

# The Contribution of Reinsurance Markets to Managing Catastrophe Risk





# The Contribution of Reinsurance Markets to Managing Catastrophe Risk

**Please cite this publication as:**

OECD (2018), *The Contribution of Reinsurance Markets to Managing Catastrophe Risk*,  
[www.oecd.org/finance/the-contribution-of-reinsurance-markets-to-managing-catastrophe-risk.pdf](http://www.oecd.org/finance/the-contribution-of-reinsurance-markets-to-managing-catastrophe-risk.pdf).

## Foreword

Disasters present a broad range of human, social, financial, economic and environmental impacts, with potentially long-lasting, multi-generational effects. The financial management of these impacts is a key challenge for individuals, businesses and governments in developed and developing countries. Insurance markets can make an important contribution to the management of disaster risks by providing a source of funding for recovery and reconstruction in the aftermath of a disaster event and therefore reducing the financial burden on households, businesses and governments that would otherwise need to absorb these costs. The global reinsurance market, both traditional and alternative, provides an additional source of capital to mitigate these financial impacts, diversifying the risk away from the domestic economy and enhancing the capacity of primary insurers to provide affordable insurance cover for catastrophe risks.

*The Contribution of Reinsurance to Managing Catastrophe Risk* makes use of a unique set of data on premiums and claims provided by global reinsurance companies to empirically examine the contribution that reinsurance has made to enhancing the capacity of the primary insurance market to manage catastrophe risk and reducing the economic and insurance market disruption that often follows catastrophic events. It examines the regulatory and supervisory measures that have been applied to risk transfer to reinsurance markets in the largest non-life insurance markets and the impact that these measures have had on the use of reinsurance and the ability of primary insurance markets to leverage the benefits of risk transfer to reinsurance markets.

The OECD supports the development of strategies and the implementation of effective approaches for the financial management of natural and man-made disaster risks under the guidance of the OECD High-Level Advisory Board on the Financial Management of Catastrophic Risks and the OECD Insurance and Private Pensions Committee. This work includes the *OECD Recommendation on Disaster Risk Financing Strategies* (OECD, 2017) which provides a set of high-level recommendations for designing a strategy for addressing the financial impacts of disasters on individuals, businesses and sub-national levels of governments, as well as the implications for public finances. This work has been welcomed by international fora, such as G20 Finance Ministers and Central Bank Governors and APEC Finance Ministers, who have recognised the importance of building financial resilience against these risks.

This report was prepared by the OECD secretariat with significant contributions from Karina Whalley in her capacity as a consultant with substantial experience in both traditional and alternative reinsurance markets. The report benefited from the support and input of the OECD High-Level Advisory Board on the Financial Management of Catastrophic Risks and the OECD Insurance and Private Pensions Committee as well as technical comments provided by a number of market participants.



## *Table of contents*

<b>Foreword</b> .....	<b>3</b>
<b>Executive Summary</b> .....	<b>7</b>
<b>Chapter 1. Introduction: The role of reinsurance in managing property catastrophe risk</b> .....	<b>9</b>
<b>Chapter 2. Forms and use of reinsurance</b> .....	<b>11</b>
2.1. Traditional reinsurance .....	14
2.2. Alternative reinsurance .....	16
2.3. Use of property catastrophe reinsurance across countries .....	18
2.4. Use of retrocession by reinsurers .....	21
2.5. Reinsurance market developments and pricing .....	21
2.6. The potential drivers of reinsurance use .....	25
<b>Chapter 3. The contribution of reinsurance to reducing economic and insurance market disruption</b> .....	<b>31</b>
3.1. The contribution of reinsurance to reducing economic disruption .....	31
3.2. The contribution of reinsurance to reducing insurance market disruption .....	35
<b>Chapter 4. Reinsurance regulation and its impact</b> .....	<b>41</b>
4.1. Regulatory oversight of reinsurers and reinsurance transactions .....	41
4.2. Consistency of regulatory measures with international commitments .....	52
<b>Chapter 5. Conclusion</b> .....	<b>63</b>
<b>References</b> .....	<b>65</b>
<b>Annex A. Overview of reinsurance coverage</b> .....	<b>75</b>
Traditional reinsurance coverage .....	75
Alternative reinsurance market coverage .....	78
<b>Annex B. Estimates of lost output and catastrophe severity</b> .....	<b>82</b>

### Tables

Table 2.1. Comparison of different types of traditional non-life reinsurance .....	15
Table 2.2. Comparison of different types of alternative reinsurance .....	17
Table 2.3. Summary of major events impacting capacity and pricing in the property catastrophe reinsurance market .....	22
Table 4.1. Regulatory and supervisory measures applied to risk transfer to reinsurers without a local presence and alternative reinsurance arrangements .....	46
Table 4.2. Causes of non-life insurer impairments in the United States: 1969-2014 .....	53
Table 4.3. Observations on the impact of regulatory measures on reinsurance use .....	58

## Figures

Figure 2.1. Global reinsurer capital.....	12
Figure 2.2. Share of gross written non-life reinsurance premium (non-affiliated).....	13
Figure 2.3. Estimated cession ratios (for property premiums written, 2014 to 2016).....	19
Figure 2.4. Change in non-life cession ratios (2012-2016 relative to 2000-2004, unaffiliated reinsurance).....	19
Figure 2.5. Catastrophe bond and ILS exposure by peril (as of February 2018).....	20
Figure 2.6. The impact of insured catastrophe losses on reinsurance pricing.....	23
Figure 2.7. Volatility in reinsurance pricing and insured losses.....	23
Figure 2.8. Commercial property insurance and property catastrophe reinsurance pricing.....	24
Figure 2.9. The use of reinsurance for underwriting more business.....	26
Figure 2.10. The use of reinsurance for managing catastrophe exposure.....	26
Figure 2.11. The benefits of pooling independent risks.....	28
Figure 2.12. The use of reinsurance for risk diversification.....	29
Figure 3.1. Cumulative loss (or gain) in GDP relative to pre-event projections for different levels of reinsurance coverage.....	35
Figure 3.2. Cumulative loss (or gain) in GDP relative to pre-event projections for different levels of insurance coverage.....	36
Figure 3.3. The impact of reinsurance coverage on post-event claims ratios (non-life): Sub-set of events.....	37
Figure 3.4. Claims ratio performance (non-life) in the aftermath of events with different levels of reinsurance coverage.....	37
Figure 3.5. Reinsurance coverage and post-event primary insurance pricing in the United States.....	38
Figure 3.6. Reinsurer loss ratios.....	39
Figure 4.1. Gross Written Premium by reinsurer credit rating.....	54
Figure 4.2. Gross written non-life reinsurance premium written by selected public reinsurers.....	55
Figure A A.1. Example of 10-line surplus cession (USD 1 million per line).....	77
Figure A A.2. Structure of a catastrophe bond.....	79
Figure A A.3. Structure of a sidecar.....	81
Figure A B.1. Loss of output in the aftermath of catastrophe events (full sample).....	82
Figure A B.2. Loss of output in the aftermath of catastrophe events with more limited reinsurance coverage.....	83

## Boxes

Box 2.1. Cession ratio estimates.....	18
Box 2.2. The impact of reinsurance pricing on primary insurance pricing in the United States.....	24
Box 2.3. Diversification reduces capital needs: an illustration.....	28
Box 3.1. Risk spreading.....	32
Box 3.2. The cost of reinsurance.....	39
Box 4.1. Regulatory requirements applied to alternative reinsurance coverage.....	42
Box 4.2. Counterparty risk in reinsurance: the available evidence.....	53
Box 4.3. Public reinsurers.....	55
Box 5.1. US-EU Covered Agreement.....	64
Box A A.1. Surplus reinsurance example.....	77

## *Executive Summary*

International reinsurance markets, supported by a number of developments and innovations in recent years, can contribute to risk management by enhancing the capacity of primary insurance markets to offer coverage and supporting their ability to manage catastrophe risks (including by providing expertise on risk quantification). The global nature of these markets provides an external source of funding for recovery and reconstruction which should also help reduce the economic and insurance market disruptions that often follow large catastrophe events.

Using a unique set of data on property reinsurance premiums and claims provided by reinsurance companies, this report assesses the contribution of reinsurance to risk management across four areas: (i) increasing primary market capacity; (ii) managing catastrophe risks; (iii) reducing economic disruption in the aftermath of catastrophe events; and (iv) reducing primary insurance market disruption from catastrophe events. There is evidence that property catastrophe reinsurance is being used by cedants to increase the amount of coverage that they make available and to manage catastrophe risks. There is also evidence that property catastrophe reinsurance coverage has had a positive impact on reducing the economic disruption of past catastrophe events and reducing post-catastrophe disruptions in primary insurance markets.

In overseeing the property catastrophe reinsurance arrangements of cedants, regulators and supervisors need to find an appropriate balance between allowing cedants to leverage the potential benefits of international reinsurance markets while ensuring that their risk transfer to international reinsurers does not lead to significant risks to their ability to meet their obligations to policyholders. Most jurisdictions impose regulatory or supervisory requirements on the use of reinsurance, normally (but not always) with the aim of mitigating the counterparty and execution risks that could materialise as a result of risk transfer to reinsurers without a local presence or locally-based assets. Some of these requirements may be creating other risks by impeding the market's ability to manage catastrophe risks – and not all of these measures are consistent with international standards and commitments. Other approaches, such as ensuring that reinsurers are appropriately supervised in their home jurisdiction and enhancing supervisory cooperation and information exchange across jurisdictions, might offer a better means to ensuring that counterparty and execution risks related to cross-border reinsurance are properly managed while reflecting the global nature of reinsurance markets.

### Key messages

- International property catastrophe reinsurance markets can make an important contribution to increasing primary insurance market capacity, managing catastrophe risk and reducing economic and insurance market disruption in the aftermath of catastrophe events. Innovations in the property catastrophe reinsurance market have supported increased market capacity and reduced the volatility and cyclicity of reinsurance pricing.
- Most jurisdictions impose some regulatory or supervisory requirements on the use of reinsurance, normally (but not always) aimed at ensuring that counterparty and execution risks are appropriately managed. Some of these requirements may be creating other risks (e.g. domestic risk concentration) to cedants and the broader economy – and may not be entirely consistent with international standards and commitments.
- Ensuring the appropriate regulation and supervision of reinsurance companies in home jurisdictions and enhancing supervisory cooperation, information exchange and recognition could provide a better approach to managing the risks of international property catastrophe reinsurance markets (than regulatory and supervisory measures that lead to domestic risk concentration), while leveraging the benefits of international diversification that these markets provide.

## Chapter 1. Introduction: The role of reinsurance in managing property catastrophe risk

Insurance markets play an essential role in mitigating risks in the economy by encouraging proper risk management and providing a source of financing to respond to the damages and losses incurred by households, businesses and governments as a result of insured events. The pooling of risks faced by many insureds allows for the diversification of those risks across populations, regions, risks, and time, leading to a reduction in the aggregate cost of protection and providing individuals and businesses with the financial protection necessary for making longer-term planning and resource allocation decisions. The pooling of risks by reinsurers allows for further diversification (in addition to the diversification of risk realised by primary insurers), providing an additional layer of risk absorption capacity at a lower cost than can be achieved (in aggregate) by insurance companies individually. The global nature of international reinsurance markets also allows for some portion of the losses from an event to be absorbed by international markets (and investors), thereby diversifying the burden away from the domestic financial system.

Reinsurance companies are regulated and supervised in a similar way as primary insurers, with the aim of ensuring that they are able to meet their obligations to their policyholders (cedants). In addition, the importance of reinsurance markets in supporting earnings stability and solvency of primary insurers has led regulators and supervisors in many countries to also apply supervisory or regulatory measures to the transfer of risk by cedants, with the aim of ensuring that the transfer of domestic risks to reinsurance markets does not lead to significant risks for cedants (and ultimately their policyholders). The different types of regulatory and supervisory interventions have different implications for the functioning of reinsurance and primary insurance markets and will be discussed in the sections below.

The purpose of this report is to examine how reinsurance is contributing to the management of risk (based on the available evidence). The analysis is focussed on property catastrophe reinsurance, given the large role that reinsurance markets have traditionally played in this business line as well as the diversity of risk transfer instruments that have been developed to cover this risk.<sup>1</sup> The focus on property catastrophe reinsurance also allows for an examination of the potential contribution of

---

<sup>1</sup> Reinsurance markets also play an important role in managing risks in other lines of business, including casualty lines and life and health. An examination of the contribution of reinsurance to risk management in those lines of business is outside the scope of this report although some of the benefits of reinsurance identified for property catastrophe risks are likely present for other lines of business as well (although there are also important differences between the life and non-life reinsurance business).

reinsurance to mitigating the economic impacts of specific disruptive (natural catastrophe) events.

The second section will provide a brief description of the traditional and alternative reinsurance and retrocession markets, including the main providers, market developments and types and uses of these risk transfer instruments (a more detailed overview is provided in Annex A). This includes some statistics on the use of reinsurance across countries, particularly for the purposes of increasing market capacity, managing catastrophe risks and capturing the benefits of diversification. The third section examines the potential contribution of reinsurance to: (i) reducing economic disruption in the aftermath of catastrophe events; and (ii) reducing the disruption to insurance markets that could occur after catastrophe events. The fourth section provides an overview of the types of risks that cedants could face as a result of their use of reinsurance and the regulatory and supervisory measures that have been put in place to manage those risks. This section also provides some observations on the impact of these measures on the use of international reinsurance markets as well as their consistency with international standards and commitments.

## Chapter 2. Forms and use of reinsurance

As noted above, reinsurance provides insurance coverage to primary insurers (or cedants) based on a contractual arrangement to indemnify losses or otherwise provide a payout to the cedant based on the occurrence of a triggering event, such as a loss incurred by the cedant.

Cedants may seek reinsurance coverage for a number of reasons, including to: (i) reduce volatility in underwriting results which could be high in business lines subject to catastrophe risk; (ii) increase underwriting capacity, either for a given policyholder/risk or for a portfolio of policies/risks; (iii) support entry into a new line of business or market (or exit), including for the purposes of leveraging the market knowledge and/or market presence of reinsurance companies; or (iv) establish an appropriate level of risk diversification (Federal Insurance Office, 2014<sup>[1]</sup>). Ultimately, reinsurance provides the cedant with an alternative to holding the reserves and capital necessary to back the policy obligations it has underwritten meaning that the decision to seek reinsurance coverage will depend (at least partially<sup>2</sup>) on the cost of that coverage relative to the cost of holding reserves or capital.

Reinsurers may also acquire insurance coverage ("retrocession") for their exposures, typically covering catastrophe or tail risk (i.e. low frequency/high severity events). A reinsurer (retrocedant) purchases retrocession from retrocessionaires, which may constitute other reinsurers or capital market investors or even primary insurers. Retrocession can provide cover on a portfolio-wide or pillar basis and provides many of the same benefits to reinsurers as reinsurance provides to primary insurers, such as allowing more business to be written and providing risk diversification.

The providers of reinsurance include independent reinsurance companies, small and large with regional and/or global presence, as well as reinsurance companies established within insurance groups to provide coverage to other group entities (often referred to as affiliated reinsurers). A significant share of all reinsurance is provided by affiliated reinsurers – in the non-life sector, the share of all premiums ceded to non-affiliated reinsurance companies (overall) is approximately 8% to 10% (Swiss Re, 2018<sup>[2]</sup>) although with significant variation across jurisdictions. This report is focused on the non-affiliated segment of the reinsurance market.<sup>3</sup>

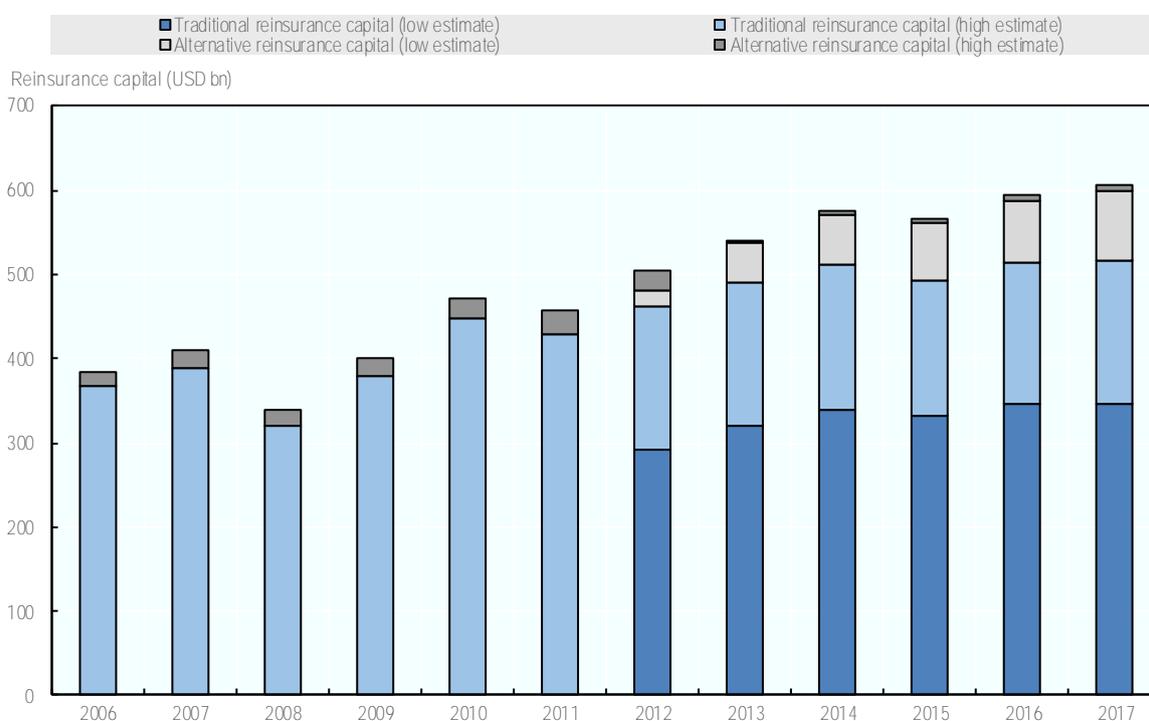
---

<sup>2</sup> The cedant's decision will also depend on its own risk appetite, tax considerations and other factors.

<sup>3</sup> While there would be many risk management benefits resulting from the transfer of risk to affiliated reinsurance companies, the risk would ultimately remain within the group and therefore not achieve all of the diversification benefits that can be realised through the transfer of risk to non-affiliated reinsurance companies.

The size of the reinsurance market (traditional and alternative) is most commonly expressed in terms of the capital available to back reinsurance coverage (see Figure 2.1). For the alternative reinsurance market, total capital available is a good approximation for the amount of reinsurance limit made available (i.e. the actual value of reinsurance coverage provided) as transactions are normally fully funded (i.e. the amount of an alternative reinsurer's contractual liability is equivalent to the amount of alternative reinsurance capital). However, for traditional reinsurance companies, this is based on estimates of shareholder capital which is not equivalent to the amount of reinsurance capacity made available as traditional reinsurance coverage is not backed by shareholder equity on a one-to-one basis (i.e. traditional reinsurers' liability is larger than traditional reinsurers' equity). As a result, the share of overall reinsurance capacity provided by traditional reinsurance companies is larger than illustrated below (i.e. based on shareholder equity alone).

**Figure 2.1. Global reinsurer capital**



*Note:* Estimates of reinsurance capital levels are available from Aon Benfield for the whole period although only accessible for 2012-2017 from Guy Carpenter/A.M. Best. The Guy Carpenter/A.M. Best methodology excludes capital dedicated by reinsurers to underwriting primary insurance.

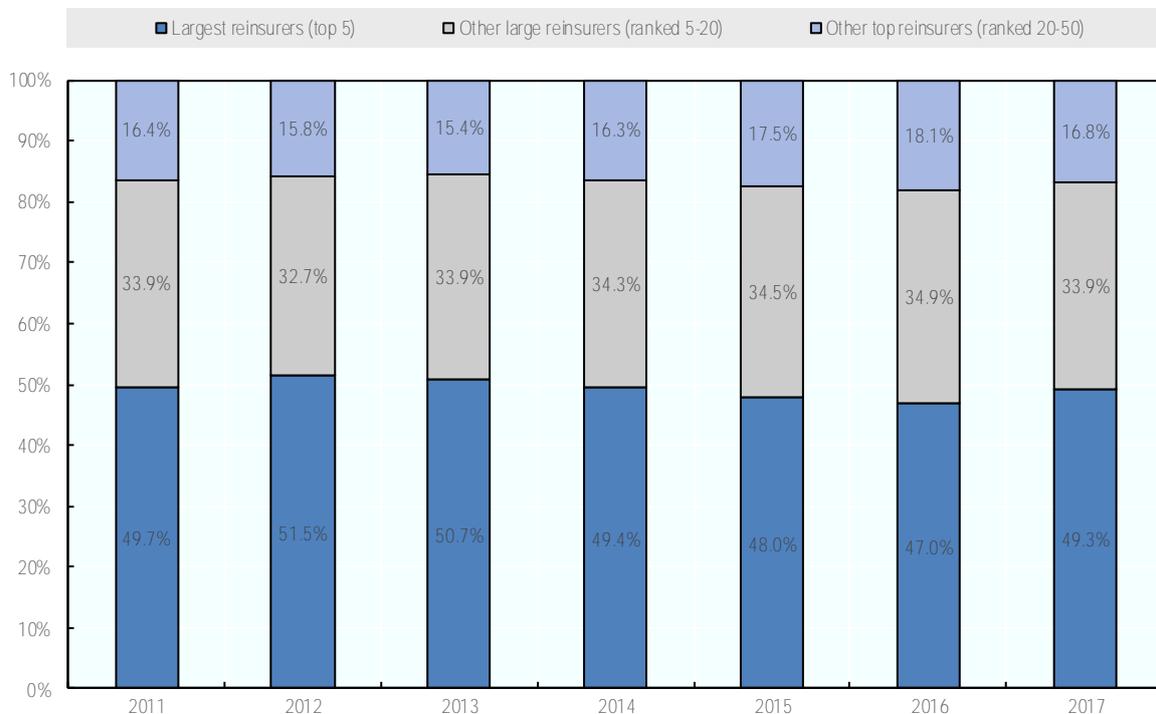
*Source:* (Aon Benfield, 2018<sup>[3]</sup>), (A.M. Best, 2017<sup>[4]</sup>), (Guy Carpenter,(n.d.)<sup>[5]</sup>), (Global Reinsurance, 2018<sup>[6]</sup>)

The capital backing non-affiliated traditional reinsurance markets (both non-life and life business) has accounted for approximately 85% to 88% of all global reinsurance market capital since 2012 and has grown at a rate of approximately 2.3% to 3.4% annually. Depending on the source of the market estimate, capital devoted to the alternative reinsurance market has grown at a rate of 15% to 34% annually (although from a significantly smaller base). Overall, the level of capital backing global reinsurance

markets has increased by 20% to 37% since 2012 and has grown on an annual basis in most years (with the exception of 2008 and 2015).<sup>4</sup>

Data on non-affiliated reinsurance premium is available for the 50 largest reinsurance companies. Since 2011, the 5 largest reinsurers have accounted for approximately 50% of (non-affiliated) gross written non-life reinsurance premium, while the top 20 global reinsurers have accounted for approximately 83% (see Figure 2.2). The share of gross written non-life reinsurance premium accounted for by the top 5 and top 20 global reinsurers declined slightly between 2011 and 2016 although increased in 2017. The non-life reinsurance market is significantly less concentrated than the life reinsurance market where the top 5 life reinsurers accounted for 74% of gross written reinsurance premium and the top 15 accounted for 99% (reflecting in part important difference in how reinsurance is used in the life sector relative to non-life).

**Figure 2.2. Share of gross written non-life reinsurance premium (non-affiliated)**



*Note:* The total includes only the top 50 largest providers of non-affiliated reinsurance coverage.

*Source:* OECD calculations, based on (AM Best, 2014<sup>[7]</sup>), (AM Best, 2013<sup>[8]</sup>), (AM Best, 2017<sup>[9]</sup>), (AM Best, 2012<sup>[10]</sup>), (AM Best, 2016<sup>[11]</sup>), (AM Best, 2015<sup>[12]</sup>), (A.M. Best, 2018<sup>[13]</sup>). The total includes only the top 50 largest providers of non-affiliated reinsurance coverage.

<sup>4</sup> It should be noted that there are different estimates of traditional reinsurer capital. For example, (Standard & Poor's Ratings Service, 2017<sup>[101]</sup>) estimates that the 40 largest reinsurance groups held USD 443 billion in adjusted shareholder funds in 2016. (Guy Carpenter, 2018<sup>[120]</sup>) estimates traditional reinsurance capital of approximately USD 340 billion at the end of 2017, based on estimates generated by A.M. Best's "Best's Capital Adequacy Ratio" (BCAR) capital adequacy model.

## 2.1. Traditional reinsurance

Traditional reinsurers provide insurance coverage to cedants in exchange for a premium. The coverage is normally provided on an indemnity basis (i.e., providing payments based on the actual levels of losses incurred) with the reinsurer's obligation to the cedant backed by reserves and capital held by the reinsurer (or retrocedant if risk is transferred through retrocession) or backed by collateral posted by the reinsurer, where required. Depending on the contractual arrangements, the reinsurer may pay the cedant a ceding commission to share some of the cedant's costs related to originating the underlying insurance policies and may also share the costs of loss adjustment (i.e. loss adjustment expenses) and/or profits.

There is a wide variety of different forms of traditional reinsurance coverage available to primary insurers for non-life business, including arrangements to share premiums, claims and expenses on a proportional basis (e.g. quota share, surplus share) as well as coverage that will only apply to losses above a certain threshold (e.g. excess-of-loss, aggregate stop loss). Reinsurance coverage can also be arranged on a per policy (per risk) basis (i.e. the coverage is only arranged for a single policy with a single underlying policyholder - facultative reinsurance) or for a portfolio of risks/policies (treaty reinsurance).

The different forms of reinsurance provide different advantages in terms of meeting the various objectives for the use of reinsurance. Quota share coverage is particularly useful for increasing underwriting capacity and entering new lines of business. Surplus share coverage provides similar benefits although it allows a cedant with more capacity to retain lower severity losses (and therefore reduce the premium amount shared with reinsurers) while still providing proportional protection in the event of larger losses. Catastrophe excess-of-loss coverage, provided on a per occurrence or aggregate basis, protects against the severe losses that can specifically result from catastrophic events such as natural disasters that create accumulation risk for cedants. Aggregate stop loss coverage also helps protect against severe losses due to catastrophic events, although it is provided based on full-year loss experience rather than as coverage tied to the occurrence of specific events. Excess-of-loss arrangements can also be used to increase underwriting capacity for a single risk/policy (e.g. where the cedant is unwilling or unable to provide the full level of coverage sought by the policyholder on its own). An overview of the different forms of traditional reinsurance coverage available for non-life insurance business and their uses is provided in Table 2.1. A more comprehensive description is included in Annex A.

Table 2.1. Comparison of different types of traditional non-life reinsurance

	Proportional		Non-proportional		
	Quota Share	Surplus Share	Excess of loss per risk	Catastrophe Excess-of-Loss (Per Occurrence & Aggregate)	Aggregate Stop Loss
<b>Description</b>	Cedant transfers a fixed percentage of every risk in a defined category from the first dollar of premium.	Cedant determines level to retain for each risk (a line) and every risk that provides coverage greater than the retained line is ceded on a proportional basis. Proportion ceded varies with size of risk.	Excess of loss reinsurance in which the reinsurance limit and the cedant's loss retention apply per risk rather than per event or in the aggregate.	Covers a cedant for the amount of loss over a specified retention with respect to an accumulation of losses resulting from a catastrophic event (per occurrence) or multiple events (aggregate).	A share of the cedant's total (cat and non-cat) losses during the period (usually a year) above an agreed retention (typically set as a percentage of aggregate net premium or a specified loss ratio) are ceded through a stop loss cover.
<b>Uses and advantages</b>	Provides good protection against frequency/severity potential and protection of net retention on a first-dollar basis. Allows recovery on smaller losses and increases capacity to underwrite larger limits with existing capital.		Provides good protection against frequency or severity depending on the retention level. Allows a greater net premium retention and reduces reinsurance premium and cost of administration.		
	Supports cedants entry into new lines of business	Allows cedant to cede higher proportion of less profitable risks than quota share or non-proportional reinsurance while helping to eliminate peaks in a portfolio.	Absorbs large single risk losses and therefore increases capacity to write larger limits while maintaining manageable risk level and stabilising financial results.	Can reduce volatility in annual catastrophe-related losses or protect against solvency risk of severe events. Aggregate provides coverage for more frequent catastrophe events and also avoids interpretation issues related to the definition of an event. Per event/occurrence coverage protects against severe losses.	Protects overall underwriting results (specifically large claims fluctuations), generally after other types of reinsurance have been applied. Avoids interpretation issues related to the definition of an event.
<b>Reinstatements</b>	N/A	N/A	Possibly	Yes (except aggregate)	No
<b>Popularity</b>	Common for new companies.	Normally more common than quota share.	Very prevalent	Very prevalent	Not as prevalent as other non-proportional reinsurance.
<b>Lines</b>	Property and Casualty	Property (mainly)	Property and Casualty	Property (mainly)	Property, Agriculture
<b>Premium calculation</b>	Calculated as a proportion of underlying insurance premium which reflects amount of risk transferred.		Two main methods:(i) exposure rating based on the sums insured and types of exposures; (ii) experience rating based on the estimated or projected loss experience		
<b>Administrative cost</b>	Less costly than surplus due to low administration	Costlier than quota share due to more administration	Less costly to administer than surplus		
<b>Commission</b>	Ceding commission paid to cover proportionate share of business acquisition costs. Profit commission may also be paid if reinsurance turns out to be profitable.		Rarely includes a ceding commission		

## 2.2. Alternative reinsurance

The alternative reinsurance market began to develop in the aftermath of Hurricane Andrew in 1992 in response to capacity shortages in the traditional reinsurance market. The alternative reinsurance market provides a means for investors such as hedge funds, private equity funds and pension funds to gain exposure to reinsurance risks that provide relatively high-yields and are usually uncorrelated to credit cycles - as an alternative to investing directly in reinsurance companies.

Alternative reinsurance coverage is normally provided by a special-purpose entity capitalised by capital market investors that assumes the insurance risk from the cedant. The special-purpose entity may be funded by equity (in the case of collateralised reinsurers and sidecars) or debt (in the case of catastrophe bonds issued by the special-purpose entity). Alternative reinsurance coverage may also be provided through tailored financial instruments such as industry loss warranties (ILWs).

Most alternative reinsurance coverage is structured in a similar way as traditional reinsurance. For example, sidecars and collateralised reinsurers both provide the same types of coverage as traditional reinsurance (i.e. a contract to indemnify the cedant for losses incurred, whether on a non-proportional or proportional basis) in exchange for a premium, although the exposures to the cedant are normally fully funded with funds (i.e. the funds raised as equity of the special-purpose entity) placed in a trust account with the cedant as the beneficiary (where there exists more than one contract, each contract will have a segregated account). Catastrophe bonds are issued as a debt instrument to fund a special-purpose entity assuming insurance risk. The proceeds from the bond sale are placed in a special purpose entity to back the assumed risk and generate a market and risk return (a premium paid by the issuer for the coverage provided). The occurrence of a catastrophe event (or events) that exceed the pre-defined trigger (which may be an indemnity trigger based on the cedant's losses or a non-indemnity trigger based on a loss index, modelled loss estimate or the parameters of the event) leads to a payout of some or all of the proceeds from the bond (invested in the special-purpose entity) to the issuer (cedant). ILWs can be structured similar to a traditional reinsurance contract or as a derivative (option) purchased by the cedant and are also usually collateralised (although there are also exchange-traded ILWs that are centrally cleared). ILW payouts are triggered when an event exceeds a specific level of losses as determined by third party loss index providers and usually only when the cedant has also suffered a loss as a result of the event.

Alternative reinsurance coverage, depending on the form of coverage, will provide similar advantages to cedants in terms of increasing underwriting capacity, entering new lines of business and smoothing underwriting volatility. Sidecars normally provide coverage on a quota share basis which means that they can be particularly advantageous in terms of increasing underwriting capacity and entering new lines of business. Special-purpose entities funded by catastrophe bonds and financial instruments such as ILWs provide comparable coverage to catastrophe excess-of-loss per occurrence coverage provided by traditional reinsurance companies and can therefore be useful for protecting against severe losses from catastrophic events. Special-purpose entities providing collateralised reinsurance predominantly provide catastrophe excess-of-loss coverage. An overview of the different forms of alternative reinsurance coverage and their uses is provided in Table 2.2. A more comprehensive description is included in Annex A.

**Table 2.2. Comparison of different types of alternative reinsurance**

	Catastrophe Bond	Industry Loss Warranty (ILW)	Collateralised reinsurance	Sidecar
Description	A special-purpose entity is established and funded by bonds issued to investors. The funds invested in the SPE generate market returns and also receives premium payments from the cedant. Should a triggering event (or events) occur, all or a portion of the proceeds are provided to the issuer. If the bond is not triggered, funds invested in the SPE are returned to investors at maturity.	ILW is offered to cedant as a reinsurance contract or option. A triggering event (industry-wide losses above a certain threshold where the cedant also incurs losses) leads to a payout to the cedant.	Reinsurance provided by a special-purpose entity funded by third party investors through the issuance of equity (usually preferred shares). The reinsurance issued by the SPE is fully-backed by the funds invested by investors.	A limited-purpose special-purpose entity that is often established as a joint-venture involving at least one licensed (re)insurer seeking to access outside capital for a set of risks. Sidecars often only service one cedant (although some assume risks from multiple cedants). The reinsurance issued by the SPE is fully-backed by the funds invested by investors.
	Normally used for protection against high severity (catastrophe) losses.		Depends on the type of reinsurance coverage provided (proportional/non-proportional).	
Uses and advantages	Protects against severe losses. Can involve basis risk depending on trigger (industry index, model and parametric triggers involve basis risks). The risks assumed by the SPE are fully-funded.	Reduces volatility in underwriting and protects against severe losses. Involves basis risk which can be significant where cedant exposure is significantly different than industry exposure.	Depends on the type of reinsurance coverage provided (proportional/non-proportional). Often considered an alternative to catastrophe bonds for non-US risks. The risks assumed by the SPE are fully-funded.	Depends on the type of reinsurance coverage provided (proportional/non-proportional). Many sidecars provide coverage on a quota share basis and therefore support increased underwriting capacity. The risks assumed by the SPE are fully-funded.
Popularity	One of the most common alternative risk transfer mechanisms.	Less commonly used.	One of the most common alternative risk transfer mechanisms.	Less commonly used (collateralised reinsurance structures are increasingly seen as an alternative).
Lines	Property catastrophe (mainly)	Property catastrophe (mainly)	Property (mainly) although also other lines	Property (mainly) although also other lines
Administrative cost	Significant costs related to issuance although provide multi-year protection. The speed, simplicity and transparency of payouts depends on the type of trigger used (indemnity; industry index; model; parametric).	Low transaction costs and transparent trigger that is usually available soon after the occurrence of an event.	There are costs related to the establishment of the special-purpose entity and the issuance of securities to investors.	
Commission	No commission is exchanged		Ceding and profit commissions are common.	

### 2.3. Use of property catastrophe reinsurance across countries

The transfer of property risks to unaffiliated reinsurance companies, estimated based on the set of data provided by reinsurance companies (see Box 2.1), appears to vary significantly across countries. In high-income OECD countries, on average, approximately 15.4% of gross written property premiums are ceded to unaffiliated reinsurers although with significant variation across those countries (less than 10% in Spain, Ireland, Sweden, Poland and Canada to more than 30% in Australia and New Zealand). In non-OECD and middle income countries, the average share of property premiums ceded is much higher (33.4%) although with a greater level of variation across countries (less than 10% in South Africa, Russia and Brazil to more than 50% in Chinese Taipei, Mexico, India and Saudi Arabia) (see Figure 2.3). The reasons for the significant difference in cession ratios between high-income OECD countries and middle income and non-OECD countries have not been examined although higher levels of affiliated reinsurance and greater retention capacity in high-income OECD countries likely contribute to this difference.

#### Box 2.1. Cession ratio estimates

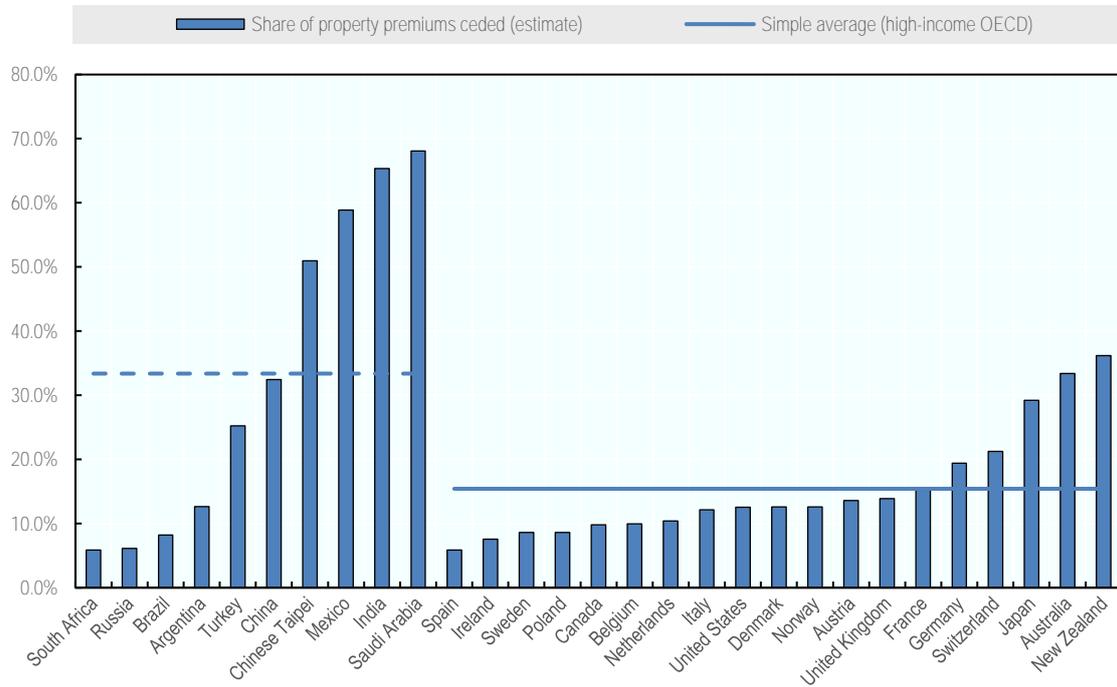
The analysis in this report is based on (and requires) an indicator on the use of unaffiliated reinsurance across countries. The most commonly-used indicator of reinsurance use is the cession ratio, which is the ratio of reinsurance premium to gross written premium (where a higher ratio indicates greater relative use of reinsurance). This ratio was calculated using the following data sources (and adjustments):

- Gross written property premiums: The OECD (OECD, 2016<sup>[14]</sup>) collects and publishes data from member and non-member countries on the amount of gross premiums written for the non-life sector and by class of insurance (including property). Swiss Re (Swiss Re, 2018<sup>[2]</sup>) also publishes data on gross written premium for the non-life sector for a broader set of countries. The data on gross written property premiums used in this study is a combination of the OECD and Swiss Re data, normally the mid-point between the two estimates or, in cases where there was a significant difference, one of the two estimates verified against other estimates from the insurance supervisor or a third party.
- Property reinsurance premium written: In late 2017, a number of reinsurance companies<sup>1</sup> voluntarily provided a set of confidential data to the OECD for use in this study, facilitated by the Global Reinsurance Forum, the Reinsurance Association of America and the Association of Bermuda Insurers and Reinsurers. The data includes premiums collected in 2014, 2015 and 2016 across major non-life insurance classes for the 30 largest property and casualty insurance markets.<sup>2</sup> The level of reinsurance premiums was adjusted upwards with the aim of accounting for reinsurance premiums written by other reinsurance companies by comparing the total amount of non-life reinsurance premium written by the contributing companies with Swiss Re (Swiss Re, 2018<sup>[2]</sup>) estimates of the amount of non-life reinsurance premium written by non-affiliated reinsurers in each country.

1. Data was received from nine reinsurance companies domiciled in Bermuda, Japan, a number of European countries and the United States, which account for approximately 40% of gross non-life reinsurance premiums written in 2017 (one of the reinsurance companies only provided data on event-related claims).

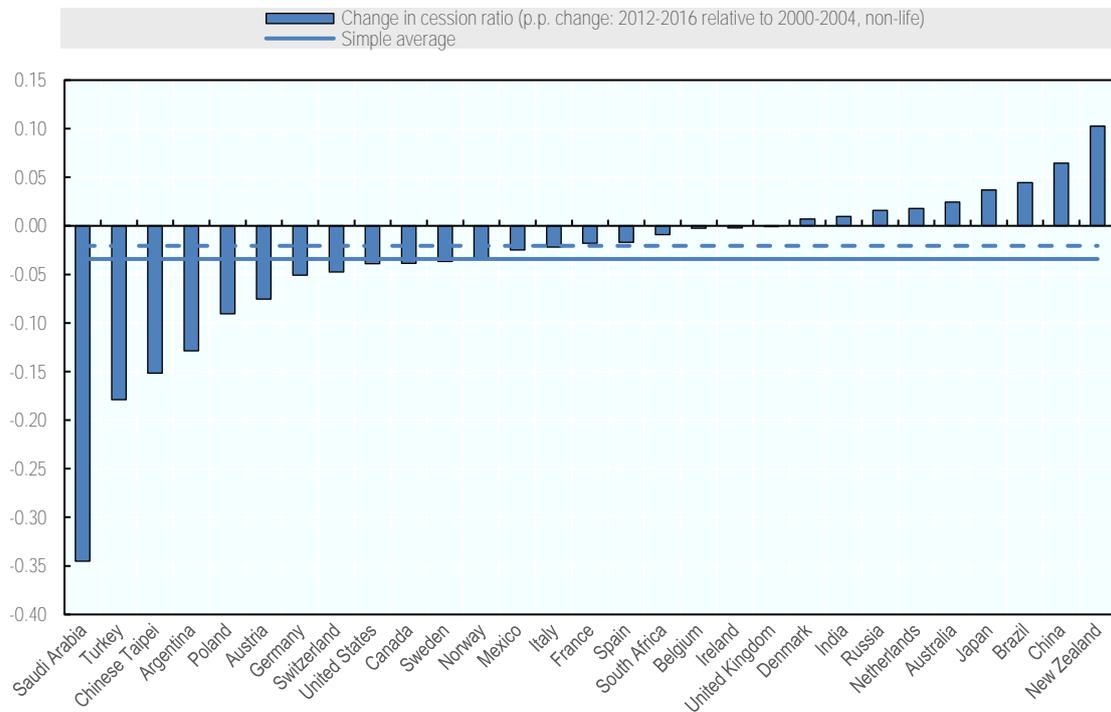
2. The markets covered by the dataset include: Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Denmark, France, Germany, India, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Russia, Saudi Arabia, South Africa, Spain, Sweden, Switzerland, Chinese Taipei, Turkey, United Kingdom, United States. Korea is not included in the subsequent analysis as a reliable estimate of gross written property premiums was not identified.

**Figure 2.3. Estimated cession ratios (for property premiums written, 2014 to 2016)**



Source: OECD calculations based on (OECD, 2017<sup>[15]</sup>), (Swiss Re, 2018<sup>[21]</sup>), and data provided by reinsurance companies on premiums and claims.

**Figure 2.4. Change in non-life cession ratios (2012-2016 relative to 2000-2004, unaffiliated reinsurance)**

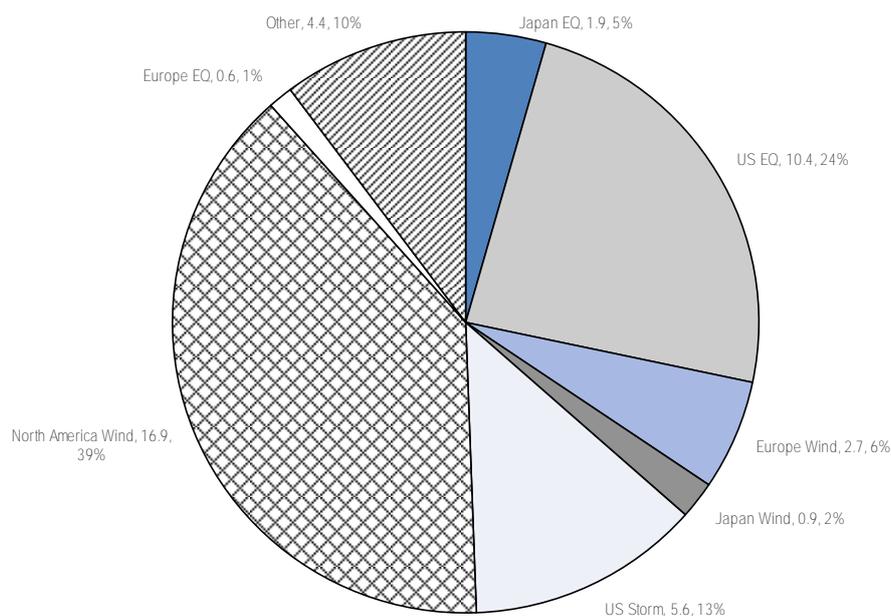


Source: OECD calculations based on (Swiss Re, 2018<sup>[21]</sup>)

In all but a few of the sample countries, the non-life cession ratio (for non-affiliated reinsurers)<sup>5</sup> was significantly lower in the 2012-2016 period relative to 2000-2004 (see Figure 2.4). Overall, non-life insurers ceded approximately 2% less of their premiums to unaffiliated reinsurers in 2012-2016 relative to the earlier period with more significant declines in many countries, including Argentina, Saudi Arabia, Chinese Taipei and Turkey).

There is more limited data on the use of alternative reinsurance coverage across countries. Information on the specific risks covered through some alternative reinsurance instruments (catastrophe bonds and insurance-linked securities (ILS), which accounts for approximately 50% of the alternative reinsurance market) is available and published by a number of organisations that aggregate data on outstanding catastrophe bond and ILS exposure. According to (Lane and Beckwith, 2018<sup>[16]</sup>), there was approximately USD 43 billion in outstanding catastrophe bond and ILS limit as of the end of February 2018, of which close to 40% was allocated to hurricane (wind) exposure in North America with a further 24% and 13% allocated to United States storm and earthquake risk, respectively (see Figure 2.5).

**Figure 2.5. Catastrophe bond and ILS exposure by peril (as of February 2018)**



*Note:* Alternative market catastrophe exposure is calculated as aggregate limits available, which is estimated at USD 43 billion although with sub-limits (i.e. where a limit is available for multiple perils but not cumulative) that would bring the actual figure to approximately USD 25 billion.

*Source:* (Lane and Beckwith, 2018<sup>[16]</sup>).

<sup>5</sup> Data for these years disaggregated by class of insurance was not available.

## 2.4. Use of retrocession by reinsurers

The use of retrocession varies substantially across global reinsurance companies with some using virtually no retrocession and others retroceding more than 50% of their gross written reinsurance premium (based on the difference between gross and net written non-life reinsurance premiums as reported by (AM Best, 2017<sup>[9]</sup>)). Based on this approach, an estimated 12% of gross written non-life reinsurance premiums were retroceded by the large reinsurers for which data is available. Among the top five global reinsurers, approximately 8% of gross written non-life reinsurance premium was retroceded in 2017 (A.M. Best, 2018<sup>[13]</sup>).

A large portion of alternative reinsurance coverage is being provided as retrocession capacity (estimated to be 25% to 30% of alternative reinsurance capital in 2013 (Bradicich et al., 2013<sup>[17]</sup>)) as reinsurers themselves establish special-purpose entities that issue catastrophe bonds, purchase ILWs and set up sidecars to cede risk to the capital markets. Investors in the alternative reinsurance market tend to prefer higher layers of risk (more severe, less frequent risks) which are the risks most likely to be retroceded.

## 2.5. Reinsurance market developments and pricing

The reinsurance market for property catastrophe risks has historically gone through cycles of high prices/limited capacity (“hard market”) and low prices/significant capacity (“soft market”) – see Table 2.3.

These cycles have normally been driven by the occurrence of major man-made or natural catastrophes. A catastrophe typically causes pricing to rise in the short term as reinsurers’ capital base is reduced and/or reinsurers re-evaluate their exposures based on the impacts of the event. Conversely, a prolonged period without significant losses could lead to reserve releases by reinsurers, enhancing profitability and their capacity and willingness to provide coverage.

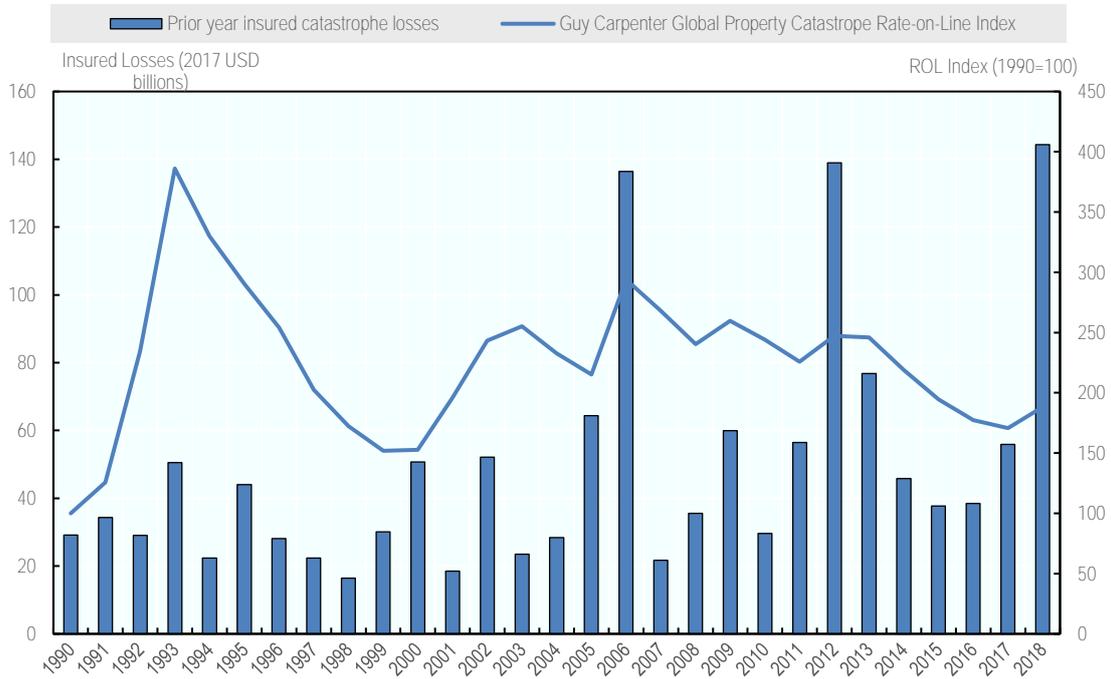
Figure 2.6 shows the relationship between prior year insured losses and January property catastrophe reinsurance pricing since 1990. Overall, property catastrophe reinsurance pricing has declined since peaks reached after Hurricane Andrew (1992), September 11th (2001), and Hurricane Katrina (2005) and declined every year between 2012 and 2017. Reinsurance pricing in January 2018, following a year of significant catastrophe losses, increased by less than 10% overall although with higher price increases in regions affected by losses (e.g. Caribbean) and for loss-affected lines (i.e. reinsurance renewals on policies that experienced losses in 2017) (Willis Towers Watson, 2018<sup>[18]</sup>) (JLT Re, 2018<sup>[19]</sup>). A correlation between pricing and prior year losses was evident (although limited) until 2006 (approximately 29%) but appears to have since disappeared.

Figure 2.7 shows that, even as volatility in insured losses has remained high, volatility in reinsurance pricing has fallen to a stable and low level for the most of the past fifteen years - most notably in the case of the milder price increases that followed large losses in 2011, 2012 and 2017. Volatility in reinsurance pricing has dropped from 50% to around 10% despite limited change in the volatility of insured losses.

**Table 2.3. Summary of major events impacting capacity and pricing in the property catastrophe reinsurance market**

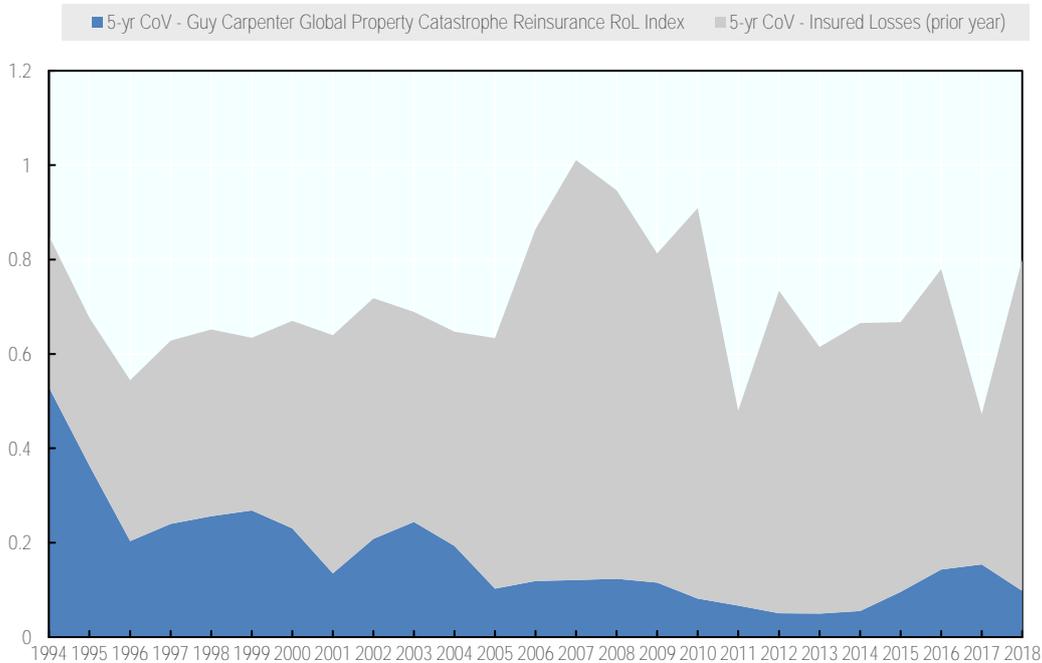
	1990 - 1995	1996 - 2000	2001	2002 - 2004	2005	2006-2007	2008	2009 - 2010	2011	2012	2013-2016	2017
<b>Events</b>	Hurricanes Andrew, Hugo and Iniki (US); European windstorms (Vivian and Daria 1990); Northridge Earthquake (US); and Piper Alpha (Europe).	No major events beside European windstorms Lothar and Martin (1999)	September 9/11 attack (US)	Hurricanes Ivan and Charley (2004)	Hurricanes Katrina, Rita and Wilma (US in 2005)	No major events	Financial crisis; Hurricanes Ike and Gustave; European windstorm Emma	Chile earthquake and tsunami (2010)	Christchurch earthquakes (2010-11 NZ), Japan Tohoku earthquake and tsunami, Thai floods and RMS v11 hurricane model update	Superstorm Sandy (US)	No major events (although multiple medium-sized losses in 2016)	Hurricanes Harvey, Irma and Maria (US and Caribbean); Mexico Earthquakes; California wildfires (US) lead to largest-ever insured loss year
<b>Impact</b>	Primary insurer failures, market disruptions and readjustment in primary and reinsurance pricing	Capital build up and property catastrophe pricing falls	Primary insurers withdraw from terror market, (re)insurers' underwriting and investment results impacted, primary and reinsurance pricing rises.	Losses absorbed. Capital build up and property catastrophe pricing falls	NFIP impacted. Reinsurance capital reduced, primary and reinsurance pricing rises.	Capital build up and primary and reinsurance pricing falls	Primary and reinsurance capital eroded through fixed income investments and underwriting losses.	Losses absorbed. Capital build up and primary and reinsurance pricing falls	Traditional reinsurance capital reduced, while alternative buoyant. Adjustment to reinsurance pricing, accumulations and capital for model update.	NFIP impacted. Reinsurance capital nevertheless grows, driven by rise in alternative. Reinsurance pricing stable.	Capital build up (mainly collateralised reinsurance) leads to primary and reinsurance pricing falls and looser terms and conditions. Competition in traditional and alternative sectors drives down pricing further.	
<b>Response</b>	<b>State interventions:</b> Wind pools, CEA and FHC set up <b>Capital:</b> Bermuda property catastrophe market and first ILS transaction <b>Cat Modelling:</b> More emphasis on modelling and Realistic Disaster Scenarios introduced to Lloyd's		<b>State interventions:</b> US TRIP/TRIA, GAREAT and other terrorism insurance programmes created <b>Capital:</b> Bermuda all lines carriers set up, sidecars and cat bonds and existing reinsurers recapitalise.		<b>Capital:</b> Bermuda all lines carriers set up (ready by 1 Jan 2006); sharp rise in sidecars and cat bonds issued and existing reinsurers recapitalise with higher additional levels than early 1990s and 2001.		<b>Capital:</b> Alternative reinsurance instrument issuance drops sharply but recovers by 2009 besides sidecars		<b>Modelling:</b> Reinsurers focus on accumulation risk after Tohoku and Thai floods exposed supply chain impacts		<b>Capital:</b> Certain ILS funds soft close funds to new capital.	

**Figure 2.6. The impact of insured catastrophe losses on reinsurance pricing**



Source: OECD calculations based on (Swiss Re, 2018<sub>[20]</sub>) and data for the Guy Carpenter Global Rate-on-Line index (provided by Guy Carpenter for traditional reinsurance coverage).

**Figure 2.7. Volatility in reinsurance pricing and insured losses**



Note: Volatility is measured as the Coefficient of Variation on a five-year rolling basis (prior five years).  
 Source: OECD calculations based on (Swiss Re, 2018<sub>[20]</sub>) and data for the Guy Carpenter Global Rate-on-Line index (provided by Guy Carpenter).

The increasing availability of coverage in the alternative reinsurance market has had an impact on the overall availability of property catastrophe reinsurance coverage and has likely reduced the volatility (and cyclical) in pricing that has historically resulted from significant catastrophe events. The availability of reinsurance coverage through the alternative reinsurance market has facilitated the entry of capital and has likely dampened reinsurance price hikes that have historically occurred in the aftermath of major events.

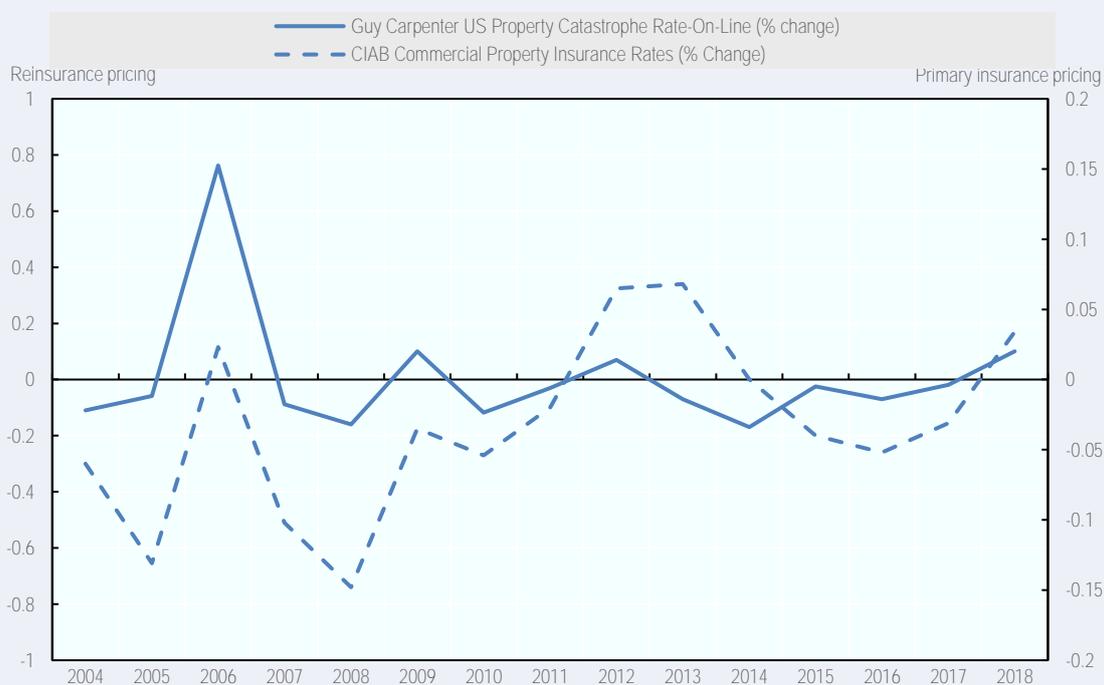
Property catastrophe reinsurance and primary property insurance pricing are generally correlated (see Box 2.2) meaning that price increases in reinsurance markets have the potential to lead to price increases in primary insurance markets.

### Box 2.2. The impact of reinsurance pricing on primary insurance pricing in the United States

While commercial property insurance and property catastrophe reinsurance provide different types of coverage and are affected by different loss experiences - there has historically been a significant level of correlation between pricing in each market (in the United States, where data is readily available).

Figure 2.8 shows the relationship between Guy Carpenter's US Property Catastrophe Rate-on-Line pricing index and movements in commercial property pricing reported by the US Council of Insurance Agents and Brokers. While property catastrophe reinsurance pricing is significantly more volatile, there was a high-level of correlation (79%) in the two prices between 2004 and 2010 - although the level of correlation declined to 35% after 2010.

**Figure 2.8. Commercial property insurance and property catastrophe reinsurance pricing**



*Note:* Commercial property insurance pricing is the average change reported by CIAB for the first quarter of each year. Property catastrophe reinsurance pricing is for 1 January renewals.

*Source:* OECD calculations based on (CIAB, 2009<sup>[21]</sup>), (CIAB, 2011<sup>[22]</sup>), (CIAB, 2017<sup>[23]</sup>), (CIAB, 2013<sup>[24]</sup>) and data for the Guy Carpenter US Rate-on-Line index (provided by Guy Carpenter).

## 2.6. The potential drivers of reinsurance use

### 2.6.1. Increasing the amount of business written

As noted above, one of the main functions of reinsurance is to allow cedants to write more business as a portion of the risk that they assume is transferred to reinsurers and therefore does not usually need to be covered by reserves or capital to the same extent that it would need to be covered if retained.<sup>6</sup> As an illustrative example, a primary insurer with sufficient capital to cover expected losses from policies generating USD 15 million in net written premiums would, without access to reinsurance, only have capacity to write USD 15 million in gross written premiums. However, by entering in a quota-share reinsurance arrangement (for example, 25% quota-share based on gross written premium), the primary insurer would have sufficient capital to cover expected losses from policies generating USD 20 million in gross written premiums (as 25% of the expected losses would be covered by the reinsurer). Therefore, for a given level of capital to cover losses, a primary insurers is able to provide 33% more capacity through the use of a 25% quota-share arrangement than without access to reinsurance (Federal Insurance Office, 2014<sup>[1]</sup>).

Across high-income OECD countries, there is a positive correlation between the property insurance cession ratio and the ratio of gross written property premiums to an estimate of primary insurer shareholder equity allocated to property business.<sup>7</sup> This suggests that, to some extent<sup>8</sup>, cedants use reinsurance to increase their capacity to write more business (i.e. cedants in countries that make greater use of reinsurance (higher cession ratio) are writing more business for a given level of shareholder equity) (see Figure 2.9).

### 2.6.2. Managing catastrophe exposure

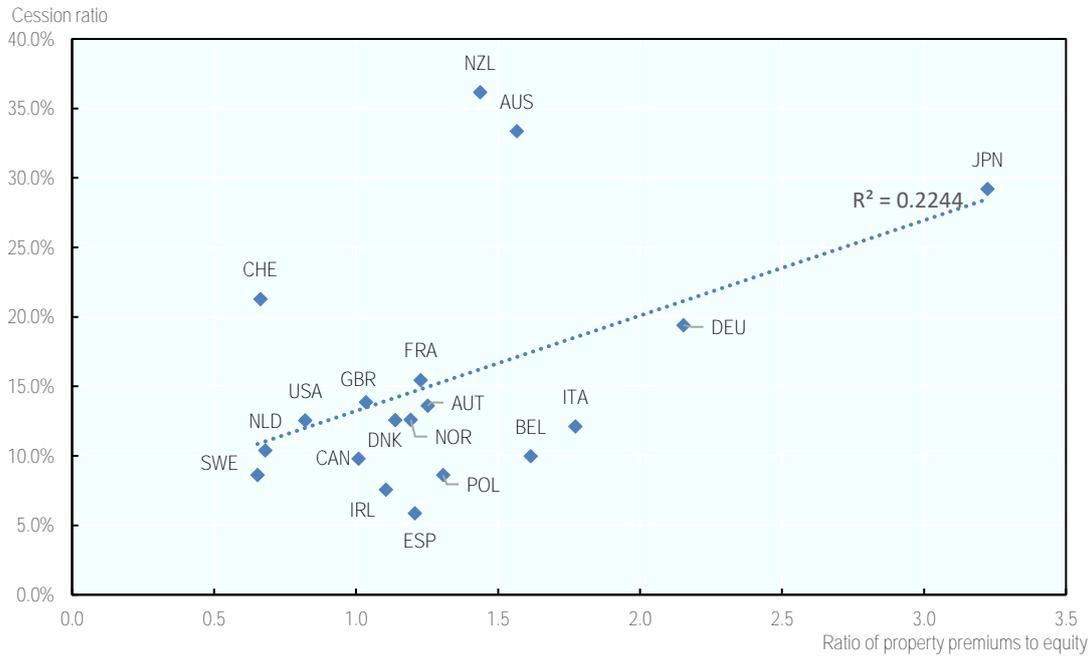
Another important function of reinsurance markets is to support the management of catastrophe risks. The comparative advantage of reinsurance markets in supporting coverage for these risks is based on the capacity of these markets to diversify risks across geographies, perils and lines of business which helps to reduce the amount of capital needed to cover potential losses. If the risks are concentrated with a large exposure to a single major event or to a series of events, then a large amount of capital needs to be kept aside to cover the high volatility in potential claims. However, if risks are diversified, then the probability that all the exposures will be affected by a loss at the same time is lower and so less capital overall is needed to cover the exposure (see Box 2.3).

<sup>6</sup> As outlined in section 4, regulators and supervisors do not always recognise the full level of risk transfer undertaken through reinsurance and sometimes require cedants to hold some capital to address risks related to that transfer (e.g. counterparty risk).

<sup>7</sup> The estimate of shareholder equity allocated to property business was calculated based on the share of property premiums in total non-life premiums and the amount of non-life shareholder equity reported for the OECD Global Insurance Statistics exercise. This calculation is imperfect as the amount of capital required for different lines of business will vary based on the level of risk and correlation in each business line.

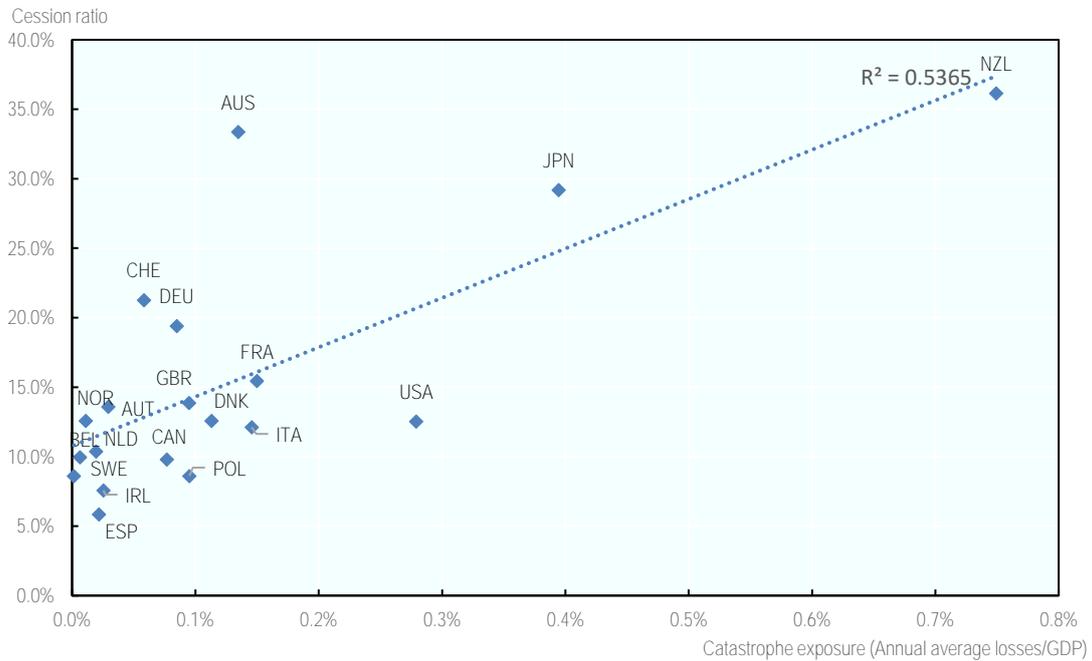
<sup>8</sup> There are a number of other reasons why primary insurers may write more or less premium for a given level of equity across countries, including differences in regulatory capital requirements. However, primary insurance companies also respond to the requirements imposed by rating agencies, which do not vary significantly across countries (i.e. potentially counteracting the impact of differences in regulatory capital requirement).

**Figure 2.9. The use of reinsurance for underwriting more business**



Source: OECD calculations based on (OECD, 2017<sub>[15]</sub>), (Swiss Re, 2018<sub>[2]</sub>), and data provided by reinsurance companies.

**Figure 2.10. The use of reinsurance for managing catastrophe exposure**



Note: The data on average annual economic losses is calculated based on (Swiss Re, 2018<sub>[20]</sub>) data for all natural catastrophes between 1990 and 2017, inflated to 2017 USD. It is presented as the annual economic loss as a share of 2017 GDP (from (IMF, 2017<sub>[25]</sub>)).

Source: OECD calculations based on (IMF, 2017<sub>[25]</sub>), (Swiss Re, 2018<sub>[20]</sub>) (OECD, 2017<sub>[15]</sub>) and data provided by reinsurance companies.

There is a positive correlation between the level of natural catastrophe exposure (measured as annual average economic losses resulting from natural catastrophes since 1990 as a share of GDP) and the use of property reinsurance by cedants across high-income OECD countries (see Figure 2.10). Cedants in some countries with relatively high-levels of exposure to natural catastrophes, such as Japan and New Zealand, tend to transfer more of their risk to reinsurance markets than cedants with more limited exposure to natural catastrophe risk (such as those operating in Sweden, Belgium and Norway). In New Zealand, approximately 63% of reinsurance arrangements in 2016 were non-proportional reinsurance arrangements relative to 28% of reinsurance arrangements overall among the countries covered, suggesting that coverage for catastrophic events is a key driver of reinsurance purchase in New Zealand.

### *2.6.3. Capturing the benefits of diversification*

Access to reinsurance could also facilitate the entry of cedants into new business lines. For example, a proportional reinsurance arrangement could reduce the risk for a cedant when entering a new business line as a share of the expected losses would be covered by the reinsurer. If the reinsurer is already active in that line of business, the cedant could also benefit from the reinsurer's underwriting expertise and/or loss experience. In addition, as outlined in Box 2.3, a diversified portfolio of risks requires less capital to cover expected losses than a concentrated portfolio meaning the use of reinsurance would allow smaller cedants (or new entrants) to capture some of the benefits of diversification through the use of reinsurance. Without access to reinsurance, insurance markets could potentially become more concentrated as only larger companies would be able to capture the benefits of diversification and therefore could have an important competitive advantage over smaller companies.

There is a negative correlation (although limited) between the level of non-life market concentration (measured by the share of non-life gross written premium accounted for by the largest five insurers) and the property insurance cession ratio across high-income OECD countries for which data on market share is available (see Figure 2.12). This suggests that there may be a greater need for reinsurance in countries where smaller insurers play a larger role in the market as smaller insurers would be more likely to gain from the diversification benefits that can be achieved through risk transfer to reinsurance markets (or may have a greater need to transfer risk to reinsurance markets in order to be competitive with larger insurers that are able to realise the benefits of diversification without risk transfer).<sup>9</sup>

---

<sup>9</sup> The measure of market concentration used here is far from ideal. A better measure of the importance of smaller insurers in a given country would be the Herfindahl index (calculated as the sum of the square of the market shares of all insurance companies in the market). Another approach would be to examine the share of large global insurance groups in each market as such groups would likely be able to realise similar diversification benefits from across their operations as those derived in global reinsurance markets.

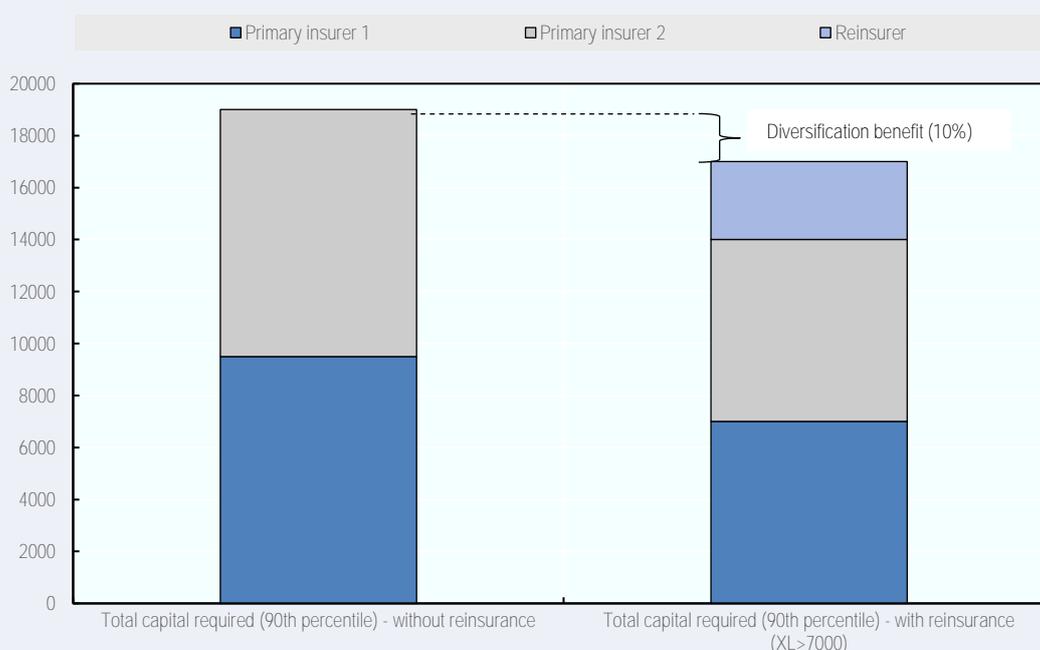
### Box 2.3. Diversification reduces capital needs: an illustration

The following simplified example provides a numerical illustration of the benefits of pooling a set of independent risks (through the use of reinsurance) in terms of reducing the overall level of capital required to manage that exposure (based on (Swiss Re, 2016<sup>[27]</sup>)):

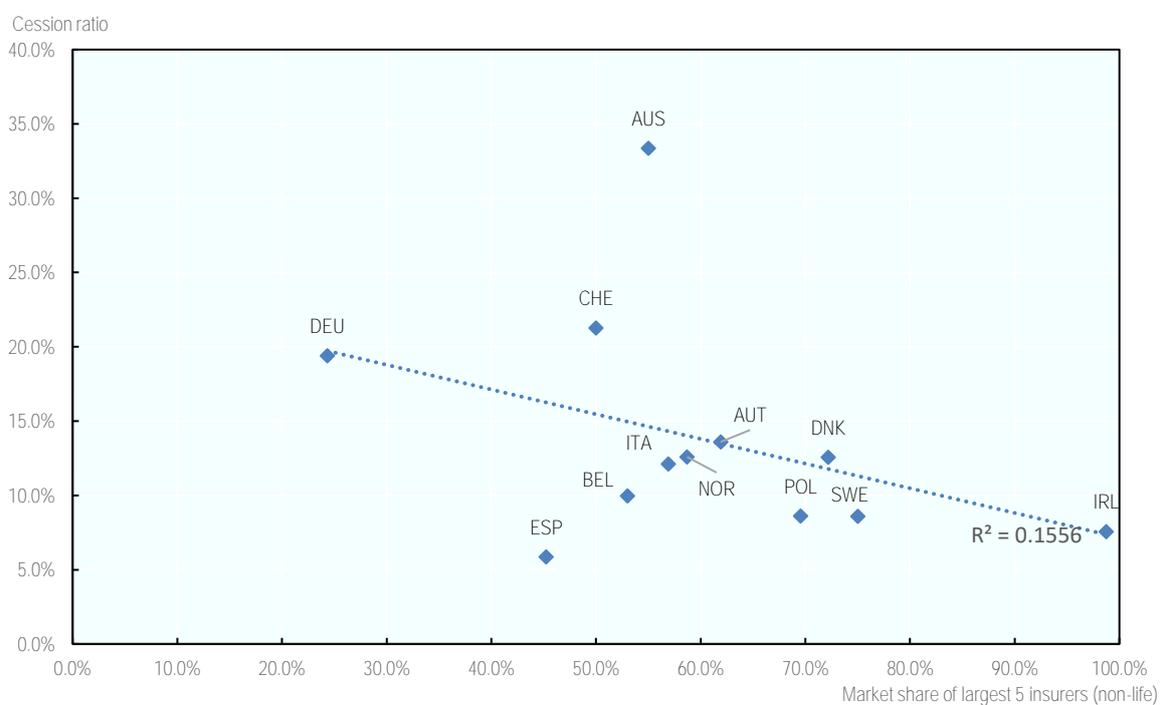
- In the first scenario (without reinsurance), there are two primary insurance companies that each write 10 separate insurance policies with a limit of 1 000 on each policy, claims of either 0 or 1 000 on each policy and an equal (and independent) probability of incurring a claim on each policy. Each primary insurer would need 9 500 in capital to cover 95% of all possible claims scenarios (where there are 11 scenarios ranging from no claims on any policy to 10 000 in losses based on a 1 000 claim on each policy).
- In the second scenario (with reinsurance), the two primary insurers (with the same written policies and potential loss distribution) enter into a reinsurance arrangement with the same reinsurer for losses exceeding 7 000 (i.e. a non-proportional Excess-of-Loss reinsurance contract). Each primary insurer would need to hold 7 000 in capital to cover 95% of all claims scenarios (a reduction of 2 500 for each primary insurer in recognition of the transferred risk). The reinsurer would need 3 000 in capital to cover 95% of all claims scenarios for the assumed risk (i.e. sufficient capital to cover 95% of all potential scenarios (or 115 of 121 potential scenarios)).

As a result of the pooling of these independent risks through reinsurance, the overall capital needed to cover the same underlying set of policies (at the same level of confidence) is reduced by 2 000 or just over 10% (see Figure 2.11).

**Figure 2.11. The benefits of pooling independent risks**



Source: OECD calculations based on (Swiss Re, 2016<sup>[27]</sup>)

**Figure 2.12. The use of reinsurance for risk diversification**

*Source:* OECD calculations based on (Swiss Re, 2018<sub>[20]</sub>), (OECD, 2017<sub>[15]</sub>) and data provided by reinsurance companies. The figure only includes countries for which information on market share is available through the OECD Global Insurance Statistics.



## Chapter 3. The contribution of reinsurance to reducing economic and insurance market disruption

This section will examine different contributions that property catastrophe reinsurance could potentially make to risk management, including:

- the contribution of reinsurance to reducing economic disruption in the aftermath of catastrophe events; and
- the contribution of reinsurance to reducing property insurance market disruption in the aftermath of catastrophe events.

### 3.1. The contribution of reinsurance to reducing economic disruption

Insurance markets can make an important contribution to risk management by reducing economic disruption in the aftermath of a disaster event. A number of analyses have examined whether an empirical relationship can be found between levels of insurance coverage and the severity of economic disruption. These analyses found (in general) that:

- The uninsured portion of catastrophe-related losses drive macroeconomic costs, whereas well insured catastrophes have insignificant or even positive effects on economic activity (Von Peter, Von Dahlen and Saxena, 2012<sup>[28]</sup>).
- Countries with high insurance penetration have smaller contractions in output from a disaster and their debt levels remain virtually unchanged. Countries with low insurance penetration but more developed financial markets also suffer smaller economic consequences in terms of output decline from disasters although debt levels usually increase (Melecky and Raddatz, 2011<sup>[29]</sup>).
- Severe disaster events (i.e. modelled 1-in-250 year events) can have important economic impacts and implications for public finances and sovereign ratings. Higher levels of insurance coverage of the assets damaged or destroyed by a natural catastrophe can, to some extent, mitigate the medium-term economic impact and the sovereign ratings impact of catastrophe events (Standard & Poor's, 2015<sup>[30]</sup>).

The contribution of primary insurance markets to reducing economic disruption is usually assumed to be due to: (i) the ability of those affected to more quickly recover after an event based on their access to a (relatively) quick source of funds for reconstruction - reducing the disruption to economic activity and also the financial stress on households and business that would otherwise need to absorb those losses; and (ii) the more limited impact on public finances in countries with high-levels of insurance coverage for damages and losses as governments will often provide financial assistance to affected households and businesses without sufficient insurance coverage. Reinsurance should also contribute to reducing the level of economic disruption in the aftermath of a disaster

event to the extent that reinsurance markets diversify the costs of disasters to global markets that are better able to absorb those costs (see Box 3.1).<sup>10</sup>

### Box 3.1. Risk spreading

Beyond the diversification benefits for individual companies (as described in Box 2.3), the use of international reinsurance markets allows for the spreading of risk across borders - ultimately reducing the amount of losses (once incurred) that would need to be absorbed domestically. In the event of a catastrophe, countries where cedants make use of international reinsurance markets will benefit from an external inflow of capital to pay reinsurance claims and support recovery and reconstruction. In the case of more extreme events, where assets need to be liquidated or capital needs to be raised in order to pay claims (or as a result of claims payments), the use of international reinsurance markets should also mitigate the potential impact of these actions on domestic financial markets. These factors should all contribute to reducing the aggregate impact of catastrophe events on the domestic economy.

Based on data provided to the IAIS (see Table 3.1), approximately 34% of premiums assumed by reinsurers (non-life and life) were ceded by insurers based outside the reinsurer's home region. Approximately 92% of reinsurance premiums ceded by insurers in Asia and Australasia were assumed by reinsurance companies based in other regions in 2016. For North America and Europe, the figures were 26% and 9%, respectively.

**Table 3.1. Risk transfer between regions (2016, USD million)**

Assumed by reinsurers in:	North America	Europe	Asia	Total
Ceded from insurers in:				
Africa, Near and Middle East	299.85	3 066.23	32.43	3 398.51
Asia and Australasia	5 575.88	19 474.25	2 164.04	27 214.17
Europe	3 439.41	45 496.33	818.91	49 754.65
Latin America	1 536.99	6 257.08	29.6	7 823.67
North America	99 323.37	35 171.83	629.14	135 124.34
Total Premium	110 175.50	109 465.72	3 674.12	223 315.34

*Note:* While the original source did not specify whether these figures include both affiliated and non-affiliated reinsurance, the total amount of assumed premium presented (USD 223 billion) is similar to the amount of unaffiliated life and non-life reinsurance premium assumed by the largest 50 reinsurers as reported by AM Best for the same year (USD 225 bn) (AM Best, 2017<sup>[9]</sup>).

*Source:* (IAIS, 2018<sup>[31]</sup>).

<sup>10</sup> Reinsurance might also contribute to the availability and/or affordability of primary insurance coverage, particularly in countries with high-levels of catastrophe exposure – which would increase the share of losses covered by insurance and therefore also contribute to reducing economic disruption. However, the available data did not provide evidence of this relationship (for example, that higher levels of reinsurance use leads to higher levels of insurance penetration for catastrophe perils).

To examine the impact of reinsurance coverage on reducing the economic disruption in the aftermath of catastrophic events, the reinsurance companies contributing to this study provided data on the claims they paid in relation to a set of 51 major natural catastrophes that occurred between 2010 and 2016 (on an ultimate loss basis, i.e. including all expected claims even if not yet paid out). The submissions provided for a relatively complete set of data for 36 distinct events.<sup>11</sup> Events that occurred in the same country and year were combined (given that the economic data was only available on an annual basis), resulting in a set of 26 events or series of events, coded as follows in the following charts (with the year for which economic impacts are analysed noted in brackets and based on whether the event occurred early or late in the calendar year):

- AUS-10 (2011) refers to the Queensland floods and tropical cyclones Yasi and Tasha, beginning in 2010;
- CAN-13 (2013) refers to the Alberta floods;
- CAN-16 (2016) refers to the Fort McMurray wildfire;
- CHL-10 (2010) refers to the 27F earthquake;
- CHN-13 (2013) refers to Typhoon Fitow;
- DNK-11 (2011) refers to the Copenhagen cloudburst;
- FRA-10 (2010) refers to winter storm Xynthia;
- DEU-13 (2013) refers to windstorm Christian and the May/June floods;
- DEU-15 (2015) refers to winter storm Niklas;
- IND-15 (2016) refers to the Chennai floods;
- ITA-12 (2012) refers to the Emilia earthquakes;
- JPN-11 (2011) refers to the Great East Japan earthquake and Typhoon Roke;
- JPN-15 (2015) refers to Typhoon Goni;
- JPN-16 (2016) refers to the Kumamoto earthquakes;
- MEX-14 (2014) refers to Hurricane Odile;
- NZL-10 (2011) refers to the Canterbury earthquakes in 2010 and 2011;
- NZL-16 (2017) refers to the Kaikoura earthquake;
- PHL-13 (2014) refers to Typhoon Haiyan;
- POL-10 (2010) refers to the Central European floods;
- THA-11 (2011) refers to the Thai floods;
- GBR-15 (2016) refers to flooding due to Eva, Frank and Desmond storms;
- USA-11 (2011) refers to the Tuscaloosa-Birmingham tornadoes;
- USA-12 (2012) refers to Hurricane Sandy;

<sup>11</sup> In some cases, the claims data provided by one or more reinsurers was incomplete or imprecise and was therefore estimated based on data on the market share of that reinsurer in the given country.

- USA-13 (2013) refers to the Moore tornadoes;
- USA-15 (2015) refers to flooding around the city of Houston;
- USA-16 (2016) refers to Hurricane Matthew and the Louisiana floods.

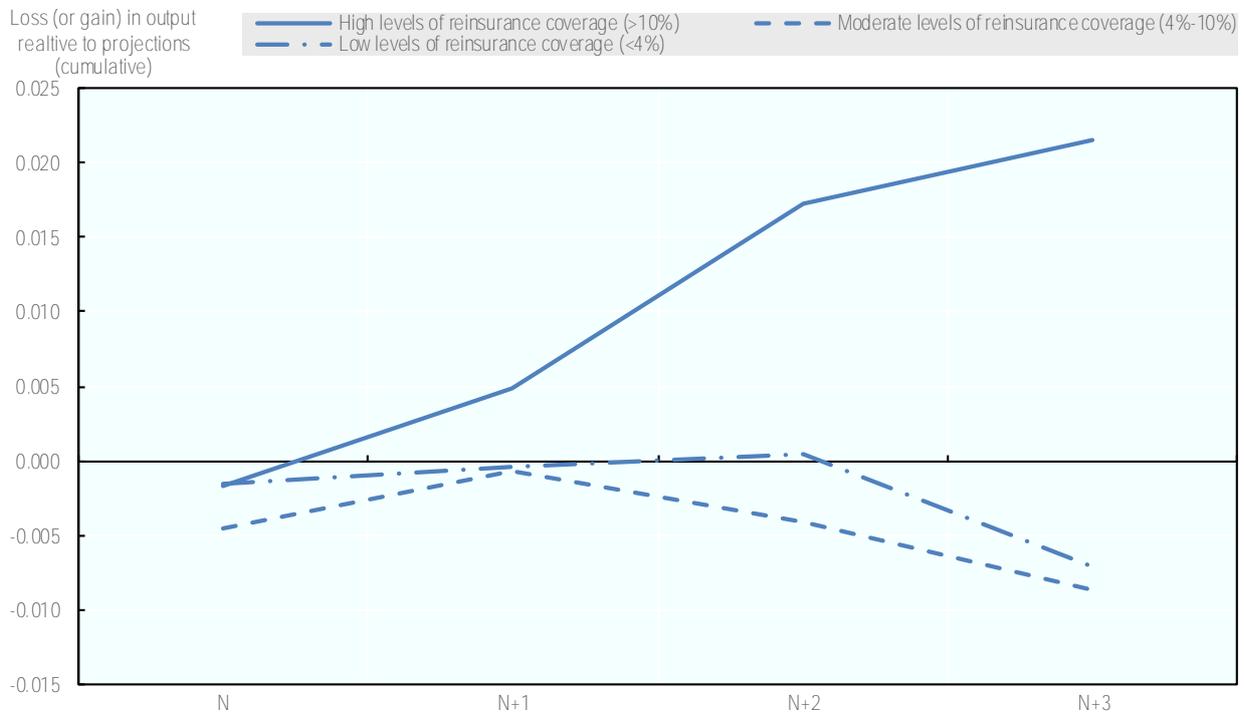
To estimate the economic disruption that could potentially be attributable to the natural catastrophe event, an estimate of lost output (GDP) was calculated based on projections of GDP growth made immediately prior to the event and actual growth rates measured after the event, taken from past releases of the IMF World Economic Outlook database. The projections were adjusted to account for broader errors in projection by adjusting the estimates to take into account actual performance across different country groups.<sup>12</sup> This methodology corresponds relatively well (although far from perfectly) across the sample of events with what would be expected based on differences in the severity of the events in the sample (measured as economic losses as a share of GDP). The relationship between lost output (relative to adjusted projections) and the severity of the catastrophe event is stronger when events that benefitted from higher levels of reinsurance coverage (i.e. where the share of economic losses covered by reinsurance exceeded 10% (based on the data provided by reinsurance companies only)) are excluded - suggesting that high levels of reinsurance coverage of losses may have played a role in mitigating the economic impact of some catastrophe events. The relationships between the estimate of lost output and the severity of the catastrophe events is included in Annex B.

Figure 3.1 shows the average cumulative loss (or gain) in output (relative to the adjusted projections) in the four years following the occurrence of the catastrophe event (with N being the year of first impact) across three categories of countries: (i) countries where a relatively high share (10% or more) of economic losses related to the specific event(s) were reinsured; (ii) countries where a moderate share (4% to 10%) of economic losses were reinsured; and (iii) countries where a low share (less than 4%) of economic losses were reinsured.<sup>13</sup> While there is little difference across the categories in terms of the average level of lost output in the first year of impact (-0.0016% of GDP in countries with high levels of reinsurance coverage, -0.046% in countries with moderate levels and -0.0015% in countries with low levels of reinsurance coverage), by the end of year four (N+3), countries with high levels of reinsurance coverage for the events that occurred had, on average, a GDP that was 2.15% higher than projected before the event while the other countries still faced a cumulative loss in output. Over time, the events that benefitted from higher levels of reinsurance coverage led to less economic disruption (and even an economic performance that was better than projected) – suggesting that the inflow of reinsurance payments supported a quicker recovery.

<sup>12</sup> Specifically, the country growth projection made immediately prior to the impact of the event was compared to the projections made for the country's "country grouping" then adjusted based on the actual experience of the country. For example, in October 2009, the IMF projected that France's GDP would grow by 0.903% in 2010, compared to 0.326% for the Euro area as a whole (i.e. a difference of +0.577%). In reality, the Euro area grew 2.082% in 2010 so the projection for France used in the analysis was 2.659% (i.e. 2.082% + 0.577%).

<sup>13</sup> It should be noted that the coverage shares were calculated based only on the data provided by reinsurance companies, capturing approximately 40% of the overall non-affiliated reinsurance market which means the actual share of economic losses covered by reinsurance was likely much higher.

**Figure 3.1. Cumulative loss (or gain) in GDP relative to pre-event projections for different levels of reinsurance coverage**



*Note:* The high levels of reinsurance coverage category includes CHL-10 (10.8% of economic losses reinsured), AUS-10 (12.2%); NZL-10 (34.9%), DNK-11 (28.4%), MEX-14 (14.6%); IND-15 (15.7); CAN-16 (21.5%); GBR-15 (13.0%); NZL-16 (25.7%). The moderate category includes: DEU-13 (4.7%), USA-16 (4.5%), USA-11 (8.1%), THA-11 (8.6%), USA-12 (6.5%), CAN-13 (7.1%), DEU-15 (5.7%). The low category includes: FRA-10 (1.8%), POL-10 (3.4%), JPN-11 (3.3%), ITA-12 (2.8%), USA-13 (3.8%), CHN-13 (1.3%), PHL-13 (1.4%), JPN-15 (1.5%), JPN-16 (1.7%).

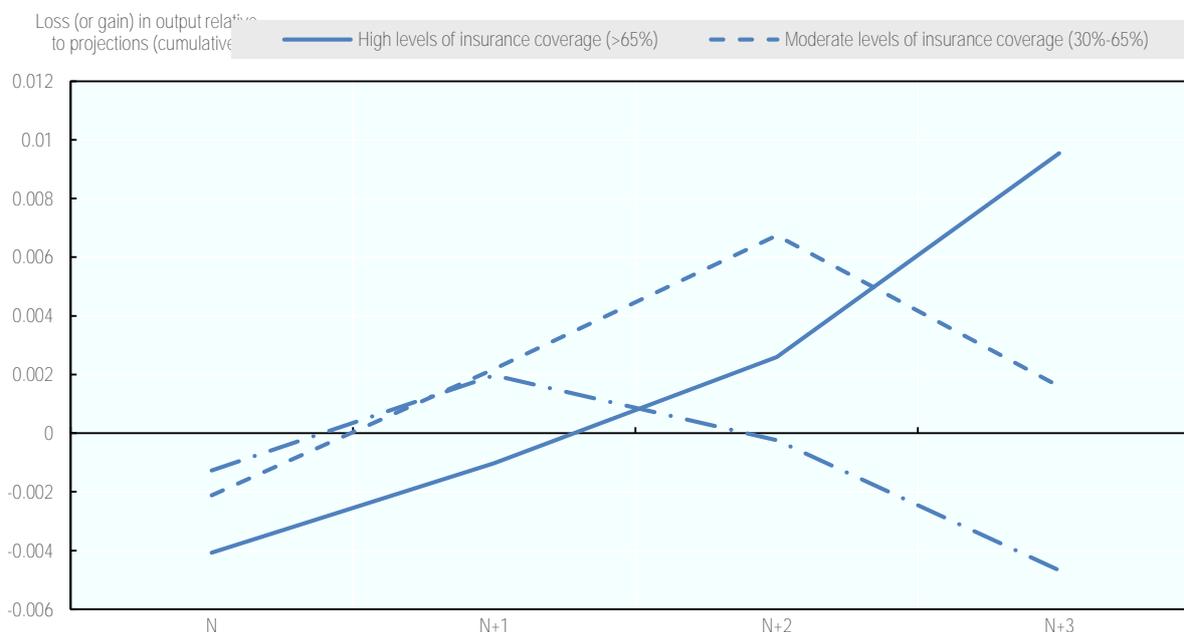
*Source:* OECD calculations based on (IMF, 2017<sup>[25]</sup>), (Swiss Re, 2018<sup>[20]</sup>) and data provided by reinsurance companies.

Interestingly, when the same exercise is undertaken based on the share of losses that were insured (rather than reinsured), the relationship is not as clear (see Figure 3.2) – suggesting that reinsurance might have an even larger role than primary insurance in mitigating economic disruption.

### 3.2. The contribution of reinsurance to reducing insurance market disruption

The use of reinsurance can also contribute to reducing disruption in the insurance market following catastrophic events. A large catastrophe event resulting in significant losses could have a number of consequences for primary insurers, including an increase in claims and combined ratios and, in the extreme, a depletion in capital. In response, primary insurers may increase the price for coverage with implications for the future availability and affordability of primary insurance. If a significant share of losses is covered by reinsurance, the impact on primary insurers would be expected to be lower.

**Figure 3.2. Cumulative loss (or gain) in GDP relative to pre-event projections for different levels of insurance coverage**

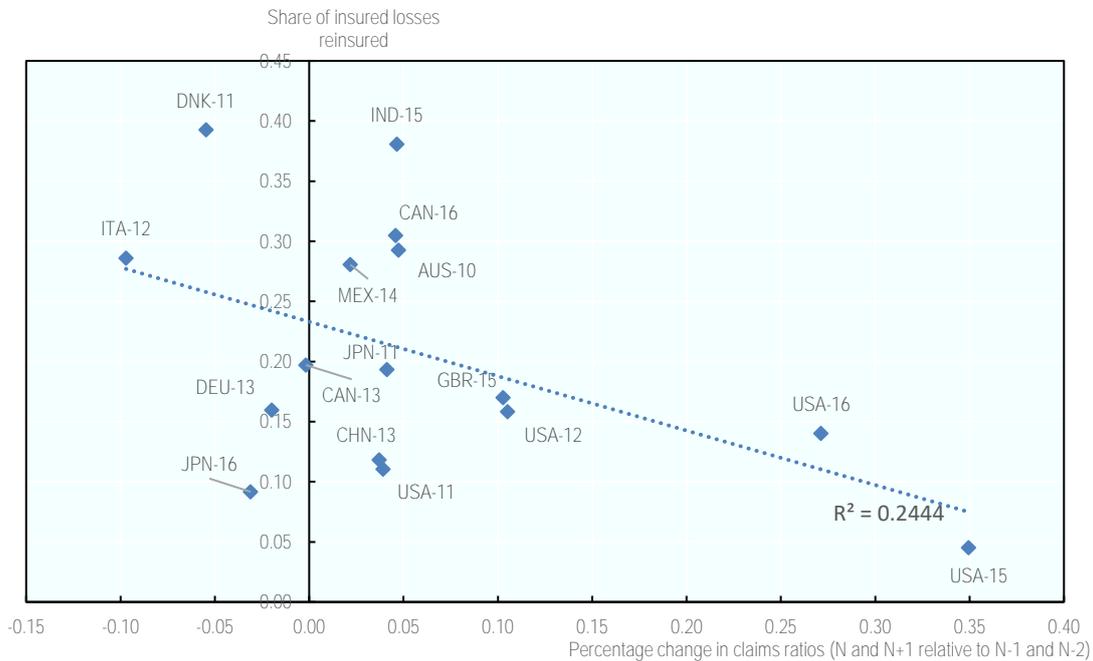


*Note:* The high levels of insurance coverage category includes DNK-11 (72.3% of economic losses insured), NZL-10 (79.8%), DEU-15 (71.4%), CAN-16 (70.4%), GBR-15 (76.4%), USA-11 (73.0%), FRA-10 (67.6%). The moderate category includes: NZL-16 (60.7%), USA-16 (32.4%), THA-11 (32.6%), USA-12 (41.2%), CAN-13 (35.9%), JPN-15 (61.7%), USA-15 (60.1%), IND-15 (41.2%), USA-13 (59.2%), MEX-14 (52.2%), AUS-10 (41.6%). The low category includes: POL-10 (10.8%), JPN-11 (17.3%), ITA-12 (9.9%), CHN-13 (11.0%), PHL-13 (4.9%), JPN-16 (18.1%); DEU-13 (29.6%), CHL-10 (26.7%).  
*Source:* OECD calculations based on (IMF, 2017<sub>[25]</sub>) and (Swiss Re, 2018<sub>[20]</sub>).

A clear relationship between non-life sector claims ratios (two years after the disaster relative to the prior two years) and the share of economic losses covered by reinsurance was not found for the full set of catastrophe events for which data is available. However, if the sample is reduced to exclude events with very low and very high levels of insured losses relative to gross written premiums (i.e. less than 1% or more than 40% of total gross written premium), a negative correlation appears to exist between the reinsured share of insured losses and increasing claims ratios (i.e. a higher share of insured losses that are reinsured reduces the deterioration (increase) in claims ratios) (see Figure 3.3).

Categorising the same (more limited) set of events based on the level of reinsurance coverage clearly demonstrates the impact of reinsurance in offsetting the claims ratio deterioration that would be expected in the aftermath of catastrophe events. On average, the eight events with a lower share of insured losses reinsured corresponded with increases in claims ratios of over 10.0 percentage points while the eight events with the largest share of insured losses covered by reinsurance corresponded with very limited changes in claims ratios (see Figure 3.4).

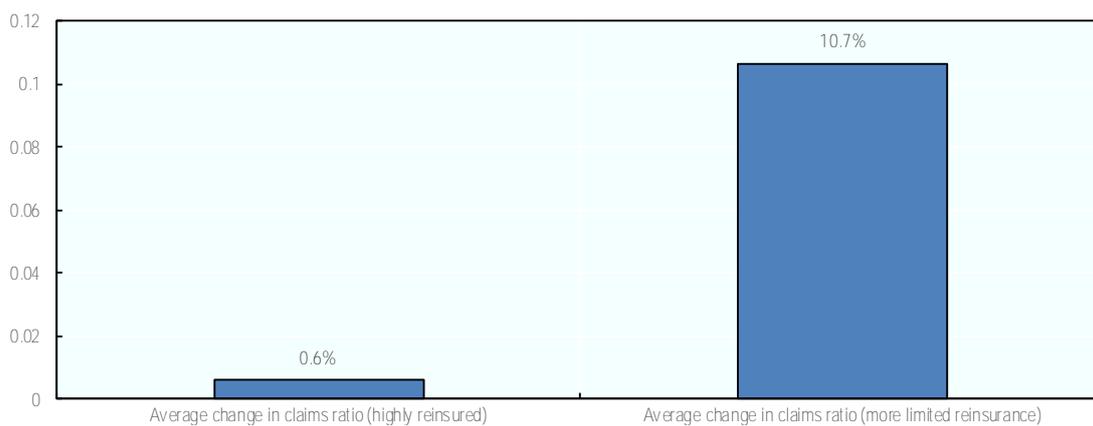
**Figure 3.3. The impact of reinsurance coverage on post-event claims ratios (non-life): Sub-set of events**



*Note:* This chart excludes the following events: JPN-15 (insured losses equivalent to 0.6% of GWP), DEU-15 (losses of 0.7% of GWP), PHL-13 (losses of 42% of GWP), CHL-10 (losses of 356% of GWP), THA-11 (losses of 368% of GWP) and NZL-10 (losses of 445% of GWP). Claims ratio data was not available for France and Poland. NZL-16 was excluded as a claims ratio for 2017 was not available. USA-13 was excluded as data on gross written premiums were not available for the Midwest region.

*Source:* OECD calculations based on (Swiss Re, 2018<sub>[20]</sub>) and data provided by AM Best and reinsurance companies.

**Figure 3.4. Claims ratio performance (non-life) in the aftermath of events with different levels of reinsurance coverage**

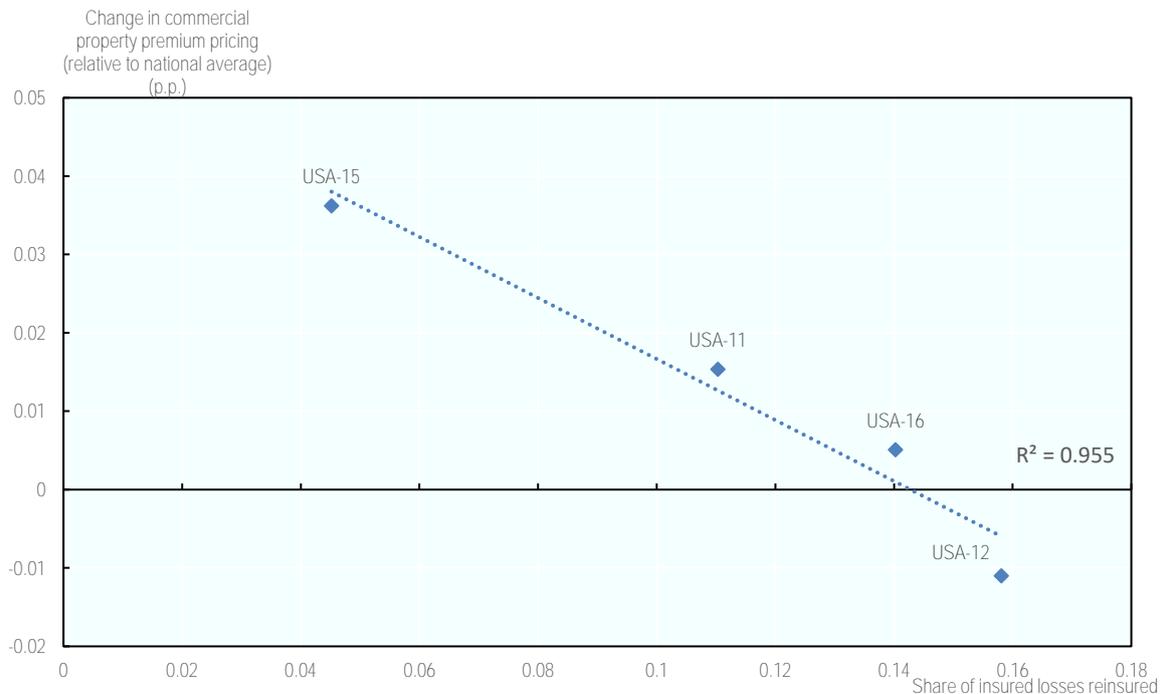


*Note:* Highly reinsured events include: JPN-11 (19.3% of insured losses reinsured), CAN-13 (19.7%), MEX-14 (28.1%), ITA-12 (28.6%), AUS-10 (29.3%), CAN-16 (30.5%), IND-15 (38.1%) and DNK-11 (39.3%). Events involving more limited reinsurance include: USA-15 (4.5%), JPN-16 (9.2%), USA-11 (11.0%), CHN-13 (11.8%), USA-16 (14.0%), USA-12 (15.8%) and DEU-13 (15.9%).

*Source:* OECD calculations based on (Swiss Re, 2018<sub>[20]</sub>) and data provided by AM Best and reinsurance companies.

Primary insurers facing a significant deterioration in underwriting performance (i.e. increasing claims ratio) can address that deterioration by tightening their underwriting standards (i.e. extending less coverage) or, to some extent, by increasing premium pricing. Therefore, the relative change in primary insurance pricing in the aftermath of a catastrophe event could provide an indicator of the extent to which reinsurance coverage has mitigated the level of insurance market disruption. Figure 3.5 shows the relationship between reinsurance coverage of insured losses and primary insurance pricing in the aftermath of four catastrophe events in the United States (for which granular data on commercial property pricing is available from the Council of Insurance Agents and Brokers).<sup>14</sup> While the data set is extremely small – the level of correlation is very high: higher levels of reinsurance coverage of insured losses corresponds with lower post-event price increases in the affected region.

**Figure 3.5. Reinsurance coverage and post-event primary insurance pricing in the United States**



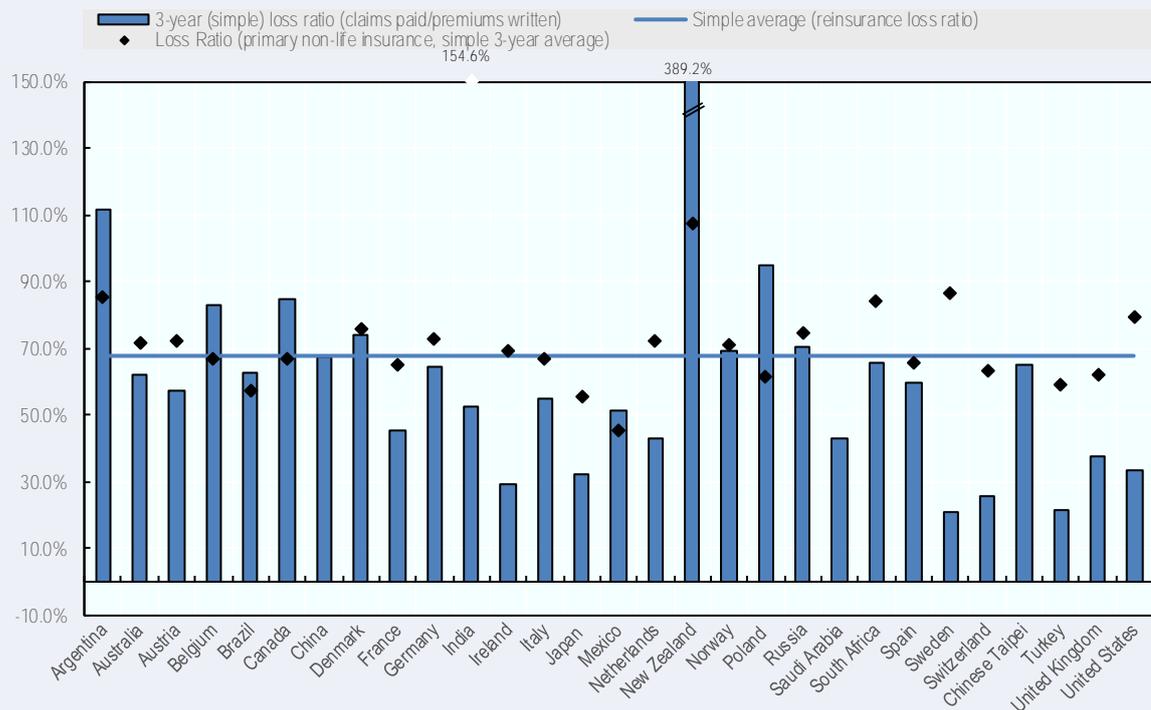
Source: OECD calculations based on (Swiss Re, 2018<sup>[20]</sup>), (CIAB, 2017<sup>[23]</sup>), (CIAB, 2016<sup>[32]</sup>) (CIAB, 2013<sup>[24]</sup>), (CIAB, 2012<sup>[33]</sup>) and data provided by AM Best and reinsurance companies.

<sup>14</sup> Unfortunately, sufficiently granular data on primary insurance pricing for more countries is not publicly available.

**Box 3.2. The cost of reinsurance**

The benefits of reinsurance purchase should ultimately be weighed against the cost of purchasing reinsurance. While a full cost-benefit analysis, taking into account the broader economic or financial stability benefits of reinsurance coverage, is outside the scope of this report, it is possible to calculate a simple loss ratio (ratio of reinsurance claims paid to reinsurance premiums written, excluding commissions and loss adjustment expenses) across the countries for which data was collected from reinsurance companies. In almost all of the countries (except Argentina and New Zealand), reinsurance companies collected more in premiums than they paid in claims. The reinsurance companies that provided data achieved a simple average loss ratio of 67.9% for property catastrophe reinsurance across the sample countries for 2014-2016. This compares to a simple average loss ratio of 73.5% (inclusive of loss adjustment expenses) for the primary non-life insurance sector across the same set of countries (where data is available), as reported to the OECD Insurance Statistics exercise. While the limited number of years included in this calculation limits the robustness of any conclusions, the large deficits in some countries offset by smaller surpluses in the others illustrates well the purpose of property catastrophe reinsurance in managing the low frequency, high severity events.

**Figure 3.6. Reinsurer loss ratios**



Source: (OECD, 2017<sup>[15]</sup>) and data provided by reinsurance companies.



## Chapter 4. Reinsurance regulation and its impact

### 4.1. Regulatory oversight of reinsurers and reinsurance transactions

Similar to primary insurers, reinsurers face a number of risks to their ability to meet obligations to their policyholders (cedants) including underwriting risk, asset risk and operational risk. Traditional reinsurance companies are regulated from a prudential perspective in jurisdictions where they have a legal presence and are normally required to comply with regulatory standards aimed at ensuring financial soundness such as licensing, financial reporting requirements and minimum capital requirements.<sup>15</sup>

A licensed (re)insurer is involved in most alternative reinsurance transactions and subject to (sometimes differing) prudential (insurance) regulation/supervision while the instruments used to fund or provide the coverage may be subject to securities or derivatives-related regulatory requirements, depending on the type of instrument (see Box 4.1).

In 2012, the International Association of Insurance Supervisors published their findings from an examination into the potential for reinsurance activities to create systemic risks to the broader financial system. The report found that traditional reinsurance activities (i.e. related to the transfer of traditional insurance risks<sup>16</sup> between cedants and reinsurers, including through the alternative reinsurance market), are unlikely to cause or amplify systemic risk (IAIS, 2012<sub>[34]</sub>).

---

<sup>15</sup> As reinsurance involves a transaction between insurance and reinsurance companies, reinsurance companies are not normally required to comply with consumer protection requirements such as policy form or rate regulation (where such forms of regulations are in place).

<sup>16</sup> The report indicates that there may be a potential for systemic risk to be generated by non-insurance activities involving risk transfer to reinsurance markets where examples of non-insurance activities include capital market business, the underwriting of collateralised debt obligations and/or credit default swaps, banking activities (including investment banking and hedge fund activities) and project finance solutions (IAIS, 2012<sub>[34]</sub>).

#### **Box 4.1. Regulatory requirements applied to alternative reinsurance coverage**

As noted above, most alternative reinsurance coverage (with the exception of ILWs) is provided by a special-purpose entity that is usually a licensed (re)insurance company. The special-purpose entity issues securities (equity, such as preferred shares or debt, such as catastrophe bonds) to capital markets investors to fully fund the reinsurance liabilities that it assumes.

As a result, some jurisdictions, have established a special licensing regime for (re)insurers solely involved in providing alternative reinsurance coverage. In Bermuda, for example, (re)insurers that: (i) carry on insurance business in the area of insurance-linked securitisations; (ii) have been established to enter into a single transaction or a single set of transactions; (iii) fully collateralise their obligations; and (iv) carryout transactions only with a limited number of sophisticated participants can be licensed as Special Purpose Insurers (Bermuda Monetary Authority,(n.d.)<sup>[35]</sup>). While subject to prudential requirements (e.g. prudent investment allocation, limits on capital distributions, etc.), the fully-funded nature of the coverage provided means that Special Purpose Insurers benefit from a minimum capital requirement of BMD 1 and no requirements for an actuarial opinion on loss reserve adequacy (as well as a low registration fee) (Conyers Dill & Pearman, 2016<sup>[36]</sup>). In 2017, there were 127 Special Purpose Insurers licensed in Bermuda (Bermuda Monetary Authority,(n.d.)<sup>[37]</sup>)

The securities issued by the special-purpose entity must comply with relevant securities regulatory requirements. Catastrophe bonds are regulated as securities and are normally issued pursuant to the US Securities Act Rule 144A (i.e. can be bought and traded only by qualified institutional buyers). There is also a market for private placement catastrophe bonds (offered under Section 4(a)(2) of the US Securities Act) which face more limited disclosure requirements.

ILWs offered as derivatives could be subjected to regulation. In the United States, ILWs that meet certain criteria (related to their use as insurance) are not considered to be swaps or security-based swaps for the purposes of regulatory requirements (Willkie Farr & Gallagher LLP, 2012<sup>[38]</sup>).

The transfer of risk from the cedant to the reinsurer can lead to risks to the cedant's ability to meet its obligations to its policyholders. The main types of risks that could materialise as a result of risk transfer to reinsurance markets include:

- **Counterparty (credit) risk:** As noted in the previous sections, from the perspective of cedants, reinsurance coverage backing primary insurer policy liabilities provides a substitute to holding reserves and capital to cover those obligations (although, as outlined below, recognition of reinsurance as a substitute for capital or reserves in calculating regulatory capital varies across jurisdictions). However, unlike reserves and capital, reinsurance is based on the promise of the reinsurer to pay claims in the future (relative to capital and reserves that are already in the possession of the cedant). As a result, the transfer of risk to reinsurance markets generally involves a degree of counterparty risk, i.e. the risk that the reinsurer will not be able to meet its future obligations to the cedant. In the case of alternative reinsurance coverage, funds are raised and placed in a special purpose entity for the full limit extended (net of premiums). These funds

are invested, which potentially leads to a risk that the collateral could be insufficient to payout the full limit under the bond at the time it is triggered (e.g. if there is a significant market disruption that leads to a reduction in the value of the invested funds (market risk) - although investments are usually limited to low risk assets).

- **Execution risk:**<sup>17</sup> The potential for reinsurance coverage to not respond as expected by the cedant creates execution risk. For example, there may be a mismatch between the terms and conditions of coverage provided by the reinsurer and the terms and conditions of coverage in the underlying policy which could potentially lead to a lower level of indemnification of cedant claims. In the case of alternative reinsurance coverage that is designed to trigger based on a non-indemnity trigger (e.g. parametric, modelled loss or industry loss), execution risk could materialise as a result of a mismatch between the payout and cedant's actual losses (i.e. basis risk).
- **Liquidity risk:** Cedants may be faced with liquidity risks in cases where payouts on reinsurance coverage are not made in advance of the cedant's payments to policyholders (which could be exacerbated if there are disagreements about the terms and conditions of the reinsurance arrangements).

Cedants can mitigate these risks through how they arrange their reinsurance programmes:

- Counterparty risk can be mitigated by: (i) securing reinsurance coverage from multiple reinsurance companies or by accessing multiple forms of reinsurance coverage (traditional and alternative reinsurance) in order to reduce the level of exposure to a single reinsurance provider (i.e. concentration risk); (ii) choosing to place reinsurance only (or mostly) with reinsurance companies that have a minimum level of financial strength; or (iii) requiring that some form of security be placed by the reinsurer to back the obligations assumed.<sup>18</sup>
- Execution risk can be mitigated by ensuring close alignment between the coverage provided to policyholders and the coverage secured through reinsurance arrangements. Some execution (basis) risk should be expected in the case of reinsurance arrangements providing non-indemnity coverage (e.g. coverage with a parametric or model-based trigger) although the relative simplicity of payout triggers should facilitate quicker payouts, reducing the potential for liquidity risk.
- Liquidity risk can be reduced by including allowances for advance payment or through collateralisation or deposit arrangements.

Consistent with Insurance Core Principle 13 (ICP 13 "Reinsurance and Other Forms of Risk Transfer"), regulators and supervisors oversee "reinsurance risk" by requiring cedants (including reinsurers in relation to their use of retrocession) to effectively manage their use of reinsurance and other forms of risk transfer (including the risks described above) and by integrating the reinsurance programme into the cedant's risk and capital

<sup>17</sup> For simplicity, this report considers contract execution risk and basis risk as forms of "execution risk" as all involve the risk that the reinsurance agreement will not perform as anticipated by the cedant. ICP 13 treats basis risks as distinct risks (not as a component of execution risk).

<sup>18</sup> The placement of a security by the reinsurer within the cedant's jurisdiction could also ensure that the funds are available for the benefit of domestic policyholders in the event of insolvency of the reinsurer.

management strategies (IAIS, 2017<sup>[39]</sup>). ICP 13 sets out the types of risks that could be generated as a result of risk transfer to traditional and alternative reinsurance markets and the controls that cedants should have in place to manage these risks.

Regulators and supervisors may also be concerned by the potential for risk transfer to reinsurance markets to be used as a form of regulatory arbitrage. For example, a foreign reinsurance company could potentially enter a market by making an arrangement with a licensed cedant to assume all (or virtually all) of the risks written by the cedant. While, as a writer of primary insurance, the cedant would still be responsible for all obligations entered into with the policyholders and subject to applicable business and market conduct requirements, there would be differences in terms of the level of access that the supervisor would have to the foreign reinsurance company ultimately holding the risk (relative to if the risk had been retained by the cedant).

Regulators and supervisors are monitoring the reinsurance programmes of cedants operating in their jurisdictions using a variety of indicators. The OECD report on *Analytical tools for the insurance market and macro-prudential surveillance* (Kwon and Wolfram, 2016<sup>[40]</sup>) found that the vast majority of countries that responded to an OECD questionnaire monitor indicators such as the premium cession ratio, the share of total claims paid by reinsurance as well as the overall reinsurance result (i.e. reinsurance expenses, including premiums ceded minus reinsurance recoveries, including claims paid). The vast majority of countries also monitor indicators related to counterparty risk resulting from reinsurance arrangements, including the level of reinsurance risk concentration and financial strength of reinsurers to whom significant risks have been transferred.<sup>19</sup>

Regulators or supervisors in many (if not most) jurisdictions have imposed additional measures or differing requirements (such as different levels of capital credit for risk transfer<sup>20</sup>) applicable to the transfer of risk to foreign reinsurance companies, usually in recognition of the reduced level of access to – and oversight of – reinsurers (and the assets backing reinsurance liabilities) without a local presence. These include:

- Measures that require or encourage the transfer of risk to reinsurers with some form of **local presence** or local recognition. For example, a number of jurisdictions require some form of registration to assume business from a domestic cedant (including specific criteria that must be met, usually related to financial strength) while others limit (or altogether prohibit) risk transfer to a reinsurer without a local presence. In some countries, reinsurers without a local presence may not be able to market their policies directly to local cedants.
- Measures that require or encourage the pledging of assets in the cedant jurisdiction (**local assets**). A number of countries require that collateral be

<sup>19</sup> Credit rating agencies will also consider the risks related to reinsurance dependence when assessing the financial soundness of primary reinsurers. Credit ratings agencies will normally consider whether capital is adequately protected from large loss exposures and whether the risk has been materially reduced by considering whether the reinsurance purchased by an insurer is appropriate for its unique risk profile, is available when needed, is not excessively costly and is provided by financially sound reinsurers.

<sup>20</sup> Most jurisdictions allow regulatory capital relief for risk transfer to reinsurance markets (which has implications for the attractiveness/cost-effectiveness of reinsurance as an alternative to holding higher levels of capital or reserves).

provided for transactions involving reinsurers without a local presence (or require that the transactions be collateralised in order to benefit from capital relief). In a few countries, branches of foreign reinsurers are not permitted meaning that foreign reinsurers wishing to assume risks in that jurisdiction would need to establish a (capitalised) subsidiary.

- Measures that require or encourage **local retention** or otherwise limit the amount of premiums ceded to foreign reinsurers (or foreign reinsurers without a local presence). Some jurisdictions provide different levels of capital credit for transactions involving reinsurers without a local presence. A number of jurisdictions, particularly in non-OECD emerging markets, have imposed local retention requirements and/or requirements that reinsurance business be initially offered to reinsurers with a local presence (or a publicly-owned domestic reinsurer (see Box 4.3)).

In addition, some jurisdictions have implemented measures that limit - or create disincentives to - the use of alternative reinsurance instruments, usually in recognition of the potential for risk transfer to the alternative reinsurance market to create execution risk (and specifically basis risk).<sup>21</sup> A few countries treat risk transfer to the alternative reinsurance market differently than risk transfer to the traditional reinsurance market, by taking into account the level of basis risk, requiring approval for capital credit for risk transfer that does not involve a licensed (re)insurance company or by not providing any capital relief at all.

Table 4.1 provides an overview of the types of regulatory and supervisory requirements that apply in the largest non-life insurance markets (i.e. the countries included within the scope of this report) focused on these four types of measures that could potentially impede or discourage cedants' use of international reinsurance markets.<sup>22</sup>

---

<sup>21</sup> Many jurisdictions have not implemented a specific approach to the treatment of risk transfer to the alternative reinsurance market.

<sup>22</sup> The table does not include measures that place ceilings on the level of insurance risk that can be ceded to reinsurance markets that are very high (e.g. a 90% limit on reinsurance cessions in Ireland). These types of limits could impede the use of fronting arrangements (where the vast majority of a cedant's premium is transferred directly to a reinsurer) - which may provide benefits (e.g. where the reinsurer has substantial underwriting or modelling expertise that is leveraged through the fronting arrangement) but can also entail significant risks (as the cedant may not have sufficient incentives to ensure quality underwriting) and be a form of regulatory arbitrage (a means for a reinsurer to take on significant risk in a jurisdiction without a primary insurance licence).

**Table 4.1. Regulatory and supervisory measures applied to risk transfer to reinsurers without a local presence and alternative reinsurance arrangements**

	Measures that require or encourage local presence	Measures that require or encourage the pledging of assets in the cedant jurisdiction ("local assets")	Measures that require or encourage local retention	Measures that limit or create disincentives to the use of alternative reinsurance instruments
Argentina	Reinsurers must be registered as admitted reinsurers subject to certain criteria (financial strength).	Minimum capital requirements that can vary based on the amount of written premium are applied for branches.	A maximum of 50% of risk can be reinsured with admitted reinsurers (increasing to 60% in July 2018 and 75% in July 2019). There is no limit for contracts with insured sums above USD 35 million (reduced from USD 50 million).	--
Australia	--	Branches of foreign reinsurers must maintain assets in Australia that exceed the total amount of their reinsurance liabilities in Australia by an amount that is greater than the relevant prudential capital requirement. Capital charges applied to reinsurance recoverables from non-authorised reinsurers are higher than for authorised reinsurers unless collateral is provided.	--	Cedant capital credit for risk transfer to alternative reinsurance markets must be approved by APRA and will be assessed based on the level of basis and liquidity risk, amongst other factors.
Austria	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Belgium	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Brazil	There is a registration requirement for occasional or admitted reinsurers subject to certain criteria (financial strength).	Admitted reinsurers face a minimum deposit requirement and an additional deposit requirement that varies depending on risk rating and business activities.	A local cession requirement (offer) for each reinsurance risk was repealed at the end of December 2017 (previously, the requirement had been set to decline to 15% by 2020). A minimum retention requirement of 50% was also recently repealed for a number of classes of	--

	Measures that require or encourage local presence	Measures that require or encourage the pledging of assets in the cedant jurisdiction ("local assets")	Measures that require or encourage local retention	Measures that limit or create disincentives to the use of alternative reinsurance instruments
Canada	--	Cedant capital credit for risk transfer is only available for transfers to "unregistered reinsurers" (i.e. reinsurers not supervised or authorised by OSFI) when the transaction is fully collateralised with assets available in Canada. Consideration is being given to increasing the level of collateral required.	--	Cedant capital credit is not available for reinsurance arrangements involving material, basis risk. In addition, reinsurance provided by special purpose entities is treated as unregistered reinsurance (where capital credit is only available if collateralised with assets available in Canada).
China	There is a registration requirement for reinsurers wishing to assume risk in China involving the submission of information related to financial strength, although this applies to both domestic and foreign reinsurers.	Cedants face a higher credit risk capital charge on non-collateralised transactions with foreign reinsurers. A proposal would require that foreign reinsurers hold admissible assets in China equivalent to 75% of admissible liabilities in China.	For property (and other classes), cedants cannot transfer more than 80% of sum insured on a proportional basis (20% on a facultative basis to an affiliated company).	--
Denmark	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
France	--	--	A public reinsurer (Caisse centrale de réassurance), backed by a state guarantee, is mandated to provide reinsurance coverage for up to 50% of a cedant's natural catastrophe risks (per policy).	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Germany	In certain cases, foreign reinsurance companies must establish a branch to assume business from reinsurers in Germany, except where the foreign reinsurer is based in an EU or EEA-jurisdiction, a jurisdiction where the solvency regime has been deemed equivalent or in the United States (as long as the conditions of the <i>Bilateral Agreement between the United States of America and the European Union on</i>	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).

	Measures that require or encourage local presence	Measures that require or encourage the pledging of assets in the cedant jurisdiction ("local assets")	Measures that require or encourage local retention	Measures that limit or create disincentives to the use of alternative reinsurance instruments
	<p><i>Prudential Measures regarding Insurance and Reinsurance</i> have been met). This requirement does not apply to reinsurance contracts completed by correspondence (i.e. instigated by the domestic cedant without the involvement of an intermediary). The vast majority (97%) of risk transfer to reinsurance markets involves reinsurers that have a local presence or meet one of the above criteria.</p>			
India	There are registration requirement for cross-border reinsurers	A foreign reinsurance company that wishes to conduct business through a branch in India must establish a Net Owned Fund of INR 50 billion.	5% of each non-life policy must be ceded to the state reinsurer, General Insurance Corporation (GIC). Limits are also placed on cession to a single reinsurer outside of India based on credit ratings (10% limit for reinsurers rated BBB or BBB+; 15% for BBB+ to A+; 20% for ratings above A+) although cedants may request regulatory approval to cede a greater share to reinsurers with a given credit rating. Draft regulations issued in January 2018 would establish an order of preference for placing reinsurance: (i) GIC or a domestic reinsurer with three years of credit ratings; (ii) foreign reinsurer branches and domestic reinsurers that do not meet the credit rating criteria; (iii) foreign reinsurers with offices in special economic zones; (iv) cross-border reinsurers and Indian primary insurers. Certain lines of business, including large infrastructure projects and climate change risks, would be exempted from this order of preference requirement.	Alternative risk transfer requires prior approval of the regulator.

	Measures that require or encourage local presence	Measures that require or encourage the pledging of assets in the cedant jurisdiction ("local assets")	Measures that require or encourage local retention	Measures that limit or create disincentives to the use of alternative reinsurance instruments
Ireland	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Italy		<p>Either the cedant or the reinsurer may be required to pledge assets locally equal to the obligations assumed in risk transfer arrangements involving a reinsurer based in a non-EU or EEA countries where the solvency regime has not been deemed equivalent (Solvency II).</p> <p>It is expected that cross-border transfer to US-based reinsurers that meet the conditions of the <i>Bilateral Agreement between the United States of America and the European Union on Prudential Measures regarding Insurance and Reinsurance</i> will be permitted</p>	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Japan	--	--	--	--
Mexico	There is a registration requirement for foreign reinsurers wishing to assume risk from cedants in Mexico, subject to certain criteria.	--	--	--
Netherlands	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
New Zealand	--	--	--	--
Norway	Reinsurers based in non-EU or EEA countries without a local presence (branch or subsidiary) can assume risks from a Norwegian cedant only when initially approached by that cedant.	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).

	Measures that require or encourage local presence	Measures that require or encourage the pledging of assets in the cedant jurisdiction ("local assets")	Measures that require or encourage local retention	Measures that limit or create disincentives to the use of alternative reinsurance instruments
Poland	Cedants cannot place cross-border reinsurance with reinsurers based in non-EU or EEA countries nor in countries where the solvency regime has not been deemed equivalent. It is expected that cross-border transfer to US-based reinsurers that meet the conditions of the <i>Bilateral Agreement between the United States of America and the European Union on Prudential Measures regarding Insurance and Reinsurance</i> will be permitted.	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Russia	--	Branches of foreign reinsurers are not permitted (although there is a commitment to repeal this prohibition by 2021).	Cedants must offer 10% of all reinsurance placements to the public reinsurer, the National Reinsurance Company.	--
Saudi Arabia	--	--	Cedants must retain at least 30% of insurance premium and reinsure at least 30% of total premium within Saudi Arabia.	--
South Africa	Foreign reinsurers are not permitted to solicit cross-border business in South Africa. A reform proposal suggests that cedants will receive lower capital credit for cross-border reinsurance transactions.	Non-approved reinsurers have been required to deposit reserves with cedants or establish a local guarantee in order for cedants to recognise risk transfer as a reduction in liabilities. A reform proposal recommends that collateral requirements be removed.	--	--
Spain	--	--	A public insurer, Consorcio de Compensación de Seguros, is mandated to cover all extraordinary risks to commercial and residential property. This risk is retained within the public insurer.	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Sweden	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
Switzerland	--	--	--	--

	Measures that require or encourage local presence	Measures that require or encourage the pledging of assets in the cedant jurisdiction ("local assets")	Measures that require or encourage local retention	Measures that limit or create disincentives to the use of alternative reinsurance instruments
Chinese Taipei	Reinsurers without a local presence (branch or subsidiary) cannot solicit reinsurance business from a cedant.	--	--	--
Turkey	--	--	--	--
United Kingdom	--	--	--	Cedant capital credit is only available if reinsurance arrangements do not involve material basis risk (Solvency II).
United States	--	Unlicensed and non-US reinsurers must post 100% collateral in order for cedants to benefit from capital relief related to the reinsurance transaction. Since 2011, many states have allowed for reduced collateral requirements for financially strong reinsurers that are licensed and domiciled in qualified jurisdictions (implemented in 34 states as of January 2018). In addition, the <i>Bilateral Agreement between the United States of America and the European Union on Prudential Measures</i> will remove remaining collateral requirement for EU reinsurers that meet the requirements of the agreement.	--	--

*Source:* (GRF, 2018<sup>[41]</sup>), (Echeverría, Andrés Amunátegui and Stullenberg, (n.d.)<sup>[42]</sup>), (Conlin, 2015<sup>[43]</sup>), (OSFI, 2015<sup>[44]</sup>), (Hu, 2016<sup>[45]</sup>), (Hirst, Bacon and Carazo Gormley, 2016<sup>[46]</sup>), (Assicurazioni Generali, (n.d.)<sup>[47]</sup>), (BaFin, 2016<sup>[48]</sup>), (Asia Insurance Review, 2018<sup>[49]</sup>), (PwC, 2018<sup>[50]</sup>), (Lloyd's, 2016<sup>[51]</sup>), (Lloyd's, 2013<sup>[52]</sup>), (Baek and Shin, 2016<sup>[53]</sup>), (Clyde & Co., 2017<sup>[54]</sup>), (Szegda, 2010<sup>[55]</sup>), (Zubarev, 2016<sup>[56]</sup>), (Clyde & Co, 2015<sup>[57]</sup>), (Government of Singapore, 2004<sup>[58]</sup>), (FSB, 2016<sup>[59]</sup>), (Le Marquer, Thaisomboon and Kleesuwan, 2015<sup>[60]</sup>), (Aon Benfield, 2017<sup>[61]</sup>), (EIOPA, 2015<sup>[62]</sup>), (IMF, 2017<sup>[63]</sup>), (IMF, 2014<sup>[64]</sup>), (IMF, 2012<sup>[65]</sup>), (IMF, 2018<sup>[66]</sup>), (IMF, 2017<sup>[67]</sup>), (IMF, 2015<sup>[68]</sup>), (IMF, 2017<sup>[69]</sup>), (IMF, 2015<sup>[70]</sup>), (European Commission, 2014<sup>[71]</sup>), (IMF, 2012<sup>[72]</sup>), (Camara de Diputados del H. Congreso de la Union, 2013<sup>[73]</sup>), (Stendahl and Smit, 2013<sup>[74]</sup>), (Scheuba, 2018<sup>[75]</sup>), (Walker et al., 2018<sup>[76]</sup>), (Lan Lan et al., 2018<sup>[77]</sup>), (Etzbach and Janning, 2018<sup>[78]</sup>), (Tuli and Jenkins, 2018<sup>[79]</sup>), (Daly, Maher and McClements, 2018<sup>[80]</sup>), (Giorgetti, 2018<sup>[81]</sup>), (Oshimo, 2018<sup>[82]</sup>), (Popova, 2018<sup>[83]</sup>), (Morscher and Rusterholz, 2018<sup>[84]</sup>), (Coskunso and Cavus, 2018<sup>[85]</sup>), (Hill and Ligere, 2018<sup>[86]</sup>), (Torchiana, Rosenberg and Leydier, 2018<sup>[87]</sup>), (Langeland and Meidell, 2014<sup>[88]</sup>), (Harty and Yeh, 2018<sup>[89]</sup>), (OSFI, 2018<sup>[90]</sup>), (APRA, 2013<sup>[91]</sup>), (Australian Government, 2014<sup>[92]</sup>), (Australian Government, 2017<sup>[93]</sup>).

## 4.2. Consistency of regulatory measures with international commitments

While there is limited guidance and jurisprudence on whether the specific measures outlined in Table 4.1 constitute appropriate prudential measures in the context of reinsurance arrangements, some preliminary observations can be made on the potential consistency of the regulatory and supervisory measures that have been imposed in many countries with the guidance provided in the Insurance Core Principles and with international trade and financial liberalisation commitments.

As noted above, ICP 13 on *Reinsurance and Other Forms of Risk Transfer* recognises the need for supervisors to ensure that cedants are properly managing risks related to their use of traditional and alternative reinsurance markets, including counterparty, execution and liquidity risks. The guidance under ICP 13 specifically recommends that supervisors take into account the credit risk posed by the reinsurer and the extent of any credit risk mitigation in place (such as pledged collateral). There is no specific requirement for regulators to grant capital credit for risks mitigated as a result of reinsurance coverage and ICP 17 (capital adequacy) recommends that determinations on granting capital credit should recognise the potential that the risk transfer arrangement might not be executed as envisioned, potentially as a result of a counterparty failure or execution risk.

The regulatory and supervisory measures outlined in Table 4.1 are, for the most part, measures that appear to be aimed at mitigating these risks in the jurisdictions that have implemented them. For example:

- Measures that require foreign (or all) reinsurers to register, provide information to the local regulator/supervisor and/or meet certain financial strength criteria (e.g. Argentina, Brazil, China, India and Mexico as well as Chile (Rozas and Morgan, 2018<sup>[94]</sup>) and Ecuador (GRF, 2018<sup>[41]</sup>)) are likely aimed at providing the regulator/supervisor with confidence about the capacity of those reinsurers to meet their obligations to local cedants.
- Restrictions on the ability of foreign (or non-EEA/EU) reinsurers without a local presence to solicit/initiate business (Germany, Norway, South Africa, Chinese Taipei as well as Korea (GRF, 2018<sup>[41]</sup>)) are also likely aimed at promoting supervisors' confidence in cedant's risk transfer arrangements as such measures would constrain the ability of reinsurers that are unknown to the supervisor to assume significant local risks. Poland appears to have an outright restriction on the transfer of risk to foreign (or non-EEA/EU) reinsurers without a local presence while the Philippines has a requirement that foreign reinsurers wishing to assume domestic risks be represented by a local agent (GRF, 2018<sup>[41]</sup>).
- Measures that require the pledging of assets locally, whether through capital/deposit requirements imposed on branches (Argentina, Australia, Brazil, India) or even a requirement to establish subsidiaries rather than branches (as in Russia as well as Indonesia) are likely aimed at ensuring that assets are available domestically for the benefit of cedants in the event of a reinsurer's insolvency (as it may be more difficult to exercise claims on the assets of a foreign company in a foreign jurisdiction).

The same applies to jurisdictions that have imposed requirements (or differential requirements) for collateral to be posted in order for cedants to receive capital credit (or a reduction in liabilities) for risk transfer to reinsurers (Australia, Canada, China, Italy, South Africa, United States and also the current case in Israel although with plans for reform (Levitan and Navon, 2018<sup>[95]</sup>)).

However, ICP13 states that the use of collateral or deposit accounts is “a commercial matter between the ceding insurer and reinsurer” (IAIS, 2017<sup>[39]</sup>), not necessarily an issue for which regulators and supervisors should establish specific requirements.

- Solvency frameworks that provide different levels of capital relief to alternative market instruments with the potential to create basis risks are likely aimed at ensuring that cedants have sufficient capital to mitigate the potentially higher level of execution and counterparty risk that these types of risk transfer arrangements could entail.

#### Box 4.2. Counterparty risk in reinsurance: the available evidence

Measures related to discouraging the transfer of risk to foreign reinsurance companies (or “unregistered” foreign reinsurance companies) or encouraging the pledging of local assets by foreign (or unregistered) reinsurance companies are often (but not always) aimed at mitigating the counterparty risk that cedants could face in the event that the reinsurance company is unable to meet its obligations to the cedant.

Many supervisors regularly ask cedants to assess the impact of reinsurance failures on their solvency, often as part of stress testing exercises. Assessments of the risk of reinsurance failure for cedants (based on scenario analysis) in the United States and the Netherlands, for example, have found a potential for reinsurance failures to create stress for cedants ( (Park and Xie, 2014<sup>[96]</sup>) and (van Lelyveld, Liedorp and Kampman, 2009<sup>[97]</sup>)).

Actual experience of the impact of reinsurer failures is limited as there has been relatively few reinsurance failures. According to some reports,<sup>23</sup> 29 reinsurers failed between 1980 and early 2011 globally. These were mostly smaller reinsurance companies that together accounted for approximately USD 1.8 billion or 0.43% of the premiums ceded in that 31-year period. Potentially reflecting the limited number of reinsurer failures, an assessment of actual non-life insurer impairments in the United States between 1969 and 2014 found that a reinsurance failure was the primary driver for only 3.0% of all non-life insurance company impairments and for only one impairment since 2000 (AM Best, 2015<sup>[98]</sup>) (see Table 4.2).

**Table 4.2. Causes of non-life insurer impairments in the United States: 1969-2014**

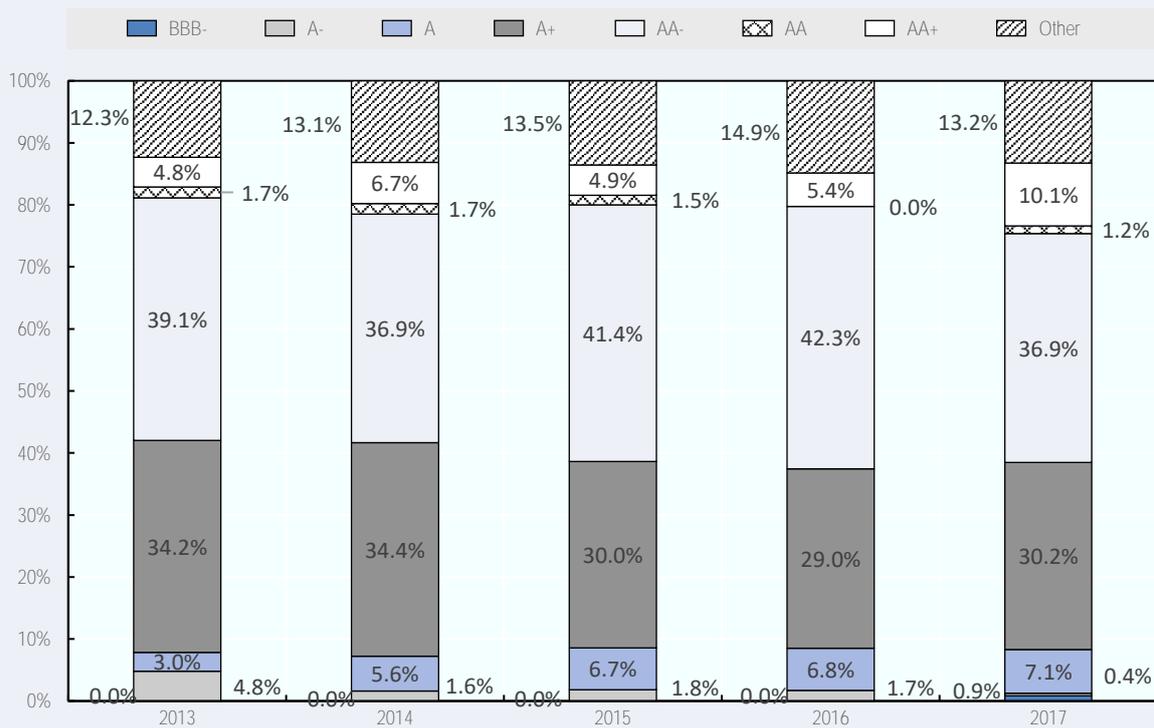
Cause	Share of impairments
Deficient loss reserves/inadequate pricing	44.7%
Rapid growth	12.1%
Affiliate problems	7.7%
Catastrophe losses	7.0%
Alleged fraud	7.0%
Investment problems/overstated assets	6.6%
Significant change in business	3.6%
Reinsurance failure	3.0%
Miscellaneous	8.3%

Source: (AM Best, 2015<sup>[98]</sup>)

<sup>23</sup> According to industry communication to the IAIS Reinsurance Transparency Group (RTG) in 2011.

The limited experience with major reinsurer failures is likely a reflection of the strong financial position of the largest reinsurance companies who are responsible for assuming the vast majority of risk transferred to reinsurance markets (which may itself reflect the requirements and standards imposed by supervisors and credit ratings agencies when assessing cedants risk transfer arrangements as well as the rational decisions of cedants themselves aiming to minimise credit risk). While credit ratings should not be relied upon as an alternative to sound supervision, the vast majority of reinsurance premium is ceded to companies that have maintained credit ratings at (or well-above) investment grade for the last five years (see Figure 4.1). Close to 80% of all reinsurance premium written by the largest global reinsurers was written by reinsurance companies with an S&P rating of A+ or higher with some signs of improving credit quality over time (e.g. the share written by reinsurance companies with ratings of AA- or higher has increased by approximately 3% since 2013). Most of the remaining non-life written reinsurance premiums was by companies with no (or only recent) ratings (including a number of public reinsurers) - none of the largest rated global reinsurers have been assigned a credit rating below investment-grade. By comparison, non-investment grade government and corporate bonds accounted for approximately 3.6% of all fixed income investments made by large North American insurance companies that responded to the OECD Large Insurer Survey in 2014 - and 5.5% of the fixed income investments of large European insurers (Gründl, Dong and Gal, 2016<sup>[99]</sup>).

**Figure 4.1. Gross Written Premium by reinsurer credit rating**



*Note:* The “other” category includes reinsurers that are not rated (e.g. GIC, IRB, Peak Re) as well as reinsurers that did not have a rating over the entire period (e.g. China Re, Markel, W.R. Berkley, Qatar Re).  
*Source:* OECD calculations based on (AM Best, 2014<sup>[7]</sup>), (AM Best, 2017<sup>[9]</sup>), (AM Best, 2016<sup>[11]</sup>), (AM Best, 2015<sup>[12]</sup>), (Standard & Poor's Ratings Service, 2018<sup>[100]</sup>), (Standard & Poor's Ratings Service, 2017<sup>[101]</sup>), (Standard & Poor's, 2016<sup>[102]</sup>), (S&P, 2015<sup>[103]</sup>), (Standard & Poor's Ratings Service, 2014<sup>[104]</sup>).

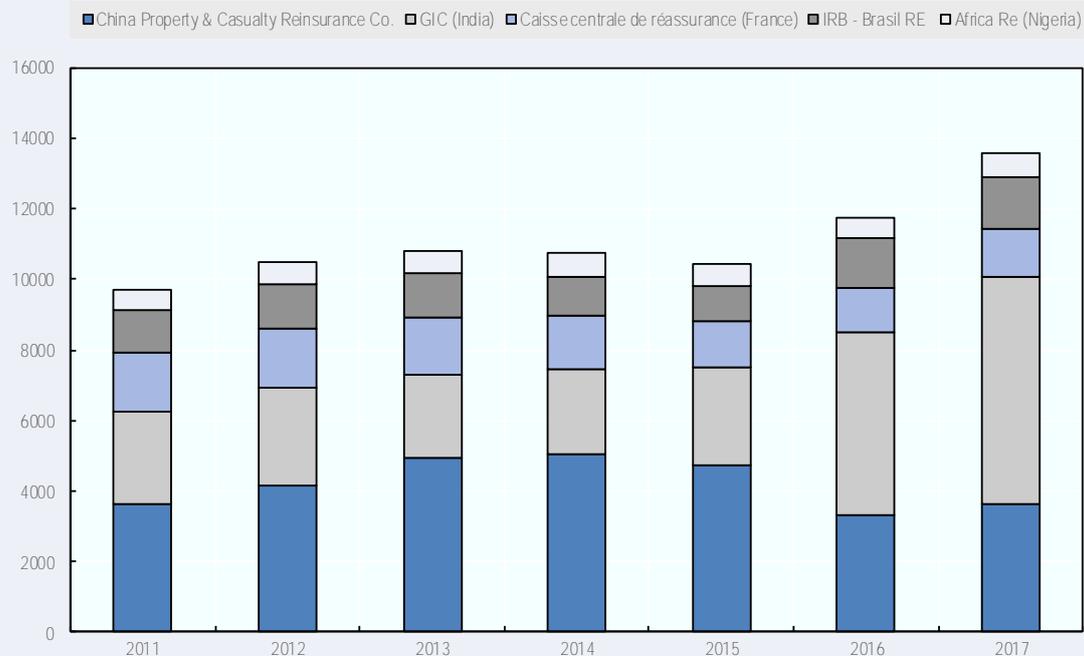
Measures that encourage local retention are less common. In China, there is a minimum retention requirement of 20% for property insurance premiums ceded on a proportional basis (other countries, including Ireland and Viet Nam (GRF, 2018<sup>[41]</sup>), have minimum retention requirements of 10%). These types of requirements would normally be imposed to discourage or prohibit fronting arrangements, particularly if the minimum retention level established is very low. Argentina, Brazil, India, Russia and Saudi Arabia have (or had) domestic preferences in recent years which required that a certain amount of risk be ceded to domestic reinsurers (or a public reinsurer – see Box 4.3). Indonesia also has a system of domestic preferences (GRF, 2018<sup>[41]</sup>). In Brazil, the system of local preferences was repealed in December 2017. In Argentina, a recent reform will allow for the share of premiums that can be ceded to foreign reinsurers to increase over time.

#### Box 4.3. Public reinsurers

While many countries have, in recent years, privatised reinsurers that were initially established as publicly-owned companies, publicly-owned reinsurers continue to operate in a number of countries (and in some cases, receive preferential access to cessions of domestic risk). In some cases, these reinsurers operate both domestically and internationally and some have become significant providers of reinsurance coverage.

Figure 4.2 provides an overview of gross non-life reinsurance premiums written by some of the larger public reinsurers which, combined, accounted for just under 8% of non-affiliated gross non-life reinsurance premium written in 2017 by the largest 50 reinsurers. All of these public reinsurers are among the 50 largest non-life reinsurers while China Re and GIC (India) rank among the top 20. GIC, IRB (Brazil), and Africa Re have seen an increase in gross non-life reinsurance premium written in recent years.

**Figure 4.2. Gross written non-life reinsurance premium written by selected public reinsurers**



Source: OECD calculations, based on (AM Best, 2014<sup>[7]</sup>), (AM Best, 2013<sup>[8]</sup>), (AM Best, 2017<sup>[9]</sup>), (AM Best, 2012<sup>[10]</sup>), (AM Best, 2016<sup>[11]</sup>), (AM Best, 2015<sup>[12]</sup>), (A.M. Best, 2018<sup>[13]</sup>).

ICP 13 recommends that regulators and supervisors should take into account the benefits of reinsurance in terms of geographical diversification of exposure, both for individual cedants and for insurance markets (and economies) more generally - and the concentration risks that could materialise as a result of placing impediments on risk transfer to international reinsurance markets. The introductory guidance for the Principle states that:

- "Geographical diversification of risk, which typically involves risk transfer across jurisdictional borders, is a key element of ceding insurer's and reinsurer's capital and risk management;"
- "By ceding insurance risk across borders, ceding insurers in the jurisdiction, and the jurisdiction as a whole, can benefit from a reduced concentration of insurance risk exposures at the ceding insurer and jurisdiction level respectively. This may also contribute to the financial stability of the jurisdiction;" and
- Referring to constraints to cross-border risk transfer: "the supervisor should be aware of and take into account the potential impacts of such limitations on individual ceding insurers and reinsurers as well as on the soundness and efficiency of the insurance market."

ICP 13 also encourages supervisors, when overseeing the cross-border reinsurance arrangements of cedants, to take into account the supervision performed in the jurisdiction of the reinsurer. ICP 3 on *Information Exchange and Confidentiality Requirements* provides guidance on how supervisors can exchange information with other jurisdictions and specifically encourages supervisors to respond promptly to information requests from other jurisdictions. The IAIS Multilateral Memorandum of Understanding (MMoU) has been established to provide a framework for cooperation and information exchange between supervisors (including an assessment process to ensure appropriate safeguards are in place for the handling of confidential supervisory information). By adhering to the MMoU, signatories (which include all of the major reinsurance hubs and many (but not all) of the jurisdictions included in Table 4.1<sup>24</sup>) indicate their intention to cooperate in terms of exchanging information with other supervisors (IAIS,(n.d.)<sub>[105]</sub>).

These elements of ICP 13 (concentration risk and the need for supervisory recognition) are reflected in reform recommendations in recent Financial Sector Assessment Program exercises in a number of countries:

- In its 2014 assessment of Canada, the IMF suggested that the insurance supervisor undertake a more systematic evaluation of the supervisory arrangements for foreign reinsurers in the context of establishing allowances for capital credit for risk transfer to unregistered reinsurers (while recognising that collateral enhances the security of those reinsurance arrangements) (IMF, 2014<sub>[64]</sub>);
- In its 2018 assessment of China, the IMF suggested that the insurance supervisor should review the solvency requirements on credit risk for offshore reinsurers (IMF, 2017<sub>[63]</sub>);
- In its 2013 assessment of Argentina, the IMF suggested that 2012 regulations limiting the ability of Argentine cedants to transfer risk to foreign reinsurers

<sup>24</sup> At the time of writing, among the largest property and casualty insurance markets, Argentina, China, Korea, Saudi Arabia and Spain were not listed as signatories to the MMoU (IAIS,(n.d.)<sub>[122]</sub>).

(since amended) would reduce risk diversification and product innovation (IMF, 2013<sup>[106]</sup>);

- In its 2012 assessment of Brazil, the IMF suggested that mandatory cession rules (since repealed) should be replaced by a risk-based approach that takes into account the credit risk of specific foreign reinsurers and applies an appropriate capital charge based on that risk assessment (IMF, 2012<sup>[65]</sup>);
- In its 2018 assessment of India, the IMF suggested that the system of domestic preferences be removed, particularly in the case of foreign reinsurers with licensed branches in India (IMF, 2018<sup>[66]</sup>)

Table 4.3 provides some observations on differences in the use of international reinsurance markets (based on the data provided by the reinsurers) across countries for four types of regulatory measures: (i) restrictions on solicitation by reinsurers without a local presence; (ii) collateral or other local asset requirements; (iii) restrictions on the use of cross-border reinsurance; and (iv) retention limits and/or domestic preferences. While the sample is small, some observations can be made:

- Restrictions on solicitation do not seem to have a significant impact on the use of international reinsurance markets. In Germany and Chinese Taipei, cedants, on average, make greater use of international reinsurers than cedants in other countries while all three countries (including Norway) make greater use of international property catastrophe reinsurance than other countries with similar levels of catastrophe exposure.
- Collateral or other local asset requirements appear to result in lower levels of international reinsurance market use. Cedants in Canada, Italy, South Africa and the United States make more limited use of risk transfer to international reinsurers generally and also relative to other countries with similar levels of catastrophe exposure.
- Restrictions on the use of cross-border reinsurance in Poland may have led to reduced levels of risk transfer to international reinsurers, including relative to other countries with similar levels of catastrophe exposure.
- Retention limits and local preferences have a mixed impact on the level of reinsurance use. In Argentina, Brazil and Russia, cedants make more limited use of international reinsurance markets than other non-OECD and/or middle income countries. Cedants in Brazil and Russia also make more limited use of risk transfer to international property catastrophe reinsurers than cedants in countries with similar levels of catastrophe exposure.

**Table 4.3. Observations on the impact of regulatory measures on reinsurance use**

		Estimated cession ratio relative to sample average	Premiums/Equity ratio relative to sample average	Cession ratio relative to sample (adjusted for catastrophe exposure)	Market concentration relative to sample average
Restrictions on solicitation	Germany	Above average (125%)	Above average (163%)	Above average (141%)	Below average (40%)
	Norway	Below average (82%)	Below average (90%)	Above average (113%)	Average (98%)
	Chinese Taipei	Above average (153%)*	--	Above average (296%)	--
Collateral or other local asset requirements	Australia	Above average (216%)	Above average (119%)	Above average (215%)	Average (92%)
	Canada	Below average (64%)	Below average (77%)	Below average (73%)	--
	Italy	Below average (77%)	Above average (134%)	Below average (76%)	Average (95%)
	South Africa	Below average (18%)*	Above average (153%)	Below average (46%)	--
	United States	Below average (81%)	Below average (62%)	Below average (61%)	--
Restrictions on cross-border reinsurance	Poland	Below average (56%)	Average (99%)	Below average (61%)	Above average (116%)
Retention limits and/or domestic preferences	Argentina	Below average (38%)*	Above average (265%)	Average (100%)	--
	Brazil	Below average (25%)*	Above average (176%)	Below average (71%)	--
	China	Average (97%)*	--	Above average (180%)	--
	India	Above average (196%)*	Above average (149%)	Above average (420%)	--
	Russia	Below average (18%)*	Above average (280%)	Below average (49%)	--
	Saudi Arabia	Above average (204%)*	--	Above average (618%)	--

*Note:* Unless marked by an asterisk (\*), all estimates are compared to the average across high-income OECD countries (estimates with an asterisk are compared to the non-OECD and middle income country average). The numbers in brackets are calculated as (i) the estimated cession ratio divided by the relevant sample average (%); (ii) the premium to equity ratio divided by the relevant sample average (%); (iii) the estimated cession ratio divided by the cession ratio calculated based on the trendline in Figure 2.10; and (iv) the market share of the top 5 non-life insurers divided by the relevant sample average.  
*Source:* OECD calculations based on (IMF, 2017<sub>[25]</sub>), (Swiss Re, 2018<sub>[20]</sub>), (OECD, 2017<sub>[15]</sub>) and data provided by reinsurance companies.

Countries have made international financial services liberalisation commitments related to how risk transfer to international reinsurers and international reinsurance markets is treated. The *OECD Code of Liberalisation of Current Invisible Operations* (the Code) is a legal instrument, adopted by the OECD Council, which establishes a framework for the elimination of restrictions on (or liberalisation of) cross-border invisible transactions (i.e. services transactions), including reinsurance and retrocession. Adherents to the Code (i.e. OECD member countries and non-members who undergo an adherence process) have agreed to comply with its provisions, including an obligation to liberalise cross-border invisible transactions, and not discriminate against non-resident providers, subject to any reservations lodged.

In the context of the Code, restrictions refer to any "law, decree, regulation, policy and practice taken by the authorities which may restrict the conclusion or execution of operations covered" by the Code, including measures that "have effects equivalent to a restriction" (in the context of capital movements, this would include deposit requirements

(OECD, 2008<sub>[107]</sub>). In addition, residence and other local presence requirements are considered to "defeat by definition the principle of freedom of cross-border trade and trans-frontier capital movements" (OECD, 2008<sub>[107]</sub>). Registration requirements would not normally be considered a local presence requirement.

In the case of insurance (including reinsurance and retrocession), members "may take regulatory measures in the field of insurance and pensions, including the regulation of the promotion, in order to protect the interests of policyholders and beneficiaries, provided those measures do not discriminate against non-resident providers of such services." Such measures do require a reservation if they prohibit promotion of cross-border services. The *Appendix to Annex I to Annex A* of the Code provides interpretive guidance on what would be considered "regulatory measures" that would apply to all categories of insurance and private pensions products, including common types of prudential safeguards such as rules on solvency, technical provisions and investments as well as measures related to the promotion of service offerings. There is no specific interpretive guidance on the types of regulatory measures that could be applied to reinsurance and retrocession without requiring a reservation beyond what is applied to all other categories of insurance and private pension products.

The Code also includes specific provisions related to establishment of branches and agencies of foreign insurers. These provisions allow for the pledging of funds locally (i.e. financial guarantees) by branches of foreign insurers as long as the amount of the financial requirements do not exceed what would be considered equivalent to that required by a domestic insurer to engage in similar activities. There are no specific provisions related to the pledging of assets in the context of cross-border transactions, other than provisions to allow for reinsurers to establish an account in which to pledge assets and for the free settlement of balances (including free transfer of excess amounts to the foreign reinsurer).

Three OECD members (Australia, Canada, United States) have reservations related to reinsurance and retrocession. Australia has a general reservation related to reinsurance and retrocession transactions and transfers (which means that Australia has not committed to implementing the provisions of the Code related to reinsurance and retrocession). Canada's reservation is applied to reinsurance and retrocession except for cases where the reinsurance or retrocession policy was initiated by the cedant and arranged in a foreign jurisdiction. The United States' reservation only applies as a result of the imposition of a tax on the reinsurance of policies covering US risks in certain classes of business by reinsurance companies not incorporated under US law.

While a more comprehensive deliberation of the consistency of individual measures with the Code would be required before any definitive conclusions could be reached, the following general observations can be made:

- The Code does not permit countries to regress in their liberalisation commitments made in relation to the Current Invisible Transactions, although there have been occasions where oversights were corrected in country reservations.
- Given that the Code requires free settlement of balances on guarantee deposits related to reinsurance transactions, it is unlikely that measures involving the pledging of assets were understood to be inconsistent with the Code as long as the amounts required are not more than what would be required of a domestic reinsurance company (including the domestically-incorporated subsidiary of a foreign reinsurance company);

- Without more specific interpretive guidance applicable to reinsurance and retrocession, differences in the level of capital relief provided for cross-border risk transfer could potentially be considered a prudential measure to protect the interests of policyholders. However, the move to risk-based capital has led to the removal of differential treatment of counterparty risk in other areas, such as for asset risk where no distinction is made between foreign and domestic assets when assessing risks for solvency purposes (which could be considered a relevant comparison in the context of publicly-traded reinsurance providers);
- Limits on the ability of foreign reinsurance companies to market their services is consistent with the requirements of the Code given the inclusion of regulatory measures related to promotional activities within the scope of prudential safeguards although adherents would be required to lodge a reservation if restrictions on promotional activities are in place;
- Quantitative limits on cross-border reinsurance transfer (when initiated by the cedant), including mandatory local cession or preferential offer to domestic entities may be inconsistent with the requirements of the Code without a specific reservation on reinsurance and retrocession. However, a mandatory cession to a specific publicly-owned reinsurer is unlikely to be inconsistent as such a requirement would impact both resident and non-resident reinsurers.
- A reservation would need to be lodged for any measure that prohibits the establishment of branches by foreign reinsurance companies.

A number of countries have made trade liberalisation commitments under the *General Agreement on Trade in Services (GATS): Annex on Financial Services* allowing for the provision of financial services by suppliers in other countries. These commitments are scheduled across different financial services sub-sectors (life insurance, non-life insurance, reinsurance and retrocession, insurance intermediation, etc.) indicating any limitations on market access and/or national treatment applicable to each sub-sector in terms of cross-border supply, consumption abroad, commercial presence, and presence of natural persons.

As part of the agreement, non-resident providers of reinsurance and retrocession services (including suppliers without any form of commercial presence in the local market) should, in principle, be able to provide those services on a cross-border basis and "under terms and conditions that accord national treatment" (WTO,(n.d.)<sup>[108]</sup>) (i.e. prohibits discrimination relative to services supplied by domestic providers). All of the countries<sup>25</sup> that have implemented measures related to reinsurance transactions (as outlined in Table 4.1) have made commitments related to reinsurance and retrocession under the GATS Annex. In many cases, the commitments to allow cross-border supply are "unbound" meaning that there is not a binding commitment and the committing country can maintain its ability to "introduce or maintain measures inconsistent with market access or national treatment" (WTO,(n.d.)<sup>[109]</sup>).<sup>26</sup>

---

<sup>25</sup> The European Union represents member countries in the GATS: Annex on Financial Services (along with other WTO agreements).

<sup>26</sup> The reinsurance and retrocession commitments related to cross-border trade made by Brazil, China, Ecuador and South Africa are unbound.

Some countries that have made binding commitments in the area of cross-border reinsurance and retrocession and that have imposed regulatory or supervisory measures that could limit or reduce the amount of premiums that are ceded to cross-border reinsurers have specifically outlined those limitations in their commitments.<sup>27</sup> Indonesia has specifically scheduled a minimum ratings requirement (BBB) for foreign reinsurers wishing to assume risks in Indonesia (although the limitation on establishing reinsurance branches and the measures related to priority domestic cession have not been scheduled). Russia has included a limit on the establishment of branches by foreign reinsurers and a commitment to allow branches by 2021 (draft legislation was published in November 2018 providing a framework for insurance and reinsurance branches to operate in Russia (Zubarev and Lukyanova, 2018<sub>[110]</sub>)).

Countries that have imposed measures that require or encourage the pledging of assets in the cedant jurisdiction (including by branches) have not scheduled these measures as limitations to market access or national treatment. Under the Annex on Financial Services, countries are not prevented from taking measures for prudential reasons, including for the protection of policy holders, or to ensure the integrity and stability of the financial system, as long as such measures (where they do not conform with the provisions of the agreement) are not used as a means of avoiding commitments or obligations under the agreement (WTO,(n.d.)<sub>[111]</sub>). There is limited guidance or jurisprudence on what might be considered a permissible "prudential" measure in the context of reinsurance and retrocession.<sup>28</sup>

---

<sup>27</sup> India, Malaysia and the Philippines have included mandatory or priority cession to publicly-owned or domestic reinsurers as a scheduled limit to market access.

<sup>28</sup> A dispute settlement initiated by Panama in 2012 in relation to measures imposed by Argentina found that limits on foreign reinsurance establishments based in countries deemed to not cooperate in tax and anti-money laundering matters were not prudential measures (WTO, 2015<sub>[123]</sub>).



## Chapter 5. Conclusion

International property catastrophe reinsurance markets can contribute to risk management by enhancing the capacity of primary insurance markets to provide insurance coverage and supporting the management of catastrophe risks. This contribution, combined with the global nature of these markets, should also help reduce the economic and insurance market disruptions that often follow large catastrophe events.

Using datasets provided by global reinsurers and others, this report has examined whether there is evidence of property catastrophe reinsurance's contribution to risk management. There is evidence that access to global property catastrophe reinsurance markets is being used by cedants to provide greater coverage capacity and manage catastrophe risks. There is also evidence that higher levels of property catastrophe reinsurance coverage have a positive impact in terms of reducing economic disruption in the aftermath of catastrophe events (potentially even more than in the case of primary insurance) and also mitigating the impact of catastrophe events on primary insurers and primary insurance market pricing.

The transfer of risk to reinsurance markets can create counterparty, execution and liquidity risks for cedants which need to be effectively managed. Supervisory or regulatory measures requiring or encouraging local presence, the pledging of local assets and/or local retention have been implemented in many jurisdictions, normally (but not always) as a means of mitigating these risks. However, there is some evidence that certain types of supervisory and regulatory measures could dampen the diversification benefits provided by risk transfer to international property catastrophe reinsurance markets and could create concentration risks for cedants and the domestic economy. The need to address these risks has been recognised in the revised version of the Insurance Core Principle 13 (*Reinsurance and Other Forms of Risk Transfer*) and in assessments of observance with this principle undertaken in the context of Financial Sector Assessment Programs.

Some of the restrictions imposed by countries may not be consistent with obligations under the *OECD Code of Liberalisation of Current Invisible Operations* or with trade liberalisation commitments made in the *General Agreement on Trade in Services: Annex on Financial Services* - however definitive conclusions on the consistency of measures with country's obligations are difficult to make without further analysis of the measures and/or jurisprudence on the scope of what should be considered prudential measures.

Greater information sharing among insurance regulators/supervisors and greater recognition of the regulation and supervision of international reinsurers by home supervisors (where consistent with international best practice) could support greater liberalisation of international reinsurance markets. For example, the US-EU Covered Agreement (see Box 5.1) is a bilateral effort that addresses some of the concerns of regulators and supervisors about counterparty risks in a liberalised reinsurance market.

**Box 5.1. US-EU Covered Agreement**

In September 2017, the United States and the European Union entered into the *Bilateral Agreement between the United States of America and the European Union on Prudential Measures regarding Insurance and Reinsurance*, commonly referred to as the "Covered Agreement". The Covered Agreement commits both jurisdictions (under certain conditions) to eliminating local presence and collateral requirements that are applied in a differential way to reinsurers based in the other jurisdiction and providing recognition to cedants (through capital credit) of the risk mitigation benefits of risk transfer to reinsurance companies in the other jurisdiction in the same way as risk transfer to domestic reinsurance companies.

To benefit from this agreement, reinsurers based in the other jurisdiction must meet certain conditions, including a minimum level of capital, a minimum solvency ratio (based on the solvency requirements of the home jurisdiction) and a certain level of claims payment performance. The assuming reinsurer must also agree to recognise the jurisdiction of courts in the cedant's jurisdiction and agree to pay any judgements against it that are declared enforceable in the cedant's jurisdiction (or else post collateral for 100% of the risks assumed). The reinsurer must also provide information to the supervisor in the cedant jurisdiction, including financial information, information on reinsurance assumed and information on its claims payment record.

## References

- A.M. Best (2018), *Best's Rankings: Top 50 World's Largest Reinsurance Groups*, A.M. Best, <http://www.ambest.com/terms>. (accessed on 13 September 2018). [13]
- A.M. Best (2017), *2017 Reinsurance Market Briefing - Zurich*, <http://www.ambest.com/events/2017RMBZurichSlides.pdf> (accessed on 13 September 2018). [4]
- AM Best (2017), *Down But Not Out: Reinsurers Look to Reposition Amid Market Disruption (Best's Special Report)*, AM Best, <http://www.bestweek.com/europe/promo/ReinsurersRepositionMktDistruption.pdf> (accessed on 23 May 2018). [11]
- AM Best (2016), *Innovation: The Race to Remain Relevant (Best's Special Report)*, AM Best, [http://www.naic.org/documents/cipr\\_events\\_impact\\_rating\\_amb\\_globe.pdf](http://www.naic.org/documents/cipr_events_impact_rating_amb_globe.pdf) (accessed on 28 May 2018). [98]
- AM Best (2015), *"It is Not Your Father's Reinsurance Market Anymore" – The New Reality (Best's Special Report)*, AM Best, <http://www.ambest.com/latinamerica/pdfs/2015reinsurancespecialreport.pdf> (accessed on 28 May 2018). [8]
- AM Best (2015), *Annual US Property Casualty Insurance Impairment Review (2014)*, AM Best. [10]
- AM Best (2014), *How Relevant is the Underwriting Cycle (Best's Special Report)*, AM Best, [http://www.biztositasizemle.hu/files/201409/document\\_1\\_.pdf](http://www.biztositasizemle.hu/files/201409/document_1_.pdf) (accessed on 28 May 2018). [3]
- AM Best (2013), *The Capital Challenge: Reinsurance Capacity Overshadows Market (Best's Special Report)*, AM Best, <http://www.bestweek.com/europe/promo/GlobalReinsurance.pdf> (accessed on 28 May 2018). [61]
- AM Best (2012), *Reinsurers Show Resilience Under Weight of Catastrophes, Economic Woes (Best's Special Report)*, AM Best, <http://www.bestweek.com/europe/promo/globalreinsurancerrpt.pdf> (accessed on 28 May 2018). [91]
- Aon Benfield (2018), *Reinsurance Market Outlook: Capacity builds ahead of mid-year renewals (April 2018)*, <http://thoughtleadership.aonbenfield.com/Documents/20180404-ab-analytics-rmo-april.pdf> (accessed on 13 September 2018). [116]
- Aon Benfield (2017), *Asia Pacific Solvency Regulation: Non-Life Solvency Calculations for Selected Markets (October)*, Aon Benfield, [http://thoughtleadership.aonbenfield.com/Documents/201710-apac-solvency-regulation.pdf?utm\\_source=slipcse](http://thoughtleadership.aonbenfield.com/Documents/201710-apac-solvency-regulation.pdf?utm_source=slipcse) (accessed on 17 May 2018). [49]
- APRA (2013), *Prudential Practice Guide: GPG 116-Insurance Concentration Risk*, Australian Prudential Regulation Authority, <http://www.apra.gov.au> (accessed on 03 December 2018). [47]
- Artemis((n.d.)), *Reinsurance sidecars. List of collateralized reinsurance sidecar vehicles*, <http://www.artemis.bm/library/reinsurance-sidecars.html> (accessed on 28 May 2018). [93]

- Asia Insurance Review (2018), “India: Reinsurance rules to be issued next month”, *Asia Insurance Review*, <http://www3.asiainsurancereview.com/News/View-NewsLetter-Article?id=41383&Type=eDaily> (accessed on 17 May 2018). [73]
- Assicurazioni Generali((n.d.)), *Regulatory news from Ecuador affecting pooling and captive arrangements*, <http://www.geb.com/through-our-world/news/regulatory-news-ecuador-affecting-pooling-and-captive-arrangements> (accessed on 17 May 2018). [23]
- Assicurazioni Generali((n.d.)), *Regulatory news from Ecuador affecting pooling and captive arrangements*, <http://www.geb.com/through-our-world/news/regulatory-news-ecuador-affecting-pooling-and-captive-arrangements> (accessed on 17 May 2018). [32]
- Australian Government (2017), *Insurance (prudential standard) determination No. 1 of 2017 - Prudential Standard GPS 114 Capital Adequacy: Asset Risk Charge*, Federal Register of Legislation, <https://www.legislation.gov.au/Details/F2017L00101> (accessed on 03 December 2018). [24]
- Australian Government (2017), *Insurance (prudential standard) determination No. 1 of 2017 - Prudential Standard GPS 114 Capital Adequacy: Asset Risk Charge*, Federal Register of Legislation, <https://www.legislation.gov.au/Details/F2017L00101> (accessed on 03 December 2018). [33]
- Australian Government (2014), *Insurance (prudential standard) determination No. 3 of 2014 - Prudential Standard GPS 110 - Capital Adequacy*, Federal Register of Legislation, <https://www.legislation.gov.au/Details/F2014L01677> (accessed on 03 December 2018). [21]
- Australian Government (2014), *Insurance (prudential standard) determination No. 3 of 2014 - Prudential Standard GPS 110 - Capital Adequacy*, Federal Register of Legislation, <https://www.legislation.gov.au/Details/F2014L01677> (accessed on 03 December 2018). [57]
- Baek, J. and H. Shin (2016), *Insurance and reinsurance in South Korea: overview | Practical Law*, Thomson Reuters Practical Law, [https://content.next.westlaw.com/Document/I2ef12a191ed511e38578f7ccc38dcbee/View/FullText.html?contextData=\(sc.Default\)&transitionType=Default&firstPage=true&bhcp=1](https://content.next.westlaw.com/Document/I2ef12a191ed511e38578f7ccc38dcbee/View/FullText.html?contextData=(sc.Default)&transitionType=Default&firstPage=true&bhcp=1) (accessed on 17 May 2018). [54]
- Baek, J. and H. Shin (2016), *Insurance and reinsurance in South Korea: overview | Practical Law*, Thomson Reuters Practical Law, [https://content.next.westlaw.com/Document/I2ef12a191ed511e38578f7ccc38dcbee/View/FullText.html?contextData=\(sc.Default\)&transitionType=Default&firstPage=true&bhcp=1](https://content.next.westlaw.com/Document/I2ef12a191ed511e38578f7ccc38dcbee/View/FullText.html?contextData=(sc.Default)&transitionType=Default&firstPage=true&bhcp=1) (accessed on 17 May 2018). [43]
- BaFin (2016), *Conduct of reinsurance business in Germany by insurance undertakings situated in a third country (Interpretative decision)*, [https://www.bafin.de/SharedDocs/Veroeffentlichungen/EN/Auslegungsentscheidung/VA/ae\\_160901\\_rueckversicherung\\_drittstaaten\\_va\\_en.html](https://www.bafin.de/SharedDocs/Veroeffentlichungen/EN/Auslegungsentscheidung/VA/ae_160901_rueckversicherung_drittstaaten_va_en.html) (accessed on 17 May 2018). [85]
- BaFin (2016), *Conduct of reinsurance business in Germany by insurance undertakings situated in a third country (Interpretative decision)*, [https://www.bafin.de/SharedDocs/Veroeffentlichungen/EN/Auslegungsentscheidung/VA/ae\\_160901\\_rueckversicherung\\_drittstaaten\\_va\\_en.html](https://www.bafin.de/SharedDocs/Veroeffentlichungen/EN/Auslegungsentscheidung/VA/ae_160901_rueckversicherung_drittstaaten_va_en.html) (accessed on 17 May 2018). [80]
- Bermuda Monetary Authority((n.d.)), *Class of insurer registered 2014*, <http://www.bma.bm/statistics/insurance/SitePages/Class%20of%20insurer%20registered.aspx> (accessed on 06 April 2018). [62]
- Bermuda Monetary Authority((n.d.)), *Class of insurer registered 2014*, <http://www.bma.bm/statistics/insurance/SitePages/Class%20of%20insurer%20registered.aspx> (accessed on 06 April 2018). [78]
- Bermuda Monetary Authority((n.d.)), *Licensing Overview (Insurance)*, <http://www.bma.bm/insurance/licensing/SitePages/Home.aspx> (accessed on 06 April 2018). [71]
- Bermuda Monetary Authority((n.d.)), *Licensing Overview (Insurance)*, <http://www.bma.bm/insurance/licensing/SitePages/Home.aspx> (accessed on 06 April 2018). [71]
- Bradicich, K. et al. (2013), *Could Third-Party Capital Transform The Reinsurance Markets?*, McKinsey & Company, [https://www.mckinsey.com/~media/mckinsey/dotcom/client\\_service/Financial%20Services/Latest%20thinking/Insurance/Could\\_third-party\\_capital\\_transform\\_the\\_reinsurance\\_markets.ashx](https://www.mckinsey.com/~media/mckinsey/dotcom/client_service/Financial%20Services/Latest%20thinking/Insurance/Could_third-party_capital_transform_the_reinsurance_markets.ashx) (accessed on 22 March 2018). [59]
- Bradicich, K. et al. (2013), *Could Third-Party Capital Transform The Reinsurance Markets?*, McKinsey & Company, [https://www.mckinsey.com/~media/mckinsey/dotcom/client\\_service/Financial%20Services/Latest%20thinking/Insurance/Could\\_third-party\\_capital\\_transform\\_the\\_reinsurance\\_markets.ashx](https://www.mckinsey.com/~media/mckinsey/dotcom/client_service/Financial%20Services/Latest%20thinking/Insurance/Could_third-party_capital_transform_the_reinsurance_markets.ashx) (accessed on 22 March 2018). [81]
- Camara de Diputados del H. Congreso de la Union (2013), *Ley de Instituciones de Seguros y de Fianzas*, Estados Unidos Mexicanos, [http://www.senado.gob.mx/comisiones/finanzas\\_publicas/docs/LISF.pdf](http://www.senado.gob.mx/comisiones/finanzas_publicas/docs/LISF.pdf) (accessed on 20 September 2018). [6]
- Camara de Diputados del H. Congreso de la Union (2013), *Ley de Instituciones de Seguros y de Fianzas*, Estados Unidos Mexicanos, [http://www.senado.gob.mx/comisiones/finanzas\\_publicas/docs/LISF.pdf](http://www.senado.gob.mx/comisiones/finanzas_publicas/docs/LISF.pdf) (accessed on 20 September 2018). [58]
- CIAB (2017), *Market sees Downward Trend for Ninth Straight Quarter*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/download/5991/> (accessed on 23 May 2018). [41]
- CIAB (2017), *Market sees Downward Trend for Ninth Straight Quarter*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/download/5991/> (accessed on 23 May 2018). [99]
- CIAB (2016), *Decreases continued in Q1 P/C Rates*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/resources/q1-market-survey-2016/> (accessed on 02 October 2018). [120]
- CIAB (2016), *Decreases continued in Q1 P/C Rates*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/resources/q1-market-survey-2016/> (accessed on 02 October 2018). [5]
- CIAB (2013), *Commercial P/C Pricing Continued Upward Trend in First Quarter*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/wp-content/uploads/2017/08/2013-Q1->

- [PC-Survey.pdf](#) (accessed on 23 May 2018). [86]
- CIAB (2012), *Commercial P/C market pricing toughened in first quarter*, The Council of Insurance Agents & Brokers, <http://www.ciab.com> (accessed on 02 October 2018). [46]
- CIAB (2011), *Market Slide Slowed in First Quarter 2011*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/wp-content/uploads/2017/08/2011-Q1-PC-Survey.pdf> (accessed on 23 May 2018). [45] [31]
- CIAB (2009), *Commercial Market Flat, But Kept Its Tread in First Quarter*, The Council of Insurance Agents & Brokers, <https://www.ciab.com/wp-content/uploads/2017/08/2009-Q1-PC-Survey.pdf> (accessed on 23 May 2018). [39] [34]
- Clyde & Co (2015), *Insurance and reinsurance in Saudi Arabia*, Clyde & Co LLP, [https://www.clydeco.com/uploads/Files/CC007080\\_PLG\\_KSA\\_Brochure\\_ME\\_V4\\_11-03-15.pdf](https://www.clydeco.com/uploads/Files/CC007080_PLG_KSA_Brochure_ME_V4_11-03-15.pdf) (accessed on 17 May 2018). [105] [122]
- Clyde & Co. (2017), *Insight & Knowledge - Asia Pacific (Reinsurance)*, Clyde & Co LLP, <https://www.clydeco.com/insight/article/asia-pacific> (accessed on 17 May 2018). [66]
- Conlin, G. (2015), *Brazilian regulatory changes good for international reinsurers, August 2015* | *Brazilian regulatory changes good for international reinsurers (August)*, Holman Fenwick Willan LLP, <http://www.hfw.com/Brazilian-regulatory-changes-good-for-international-reinsurers-August-2015> (accessed on 16 May 2018). [25] [67] [63]
- Conyers Dill & Pearman (2016), *Bermuda Special Purpose Insurers*, [https://www.conyersdill.com/publication-files/2016\\_12\\_BDA\\_Special\\_Purpose\\_Insurers.pdf](https://www.conyersdill.com/publication-files/2016_12_BDA_Special_Purpose_Insurers.pdf) (accessed on 06 April 2018). [69] [68]
- Coskunso, C. and B. Cavus (2018), *Insurance & Reinsurance (Getting the deal through): Turkey*, Cavus & Coskunso Law Firm. [70]
- Daly, S., D. Maher and A. McClements (2018), *Insurance & Reinsurance (Getting the deal through): Ireland*, Matheson. [64]
- Echeverría, Andrés Amunátegui and Stullenberg, S. (n.d.), *Changes in the regulatory framework of the Argentine reinsurance market*, DAC Beachcroft, <https://www.dacbeachcroft.com/en/gb/articles/2017/june/changes-in-the-regulatory-framework-of-the-argentine-reinsurance-market/> (accessed on 16 May 2018). [106] [65] [72]
- EIOPA (2015), *Guidelines on basis risk*, European Insurance and Occupational Pensions Authority, [https://eiopa.europa.eu/Publications/Guidelines/BR\\_Final\\_document\\_EN.pdf](https://eiopa.europa.eu/Publications/Guidelines/BR_Final_document_EN.pdf) (accessed on 17 May 2018). [19] [40]
- Etzbach, P. and J. Janning (2018), *Insurance & Reinsurance (Getting the deal through): Germany*, Oppenhoff & Partner. [77]
- European Commission (2014), *Commission Delegated Regulation (EU) 2015/35 of 10 October 2014 - supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)*, Official Journal of the European Union, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0035&from=EN> (accessed on 20 September 2018). [16] [88] [60]
- Federal Insurance Office (2014), *The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States*, U.S. Department of the Treasury, Washington, D.C., [95] [51]

- <https://www.treasury.gov/initiatives/fio/reports-and-notice/Documents/FIO%20-%20Reinsurance%20Report.pdf> (accessed on 05 April 2018). [52]
- FSB (2016), *Reinsurance Regulatory Review: Position Paper*, Financial Services Board, [https://www.fsb.co.za/Departments/insurance/Documents/Position%20Paper%20-%20Reinsurance%20Regulatory%20Review%20\(09%20September%202016\).pdf](https://www.fsb.co.za/Departments/insurance/Documents/Position%20Paper%20-%20Reinsurance%20Regulatory%20Review%20(09%20September%202016).pdf) (accessed on 17 May 2018). [29] [84] [15]
- Giorgetti, A. (2018), *Insurance & Reinsurance (Getting the deal through): Italy*, Studio Legale Giorgetti. [14]
- Global Reinsurance (2018), “Reinsurance market shows resilience against 2017 losses, Guy Carpenter reports”, *Global Reinsurance*, <https://www.globalreinsurance.com/news/reinsurance-market-shows-resilience-against-2017-losses-guy-carpenter-reports/1426088.article> (accessed on 13 September 2018). [107] [90] [44]
- Government of Singapore (2004), *Insurance (Authorised Reinsurers) Regulations*, <https://sso.agc.gov.sg/SL/IA1966-RG13?DocDate=20041231>. [82]
- GRF (2018), *Reinsurance Trade Barriers and Market Access Issues Worldwide (9 February)*, Global Reinsurance Forum, [http://www.grf.info/images/Publications/TradeBarriers/Feb-2018-GRF-Reinsurance-Trade-Barriers\\_FINAL.pdf](http://www.grf.info/images/Publications/TradeBarriers/Feb-2018-GRF-Reinsurance-Trade-Barriers_FINAL.pdf) (accessed on 16 May 2018). [96] [83]
- Gründl, H., M. Dong and J. Gal (2016), “The evolution of insurer portfolio investment strategies for long-term investing”, *OECD Journal: Financial Market Trends* 1, <http://www.oecd.org/investment/Evolution-insurer-strategies-long-term-investing.pdf> (accessed on 25 May 2018). [50] [94]
- Guy Carpenter (2018), *Reinsurance Market Assessment: What the Numbers Reveal about the Current Industry Status. Chapter 1* | *GCCapitalIdeas.com*, <http://www.gccapitalideas.com/2018/03/27/reinsurance-market-assessment-what-the-numbers-reveal-about-the-current-industry-status-chapter-1/> (accessed on 13 May 2018). [103] [75] [112]
- Guy Carpenter((n.d.)), *Guy Carpenter Reports Moderating Reinsurance Pricing Decline at January 1, 2017 Renewals*, 2017, <http://www.gccapitalideas.com/2017/01/05/guy-carpenter-reports-moderating-reinsurance-pricing-decline-at-january-1-2017-renewals/> (accessed on 13 September 2018). [115] [102]
- Harty, M. and A. Yeh (2018), *Insurance & Reinsurance 2018 (International Comparative Legal Guides): Taiwan*, LCS & Partners. [30] [100]
- Hill, J. and E. Ligere (2018), *Insurance and Reinsurance (Getting the deal through): United Kingdom*, Debevoise & Plimpton LLC and American International Group. [101]
- Hirst, P., L. Bacon and A. Carazo Gormley (2016), *Insurance: Ecuador (April)*, Clyde & Co LLP, [https://www.clydeco.com/uploads/Files/CC010223\\_Ecuador\\_chapter\\_26-04-16\\_v2.pdf](https://www.clydeco.com/uploads/Files/CC010223_Ecuador_chapter_26-04-16_v2.pdf) (accessed on 17 May 2018). [104] [74]
- Hu, S. (2016), *China Proposes Requirements for Collateral in Cross-border Reinsurance Transactions*, Hogan Lovells Global Insurance Blog, <https://www.hlinsurancelaw.com/2016/08/china-proposes-requirements-for-collateral-in-cross-border-reinsurance-transactions/> (accessed on 16 May 2018). [2] [20]
- IAIS (2018), *Global Insurance Market Report (GIMAR) 2017*, International Association of Insurance Supervisors. [27] [113]

- IAIS (2017), *Insurance Core Principles (Updated November 2017)*, International Association of Insurance Supervisors.
- IAIS (2012), *Reinsurance and Financial Stability*, International Association of Insurance Supervisors, <https://www.iaisweb.org/file/34383/reinsurance-and-financial-stability-july-2012>.
- IAIS((n.d.)), *IAIS Multilateral Memorandum of Understanding (MMoU)*, <https://www.iaisweb.org/page/supervisory-material/mmou> (accessed on 18 May 2018).
- IAIS((n.d.)), *MMoU Signatories listed alphabetically (by jurisdiction)*, <https://www.iaisweb.org/page/supervisory-material/mmou/mmou-signatories/> (accessed on 18 May 2018).
- IMF (2018), *India: Technical Note on Insurance Sector Regulation and Supervision*, International Monetary Fund.
- IMF (2017), *Gross Domestic Product (current prices, USD) 2016 (World Economic Outlook Database (October 2017))*, International Monetary Fund, <http://www.imf.org/external/pubs/ft/weo/2017/02/weodata/weorept.aspx?sy=2016&ey=2016&scsm=1&ssd=1&sort=country&ds=.&br=1&pr1.x=67&pr1.y=12&c=213%2C548%2C193%2C122%2C273%2C124%2C218%2C223%2C138%2C196%2C278%2C142%2C156%2C228%2C924%2C233%2C288%2C293%2C964%2C> (accessed on 27 March 2018).
- IMF (2017), *New Zealand: Detailed Assessment of Observance - Insurance Core Principles*, International Monetary Fund.
- IMF (2017), *People's Republic of China: Detailed Assessment of the Observance of the Insurance Core Principles*, International Monetary Fund.
- IMF (2017), *Turkey: Detailed Assessment of Observance - IAIS Insurance Core Principles*, International Monetary Fund.
- IMF (2015), *South Africa: Insurance Core Principles - Detailed Assessment of Observance*, International Monetary Fund.
- IMF (2015), *United States: Detailed Assessment of Observance of Insurance Core Principles*, International Monetary Fund.
- IMF (2014), *Canada: Insurance Core Principles - Detailed Assessment of Observance*, International Monetary Fund.
- IMF (2013), *Argentina: Financial System Stability Assessment*, International Monetary Fund.
- IMF (2012), *Brazil: Financial System Stability Assessment*, International Monetary Fund.
- IMF (2012), *Japan: Insurance Core Principles - Detailed Assessment of Observance*, International Monetary Fund.
- JLT Re (2018), *Reinsurance Market Prospective*, JLT Re, <https://www.jltre.com/our-insights/publications/reinsurance-market-prospective-2018> (accessed on 13 May 2018).
- Kwon, W. and L. Wolfrom (2016), “Analytical tools for the insurance market and macro-prudential surveillance”, *OECD Journal: Financial Market Trends* 11, <https://www.oecd.org/pensions/Analytical-tools-insurance-market-macro-prudential-surveillance.pdf> (accessed on 16 May 2018).
- Lan Lan, E. et al. (2018), *Insurance & Reinsurance (Getting the deal through): China*, Jincheng Tongda & Neal.

- Lane, M. and R. Beckwith (2018), *Last Man Standing – The Synthetic Cat Reinsurer Annual Review and Commentary for the Four Quarters, Q2 2017 to Q1 2018*, Lane Financial LLC, <http://www.lanefinancialllc.com/images/stories/Publications/2018-03-31%20annual%20review%20four%20quarters%20Q2%202017%20to%20Q1%202018.pdf> (accessed on 14 May 2018).
- Langeland, A. and A. Meidell (2014), *Insurance and Reinsurance Law and Regulation - Jurisdictional Comparisons: Norway*, Thommessen AS.
- Le Marquer, A., K. Thaisomboon and S. Kleesuwan (2015), *Insurance and reinsurance in Thailand: overview*, Practical Law, [https://www.tilleke.com/sites/default/files/2015\\_Jul\\_PLC%20Insurance%20and%20Reinsurance%20-%20Thailand.pdf](https://www.tilleke.com/sites/default/files/2015_Jul_PLC%20Insurance%20and%20Reinsurance%20-%20Thailand.pdf) (accessed on 17 May 2018).
- Levitan, R. and Y. Navon (2018), *Insurance & Reinsurance (Getting the deal through): Israel*, Levitan Sharon & Co Advocates and Notaries.
- Lloyd's (2016), *Indonesia: New Regulation on Reinsurance*, Lloyd's Regulatory Communications, <https://www.lloyds.com/market-resources/market-communications/regulatory-communications/regulatory-communications/regulatory-news-articles/2016/04/Indonesia> (accessed on 17 May 2018).
- Lloyd's (2013), *Revision to Reinsurance Best Practices Guidelines in South Korea*, Lloyd's Regulatory Communications, <https://www.lloyds.com/market-resources/market-communications/regulatory-communications/regulatory-communications/regulatory-news-articles/2013/12/revision-to-reinsurance-best-practices-guidelines-in-south-korea> (accessed on 17 May 2018).
- Melecky, M. and C. Raddatz (2011), “How Do Governments Respond after Catastrophes? Natural-Disaster Shocks and the Fiscal Stance”, *Policy Research Working Paper*, No. 5564, World Bank, <https://openknowledge.worldbank.org/bitstream/handle/10986/3331/WPS5564.pdf?sequence=1&isAllowed=y> (accessed on 22 March 2018).
- Morscher, L. and L. Rusterholz (2018), *Insurance & Reinsurance (Getting the deal through): Switzerland*, Lenz & Staehelin.
- OECD (2017), *Business Written in the Reporting Country (Premiums Ceded)*, <http://stats.oecd.org/Index.aspx?DatasetCode=INSIND> (accessed on 26 March 2018).
- OECD (2016), *OECD Insurance Statistics (database)*, OECD, <https://stats.oecd.org/Index.aspx?DatasetCode=INSIND> (accessed on 27 August 2018).
- OECD (2008), *OECD Codes of Liberalisation: User's Guide*, Organisation for Economic Co-operation and Development, <http://www.oecd.org/daf/inv/investment-policy/38072327.pdf> (accessed on 18 May 2018).
- OSFI (2018), *Discussion Paper on OSFI's Reinsurance Framework*, Office of the Superintendent of Financial Institutions, [http://www.osfi-bsif.gc.ca/Eng/fi-if/rg-ro/gdn-ort/pp-do/Pages/reins\\_frmwk.aspx](http://www.osfi-bsif.gc.ca/Eng/fi-if/rg-ro/gdn-ort/pp-do/Pages/reins_frmwk.aspx) (accessed on 19 November 2018).
- OSFI (2015), *Minimum Continuing Capital and Surplus Requirements*, Office of the Superintendent of Financial Institutions, <http://www.osfi-bsif.gc.ca/Eng/fi-if/rg-ro/gdn-ort/gld/Pages/MCCSR2016.aspx#toc9-7> (accessed on 16 May 2018).
- Oshimo, K. (2018), *Insurance & Reinsurance (Getting the deal through): Japan*, Nagashima Ohno & Tsunematsu.

- Park, S. and X. Xie (2014), “Reinsurance and Systemic Risk: The Impact of Reinsurer Downgrading on Property-Casualty Insurers”, *Journal of Risk and Insurance*, Vol. 81/3, pp. 587-622, <http://dx.doi.org/10.1111/jori.12045>.
- Popova, E. (2018), *Insurance & Reinsurance (Getting the deal through): Russia*, Sokolov, Maslov & Partners Law Firm.
- PwC (2018), *IRDAI issues draft IRDAI (Reinsurance) Regulations, 2018*, PwC, [https://www.pwc.in/assets/pdfs/news-alert/2018/pwc\\_news\\_alert\\_9\\_january\\_2018\\_irdai\\_issues\\_draft\\_irdai\\_reinsurance\\_regulations\\_2018.pdf](https://www.pwc.in/assets/pdfs/news-alert/2018/pwc_news_alert_9_january_2018_irdai_issues_draft_irdai_reinsurance_regulations_2018.pdf) (accessed on 17 May 2018).
- Rozas, R. and M. Morgan (2018), *Insurance & Reinsurance (Getting the deal through): Chile*, Jorquiera & Rozas Abogados.
- S&P (2015), *Global Reinsurance Highlights 2015: Defense Provides Stability, But Pressure Remains*, Standard & Poor's, <https://www.spratings.com/documents/20184/86966/Global+Reinsurance+Highlights+2015/e9e94c98-f750-4df8-be0a-9b52f73c9978> (accessed on 25 May 2018).
- Scheuba, P. (2018), *Insurance & Reinsurance (Getting the deal through): Austria*, BLS Rechtsanwälte Boller Langhammer Schubert GmbH.
- Schwepecke, A., D. Arndt and Swiss Re Germany AG (Unterföhring) (2004), *Reinsurance : principles and state of the art ; a guidebook for home learners*, VVW.
- Soar, K. (2014), *Collateralised reinsurance: A practical checklist to avoid collateral damage | International Law Firm*, INCE & Co Knowledge Bank, <http://www.incelaw.com/tw/knowledge-bank/collateralised-reinsurance-a-practical-checklist-to-avoid-collateral-damage> (accessed on 22 March 2018).
- Standard & Poor's (2016), *Global Reinsurance Highlights 2016*, Standard & Poor's Rating Service, <https://www.spratings.com/documents/20184/86966/Global+Reinsurance+Highlights+2016+version+2/1f311cdc-bb98-4e19-9214-b19fbd5042f1> (accessed on 22 March 2018).
- Standard & Poor's (2015), *The Heat Is On: How Climate Change Can Impact Sovereign Ratings*, Standard & Poor's Rating Service, [https://www.agefi.com/uploads/media/S\\_P\\_The\\_Heat\\_Is\\_On\\_How\\_Climate\\_Change\\_Can\\_Impact\\_Sovereign\\_Ratings\\_25-11-2015.pdf](https://www.agefi.com/uploads/media/S_P_The_Heat_Is_On_How_Climate_Change_Can_Impact_Sovereign_Ratings_25-11-2015.pdf) (accessed on 22 March 2018).
- Standard & Poor's Ratings Service (2018), *Global Reinsurance Highlights 2018*, Standard & Poor's, <http://www.spratings.com/GRH> (accessed on 02 October 2018).
- Standard & Poor's Ratings Service (2017), *Global Reinsurance Highlights 2017*, Standard & Poor's Ratings Service, [http://images.ratingsinfo.standardandpoors.com/Web/StandardPoorsRatings/S&PGRH2017\\_LOW.pdf](http://images.ratingsinfo.standardandpoors.com/Web/StandardPoorsRatings/S&PGRH2017_LOW.pdf) (accessed on 23 March 2018).
- Standard & Poor's Ratings Service (2014), *Global Reinsurance Highlights 2014: Innovation and Adaptation Are Key to Relevance*, Standard & Poor's Ratings Service, <https://www.spratings.com/documents/20184/544129/Global+Reinsurance+Highlights+2014/8d0a7dcb-3b36-48fe-ac57-a3486723286e> (accessed on 28 May 2018).
- Stendahl, A. and M. Smit (2013), *Insurance & Reinsurance (Getting the deal through): Netherlands*, Van Steenderen Mainport Lawyers, <http://www.gettingthedealthrough.com> (accessed on 20 September 2018).

- Swiss Re (2018), *Swiss Re sigma - International Insurance Premiums Written (database)*.
- Swiss Re (2018), *Swiss Re sigma - Natural catastrophes and man-made disasters (database)*.
- Swiss Re (2016), *The benefit of global diversification: how reinsurers create value and manage risk*, Swiss Re,  
[http://media.swissre.com/documents/Expertise%20Publication%20The\\_benefit\\_of\\_global\\_diversification.pdf](http://media.swissre.com/documents/Expertise%20Publication%20The_benefit_of_global_diversification.pdf) (accessed on 19 September 2018).
- Swiss Re (1997), *Proportional and non-proportional reinsurance*, Swiss Reinsurance Company,  
[http://media.swissre.com/documents/pub\\_proportional\\_non\\_proportional\\_en.pdf](http://media.swissre.com/documents/pub_proportional_non_proportional_en.pdf) (accessed on 22 March 2018).
- Szegda, L. (2010), *Poland: Foreign Insurers*, Wardynski & Partners,  
<http://www.lexmundi.com/Document.asp?DocID=1239>.
- Torchiana, W., M. Rosenberg and M. Leydier (2018), *Insurance & Reinsurance (Getting the deal through): United States*, Sullivan & Cromwell LLP.
- Tuli, N. and C. Jenkins (2018), *Insurance & Reinsurance (Getting the deal through): India*, Tuli & Co.
- van Lelyveld, I., F. Liedorp and M. Kampman (2009), *An empirical assessment of reinsurance risk*, De Nederlandsche Bank,  
[https://www.dnb.nl/en/binaries/Working%20paper%20201\\_tcm47-212957.pdf](https://www.dnb.nl/en/binaries/Working%20paper%20201_tcm47-212957.pdf) (accessed on 25 May 2018).
- Von Peter, G., S. Von Dahlen and S. Saxena (2012), “Unmitigated disasters? New evidence on the macroeconomic cost of natural catastrophes”, *BIS Working Papers*, No. 394, Bank for International Settlements, <https://www.bis.org/publ/work394.pdf> (accessed on 22 March 2018).
- Walker, J. et al. (2018), *Insurance & Reinsurance (Getting the deal through): Canada*, Walker Sorensen LLP.
- Willkie Farr & Gallagher (2016), *Developments and Trends in Insurance Transactions and Regulation: 2015 Year in Review*, Willkie Farr & Gallagher LLP,  
[http://www.willkie.com/~media/Files/Publications/2016/01/2015\\_Year\\_in\\_Review\\_Developments\\_and\\_Trends\\_in\\_Insurance\\_Transactions\\_and\\_Regulation.pdf](http://www.willkie.com/~media/Files/Publications/2016/01/2015_Year_in_Review_Developments_and_Trends_in_Insurance_Transactions_and_Regulation.pdf) (accessed on 22 March 2018).
- Willis Towers Watson (2018), *Willis Re 1st View (January 2018)*, Willis Towers Watson,  
<https://www.willistowerswatson.com/en/insights/2018/01/willis-re-1st-view-january-2018> (accessed on 13 May 2018).
- Willkie Farr & Gallagher LLP (2012), *CFTC and SEC adopt definition of “swap” and “security-based swap”*, (Client Memorandum), Willkie Farr & Gallagher LLP,  
<https://www.willkie.com/~media/Files/Publications/2012/08/CFTC%20and%20SEC%20Adopt%20Definition%20of%20Swap%20and%20Security%20Based%20Swap.pdf> (accessed on 28 May 2018).
- WTO (2015), *Argentina - Measures relating to trade in goods and services: Report of the Panel (WT/DS453/R)*, World Trade Organization.
- WTO((n.d.)), *Annex on Financial Services*, [https://www.wto.org/english/tratop\\_e/serv\\_e/10-anfin\\_e.htm](https://www.wto.org/english/tratop_e/serv_e/10-anfin_e.htm) (accessed on 22 May 2018).

- WTO((n.d.)), *Guide to reading the GATS schedules of specific Commitments and the list of article II (MFN) exemptions*, Services: Schedules, [https://www.wto.org/english/tratop\\_e/serv\\_e/guide1\\_e.htm](https://www.wto.org/english/tratop_e/serv_e/guide1_e.htm) (accessed on 22 May 2018).
- WTO((n.d.)), *Understanding on Commitments in Financial Services*, Services: Agreement, [https://www.wto.org/english/tratop\\_e/serv\\_e/21-fin\\_e.htm](https://www.wto.org/english/tratop_e/serv_e/21-fin_e.htm) (accessed on 22 May 2018).
- Zubarev, L. (2016), *Russia to introduce quasi-state compulsory reinsurance*, CMS International, [http://www.cms-russia.info/legalnews/2016/06/cms\\_client\\_alert\\_2016\\_06\\_28.html](http://www.cms-russia.info/legalnews/2016/06/cms_client_alert_2016_06_28.html) (accessed on 17 May 2018).
- Zubarev, L. and D. Lukyanova (2018), *WTO update: A bill authorising the activities of branches of foreign insurers in Russia is now under discussion*, CMS Russia, [https://www.lexology.com/library/detail.aspx?g=76c9567a-1989-4702-8766-9264dea0a079&utm\\_source=lexology+daily+newsfeed&utm\\_medium=html+email+-+body+-+general+section&utm\\_campaign=lexology+subscriber+daily+feed&utm\\_content=lexology+daily+newsfeed+2018-11-1](https://www.lexology.com/library/detail.aspx?g=76c9567a-1989-4702-8766-9264dea0a079&utm_source=lexology+daily+newsfeed&utm_medium=html+email+-+body+-+general+section&utm_campaign=lexology+subscriber+daily+feed&utm_content=lexology+daily+newsfeed+2018-11-1) (accessed on 13 November 2018).



## Annex A. Overview of reinsurance coverage

### Traditional reinsurance coverage

Traditional reinsurance contracts typically take one of two basic forms - treaty or facultative agreements:<sup>29</sup>

- *Facultative reinsurance*: The oldest form of reinsurance, facultative reinsurance allows a cedant to select which policies or individual risks to reinsure and gives the reinsurer the option to accept or refuse any offered policy or risk. Risk is analysed on a policy-by-policy basis, making the process administratively more burdensome than treaty reinsurance. Facultative reinsurance is typically used for complex, large individual risks that require individual analysis and fall outside of the scope of a treaty.
- *Treaty reinsurance*: Treaty reinsurance is used to reinsure entire portfolios and is therefore more administratively efficient than facultative reinsurance for reinsurers. Under treaty reinsurance agreements (also known as obligatory reinsurance), a set of insurance risks specified in the contract is covered and a share of the premium and losses linked to these covered risks are transferred to one (or more) reinsurer(s). Because reinsurers do not analyse each policy relating to the reinsured business before accepting the cession, reinsurers are dependent on the cedant's underwriting and claims management ability.

Both treaty and facultative reinsurance can be structured as proportional or non-proportional.

Under *proportional reinsurance*, the cedant and the reinsurer share premium, liabilities, losses and loss adjustment expenses related to covered policies in a contractually agreed proportion. The reinsurer pays the cedant commission for its acquisition and administration costs. There are two main types of proportional reinsurance agreements – quota share (used in property and liability lines) and surplus reinsurance (usually used in property lines):

- *Quota share reinsurance*: Under a quota share agreement, the cedant transfers a fixed quota or percentage of policies written (generally applied to the entire portfolio of risks) to the reinsurer. The reinsurer would receive the proportional share of the premium and would be liable to the cedant for an equivalent share of losses and loss adjustment expenses paid by the cedant. Normally, a cedant would use quota share reinsurance for any of the following reasons: (i) entry into a new market where it faces higher levels of uncertainty; (ii) to address liquidity needs

---

<sup>29</sup> A hybrid of the two main forms of reinsurance agreements exist in the form of facultative-obligatory reinsurance where the direct insurer can select which individual risks to cede to the reinsurer through a treaty, however the reinsurer must accept all business that the insurer wishes to cede subject to the scope of the treaty.

related to fast growth (as reinsurers will provide upfront funding for the acquisition of business); (iii) to increase underwriting capacity (as an alternative to issuing new equity); or (iv) to incentivise reinsurers to accept highly-exposed risks by offering a share of a profitable book of business (Schwepcke, Arndt and Swiss Re Germany AG (Unterf hring), 2004<sup>[112]</sup>).

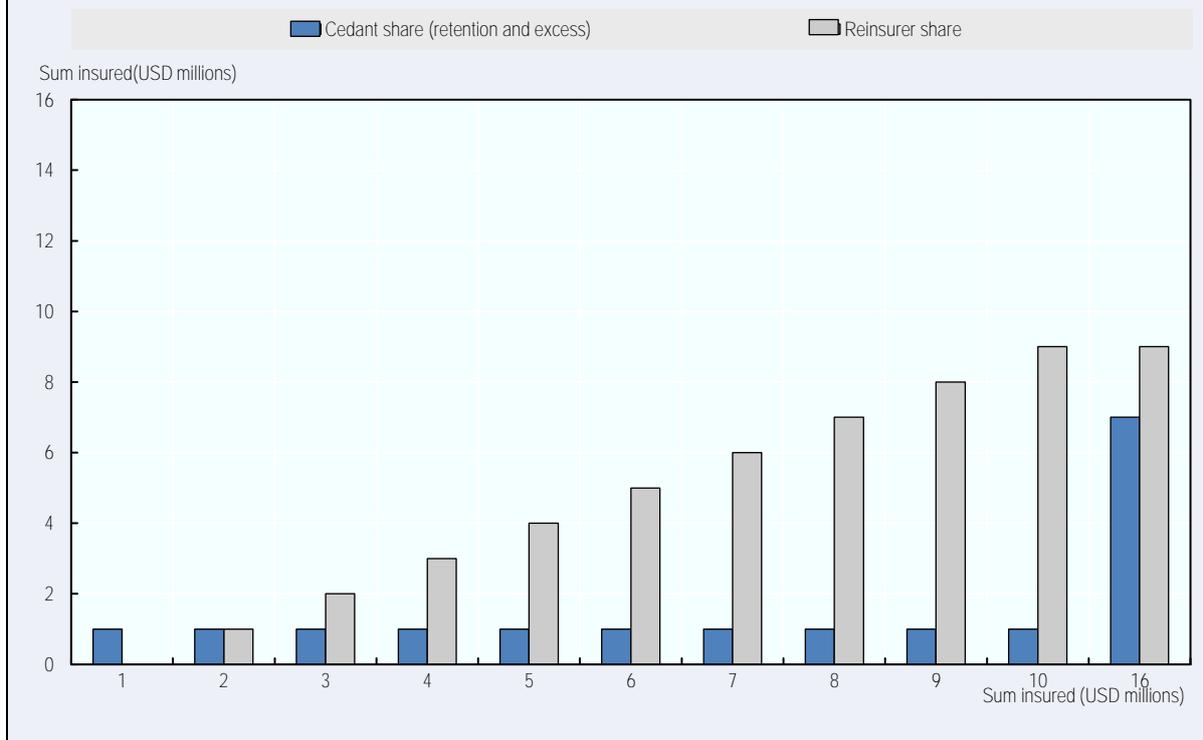
- *Surplus Reinsurance*: Under surplus reinsurance, the cedant retains all risks (underlying policies) up to a specific amount of liability (retention or line) and cedes to the reinsurer a percentage of losses for risks above that amount. The percentage of business above the retention that is ceded is set as a multiple of the retention. As a result, a small risk (an underlying policy with a small sum insured or limit) in the cedant's portfolio might fall fully within the cedant's retention with none of the risk ceded under the surplus reinsurance cover while larger risks in the cedant's portfolio (underlying policies with limits above the retention amount) would have a portion of the risk retained by the cedant and a portion of the risk ceded to the reinsurer (with the share ceded to the reinsurer increasing for larger risks). An excess portion of the largest risks (underlying policies with limits above a multiple of the retention) are also retained by the cedant (see Box A A.1). Surplus reinsurance tends to align more closely with an cedant's reinsurance needs by providing the advantages of a quota share arrangement without requiring the cedant to share premiums on smaller risks that it does need to reinsure. It is used to eliminate the peaks in a cedant's portfolio by homogenising the risks (cutting back the risks to the maximum retention). However, relative to quota share, surplus coverage does not protect the portfolio as a whole but only triggers for risks above a certain size and only partially covers risks that affect the overall portfolio. This is why surplus reinsurance is used where the potential for major and partial claims grows in line with the sums insured. Through surplus reinsurance, reinsurers provide the cedant with a relatively high underwriting capacity relative to the volume of ceded business.
- *Non-proportional reinsurance* has no fixed or pre-agreed division of premium and losses between cedant and reinsurer. Rather, all losses up to a specific loss amount (i.e. deductible, net retention or excess point) are retained by the cedant and any losses above that amount, up to a pre-agreed limit, are transferred to the reinsurer. The terms "excess of loss" and "non-proportional" reinsurance are often used interchangeably, however, some consider that stop loss is a type of non-proportional reinsurance that is different from excess of loss reinsurance. Excess of loss reinsurance protection is typically divided into layers which fit on top of each other. The working layer will absorb losses that are more frequent while higher layers will cover less frequent, but more severe losses. These layers have the same or similar terms but different limits and together add to the total limit of the reinsurance programme. Multiple reinsurers may participate on each layer. The working layer absorbs losses above the cedant's retention up to a certain loss amount above which higher layers of the programme take on liability up to the overall limit. Every claim under an excess of loss contract reduces the programme's limit by the size of the claim and once the cover is exhausted, reinsurers may allow the cover to be reinstated up to an agreed number of times (for an additional amount of premium). Excess of loss reinsurance allows a cedant to limit its liability in a way that is consistent with its risk appetite. Non-proportional reinsurance therefore helps to stabilise losses and, for certain types of cover, provides a cedant with increased underwriting capacity. Non-proportional

reinsurance is also less costly and complex to administer than surplus reinsurance. Unlike proportional reinsurance, non-proportional reinsurance cover is priced independently of the original insurance portfolio but using data from the underlying portfolio (Swiss Re, 1997<sup>[113]</sup>).

### Box A A.1. Surplus reinsurance example

A surplus treaty with a retention ("line") of USD 1 million will only apply to those risks (underlying policies) in the insurer's portfolio with a sum insured in excess of USD 1 million. For those risks included in the surplus treaty (i.e. those with limits above USD 1 million), USD 1 million is retained by the cedant with the rest ceded to the reinsurer with a capacity ceiling set as a multiple of the retention amount (e.g., ten times the line or  $10 \times \text{USD } 1 \text{ million} = \text{USD } 10 \text{ million}$ , so a maximum of USD 9 million is ceded and USD 1 million is retained per risk). Premium and losses are shared in this proportion from the ground up by the cedant and the reinsurer. Figure A A.1. provides a graphical representation of how losses would be shared under a (simplified) surplus reinsurance treaty with USD 1 million retained on each risk and a multiple of this ceded (up to USD 9 million ceded on a 10-line surplus), for risks with sums insured above USD 1 million.

**Figure A A.1. Example of 10-line surplus cession (USD 1 million per line)**



There are three main types of non-proportional reinsurance:

- *Excess of loss per risk (or per policy) reinsurance*: provides cover up to a pre-agreed ceiling above a cedant's retention for individual risks or policies in a cedant's portfolio. Only the actual amount of the loss incurred with respect to the specific risk is used to determine the amount of the claim for the purpose of reinsurance. Claims are typically also limited to a threshold of total claims paid over the annual risk period. Because the per risk reinsurance caps the cedant's exposure to that specific risk, this type of reinsurance is suitable for protection against large single risk losses and risks that are particularly prone to total losses. However, it is not suitable for protecting against cumulative losses, for example, a large number of risks could suffer small losses that each do not trigger the per risk reinsurance (such as a catastrophe event causing a large number of small claims).
- *Catastrophe excess of loss (per event/occurrence and aggregate) reinsurance*: In order to limit an accumulation of losses from a single event (e.g. a natural disaster or large-scale loss event), cedants will often purchase catastrophe per event excess of loss reinsurance. Instead of covering an individual loss per policy, catastrophe per event excess of loss protects against the total loss suffered by a number of policies within the covered insurance portfolio stemming from one event, irrespective of how many policies within the portfolio are affected. There will typically be a time limitation clause related to the occurrence of the peril depending on the peril and treaty (e.g. losses occurring within 96 hours for wind or 168 hours for earthquake are considered a single event). Cedants can also purchase catastrophe aggregate excess of loss reinsurance in order to protect against multiple catastrophes that each cause a loss that fall within the retention of the catastrophe per event reinsurance cover (i.e. do not trigger the per event cover) but together add up to substantial losses (although each event would normally need to individually cause losses above a minimum threshold). Catastrophe excess of loss per event reinsurance often allows for a reinstatement (for an additional premium) which provides cedants with assurance that reinsurance coverage will be available after a significant event.
- *Aggregate excess reinsurance (Stop-loss)*: A stop-loss treaty (or aggregate excess reinsurance) provides cover for an accumulation of losses over the effective period of the reinsurance contract. A share of total losses suffered by a cedant during the period, above an agreed deductible (typically set as a percentage of aggregate net premium), are covered by the reinsurer. Despite providing comprehensive cover, stop-loss reinsurance is not as common as other types of non-proportional reinsurance. A cedant would purchase this type of cover to protect against large claims fluctuations, specifically against an accumulation of losses in a single year. Stop-loss reinsurance is generally applied to a cedant's "net net retention", the liability remaining after a combination of other reinsurance has been used (Swiss Re, 1997<sup>[113]</sup>). Stop-loss reinsurance normally does not come with a commitment to reinstate coverage.

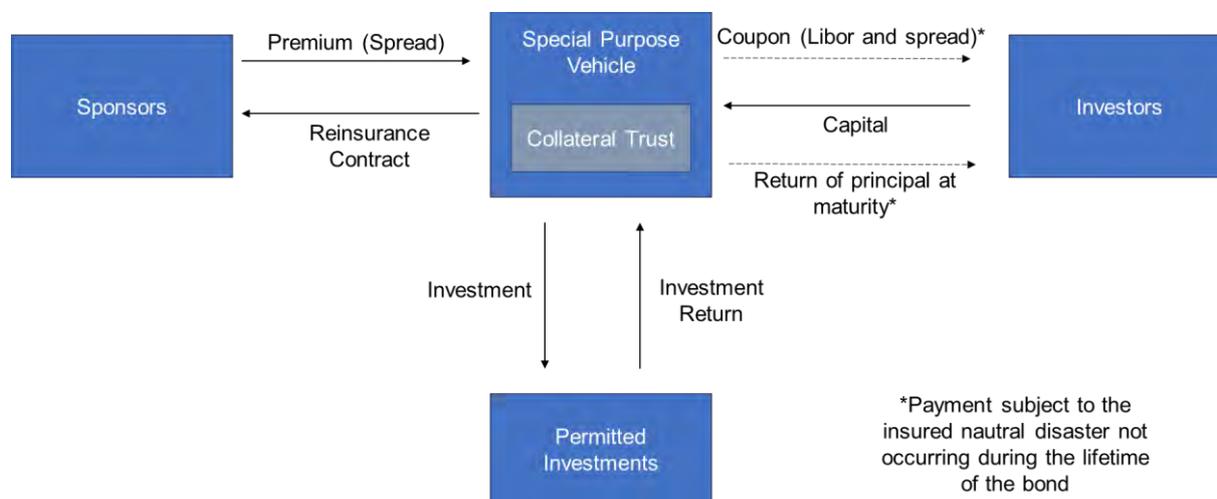
### Alternative reinsurance market coverage

There are a number of structures that have been developed to transfer insurance risk to capital markets, including special-purpose entities established to assume insurance risk and funded by securities issued to capital market investors as well as specific financial instruments such as industry loss warranties (ILWs):

- *Catastrophe bonds*: A catastrophe bond (or “cat bond”) is a structured debt instrument, usually structured as floating rate notes, which is used to fund reinsurance protection provided through a special-purpose entity. The risk is transferred from a cedant (usually an insurer or a reinsurer) to a special-purpose entity which issues a catastrophe bond to investors under terms and conditions similar to a reinsurance contract.

Cat bonds are usually structured as follows: (i) a cedant sets up a special purpose vehicle (SPV) that establishes a reinsurance agreement with the sponsoring cedant; (ii) the SPV issues a note to investors which have default conditions mirroring those of a reinsurance contract (i.e. a catastrophe event that would trigger a typical reinsurance catastrophe contract would cause a default on the bond); and (iii) the funds raised from investors through the note sale are managed by the SPV in a segregated collateral account and invested in near risk-free assets to generate money market returns (see Figure A A.2). The cedant (primary insurer or reinsurer) will periodically pay a premium to the SPV which is transferred as a coupon payment to the investors along with the yield earned on the invested funds. If the notes mature without a triggering event, the full principal as well as yield earned and any final coupon will be transferred to the investors. If an event does trigger the notes during the risk period, a portion or all of the principal is transferred to the cedant and the premium payments (coupons) are reduced or cease. The principal is therefore equivalent to the reinsurance (or retrocession) coverage limit under a reinsurance/retrocession contract.

**Figure A A.2. Structure of a catastrophe bond**



Cat bonds can be designed to trigger payouts based on: (i) the actual losses experienced by the cedant (indemnity-based); (ii) an index of industry-wide loss estimates for a given event (industry index-based); (iii) a modelled loss index where losses are estimated by a model using an event’s physical parameters and other vulnerability and exposure data (model-based); or (iv) the physical characteristics of the disaster event, such as magnitude and location of an earthquake or hurricane (parametric-based). Non-indemnity triggers have been significantly more prevalent in the alternative reinsurance market (relative to the traditional market). Because the parameters of an event are quickly known, the

payout from a parametric or modelled loss cover can be calculated and paid swiftly. A payout based on an industry loss index takes slightly longer to ascertain as the industry-wide data has to be collated. Payouts from an indemnity reinsurance cover take longer as the cedant needs to first calculate its underlying losses. Indemnity cover is also relatively more costly as it also needs to cover loss adjustment expenses. However, non-indemnity triggers will usually involve basis risk as the cedant's actual losses are likely to differ from the losses calculated using industry index-based, model-based or parametric triggers.

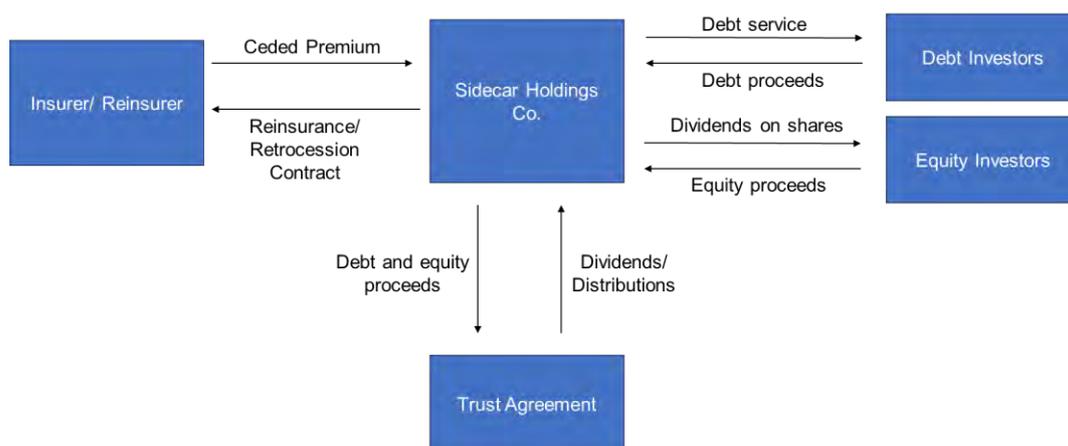
Cat bonds are mainly offered pursuant to Rule 144A of the US Securities Act which means they are securities which can only be bought by - and traded among - qualified institutional buyers. The relatively active secondary cat bond market allows investors to buy and sell out portions of their bonds and to adjust their exposure throughout the year. These transactions also tend to have multi-year duration - offering coverage over a number of years (compared to traditional reinsurance coverage which renews annually). The majority of cat bonds are exposed to property catastrophe, with a small portion covering a range of other risks such as pandemics, extreme mortality, healthcare, life embedded value, third party motor liability, lottery winning risk, mortgage insurance risks and operational risk. The majority of cat bonds provide coverage against US risk with some Japanese and European catastrophe exposure.

- *Private placement cat bonds*: Private placement cat bonds (or cat bond lites) are usually arranged by smaller insurers that are new to the cat bond market. These are offered under Section 4(a)(2) of the US Securities Act (i.e. securities not for public offer), meaning a lower level of disclosure on the underlying modelling and policy portfolio is required than for 144A cat bonds (therefore reducing the cost of set up) (Wilkie Farr & Gallagher, 2016<sup>[114]</sup>). A number of platforms have been established by reinsurance brokers and ILS fund administrators to issue private cat bonds. Additionally, reinsurance contracts can be converted into a cat bond lite in order to be able to trade the instrument. Private placement cat bond issues tend to involve smaller limits than 144A cat bonds and are less liquid.
- *Industry Loss Warranties*: An ILW is typically structured as a reinsurance contract or option (derivative contract) for which the payout is triggered by a catastrophic event causing aggregate industry losses that are above a predetermined trigger amount. The cedant purchasing the ILW cover would typically also need to suffer a loss from the event over a certain amount (dual trigger). There are a wide variety of ILWs sold on the market covering customised combinations of region/peril and industry loss trigger levels. Property Claims Services (PCS) and PERILS are third party index providers which calculate and report industry insurance losses. Industry loss triggers are more transparent than pure indemnity transactions as the first industry loss estimates are available within weeks of an event. However, using an industry loss index to trigger payment does not correlate fully with an individual company's losses and so introduces basis risk. ILWs mostly cover property catastrophe risk although a small portion of ILWs cover industry, energy and marine losses. ILWs are increasingly used in the retrocession market as reinsurers' portfolios tend to be more closely correlated to the industry as a whole and therefore face less basis risk.
- *Collateralised Reinsurance*: Collateralised reinsurance is reinsurance coverage provided by a special-purpose entity that issues securities to investors to fully

fund the potential claims that could arise from the coverage provided. The funding provided by investors typically amounts to the reinsurance contract limit net of premium and is held as collateral, together with the premium monies, in a trust account set up by the special-purpose entity and having the cedant as the beneficiary. It can take the form of a letter of credit or the two parties can enter into a trust agreement with a bank with the fund being held by a trustee until maturity or until a claim is made against the reinsurance coverage and a portion of the funds is paid out to the cedant (Soar, 2014<sup>[115]</sup>). The reinsurance premium constitutes the investor's return. Compared to cat bonds and ILWs, which predominantly cover property catastrophe risks, collateralised reinsurance arrangements have been established for a broader range of perils/business lines. Collateralised reinsurance deals tend to be smaller in size than cat bonds, do not normally offer multi-year coverage and are not liquid. Collateralised reinsurance is more often used to cover non-US exposures and multi-country or global exposures (as cat bonds are preferred for US risk).

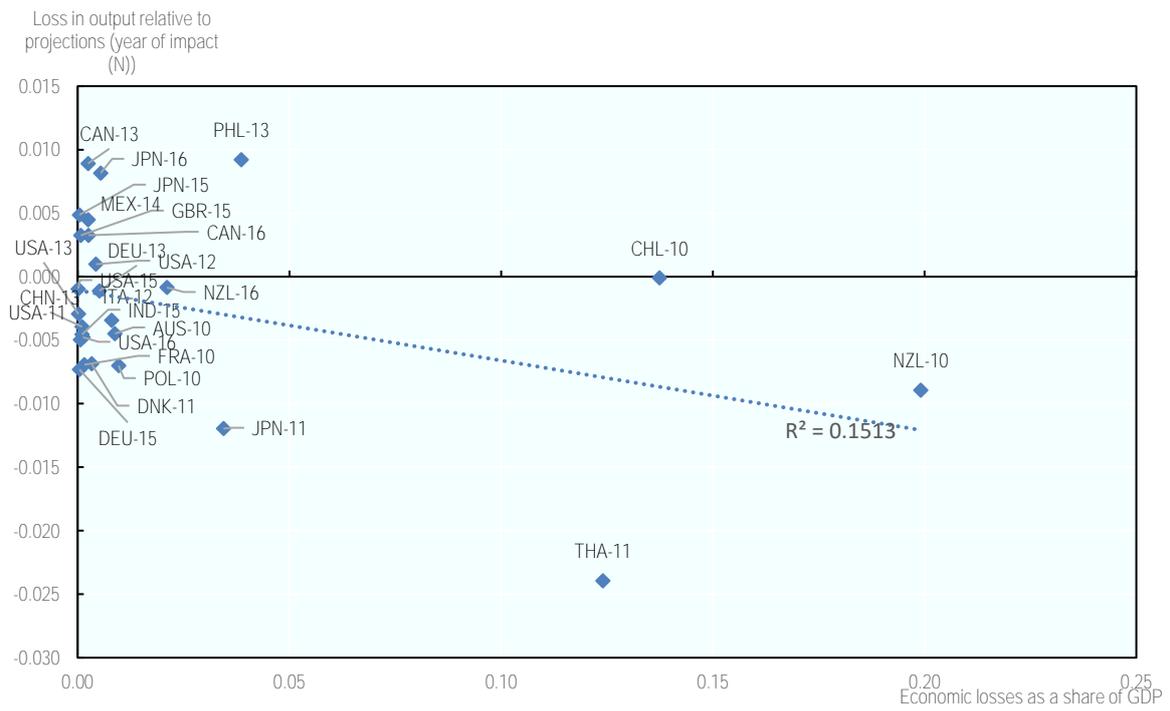
- *Sidecars*: A sidecar is a temporary special purpose reinsurer established by an insurer (or reinsurer for retrocession purposes) to transfer a specific book of business to the capital markets. A sidecar usually has a limited purpose and duration (usually one to three years), although some sidecars are more permanent and renew business annually depending on the capital available. Sidecars are financed by offering debt (usually bank loans) and equity to investors with the proceeds placed in a trust account as funding for losses that may arise under the ceded policies (see Figure A A.3). Most sidecars cede risk on a quota share basis and so provide the cedant (sidecar sponsor) with ceding and profit commissions. The number of sidecars has tended to increase after a catastrophic event when reinsurance pricing has risen (a hard market). A sidecar allows an investor to gain exposure to reinsurance risk without investing in existing reinsurers or having to set up a reinsurance company. Sidecars offer cedants a way to transfer risk at a potentially lower cost to the capital markets. Most sidecar exposure is to property catastrophe (reinsurance and retrocession) although sidecars have also been established to cover includes marine, energy and aviation risks (Artemis,(n.d.)<sup>[116]</sup>).

**Figure A A.3. Structure of a sidecar**



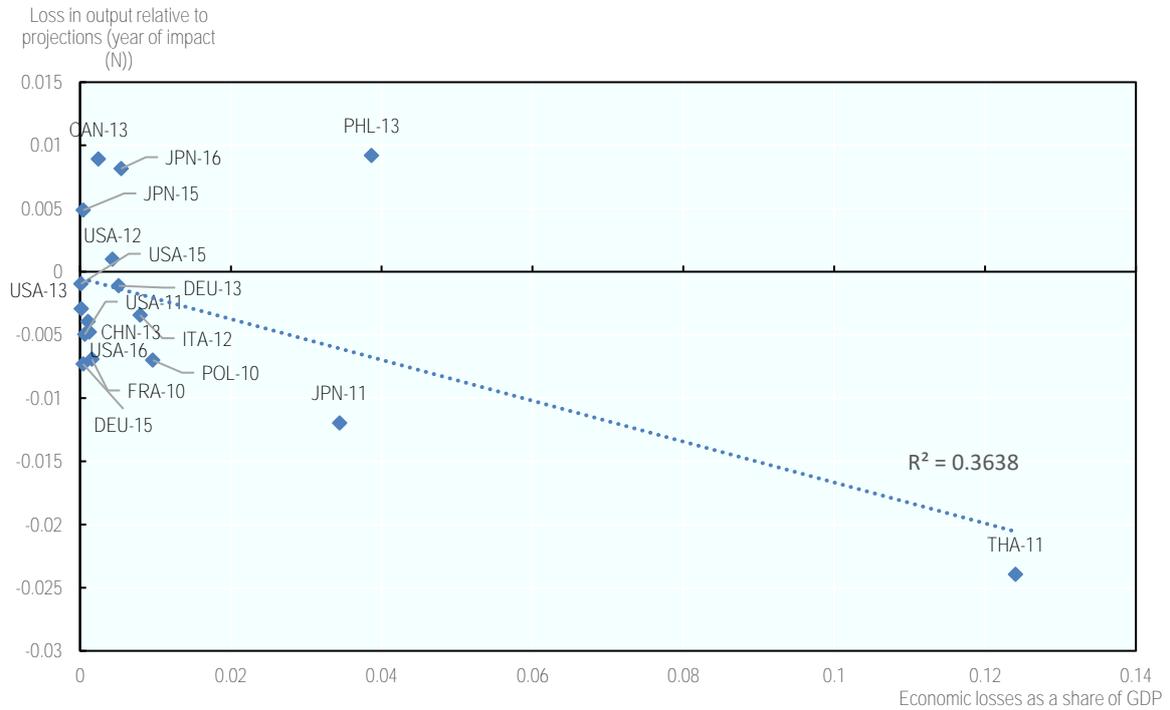
## Annex B. Estimates of lost output and catastrophe severity

**Figure A B.1. Loss of output in the aftermath of catastrophe events (full sample)**



Source: OECD calculations based on (IMF, 2017<sub>[25]</sub>) and (Swiss Re, 2018<sub>[20]</sub>).

**Figure A B.2. Loss of output in the aftermath of catastrophe events with more limited reinsurance coverage**



Source: OECD calculations based on (IMF, 2017<sup>[25]</sup>), (Swiss Re, 2018<sup>[20]</sup>) and data provided by reinsurance companies.





<http://www.oecd.org/finance/insurance>

