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Managing Climate Change Risk Through CAT Bonds : Global Perspectives and Implications for Indian Re/Insurers

This study is focused on managing climate change risk through the use of catastrophe bonds as alternate risk transfer mechanism which allows insurers to spread their risks through capital markets and financial instruments rather than reinsurance market. In the last 20 years India has endured several natural catastrophes which were categorized as the direct result of climate change. Such events have immense impact on human life, economy of the country and the insurance industry as well as reinsurers' balance sheets. In this paper we explore the feasibility of catastrophe bonds and swaps as alternatives to risk transfer mechanism. It also attempts to analyze the need for alternate risk management mechanisms.

Key words: CAT bonds – Swaps – Climate Change Risk – Alternate Risk Transfer Mechanism – Solvency

Introduction

Several years ago, climate change has been one of the least relevant topics, but it has recently become one of the most pressing challenges. Floods, cyclones, forest fires and similar disasters that were exceptional or undefined before the last century, have now become the greatest concern for the entire human race in the twenty-first century. Climate change has a major impact on the entire world's population, and the expense of dealing with it has become enormous, posing anytime anywhere threat to a country's economy.

Insurance assures policyholders that losses will be covered according to the contract in the event of a mishap. Reinsurance assures insurers and Retrocession assures reinsurers.

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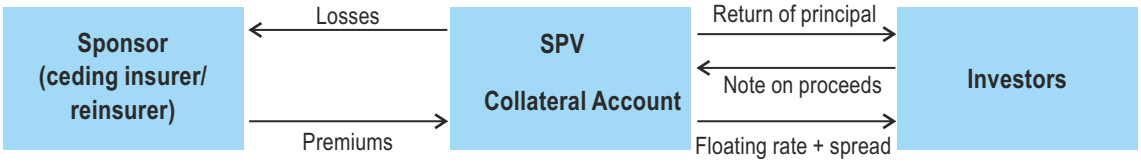
This chain cannot last forever, but the magnitude of losses has no such limit; they can exceed all limits in a fraction of a second, leaving insurers on the verge of bankruptcy (Heren, K. (2021, March 12).[1]

Alternate Risk Transfer (ART) mechanisms include Self-insurance, Risk Retention Groups, Pools, Captives, Risk Transfer, and Risk Retention Financing are some of the newest products in the insurance market. Risk Retention Group is a licensed group of insurers who retain and share their risks among the group members only rather than reinsuring. Pools are a group of insurance companies that pool their assets, allowing them to bear large losses collectively and Captives are insurance companies created by their members just for the purpose of insuring their risks. Alternate Risk Transfer entails the transfer of risks through reinsurance, while Risk Retention Financing entails a high level of retention backed by an investment foundation titled Reinsurance Management Insurance Institute of India in 2013.

Figure 1.1 : Structure of a CAT Bond



Source : Risk Management Solutions, 2013. (For illustrative and discussion purpose only)

Figure 1.1 shows Catastrophe Bonds as high-yielding special bonds issued by insurers or reinsurers to raise money in the event of a natural disaster. The subscribed money which is stored in a Special Purpose Vehicle (SPV) is inaccessible to the issuer until a specific catastrophe event occurs as defined at the time of the bond's issue. The investor earns interest on his investment at a predetermined rate until the stated catastrophe event occurs, at which point the fund is transferred from the Special Purpose Vehicle to the Bond Issuer, freeing him from paying interest and principal to the investor.

Insurance swaps are types of derivatives that entail a risk exchange agreement with different terms. Catastrophe swaps are specialized insurance schemes in which the risk is a natural disaster. This means that in the event of an insured catastrophe, both insurers will mutually safeguard one another. For example, a Philippine insurer may trade his Tsunami risk for a Hurricane risk in the United States, and in the case of a windstorm in

[1] *Use Broader Set of Cat Models to Avoid Bankruptcy "Cascade": Oxford Study, Trading Risk. https://www.trading-risk.com/article/289ct1qmvq4tm2xl0nuv4/use-broader-set-of-cat-models-to-avoid-bankruptcy-cascade-oxford-study.*

the United States, both insurers will share the loss in the agreed proportion. If a Tsunami strikes the Philippines, the opposite will also be true.

The investment base, which must provide a cushion for the company in the event of large losses, is the most crucial part of Risk Retention Financing. In order to support their retention, insurance companies use Capital Market Instruments such as debt, equity and hybrid methods. Bonds are debt instruments; stocks, derivatives, and other equity instruments are equity instruments; and a hybrid instrument is a blend of debt and equity. Alternative Risk Transfer does not have to be organized solely by insurance companies. Through capital market instruments, sovereign governments can actively participate in the active risk management.

The first successful CAT bond was a US$ 85 million issue by Hannover Re in 1994 (Swiss Re, 2001). The first CAT bond issued by a non-financial firm, occurring in 1999, covered earthquake losses in the Tokyo region for Oriental Land Company – the owner of the Tokyo Disneyland. We can observe that both financial and non-financial firms have been interested in these instruments since the last 5 years (Cummins, 2008).

The World Bank has assisted Jamaica in issuing and pricing specifically-named storm disaster bonds for three tropical Atlantic cyclones. The Jamaican government was the first in the Caribbean region to issue a catastrophe bond on this basis. If the loss from the insured perils exceeds a predetermined threshold, the bond will be paid out. Not only Jamaica, but the World Bank has supported several countries in distress. In 2017 and 2018 the World Bank helped earthquake-prone Philippines manage its catastrophe risks through World Bank Catastrophe Bonds. Mexican FONDEN is also supported by the World Bank. However, instead of taking a step after facing major disasters, if countries design their catastrophe programs in collaboration with the government and theinsurance companies, the post-disaster recovery will become relatively fast and planned.[2]

Other notable CAT bonds issued globally include Sempra Energy's SD Re Ltd.; catastrophe bond for California wildfires; Swiss Re's Matterhorn Re Ltd Series CAT bond for a 'named' storm in the United States; Zenkyoren's Nakama Re Ltd. CAT bonds for earthquakes in Japan; Pool Re's Baltic PCC Ltd CAT bonds against Terrorism Risks, etc. (Artemis, 2019).[3]

[2] *World Bank Catastrophe Bond Transaction Insures the Republic of Philippines Against Natural Disaster-related Losses up to US$225 Million. World Bank. https://www.worldbank.org/en/news/press-release/2019/11/25/world-bank-catastrophe-bond-transaction-insures-the-republic-of-philippines-against-natural-disaster-related-losses-up-to-usd225-million*

[3] *Catastrophe Bond and Insurance-Linked Securities Deal Directory - Artemis.bm. Artemis.bm - The Catastrophe Bond, Insurance Linked Securities and Investment, Reinsurance Capital, Alternative Risk Transfer and Weather Risk Management site. Available at: https://www.artemis.bm/deal-directory/.*

Alternate Risk Transfer using catastrophe bonds and swaps are better than traditional reinsurance as the former does not require a policyholder to pay to the insurance sector. Instead, an investor can invest through bonds and swaps, distributing the risk across a larger base. Furthermore, capital market instruments have well-defined growth indicators, whereas no such indexes exist for insurance. Natural disasters have become more common in recent years disrupting the entire insurance ecosystem and the traditional reinsurance is growing more expensive as a result of the rising frequency of very large claims for insurers. Furthermore, the reinsurance program was created with the goal of securing rather than investing and reaping profits. Catastrophe bonds and swaps, as capital market instruments, provide a (handsome) return to investors based on their investment. Different products can be designed based on the risk appetite of the investors, ensuring a higher return to an investor investing in high-risk instruments. E. 2. (2005).[4]

Even if a country's insurance ecosystem is very weak, catastrophe bonds can attract investors from within and beyond the country when the bonds are issued by the government and provide a sovereign guarantee for returns to investors. In addition, by issuing such a bond, the government will establish a distinct special catastrophe fund, making disaster recovery financing simple and quick. This will also reduce the drain on the government funds and strain the resources in the event of a disaster, because a pre-determined fund base will be readily available.

Significance of the Study

In India climate change is becoming intense due to the frequency and intensity of heat waves which also cause increase in floods and landslides. During the last two decades, India has witnessed an increase of climate-change related disasters by three-fold starting with Gujarat earthquake in 2001, tsunami in 2004, Bihar flood disaster in 2007, Uttarakhand flash floods in 2013, Kashmir flood in 2014, Kerala floods in 2018 and 2019 and recently Maharashtra floods in 2021. As per the UN report, India has suffered a total loss of Rs. 31,000 crore in Kerala floods 2018. In Maharashtra floods (2021) the losses are somewhere to the tune of Rs. 700 crore. The economic losses around the world, due to climate-related disasters, are between US$ 250 to 300 billion as per the United Nations office for disaster risk reduction. Less developed countries are the most affected due to natural disasters.

[4] *ECB Financial Stability Review. ECB.*

The frequency and severity of natural catastrophes have devastating effects on the economy. Thus, disaster risk management is becoming increasingly significant and calls for urgent attention. There may come a time, when government funds may not be able to compensate for the losses and damages arising out of extreme natural calamities, which may lead to high fiscal deficit. Such catastrophe losses may also lead to bankruptcies of many insurance and reinsurance companies. Hence, there is a need to study and suggest alternative risk mechanisms like CAT bonds and SWAPS to transfer risks to securities.

Objectives of the Research

1. To analyze the need and utility of Catastrophe Bonds (CAT bonds) as an alternative risk management mechanism in managing climate change risk.
2. To analyze the implication of CAT Bonds on Indian Insures/Reinsurers and their role in managing climate change risk.
3. To do a comparative study on the implemented use cases of the CAT bonds globally through various organizations.

Methodology

Using the literature review method, we conducted a thorough investigation and interpretation of data by in depth content analysis. The focus of the study was on climate change risks and alternative risk-management mechanisms with respect to catastrophic (CAT) bonds and swaps. Data is collected from reputed research journals, articles and various reports of the past 20 years. Data analysis was carried out by reviewing in depth selected research papers and publications; specific attention was given to reports and statistics produced by global financial institutions such as the World Bank in order to gain a global perspective at the macro level.

In depth literature, review methodology was chosen as the availability of literature and paper on the study was comparatively more than the available implemented use cases of the CAT bonds globally. We attempted to establish an essence that would serve as a foundation for re/insurers and research academics by combining existing research work with implemented use cases by global organization.

Literature Review

Ample literature on this study is available to substantiate the objectives framed. This not only facilitates an in-depth analysis on the subject but also provides a basis for critical thinking and a scope for further research. Literature review on managing climate-change risk and alternate-risk transfer mechanism is inclusive and illuminating.

Articles and Published Papers

The catastrophic bonds are event-linked securities which pay a premium to investors that provide benefits to the UK-based pension scheme (Mann, 2013). The catastrophic bonds had a favorable outcome to many asset classes. Therefore, catastrophic bonds help in distributing the catastrophic risk through insurance-linked securities enthralling investment option for pension schemes (Green, 2013).

The application of catastrophe bond by non-financial companies identify the limitations of its usage. Further, it discusses that CAT bonds are applied in investment decisions to develop high returns in comparison to traditional bonds and also increase diversification of investment portfolio (Blach, 2014). The researcher finds that CAT bonds may be applied by non-financial companies to improve their portfolio. However, the researcher is of the opinion that one should reconsider the use of CAT bonds as there are various limitations. Thus, CAT bonds are relatively expensive owing to intricacies, besides the adoption of this application is limited (Wierzorek-Kosmala, 2014).

The World Bank issues catastrophe bonds and pandemic bonds which have potentially higher yields and diversifies portfolios that include new perils. It also provides the example of the 2014 Ebola Crisis in West Africa, after which the Pandemic Emergency Financing Facility (PEFF), catastrophic bonds were issued by the World Bank and sold to investors and insurance-linked swaps (The World Bank, 2013).

Another method of transferring risk has been identified through the financial instruments such as options, bonds and property catastrophe swaps (securitization) in order to trade property risk. These insurance firms can hedge their exposure by shifting the risk to investors who take positions on the occurrence and cost of catastrophes. Thus, these instruments must be promoted to the insurers and investors to reduce liquidity risk (Borden & Sarkar, 1996). A study on how CAT bonds respond to the after-effects of a financial crisis or a natural catastrophe shows that the financial crisis has had a considerable impact on the premiums on CAT bonds. Furthermore, it is assumed that investors are to make investment decisions through rating information. Therefore, a standardization of CAT bonds could also appeal to the less-experienced investors. The lesser uncertainty and stronger demand might result in cheaper premiums, which would be favorable to both the originator and the consumer (Gürtler, Hibbeln & Winkelvos, 2012).

These CAT bonds are used for strengthening the balance sheet of a reinsurance company which has made them insolvent. The insurance-linked securities have attracted more investors who deliver high returns and prospective long-term investment in the asset class. Thus, the diversification of asset class are those valuations that are set on the impact

of the natural catastrophes rather than financial market fluctuations. Additionally, as the market grows the scope for diversification of various tailor-made portfolios for different perils, regions and trigger-exposure support the liquidity (Difiore, Drui & Ware, 2021).

The catastrophe bond market has offered insurance companies with protection against the more common but costly natural disasters. This article describes how CAT bonds function before examining how the market has evolved in size, coverage, and sophistication over the last two decades. It also looks at how and why various organizations employ CAT bonds to transfer insurance risks (Polacek, 2018).

CAT bonds work well in high-risk layers and where the reinsurer default risk is high; it acts also as a protection over and above the RI blanket (Gotze & Gurtler, 2021). It reduces the counter- party credit risk of the reinsurer in case of large claims, and also extensively help in areas where adequate reinsurance capacity is not available. For investors, though CAT bonds are a market instrument, their return and trigger are independent of market factors (Swiss Re, 2012). Implementing CAT bond with a global organization, like the World Bank, requires a lot of expertise as the organization already has the idea and experience of implementing it. Further, the organization can help various countries manage and transfer risks in conjunction with each other.[5] (World Bank Capital Market Department, 2018).

Implementing CAT Bonds requires a lot of preparatory study which may take a long period of time. The World Bank's solutions and expertise can help countries plan and implement the CAT bonds at a much faster pace with its expertise and experience (World Bank, 2018).

The use of derivative instruments can help in sustainable financing; it can also pool resources and funds to finance the low-carbon economy. Working towards a sustainable development by reducing carbon footprints will put a strain on resources which can be managed through derivatives (Lannoo & Thomadakis, 2020).

The government plans assume that big risks of corporations are insured fully by insurers and in the event of any mishap, the insurance company will balance the loss. However, practically, insurers may not be having that large capacity even after having resort to reinsurance. CAT bonds can play a significant role in such scenarios in order to insure the uninsurable risk (Schwarcz, 2020).

The capital market instruments are subject to market risk and so the CAT bonds may not get a good response during a major financial crisis, like in 2007 (Edesses, 2014).

[5] *Demystifying CAT Bonds for Each Other, World Bank Capital Market Department, 2018.*

Although, catastrophe bonds can help fill any insurance or reinsurance gap to support the economy during any unprecedented catastrophe event, countries may not be able to depend fully on such bonds due to the associated risks, but they can certainly help manage the reinsurance capacity gap (Nell & Martin, Richter & Andreas, 2000).

These CAT bonds transfer the risk to a larger number of the public via the capital market and this helps manage the reinsurance gaps. However, an underlying requirement is a well-established and regulated capital market without which these bonds may fail their purpose (Lakdawala & Zanjani, 2006).

India's stance appears to be mostly idealistic and ideological, asserting that India remains a poor country and that climate change mitigation can be viewed as the responsibility of the rich world (Messner, 2017: 21). The Indian climate negotiators, who were mostly selected from the Indian Foreign Service (IFS), supported the negotiation techniques that were mostly unaffected by domestic politics. The Indian media and environmentalists were likewise skeptical of the global climate change debate and took a neutral stance on the subject (Lele, 2011). Of all the adaptation measures identified and developed, community-based containment and preparedness planning are the keys, as this strategy would significantly enhance the capacities of communities by expanding their response spectrum. Community climate change adaptation mechanisms across the country need to be identified, improved, and extended to larger areas with similar socio-economic backgrounds (Prabhakar & Shaw, 2007). While India understands the gravity of the situation, mitigating climate change at the expense of its development appears to be an unfair bargain. The previous climate policy of the Government of India was not motivated by domestic demand, but by external pressure. This is deeply ironic, as India faces much greater immediate threats from climate change than the rich countries that pressure her to act more objectively (Wasnik, 2014).

The proposed Risk Management Index (RMI) is the first systematic and consistent international index designed to measure risk management performance. The conceptual and technical foundations of this index are solid, although inherently subjective. The RMI will enable systematic and quantitative benchmarking of each country over the different time periods, as well as cross-country comparisons. This index allows disaster risk management to be represented not only at the national (macro) level, but also at the sub-national (rural ?) and urban (micro) levels, and permits risk management performance benchmarks to set performance targets to improve the effectiveness of risk management (Liliana, Carreño, Tibaduiza, Omar, Cardio & Barbat, 2007).

Two important aspects of risk management are inclusiveness and specificity. Risk management and transfer mechanisms must take into account the vulnerabilities of all members of the society and their specific needs based on actual data and the local circumstances, considering also the socio-cultural factors and the existence of traditional mechanisms of risk-sharing, such as borrowing, lending, pledging, livelihood diversification, community risk groups, community planning, information sharing, seasonal migration and wealth accumulation (Trust, 2021).

Natural disasters generally have greater varied impacts on less-developed societies. Not only do they kill and maim people, cattkle, physical structures, economic assets, and sensitive environments but they also have the effect of severely restricting sustainable development. Shook, (1997), and Jha *et al.* (2010) highlighted a strong link between disaster and poverty, whereby the poor households are often the most affected when disasters strike. For this reason, countries around the world has started paying more attention to alternate risk transfer mechanism as way to mitigate losses and recovery.

Cummins and Mahul (2009) state that international financial institutions (such as the World Bank) and donor countries have supported the guidelines for disaster risk management. The governments should therefore focus on an integrated disaster risk management system. This includes developing enhanced early warning systems, strengthening institutional capabilities and structures for emergency preparedness and response, investment in mitigation for critical infrastructure protection, and developing risk management products.

Michel-Kerjan *et al.* (2011) proposed the use of tools in managing disaster risks, depending on the country's level of economic development (high or low) and the demand for risk management. They concluded that countries with the lowest economic development often have insufficient budgets for preventative/proactive risk management and, therefore, utilize assistance funding from international organizations or international donation organizations, which results in having to wait long periods for financial assistance to reach the affected destination/nation. On the contrary, countries with the highest economic development often find that the insurance market is relatively developed and governments proactively engage in reinsurance for disaster forecasting and management.

Hochrainer and Mechler (2011) shed light on the events of frequent occurrences with damages valued at low to medium amounts. The government should, therefore, deploy prevention mechanisms which would be more effective in terms of capital in comparison to risk financing. The emergence of alternative risk transfer instruments, like the CAT

bonds and swaps, are not accidental; in fact the preconditions are well-defined. Santomero and Babbel (1997) are of the view that climate change is a more focused rationale for such a kind of risk management that combines hedging strategy with corporate financial management.

The cost of catastrophic insurance and reinsurance reflects the burning cost in addition to high transaction cost, actual losses and expectations of future losses that have increased in recent years. Thus, there has been an unprecedented level of insured catastrophe losses in the past decade compared with earlier periods (Lewis & Murdock, 1996; D' Arcy & France 1992; Cummins, Lewis & Phillips, 1998).

High Frequency and low severity catastrophes are managed better using traditional reinsurance, but in the case of low frequency high severity risks, the insurance capacity may fall short and thus catastrophe bonds prove better.

CAT bonds provide an opportunity to insurance and reinsurance companies to transfer non-diversible risks. For an investor, these bonds attract investors who are interested in instruments that are uncorrelated with traditional financial instruments. Designing appropriate catastrophe bonds to securitize systemic risks in agriculture is also required (Vedenov, Epperson & Barnett, 2006).

Catastrophe bonds were introduced to give protection against the world's most expensive/ destructive natural disasters. The two dimensions "peril" and "territory" are commonly used to characterize the underlying natural catastrophe risk. The peril is the type of hazard that the catastrophe bond protects against, and the reference to the territory establishes where the hazard occurrence must occur in order for the bond to be valid (Braun & Kousky, 2021).

The Chicago Board of Trade has been using insurance index derivatives since December 11, 1992. The claims' ratio of a given reference pool of insured risks serves as the basis value for an insurance index derivative. The pool is a made-up portfolio of natural disaster risks that are genuinely insured by certain insurance businesses known as pool insurers. Risk securitization is an alternative to risk transfer of insurance companies (Wagner, 1998).

The quantum of funds utilized to finance reinsurance has been rapidly increasing for all the countries around the world. The majority of growth continues to come from the reinsurer and the insurance profits, but fresh capital is coming in from places that did not exist 15 to 20 years ago. While these alternative capital structures have had little effect on the average policyholder, they have had a huge impact on how reinsurance is written around the world (Hartwig, 2015).

Insurance companies are active risk-takers in credit transfer markets, employing credit derivatives to gain access to risks not available in cash markets. Some large insurance companies function as intermediates, offering clients various financial products and services in addition to standard insurance products. The largest property-casualty businesses - European and Bermuda Reinsurers and mono-line insurance companies – are among the types of insurance companies participating in markets (Andersen, 2002).

The insurance sector has chosen the mono-line approach to risk, isolating different categories of risks into different insurance products. Complex business hazards and sophisticated risk management, on the other hand, are increasingly advocating an integrated strategy. ART solutions were created to meet these needs and to lower the risk cost over time (Gaste, 2004).

The government's active involvement in disaster relief, rehabilitation and reconstruction entails a significant and immediate financial cost. While the burden varies widely depending on the country's definition of the government's contingent duty for natural catastrophes, there are many commonalities. The government is expected to give emergency relief to the affected populace during and immediately after a catastrophe. These expenses are usually minor in comparison to the total event cost that would be involved, but necessitate immediate and urgent cash flow.

Discussion

For decades, climate change was an under-appreciated issue, until its direct impact on natural catastrophe risks posed a direct and major threat to humanity's survival. Various natural disasters have occurred during the last 20 years, wiping off large swaths of the population and devastating the economies of several countries. Californian wildfires, Australian bushfires, flash floods, Amphan cyclone, Vamco typhoon, and other natural disasters occuring intermittently have compelled governments and countries throughout the world to stop, think and act quickly in order to safeguard the areas of vulnerability and also rehabilitate the stricken areas and people.

However, because the damage did not occur overnight, rehabilitating will take time, and the cost of post-disaster recovery will continue to burden governments and the general public. Governments have begun making budget allocations to deal with such disasters. California state budget for 2021-22 includes a $1.2 billion allocation for fires (Budget and Policy Cost, Legislative Analyst's Office, 2020). However, such provisioning will never be sufficient to adequately manage all risks, and, such budgetary provisions will be extremely challenging economically for developing and underdeveloped countries that already have large fiscal deficits and debts.

It is difficult to have a pre-defined and foolproof solution for such natural catastrophes because their location, frequency and intensity are unknown and unpredictable factors. Insurance firms try to cover these disaster risks, but if the frequency of such hazards increases, the insurance companies' capital will dwindle and they will eventually go bankrupt. On the other side, the government has difficulty in supporting catastrophe-recovery programs because it would have a cascading effect and significant impact on its funds and the related-government development activities.

Even if reinsurance facilities are well developed in various countries, credit risk must be considered. In the event that an unanticipated climatic change causes a never-before-seen catastrophe, reinsurance capacity may be insufficient to meet the requirements. The Canadian heatwaves of 2021 are an excellent example of the problem. Canadian reinsurers would never have imangined that heat waves would be a risk in Canada and hence no disaster recovery plans would have been put in place. It is tough to build additional reinsurance capacity for such a scenario and initially such catastrophic events could jeopardize the reinsurer's very existence. Governments and reinsurers, on the other hand, can design and launch catastrophe bonds for a period of time until strong reinsurance capacity is built up.

In the case of some developing and underdeveloped nations, governments must borrow funds from other countries or international organizations, such as the World Bank, which carries also an interest component that puts pressure on government finances. External commercial borrowings also result in the depreciation of the domestic currency, a decrease in foreign exchange flow, a sudden shift in the market equilibrium, and other issues, all of which create problems for governments. As a result, governments should become more involved in resolving disaster management issues besides ensuring the overall growth of the country. It may lead to a vicious cycle that is harmful to the country but it is also a priority.

The insurance firm's solvency and profitability deteriorate as a result of a large number of claims triggered by disasters and diminish investor interest in the company. Furthermore, due to the insurance business's weak financials, policyholders' trust shifts to other companies, which would have a negative impact on the company’s existence thus creating a vicious cycle for the insurance company. As a result of such scenario, insurance companies are hesitant to cover large risks or develop new risk products, thus putting the country's economic progress at risk.

Insurance, reinsurance, and self-financing (no insurance) are all traditional ways of managing a post-risk recovery. Predictions about on-coming disasters and ameliorating

strategies have been supported by a number of researchers over a long period of time. However, as the frequency of catastrophe events increases, these traditional approaches do not fully serve their purpose. The occurrence of such events have put immense pressure on the government resources and insurers' coffers. Alternate Risk Transfer (ART) mechanism is a novel yet interesting concept that has gained desirable popularity in recent years. It encourages non-traditional risk management in order to successfully manage the consequences of natural disasters.

Alternate Risk Transfer (ART) umbrella includes Self-insurance, Risk Retention Groups, Pools, Captives, Risk Transfer, and Risk Retention Financing which comprise managing risk from using traditional insurance instruments to latest capital market instruments like bonds and swaps. Risk Retention Group is a licensed group of insurers who retain and share their risks among the group members only rather than reinsuring. Pools are a group of insurance companies that pool assets, allowing them to bear large losses collectively, and Captives are insurance companies created by member companies just for the purpose of insuring their risks. Risk Transfer entails the transfer of risks through reinsurance, while Risk Retention Financing requires a high level of retention backed by an investment foundation.

Risk Retention Financing is a hybrid instrument that combines traditional insurance with a return-based financial product that may be traded on the capital market and sold to a diverse groups of investors. Capital market instruments such as Bonds and Swaps, which are better known as return-based instruments, are included in risk retention financing. Combining returns with risk management attracts a huge number of investors who are willing to put money into the instruments in the hope of making a reasonable profit.

Bonds and swaps are not new to the sector, but adding insurance is, and utilising them to manage disaster risks is the most recent addition. Bonds are fixed-income debt securities sold to investors by corporations (including the government), and they function entirely as a loan from the investor to the insurer.

Catastrophe bonds and swaps are two different forms of financial securities with different uses, advantages, and disadvantages. Each of them, however, takes a different approach to catastrophic risk management than traditional insurance. Catastrophe bonds have sparked a lot of attention and inquiry, but swaps remain a complicated topic that necessitates in-depth investigation. Few global organizations, such as the World Bank, have begun actual work on the use of catastrophe bonds with nations such as the Philippines and Mexico, but swaps remain a niche product that has yet to be proven in practice.

Capital Market Instruments are frequently viewed as high-risk instruments whose values are subject to market forces, which discourage potential investors from participating in the market. Catastrophe bonds, on the other hand, are debt securities with an assured return, thus investors will only lose money if the bonds' threshold condition is fulfilled. This could entice investors to invest in the bonds due to the guarantee of a high fixed rate of return for the duration of the bonds.

Global Disaster Scenario

1. Mexico's FONDEN

Mexico's western coast is located in the Ring of Fire Zone of the Pacific Ocean, which is prone to regular catastrophic earthquakes, storms, floods and hurricanes. The Mexican government proactively established the FONDEN National Disaster Relief Fund to assist the post-disaster recovery efforts. However, the FONDEN system failed owing to financial constraints and insufficient support. Based on the review of a consultant firm, and in Partnership with Swiss Re, the Government of Mexico issued the Catastrophe Bonds to reinvigorate Mexico's FONDEN. SWISS Re also managed the reinsurance for the Mexico program along with creation of a catastrophe fund. Thus, Mexico became the first developing nation to issue catastrophe bonds.

The entire country of Mexico was divided into three seismic zones based on the magnitude of the quake, with each zone having a distinct threshold level for bond redemption. The bonds were issued *via* private placement for a period of three years, with the expectation that if no earthquake occurred during that time, the investors' money would be returned with interest, and that if an earthquake occurred, the bond money would be transferred to the government according to the risk zone, leaving investors with a very low or no return, premium, or interest. The FONDEN scheme later launched catastrophe bonds with the World Bank to cover various catastrophic risks.

The situation of Mexico is a typical example of the need for and application of catastrophe bonds. Based on consultant reviews, Mexico made the correct decision to issue CAT bonds in order to effectively optimize FONDEN, but a bit late. The problem of fund shortage would have been significantly reduced if the FONDEN had been equipped with catastrophe bonds from the outset.

The establishment of a catastrophe bond with a foreign corporation would have resulted in a loss of foreign exchange in the form of reinsurance premiums and

other associated costs. Also, as the catastrophe bonds were placed via private placement, the role of capital markets would have been negligible. If on the other hand, the bonds would have been issued in the open market of Mexico, major portion of the funding would have been raised domestically and greater portion of the interest paid on the bond would have been retained in the domestic market.

Despite the fact that large corporations, hedge funds, and Asset Management Companies (AMC) dominate the bond market, the majority of these funds are drawn from the general population. In the case of AMCs, they collect money from investors and pool it together to invest in a large project. This ensures a well-diversified pool of investors, which leads to a greater risk spread resulting in better risk management.

The Mexican bond was issued with a life-time of 3 years which is too short to predict a catastrophe and attract a larger investor base. Investors tend to look for a stable return based long-term bond issues that may act as a stable income source over a period of time. If the life of the bond is marked for a period of 10 or more years, it may attract better customer base. For the same reason, the sovereign bonds of a country have a long life ranging from 7 years to 25 years with a fixed income source for the investor.

Catastrophe bonds carry a higher level of risk, with the possibility of total loss of the investor's capital. Hence a better offer terms and return must be in-built to attract consumers. In this instance, a larger yield than the typical bond yield will be advantageous. Moreover, adding a sovereign guarantee and a good credit rating to the instruments will ensure a higher level of investor trust. In India, a scheme can be formulated by the government to either mandate a certain limit of investment mandatory of a section of the population, as in the case of Motor Third-Party or a Tax exemption can be allowed for the investors as in the case of Health Premiums and approved infrastructure bonds.[6]

2. Philippines CAT Bond (World Bank Sponsored)

The Philippines is among the most disaster-prone island nation that lies in the Ring of Fire region between the Pacific and Indian Ocean. It is very prone to natural catastrophes like occasional earthquakes and frequent tropical cyclones that pose great threat to human lives and property. The World Bank has issued two tranches of catastrophe-linked bonds for covering the earthquake and tropical cyclone threats.

[6] *Source : https://thedocs.worldbank.org/en/doc/737151585254940284034002202O/original/FONDENMexicoCatBondCaseStudy3.4.2020final.pdf and https://www.firstinitiative.org/stories/mexico-developing-framework-issuance-catastrophe-bonds*

The catastrophe bonds as per their nature transfer the risks to the capital markets thereby ensuring a wide spread of risk resulting in a better risk management. Like the Mexican FONDEN, these bonds were not issued primarily by the Government of Philippines and hence the associated problems of forex drain, local market involvement are negligible.

For a country like the Philippines which is very prone to such catastrophe disasters, long- term catastrophe bonds issued by the government would have ensured a larger acceptance and investor base. Also the 3-year validity of the bonds is too short a period for a highly disaster- prone country like the Philippines.[7]

The Philippines is an island country surrounded on all sides by the ocean, therefore the chances of getting affected by catastrophes like earthquake are high. Also, the Philippines lies on the boundary of the Pacific (rim) Plate making it more prone to volcanic and earthquake catastrophe events. In such a scenario wherein the whole country is identified to be in a high risk zone, the catastrophic bonds alone will not serve the purpose as there will be no geographic diversification of risk. Swaps in combination with catastrophic bonds would serve the purpose of risk management better.

If the Government of Philippines issues catastrophe bonds on their own and swap the risk with a country having a different geography, the risk diversification would be wiser in view of its geographical situation as well.

In Table 1.1 it can be seen that, though India ranks much higher than Philippines and Mexico in terms of land mass, the per capita income (1900.707) in India is way behind both the nations in comparison, due to the inflation (@ 6.623%), which is also much higher in India as compared to Philippines and Mexico, where the per capita incomes (3298.83 and 8346.702 respectively) are higher. A low per capita income will add extra burden to the government during the time of natural catastrophes as the individuals will depend more on the government for relief measures. These factors may be taken as pre-requisites and indicators. It is high time for India to issue catastrophe bonds in order to manage risks.

[7] *https://thedocs.worldbank.org/en/doc/737151585254940284-0340022020/original/FONDENMexicoCatBondCaseStudy3.4.2020final.pdf https://www.firstinitiative.org/stories/mexico-developing-framework-issuance-catastrophe-bonds*

Table 1.1 : Comparison between Mexico, Philippines and India on CAT Bonds and Swaps

Types	India	Philippines	Mexico
Geography	Diversified : Ranging from the Andaman and Nicobar islands to the sea coast of the peninsular India to the Thar desert and to the Himalayan snow peaks	Limited geographical structure including sea coasts and active volcanoes	Diversified : Ranging from sea coasts, mountains, volcanoes, islands, depression zones and deserts
Major Natural Catastrophe Risks	Earthquake, Floods, Inundation, Sand- storm, Snowstorm, Tsunami, Cloud- burst, Landslide	Earthquakes, Storms, Volcanic Eruption, Tsunami	Earthquake, Flood, Inundation, Storm, Tsunami, Landslide, Volcanic Eruptions
Risk Diversification	High	Low	High
Economy Ranking by Nominal GDP	6	34	15
Government Status	Stable	Very Stable	Stable
Per Capita Income (US$) as per World Bank	1900.707	3298.83	8346.702
Inflation as per World Bank	6.623%	2.635%	3.397%
Presence of CAT Bonds	No	Yes	Yes

(Source: Author's adaptation of information)

Theoretical Implications

The use of catastrophe bonds and swaps to manage natural catastrophe risks will provide significant risk diversification. With a back-up fund formed through the catastrophe bond issue, the government will be able to plan and implement risk management across the country more effectively. In addition, insurance companies will have a more stable book of accounts, allowing them to better develop new products to better cover new forms of risks, thereby providing value addition to the insurance ecosystem.

Through the involvement of the general public in such instruments, investors will become more aware of the catastrophic risks and their contribution to nation building. The general population will become more aware of insurance, which may contribute to an increase in insurance coverage in the country. In addition, public awareness of disasters will increase, potentially motivating the people to contribute their mite in combating climate change on a global scale.

With the issuing and trading of disaster bonds, a vibrant and active market will be created, which may lead to additional economic improvements by attracting investors from all across the country and combining their funds to invest in better enterprises that will help the country's economic development.

Practical Implications

With the issuance of domestic catastrophic bonds in the country, insurance companies' need for additional overseas security and the government's need for external commercial borrowings to manage post-disaster recovery will be significantly reduced, saving the country's valuable forex reserve and strengthening the domestic currency. Likewise, receiving the consideration for a swap in foreign currency, the usage of disaster swaps may also help in increasing the country's forex reserve.

Insurers will be able to have a consolidated and stable book as a result of better risk spread and diversification through the use of catastrophe bonds and swaps, contributing to greater profitability and solvency. Profitability and solvency are the best indicators of an insurance company's strength, and as they increase, so will the public's and investors' trust, and their view of the industry, boosting the sector's worth. A good catastrophe bond will ensure that insurers and the government have access to contingency catastrophe funds, allowing them to better manage finances in the aftermath of a disaster without straining available resources.

Conclusion

Alternate Risk Transfer is a viable method to manage natural disaster risks. While much work has been done globally, it is still one of our country's yet untapped frontiers. The government and insurance firms will be able to diversify their risk base by including the public through this investment channel in addition to policyholders subscribing to disaster bonds and swaps.

India is still a developing country, and sudden catastrophic disasters put the economy under duress. An effective model can be built and applied over time using alternative risk management as a tool, with the goal of managing catastrophe events recovery in a cost-efficient manner. Global organizations such as the World Bank and large reinsurers are already assisting countries in building risk management programs, and the government can benefit from their advice and suggestions to improve the model.

India already has authorities and experts in institutions, such as the IRDAI, SEBI, PFRDA, and the RBI, to oversee the issuing of these instruments in the domestic market.

Issuing bonds is not a novel concept in India, and the necessary infrastructure and market are already in place. A high yield on these products will draw retail and corporate investors from across the country, as well as from around the world. With relation to the insurance sector, the difficulty of maintaining the country's forex reserve will be more simplified; a higher forex reserve will enable the country to effectively manage markets.

According to the ranking of countries, based on Nominal GDP (PPP) 2021 data, Jamaica is ranked 128th, Philippines 34th, and Mexico 15th, and all these three countries have successfully adopted the catastrophe bond route to face the threats and impact of sudden calamities, either on their own or with the help of a global organization such as the World Bank. India is the world's sixth largest economy in nominal GDP ranking and the largest in South Asia, but it has yet to implement the Alternate Risk Transfer method to handle disaster risks. When it comes to the Indian population, the impact of any disaster risk is multiplied several times because a large number of people are affected.

The duration of a catastrophe bond is the most important factor to consider while issuing it; it's a tricky factor that will influence the bond's popularity and efficiency. If the bond is only valid for a limited duration, the catastrophe fund generated will not be able to provide complete protection without additional reinsurance. However, investors may be more attracted to short-term instruments because the risk of losing money is lower than with long-term instruments. A long-term bond, on the other hand, may be a better approach to meet the needs of the government and the insurer, but investors may be hesitant to participate in such long-term securities because the risk of losing all of their money is considerable.

The Way Forward

Once a working model of alternative risk management, using catastrophe bonds and swaps, has been implemented in the country, several studies on its progress must be conducted based on the initial performance. Data analysis of catastrophe event costs can help model a suitable bond size and yield based on the risk characteristics observed. Managing it will always be a continuous process, with the future implementation approach determined by historical data and performance of the bond.

New individual risk bonds, such as a Flood Bond, that is suited for flood-prone areas and a Snowstorm Bond that is suitable for snow storm-prone areas, can be created from a catastrophe bond, resulting in improved bond pricing and a more effective study of disaster recovery per risk. Catastrophe bonds will be more appealing to the general public in terms of risk because the costs and returns will be based solely on the overall frequency and severity of a given risk; the higher the risk, the higher the return and *vice versa*.

Researchers will be able to conduct a comparative study on cost management in various countries for post-risk recovery if catastrophe swaps are implemented. This will also allow for a comparative analysis of disaster trends over the same time period in other locations, which may be utilized to build a global risk management tool over time. After the comparative analysis of catastrophic events occurring concurrently in multiple locations, climate change and its impact on the ecosystem will become clearer for research purposes.

New alternative risk management tools can be devised and designed based on the performance of existing risk management tools that can assist countries better manage the impact of catastrophe risks than they are now using. There is no end to improvization and development, and a pepper can be used indefinitely to improve the effectiveness of these alternative risk transfer tools.

The ART instruments will involve a significant quantity of money and risk (e. g. Catastrophe Risks); any flaw in these products or its regulation could have severe consequences due to their magnitude and relationship to numerous sectors combined and hence they need to be properly managed and regulated. Currently, the insurance and the reinsurance segment are regulated by the IRDAI, while the banking segment is regulated by the Reserve Bank of India, and, the Securities and Exchange Board of India (SEBI) and RBI jointly regulate other markets, such as the money market, capital market, and bond market.

Alternative risk investment products will require joint regulation from all the three authorities, as well as government controllers. As these ART products involve several components, like insurance, bonds, swaps, etc. These are difficult to be managed by a single entity; however, already have several regulators that govern these components as mentioned above, hence there is no need for a new regulator for ART products.

Currently, IRDAI has enacted Investment Regulations which specify the type of investment, as well as its limits and ratings for the insurance and reinsurance sectors in the country; the SEBI has categorized investment categories for various types of capital market instruments, and the RBI has enacted similar regulations for banking industry. ART products can be regulated in a similar way, with the category of investor, the quantum of investment returns on the investment, and other similar factors easily stipulated by the concerned regulators in order to achieve the maximum efficiency of the ART products while at the same time complying with the stiplulated statutes and regulations.

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