

# CATASTROPHE BONDS

## AS AN IMPORTANT SEGMENT OF INSURANCE-LINKED SECURITIES

BY **KRZYSZTOF BURNECKI** AND **GRZEGORZ KUKLA**

Innovative risk-transfer solutions can help to close identified protection gaps and increase personal and societal resilience. In this context, the insurance-linked securities (ILS) market, as a form of alternative risk transfer, has been at the forefront. The actuarial techniques play a key role in the valuation of catastrophe instruments.

**A**ccording to the Swiss Re Institute's sigma report No. 1/2023, natural disasters resulted in global economic losses of USD 275 billion in 2022, of which only USD 125 billion were covered by insurance, the fourth highest one-year total. In Europe the economic and insured losses amounted to approx. USD 20 and 11 billion, respectively. With climate change, environmental devastation, global inflation and ever more people concentrated in high-risk areas, natural catastrophes such as earthquakes, floods, hurricanes, wildfires and winter storms have become more intense and frequent in recent years, posing a threat to people and economies worldwide. The financial burden of such events is enormous, but despite this threat many people and businesses remain uninsured leaving them vulnerable when a natural catastrophe does strike. A large protection gap weakens the financial resilience of economies as lack of insurance makes it more difficult for businesses and people to recover from disasters. >

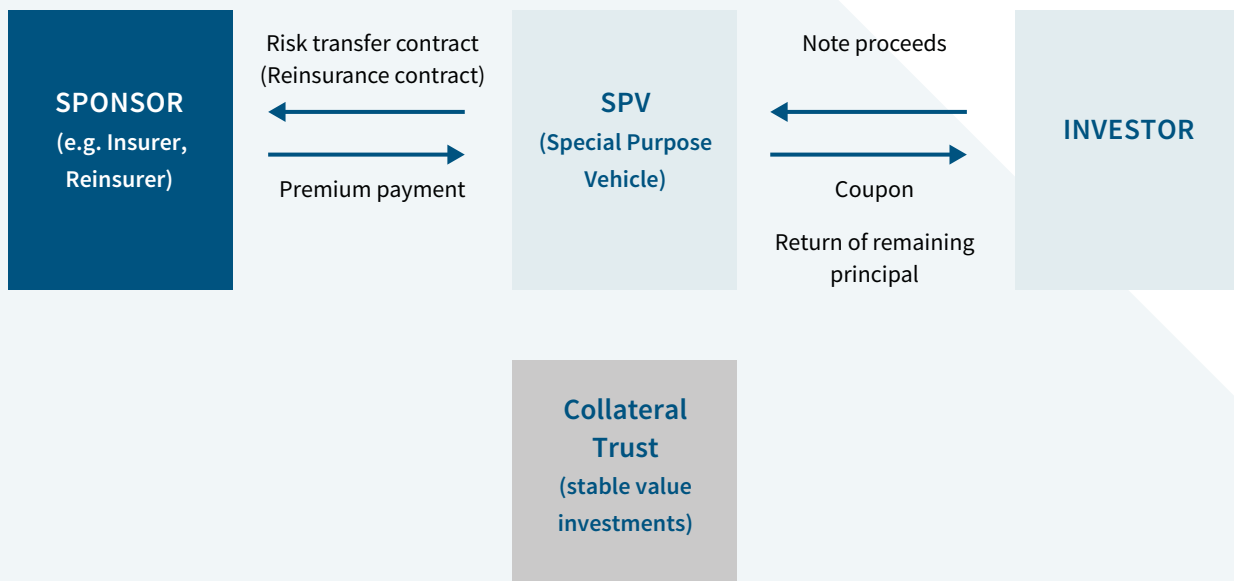


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FIGURE 1: TYPICAL ILS STRUCTURE



ILS are investment assets linked to insurance-related, non-financial risks such as natural disasters, life and health insurance risks including mortality or longevity, but also newly present in other risks such as mortgage, casualty and cyber. They are generally thought to have little to no correlation with the wider financial markets.

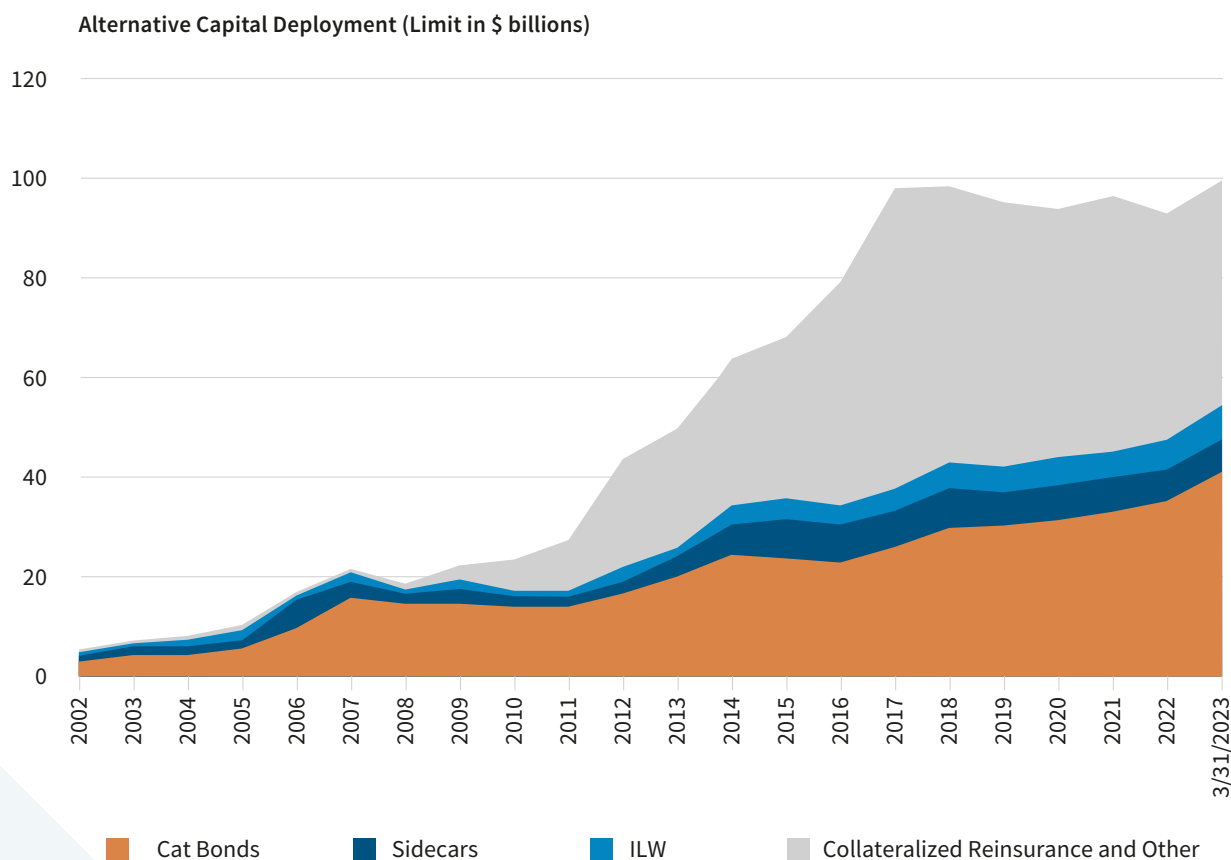
The ILS operating pattern is as follows (see Figure 1):

- A sponsor (usually an insurer or reinsurer looking to get protection but also large corporations, public authorities, and even sovereign nations) enters into a risk transfer contract (reinsurance or derivative) with a special purpose vehicle (SPV) set up by the sponsor. A risk transfer contract is established and the sponsor pays a premium to the SPV.
- The SPV capitalises itself by issuing notes (e.g. catastrophe bond) to investors in the capital markets in an amount equal to the limit of the risk transfer contract.

- Proceeds from the securities offering are transferred into a collateral trust account and invested to provide a stable return.
- If no covered event occurs during the risk period, the securities will be redeemed at 100% of face value. In case of a covered event meeting the thresholds set forth in the risk transfer contract, funds will be withdrawn from the collateral account to make an event payment to the sponsor. The redemption price of the securities is reduced accordingly.

The first ILS were issued in the mid-1990s. To date, most ILS issues have been collateralized reinsurance and catastrophe bonds (see Figure 2 from Aon Securities LLC). We can observe that the catastrophe bond market now stands for almost half of the whole ILS market and is steadily growing. Let us now concentrate on that market, which is also important for an actuary as involved person in the crucial pricing process. >

FIGURE 2: EVOLUTION OF ILS MARKET (2002 - Q1 2023), CUMULATIVE



Source: Aon Securities, LLC

Four broad types of catastrophe bond triggers exist, with the first three being more traditional, namely:

- 1 indemnity triggers, where the trigger is based on the actual losses of the issuer/sponsor;
- 2 parametric triggers, where the trigger is based on the occurrence of pre-specified characteristics or criteria of a pre-specified natural disaster;
- 3 industry index triggers, where the trigger is based on insurance-industry catastrophe loss indices;
- 4 modelled loss triggers, wherein a risk-modelling firm provides an evaluation of the catastrophe risk.

Most catastrophe bonds rely on a single trigger. However, in some cases, multiple triggers are used. In Europe, European windstorms, earthquakes and multi-peril risks are covered.

The vast majority of catastrophe bond transactions issued are rule 144a bonds. Rule 144a allows institutions to trade these securities before any public offering or sale, thereby increasing its liquidity. 144a property catastrophe bond issuance at the end of third quarter of 2023 exceeded USD 10 billion with the market on track to break all records this year (see Artemis Deal Directory). >

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In 2020, the government of Mexico with the help of the World Bank and its International Bank for Reconstruction and Development (IBRD), issued an innovative USD 485 million bond that provides insurance protection against both earthquakes and hurricanes, all on a parametric trigger basis. It is the first catastrophe bond in which the proceeds from the sale of the notes can be used by the IBRD to finance sustainable development projects in its member countries. It is a hybrid structure that incorporates elements of a sustainable development bond alongside a catastrophe bond, a concept that has been broadly discussed around the market as one way to tap into investor appetite for ESG assets.

The issuance of a catastrophe bond typically requires engaging a specialised modelling firm to quantify the catastrophe risk.

The modelling companies develop probabilistic models that help to assess financial impacts of catastrophes. In practice, advanced software is used to mathematically represent the physical characteristics of natural catastrophes.

The pricing, which involves experts including actuaries, is based on those analyses and the competing financial environment and the catastrophe market. It is a challenging task especially in the context of multi-peril triggers and it involves the usage of innovative

techniques like machine learning. It is worth mentioning that the developed techniques can also be used in modelling and pricing different risks such as terrorism, pandemics, extreme casualty events, and cyber incidents. The standardisation and the adequate modelling and valuation (including actuarial techniques) are the key to the success and development of the innovative catastrophe bond market which is the essential part of the ILS market. Actuarial pricing techniques are becoming an important complement to the standard catastrophe models as the character and frequency of natural events is becoming ever more unpredictable with the acceleration of the climate change dynamics. <