

UNIVERSITY OF LJUBLJANA  
SCHOOL OF ECONOMICS AND BUSINESS

MASTER THESIS

**ALTERNATIVE CAPITAL IN NON-LIFE INSURANCE RISK  
TRANSFER**

Ljubljana, May 2025

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## LIST OF ABBREVIATIONS

AEP – Aggregate Exceedance Probability

CAT – Catastrophe

CAT Bond – Catastrophe Bond  
CAT XL – Catastrophe Excess of Loss  
CCRIF – Caribbean Catastrophe Risk Insurance Facility  
ECB – European Central Bank  
EIOPA – European Insurance and Occupational Pensions Authority  
EML – Estimated Maximum Loss  
ESG – Environmental, Social, and Governance  
EU – European Union  
FINRA – Financial Industry Regulatory Authority  
ILW – Industry Loss Warranty  
ILS – Insurance-Linked Securities  
NAT CAT – Natural Catastrophe  
OEP – Occurrence Exceedance Probability  
PML – Probable Maximum Loss  
PPP – Public-Private Partnership  
ROL – Rate on Line  
RMS – Risk Management Solutions  
SEC – Securities and Exchange Commission  
SPI – Special Purpose Insurer  
SPV – Special Purpose Vehicle  
TRACE – Trade Reporting and Compliance Engine  
U.S. – United States  
UK – United Kingdom  
XL – Excess of Loss  
xs – in excess of

# **1 INTRODUCTION**

Individuals and businesses commonly manage risks by purchasing insurance coverage. In return for a premium, the insurance company compensates the policyholder in case of a financial loss covered by an insurance policy. Insurance companies, however, assume a wide range of risks, some of which can be very large or highly unpredictable. Additionally, multiple risks may be impacted by a single event, leading to a potential accumulation of losses. This can lead to a level of risk that the insurance company may be unable or unwilling to retain. To manage such situations, insurance companies can transfer a portion of these risks to other entities. These entities are typically reinsurance companies, and the process is known as reinsurance. Reinsurance companies may also transfer parts of the risks they assume to other reinsurance companies. This subsequent stage is called retrocession, which is essentially reinsurance for reinsurers.

This thesis focuses on the reinsurance and retrocession stages of risk transfer. It explores an alternative or complementary approach to transferring non-life insurance risks, one that involves broader capital markets. In this approach, funds that support insurance risks and can absorb losses are provided by capital markets. Since these funds come from outside the traditional reinsurance sector, they are often referred to as alternative reinsurance capital. By analysing various strategies and comparing their features, benefits, and limitations, the thesis aims to provide insights into how these strategies can complement conventional reinsurance and benefit the insurance industry. Furthermore, it aims to explore the motivations and challenges of key stakeholders: cedants seeking coverage and investors providing capital.

In Chapter 2, we begin with an overview of the role of reinsurance and describe conventional reinsurance products, providing a foundation for understanding the approaches to transferring risk. In Chapter 3, we explore arrangements involving alternative capital, including practical examples of their applications. We also consider the perspective of cedants, discussing the benefits and challenges of these arrangements. Since these arrangements involve a counterparty—usually institutional investors—we also examine their motivations and potential concerns. Finally, in Chapter 4, we outline the factors that could influence the future development of this alternative reinsurance capital market.

# **2 CONVENTIONAL REINSURANCE**

This chapter begins by explaining the reasons for using reinsurance and the factors that influence its extent. These same reasons also largely apply to risk transfer through alternative capital products. Next, the chapter describes how the reinsurance business can be written and examines the basic reinsurance products. These are categorized into two types: proportional and non-proportional. We describe both types, the corresponding products, and their typical uses in reinsurance. Finally, we briefly mention some other products in the reinsurance market. These include financial reinsurance products, where risk transfer is not

the primary goal, and reinsurance products involving alternative capital, which are covered in Chapter 3.

Reinsurance is a broad subject that could be explored in far greater depth than is possible within the scope of a single master's thesis. As conventional reinsurance is not the primary focus of this work, this chapter aims to provide a brief overview of the topic, offering a basic understanding of the concepts involved and common approaches to transferring risk.

## **2.1 Purpose and extent of reinsurance**

As mentioned in the introduction, the primary purpose of reinsurance is to manage risks that are too large or unpredictable for the cedant to retain. The definition of a “large risk” depends on factors such as the insurer's size and risk appetite. It is typically measured in terms of the sum insured, the probable maximum loss (PML), or other similar exposure metrics. Large individual risks, such as industrial facilities, and accumulations of risks, such as portfolios exposed to natural catastrophes, can significantly impact the insurer's financial position. While mitigating these risks is the main reason for using reinsurance, there are several other reasons, most of which are closely related to this primary purpose. We outline them in the list below (Institute and Faculty Education Limited, n.d.).

- Reducing the impact of large individual losses. When the potential impact of a single risk is too large for an insurer to bear, it can cede a portion of the risk—often the top layer—to the reinsurer. This reduces the insurer's involvement in the risk and can cap its maximum potential payout.
- Limiting exposure to risk accumulations. There may be accumulations of risks within the insurer's portfolio, and reinsurance can help to mitigate the impact when multiple risks are affected simultaneously. For example, a severe convective storm could damage numerous properties and vehicles within hours.
- Increasing underwriting capacity. Writing new insurance business requires sufficient capital to support the underlying risks. Limited capital can restrict the insurer's ability to expand its business and market share. By ceding risks, the insurer reduces its need for capital, allowing it to write more business.
- Spreading risk. Being able to write additional business allows the cedant to improve the portfolio diversification. Additionally, insurers may also engage in reciprocal arrangements, swapping portions of portfolios with other insurers to achieve better diversification.
- Smoothing results. The benefits of using reinsurance, such as reducing claim fluctuations, stabilize financial results. This can lead to a more favourable risk-return profile, potentially lowering the cost of capital.
- Improving solvency position. Reinsurance reduces the net value of liabilities and capital requirements, potentially improving the insurer's solvency position.

- Increasing returns and profitability. By reducing the need for capital, reinsurance can serve as an alternative to raising new capital. Depending on the costs, it may improve the return on capital. Additionally, more stable results enable the insurer to plan its operations better, potentially increasing profitability.
- Regulation. In some cases, statutory requirements mandate a certain level of reinsurance protection.
- Access to expertise. Reinsurers often conduct business globally and have knowledge of various markets and products. In addition to providing protection, they may offer guidance on pricing, underwriting, reserving, and claims handling. This is particularly valuable for insurers entering new markets or developing new products.
- Financial assistance. Certain reinsurance arrangements include a ceding commission, where the reinsurer compensates the insurer for acquisition and administrative expenses. Paying a significant portion of this commission upfront can improve the insurer's cashflow position. This can, for instance, help insurers write new business or provide immediate funds to assist in merger or acquisition transactions.

Having outlined the main reasons for purchasing reinsurance, note that insurers may use reinsurance to different extents. This depends on their risk appetite and several other factors. These factors include (Institute and Faculty Education Limited, n.d.):

- Size of the insurer. Larger insurers tend to have more diversified portfolios and more predictable claim experience, reducing the need for reinsurance. However, they may write more significant and/or more complex risks and may be more exposed to accumulations, potentially increasing the need for reinsurance.
- Size of the portfolio. Larger portfolios may contain more significant single risks and potential accumulations, increasing the need for reinsurance. On the other hand, in addition to greater diversification, larger portfolios tend to have more credible past claims experience, allowing for better predictions of future claims. This reduces the need for reinsurance.
- Level of free reserves. Insurers with larger free reserves are more capable of absorbing random fluctuations in claims experience, reducing the need for reinsurance. Insurers with lower levels of free reserves may additionally face more scrutiny from regulators, who could require greater use of reinsurance.
- Uncertainty of claims. Volatile and unpredictable claims increase the need for reinsurance.
- Experience in the market. With greater experience in the market, insurers develop a better understanding of potential risks. Being in the market for a long time also provides insurers with more data, allowing future claims to be estimated more accurately. These factors reduce the need for reinsurance.
- Market conditions. Insurers also consider the availability and cost of reinsurance. Reinsurers may be unwilling to cover certain risks, or reinsurance premiums may be prohibitively expensive. Value for money is also a factor influencing the extent of

reinsurance used. Market conditions depend largely on the reinsurance market capacity mentioned in the introduction.

## **2.2 Writing reinsurance**

Reinsurance is primarily written in a facultative or obligatory way. Facultative reinsurance is the oldest form and involves reinsuring individual risks on a case-by-case basis. The other form is obligatory reinsurance, also known as treaty reinsurance. It obliges the cedant to cede and the reinsurer to accept the specified risks according to the terms of the agreement (GOV.UK, 2016b).

### **2.2.1 Facultative reinsurance**

Facultative reinsurance involves offering individual risks to the reinsurer, with each contract negotiated separately. This allows for specific risk assessment and transfer. There is no obligation for either the ceding company to offer or the reinsurer to accept the business (GOV.UK, 2016b).

The main advantage of facultative reinsurance is the flexibility it offers to both parties. The insurer can approach multiple reinsurers to secure the best possible terms for a given risk, while reinsurers have the freedom to propose whatever terms they consider suitable and the discretion to decline the offered risk altogether.

However, the process can be time-consuming and costly due to the negotiations and assessments required for each individual risk. Additionally, there is uncertainty regarding the availability of the coverage, as it is not guaranteed. This uncertainty may affect the primary insurer's ability to promptly accept large or complex risks, as it may first need to find the required reinsurance cover. Even when coverage is available, the price and terms may be unacceptable for the insurer (Swiss Re, 2013).

In practice, facultative reinsurance is often used as a complementary reinsurance to treaty arrangements. It is mainly used to cover significant risks exceeding the limits of treaty arrangements, such as large and complex commercial facilities (Swiss Re, 2013).

### **2.2.2 Obligatory or treaty reinsurance**

As mentioned, arranging reinsurance for each risk can be time-consuming and costly. Insurance companies may instead prefer to set up treaty arrangements, which allow risks to be automatically insured under predetermined terms without the need to negotiate each individual risk (Swiss Re, 2013).

In treaty reinsurance, the insurer is obliged to cede all risks within the treaty's scope, and the reinsurer is obliged to accept them. Unlike facultative reinsurance, treaty reinsurance ensures

that coverage is available, as it eliminates the possibility of risks being rejected by the reinsurer. Most non-life reinsurance treaties are renewed annually (Swiss Re, 2013).

Treaty reinsurance has just the opposite features of facultative reinsurance. Its main advantage is efficiency. Because the risks are placed automatically, administration is much quicker and less costly. However, this comes at the expense of flexibility, as both parties are bound by the terms of the treaty.

Some treaties may also operate on a facultative/obligatory basis, offering insurers the option to select which risks to include, but reinsurers are required to accept all submitted risks (GOV.UK, 2016b).

## **2.3 Conventional reinsurance types**

So far, we have seen that reinsurers accept risks through facultative or treaty arrangements. Regardless of the approach, there are two mechanisms that determine how premiums and claims are passed to the reinsurer (Swiss Re, 2013):

- Proportional reinsurance: The insurer cedes a specified proportion of the risk and premium to the reinsurer, and the reinsurer pays a specified proportion of claims.
- Non-proportional reinsurance: The insurer pays an agreed premium to the reinsurer, who covers all claims within a specified layer.

While insurers can purchase reinsurance coverage directly from reinsurers, intermediaries often play a significant role, particularly in non-proportional arrangements. These intermediaries are specialist brokers who facilitate the placement of risks by connecting insurers and reinsurers. They assist insurers in securing the coverage they need and help reinsurers acquire business. For their services, brokers receive a fee known as brokerage, which is usually paid by the reinsurer (Swiss Re, 2013).

In the following, we examine proportional reinsurance and its related products, followed by a similar review of non-proportional reinsurance.

### **2.3.1 Proportional reinsurance**

With proportional reinsurance, the insurer and the reinsurer share premiums and claims based on specified proportions defined in the contract.

One of the benefits of using proportional reinsurance is that it reduces the size of the insurer's net account, enabling the insurer to underwrite more risks. By retaining smaller portions of a larger number of individual risks, the insurer can achieve greater portfolio diversification and reduce the volatility of its overall result.

In this type of reinsurance, the reinsurer usually pays the insurer a reinsurance commission, which is typically determined as a percentage of the reinsurance premium. This commission was initially designed to compensate the insurer for the portion of its expenses associated with managing the business, such as acquisition, administration, and claims handling costs. Over time, the basis for the commission has shifted more towards commercial considerations. Reinsurers are now increasingly paying commissions based solely on the portion of premiums that is not paid out in claims (Swiss Re, 2013). In other words, reinsurance commissions may depend on the quality of the insurer's portfolio and may deviate from the insurer's expenses. These types of commissions are often referred to as profit commissions and are more related to the portfolio's underwriting result.

Proportional reinsurance has two basic types: quota share and surplus. In a quota share, a constant proportion of each risk is ceded to the reinsurer. In contrast, surplus allows for different proportions of risk to be ceded, depending on the size of the risk. These arrangements are generally written as treaties. However, individual risks can also be reinsured proportionally, for example, through facultative cover. The following two sections describe quota share and surplus treaty in greater detail.

#### *2.3.1.1 Quota share*

Quota share reinsurance is the simplest form of proportional reinsurance, where both premiums and losses are split according to a constant proportion for all risks (Swiss Re, 2013). For example, if the insurer and reinsurer agree to a 10% quota share, the insurer cedes 10% of the premiums to the reinsurer, and the reinsurer reimburses the insurer for 10% of the claims. Below is an example illustrating how quota share works.

##### *Example: Quota share*

Consider an insurer with an underwriting capacity of 10 million (in terms of the sum insured). Suppose it wants to increase this capacity through a quota share arrangement. If the insurer enters a 60% quota share, its underwriting capacity increases to 25 million (40% of 25 million equals the initial underwriting capacity of 10 million).

Further, assume that the original premium is 0.2% of the sum insured and that the insurer fully utilizes its underwriting capacity. Expenses account for 30% of the written premium, and the reinsurance commission is 30% of the reinsurance premium. We assume a loss ratio of 60%. The loss ratio is typically expressed relative to earned premium, but for simplicity, we state it here in relation to written premium, meaning that losses amount to 60% of the written premium.

Table 1 illustrates the functioning of a 60% quota share. The first row highlights the increased underwriting capacity, which allows the insurer to write more business and achieve better diversification. The total written premium is 50,000 (0.2% of the sum insured), of

which 60% (30,000) is ceded to the reinsurer. Total claims amount to 30,000, with the reinsurer reimbursing 60% (18,000). The insurer incurs expenses of 15,000 but receives 9,000 from the reinsurer through the reinsurance commission. After accounting for this commission, expenses are also split between the insurer (6,000) and the reinsurer (9,000) in the same proportion (because the reinsurance commission rate is equal to the expense rate in this case). Consequently, the profit (or loss) is also shared in the same proportion.

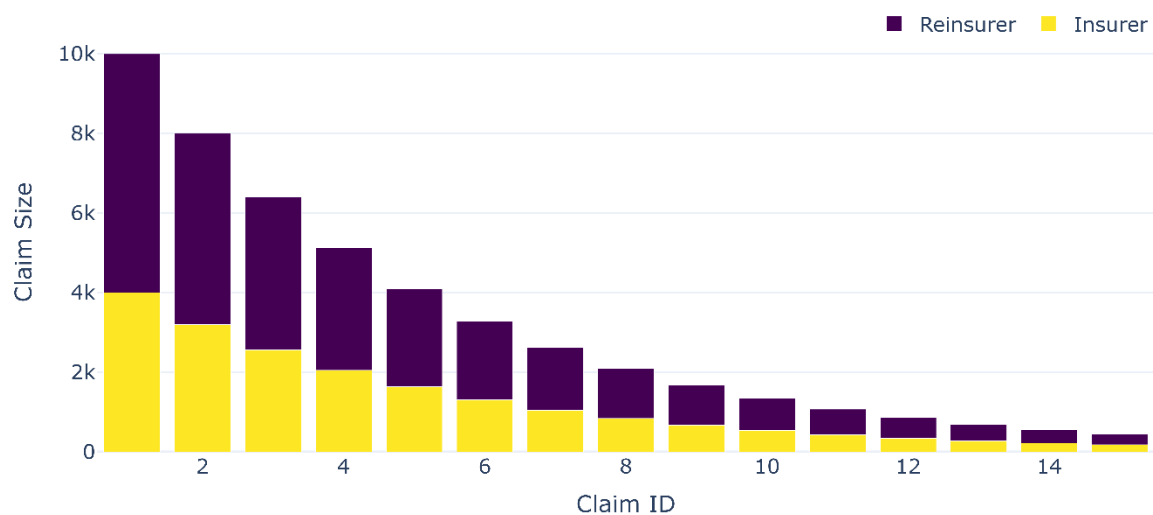
*Table 1: Example of a 60% quota share*

|                                  | <b>Total</b> | <b>Insurer</b> | <b>Reinsurer</b> |
|----------------------------------|--------------|----------------|------------------|
| <b>Underwriting capacity</b>     | 25,000,000   | 10,000,000     | 15,000,000       |
| <b>Premium</b>                   | 50,000       | 20,000         | 30,000           |
| <b>Claims</b>                    | -30,000      | -12,000        | -18,000          |
| Expenses                         | -15,000      | -15,000        | 0                |
| Commission                       | 0            | 9,000          | -9,000           |
| <b>Expenses after commission</b> | -15,000      | -6,000         | -9,000           |
| <b>Profit or loss</b>            | 5,000        | 2,000          | 3,000            |

*Source: Own work.*

Figure 1 shows the split of potential individual claims (ordered by size) under a 60% quota share.

*Figure 1: Claim split in a 60% quota share*



*Source: Own work.*

Below is a summary of the advantages and disadvantages of quota share reinsurance (Institute and Faculty Education Limited, n.d.; Swiss Re, 2013).

Advantages:

- Increased underwriting capacity. A quota share enables the cedant to accept more risks and improve diversification. This is particularly beneficial for young and growing companies or those entering new business areas.
- Improved solvency margins. By reducing the portfolio's net size, quota share helps improve the insurer's solvency margins.
- Administrative simplicity. All risks are reinsured in the same manner, making quota share easy to manage and administer.
- Improved cash flow. Upfront payment of reinsurance commission can positively impact an insurer's cashflow position.

Disadvantages:

- Fixed proportion. A fixed percentage of all risks is ceded to the reinsurer, regardless of the size or variability of these risks.
- Claims not capped. Quota share does not cap claims, offering no protection against large claims or catastrophic events.
- Ceding profit. A portion of the profit is typically passed to the reinsurer, which may reduce the insurer's overall profitability.

### 2.3.1.2 *Surplus*

The most common form of proportional reinsurance is surplus treaty reinsurance (Swiss Re, 2013). Unlike quota share, which applies fixed proportions to all risks, surplus allows the cedant to tailor these proportions to individual risks.

Insurance companies use surplus reinsurance to manage risks that exceed their capacity for individual risks. For example, if an insurer has a specific capacity limiting the size of risks it can underwrite, it would need to decline any risk that exceeds this limit. Surplus enables insurers to accept and manage such risks. An alternative to surplus would be facultative arrangements, but surplus has the advantage of automatic coverage being readily available for all risks within the treaty terms.

To illustrate the motivation behind surplus reinsurance, consider a simple example. Suppose an insurer can underwrite individual risks up to the size<sup>1</sup> of 1 million. If the insurer encounters a risk of 2 million, it may want to cede half of it to the reinsurer. Surplus facilitates this by allowing the insurer to cede 50% of the premium and claims, effectively reducing the net size of the risk to 1 million. Similarly, if the risk is 4 million, the insurer

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<sup>1</sup> The size of risk can be measured in terms of the sum insured, for instance. However, in practice, it is very unlikely for the full sum insured to be paid out in the case of a claim. Insurers often rely on other measures like probable maximum loss (PML) or estimated maximum loss (EML). These estimates provide a more realistic view of what the maximum loss could be and are often considerably lower than the sum insured.

could cede 75% to the reinsurer, retaining a net risk of 1 million. In this way, surplus reinsurance enables the insurer to underwrite risks larger than its capacity.

A surplus treaty specifies several elements that define its terms and conditions. The two most important elements are:

- **Maximum retention limit:**  
The purpose of the maximum retention limit, often referred to as a “line”, is to limit the insurer's liability. Additionally, since smaller risks are not ceded, the administrative burden for the reinsurer is reduced. This feature is also the origin of the name “surplus”, as the reinsurer only accepts the surplus exceeding the insurer’s retention (Swiss Re, 2013). In the example above, the maximum retention limit would be 1 million.
- **Maximum level of coverage:**  
The second element is the maximum level of coverage the reinsurer offers. This coverage is often expressed as a multiple of the insurer's maximum retention, namely, in terms of the number of lines. For example, in a five-line surplus, the reinsurer would cover risks up to five times the insurer's maximum retention (GOV.UK, 2016b; Swiss Re, 2013).

The number of lines in a surplus treaty also determines the maximum size of the risk that can be included in the treaty. If a risk exceeds this limit, it cannot be included. In such cases, the insurer has to consider other options, such as facultative cover for the excess risk, retaining the excess risk itself, or arranging an additional surplus treaty.

These two elements also determine how the risk is shared between the insurer and reinsurer. Often, the proportion used to split premiums and claims is the ratio between the maximum retention and the size of the risk. In other words, the insurer uses the exact number of lines needed to cover the entire risk. However, the number of lines may also serve to fine-tune the proportion ceded. For instance, the insurer may choose to use all available lines in the treaty, thereby retaining a smaller portion of the risk.

Example: Surplus

*Table 2: Risks covered under the surplus treaty*

|                    | <b>Risk 1</b> | <b>Risk 2</b> | <b>Risk 3</b> |
|--------------------|---------------|---------------|---------------|
| <b>Sum insured</b> | 750,000       | 12,500,000    | 35,000,000    |
| <b>PML</b>         | 500,000       | 10,000,000    | 25,000,000    |
| <b>Premium</b>     | 1,125         | 18,750        | 52,500        |
| <b>Claim</b>       | 250,000       | 100,000       | 12,000,000    |

*Source: Own work based on Swiss Re (2013).*

Consider a surplus treaty where the insurer's maximum retention is 2 million, and the reinsurer provides coverage up to 8 million. Table 2 shows three risks covered under this treaty. The first two rows show the sums insured and the corresponding PMLs. The premium

is calculated at 0.15% of the sum insured. We assume a specific claim amount for each risk to demonstrate how the surplus treaty works.

Table 3 details how premiums and claims are split for the risks outlined in Table 2. In this example, we assume the insurer always uses the minimum number of lines necessary to cover each risk.

- Risk 1: The PML is less than the insurer's maximum retention, so the insurer retains 100% of the premium and claims. Even if a claim would exceed the retention, the insurer would have to cover the full amount of the claim on its own. This situation would indicate that the PML was underestimated.
- Risk 2: The PML equals 10 million, which is exactly the combined retention of the insurer and reinsurer (2 million + 8 million). The insurer cedes 80% of the risk to the reinsurer, retaining 20%.
- Risk 3: The PML exceeds the surplus treaty's limit. To include this risk in the treaty, the excess portion (60% of the PML) must be managed separately, for instance, through a facultative cover. The remaining 40% is divided between the insurer and reinsurer, similar to Risk 2.

*Table 3: Premium and claim split in a surplus treaty*

|        |         | Total      | Insurer |           | Reinsurer |           | Excess risk |                     |
|--------|---------|------------|---------|-----------|-----------|-----------|-------------|---------------------|
| Risk 1 | PML     | 500,000    | 100%    | 500,000   | 0%        | 0         | 0%          | 0                   |
|        | Premium | 1,125      |         | 1,125     |           | 0         |             | 0                   |
|        | Claim   | 250,000    |         | 250,000   |           | 0         |             | 0                   |
| Risk 2 | PML     | 10,000,000 | 20%     | 2,000,000 | 80%       | 8,000,000 | 0%          | 0                   |
|        | Premium | 18,750     |         | 3,750     |           | 15,000    |             | 0                   |
|        | Claim   | 100,000    |         | 20,000    |           | 80,000    |             | 0                   |
| Risk 3 | PML     | 25,000,000 | 8%      | 2,000,000 | 32%       | 8,000,000 | 60%         | 15,000,000          |
|        | Premium | 52,500     |         | 4,200     |           | 16,800    |             | 31,500 <sup>2</sup> |
|        | Claim   | 12,000,000 |         | 960,000   |           | 3,840,000 |             | 7,200,000           |

*Source: Own work.*

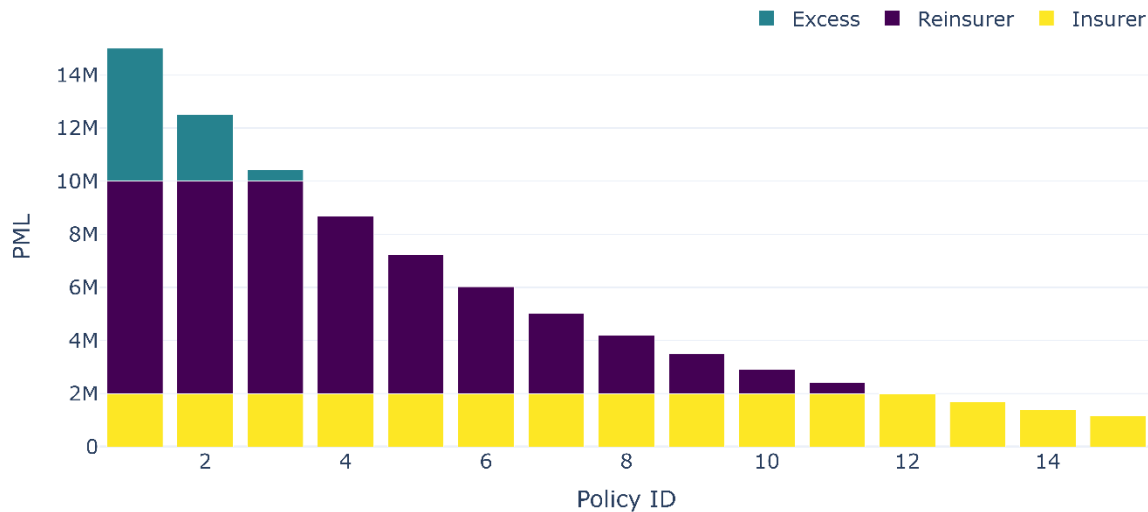
The example demonstrates that determining the retained proportion for each risk is a key point in a surplus treaty. Once this proportion is established, the surplus treaty operates similarly to a quota share, splitting premiums and claims according to this proportion, regardless of the claim size—even if it exceeds the PML.

Figure 2 illustrates how the PMLs of hypothetical risks would be divided between the insurer and reinsurer in the surplus treaty with terms as specified above. The insurer retains the entire

<sup>2</sup> The premium is not necessarily 60% of the original premium. For example, if excess risk is managed through a facultative cover.

risk for risks with a PML below the insurer's retention limit. As the PML increases, the insurer's retained proportion gradually decreases.

*Figure 2: PML split in a surplus treaty*



*Source: Own work.*

While a surplus treaty offers certain advantages over quota share, it also has some drawbacks. Its advantages and disadvantages are outlined below (Institute and Faculty Education Limited, n.d.; Swiss Re, 2013).

#### Advantages:

- Underwriting large risks. A surplus treaty enables the insurer to underwrite risks that exceed its capacity.
- More homogeneous retained portfolio. A surplus treaty is particularly beneficial for heterogeneous lines of business, such as commercial fire risks. By ceding different proportions of risks depending on their size, surplus helps to fine-tune exposure and makes the retained portfolio more homogeneous. It is less beneficial for personal lines, where claims tend to be smaller and more predictable.
- Flexibility in proportion retained. The proportion of risk retained varies depending on the size of the risk. Additionally, the insurer can further fine-tune the proportion retained by choosing the number of lines.
- Improved cashflow. Similarly to quota share, upfront reinsurance commission payment can positively impact cashflow.

#### Disadvantages:

- Complex administration. A surplus treaty requires insurers to assess and estimate PMLs and record the ceded proportion for each individual risk, which can be more time-consuming and costly.

- Claims not capped. Like quota share, a surplus treaty does not cap claims, meaning it does not provide protection against very large claims or catastrophic events. For instance, it is not suitable for classes where coverage may be unlimited, such as liability business.
- Managing the excess risk. Risks exceeding the treaty limit may require additional reinsurance cover, potentially increasing reinsurance costs.

### 2.3.2 Non-proportional reinsurance

A key disadvantage of proportional reinsurance products described above is their inability to cap very large claims. To address this limitation, non-proportional reinsurance products emerged in the past, aiming to offer protection against exceptionally large or accumulated claims.

Unlike proportional covers, non-proportional reinsurance does not involve a predetermined split of premiums and claims. Instead, it focuses on the claim amount (Swiss Re, 2013). In these arrangements, the reinsurer covers the portion of a claim that exceeds a specified threshold, referred to as the priority, attachment point, deductible, retention, or excess. Claims below this threshold are fully retained by the insurer.

The coverage often includes an upper limit and is therefore structured as a layer. The layer is typically described as the “amount of layer in excess of lower limit” (e.g., 10 million in excess of 5 million). The term “excess of” may also be abbreviated as “less” or simply “xs” (GOV.UK, 2016b). Furthermore, within the layer, the cedant may be required to retain a certain percentage of the claim, for instance, 10%. This helps mitigate potential moral hazard. In practice, however, insurers typically try to maintain good relationships with reinsurers and usually manage claims prudently. Non-proportional covers can be structured into multiple layers, with each layer potentially covered by a different reinsurer. Additionally, a single layer may be shared among several reinsurers, each assuming a specific portion.

Full cover can sometimes be restored following a claim, providing further protection. This is called a reinstatement. Once agreed, reinstatements are automatic and obligatory and may require the insurer to pay an additional premium, known as the reinstatement premium. Unlike proportional reinsurance, commission payments are generally not required, as they can be incorporated into the reinsurance premium. However, brokerage fees are commonly incurred since these arrangements are often negotiated through brokers.

The key advantages and disadvantages of non-proportional forms of reinsurance are outlined below (Institute and Faculty Education Limited, n.d.; Swiss Re, 2013).

Advantages:

- Capping large claims. Non-proportional reinsurance effectively caps large claims, limiting the insurer's liability to the retention limit.
- Retaining smaller, more manageable claims. The insurer retains claims below the excess. Since these claims are generally more predictable and manageable, the insurer may retain a larger portion of the premiums, potentially leading to higher profitability.
- Independent reinsurance pricing. Non-proportional reinsurance allows the reinsurer to price risks independently of the insurer's pricing.

Disadvantages:

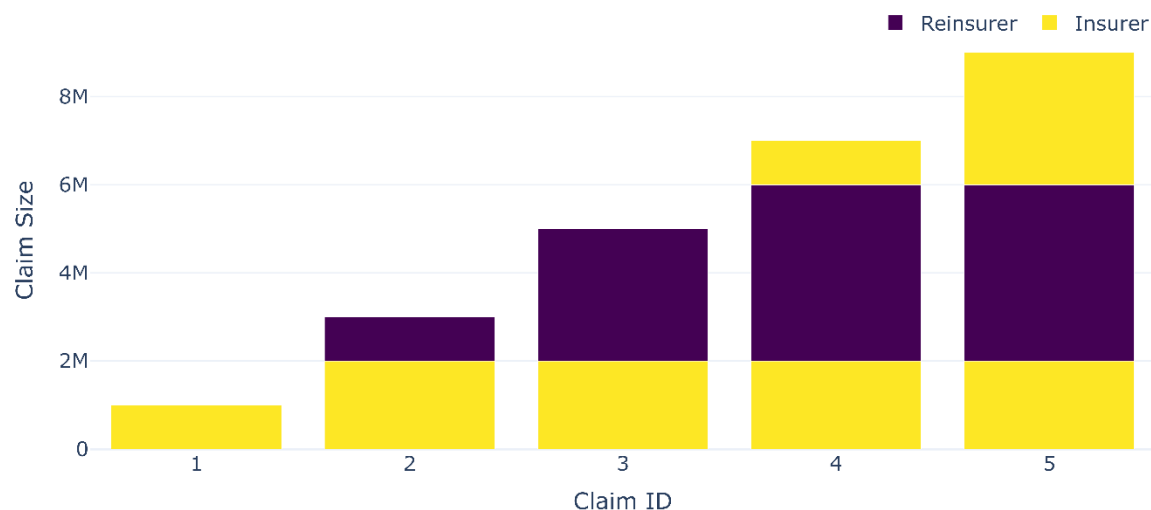
- Retention of claims below the priority. While retaining smaller losses can be beneficial, a high attachment point may result in high claim payments. Additionally, a large number of claims can increase the aggregate cost of these retained claims.
- Challenges in obtaining coverage. Securing suitable reinsurance coverage can be difficult, and/or premiums may be prohibitively expensive.
- Reinsurer loadings. Over the long term, the reinsurance premium typically exceeds claim recoveries, as it incorporates the reinsurer's profit margins and contingency loadings.

Several types of non-proportional reinsurance products exist, each designed to meet specific needs. These products are explored in more detail below.

### 2.3.2.1 Risk excess of loss

Risk excess of loss (risk XL) is a non-proportional reinsurance product that protects against individual large claims, such as a significant motor third-party liability claim or a major property fire claim. It can be arranged either on a facultative basis to cover individual risks or through a treaty to cover a portfolio of risks. This type of coverage is less effective in protecting against the frequency of claims or accumulation of claims.

Figure 3: Claim split in a 4 xs 2 risk XL



*Source: Own work.*

To illustrate the concept of risk XL, Figure 3 shows how claims of various sizes are split between the insurer and the reinsurer in a 4 xs 2 million risk XL.

#### *2.3.2.2 Aggregate excess of loss*

Aggregate excess of loss (aggregate XL) extends the risk XL by providing coverage for the aggregation of multiple claims. Claims can be aggregated in various ways, and the boundaries between these approaches are not always distinct. The most common types of aggregations include:

- **Single event.** For example, a motorway pile-up caused by a single driver may result in multiple injury claims. While none of the claims may be significant on its own, the aggregate claim can be substantial. When claims are aggregated due to a major event, such as a natural disaster or a large fire, this type of coverage is often referred to as catastrophe excess of loss (catastrophe XL, or CAT XL). Catastrophe XL is an important form of non-proportional reinsurance and is described in greater detail below.
- **Peril or cause.** This type of aggregation provides coverage based on a common peril or cause of claims, regardless of the specific events that triggered them. For instance, it may cover all claims related to asbestosis.
- **Class.** When claims from a specific class are aggregated, the aggregate XL is commonly referred to as stop loss. Stop loss provides coverage for all claims within a particular class of business or even across the entire cedant's account. It will be briefly described below.

#### *2.3.2.3 Catastrophe excess of loss*

Catastrophe excess of loss is a reinsurance product designed to protect against the impact of catastrophic events. These events can include natural disasters such as earthquakes, hurricanes, convective storms, hailstorms, floods, and windstorms, as well as man-made catastrophes like large-scale fires or explosions. In a catastrophe XL, an event is usually defined within a specific time period, such as 48 or 72 hours. These events can generate claims affecting thousands of policies. While individual claims may not be significant on their own, the aggregate claim can exceed the capacity of even large insurance companies.

Extreme risks are an important part of the non-life insurance and reinsurance industry. It is in the aftermath of such events that the industry can contribute most to the economy and society. By promptly paying insurance claims, it ensures faster recovery for both the economy and affected populations. However, these extreme risks are highly unpredictable in terms of both frequency and severity, leading to significant volatility in associated claims. This volatility and the potential for significant claims require insurance and reinsurance

companies to maintain adequate capital to be able to absorb such claims. Compared to the expected claim amount, this additional capital requirement is relatively high for extreme risks, making these risks capital-intensive. Pricing these risks—particularly at very high layers—is typically challenging due to the sparse data available. Reinsurance companies typically rely on catastrophe models. In some cases, even the cost of the capital required to support these risks is considered when pricing these covers. As we will see later, this is one of the reasons why alternative reinsurance capital is most often deployed in these capital-intensive segments.

Returning to catastrophe XL reinsurance, its advantages and disadvantages include the following (Institute and Faculty Education Limited, n.d.; Swiss Re, 2013).

#### Advantages:

- Insuring risks potentially leading to large or accumulated claims. By capping the insurer's liability, catastrophe XL allows insurers to underwrite risks that could result in large claims. It also mitigates the potential accumulations of claims, enabling the insurer to provide coverage in areas prone to natural disasters.
- Reduced risk of insolvency. Catastrophe XL reduces the risk of insolvency following a catastrophic event.
- Stabilizing the technical result. Since catastrophe XL covers extreme and very volatile risks, its effect on the stability of the technical result is typically more significant than that of other reinsurance products.

#### Disadvantages:

- High reinsurance premiums. Premiums can sometimes be considerably higher than pure risk premiums. This is often influenced by the state of the reinsurance cycle.
- Difficult to price. The unpredictable nature of catastrophic events makes pricing of these products challenging. Catastrophe models are typically used to assist with pricing.

#### Example: Catastrophe XL

Consider a 90 xs 10 million catastrophe XL program, divided into three layers:

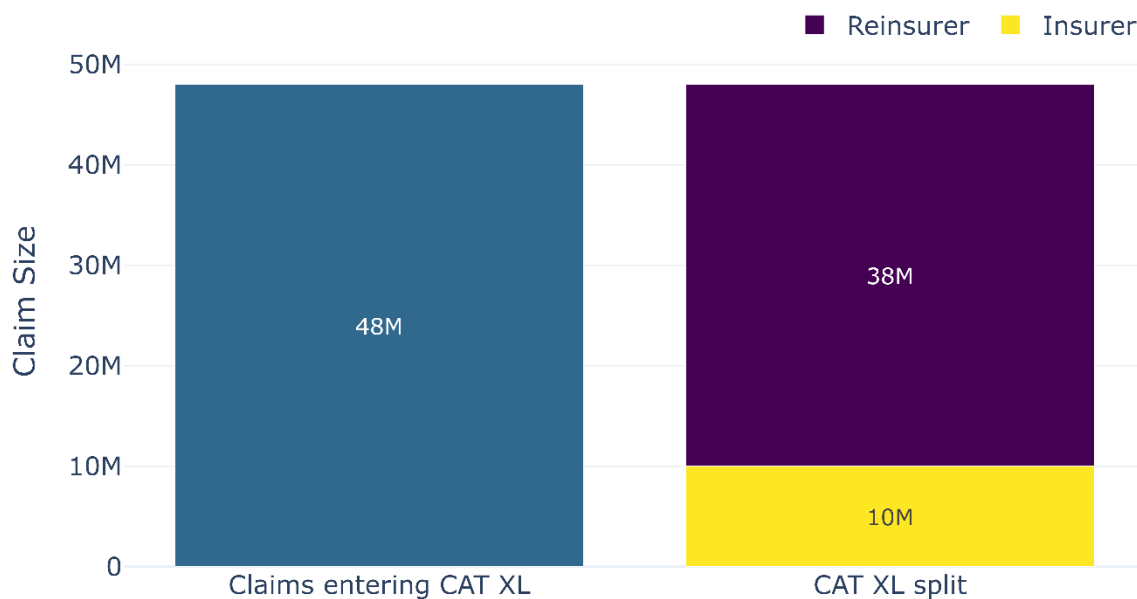
- First layer: 15 xs 10 million
- Second layer: 25 xs 25 million
- Third layer: 50 xs 50 million

Consider now a large-scale convective storm causing aggregate losses of 60 million for the insurer. Assume that 12 million is recovered from facultative coverages and proportional treaties. The remaining 48 million enter the catastrophe XL. This fully exhausts the first layer and uses 23 of the 25 million available in the second layer. For these two layers to continue providing protection, the insurer typically needs to pay an additional reinstatement

premium (if reinstatements are possible). This represents an additional cost when a layer is hit.

Total reinsurance recoveries amount to 50 million (12 million from facultative coverages and proportional treaties and 38 million from catastrophe XL), resulting in a net retained loss of 10 million for the insurer. Figure 4 shows how the claims entering the catastrophe XL are split between the insurer and CAT XL reinsurer.

*Figure 4: Claim split in a catastrophe XL*



*Source: Own work.*

#### 2.3.2.4 Stop loss

Stop loss is a reinsurance product designed to stabilize earnings over time and offers the most comprehensive protection (Swiss Re, 2013). Unlike typical aggregate XL, which limits coverage to specific causes or events, stop loss covers all causes and events during a specified period, usually one year.

This cover is typically based on a loss ratio. It is usually triggered when the insurer experiences a technical loss, meaning the loss ratio exceeds 100%. This encourages the insurer to maintain interest in the risks it underwrites, mitigating excessively risky or careless underwriting practices (Swiss Re, 2013). For example, a stop loss might cover losses exceeding 110%, up to a maximum of 130% of premium income.

Reinsurers are generally reluctant to offer stop loss cover due to its broad protection and their limited control over the insurer's underwriting and claim handling. When a reinsurer provides a stop loss cover, it typically requires a deductible and may also require the insurer

to pay a portion of claims within the layer. Additionally, the reinsurer may seek some influence over the insurer's underwriting, pricing, and claims handling practices.

### 2.3.3 Other products

Beyond the traditional reinsurance products discussed above, the reinsurance market continually develops solutions that enable insurers to manage risk more effectively. We mention two notable categories: finite risk (or financial reinsurance) products and products involving alternative reinsurance capital. While we categorize these reinsurance products into distinct groups, note that the boundaries between them are not always clear-cut.

#### 2.3.3.1 *Finite risk or financial reinsurance*

Finite risk or financial reinsurance products are products characterized by a limited risk transfer. This feature distinguishes them from traditional reinsurance products. While typically provided by reinsurers, some of these products may also be classed as capital market products. Their primary purposes include smoothing earnings over time, improving the apparent accounting position, or enhancing cashflow. Examples include spread loss covers, time-and-distance deals, and financial quota share agreements. To provide some understanding, we describe an example of a spread loss cover.

##### Example: Spread loss cover

In a spread loss cover, an insurer pays premiums to obtain coverage over a multi-year period. These premiums are paid annually or as a lump sum and accumulate in a fund with interest. This arrangement can be particularly beneficial for insurers exposed to significant and infrequent risks, such as earthquakes. By distributing the financial impact of these risks over several years, spread loss covers help stabilize claim fluctuations and smooth financial results over time.

Consider the following example provided by GOV.UK (2016b). Suppose the cedant pays an annual premium of 10 million for five years in return for coverage of up to 25 million in any given year and 50 million in total. This arrangement may, for instance, be placed above the top layer of a conventional reinsurance program, such as catastrophe XL. Premiums, less claims paid, form a fund that accumulates at an interest rate of 7%. At the end of the five-year period, the reinsurer returns 80% of any positive balance to the cedant. This resembles a profit commission in the context of reinsurance.

Let's examine two extreme outcomes (from the reinsurer's perspective):

- In the best-case scenario, with no claims over the five years, the fund accumulates to approximately 61.5 million. After returning 80% as a profit commission, the reinsurer's profit is around 12.3 million.

- The worst-case scenario is when the entire coverage is used at the beginning of the first two years. After accounting for the interest rate of 7%, the reinsurer would incur a loss of about 6.3 million.

For any other scenario, the reinsurer's result falls between these two extremes, ranging from a 24.6% profit to a -12.6% loss on total premiums received. This limited potential for losses contrasts with conventional reinsurance (such as non-proportional reinsurance), where losses can easily reach multiple times the reinsurance premiums.

From the cedant's perspective, the net present value of the premiums paid is approximately 43.9 million. Depending on the claim scenario, the net present value of the payments to the cedant will range from 35.1 million in a no-claim scenario to 48.4 million if the full coverage is used at the beginning of the first two years.

This arrangement demonstrates that recoveries cannot significantly exceed premiums paid, highlighting the limited risk transfer. However, there is investment risk involved. As premiums accumulate with interest, the primary risk to the reinsurer is the possibility of earlier-than-expected claims payments. This investment component is a typical feature of finite risk reinsurance products.

#### *2.3.3.2 Products involving alternative reinsurance capital*

The reinsurance market also includes products that involve alternative capital sources, distinct from traditional reinsurance. Unlike finite risk products, these products' primary purpose is risk transfer. The next chapter examines these products in greater detail.

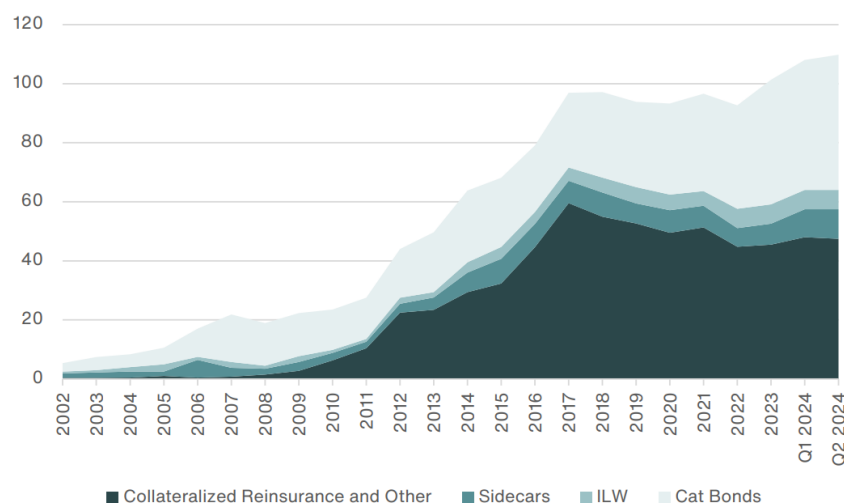
### **3 ALTERNATIVE REINSURANCE CAPITAL**

Having described conventional reinsurance, we now move to alternative reinsurance capital. Unlike traditional capital from reinsurance companies, alternative capital comes from broader capital markets. These sources typically include institutional investors such as dedicated insurance-linked securities funds, hedge funds, and (re)insurance companies.

The origins of alternative capital in reinsurance trace back to the 1990s, a period when natural disasters caused significant insured losses. These events strained reinsurance capacity and simultaneously drove up demand for property insurance and reinsurance. This imbalance between supply and demand led to higher and more volatile costs of property reinsurance. Concerns over the future availability and affordability of property reinsurance prompted the insurance industry to explore alternative means of transferring these risks, particularly risks related to natural catastrophes. To secure cover, some insurers turned to capital markets (Kampa & Siegert, 2010).

One innovative solution that emerged at that time was a catastrophe bond, or CAT bond, which was designed to transfer natural catastrophe risks to investors in the broader capital markets (Spry, 2009). The beginnings were characterized by limited expertise among investors and issuers, immature catastrophe modelling, lengthy processes, and high transaction costs. Despite these obstacles, the CAT bond market grew steadily, particularly following major catastrophic events (American Academy of Actuaries, 2022; Spry, 2009).

*Figure 5: Alternative capital deployment across different products (in USD billions)*



*Source: Aon (2024).*

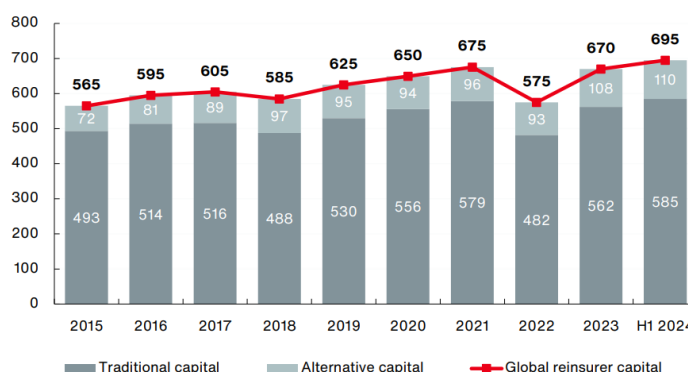
Other alternative capital products also began to emerge, contributing to the development of a broader market. These products included industry loss warranties (ILWs), collateralized reinsurance, and sidecars. They have enhanced the options available to cedants and strengthened the role of alternative capital in the industry. Figure 5 shows the contribution of these products to total alternative capital over the past two decades. While CAT bonds are the most prominent product in the market, we see that other products also contribute meaningfully to the overall alternative capital. These arrangements are described in greater detail later in this chapter.

Figure 5 also shows that the growth of alternative capital accelerated after the great financial crisis. At that time, low interest rates and heightened investors' appetites increased the flow of alternative capital into the industry. As of 2024, the two most significant components of alternative capital are CAT bonds and collateralized reinsurance, representing approximately USD 46.0 billion and USD 47.5 billion, respectively. Other products, such as ILWs and sidecars, collectively account for around USD 16.5 billion (Aon, 2024).

Today, these products contribute about USD 110 billion to global reinsurance capital. By comparison, traditional reinsurance capital stands at approximately USD 585 billion. Methodologies for estimating traditional reinsurance capital vary among reinsurance

brokers, who typically provide these data. In the case of Aon (2024), this figure represents the equity of reinsurers worldwide. It is important to note that this number also includes the capacity for life-related risks. In contrast, most alternative capital is allocated to non-life risks, particularly to property peak risks (i.e., natural catastrophes). For these risks, alternative capital therefore constitutes a relatively larger share and forms an important component of the global capacity. The development of alternative capital and traditional capital over the past decade is illustrated in Figure 6.

*Figure 6: Alternative and traditional reinsurance capital over time (in USD billions)*



*Source: Aon (2024).*

In the remainder of this chapter, we examine alternative capital in the reinsurance industry in greater detail. First, we explore arrangements designed to utilize alternative capital. We highlight their features, benefits, and limitations and provide examples of their use in practice. Next, we summarize common advantages and challenges associated with these products from the cedant's perspective. Finally, we consider investors' perspective, exploring why this asset class may appeal to them, identifying key characteristics they find important, and presenting some market data.

### 3.1 Key features in contrast with conventional reinsurance

Before examining the individual arrangements in detail, it is helpful to highlight a few key features that may differ from those in conventional reinsurance. Understanding these will provide a context for concrete arrangements.

#### 3.1.1 Counterparties

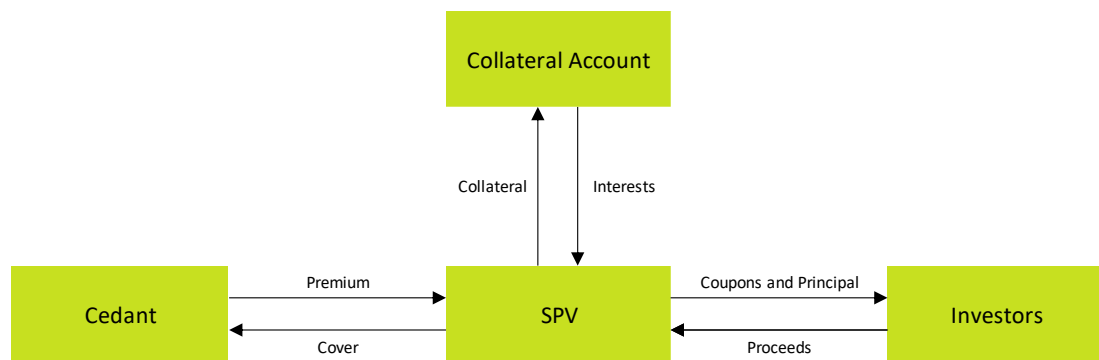
Conventional reinsurance contracts are typically written between the cedant and one or more reinsurers. In contrast, alternative capital arrangements often involve different counterparties, typically institutional investors. For example, CAT bonds can include a large number of investors. Their variations, private CAT bonds, are negotiated as private deals and involve fewer investors. Similarly, ILWs and sidecars are also usually structured as

private arrangements. Among all alternative arrangements, collateralized reinsurance most closely resembles conventional reinsurance in terms of counterparty relationships, typically involving a single investor assuming the insurance risk (Ben Ammar et al., 2015).

### 3.1.2 Special purpose vehicles

Most alternative capital arrangements use a special purpose vehicle (SPV) as an intermediary between the cedant and investors. The SPV is a separate legal entity created to isolate the insurance risk from the cedant's other operations and to improve security and transparency for investors (Swiss Re, 2013).

*Figure 7: The role of SPV*



*Source: Own work based on Swiss Re (2013).*

The typical structure of an alternative capital arrangement is illustrated in Figure 7, which also highlights the role of the SPV. This is (Swiss Re, 2013):

1. Capital raising. The SPV raises funds by issuing securities (insurance-linked securities or ILS) to investors.
2. Collateral management. Proceeds from the securities are deposited into a collateral account and invested in low-risk assets (e.g., government bonds or money market funds). This collateral backs the SPV's reinsurance obligations to the cedant.
3. Reinsurance contract. The SPV enters into a reinsurance contract with the cedant, who pays a premium, much like a traditional reinsurance premium. Typically, the collateral amount matches the reinsurance contract limit.
4. Investor returns. The SPV distributes returns to investors in the form of coupons. These are paid from the interest earned on the collateral and the reinsurance premium received.
5. Triggering event. If an event occurs (e.g., a major hurricane) that triggers the reinsurance contract, coupon payments may be suspended. Additionally, the SPV may need to liquidate part or all of the collateral to compensate the cedant.
6. No triggering event. If no triggering event occurs, the SPV returns the entire principal (i.e., the collateral) to investors at the end of the contract period.

### 3.1.3 Basis for payment

In traditional reinsurance, payouts are almost always based on the indemnity principle, where the reinsurer reimburses the cedant for actual losses incurred. Many alternative capital arrangements follow the same principle, but some use different criteria for determining payouts. These payout triggers generally fall into four categories (American Academy of Actuaries, 2022; Swiss Re, 2011):

- **Indemnity:** The payout is based on the cedant's actual losses, resembling conventional reinsurance. For instance, an arrangement may cover the cedant's claims from an earthquake exceeding 100 million.
- **Industry loss index:** The payout is based on the total industry loss from a specific event exceeding a predetermined threshold. For instance, a payout may be triggered if a hurricane causes industry-wide insured losses exceeding 1 billion. The cedant would then recover a percentage of the industry-wide losses above this threshold. A weighted industry index may be used to better align with the cedant's actual exposure, assigning different weights to different locations.
- **Parametric:** The payout is based on an objective measure or parameter related to the natural hazard. For example, it might be triggered by an earthquake with a magnitude greater than 7.0 on the Richter scale. Parametric triggers can also combine multiple parameters into an index. Similarly to the weighted industry loss index, a parametric index would assign different weights to different locations to reflect the cedant's exposure more accurately.
- **Modelled loss:** The payout is determined using a third-party model that estimates the cedant's losses based on the event's characteristics.

Hybrid triggers are also possible. For instance, the industry loss index may trigger the payout, but the final amount is based on the cedant's actual losses.

Several factors influence the choice of trigger. One of the most important is basis risk (see Section 3.1.4). Other factors include transparency, claims settlement time, and regulatory or accounting considerations (American Academy of Actuaries, 2022). Parametric triggers, for example, offer greater transparency to investors and enable quick determination of payouts without requiring claims to be reported and settled. In contrast, indemnity triggers require more time to determine the final loss amount, which can tie up the investor's capital for longer than anticipated. Furthermore, indemnity triggers require the cedant to disclose more detailed internal information. Regulatory treatment of different triggers can also vary. For example, indemnity-based covers may fully qualify for capital relief, while parametric triggers often provide only partial relief or none at all.

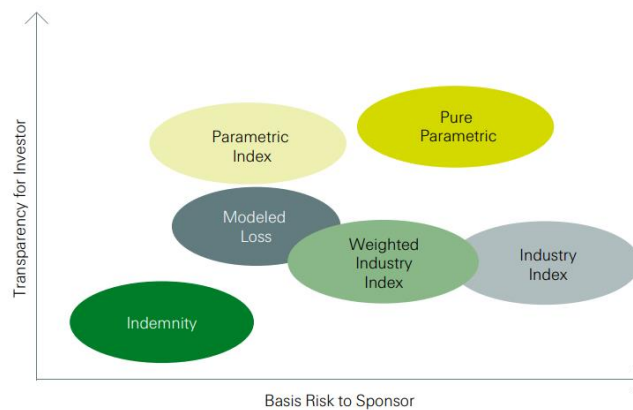
### 3.1.4 Basis risk

Basis risk refers to the potential mismatch between the payout provided by an insurance policy or reinsurance contract and the actual loss incurred. In direct insurance, basis risk may arise from policy features such as deductibles, limits, or participation clauses. A more important example is index-based or parametric insurance, where payouts are determined by proxies for losses rather than by the actual losses themselves.

In the context of alternative capital arrangements, basis risk is primarily a concern when choosing a trigger. If a non-indemnity trigger is used, the payout may not match the cedant's actual losses. Consequently, even if a triggering event occurs, the payment may be either higher or lower than the actual loss, leaving the cedant with residual risk.

Figure 8 shows the comparison of different triggers in terms of basis risk and transparency for investors (Swiss Re, 2011).

*Figure 8: Basis risk and transparency of different triggers*



*Source: Swiss Re (2011).*

Cedants typically prefer indemnity triggers because they ensure full recovery of incurred losses. In contrast, investors often favour transparent parametric triggers for their simplicity and ease of verification. However, over time, investors have become more comfortable also with indemnity triggers, making them the most widely used trigger today. The industry loss index is the second most common trigger, likely because industry losses often closely correlate with cedant's actual losses. This is particularly true for large insurers and reinsurers, whose portfolios usually reflect the broader industry exposure (Artemis Deal Directory, n.d.).

## 3.2 Alternative reinsurance capital arrangements

In this section, we describe strategies involving alternative reinsurance capital in greater detail. Due to their prominent role in the market, we begin with CAT bonds. We examine them in greater depth, including a detailed comparison with conventional reinsurance. Understanding the concept and mechanics of CAT bonds will also provide a foundation for understanding other products. For other arrangements, we focus on their key characteristics and provide examples of their practical application. We also include comments on how they compare with CAT bonds and conventional reinsurance. Later in the chapter, we revisit and analyse the common features of these arrangements.

### 3.2.1 Catastrophe bonds

Catastrophe bonds operate similarly to traditional catastrophe XL reinsurance, offering a capital market alternative. Apart from insurers and reinsurers, they may also be issued by non-insurance entities, such as corporations or governments.

The entity issuing a CAT bond is often referred to as the sponsor or cedant. It typically seeks protection against high-severity, low-probability events like natural disasters. As mentioned earlier, a special purpose vehicle typically acts as an intermediate structure between the cedant and investors.

Most CAT bonds are issued under Rule 144A<sup>3</sup> and are generally more liquid than those placed privately. Although Rule 144A governs the resale of securities, it also facilitates the initial issuance of CAT bonds by enabling broker-dealers or investment banks to act as initial purchasers. These intermediaries then resell the bonds to qualified institutional buyers under the Rule 144A. A well-functioning secondary market is important for the CAT bond market. Better liquidity has had a positive impact on the market, making CAT bonds more accessible to a broader range of investors and helping them manage their portfolios better (Artemis, n.d.). The data for 144A bond transactions is available through the Trade Reporting and Compliance Engine (TRACE), a facility for reporting over-the-counter bond market trades operated by FINRA (Financial Industry Regulatory Authority in the U.S.). While this data is not readily available, it can be found in industry reports. It is mentioned again in Section 3.4 on investors' perspectives.

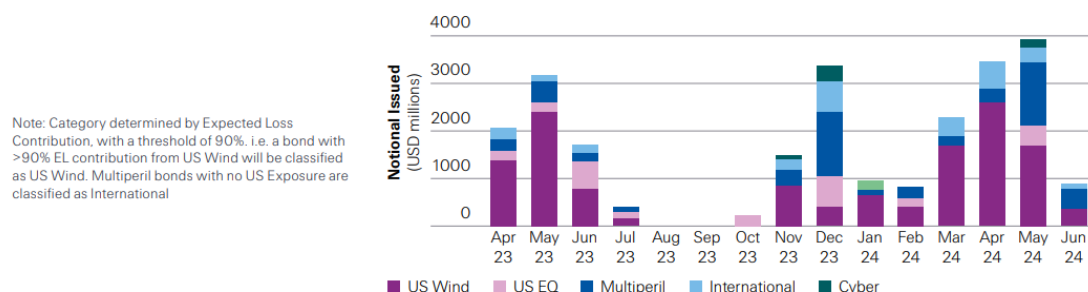
To provide an idea of the perils typically covered by CAT bonds, Figure 9 shows the capacity of CAT bonds issued by peril over the past year. We see that the U.S. wind is by far the most commonly covered peril, followed by U.S. earthquakes and multiperil risks (which often

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<sup>3</sup> Rule 144A is a regulation by the U.S. Securities and Exchange Commission that allows purchasers of privately placed securities to resell them to qualified institutional buyers under certain conditions (Legal Information Institute, n.d.).

include U.S. wind). More figures on the actual amounts of capacity issued and capital outstanding for CAT bonds is presented in Section 3.4 on investors' perspective.

*Figure 9: CAT bonds: issuance by peril*



Source: Swiss Re (2024b).

### Example: Catastrophe bond

The following example, based on the Artemis Deal Directory (n.d.), aims to provide a better understanding of CAT bonds and their application in practice. It introduces some additional aspects not yet mentioned, accompanied by brief explanations.

In December 2023, the global insurance group Allianz sought reinsurance protection against European windstorm through the capital markets. The arrangement would cover the entire Allianz group across all main exposed countries for three calendar years, from the start of 2024 through the end of 2026. The coverage is structured on a per-occurrence<sup>4</sup> basis, using a weighted industry loss index as the trigger.

Since issuing a CAT bond is a complex process, sponsors usually engage a third-party structuring agent, who provides guidance throughout the process and assists with the transaction. In this case, Allianz engaged GC Securities and Howden Tiger Capital Markets & Advisor as joint structuring agents. To raise capital, Allianz established a special purpose vehicle in Ireland named Blue Sky Re DAC. Initially, it planned to issue EUR 250 million in notes to investors, which would serve as collateral for Allianz's reinsurance arrangement.

For pricing guidance on the notes, sponsors typically hire a third-party modelling firm to assess the riskiness of the transaction. This is typically done using catastrophe models that try to estimate the financial impact of extreme events. These models play an important role in structuring CAT bonds and are widely used across the insurance and reinsurance industry for assessing and managing risks. Catastrophe models involve simulating natural phenomena, estimating the resulting physical damage, and translating it into financial losses.

<sup>4</sup> The coverage can also be on an aggregate basis, covering losses arising from multiple events within a specified period. Aggregate covers represent around 40 % of outstanding cat bond capital as of 2024, while per-occurrence covers represent around 60 % (Artemis, n.d.).

These models are further described in Section 3.4 on investors' perspective. For this transaction, Allianz engaged Risk Management Solutions (RMS) from Moody's Analytics to provide modelling services. The modelling produced the following key information:

- Attachment probability: 3.03%, representing the likelihood of some loss to the bond in a given year. This is analogous to the default probability for conventional bonds, with CAT bond probabilities often comparable to those of high-yield bonds (American Academy of Actuaries, 2022). Another possible estimate would be the exhaustion probability, which indicates how likely the CAT bond is to experience a total loss during a given period.
- Expected loss: 2.14%, calculated as the weighted average of modelled losses based on their corresponding probabilities. It was mentioned that the countries contributing the most to expected losses are Germany, the UK, and France.

Based on this information, Allianz offered notes to investors with initial price guidance for a spread between 5% and 5.75%. The spread refers to the difference between the required return on the notes and the underlying expected loss. In this transaction, the spread guidance was later narrowed to a range of 5.5% to 5.75% and ultimately priced at the top end at 5.75%.

CAT bond pricing is also commonly expressed as a “multiple”, defined as the ratio of the expected return (expected loss plus spread) to the underlying expected loss. For this transaction, the multiple was 3.69, calculated as  $(2.14\% + 5.75\%) / 2.14\%$ . Pricing is influenced by various factors, including the underlying risk, the supply of similar instruments, and investors' appetites.

#### *3.2.1.1 Comparison with conventional catastrophe XL covers*

This section provides a more detailed comparison of CAT bonds to conventional reinsurance. As mentioned previously, CAT bonds share most similarities with conventional catastrophe XL covers, but there are a few distinctions. The main similarities and differences are outlined below (American Academy of Actuaries, 2022):

- Perils. Both products aim to protect against significant losses resulting from catastrophic events. While CAT bonds primarily focus on natural disasters, CAT XL covers often include coverage for man-made catastrophes.
- Pricing. Both rely on historical data and catastrophe models for pricing. An additional key factor in conventional CAT XL pricing is the reinsurance capacity available in the market. CAT bond pricing, on the other hand, is also influenced by conditions in the broader capital markets.
- Costs. Issuing a CAT bond involves higher costs, including costs of setting up an SPV, meeting filing requirements, performing modelling, and preparing presentations and a prospectus. These expenses are often significantly higher than those for conventional CAT XL covers.

- Coverage period. CAT bonds are typically multi-year arrangements to justify their higher initial costs. In contrast, CAT XL covers are usually renewed annually. If reinsurance rates are favourable, the multi-year nature of CAT bonds allows cedants to lock in favourable rates over a longer period, ensuring more stable reinsurance costs.
- Reinstatements. CAT XL layers often include a reinstatement option after coverage is used, extending cover for further protection. This involves the payment of the reinstatement premium. In contrast, while CAT bonds can be structured to provide aggregate protection, they typically do not include reinstatement options.
- Cover focus. Both products typically cover infrequent, high-severity events. However, CAT bonds often target risks in the highest layers of CAT XL programs or even above these layers. Claims tend to be less likely in these layers, which aligns with the non-reinstatement nature of CAT bonds.
- Basis risk. Depending on the trigger type, CAT bonds may involve basis risk. In contrast, CAT XL covers are typically indemnity-based, eliminating this risk.
- Credit risk. Although cases of reinsurer insolvency are rare, CAT bonds generally carry less credit risk, as they are fully collateralized.

### 3.2.2 Industry loss warranties

An industry loss warranty provides coverage based on the total insured losses sustained across the industry from a specific event (Artemis, n.d.). ILWs primarily cover natural catastrophes but can also extend to other risks, such as cyber risks. They may also be used to address gaps in existing reinsurance programs or to take advantage of lower costs compared to conventional reinsurance (Hartwig & Lynch, 2015).

Although ILWs may resemble CAT bonds with an industry loss trigger, they differ in several ways. For instance, CAT bonds are typically structured as securities and can be traded on the secondary market, whereas ILWs are usually written as ordinary reinsurance contracts (Artemis, n.d.). Another difference is the amount of coverage provided. The simpler structure of ILWs reduces issuance costs, which makes even smaller coverage amounts still cost-effective. While CAT bonds generally provide coverage exceeding USD 100 million, the coverage of ILWs can start at just USD 1 million. Additionally, ILWs usually provide one-year coverage, whereas CAT bonds typically span multiple years (Ben Ammar et al., 2015).

ILWs are particularly popular among global insurance groups, with broad portfolios reflecting overall industry exposure. These instruments allow companies to secure reinsurance protection without disclosing internal data (Hartwig & Lynch, 2015). As the name suggests, ILWs are based on an industry loss trigger (Artemis, n.d.; Swiss Re, 2011); however, some may also incorporate a double-trigger mechanism. In this case, once the industry loss threshold is reached, the cedant is compensated up to the policy limit based on actual losses incurred (Ben Ammar et al., 2015).

### Example: Industry loss warranty

Industry loss warranties are typically private contracts, making specific examples harder to find. However, the following case, based on the Artemis Deal Directory (Evans, 2024a), provides insights into a recent transaction. Note that some details may be uncertain due to limitations in the source information.

In December 2023, Swiss Re secured USD 50 million of ILW cyber coverage. The transaction was supported by several specialist reinsurers, including the broker Gallagher Re, which described it as the first-ever cyber retrocession ILW. The coverage is triggered when industry-wide cyber losses in the U.S. exceed 9 billion USD.

The transaction relies on the modelling services provided by CyberAcuView, a company specializing in cyber risk analytics. CyberAcuView collects, aggregates, and analyses data on cyber incidents to estimate the possible financial impact of these events on the insurance industry. Another company, PERILS, known in the industry for its role in natural catastrophe reporting, serves as a reporting agency. It independently verifies and reports whether the USD 9 billion industry loss threshold has been reached.

The Artemis Deal Directory also mentions a cyber catastrophe bond issued by Swiss Re that offers the same protection. At the time of writing, it remains unclear whether these represent separate transactions or if the ILW was restructured into a 144A-format CAT bond to appeal to a broader range of investors. Nevertheless, this transaction allowed Swiss Re to access external sources of cyber capacity to support its inward cyber business.

Gallagher Re anticipates that similar ILW and CAT bond transactions will play an increasingly important role in cyber insurance. These instruments can expand access to capital and offer alternative solutions for insurers and reinsurers in the growing field of cyber risk.

### 3.2.3 Collateralized reinsurance

Collateralized reinsurance arrangements are private contracts between the cedant and investors. These arrangements resemble ordinary reinsurance contracts, but with a key difference: it is the investors who assume the insurance risk. They provide collateral to back the contract's liabilities. For ceding companies, collateralized reinsurance offers the simplest way to access alternative reinsurance capital. Compared to issuing a 144A CAT bond, these arrangements are simpler, quicker, and more cost-effective. Moreover, as they are usually indemnity-based, collateralized reinsurance can serve as a compelling alternative to traditional reinsurance. These features have established collateralized reinsurance as the largest segment of the ILS market in recent years, surpassing CAT bonds. However, as of the end of 2024, CAT bonds have nearly closed this gap (Artemis, n.d.).

These instruments offer investors greater customization and diversification possibilities than CAT bonds. However, they lack a secondary market, which limits their liquidity (Euler ILS Partners, n.d.). As with CAT bonds, the collateral is typically invested in low-risk money-market instruments. The returns therefore comprise a floating interest rate plus a reinsurance premium (Barrieu & Albertini, 2009; Euler ILS Partners, n.d.).

The collateralized nature enables entities without ratings to participate in the reinsurance market. Because these investors generally lack reinsurance licenses, a “transformer” entity—often a licensed special purpose insurer—is used to convert reinsurance agreements into financial instruments (Euler ILS Partners, n.d.). Some investors have even established their own transformer companies, often located in Bermuda, to write collateralized reinsurance contracts (Hartwig & Lynch, 2015).

Example: Collateralized reinsurance

This example is based on information provided by Artemis (n.d.).

In 2021, Lloyd’s of London, the insurance and reinsurance marketplace in London, sought protection for its Central Fund. The Central Fund acts as a last-resort safety net for policyholders, backing all insurance policies underwritten at Lloyd’s (GOV.UK, 2016a). With a size of around GBP 3 billion, the fund is financed through annual levies on Lloyd’s members.

For Lloyd’s, the protection of the Central Fund improves security for policyholders and strengthens its solvency position. In the past, Lloyd’s has explored various means of protecting the fund, including CAT bonds and other ILS structures. In 2021, it secured GBP 650 million of cover through a fully collateralized reinsurance layer. This coverage protects the fund from an attachment point of GBP 600 million up to the exhaustion point of GBP 1.25 billion. Of the total GBP 650 million, GBP 450 million was provided by investment bank JP Morgan, with the remaining GBP 200 million contributed by eight major global reinsurers: Arch Capital, Berkshire Hathaway, Everest Re, Hannover Re, Munich Re, RenaissanceRe, SCOR, and Swiss Re.

The coverage spans five years, starting in January 2021, and is designed for extreme loss scenarios. Historically, the Central Fund has been claimed upon only once, in 2007, and aggregate claims have never reached the attachment point of this coverage. This low likelihood of claims makes the arrangement potentially attractive to ILS investors also in the future.

### 3.2.4 Sidecars

Reinsurance sidecars are structures that gained popularity following significant catastrophic events like Hurricane Katrina (Michel-Kerjan & Morlaye, 2008). These events caused

significant insured losses that weakened insurers' capital position and limited their ability to underwrite new business. Generally, insurers can address such capital constraints by raising premiums, issuing new equity, or through debt financing. However, each approach has limitations: increased premiums take time to have an effect, issuing equity dilutes existing shareholder ownership, and debt increases leverage. Moreover, equity and debt financing are long-term commitments that require additional profits to maintain the same return on capital. In contrast, reinsurance sidecars offer a quicker solution for enhancing underwriting capacity. By responding swiftly to changes in the market environment, sidecars allowed insurers to gain an advantage over the competition and expand their market share (Lambert & Pierce, 2009).

Sidecars are typically structured as special purpose vehicles, established by insurers or reinsurers to attract additional capital from capital markets (Barrieu & Albertini, 2009). Funding can be raised either in the form of equity or debt, with debt introducing leverage into the structure. For investors, sidecars can therefore offer both fixed-income returns through coupons, and equity-like returns based on the profitability of the underlying business. The capital is invested directly into the SPV, avoiding diluting existing ownership and not increasing the cedant's leverage. (Ben Ammar et al., 2015).

Sidecars operate similarly to quota share arrangements, sharing both premiums and claims. This allows insurers to increase their underwriting capacity while also offering an opportunity to earn fees. These fees are analogous to a profit commission and reflect the investors' willingness to pay a portion of their premiums for access to cedant's underwriting expertise and profitable business (Lambert & Pierce, 2009).

These arrangements are usually fully collateralized and have limited lifespans, though their duration can be extended depending on market conditions (Michel-Kerjan & Morlaye, 2008). Recently, their popularity has declined, largely due to the rise of collateralized reinsurance, which serves as an alternative structure (Artemis, n.d.; Hartwig & Lynch, 2015).

#### Example: Sidecar

This example, based on Artemis (n.d.), illustrates the use of sidecar structure by Munich Re.

Since 2014, Munich Re has been using a collateralized reinsurance sidecar structure named Eden Re. The current iteration, Eden Re II Ltd., has been in operation since 2016. For the January 2024 renewal season, Eden Re II Ltd. raised USD 150 million from capital market investors. The funding was divided into USD 28.5 million in debt-like notes and USD 121.5 million in equity-like participating notes. These notes were privately placed with qualified investors, and both tranches are listed on the Bermuda Stock Exchange.

This sidecar provides Munich Re with a fully collateralized source of retrocessional protection, allowing the reinsurer to share underwriting profits and losses with capital market

investors. Since this reduces the portfolio's net size, it enables Munich Re to better manage its exposures, particularly in property and catastrophe lines.

It is worth noting that only listed tranches are publicly visible. Munich Re may also have private sidecars and quota share arrangements directly negotiated with large investors. According to a news article, in 2023, Munich Re secured USD 513 million in collateralized quota share capacity through a combination of sidecars and private agreements.

### 3.2.5 Other arrangements

So far, we have described the main types of products that can be used to utilize alternative reinsurance capital. Here, we outline some other arrangements related to alternative capital.

These include fronting arrangements, which can also be considered a form of collateralized reinsurance. We also mention derivatives related to insurance risk. Finally, we briefly mention products related to life and health risks. While this thesis focuses on alternative capital in the non-life insurance segment—which constitutes most of the alternative reinsurance capital—it is worth acknowledging the existence of products designed to transfer life- and health-related risks to capital markets.

#### 3.2.5.1 *Fronting arrangements*

In the insurance industry, a fronting arrangement is an arrangement where a (re)insurer underwrites a risk but subsequently transfers all or most of that risk to another (re)insurer. This process is technically a reinsurance, so the party assuming the risk may be referred to as a reinsurer.

There are several reasons to underwrite risks through fronting rather than directly. A common reason is licensing. If an insurer is not licensed to write insurance in a particular country, it may collaborate with a local insurer, who acts as the fronting company. For instance, a multinational retailer insured by a particular insurer may operate in a country where the insurer is not licensed. In this case, a local insurer can issue the policy as the fronting company and transfer the risk to the original insurer.

Even when licensing is not a constraint, fronting arrangements can be advantageous. For example, a local insurer may be able to handle claims more efficiently. Additionally, credit rating can be a factor. If a (re)insurer's credit rating does not meet the insured's requirements, coverage may be arranged through a fronting company with an acceptable rating. This situation may, for instance, arise when the insured has a long-standing relationship with an insurer who experiences a downgrade just before a policy renewal.

For the fronting company, these arrangements provide an opportunity to earn a fee, covering its expenses and generating profit. While the fronting company typically has little interest in

the profitability of the underlying business, it retains legal liability to the insured. This means the fronting company faces credit risk if the reinsurer fails to meet its obligations. The compensation for this risk is factored into the fronting fee.

In the context of alternative reinsurance capital, fronting arrangements facilitate the transfer of insurance risk to capital market investors rather than to traditional reinsurers (Artemis, n.d.; Barrieu & Albertini, 2009). These arrangements resemble those in collateralized reinsurance, where investors establish special purpose insurers to underwrite risks. However, in fronting arrangements, the entity underwriting risks is a conventional insurer or reinsurer rather than a special purpose insurer.

One feature that may appeal to investors is the possibility that the fronting company can retain tail risk, making the arrangement more attractive. Additionally, fronting arrangements enable investors to collaborate with a broader range of cedants. For instance, some cedants may not accept fully collateralized contracts and instead require contracts with rated entities—a requirement that fronting arrangements can accommodate (Artemis, n.d.).

#### Example: Fronting arrangement

This example, based on a report by Artemis (n.d.), illustrates how a conventional reinsurer can facilitate capital market access to insurance risk through fronting arrangements.

Hannover Re, a global reinsurance company, also operates as a fronting company for ILS funds and investors. In these arrangements, Hannover Re underwrites the risk while investors provide collateral to support reinsurance obligations.

The growth of Hannover Re's fronting business is evident in the increasing collateral investors provide. In 2023, the company reported EUR 5.1 billion in collateral, up significantly from EUR 3.3 billion in 2022. By mid-2024, this figure had risen further to nearly EUR 7.0 billion on an annualized basis.

Through its fronting structures, Hannover Re not only enables investors to access insurance risk but also offers the option to absorb some tail risk on its balance sheet. This makes it easier for investors to assume risks while ensuring clients remain adequately protected. As a result, Hannover Re's retained exposure, which is uncollateralized, has also increased.

These operations generate additional revenue for Hannover Re through fronting fees and strengthen its role as a reinsurance partner for its clients. Simultaneously, clients benefit from access to capital market capacity while maintaining the security provided by Hannover Re's rated balance sheet. Furthermore, the reinsurer is extending its relationships with ILS funds and investors.

Hannover Re recognizes the long-term potential of ILS-related business and anticipates growing demand over time. To capitalize on this trend, the company is focusing on offering

tailored solutions to capital markets, including not only collateralized reinsurance through fronting arrangements but also support for CAT bond issuances. Hannover Re expects these activities to play an increasingly important role in its profitability in the future.

#### *3.2.5.2 Derivatives*

The most well-known derivatives linked to insurance risks are catastrophe futures and catastrophe options. These instruments derive their value from certain catastrophe claims indices. For example, if losses from catastrophic events are high, the value of the futures contract would increase, and if losses are low, the value would decrease. These instruments typically involve significant basis risk but can enable insurers to hedge their losses to some extent (Barrieu & Albertini, 2009; Kampa & Siebert, 2010).

These derivatives can be considered a form of alternative reinsurance capital because they involve capital from broader financial markets. By participating in the derivatives transactions, investors provide capital that can absorb insured losses. A key advantage of these instruments is the possibility of quicker payouts, as they do not require claims to be assessed and settled. However, they also do not require an insurable interest, which introduces a speculative element that may be a less desirable feature in the insurance industry.

Over the years, various stock exchanges have attempted to introduce CAT futures and CAT options. Despite the efforts, all these initiatives were discontinued after a few years. This may be attributed to a combination of the basis risk involved and a limited investors' interest (Ben Ammar et al., 2015; Kampa & Siebert, 2010).

Another category of derivatives is weather derivatives, which are designed to hedge against weather-related risks. These instruments are commonly used by industries such as energy and agriculture, where business performance depends on weather conditions. Weather derivatives may also present options for insurance companies to hedge certain losses. For example, prolonged periods of heavy rainfall may lead to an increase in car accidents and associated claims. Again, these derivatives involve significant basis risk but could hedge these losses to some extent.

#### *3.2.5.3 Life-risk and health-risk related arrangements*

Similar structures to those used in non-life insurance can be employed in life and health insurance to transfer risks to the capital markets. Many of these strategies focus on transferring peak risks, such as extreme mortality events, surges in healthcare utilization, or deviations from expected trends in mortality improvements. These arrangements are often structured similarly to catastrophe bonds, isolating specific insurance risks. They generally

exhibit a low correlation with broader financial markets, offering investors additional opportunities for diversification (Swiss Re, 2011).

Another product is embedded value securitization, which involves monetizing expected future profits from a defined block of insurance business. This approach can serve as an alternative or complement to debt financing and can be used for capital management purposes.

Additionally, reserve financing transactions can help life insurers meet regulatory requirements to hold reserves in excess of best estimates. These additional reserve requirements can be substantial in some jurisdictions, such as the U.S. Reserve financing transactions involve funds provided by investors, which are placed in trust accounts to support regulatory reserve requirements (Swiss Re, 2011).

### **3.3 Cedant perspective**

While various strategies for accessing alternative reinsurance capital have been discussed so far, this section summarizes the key features of this approach. It examines the main factors relevant to cedants' decisions. These factors include reinsurance capacity and pricing, market stability and relationships, structural features, and capital management. By discussing these aspects, we aim to provide an understanding of the cedants' perspective and highlight how alternative capital can complement conventional reinsurance.

#### **3.3.1 Reinsurance capacity and pricing**

The cost of reinsurance is significantly influenced by the position in the reinsurance cycle, which depends on recent industry-wide losses and the reinsurance capacity available. Significant losses deplete the industry's capital, prompting reinsurers to increase rates to restore their capital positions. This stage, known as a hard market, is characterized by a reduced supply of reinsurance and increases in reinsurance rates. In addition to constrained capacity, in some cases, conventional reinsurance may even become unavailable, especially for peak risks. In such cases, alternative arrangements like CAT bonds can be particularly beneficial (Swiss Re, 2013).

Hard markets also present opportunities for investors to earn high returns by assuming insurance risk. For cedants, the additional inflow of capital from alternative sources can improve their negotiation position, help mitigate the increases in reinsurance rates, and contribute to their stability (Besson, 2009; Kampa & Siegert, 2010).

For example, Agarwal et al. (Agarwal et al., 2023) analysed increases in reinsurance rates following five significant catastrophic events: Hurricane Andrew in 1992, the September 11 attacks in 2001, Hurricane Katrina in 2005, the Atlantic hurricane seasons of 2017 and 2018, and Hurricane Ian combined with COVID-19. They measured the increases using the rate

on line (ROL), defined as the ratio of the reinsurance premium relative to the width of the layer. This metric indicates how expensive the reinsurance coverage is. The respective increases in property catastrophe ROL were 106%, 60%, 76%, 11%, and 29%, suggesting more moderate rate increases in recent years, possibly due to the broader adoption of alternative capital. These figures are based on data from reinsurance broker Guy Carpenter and represent the difference between the lowest ROL before the event and the highest ROL after the event.

In contrast to hard markets, soft markets are characterized by excess reinsurance capacity. Competition among reinsurers drives premiums down during this stage, making cedants less likely to seek coverage from alternative sources as conventional reinsurance becomes more accessible and affordable. For investors, soft markets therefore offer fewer opportunities to earn high returns on insurance-linked investments.

Beyond the reinsurance cycle, the cost of alternative capital arrangements is also influenced by broader capital market conditions. Since these are generally less correlated with insurance-specific risks, the returns required by investors can differ significantly from corresponding conventional reinsurance premiums. They are more influenced by investment opportunities in other asset classes.

Structural differences between conventional and alternative arrangements also influence pricing. Alternative capital primarily targets peak risks, and covers are typically fully collateralized. One of the explanations for this predominance in peak risks is the following. Collateralized covers tend to be expensive because they set aside capital to cover the full extent of potential losses. This does not benefit from the diversification of risks. In contrast, conventional reinsurers can diversify across a wide range of risks. This reduces the capital needed to support these risks, making conventional reinsurance more capital efficient. However, capital requirements remain high for peak risks—which are inherently less diversifiable—and collateralized arrangements may not be so inefficient. Consequently, while reinsurers may have a pricing advantage for non-peak risks, they face stronger competition from alternative capital providers for peak risks. Note that this is not the only factor explaining why alternative capital predominantly targets peak risks. We mention some further aspects in the remainder of this chapter.

### 3.3.2 Market stability and relationships

Alternative reinsurance capital is often provided opportunistically, with investors seeking higher returns during favourable market conditions. For example, the increased inflow of alternative capital in the industry over the past decade was partly driven by lower interest rates and heightened investor appetite for risk. This opportunistic nature introduces vulnerabilities for (re)insurers that become more reliant on alternative capital. In contrast with traditional reinsurance, alternative capital can enter and exit the market relatively quickly, making the market less predictable and stable (Pande, 2023).

This can happen due to a decline in investors' interest, which can be driven by several factors. For instance, changes in financial market conditions—such as rising interest rates—may make reinsurance less attractive compared to other investment opportunities. Other factors include uncertainties in catastrophe modelling, inadequate pricing of reinsurance premiums relative to loss costs, and potentially higher default rates due to significant losses (Adena et al., 2009; Hartwig & Lynch, 2015; Pande, 2023). Furthermore, major catastrophes can tie the capital in the collateral backing these arrangements, delaying its redeployment or even leading to a further withdrawal of alternative capital from the market (Hartwig & Lynch, 2015).

If alternative capital exits the market swiftly, (re)insurers may need to turn back to traditional reinsurance markets. However, this opportunistic behaviour may not always be welcomed. In traditional reinsurance, long-term relationships play an important role. Trust and partnership are important, and agreements are often underpinned by mutual understanding and informal “gentlemen’s agreements”. This contrasts with the more transactional nature of relationships with third-party investors.

Additionally, reinsurance is a well-established practice, with reinsurers typically ensuring prompt payments following a loss event. While investors may utilize advanced modelling tools, they often face more significant information asymmetry. This may lead to the increased risk of disputes over payouts, particularly in indemnity-based arrangements (Hartwig & Lynch, 2015).

As long-term partners, traditional reinsurers often offer more than just reinsurance coverage. With their often global portfolios, they have extensive knowledge and expertise across various insurance markets and products. They can advise and provide valuable insights to insurers. For example, reinsurers have traditionally supported their clients in risk assessment, underwriting, contract wording design, and claims handling. Additionally, they often assist insurers in developing and pricing products or entering new markets (Swiss Re, 2013).

### 3.3.3 Structure and cover

Alternative capital arrangements may differ from traditional reinsurance in both their structure and the characteristics of the coverage they provide. While some arrangements, such as collateralized reinsurance, closely resemble traditional reinsurance contracts, others, particularly catastrophe bonds, have a more complex structure.

A key feature of many alternative capital arrangements is the use of SPVs to issue notes, hold collateral, and manage payouts. However, setting up an SPV introduces additional costs, particularly for first-time sponsors. Further expenses arise from the need for third-party modelling services. In the case of CAT bonds, there are also significant costs associated with structuring and issuing the bond, which often limits their use to covering large amounts and multi-year periods. In contrast, collateralized reinsurance arrangements

are less costly and more accessible to cedants. They offer greater customization and more closely resemble traditional reinsurance agreements (American Academy of Actuaries, 2022; Euler ILS Partners, n.d.).

As already mentioned, collateralization is a defining feature of nearly all alternative capital arrangements. This feature minimizes credit risk and ensures better security for the cedant. However, it also creates a pricing disadvantage compared to traditional reinsurers, who benefit from diversification, particularly when covering non-peak risks. This contributes to the focus of the alternative capital on the most extreme and capital-intensive risks. Some of these peak risks are also relatively well-modelled, which is another feature that appeals to investors who may lack the industry expertise of traditional reinsurers.

The typically remote nature of the risks covered also justifies some other structural differences between traditional and alternative reinsurance solutions. For example, CAT bonds do not include reinstatement provisions, which are common in traditional reinsurance (Hartwig & Lynch, 2015). This is often acceptable due to the low likelihood of multiple claims on the remote risks CAT bonds typically cover. Nevertheless, CAT bonds can also be structured to pay out on an aggregate basis, offering some flexibility similar to traditional reinsurance arrangements.

Another significant distinction lies in the payout triggers. Traditional reinsurance primarily uses indemnity-based payouts, which align with actual losses incurred. In contrast, alternative capital arrangements may often use other triggers, such as industry-loss or parametric triggers.

Finally, some alternative capital arrangements, particularly CAT bonds, often provide multi-year coverage. This is partly due to their higher initial setup costs, which make it more efficient to cover large amounts over multiple years (Kampa & Siegert, 2010). Multi-year coverage also allows cedants to lock in favourable rates for longer periods, reducing exposure to the cyclical nature of reinsurance pricing, and supports the cedant's long-term capital management (Adena et al., 2009; Hartwig & Lynch, 2015; Swiss Re, 2013).

#### 3.3.4 Capital management

Alternative capital arrangements, similar to conventional reinsurance, enable cedants to transfer insurance risk. These solutions support capital management and financial stability by reducing their net exposure, particularly to extreme risks.

A key advantage of alternative capital arrangements is that they expand risk transfer options for cedants. This not only improves their negotiating position but also diversifies sources of reinsurance protection. Although the likelihood of reinsurer defaults is low, there is always an element of credit risk present. On the other hand, the fully collateralized alternative capital

arrangements provide an additional layer of security and minimize credit risk (Adena et al., 2009; American Academy of Actuaries, 2022; Swiss Re, 2013).

From a regulatory perspective, reinsurance is a well-established practice and typically has a well-defined regulatory treatment. In contrast, alternative capital arrangements may face greater uncertainty in this regard. However, the growing emphasis on the economic view of capital needs within regulatory frameworks is beneficial in this context. For example, the Solvency II framework introduced significant changes to regulatory capital requirements within the EU, including the principle of the substance of risk transfer over its form. This allows cedants to use alternative arrangements to reduce their regulatory capital requirements, provided these arrangements are recognized by the regulator (Swiss Re, 2011).

However, not all alternative capital arrangements may qualify for capital relief. Certain arrangements, particularly those involving non-indemnity triggers, may introduce basis risk, making it challenging to justify reductions in capital requirements. As a result, the effectiveness of alternative capital arrangements in managing capital depends on their structure and the nature of the risk transfer they facilitate.

### **3.4 Investor perspective**

In this section, we consider the investor's perspective on alternative capital arrangements. Being counterparties in these arrangements, their perspective and motivations are as important as the demand from the cedants in this market.

Due to the scale and expertise required to participate in this market, access to these investments is limited to institutional investors. Notably, insurance and reinsurance companies themselves often participate in these arrangements as investors. This not only diversifies their asset portfolios but also helps them diversify their insurance risk. For example, smaller reinsurers may find it particularly useful, as they may have limited access to global perils.

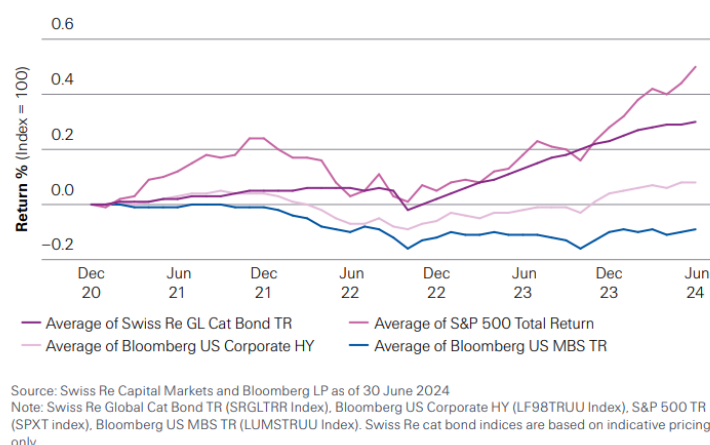
In the following, we examine the key features of these investments that are important to investors. These are return characteristics, diversification benefits, underlying risk, and liquidity. Since the evaluation and pricing of these arrangements differ significantly from those of traditional corporate investments, we also provide some insights into this process.

#### **3.4.1 Returns**

Historically, investors could gain exposure to the reinsurance business by investing directly in reinsurers' equity. In this case, returns depend on the reinsurer's overall performance and the broader equity market. In contrast, alternative capital arrangements allow investors to access pure, isolated insurance risks without the need to invest in reinsurer equity.

These arrangements can offer attractive returns. For example, in 2023, the Swiss Re CAT Bond Index posted a return of 19.7%, which is also the highest on record (Swiss Re, 2024a). Figure 10 compares this index to other benchmarks such as the S&P 500, Bloomberg Mortgage-Backed Securities Index, and Bloomberg US Corporate High Yield Index. Among these, only the S&P 500 performed better than the Swiss Re CAT Bond Index since 2021.

*Figure 10: Swiss Re CAT Bond Index compared to other benchmarks*



*Source: Swiss Re (2024b).*

An important feature of this asset class is its low correlation with traditional capital markets. As shown in Figure 10, the Swiss Re CAT Bond Index is mainly unaffected by fluctuations in other indices. However, because of the yield on the collateral backing these arrangements, trends in the index do reflect short-term interest rates. These rates rose in 2022 when central banks tried to mitigate inflation pressures.

### 3.4.2 Diversification

Returns from ILS are generally uncorrelated with traditional capital markets. Rather than broader market conditions, they are driven by insurance-specific risks, such as catastrophic events. While major catastrophes can have a spillover effect on the economy and financial markets, the overall correlation remains relatively low.

Unlike conventional asset classes, such as stocks or corporate bonds, which often exhibit greater correlation during periods of market uncertainty, ILS assets generally maintain a low correlation. This is because their returns and default risks are fundamentally independent of other asset classes. Therefore, including these assets in a portfolio can reduce overall volatility and improve its efficient frontier. A key advantage of ILS compared to reinsurer equity is its ability to isolate and target specific insurance risks. In contrast, the value of reinsurer equity reflects broader market movements, limiting the diversification benefit. In addition, the overall return depends on the risks across the entire reinsurer portfolio.

However, diversification within the ILS market itself can be limited, as a significant portion of CAT bonds and many multi-peril bonds cover U.S. wind risks. Therefore, achieving a good diversification solely within the CAT bond market can be difficult. Nonetheless, incorporating other instruments, such as collateralized reinsurance, may help to diversify the portfolio further (Euler ILS Partners, n.d.).

For these reasons, bonds covering rarer perils are typically in higher demand, as they offer diversification from U.S. wind risks. This often results in narrower spreads and more favourable pricing for the cedant on rarer perils. Conversely, spreads for common risks like U.S. wind tend to be wider (Swiss Re, 2024b).

### 3.4.3 Underlying risk

Of course, an important aspect for investors is the actual underlying risk involved in these arrangements. Since the sustainability of the market depends on informed decisions, it is important that investors understand the risks involved in these transactions. Currently, alternative capital primarily targets property risks related to natural catastrophes, so we focus mainly on these risks.

These risks appeal to investors for several reasons. First, as noted earlier, is the diversification benefit. Second, these arrangements often cover remote risks, meaning the probability of a triggering event is low. This reduces the likelihood of capital being tied in the collateral beyond the risk period, allowing it to be efficiently redeployed. Even when events occur, property claims are typically resolved quickly, often within a year (Hartwig & Lynch, 2015).

Another reason is that natural catastrophe risks are relatively well-modelled. Investors may face greater challenges in evaluating reinsurance arrangements than reinsurers. Reinsurers are more familiar with the insurance business and have access to extensive data provided during annual renewals. This gives them more profound insights into the underlying risks (Albertini, 2009). Nonetheless, historical data is scarce for these peak risks, requiring both reinsurers and investors to rely on catastrophe models. From the inception of this market, catastrophe models have been vital to its development. We provide a more detailed description of these models below.

#### Understanding risk: Catastrophe models

Major natural catastrophes are infrequent, with return periods often spanning decades or centuries. Consequently, sparse historical data, accompanied by evolving underlying exposure, such as geographic changes or advancements in construction materials, makes it difficult to estimate future losses using traditional methods.

Catastrophe models address these challenges. These models, developed by companies like AIR Worldwide and Risk Management Solutions (RMS), consider both past and artificial catastrophe events and estimate corresponding losses. The modelling usually aims to derive a distribution of insured losses, helping to understand the likelihood and severity of potential outcomes. A catastrophe model typically consists of the following interconnected modules (Swiss Re, 2011):

1. Event module. The event module defines a set of stochastic events, each characterized by a location, physical parameters, and probability of occurrence. It includes historical and artificially generated events, relying on historical data and insights from scientific disciplines such as meteorology, seismology, and hydrology.
2. Hazard module. The hazard module determines the intensity of each event at different locations, representing the physical forces that cause damage. For example:
  - Earthquake: The primary hazard is ground shaking. Earthquake models incorporate knowledge of fault ruptures and account for local geological features when modelling seismic wave propagation and attenuation.
  - Hurricanes: The primary hazard is wind speed. Hurricane models simulate storm paths and map the spatial distribution of wind speeds, considering factors such as terrain roughness from mountains, forests, or urban landscapes, which can alter wind intensity and distribution.
3. Exposure module. The exposure module describes the portfolio of insured risks, including their locations, sums insured, and characteristics of buildings. This data is typically provided by users of catastrophe models to reflect their specific portfolios.
4. Vulnerability module. Given the hazard intensity and individual risk characteristics, this module quantifies the degree of damage (often expressed as a percentage of the sum insured). It estimates the degree of loss based on historical damage records and engineering assessments.
5. Financial analysis module. The financial analysis module translates physical damage into monetary losses by applying insurance contract terms such as deductibles, limits, and any inuring reinsurance. The final output is the estimated insured loss for a given event.

Catastrophe models may also account for additional factors, such as post-disaster increases in claim costs. This phenomenon, known as a demand surge, arises from increased demand for materials and labour following a catastrophe, coupled with a reduced supply due to potential damage to material stocks and evacuations that reduce labour availability.

Note that depending on the transaction's trigger mechanism, some modules may be more relevant than others. For instance, for parametric triggers, only the event and hazard modules are relevant, while indemnity or industry index-based triggers involve all modules .

The results of these models are often summarized using occurrence exceedance probability (OEP) and aggregate exceedance probability (AEP) curves. These curves represent the

estimated probabilities of losses exceeding specific thresholds, either for the most severe single event or for aggregate losses within a year.

The insights derived from these estimates allow reinsurers and investors to assess the associated risks. These distributions form a basis for calculating various features of the transactions, such as attachment probabilities, expected annual losses, and other risk measures, which play a role in pricing these products. By providing a deeper understanding of the underlying risks, these insights allow investors and reinsurers to make informed decisions.

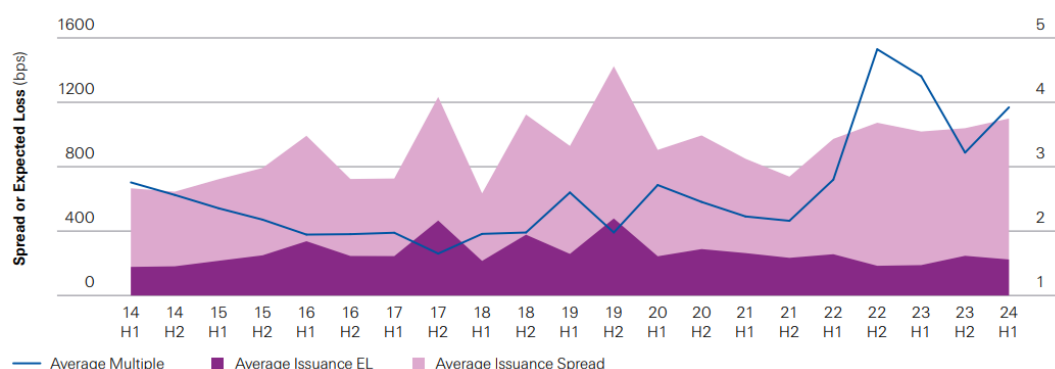
In the following, we focus on 144A CAT bonds, the segment with the most data available. Based on the information derived from catastrophe models, two commonly used indicators in pricing CAT bonds are:

- **Spread:** This is the difference between the bond's annual coupon attributable to reinsurance premium (excluding the collateral yield) and its underlying expected loss. It represents the risk premium that investors require.
- **Multiple:** This is the ratio of the coupon rate attributable to the reinsurance premium to the expected loss, indicating how many times this premium covers the expected loss. The multiple is therefore a relative measure.

Movements in spreads and multiples over time provide insights into the returns investors require. These metrics are influenced by factors such as the demand for reinsurance, the availability of conventional reinsurance capacity, and investor sentiment. An increase in these pricing metrics is analogous to rising reinsurance rates, which makes returns more appealing to investors (Hartwig & Lynch, 2015).

Figure 11 shows the expected loss and spread of catastrophe bonds covering natural catastrophes issued over the past decade. While the expected loss is relatively stable, the spread fluctuates more, reflecting shifts in investor sentiment and market conditions.

*Figure 11: CAT bonds: expected losses, issuance spreads, and multiples*



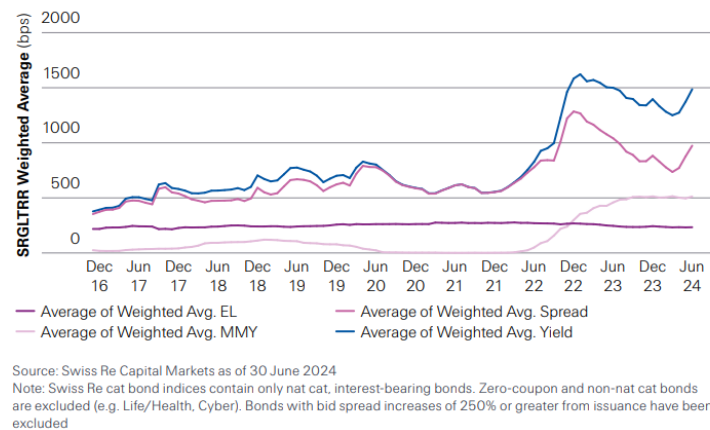
Source: Swiss Re Capital Markets Deal Database as of 30 June 2024

Note: Includes nat-cat bonds only, excludes bonds covering Wildfire only, 2nd event, zero coupon bonds with duration of less than 9 months, as well as select Sanders Re, Topanga Re, and Bonanza Re aggregate bonds

Source: Swiss Re (2024b).

In addition to spread, another component of return is the yield earned on the collateral. Collateral for CAT bonds is typically invested in safe, short-term assets, producing floating returns that follow short-term interest rates. Figure 12 shows all three components of the yield from the Swiss Re CAT Bond Index: the underlying expected loss, the spread, and the money market yield.

Figure 12: Swiss Re CAT Bond Index: total yield and its components



Source: Swiss Re (2024b).

### 3.4.4 Liquidity

Liquidity is another important factor for investors to consider. Among alternative capital products discussed in this thesis, 144A CAT bonds are the most liquid ones. They can be traded on the secondary market, enabling investors to monitor the value of their portfolios, exit existing positions, or enter new ones. In contrast, other arrangements, such as collateralized reinsurance, are generally highly illiquid (Albertini, 2009). In this section, we again focus on CAT bonds. Before examining the secondary market, let us first briefly consider the primary market.

#### 3.4.4.1 Primary market for catastrophe bonds

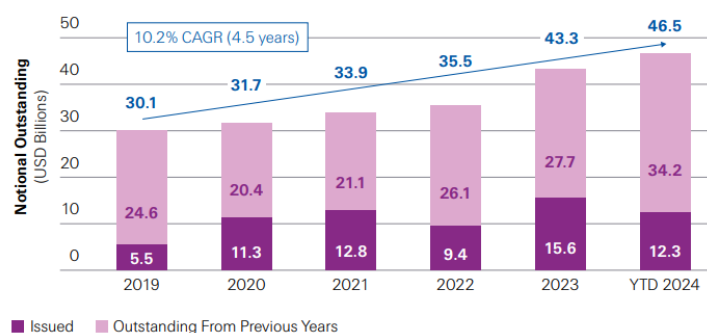
As shown in Figure 5 earlier in this chapter, the capital outstanding in the CAT bond market has been growing over time. Figure 13 provides a more detailed view, showing the breakdown of outstanding capital into new notional issued during a year and notional carried over from prior years.

New CAT bond issuances are typically concentrated around traditional reinsurance renewal seasons, such as January 1st and June 1st. The mid-year renewal is especially significant as

it coincides with the start of the hurricane season. Figure 14 illustrates the seasonal pattern of CAT bond issuance over recent years.

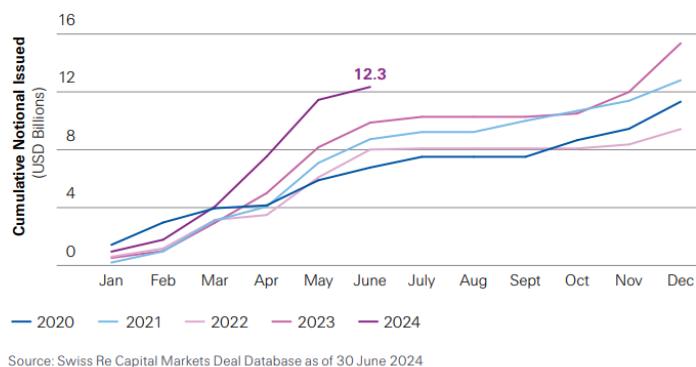
Regarding pricing, transactions closer to the end of the renewal periods usually command higher spreads. This occurs because investors may have already allocated much of their available capital, leaving less capacity for the remaining issuances.

*Figure 13: CAT bonds: issued and outstanding notional*



Source: Swiss Re (2024b).

*Figure 14: CAT bonds: issued notional and renewal seasons*



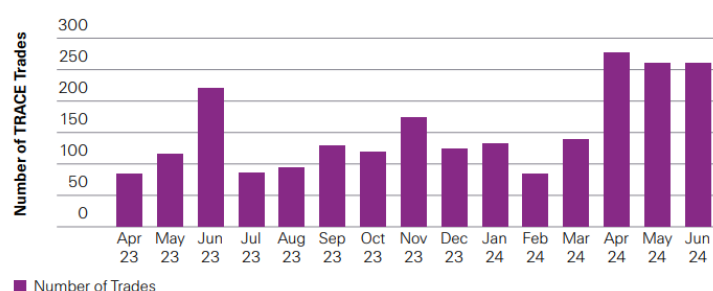
Source: Swiss Re (2024b).

### 3.4.4.2 Secondary market for catastrophe bonds

144A CAT bonds can be traded in the secondary market, providing investors with some liquidity. Trade data for these transactions is captured in the TRACE (Trade Reporting and Compliance Engine), a facility for reporting over-the-counter bond market trades operated by FINRA (U.S. Financial Industry Regulatory Authority). Although TRACE data is not readily accessible to the public, industry reports may include it and provide insights into the secondary market activity.

For example, Figure 15 from Swiss Re report shows the monthly number of trades in the secondary market. According to Swiss Re (2024b), April, May, and June 2024 were particularly active months, with April recording 272 trades—the highest number of trades within a month in the history of the CAT bond secondary market.

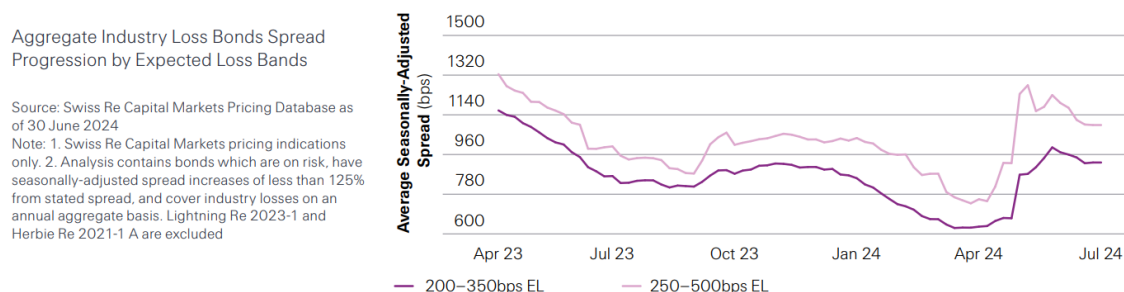
*Figure 15: CAT bonds: number of trades in the secondary market*



Source: Swiss Re (2024b).

Secondary market activity influences bond pricing and is closely connected to the primary market. For example, according to Swiss Re (2024b), the year 2024 started with a strong investor demand and a large amount of maturing capacity that needed to be reinvested in January. This caused increased activity in the secondary market, driving prices up and spreads down. As mid-year renewals approached, primary market issuance increased. This led to widening spreads in the secondary market, as investors sought to sell existing CAT bonds and buy longer-dated ones in the primary market. This especially affected bonds with industry-loss triggers, which tend to be more liquid than indemnity-based bonds. Figure 16 illustrates these movements in spreads for aggregate industry-loss bonds for two bands of underlying expected loss (Swiss Re, 2024b).

*Figure 16: CAT bonds: secondary trading and spreads*



Source: Swiss Re (2024b).

In addition, the trading activity of CAT bonds usually exhibits a seasonal pattern that aligns with natural catastrophe seasons, especially the U.S. hurricane season. Trading volumes

often increase as investors adjust their positions to manage exposure to heightened risk. For example, investors seeking higher returns may earn an additional seasonal risk premium by buying and holding “on-risk” bonds during peak seasons when secondary market prices are lower. Conversely, risk-averse investors can reduce their exposure by selling bonds in anticipation of high-risk periods (Swiss Re, 2011).

Therefore, the secondary market enables this migration of CAT bonds between investors with varying risk appetites. This liquidity enhances the attractiveness of 144A CAT bonds as an asset class and distinguishes them from other less liquid alternative capital arrangements.

### 3.4.5 Other features

In addition to the features discussed above, several other characteristics can influence the attractiveness and suitability of alternative capital products for investors. These include trigger types, extension periods, multi-year reset features, and early termination options. A brief description of each of these features is provided below.

**Trigger types.** The trigger type is important for investors, as it affects risk perception, transparency, and, consequently, pricing. In indemnity-based transactions, investors have to consider additional factors, such as the cedant’s underwriting practices, portfolio characteristics, data accuracy, and claims handling practices. Furthermore, with these transactions, it takes some time for the full extent of losses to emerge. Therefore, investors typically demand a premium for these transactions. For cedants, this additional premium is justified, as indemnity-based covers eliminate basis risk. On the other hand, non-indemnity transactions generally rely on external data or third-party models. In these cases, it is important to consider how data is collected, how it is incorporated into formulas, what inputs are used in the model, and how the model works (Albertini, 2009).

**Extension periods.** Extension periods allow a transaction to be extended, ensuring sufficient time to accurately assess the ultimate claims. However, these extensions are unfavourable for investors, as their capital remains tied up in the collateral during this period. To mitigate this drawback and make the transaction more appealing, some arrangements allow investors to continue earning a certain return during the extension period. The length and terms of extension periods are therefore an important consideration for investors (Albertini, 2009).

**Multi-year reset feature.** Some arrangements, particularly CAT bonds, are structured as multi-year transactions. Since the underlying exposure can evolve over time, some transactions include a reset feature, which can be used to adjust the attachment point. This ensures the risk profile remains consistent throughout the duration of the transaction and is aligned with investors' risk-return expectations (Albertini, 2009).

Early termination option. Certain transactions include an early termination option, allowing cedants to terminate the arrangement before its scheduled maturity. This flexibility can be advantageous for cedants, particularly if traditional reinsurance becomes a more cost-effective option during the term of the transaction. For investors, however, early termination introduces reinvestment risk, as they may not be able to redeploy their capital under comparable terms. To compensate for this risk, investors typically require a premium (Albertini, 2009).

## **4 FUTURE OUTLOOK**

This final chapter examines the factors that may shape the future of alternative capital in the insurance industry. We focus on the future risk landscape, various other initiatives, and the role of investors in supporting insurance risks.

### **4.1 Future risks**

Currently, alternative capital in risk transfer is primarily concentrated in natural catastrophe risks. Due to their unique characteristics, these risks are expected to remain the dominant focus in the future. This section first addresses these well-established risks and then considers other risks that could become attractive to alternative reinsurance capital over time.

#### **4.1.1 Natural catastrophe risks**

Figure 17 shows the consistent upward trend in insured losses from natural catastrophes. Over the last 30 years, these losses have grown at an annual rate of 5–7%, averaging USD 110 billion annually between 2017 and 2022. While primary perils such as hurricanes, earthquakes, and European winter storms are typically associated with major natural catastrophes, secondary perils are important as well. These include severe convective storms, floods, droughts, and wildfires, which have collectively accounted for approximately 50% of insured natural catastrophe losses over the past 30 years (Pande, 2023).

While climate change is often cited as a driver of rising natural catastrophe losses, its precise impact on the frequency and severity of these events remains uncertain (Pande, 2023). Note that certain perils, such as earthquakes, are unlikely to be influenced by climate change. However, atmospheric-related perils may be more affected. For instance, rising temperatures could increase the risks of droughts, wildfires, and subsidence. A warmer atmosphere may also lead to more frequent and intense thunderstorms, along with the associated perils, such as hail, strong winds, and heavy rainfalls (Smith & Malena-Chan, 2024).

Beyond climate change, there are other factors contributing to increasing insured losses, which are much better understood. These are (Pande, 2023):

- **Asset value growth.** Economic growth and inflation are constantly increasing the value of assets. Additionally, the nominal value of insured assets, such as buildings and vehicles, has grown at a faster pace than both headline inflation and real GDP growth. This trend is expected to continue in the future, driving demand for insurance protection and reinsurance capacity.
- **Asset accumulation.** Population growth and urbanization, particularly in developing regions, have led to an increase in both asset values and their concentration. Many growing cities are located near coasts or rivers, making them more exposed and vulnerable to natural disasters. On the other hand, in developed countries, a growing number of people are moving to suburban and coastal regions, which are more vulnerable to wildfires, severe flooding, and hurricanes.

Given these developments, despite the year-to-year fluctuations, there is a consensus that insured losses are expected to rise in the future (Pande, 2023). This highlights the increasing need for insurance and reinsurance coverage. As traditional reinsurance capacity may not be able to keep pace with the growing demand, capital markets may play an important role in providing the additional capacity needed.

*Figure 17: Insured natural catastrophe losses (in USD billions)*



*Source: Pande (2023).*

#### 4.1.2 Other risks

The future of alternative capital may extend beyond natural catastrophe risks. One specific area frequently discussed is the casualty business. However, there are factors that make these risks less attractive to investors compared to natural catastrophe risks. These challenges include the long-tail nature and difficulties in modelling these risks. However, alternative capital can in general be beneficial for many lines of business, particularly in times of constrained reinsurance capacity. In these situations, sidecars and collateralized reinsurance arrangements may be able to provide cedants with additional reinsurance protection.

One area which is believed to have a significant potential for the insurance industry in the future is cyber risk. The significant protection gap in cyber insurance highlights the need for insurance coverage and additional reinsurance capacity. Alternative capital could be important in complementing traditional reinsurance to meet this demand in the future. Although cyber risks are difficult to fully understand, there are efforts to develop models for assessing and quantifying these risks. For investors, cyber risks may be appealing for many reasons. These include similarities to natural catastrophe risks, their low correlation with both financial markets and natural catastrophe risks, and attractive risk-adjusted returns.

In recent years, a few catastrophe bonds specifically focused on cyber risks were issued, highlighting the potential of alternative capital in addressing this emerging risk (Agarwal et al., 2023).

#### **4.2 Other initiatives and regulatory frameworks**

Regulatory frameworks also play a role in the adoption of alternative reinsurance capital. One key aspect is the possibility of achieving capital relief by using these arrangements. Over time, regulatory frameworks have increasingly moved toward more risk-based capital requirements. For example, under Solvency II, the “substance over form” principle focuses on the actual risk transfer achieved rather than the specific mechanism used to transfer the risk. This allows cedants to obtain capital relief by using alternative arrangements, as long as they meet certain criteria.

Beyond regulatory considerations, there are other public initiatives that may shape the future of alternative reinsurance capital. The European Insurance and Occupational Pensions Authority (EIOPA) and the European Central Bank (ECB) recently highlighted the need to address the protection gap for natural disasters in the EU, where around 75% of corresponding losses still remain uninsured. This gap partly stems from the underestimation of risks and reliance on government support. Insufficient insurance coverage can hinder the recovery of households and firms after a disaster, negatively impacting the recovery of the economy overall. To reduce this protection gap, EIOPA and the ECB have proposed various measures, including promoting the use of CAT bonds and promoting public-private partnerships (EIOPA & ECB, 2023).

One proposal in their report is the development of a platform for issuing catastrophe bonds within the EU. Increasing access to alternative reinsurance capacity could lower reinsurance costs and make insurance against natural disasters more affordable for policyholders. This could increase the uptake of insurance and reduce the protection gap. Currently, the process of issuing CAT bonds in Europe is more cumbersome compared to some other jurisdictions (ECB & EIOPA, 2023; Gallin, 2023a).

Bermuda, for example, has significantly improved its position in the CAT bond market by streamlining the issuance process. The registration process for CAT bond SPVs can be completed in just three working days. This allows insurers to access capital markets quicker

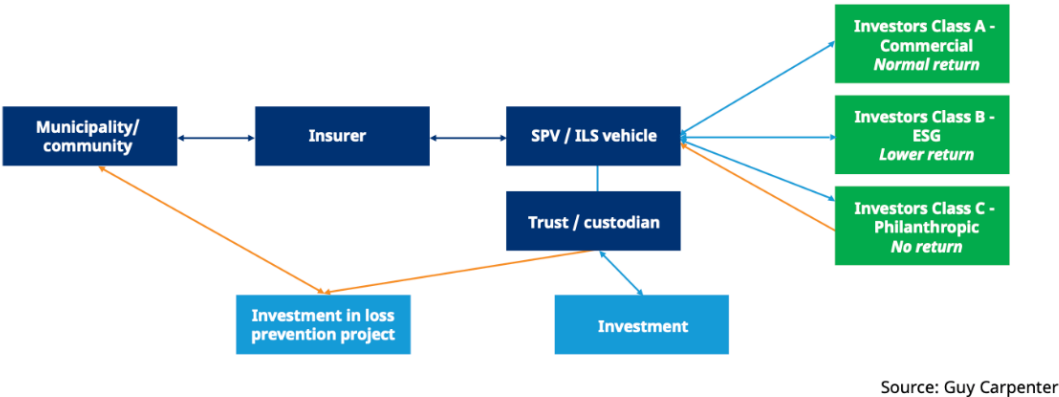
and provides greater flexibility in choosing between traditional and alternative reinsurance sources (Evans, 2021).

The report mentioned above also discusses the potential for increasing CAT bond issuance by the public sector through public-private partnerships (PPPs). These partnerships can enable the pooling of residual risks at higher layers more efficiently than the private sector alone. Subsequently, these risks can then be transferred to the capital markets (ECB & EIOPA, 2023; Gallin, 2023a).

Examples of these partnerships already exist. One example is the Caribbean Catastrophe Risk Insurance Facility (CCRIF), which was established as a regional catastrophe fund for Caribbean governments. Its goal is to mitigate the financial impact of hurricanes, earthquakes, and excessive rainfalls. It operates similarly to an insurance mutual, pooling the resources of its members. It retains some risks and transfers excess risk to the capital and reinsurance markets. By primarily offering parametric insurance solutions, CCRIF is able to provide liquidity shortly after the event and, at the same time, offer insurance coverage at lower premiums (Evans, 2024b; UNFCCC, n.d.).

Another potential innovative structure is the Climate Resilient Development Bond (CRD Bond) proposed by Guy Carpenter. This bond not only offers protection against losses but also funds preventive measures, such as building flood defences, which enhance resilience to future disasters. It allows municipalities to secure insurance coverage while simultaneously accessing financing for these preventive projects. By funding loss-prevention measures, the CRD bond can help reduce risks and lower insurance costs over time, essentially monetizing avoided losses (Evans, 2023a; Gallin, 2023b).

Figure 18: Climate Resilient Development Bond



Source: Evans (2023a).

### 4.3 Investors

One of the most important factors influencing the future of alternative reinsurance capital arrangements is the investors themselves. The sustainability and growth of the market largely

depend on their willingness to provide funds to absorb insured losses. Therefore, it is important to ensure that investors fully understand the risks they are assuming.

Catastrophe models play an important role in this process. By consistently demonstrating the ability to quantify risks accurately, these models can help investors become more comfortable with them. Understanding risks is essential for investors to make informed decisions and ensure the long-term sustainability of the market. As catastrophe models continue to evolve, risk understanding will likely improve, potentially attracting a broader base of investors to the market.

Another factor worth mentioning is the increasing focus on environmental, social, and governance (ESG) considerations. Despite the debates about the long-term returns of ESG investments, ESG considerations tend to influence investors' behaviour. Recently, ESG disclosures have become more common also in catastrophe bond issuance documents. The ILS market naturally aligns with many ESG objectives. For example, by providing protection against natural catastrophes, it directly supports societal recovery following a disaster. Therefore, ESG may be another factor that could attract investors to this market, increasing the flow of alternative capital into the industry (Evans, 2023b).

## **5 CONCLUSION**

The thesis examined the role of alternative capital in the reinsurance industry, focusing on the transfer of non-life insurance risks. Reinsurance plays an important role not only for insurers but also for the broader economy and society. By providing insurance companies with reinsurance protection, it enables them to offer coverage to policyholders even when doing so involves significant risks, such as in regions prone to natural disasters. The thesis first reviewed conventional reinsurance and associated products, which provided a foundation for understanding arrangements involving alternative reinsurance capital.

One key function of reinsurance is to absorb major insured losses. However, following major catastrophic events, traditional reinsurance markets sometimes lack sufficient capacity to provide adequate protection. In the past, this led the insurance industry to explore alternatives, resulting in the emergence of the first catastrophe bonds, which enabled insurance companies to transfer natural catastrophe risks to capital markets. Beyond catastrophe bonds, the thesis examined other strategies, including collateralized reinsurance, industry loss warranties, and sidecars. It also provided practical examples of how these strategies are applied.

By utilizing broader capital markets to secure additional capacity, these products complement traditional reinsurance and help stabilize and mitigate reinsurance rate increases. They also offer several other benefits. For example, fully collateralized coverages minimize credit risk, and some arrangements provide multi-year coverage, allowing cedants to lock in favourable terms and support long-term capital management. However, these

arrangements also come with certain challenges. For example, they often involve higher initial costs, particularly for first-time sponsors of catastrophe bonds. Additionally, the transactional nature of these arrangements contrasts with the importance of relationships in traditional reinsurance markets. While many investors view this asset class as a long-term opportunity, alternative capital often behaves more opportunistically. This introduces uncertainty, as capital may exit the market quickly in favour of more attractive investment opportunities, reducing its predictability and stability. Nevertheless, when traditional reinsurance capacity is constrained, alternative capital tends to flow into the market, attracted by the potential for high returns.

From the investors' perspective, alternative capital arrangements provide a unique investment opportunity, combining attractive returns and diversification benefits. The most valued feature of these instruments is the low correlation with traditional asset classes. Unlike investing in the equity of a reinsurer, which is influenced by fluctuations in broader capital and other risks on its balance sheet, these arrangements allow investors to gain exposure to isolated, pure insurance risks. Currently, alternative capital is mainly focused on property natural catastrophe risks. While this asset class provides a good diversification from traditional investments, the market remains relatively concentrated in U.S. wind perils, limiting diversification opportunities within the asset class itself.

Looking ahead, the thesis identified several factors that could shape the future of alternative capital in the reinsurance industry. The increasing value and concentration of assets and the potential impacts of climate change are expected to drive up insured losses, thereby increasing demand for reinsurance coverage. Emerging risks, particularly cyber risks, present another significant area of growth. As the need for coverage of these risks grows, adequate reinsurance capacity will be important to support insurers in offering protection. Alternative capital could help provide additional capacity and serve as a complement to traditional reinsurance in addressing these challenges. Additionally, initiatives like public-private partnerships may further support the integration of alternative capital into the industry. Ultimately, the sustainability of the market depends on investors being able to make informed decisions. In this regard, catastrophe models have played an essential role and will likely continue to do so. Advances in modelling are improving risk assessment, helping investors better understand potential risks and make more informed decisions.

In conclusion, this thesis has shown that alternative reinsurance capital can be a valuable complement to traditional reinsurance. It outlined the key reasons why alternative capital can support the industry and also highlighted the challenges involved. As the insurance and reinsurance industries continue to evolve, alternative capital will likely remain an important part of the industry. Particularly through the transfer of extreme risks, it can continue to support the industry in providing coverage to policyholders and contribute to addressing and reducing protection gaps.

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## **APPENDICES**



## **Appendix 1: Povzetek (Summary in Slovene language)**

Zavarovanje je eden od glavnih načinov kako se posamezniki in podjetja zavarujejo pred morebitnimi posledicami nepredvidljivih škodnih dogodkov. V zameno za zavarovalno premijo zavarovalnica jamči za finančne izgube zavarovanca, ki so posledica dogodkov kritih v zavarovalni polici. Zavarovalnica sklepa razne police, s tem pa prevzema tudi tveganja, ki jih v mnogih primerih sama ni zmožna ali ni pripravljena nositi v celoti. Takšna tveganja so lahko posledica izpostavljenosti individualnim policam ali agregirani izpostavljenosti posameznih polic. V tem primeru se lahko tudi zavarovalnice, prav tako kot zavarovanci, zavarujejo pri drugih specializiranih podjetjih.

Navadno so ta podjetja pozavarovalnice, prenosu tveganj pa pravimo pozavarovanje. Prav tako lahko pozavarovalnica del prevzetih tveganj prenese na drugo pozavarovalnico, čemur pravimo retrocesija. Takšne verige retrocesij tveganje razpršijo med več pozavarovalnic, kar je eden od razlogov, da je možno zavarovati tudi največje svetovne rizike.

Pozavarovanje za cedenta predstavlja enega ključnih načinov za upravljanje s tveganji. Poleg tega je pozavarovanje pomembno tudi za širšo družbo in gospodarstvo. Ko pozavarovalnice nase prevzamejo del tveganj, zavarovalnicam omogočijo, da lahko te zagotavljajo zavarovalno kritje zavarovancem samim. Na primer, v odsotnosti pozavarovanja bi zavarovalnice težko zagotavljale kritje na območjih, ki so izpostavljena naravnim nesrečam. Večji delež zavarovanih tveganj pa pripomore k lažjemu soočanju z morebitnimi finančnimi posledicami naravnih nesreč in drugih škodnih dogodkov.

Osrednja tema magistrskega dela sta fazi prenosa tveganj, ki sta zgoraj opisani kot pozavarovanje in retrocesija. Delo opisuje način prenosa tveganj, ki namesto klasičnih pozavarovalnic vključuje širše kapitalske trge. V tem primeru so institucionalni investitorji tisti, ki zagotovijo kapital za kritje morebitnih škod. Ker ta kapital izvira izven tradicionalnega pozavarovalnega trga, mu pravimo tudi alternativni pozavarovalni kapital. Ena od prednosti tega pristopa je, da je celoten kapitalski trg veliko večji od samega pozavarovalnega trga in lahko zato zagotovi potrebne kapacitete za kritje tudi največjih zavarovanih rizikov. Delo se osredotoča na prenos tveganj neživljenjskih zavarovanj. Najprej se posveti običajnemu načinu pozavarovanja omenjenih tveganj ter opiše klasične pozavarovalne produkte. To služi kot podlaga za razumevanje konceptov prenosa tveganj v pozavarovanju in je v pomoč pri razumevanju produktov, ki vključujejo alternativni kapital.

Ena od glavnih nalog pozavarovalnega trga je, da absorbira finančne posledice večjih škodnih dogodkov. Pomembno vlogo pri tem ima sama kapaciteta pozavarovalnega trga, saj ta vpliva na ponudbo pozavarovalnega kritja na trgu. Ta kapaciteta je odvisna predvsem od finančnih rezultatov pozavarovalnic v preteklih obdobjih. Večji škodni dogodki lahko precej znižajo nivo kapacitet, kar po navadi vodi do višjih premij, ki jih za prevzemanje tveganj zahtevajo pozavarovalnice. V tem primeru lahko kapitalski trgi zagotovijo dodaten kapital in tako stabilizirajo pozavarovalne premije oziroma omilijo njihovo rast. V preteklosti so

cedentom prenos zavarovalnih tveganj na kapitalske trge prve omogočile CAT obveznice (*angl.* catastrophe bonds, CAT bonds). Delo podrobno predstavi CAT obveznice ter ostale produkte, ki tak prenos tveganj omogočajo. Prav tako predstavi praktične primere njihove uporabe.

Poleg dodatnih pozavarovalnih kapacitet, imajo ti produkti tudi nekatere druge prednosti. Na primer, kritja teh produktov so večinoma v celoti jamčena z depozitom (*angl.* collateralized cover), kar zmanjšuje tveganje, da pozavarovalne obveznosti ne bi bile poravnane. Poleg tega nekatera kritja trajajo več let, kar cedentom zagotavlja bolj stabilne stroške pozavarovanja ter pripomore k bolj stabilnemu upravljanju s kapitalom. Ti produkti pa imajo tudi nekatere pomanjkljivosti. Na primer, stroški so lahko dosti višji kot pri klasičnem pozavarovanju, sploh recimo za cedente, ki prvič izdajajo CAT obveznico. Poleg tega se odnosi med strankami v teh transakcijah pa navadi razlikujejo od poslovnih odnosov v klasičnem pozavarovanju, ki so praviloma bolj dolgoročni. Tudi investitorji na te naložbe večinoma gledajo dolgoročno, vseeno pa je lahko alternativni kapital veliko bolj oportunistične narave. Boljše investicijske priložnosti drugje lahko povzročijo hiter odtok kapitala s pozavarovalnega trga, kar za cedente predstavlja dodatno negotovost. Kakorkoli, v obdobjih, ko pozavarovalnih kapacitet na trgu primanjkuje, trg navadno ponuja možnosti visokih donosov, kar privabi dodaten kapital.

Z vidika investitorjev te naložbe združujejo privlačen donos ter možnost diverzifikacije. V nasprotju z lastniškim kapitalom pozavarovalnic, ti produkti omogočajo pridobiti izpostavljenosti do zelo specifičnih, izoliranih zavarovalnih tveganj. Donos na lastniški kapital pozavarovalnic je na drugi strani odvisen od rezultatov celotnega portfelja ter fluktuacij celotnega trga. Omenjena zavarovalna tveganja so praviloma praktično nekorelirana z ostalimi tradicionalnimi naložbami. Večina alternativnega pozavarovalnega kapitala trenutno krije tveganja iz naslova naravnih nesreč. Kljub temu, da ti produkti nudijo možnosti diverzifikacije izven kapitalskega trga, so možnosti diverzifikacije znotraj samega pozavarovalnega trga manjše, saj je večina kapitala izpostavljena škodam, ki so posledica hurikanov v Združenih državah Amerike.

Delo identificira tudi dejavnike, ki bi lahko vplivali na razvoj trga v prihodnosti. Eden od dejavnikov je pričakovana rast zavarovanih škod in posledično potrebe po dodatnih pozavarovalnih kapacitetah. Iz vidika naravnih nesreč je rast škod pričakovana predvsem zaradi povečevanja vrednosti objektov ter njihove geografske koncentracije. Poleg tega bi lahko klimatske spremembe vplivale na pogostost in intenzivnost naravnih nesreč. Dodaten dejavnik so tveganja, kjer se v prihodnosti pričakuje velika rast v povpraševanju, na primer kibernetika tveganja. Alternativni kapital bi lahko bil koristen tudi pri prenosu tveganj od javno-zasebnih partnerstev na kapitalske trge. Navsezadnje pa so tudi investitorji tisti, od katerih ja razvoj trga odvisen. Pomembno je, da investitorji razumejo tveganja, ki jih te naložbe predstavljajo, da lahko sprejemajo ustrezne investicijske odločitve. Pri tem so imeli od nekdaj pomembno vlogo modeli, ki poskušajo kvantificirati potencialne finančne posledice naravnih nesreč. Nadaljnji razvoj teh modelov bi lahko pripomogel k bolj

natančnim ocenam tveganj, kar bi pozitivno vplivalo na njihovo kredibilnost in zaupanje investitorjev.

Magistrsko delo tako z obravnavo raznih vidikov alternativnega pozavarovalnega kapitala predstavi njegovo vlogo v zavarovalni in pozavarovalni industriji. Delo pokaže, da je alternativni kapital pomemben del industrije in pozavarovalnih kapacitet, ter da dopolnjuje klasično pozavarovanje, sploh v nekaterih zavarovalnih segmentih. Trenutno je njegova vloga najbolj pomembna pri prenosu tveganj iz naslova naravnih nesreč. V tem segmentu alternativni kapital z dodatnimi kapacitetami industriji pomaga pri zagotavljanju zavarovalnega kritja, sploh na območjih izpostavljenih naravnim nesrečam.