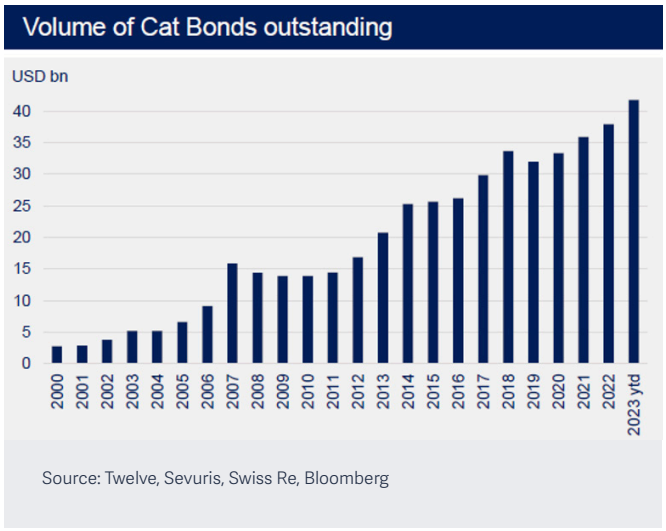
Source: https://www.artemis.bm/

What's the Background?

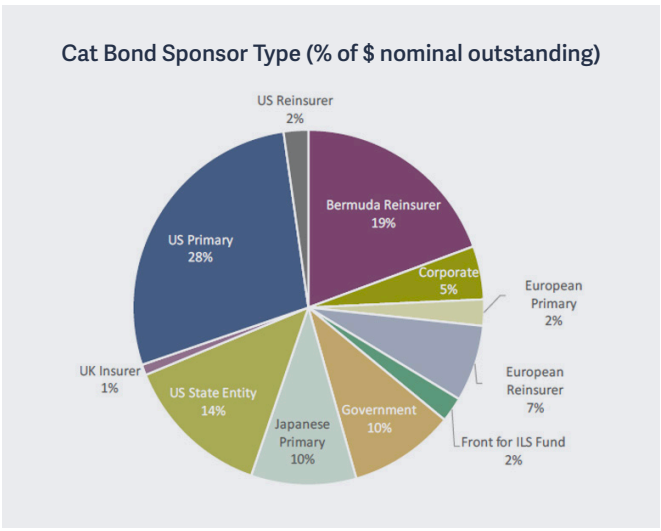
Reinsurance companies first introduced catastrophe bonds to strengthen their balance sheets in the aftermath of Hurricane Andrew in 1992. They enable the insurance industry to transfer catastrophe risk to broader capital markets. Andrew caused over U$15bn in insured property loss and led to the insolvency of at least 16 insurance companies. The first successful catastrophe bond was a U$85mn issue by Hannover Re in 1994. During the early years, insurers and reinsurers such as SwissRe and USAA dominated issuance but, in 2005, Hurricane Katrina resulted in insurance losses of U$62bn, depleting reinsurance capital and causing coverage prices to increase. This attracted fresh entrants to the space.

How big is the Asset Class?

As of 2023, Cat bonds have grown into a U$40bn market.
The main sponsors are primary insurers in the US and Japan and reinsurers in Bermuda and Europe. There is a notable seasonality to issuance, closely linked to the US hurricane season.



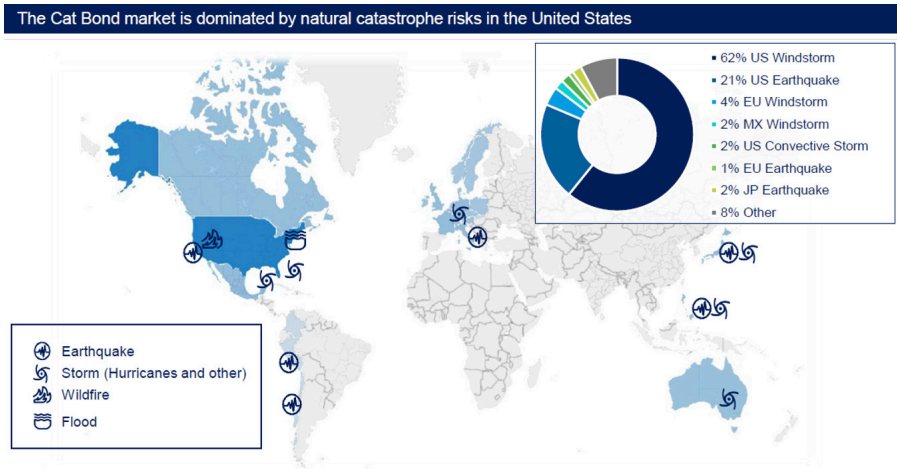
Source: Twelve, Sevuris, Swiss Re, Bloomberg



Secondary market liquidity for Cat bonds occurs primarily over-the-counter (OTC) and totals approximately U$4 billion annually. This level of liquidity translates to an average daily trading volume of around U$15 million, based on data from TRACE and Tullett Prebon. This secondary market liquidity gives investors the option to enter or exit positions relatively frequently rather than having to own the bonds on a "buy-and-hold" basis.

What are the Principal Catastrophe Risks?

Cat bonds play a significant role in underwriting four primary categories of catastrophic risk: Wind, Earthquake, Wildfire and Flood. Among these categories, US hurricane risk (centred mainly around the state of Florida) represents a substantial portion of the market due to the frequency and severity of hurricanes in the region.



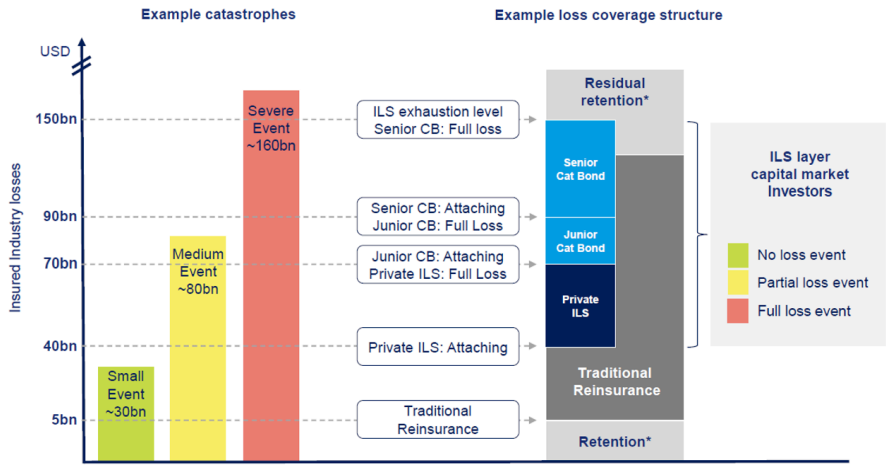
Source: Twelve

The majority of Cat bonds employ indemnity structures, which means that the payout to investors is based on the actual losses incurred or reserved by the sponsor. This structure aligns the bond more closely with the financial performance of the sponsor and helps investors better understand the risk.

An important metric for Cat bonds is the average expected loss, which typically falls in the range of around 2% p.a.. This expected loss reflects the estimated annual risk of a catastrophic event triggering a payout to the sponsor.

Cat bonds are designed to absorb losses only above a certain threshold. In most cases, insurance and reinsurance companies cover the initial or "first losses" up to a specific level. Cat bonds start to lose money when the sponsor's losses exceed this threshold.

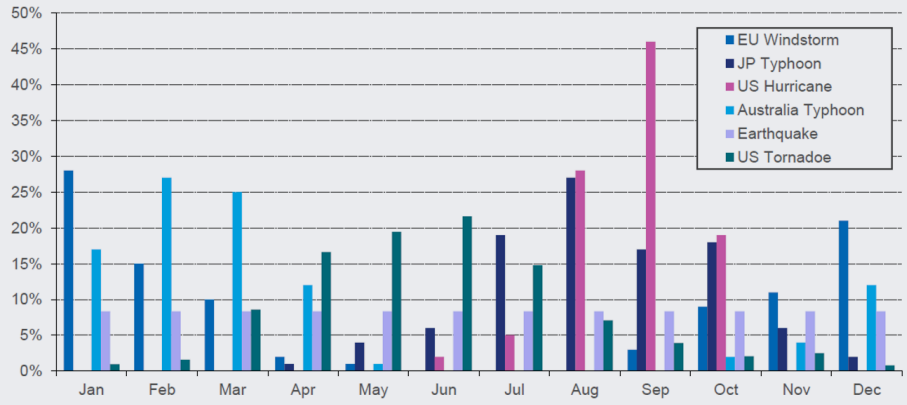
In recent years, Cat bonds have only experienced losses when the insurance and reinsurance industry as a whole has faced exceptionally high insured losses, typically in the range of U$50 billion to U$70 billion. This highlights how Cat bonds can absorb a high degree of catastrophic events without necessarily triggering losses for the bondholder.



Source: Twelve

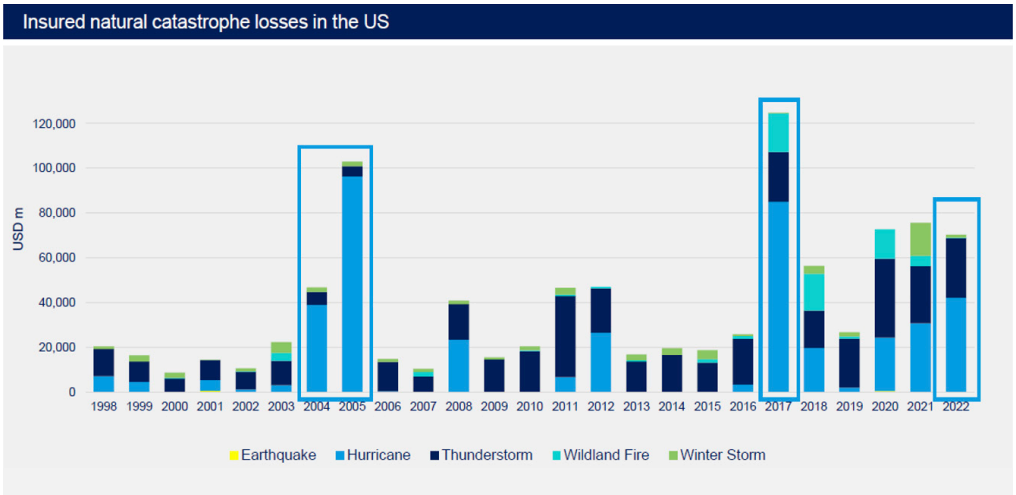
There tends to be a high degree of seasonality in Cat bond losses with most typically occurring between August and October due to the timing of the US hurricane season (see pink bars in the chart below). European windstorm losses typically occur in the December-January period. There is no seasonality observed in earthquake losses.

Occurrence probability of catastrophe per month



Source: AXA

Ultimately, weather events are unpredictable and insured losses can vary significantly from year to year. The largest US catastrophe losses were in 2017, due to the three large Atlantic hurricanes (Harvey, Irma and Maria). 2005 is also highlighted in the chart below, which reflects the widespread devastation caused by hurricane Katrina. More recently, hurricane Ian led to significant insured losses (and volatility in the Cat bond market) in 2022.



Source: Twelve

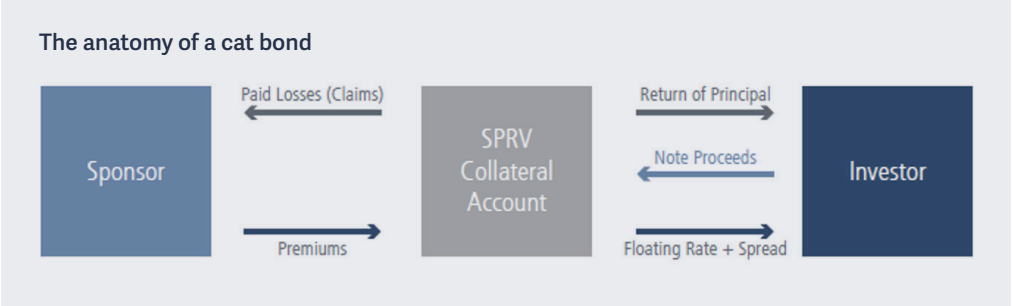
How are the Bonds Structured?

Cat bonds are fixed income instruments. Technically-speaking, they tend to be structured as 114A floating-rate, principal-at-risk notes. These bonds often come in varying sizes, ranging from U$50 million to U$500 million, with an average issuance size of approximately U$170 million. Their maturities typically fall within the one to five-year range, with an average maturity of around two years.

Cat bonds are usually structured within a Special Purpose Reinsurance Vehicle (SPRV). Here's how the mechanics work:

- **Investor Participation:** Investors purchase Cat bonds by providing cash upfront for the bond.
- **Coupon Payments:** Bondholders receive periodic coupon payments, which can be quarterly or monthly. These coupon payments are composed of two parts:
  - Collateral: The interest payments are generated from the collateral pool, which is invested in low-risk, interest-bearing securities. This creates a floating-rate component.
  - Spread (Risk Premium): The spread represents the risk premium paid by the insurance company to the investors for providing coverage against specified catastrophic events.
- **Principal at Risk:** The principal amount invested by the investors is at risk if a predefined catastrophic event occurs. In such cases, the collateral pool may be used to cover the losses incurred by the insurance company (sponsor).

Cat bonds, structured in this manner, provide a mechanism for transferring catastrophic risk from insurance companies to the capital markets. Investors receive periodic income while taking on the potential for principal loss in the event of a catastrophe. This structure is designed to align the interests of investors, insurance companies and the broader market in managing and mitigating the impact of catastrophic events.



Source: Neuberger Berman.
For illustrative and discussion purposes only.

Cat bonds can offer coverage for specific risks or a combination of multiple events in one or more geographical locations. The terms and conditions of this coverage are based on different definitions, which can include:

- **Single Event**: Cat bonds may be triggered (and losses incurred by the bondholder) when a specific catastrophic event, such as a hurricane or earthquake, occurs and leads to a predefined level of loss or damage.
- **Annual Aggregate Losses:** Some bonds are triggered by the cumulative losses incurred over a defined period, typically one year. Once the cumulative losses exceed a specified threshold, the bond may be triggered.
- **Frequency Losses:** In certain cases, Cat bonds are designed to trigger based on the frequency of specific events, such as a certain number of hurricanes or earthquakes occurring within a given timeframe.

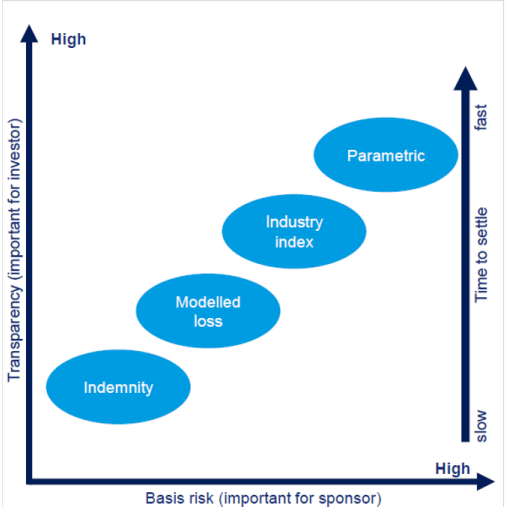
Additionally, many Cat bonds incorporate an **extension period**. This provision allows the sponsor time to collect and assess third-party loss estimates following a catastrophic event. During this extension period, an addiotnal sum (the "extension spread") is typically paid to investors.

Cat bonds feature pre-defined trigger parameters that determine when and how much should be paid to the sponsor in the event of a catastrophe. There are four main types of triggers:

- **Indemnity Trigger:** This trigger is based on actual losses incurred by the sponsor. It pays out when the sponsor's losses from a specific event exceed a predetermined level.
- **Parametric Trigger**: Parametric triggers rely on objective, predefined parameters such as wind speed or earthquake magnitude. If these parameters are met or exceeded, the bond is triggered, regardless of the actual losses incurred.
- **Industry Loss Trigger:** This is based on the total insurance industry losses resulting from a catastrophic event. When industry losses surpass a specified threshold, the bond may be triggered.
- **Modelled Loss Trigger:** Modelled loss triggers use catastrophe models to estimate potential losses based on various factors. If the modelled losses surpass a predefined level, the bond is triggered.

These diverse trigger mechanisms allow Cat bonds to be customised to specific risk profiles and provide flexibility in managing and transferring catastrophic risks within the insurance and reinsurance industries.

Trade off between transparency, response time and basis risk



Trigger mechanics

ILS trigger payout to the protection buyer if certain pre-defined conditions are met. A qualifying event per a pre-defined catalogue of criteria needs to occur within the bond's risk period.

Common trigger mechanisms

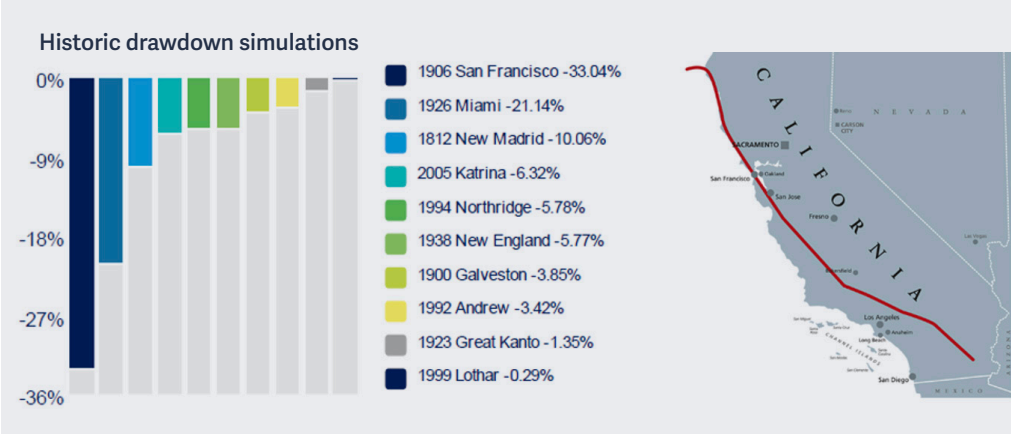
1. **Parametric:** Payout depending on specific formula, e.g. a hurricane making landfall in Florida with a specific minimum central pressure.
2. **Index-linked:** Payout depending on cumulative industry losses exceeding certain thresholds.
3. **Modelled loss:** Payout depending on modelled losses given the characteristics of a certain event.
4. **Indemnity:** Payout depending on actually incurred or reserved losses of specific book of (re)insurance contracts.

Source: RMS, Twelve

What's a Worst-Case Scenario?

Cat bonds remain a relatively young asset class so actual historical drawdowns represent only a fraction of the potential weather-related risks. A credible worst-case scenario involves a major earthquake striking California. Such an event could lead to substantial insured losses, and it's possible that these losses would be correlated with a decline in equity markets, given the significant exposure of tech companies in Silicon Valley.

Most Cat bond managers engage in modelling exercises to estimate the potential impact of such an event. In the historical simulation below, a repeat of the 1906 San Francisco earthquake would see the Cat bond index fall by 33%.

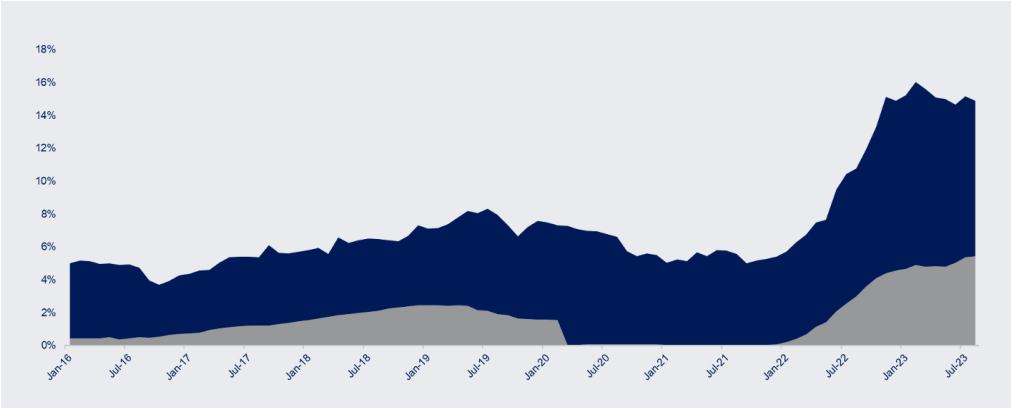


Source: Twelve

Valuation / Yields

In recent times, the yield on Cat bonds has risen to a record high, driven by two primary factors.

First, as Cat bonds feature a floating-rate coupon, yields have automatically increased in tandem with rising interest rates. Second, widening spreads have become notable, primarily due to a supply-demand imbalance following the occurrence of Hurricane Ian. It's worth noting that the Cat bond market can experience periods of "hard" and "soft" market conditions, with high losses leading to higher spreads (a hard market) and vice versa (a soft market). The accompanying graph illustrates this trend, with the grey line representing the cash rate and the blue line depicting the spread.

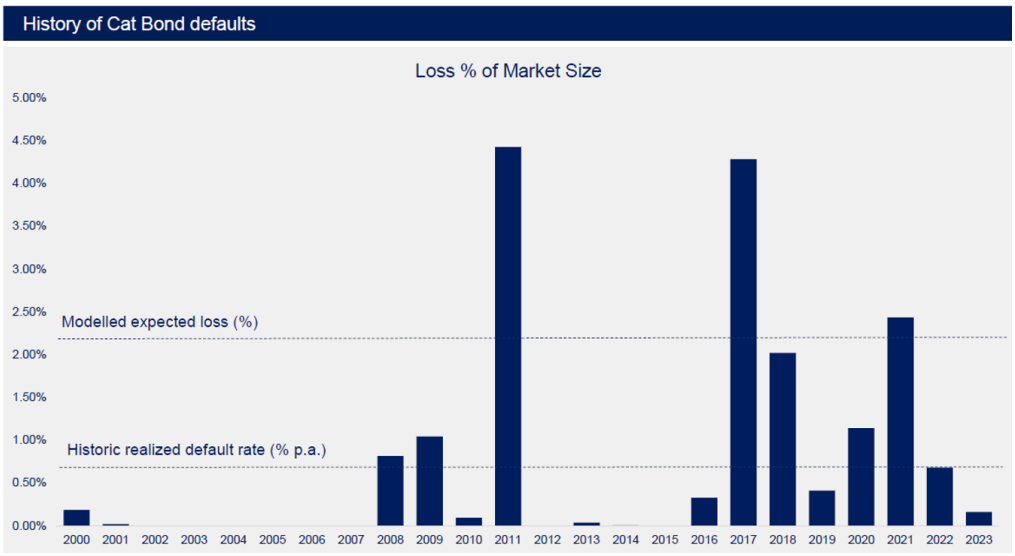


Source: Artemis, Twelve Capital (end August '23)

To us, yields well above 10% (net of fees) present a very attractive value proposition and compensation for event risk.

What about Default Rates?

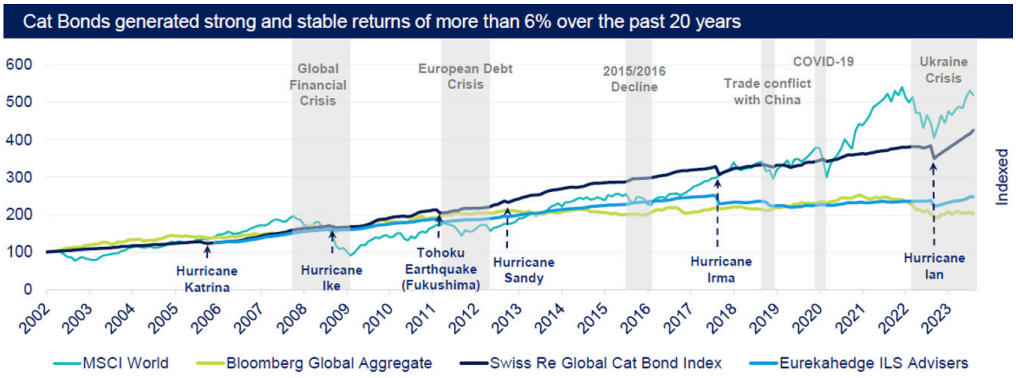
The chart below shows the historic annual default rates for cat bonds, which measures losses as a percentage of the total market size. Notably, 2011 and 2017 stand out as the two worst years with a default rate of 4%. This compares to a modelled expected loss of around 2% p.a., on average, which is low compared to the double-digit yields currently being generate by Cat bonds.



Source: Twelve

What does Historic Performance Look Like?

Over the past 20 years, Cat bonds have delivered an annualised return in excess of 6% p.a. with lower volatility and drawdowns than equity or bond markets. The chart below shows the performance of the Swiss Re Cat Bond index (since its 2002 inception until August 2023) and encompasses various market events and natural catastrophes.



	Swiss Re Cat Bond Total Return Index	MSCI World Free USD Index	Bloomberg Global Aggregate Index	Eurekahedge ILS Advisers
Return p.a.	6.87%	8.96%	3.88%	3.95%
Volatility p.a.	3.82%	13.78%	5.05%	3.52%
Sharpe	1.80	0.65	0.77	1.12
Max Drawdown	-8.99%	-50.44%	-18.14%	-12.50%

Source: Twelve

The US hurricane season, rather than economic factors, tends to have the greatest influence on Cat bond returns.

North Atlantic Hurricane Forecast				
Forecaster	**# Named Storms**	**# Hurricanes**	**# Major Hurricanes**	**ACE***
Colorado State University (CSU)	14	7	3	125
NOAA	12 - 17	5 - 9	1 - 4	-
Tropical Storm Risk	13	6	2	90
UK Met Office	14 - 26	8 - 14	3 - 7	137 - 307
Accuweather	11 - 15	4 - 8	1 - 3	-
Historical North Atlantic Hurricane Statistics				
Time	**# Named Storms**	**# Hurricanes**	**# Major Hurricanes**	**ACE***
1950 – 2022 Average	12	6	3	105
1991 – 2022 Average	15	7	3	122
2013 – 2022 Average	16	7	3	122
2021	21	7	4	146
2022	14	8	2	95

Which means they typically serve as an excellent source of portfolio diversification, historically demonstrating a low correlation to major asset classes, like equities and government bonds (see column 1 in the table below).

Correlation Matrix (20yrs)

Time Period: 01/09/2003 to 31/08/2023

Currency: US Dollar Source Data: Monthly Return

		1	2	3	4	5
1	SwissRe Cat Bond TR USD	1.00				
2	Bloomberg US Treasury TR USD(1987)	0.14	1.00			
3	S&P 500 TR GBP	0.25	-0.14	1.00		
4	LBMA Gold Price PM USD	0.08	0.31	0.07	1.00	
5	S&P GSCI TR USD	0.15	-0.31	0.44	0.20	1.00

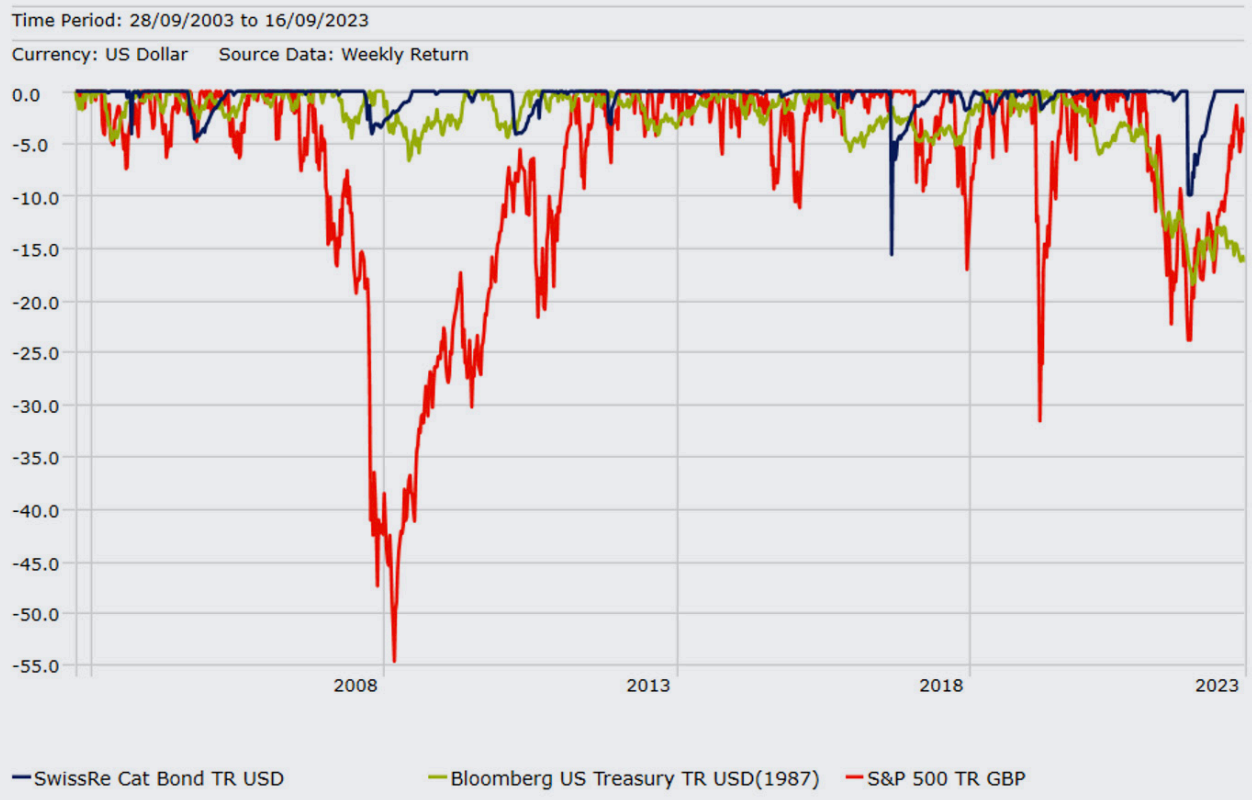
1.00 to 0.80 0.80 to 0.60 0.60 to 0.40 0.40 to 0.20 0.20 to 0.00
0.00 to -0.20 -0.20 to -0.40 -0.40 to -0.60 -0.60 to -0.80 -0.80 to -1.00

Source: Morningstar

What about Drawdowns?

Over the past 20 years, Cat bonds have delivered an annualised return in excess of 6% p.a. with lower volatility and drawdowns than In the past two decades, the Cat bond index (blue line) has experienced a couple of 10%+ drawdowns. The first was in 2017, when it fell 16% peak-to-trough, in dollar terms. The most recent was the 10% decline in 2022 due to Hurricane Ian. Both drawdowns recovered quickly and compare favourably to both the scale and frequency of equity drawdowns (red line).

Drawdown (20yrs)



Source: Morningstar

Why Invest via Specialist Managers?

We use specialist managers for this asset class as they have a more diverse basket of weather risk. Active managers typically have less exposure to US hurricane risk, which dominates the Cat bond index. Specialist managers will seek to diversify their portfolios by types of event risk (hurricane, earthquake, etc.) and by geography.

Because of this, many Cat bond funds outperform the index in a drawdown. The table below shows the performance of the Twelve Cat Bond fund over the past five years since inception in USD. In September 2022 the fund lost -2.87% (highlighted in yellow) due to hurricane Ian. This compares favourably to the immediate drawdown of -10% using weekly index data

Twelve Cat Bond UCITS ICAV Fund													
Ireland UCITS ICAV						Monthly return							Fund size: USD 2,729.69m
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2018		0.98%	0.23%	0.32%	0.47%	0.42%	0.55%	0.68%	0.76%	0.48%	-0.54%	-0.50%	3.91%
2019	0.99%	0.38%	0.17%	0.26%	-0.44%	0.55%	0.69%	0.65%	1.15%	0.82%	0.01%	0.31%	5.66%
2020	0.50%	0.51%	-1.11%	0.38%	0.28%	0.74%	1.04%	0.85%	1.41%	0.61%	0.06%	0.32%	5.72%
2021	0.46%	0.24%	0.46%	0.30%	0.32%	0.24%	0.52%	0.43%	0.18%	-0.12%	0.17%	0.07%	3.32%
2022	0.14%	0.03%	-0.06%	-0.13%	0.06%	-0.42%	0.05%	0.55%	-2.87%	0.12%	-0.77%	0.45%	-2.86%
2023	1.02%	1.05%	1.45%	1.53%	1.33%	1.82%	1.17%	1.55%					11.45%
Inception date: 02.02.2018						Share class: S USD							ISIN: IE00BDRJLK70

Source: Twelve

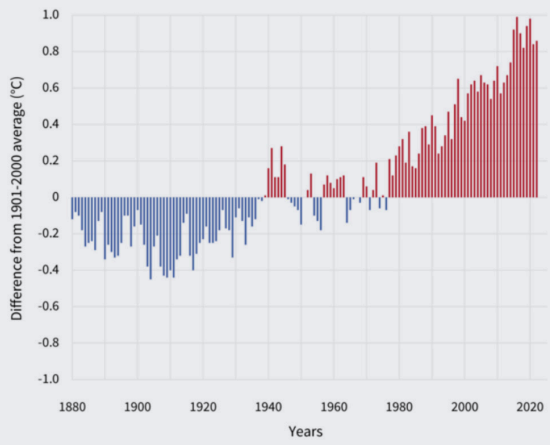
Is Climate Change an Issue?

Climate change represents significant risk for Cat bonds and the broader insurance industry. The implications of a warmer planet and oceans on weather-related events, such as hurricanes and wildfires, are complex and multifaceted.

The frequency and severity of weather events appears to be on the rise, which creates challenges for risk-modelling in the insurance industry.

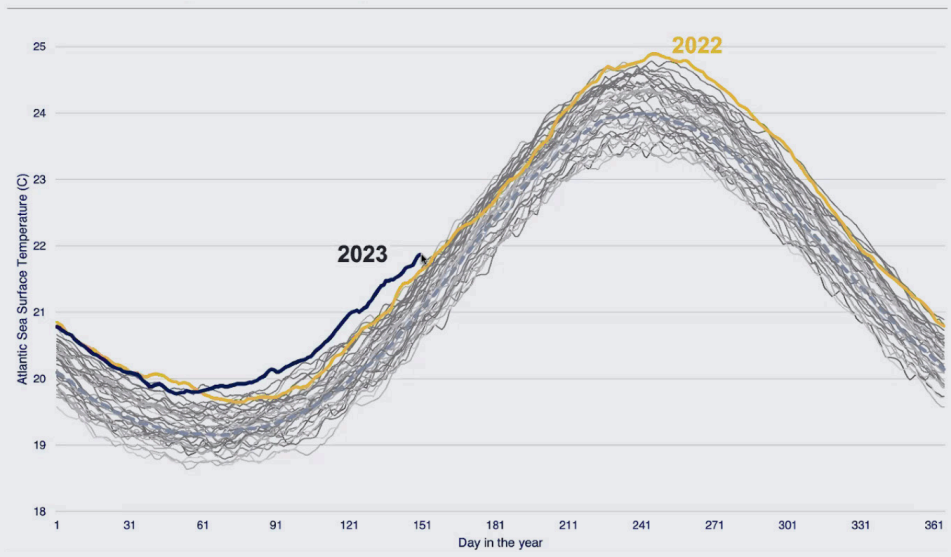
The chart below (source: NCEI) shows the yearly surface temperature of the globe compared to the 20th century average and highlights that the ten warmest years on record have all occurred since 2010. Indeed, June 2023 was the hottest month on Earth since records began in 1850.

Global average surface temperature



Of greater significance to the Cat bond market is rising ocean temperatures as warmer seas typically lead to the formation of more powerful storms. The chart below shows how the Atlantic's surface temperature has trended significantly higher since 1981.

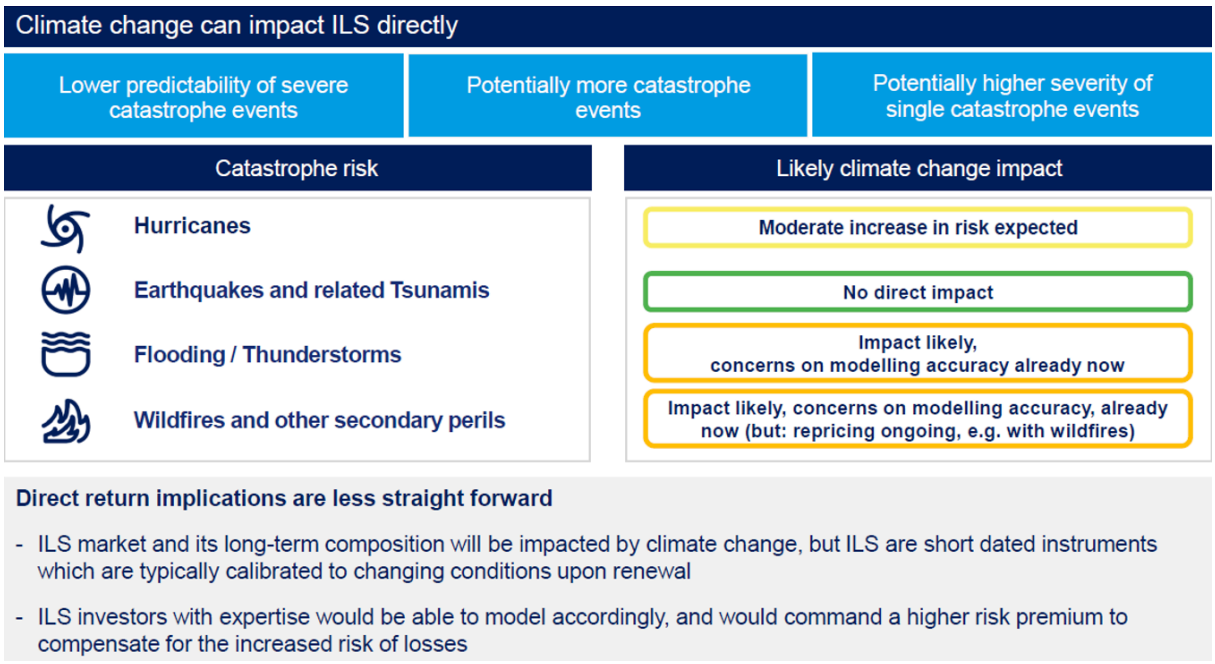
Sea Surface Temperature development in the Atlantic (1981-2023)



Source: climatereanalyzer.org/clim/sst.daily/. As at 31 May 2023.

It's encouraging that insurers and Cat bond managers are actively addressing the risks associated with climate change. A 2022 study by risk-modelling firm Reask and Twelve Capital (a Cat bond manager) concluded that climate change is likely to cause the following:

- Increased frequency of hurricanes
- A shift in the geographical distribution of affected areas (states further North and East along the Atlantic coast may experience more hurricane damage in the future)
- Greater wildfire and flood risk, but
- Earthquake risk is unlikely to be significantly affected



Which begs the question, how exactly will climate change affect Cat bonds?

Increasing premiums is one of the primary ways for insurers to mitigate the heightened risks associated with climate change and catastrophic events. Cat bonds, with their typically short duration and annual renewal process, offer flexibility in adjusting the risk/reward ratio each year based on the latest risk models. This adaptability allows insurers and investors to incorporate evolving catastrophe risks into the valuation of Cat bonds whenever the need arises.

Moreover, this approach creates opportunities to extend coverage to new populations and regions affected by climate change-related risks. The entry of US corporates like Google into the Cat bond market and the issuance of new disaster relief bonds in Africa are positive developments. These initiatives not only provide diversification but also contribute to the resilience of the insurance and Cat bond markets.

Diversifying the sources of hurricane risk in Florida, for example, can help distribute risk more broadly and reduce concentration risk. This is an important step in managing the impact of catastrophic events in an environment where climate change-related risks are evolving. It demonstrates the capacity of the insurance and reinsurance industries to adapt to new challenges and provide effective risk mitigation solutions.

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