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◆ INTRODUCTION

Natural disasters resulting in significant losses have become more frequent in recent decades, with 2011 being the costliest year in history. This feature explores how risk is transferred within and beyond the global insurance sector and assesses the financial linkages that arise in the process. In particular, retrocession and securitisation allow for risk-sharing with other financial institutions and the broader financial market. While the fact that most risk is retained within the global insurance market makes these linkages appear small, they warrant attention due to their potential ramifications and the dependencies they introduce.

◆ FINANCIAL LOSSES

The year 2011 witnessed the greatest natural catastrophe-related losses in history, reaching \$386 billion (Graph 1 on the following page, top panel). The trend in loss developments can be attributed in large measure to weather-related events (Graph 1, bottom right-hand panel). And losses have been compounded by rising wealth and increased population concentration in exposed areas such as coastal regions and earthquake-prone cities.

These factors translate into greater insured losses where insurance penetration is high. At \$110 billion, insured losses in 2011 came close to the 2005 record of \$116 billion (in constant 2011 dollars). The reinsurance sector absorbed more than half of insured catastrophe losses in 2011. This considerable burden on reinsurers reflected the materialisation of various peak risks, notably in Japan, New Zealand, Thailand and the United States.

◆ RISK TRANSFER

Natural catastrophe-related losses are large and unpredictable. This section describes the sequence of payments based on contractual obligations that is triggered when an insured event materialises.

One can think of the insurance market as organising risk transfer in a hierarchical way. Losses cascade down from insured policyholders to the ultimate bearers of risk. When catastrophe strikes, the extent of physical damage determines total economic losses, a large share of which is typically uninsured. The insured losses, however, must be shouldered by the global insurance market. The public sector, when it insures infrastructure, often does so directly with reinsurers through public-private partnerships, although more data would be necessary to pin down the exact scope worldwide.¹ The majority of the losses relate to private entities contracting with primary insurers, the firms that locally insure policyholders against risks.

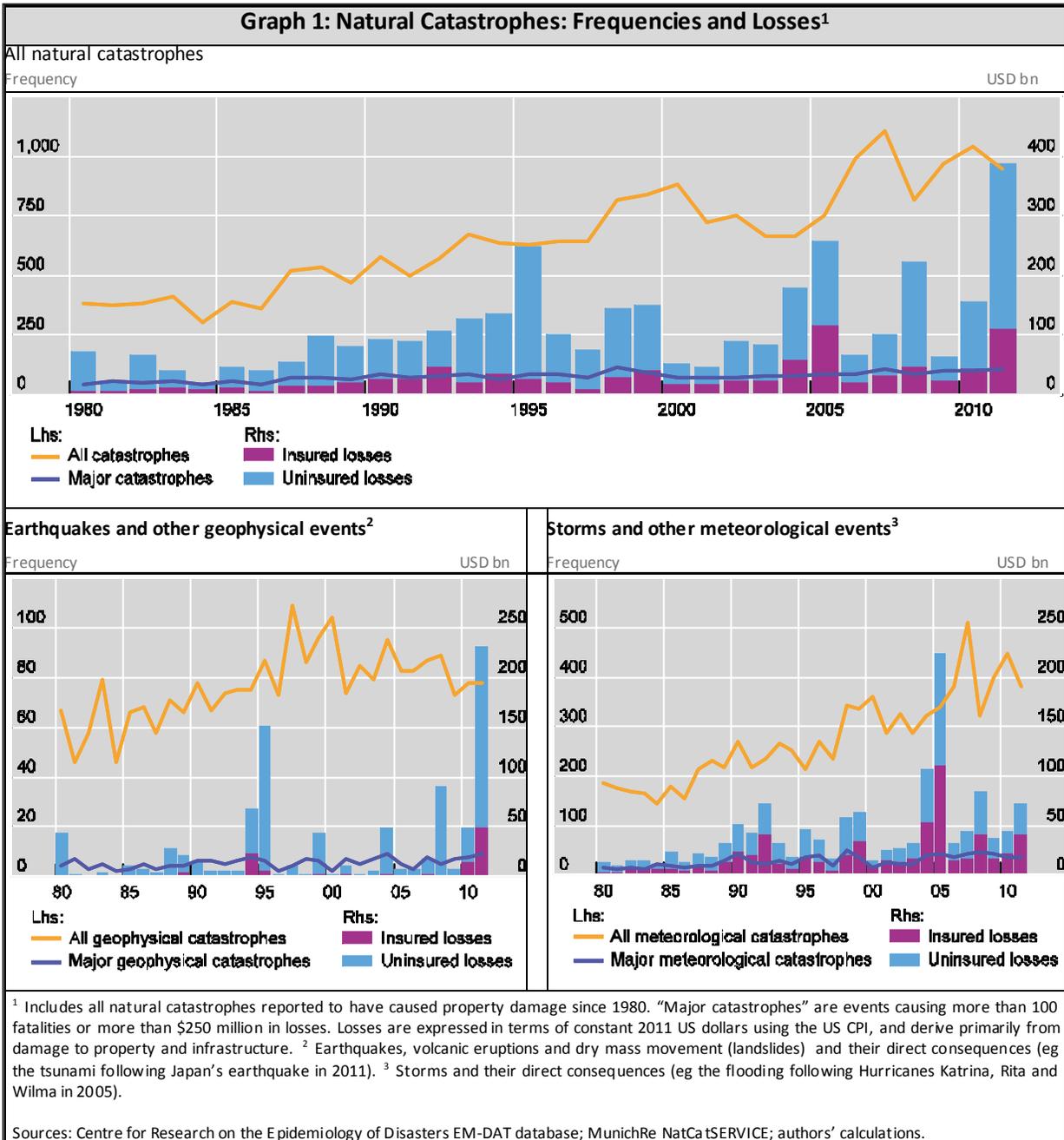
Claims for reimbursement thus first affect primary insurers. But they absorb only some of the losses, having ceded (transferred) a share of their exposure to reinsurance companies. Reinsurers usually bear 55–65% of insured losses when a large natural disaster occurs. They diversify concentrated risks among themselves and pass a fraction of losses on to the broader financial market, while ultimately retaining most catastrophe-related risk.

Before disaster strikes, however, there is a corresponding premium flow in exchange for protection. Based on worldwide aggregate premium payments in 2011, policyholders and insured entities, both private and public sector, spent \$4,596 billion to receive insurance protection. Some 43% of this global premium volume (\$1,969 billion) relates to non-life insurance and the remainder to life insurance products (IAIS (2012)). Primary insurers, in turn, paid close to \$215 billion to buy coverage from reinsurers. The lion's share, nearly \$165 billion, came from primary insurers active in the non-life business. About one third of this amount, \$65 billion, was geared towards protection against peak risks, with \$18 billion for specific natural catastrophe contracts.

(Continued on page 21)

¹ For example, in the late 1990s the Mexican government established a mechanism to support the rapid rehabilitation of federal and state infrastructure affected by natural disasters (Fonden), in which reinsurers play a key role in transferring risks outside Mexico.

NATURAL CATASTROPHES AND GLOBAL REINSURANCE—EXPLORING THE LINKAGES (CONTINUED)



By way of comparison, life insurance companies spent 2% of their premium income, \$40 billion, on reinsurance protection. This comparatively low degree of reinsurance protection is due to the fact that results are typically less volatile in life insurance than in non-life insurance. Following any risk transfer, insurers remain fully liable vis-à-vis the policyholder based on the initial contractual obligations, regardless of whether or not the next instance pays up on the ceded risk.

Reinsurance companies, in turn, buy protection against peak risks from other reinsurers and financial institutions. In this

process of retrocession, reinsurers spent \$25 billion in 2011 to mitigate their own downside risk. The bulk of this amount represents retroceded risks transferred to other reinsurance companies (\$20 billion in premiums), while a relatively small share is ceded to other market participants such as hedge funds and banks (\$4 billion) and financial markets (\$1 billion). An important aspect of this structure is the prefunding of insured risks. Premiums are paid ex ante for protection against an event that may or may not materialise over the course of the contract. These payments by policyholders

(Continued on page 22)

and insurers generate a steady premium flow to insurers and reinsurers, respectively. Only if and when an event with the specified characteristics occurs are the claims payments triggered. At all other times, premium flows are accumulated in the form of assets held against technical reserves (see next section).

Reinsurance contracts come in two basic forms which differ in the way primary insurers and reinsurers determine premiums and losses. Proportional reinsurance contracts share premiums and losses in a predefined ratio. Since the 1970s, non-proportional contracts have increasingly been used as a substitute. Instead of sharing losses and premiums in fixed proportions, both parties agree on the insured risks and calculate a specific premium on that basis. The typical non-proportional contract specifies the amount beyond which the reinsurer assumes losses, up to an agreed upon ceiling (first limit). Depending on the underlying exposure, a primary insurer may decide to buy additional layers of reinsurance cover, for example with other reinsurers, on top of the first limit.

“Excess of loss” agreements are the most common form of non-proportional reinsurance cover. For natural catastrophes, these contracts are known as CatXL (catastrophe excess of loss) and cover the loss exceeding the primary insurer’s retention for a single event. A major earthquake, for example, is likely to affect the entire portfolio of a primary insurer, leading to thousands of claims in different lines of business, such as motor, business interruption and private property insurance. As a result, primary insurers often purchase CatXL coverage to protect themselves against peak risks.

◆ PEAK RISKS AND THE REINSURANCE MARKET

A reinsurer’s balance sheet reflects its current and past acceptance of risks through its underwriting activity. Dealing with exposure to peak risks, which relate to natural catastrophes, is the core business of the reinsurance industry. Natural catastrophes are rooted in idiosyncratic physical events such as earthquakes. When underwriting natural catastrophe risks, reinsurers can rely to a large extent on the fact that physical events do not correlate endogenously in the way financial risk does. To achieve geographical diversification, reinsurers offer peak risk protection not just for one country but ideally on a worldwide basis.²

Another form of diversification takes place over time. Premiums are accumulated over years, and claims payments are usually paid out over the course of months or sometimes years. Statistics on reinsurance payments show that claims are typically settled over an extended period. On average, 63% of the ultimate obligations are paid within a year and 82% within

two years, and it takes more than five years after a natural disaster strikes for the cumulative payout to reach 100%.

The occurrence of a major natural catastrophe dents reinsurers’ underwriting profitability, as reflected in the combined ratio. This indicator sets costs against premium income.³ A combined ratio above 100% is not sustainable for an extended period.⁴ By contrast, *temporary* spikes in the combined ratio are indicative of one-off extreme events which can be absorbed by an intertemporal transfer of risk. The combined ratio spiked in the years featuring the most costly natural catastrophes to date: 2005, the year of major hurricanes in the US, and 2011, following earthquakes and flooding in Asia and Oceania. Both occasions also reduced the stock of assets reserved for meeting claims. Yet these temporary spikes in the combined ratio did not cut through to shareholder equity to any significant extent. Catastrophes affect equity only if losses exceed the catastrophe reserve.

Recent market developments caused shareholder equity to decrease more than insurers’ core underwriting business ever has. During the global financial crisis of 2008–09, shareholder equity (book value) declined by 15%, and insurance companies’ share prices dropped by 59%, more than after any natural catastrophe to date. In contrast, shareholder equity remained resilient in 2005 and 2011, when reinsurers weathered record high catastrophe losses.

In dealing with the consequences of peak catastrophe risks, the industry has gravitated towards a distinctive market structure. One important element is the size of reinsurance companies. Assessing and pricing a large number of different potential physical events involves risk management capabilities and transaction costs on a large scale. Balance sheet size is therefore an important tool for a reinsurer to attain meaningful physical diversification on a global scale. Partly as a result, the 10 largest reinsurance companies account for more than 40% of the global non-life reinsurance market.

In spite of the reinsurance market’s size and concentration, failures of reinsurance companies have remained limited in scope. The largest failures to date, comprising two bankruptcies in 2003, led to an essentially inconsequential reduction in

(Continued on page 23)

² For instance, the exposure to certain types of natural catastrophes is higher in the United States than in Europe. To diversify, US insurers cede (transfer) nearly twice as much in premium volume to European reinsurers than European insurers cede to US reinsurers.

³ The combined ratio is computed as $100 * (\text{losses} + \text{expenses}) / (\text{premium income})$.

⁴ That said, when financial market conditions were favourable, some insurance companies pursued a business model of loose underwriting standards and low risk premiums, believing that their investment returns would compensate for their elevated combined ratio. These companies were particularly exposed when markets deteriorated.

available reinsurance capacity of 0.4%. That said, any failure of a reinsurer leads to a loss of reinsurance recoverables by primary insurers, and could cause broader market tensions in the event of a disorderly liquidation of large portfolios.

In this respect, the degree of connectedness within the global insurance market plays an important role. Based on their business model, reinsurers enter into contracts with a large number of primary insurance companies, giving rise to numerous vertical links. In addition, risk transfer between reinsurers leads to horizontal linkages.⁵ We estimate that 12% of natural catastrophe-related risk accepted by reinsurers is transferred within the reinsurance industry, which implies that the industry as a whole retains most of the risks it contracts. In 2011, reinsurers paid 3% of earned premiums to cede catastrophe risk to entities outside the insurance sector. Judging by premium volume, the global insurance market transfers a similarly small share of accepted risk to other financial institutions and the wider financial markets.

◆ LINKAGES WITH FINANCIAL MARKETS

Arrangements designed to transfer risk out of the insurance sector create linkages with other financial market participants. Retrocession to other financial institutions uses contractual arrangements similar to those between reinsurers,

and commits banks and other financial institutions to pay out if the retroceded risk materialises. Securitisation, on the other hand, involves the issuance of insurance liabilities to the wider financial market.⁶ The counterparties are typically other financial institutions, such as hedge funds, banks, pension funds and mutual funds.

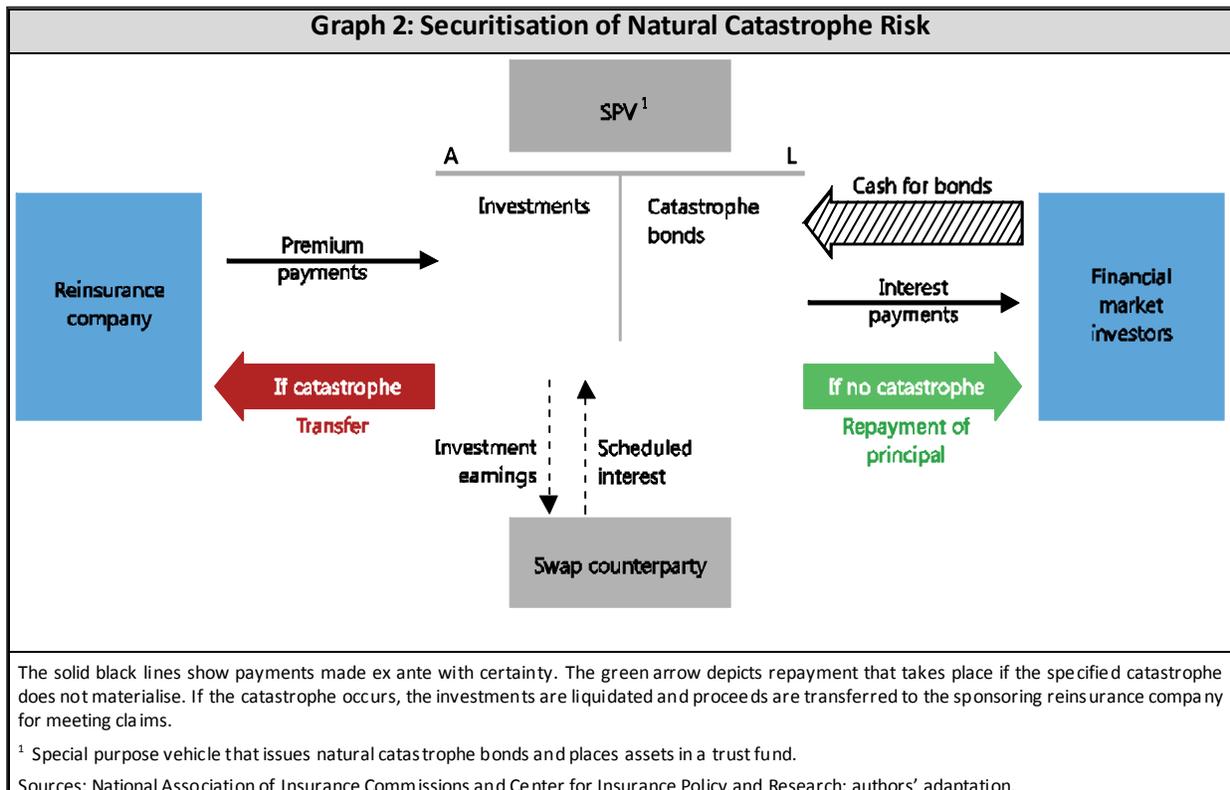
Among insurance-linked securities, catastrophe bonds are the main instrument for transferring reinsured disaster risks to financial markets. The exogenous nature of the underlying risks supports the view that catastrophe bonds provide effective diversification unrelated to financial market risk. For these reasons, industry experts had high expectations for the expansion of the catastrophe bond market (eg Jaffee and Russell (1997), Froot (2001)).

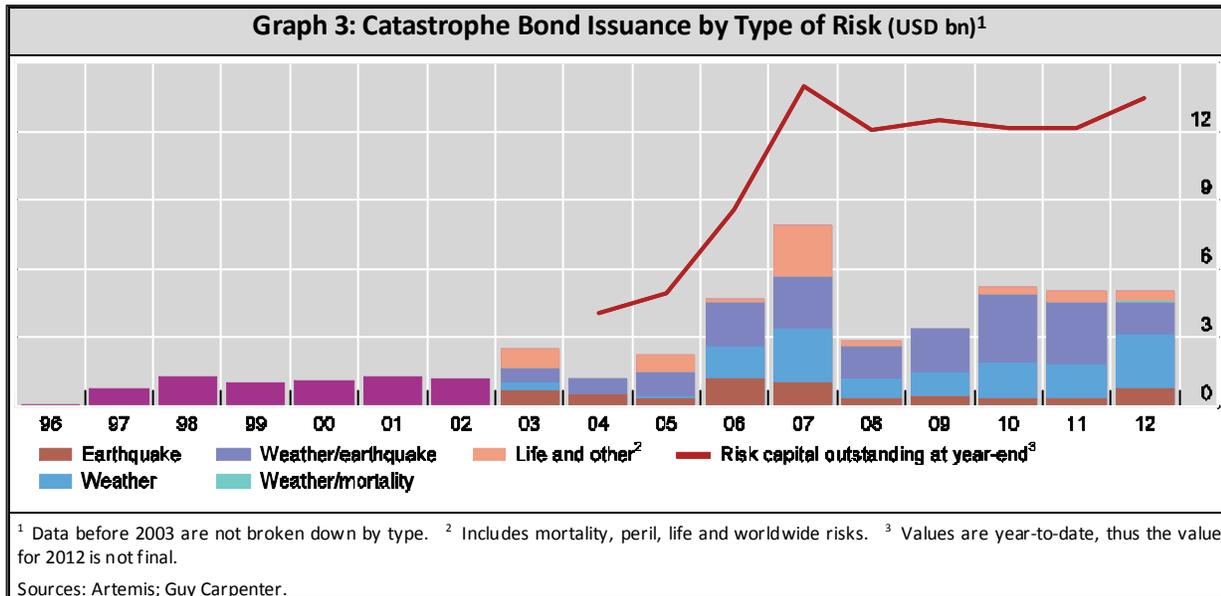
The issuance of catastrophe bonds involves financial transactions with a number of parties (Graph 2). At the centre is a special purpose vehicle (SPV) which funds itself by issuing

(Continued on page 24)

⁵ For example, a reinsurer might exchange some of its exposure to earthquake risk in Japan for US flood risk with another reinsurer.

⁶ This form of securitisation differs from the practice in credit markets in two ways: the securitised item is an insurance liability, and the sponsoring insurer retains ultimate liability should the counterparty fail to pay.





notes to financial market participants. The SPV invests the proceeds in securities, mostly government bonds which are held in a collateral trust. The sponsoring reinsurer receives these assets in case a natural disaster materialises as specified in the contract. Verifiable physical events, such as storm intensity measured on the Beaufort scale, serve as parametric triggers for catastrophe bonds.⁷ Investors recoup the full principal only if no catastrophe occurs. In contrast to other bonds, the possibility of total loss is part of the arrangement from inception, and is compensated ex ante by a higher coupon.

Despite experts' high expectations, the catastrophe bond market has remained relatively small. Bond issuance has never exceeded \$7 billion per year, limiting the outstanding capital at risk to \$14 billion (Graph 3). Very few catastrophe bonds have been triggered to date. The 2005 Gulf Coast hurricanes activated payouts from only one of nine catastrophe bonds outstanding at the time (IAIS (2009)). Likewise, the 2011 Japan earthquake and tsunami triggered one known catastrophe bond, resulting in a payout of less than \$300 million. Payouts to reinsurers from these bonds are small when compared to the sum of insured losses (\$116 billion in 2005 and \$110 billion in 2011).

The global financial crisis has also dealt a blow to this market. The year 2008 saw a rapid decline in catastrophe bond issuance, reflecting generalised funding pressure and investor concern over the vulnerability of insurance entities. The

crisis also demonstrated that securitisation structures introduce additional risk through linkages between financial entities. A case in point was the Lehman Brothers bankruptcy in September 2008. Four catastrophe bonds were impaired—not due to natural catastrophes, but because they included a total return swap with Lehman Brothers acting as a counterparty. Following Lehman's failure, these securitisation arrangements were no longer fully funded, and their market value plunged. Investors thus learned that catastrophe bonds are not immune to “unnatural” disasters such as major institutional failures.⁸

A further set of financial linkages arises with other financial institutions through cross-holdings of debt and equity. Insurance companies hold large positions in fixed income instruments, including bank bonds. At the same time, other financial entities own bonds and stocks in insurance companies. For instance, the two largest reinsurance companies stated in their latest (2011) annual reports that Warren Buffett and his companies (Berkshire Hathaway Inc, OBH LLC, National Indemnity Company) own voting rights in ex-

(Continued on page 25)

⁷ Such parametric solutions prevail because they are triggered by a predefined physical event and hence provide immediate clarity for all parties involved. Less common are, for example, indemnity solutions, where the trigger is based on actual losses, because it often takes a significant amount of time to determine the full loss amount.

⁸ Following this episode, sponsors of catastrophe bonds employed other types of collateral arrangements in lieu of total return swaps. There has recently been a shift towards the use of government bonds as collateral.

cess of the disclosure threshold (10% in one case and 3.10% in another). Additional shareholders with direct linkages to the financial sector have been disclosed by a number of reinsurance companies. The ramifications of such linkages in this part of the market are difficult to assess.

◆ CONCLUSION

The upward trend in overall economic losses in recent decades highlights the global economy's increasing exposure to natural catastrophes. This development has led to unprecedented losses for the global insurance market, where they cascade from the policyholders via primary insurers to reinsurance companies. Reinsurers cope with these peak risks through diversification, prefunding and risk-sharing with other financial institutions.

This global risk transfer creates linkages within the insurance industry and between insurers and financial markets. While securitisation to financial markets remains relatively small, linkages between financial institutions arising from retrocession have not been fully assessed. It is important for regulators

to have access to the data needed for monitoring the relevant linkages in the entire risk transfer cascade, as no comprehensive international statistics exist in this area.

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