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CONTRIBUTION OF INSURANCE AND CAT BONDS TO DISASTER RISK MANAGEMENT

Abstract: There is almost no part of the world which has not experienced natural disaster of any kind. In the past decade the Western Balkans has seen a significant growth in the number of natural disasters. Statistics not only reflect the changes in their magnitude but also tell us that this trend is likely to become more pronounced in years to come. Households, businesses and governments can transfer their catastrophic risk by means of insurance and/or reinsurance. The natural catastrophes are the source of highly complex risks and that is the reason why the concept of insuring the risks is very challenging. In our century the losses caused by the natural disasters have been so high that it has become urgent to address the insurability of the risks. Nevertheless, it has been made possible for the investors to bear these risks and divide them at a proper cost for the involved risk by transferring CAT bonds to the capital market. The reductions of unpredictability as well as the creation of values are the advantages of hedging risks in the capital markets as defined in the financial market theory. Even though there is a small quantity of CAT risk, transferred to capital market it may have reduced the pricing cycle in the reinsurance market. The provision of capital when it is necessary by the security related to CAT diminishes the volatility of insurer or reinsurer's earnings. The advantage of most of the above-mentioned securities is that they cover at a known premium all the expenditure caused by a catastrophe. This may enable the reduction of any increase of reinsurance premium in a hard market.

Key words: insurance, DRM, challenges of insurability, CAT bonds, financial instruments

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1 INTRODUCTION-

There is almost no part of the world which has not experienced natural disaster of any kind [2]. In the past decade the Western Balkans has seen a significant growth in the number of natural disasters. Statistics not only reflect the changes in their magnitude but also tell us that this trend is likely to become more pronounced in years to come. More people are suffering the direct and indirect adverse consequences of these events and it will continue to be the most vulnerable who bear a disproportionate share of the impact [47].

- In the third week of May 2014, a massive low-pressure cyclone swept through South-Eastern Europe resulting in extensive flood damage in Croatia, Bosnia and Herzegovina, and Serbia. Within these three countries, the storm resulted in the loss of 79 lives, the evacuation/displacement of over 990,000 people and the loss of tens of thousands of homes, livestock, agricultural land, schools, hospitals and businesses.

- In Bosnia and Herzegovina, the estimated total economic impact of the disaster reached 2.04 billion Euros or fifteen per cent of the country's gross domestic product (GDP) for 2013.

- Similar flood disasters have occurred in Albania. In 2015, over a three-day period from 31 January to 2 February, around 350 mm of rain fell in south-eastern Albania, affecting 42,000 people and flooding 12,225 hectares of arable land. The economic cost of damage to the agricultural sector alone was 31.5 million Euros.

- In the Former Yugoslav Republic of Macedonia during this same three-day period 0.75 meters of recorded rainfall affected 965,569 people in 43 municipalities and resulted in the death of one child. On 3 August 2015, a severe storm and intense rainfall in the Polog region affected more than 85,000 people causing 6 casualties and inflicting € 30 million in damages.

There is evidence related to the increase of the cost of natural disasters as often more and more valuable properties are being built in risky locations [44]. This chapter will give a comprehensive overview of contribution of insurance and cat bonds to Disaster Risk Management. The first part of the paper will offer an overview of the products offered for Disaster Risk management in the Insurance Market and will focus on the challenges of insurability in cases of disasters. Later, the following sections will deal more in detail with capital markets instruments such as Cat Bonds.

2. RISK FINANCING INSTRUMENTS AGAINST DISASTER RISKS

Risk financing instruments against disaster risks can be categorized into risk transfer and risk spreading instruments. While the dominant risk financing instrument is a risk transfer by insurance and reinsurance, other non-market risk

transfer instruments, e.g. collective loss sharing, are also available [35]. Table 1 illustrates the main risk management approaches and instruments.

Table 1: Main risk management approaches and instruments

Approaches	Examples of Instruments
Non Market Risk Transfer	Government assistance (taxes) for private and public sector relief and reconstruction funding Kinship arrangements Some mutual insurance arrangements Donor Assistance
Market Risk Transfer	Insurance and reinsurance, Micro Insurance, Financial Market Instruments, Catastrophe Bonds
Inter-temporal risk spreading	Contingent credit (financial market instrument), Reserve fund, Microcredit and savings

(Source: [22])

According to Hochrainer (2006), post disaster government assistance can be seen as one of the most important arrangements of non-market risk transfer. Governments generally have access to various sources of financing following a disaster. These sources can be categorized as ex-post and ex-ante financing instruments. Ex-post instruments are sources that do not require advance planning. This includes budget reallocation, domestic credit, external credit, tax increase, and donor assistance. Often the public sector relies on such ex post financial means, where international assistance has been especially important. Even though funding from donors and international development banks can be an important part of government catastrophe risk management strategy, over-reliance on this approach has often been the cause of the lack of economic incentives for countries to engage in proactive disaster risk management [21]. In addition, ex post international assistance in some occasions can result inadequate, since often is offered in-kind, which has several disadvantages [28].

Households, businesses and governments can transfer their catastrophic risk by means of insurance and/or reinsurance. According to Bayer and Mechler (2008) insurance and other risk-transfer instruments are justified by the concept of risk aversion. In addition to reducing direct and indirect losses, insurance provides

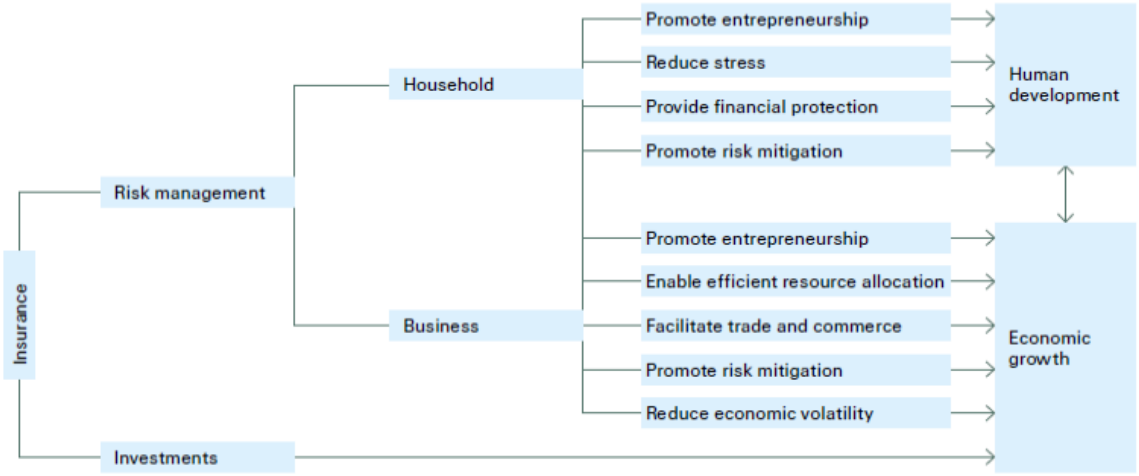
economic security. For businesses, insurance removes risks from balance sheets, meaning that higher-profit and higher-risk activities can be pursued. For governments, insurance assures timely assistance and recovery, which can attract more investment to the country. However, there are several problems of supply and demand side of the insurance market. The low insurance density in the developing world is not surprising. Furthermore, they use traditional coping mechanisms to protect themselves from the economic impacts of natural disasters: diversification of crops and livelihoods, different sources of income, remittances from family members who are living abroad or spatial diversity of family members ([22, 34].

Ex-ante risk financing instruments require pro-active advance planning and include reserves or calamity funds, budget contingencies, contingent debt facility and risk transfer mechanisms. In this respect, risk transfer instruments are of major importance and much emphasized in academic literature, financial strategies and international institution's recommendation, as a mean of risk management that should be considered and implemented in developing countries [21, 28]. In addition to traditional insurance and reinsurance, there is emerging interest in other alternative risk transfer instruments, e.g. catastrophe bonds Catastrophe bonds emerged as instruments primarily for re-insurers; however, there are also governmental efforts in some countries (e.g. Mexico) to transfer their risk with this instrument [22].

Finally, inter-temporal risk spreading is another approach for risk management. At the household level risk spreading over time can be achieved in the form of savings. On the country level, governments can establish catastrophe reserve funds, usually financed by taxes, which are depleted only in the case of a disaster event. Contingent credit arrangements allow borrowing money after an event, whereas the post-event annuity payments are smaller in comparison to a regular credit. Borrowing is also a kind of inter-temporal risk spreading of losses, because payments will be made in the future. As one can see, a contingent credit is a mixture of saving and borrowing [22].

3. THE CONTRIBUTIONS OF INSURANCE INDUSTRY

The insurance industry is one of the oldest in the financial sector, with over 400 years of experience. The contribution of insurance to lessen financial instability for consumer and business has been widely recognized. Apart from that the emerging market benefits from insurance as it also contributes to alleviating poverty and to enabling inclusive increase [44]. No matter how challenging is to estimate its values the findings confirm that through it ex-ante risk management, insurance contributes to a better distribution of resources, the improvement of trade and to promoting risk management. On the other hand insurance enables the whole societies to get over serious shocks faster through the ex-post protection. The above mentioned benefits from insurance pertain in both advanced and emerging markets.



Source: Swiss Re Institute.

Figure 1: The contributions of insurance industry

4. PRODUCTS OFFERED FOR DISASTER RISK MANAGEMENT IN THE INSURANCE MARKET

Disasters were not included in the insurance scheme for years, because of their characteristics. Meanwhile, today in developed economies the majority of natural catastrophes or human disasters have been included in the insurance market functioning as shock absorber for various risks. Considering the indispensability of cost-effective loss reduction measures to rebuild and recover damages from disasters, it should be prioritized insurance as an essential component of household and community resilience against disasters [46]. Furthermore in some developed countries some elements of catastrophic events are mandatory as stated by law. For instance commercial banks request this mandatory insurance from those who apply for a loan in order to cover the risk. Brown and Churchill (2000) explained that there is a difference between disaster insurance and other products of insurance. Due to the fact that they are experienced by a large number of populations at the same time, the existence of informal safety nets (family and friends) which suffer simultaneous consequences related to their life, health and property it is difficult to estimate them.

A question raised in literature is whether all types of catastrophic risk are insurable. The disaster risk is characterized by almost all the aspects of an insured risk. It is considered as a random event, with relatively low probability, and a large number of similar exposures. Nowadays many insurance companies offer policies

that cover a considerable part of the catastrophic risk. However there are certain cases excluded from the insurance industry.

In the case of catastrophe insurance products there are no separate policies. They are included in the insurance policies against natural events or fire. In general the term of the insurance policy is annual. The products through which catastrophic risk can be transferred also differ according to what they cover and who the insured are [8]:

Home Insurance: In many countries, home insurance is not a mandatory insurance. Home coverage is provided in case of catastrophic events such as earthquakes, hurricanes, floods, cyclones, etc. To recover a loss it is usually used the method of replacement costs. In the cases where the property is completely destroyed and not rebuilt or replaced, the actual cash value is used (value of replacement minus depreciation). The home insurance is partial and is considered a coinsurance which implies that a part of the loss is covered by the insurance company and the rest by the owner.

Automobile Insurance: Typically, the all-risk type car insurance contract includes partial coverage for a catastrophic event such as floods, hurricanes, etc. In this case it is typical to apply deductible discount which is the amount the insured agrees to pay before insurance coverage kicks in, and it can be thought of as a coinsurance.

Life Insurance: Typically, life insurance policies also provide coverage for cases of loss of life and as a result of catastrophic events. The application of catastrophic coverage in the case of group life insurance may pose additional cost to the insurer if the insured are all located in the same area of the disaster.

Health Insurance and Employee's Insurance: This type of insurance covers the risks of health damage from disasters and it provides coverage for medical expenses, diagnosis, hospital service, medication, etc. It also covers the payments to the insured in the event that income is interrupted by his/her disability.

Liability Insurance: Liability insurance can also include coverage of elements from catastrophic events. It is mainly applied for building liability and rented buildings as well as others elements. Some of the cases covered by the policies of liability insurance are damages caused by lack of protective measures or negligence related to technical regulations.

Business Interruption Insurance: Business interruption insurance (also known as business income insurance) is a type of insurance that covers the loss of income that a business suffers after a disaster. The income loss covered may be due to disaster-related closing of the business facility or due to the rebuilding process after a disaster. It differs from property insurance in that a property insurance policy only covers the physical damage to the business, while the additional coverage allotted by the business interruption policy covers the profits that would have been earned.

This extra policy provision is applicable to all types of businesses, as it is designed to put a business in the same financial position it would have been in if no loss had occurred.

Commercial and Industrial property Insurance: Commercial property insurance is used to cover any commercial property. Commercial property insurance protects commercial property from such perils as fire, theft and natural disaster. A variety of businesses, including manufacturers, retailers, service-oriented businesses and not-for-profit organizations carry commercial property insurance. Commercial property insurance can be a major expense for businesses that use equipment worth millions or billions of dollars, such as railroads and manufacturers. This insurance essentially provides the same kind of protection as property insurance for consumers. However, businesses can usually deduct the cost of commercial property insurance premiums as expenses. When determining how much a company should pay for commercial property insurance, the value of a business' assets, including the building, is the primary factor. Before meeting with an agent to discuss coverage, a company should take an inventory of their physical assets located at their property. This information will help determine what exactly would be the replacement value and the level of coverage the business should get.

Agricultural Insurance: Agricultural insurance protects against loss of or damage to crops or livestock. Agriculture is one of the sectors experiences numerous natural catastrophic disasters. Agricultural insurance has great potential to provide value to low-income farmers and their communities, both by protecting farmers when shocks occur and by encouraging greater investment in crops. However, in practice its effectiveness has often been constrained by the difficulty of designing good products and by demand constraints. Example: The Indian government adopted risk financing and insurance principles to transition its National Crop Insurance Program from a social crop insurance scheme to a market-based crop insurance program. As a result, farmers receive the claims payments much faster and have improved coverage of their assets.

5. *VARIOUS BARRIERS CAUSED BY DEMAND AND SUPPLY CONCERNING INSURANCE*

The various barriers caused by demand and supply have caused less efficiency in the emerging markets than in the advanced ones. The benefit of insurance and the cost of providing insurance are related to that extent that when the former gets higher so does the latter. In the emerging market framework there have been identified eight relevant barriers and are summarized by Swiss Re Institute, (2017).

5.1 Demand-side barriers

Affordability: There is a negative correlation between the price of goods and demand for them. Demands fall as prices rise. Yet in emerging markets demand for insurance remains very low even when subsidies are provided [37].

Liquidity constraints: Liquidity constrains remain a concern which refrain consumers from purchasing insurance. Lack of finance is one of the most serious barriers for consumers as individuals (ex. farmers), for small and even medium enterprises in emerging markets [13].

Trust: Another serious barrier to insurance demand is the lack of trust in insurance providers. This is even more evident in emerging markets where payment of valid claims can hardly be enforced because the legal system does not function properly. Contract non-performance is significantly resulting in lack of trust which then affects demand negatively [15].

Awareness: Insurance demand is also influenced by lack of awareness. There are findings which show that consumers with high financial literacy are likely to have higher demand for insurance. Still when programs to increase consumers' financial literacy have been conducted, the outcomes have been mixed with some increase in insurance demand on the one hand [13] and on the other no impact at all on the some consumers [15].

Insuring SMEs in emerging markets: Even though small businesses owners are crucial to economic development, there are findings related to insurance of SMEs in emerging markets which is much lower than health and agricultural insurance [20].

Informal risk sharing: Development of formal insurance market is hindered by informal risk sharing networks. There are findings which prove that strong informal networks have been a barrier to the health insurance schemes of the government [26]. On the other hand there are also cases when risk-sharing networks compliment formal insurance [37]. Still recently there is evidence that the formal insurance mechanisms can be a barrier to informal risk-sharing mechanisms. To get a better understanding of the formal insurance it needs to observe the awareness of how beneficial is informal sharing to the participants [33].

Quality of service: The consumers also take into consideration the quality of service when they decide to buy insurance. This factor is decisive especially in the case of health insurance where the consumers observe the quality of health case, the distance to and quality of hospitals [14].

Behavioural biases: Individuals demonstrate behavioral biases when they have to make decisions concerning insurance. The main biases are as follows: 1. Loss aversion is the case when they disapprove to having to experience losses related to gains they are expected to get. (eg. When individuals have purchased insurance but do not experience a loss and as a consequence they consider insurance policy they have bought as a loss.) 2. Self-control is another bias according to which individuals are inclined to put more value to the present consumptions and as a result they do not purchase insurance in advance for a benefit which they will get in the future. Some of the different ways to address behavioral biases is by promoting saving aspects of whole life insurance instead of term life products with no saving aspects.

Cultural factors: Cultural factors sometimes demonstrated in very specific contexts may be a barrier to insurance demand. In the case of natural disasters the lack of risk-preparedness culture associated with the dependence of the government or non-government funding relief is a serious barrier.

5.2 Supply-side barriers

There are four supply-side barriers faced by emerging markets related to insurance.

Transaction costs: Premium collections and distribution costs, underwriting costs and the costs to very insurance claims comprise the administrative costs for the insurers. All these costs result in the increase of the insurance price, and as a consequent the market size is reduced. Another barrier which insurers have to face is the dispersion of risk pool together with the small sums insured. They hinder the benefits of the insurers from economies of scale.

*Adverse selection and moral haza*rd: The insured may become less careful after buying insurance which may result in either less preventive efforts (ex-ante moral hazards or increase loss amount in case of a shock (ex-post moral hazard). Sometimes insurers are not effective in making the distinction between good and bad risks and good risks are priced out of the market.

Institutional setting: The basis for an insurance market is the insurance law which states the definition of the insurance as well as a supervisory authority, licensing criteria and prohibited practices. If the legal system and regulatory environment are weak and ineffective they have a negative effect on the insurance market. Without a regulatory framework to ensure an effective supervision, an insurance industry can decrease because of ineffective and costly regulatory interventions and as a result the consumers' trust can be diminished.

Regulation: There is evidence that some markets are retracting to nationalistic, re/insurance regulations while others are liberalizing. The increased concern about capital outflow in the form of profit repatriation and the deteriorating balance of profit repatriation and overseas reinsurance have resulted in the rise of nationalistic re/insurance regulations. On the other hand a liberal insurance market can improve the professionalism of industry to the benefit of consumers and businesses. A liberal insurance market needs detailed and effective regulations on market conduct, competition laws so as to enable the balance between market stability and value of consumers.

6. CHALLENGES OF INSURABILITY IN CASES OF DISASTERS

Savitt (2017) evaluates the literature about hazard insurance availability and purchase and the challenges of insurability in case of disasters. A total of 70 articles were included in his study. A summarized version of the main challenges is presented in the following section.

6.1 How insurance companies can calculate and diversify risk?

Although some authors argue that the failure to insure hazard risks may be irrational [23], most scholars agree that there are explanations for why a rational insurance company would not be able to provide insurance. Some of the criteria which must be considered by insurance companies in cases of disasters are classified as follows: Calculation of the risk to a property. Insurance companies must be able to calculate the risk to a property, and provide coverage of damages in case of disasters. Simultaneously they have to make their profit and ensure the agreement of the consumer related to the prime. Considering the present situation where climate change etc is resulting in an increase of disasters many authors are debating whether the above mentioned criteria can be met by the insurance companies.

One the one hand most scholars support the argument that decrease of insurability is due to the changing climate and demographic trends but on the other hand they do not come to an agreement related to the statement that the characteristics of disasters make them less insurable than other types of risks. It seems easy to calculate risk in case of disasters as the probability of loss can be multiplied by the amount of loss upon occurrence. However, it is difficult to calculate risk in an area or property considering the infrequency of historical disaster losses [36]. On the other hand insurance companies refrain from or even refuse to provide insurance in the areas where disasters have been more frequent which implies the certainty of their repeated future occurrence.

The climate changes are affecting the calculation of the probability of the disasters which makes it difficult to consider historical data as a source of disaster estimation [12, 36]. Another factor which makes it more difficult to diversify and insure the risk from disasters is that climate risks are also geographically correlated.

Adverse selection also constitutes another hindrance to insure the risk of disasters. It implies that the people that are expected to face more risks of disasters tend to apply for insurance [12, 41].

One of the fundamental problems related to the calculation of disasters risk is covariance risk. In order to be calculable, risks must not be systemic [12, 36]. For example the risk that my car experiences an accident is not correlated with the accident that your car will suffer. This condition is less likely to be met in case of disasters, which tend to affect a large number of properties at once. The risk that my home and that of the neighbor will be affected by the earthquake is perfectly and positively correlated. In this case the cost created for the insurance companies is not similar to that of an independent risk coverage [36]. The existence of reinsurance (the concept of risk sharing) and techniques optimization have avoided this problem and nowadays most of disasters are considered insurable events [4]. As a conclusion the two main challenges for the provision of insurance remain the calculation and

diversification of disaster risk. As a result it is necessary for all the countries to consider other means for risk management in case of disaster events [42].

6.2 How can insurance companies provide coverage?

There are other factors which need to be considered when analyzing the availability of the reserves of insurance company and the insurance industry as a whole to cover the damages experienced by a property. The availability of funds for the payout and decision making whether to insure a certain disaster risk or not depend on factors like the amount of money the insurance company has in reserve, the reinsurance available (the insurance purchased by the insurers to protect their contracts) and the amount of damage of the insured events [42].

The ability to provide coverage for disasters is as difficult as the ability to estimate risk. Insurance companies and the insurance industry itself, as scholars argue, can hardly guarantee the availability of sufficient money in reserve to cover the damage after a large disaster is experienced. Inability of an insurance company to accumulate financial reserves ends up in the reduction of financial capacity of the entire insurance industry [19]. As a result it becomes more difficult to insure disasters. Trying to accumulate reserves by charging higher rates insurers may have to face other problems related to insurability [30].

Still the competitions from non insurance- companies for risk spreading including self-insurance as an option to increase capacity may lead to difficulties for insurance companies to provide insurance despite the fact that the financial capacity of insurance market is indispensable for insurability [36]. To cover large damages of serious disasters it is necessary that reinsurance industry provide funds to the insurance companies as the latter have inadequate financial reserved to cover damages [12].

Insurance companies have been clients of reinsurance companies which have functioned traditionally like large insurance companies. So it is evident that the provision of insurance contracts by the reinsurance companies is also made difficult for the same reasons mentioned as in the case of insurance companies [31]. Nonetheless many authors note that the availability of reinsurance can be increased by novel sources which include governmental run programs, state pools and catastrophe bonds. Still there are disputes as to the extent of the availability of these novel forms of reinsurance [42].

Traditionally, the ability of the insurance company to provide coverage for damages in case of disaster is also affected by the amount of losses it is subject to [12]. The options of insurability are higher for people who have insurance and carry out disaster mitigations and preparedness. So they experience lower losses. If insurance companies are able to encourage mitigation the expected losses get reduced and the reputation of the company improves. If the opposite happens that is if the insurance company fails to encourage mitigation and prevent losses then it is

more difficult for insurance companies to continue providing insurance for hazard risks [36].

6.3 How do insurance companies obtain profitability?

Just like in the case of any businesses profitability is what motivates insurance companies to insure disaster risks [36]. So it is doubtful whether the issue of insurance contracts is effective. It is the revenues (in this case, the premiums collected from property owners) minus costs (administrative costs plus losses minus deductibles) which define the profit.

Transaction costs as one of the type of costs arise from lack of effectiveness in the insurance market. They include for example government intervention which may be efficient and they may make disaster risks more insurable [10].

Insurance premiums constitute primarily the insurance revenues for disaster risks. Insurance companies find it difficult to adjust rates because of climate change and increase of population in areas of disaster risks, which result in lower profits and decreased insurability. However, if insurance companies come up with innovative plans and adapt to climate change the profitability will be higher [6]. Still this is far from reality. An immediate step to be undertaken by insurance companies is to set prices for premiums on disaster insurance contract with the consumers.

6.4 What challenges do insurance companies face negotiating with consumers?

Some of the challenges which make negotiations of the customers with the insurers difficult are unrealistic optimism, unwillingness to maintain relationships with the insurers and expectations and beliefs about the role of governments after disasters [42].

The customers happen to be more optimistic about their damages caused by disasters than the insurance companies and as a result they may not agree on the prices the insurers want to charge them [38].

Another difficulty faced by insurance companies is that of enforcing log-term insurance contracts nowadays due to the increase of disaster risks and climate change [25]. In fact, this type of contract does not only benefit insurance companies but also the customers as they reduce insurers‘administrative costs. The consumers do not rate their disaster risks accurately and so they do not repurchase insurance especially when they have not experienced any disasters during their contract period [24]. Re-purchasing of the insurance contract would have the same effect as the long-term contract but the customers are not willing to do. So the disaster insurance is ineffective because of the failure to negotiate long-term contracts.

Negotiations of contracts by the insurance companies with the consumers are also affected by the perceived role of government in disaster and risk management.

Government assistance in case of disasters may result in separating "bad" risk form "good" risk. So only those customers representing bad risk want to purchase insurance and in this case the insurance companies are not willing to provide insurance to those who need it. Apart from that the government assistance my result in charity for disaster because people believe that they will be helped by the government in case of a disaster and they do not have to purchase insurance [29].

All the theoretical findings referring to insurability of the disaster risks are either not determinate or contradictory. Considering the fact that because of climate change and population movement the disaster risk may shift from one area to another the value of disaster insurance as a risk management tool is being limited and it is likely to continue similarly [42].

6.5 Why do consumers hesitate to purchase insurance?

The existence of the market of disaster insurance depends not only on the insurer's decision to provide insurance but also on the consumer's interest to purchase insurance. Whether the insurance must be included in the measurements of preparedness adoption depend on the risk people face, However, what makes it complicated for the advocates of insurance as a preparedness tool is that actual risk is not the most important factor in determining insurance adoption and in some cases no factor at all.

There is much more inconsistence and diversity in the literature about people's decision to purchase disaster insurance than in the literature about disaster insurability. So literature addresses the issue of understanding why people do not purchase as much insurance as they are expected to. There have been identified the following categories related to the decision to purchase insurance: economic considerations, psychological characteristics, risk preferences and perceptions, structural features of insurance programs, and demographic characteristics.

*Economic considerations***:** Some of the conclusions related to economic considerations are: The demand for disaster insurance increases as income increases which is related to the fact that disaster insurance is a normal good; demand increases as price increases; when price for insurance or income change this does not result in considerable change of demand for insurance [1].

Psychological characteristic: The costs and benefits of the insurance urge the consumers to decide whether to purchase insurance or not. If the cost of insurance goes beyond the expected value the consumers may not want to purchase insurance. However, another concern is that the cost of discovering one's disaster risk may be very high and the information on insurance may be missing or difficult to find.

As mentioned above there is evidence on the rationality of the customers. However they have proven also to be irrational as they do not understand considerably what is the appropriate amount of insurance they should purchase. It is not that they are unaware about the risk but they do not know how to react when

they get the appropriate assessment of the risk and how probable it is. It is stated in the literature by most of the authors that no matter how rational or irrational the consumers are to make decisions on purchasing insurance, the number of those who buy disaster insurance is very limited from a societal perspective [31].

Apart from the issue of how rational or irrational the consumers are when making their decision on insurance, what affects their decision is also the issue of major differences among consumers on how they assess the value of gains and damages [6].

The decision to purchase disaster insurance is so complex because of so many psychological reasons and as a result the study of disaster risk management becomes more difficult [42].

Risk preferences and perceptions: The issue of to what extent people are able to estimate their disaster risks is questionable. However there is evidence that while the perceived risk increases the insurance purchase and the price people are willing to pay increase. A consumer's interest to purchase insurance increases due to his/her belief that a disaster is expected to affect him/her as an individual [1].

It has been argued about the extent of accuracy that the disaster risk is evaluated by people. There are findings that people are willing to pay more for houses in safer locations, which reveal that they are aware to some extent of the disaster risk, related with the place they decide to live [9]. Apart from that insurance purchase increases in relation to geographical proximity to disasters.

The rates of insurance purchase is also affected by the consumers'' perception on disaster risk. Flood insurance is more purchases than other types of insurance when consumers perceive that they will experience flooding in the future [5]. Risk reduction including insurance purchase is more requested when people expect that the consequences of disaster will be more significant than in the case when they believe that it will be less severe. Even though the correlation between the estimation of risk and consumer's perception of risk has not been specified it is probable that it is positive but still weak [42].

Demographic characteristics: The effect of demographic factors on consumer's insurance has also been addressed in the researches but still not so conclusively and consistently [42]. There are findings that the insurance purchase increases just as the value of homes increases [31]. Still the amount of insurance purchases is questionable as some findings show that the home value does not affect how much insurance is purchased and others show that homes with very high or very low value are more likely to have insurance than the homes of medium value. The disaster insurance purchase is likely to increase in the case of higher social classes [9] and also in the case of having children [40]. Despite the disagreements as in some cases of being females or older ages the level of insurance purchase is lower [7] still it is

concluded by the researches that consumers who have experienced disasters and have insurance are more likely to purchase disaster insurance.

It is difficult to understand and predict who will purchase insurance and who will not because of the theoretical and empirical diversity. The numerous variables that affect the consumers' decision to buy or not to buy the disaster insurance contribute in understanding this attitude of the customers' to insurance purchase. On the one hand the huge number of variables and on the other the uncertainty of the customers to decide whether to purchase or not the disaster insurance makes the value of insurance for managing disaster risks for society highly questionable [42].

7. APPROACHES OF CATASTROPHE BONDS

Nowadays the institutional investor market covering the issue and trade of catastrophe bonds (CAT Bonds), operates like hedge funds. There is a similarity between CAT bond and corporate bond viewed from the cash flow angle. After buying the bond with a principal payment nearly equal to the face worth of the bond he/she gets paid usually quarterly. The bond maturity extends from one to five years; however, its span is usually three years. During the period before the bond maturity, in case a covered disaster goes beyond the "trigger point" specified in the bond's contract then a part of the principal paid by the investor covers the indemnities of the issue and the bond defaults [17]. A reinsurer, an insurer, a government entity, a corporation, a pension fund, or a non-profit organization can issue bonds. In order to guarantee the claim coverage in case of a disaster the bond is kept in reserve by the Treasury money market fund in safe security.

The amount of CAT bond of $ 200 million is used to cover a part of the risk such as indemnities which may go beyond $ 1 billion but not exceed $ 1.2 billion. A part of principal covers the claims for the $ 1 billion called attachment point, whereas for the amount $1.2 billion called the exhaustion point, the principal is used up and so the investors are not subject to any additional claims [17]).

One of the reasons why the investors are interested in CAT bonds is that the CAT bonds are almost not correlated with the credit risk, interest rate risk and equity market fluctuations [17]. Generally there is no correlation between the happenings of natural disasters and stock market and interest rate movement. The second reason why the investors are interested in CAT bonds is that the interest rate offered is much higher than the default risk. The interest rate includes the low base interest offered by the Treasury money market funds where the bonds are deposited and also the premium paid by the issuer to cover the insurance aspect. As the reserve requirements for the issuer are reduced and the insurance protection is increases the CAT bonds appear to be really attractive to the issuers.

The structure of a CAT bond transaction is displayed in Figure 2. The investors need a special purpose vehicle (SPV) or else they have to receive a license (to take on a contract of insurance) in order to provide insurance to the issuer directly.

Sometimes SPV is labeled as "transformer" as it transforms the investment of the fund by the investors in a sale of insurance because of its being licensed itself [43].

The types of trigger loss of principal are very difficult to be defined when a CAT bond is created. There are four main triggers [17].

- Indemnity trigger: coverage of actual excess claims paid by issuer
- Industry loss trigger: coverage based on whole-industry losses on the extreme event
- Parametric trigger: coverage based on exceedance of specified natural parameters
- Modelled trigger: coverage based on claims estimated by a computer model

8. THE MAIN ACTORS IN A CATASTROPHE BOND TRANSACTION

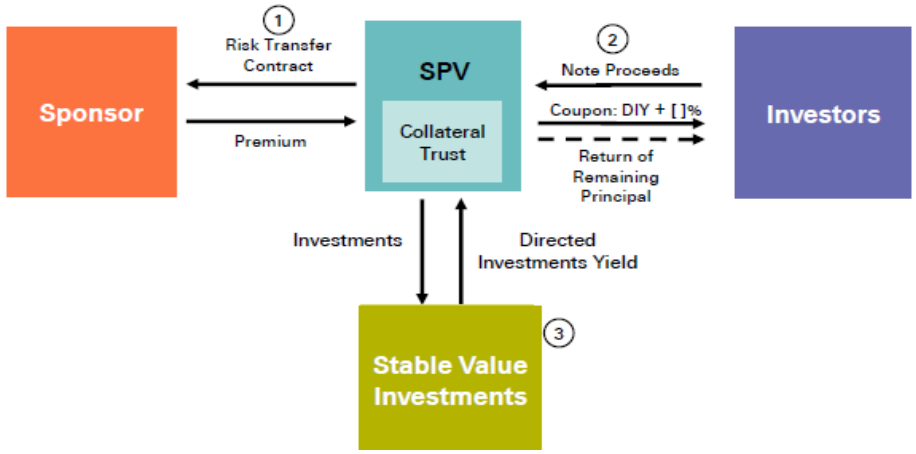
The CAT bond market consists of the following participants: issuers, structuring agents, modeling agents, ratings agencies, performance index compilers, investors, industry loss index compilers, and media [17].

Issuers: Reinsurers and insures constitute mainly the Issuers such as Munich Re, Swiss Re. However, the issuers can also include a government entity, corporation or a pension fund intending to cover an unexpected extent of longevities.

Structuring agents: As the issuers need to define the trigger type and the level of protection that is the attachment and exhaustion points, it is the structuring agents who assist them in this process. The attachment and exhaustion points are defined by the structural agents on the basis of their belief in what is beneficial to be sold to the investors. The assistance of the structuring agents also consists in placing the bond with the investors. Investment banks or the capital markets sections of a major broker or insurer play the role of structuring agents. Examples include Swiss Re Capital Markets.

Ratings agencies: It is because of their high probability of default (historically averaging 1.4%). CAT bonds are rated by Standard & Poor (S&P) at below investment grade a like high-yield ("junk") bonds.

Performance index compilers: The regular calculation of the average CAT Bond process that is the performance of indexes including rates of returns on investment over historical time periods has been enabled by the establishment of a secondary market in CAT bonds. The Swiss Re Global CAT Bond Index are regularly compiled by Swiss Re.



Source [43]

Figure 2: How do CAT Bonds work?

Investors: Pension funds, endowment funds and hedge funds comprise the institutional investor in CAT bonds. Institutional investors and accredited individual investors can invest in dedicated ILS funds which are organized like hedge funds.

Industry loss index compilers: PERILS in Europe is the main compliers of the industry loss estimates which conduct confidential surveys "insurers, agents, adjusters, public officials, and others". To calculate a loss estimate the already gather data on claims volumes and amounts are combined with trend factors.

*Media***:** The news on CAT bonds, insurance-linked securities, and reinsurance capital and investment are covered by the Bermuda-based online web site ARTEMIS[2]

9. WHY TO INVEST IN CATASTROPHE BONDS?

A unique characteristic of catastrophe bonds is that the return from them is not correlated with macroeconomic factors and in this way it enables profitable diversification qualities to portfolios of more traditional asset classes. Apart from it is of interest to the investors to protect themselves from market forces in uncertain financial climates. Furthermore another beneficial characteristic of catastrophe bonds is that the poor performance is likely to be self-correcting. The investors are enabled to recover from some of their losses after a natural disaster as the insurance premium increases (and thus the potential returns to catastrophe risk securities) in a relatively short period. Therefore the increased request for insurance, a decreased

[2] www.artemis.bm.

ability of insurance and reinsurance companies to take risk and the growing evaluation of probability modes used to evaluate the cost of security risk of catastrophes and insurance are some of the advantageous factors [11].

While the recent earthquake in Japan has led to large losses in the catastrophe risk market, insurance premiums have since been pushed up by around 50% of earthquake risk and 20% for another catastrophe risk. Some investors may be worried of entering the market with the recent disaster still fresh in their minds. However, while further seismic activity in Japan may serve as a well-justified deterrent against investments in Japanese earthquake risk, the potential enhanced returns associated with elevated insurance premiums mean that this could be a good time to invest in another catastrophe risk securities. Even though the investors may lose a part or all of their principal investment in case of a disaster , it is because of the low option of numerous large-scale natural disaster to occur within the same period of time, that their risk exposure is reduced by the .diversifying across different catastrophe bonds.

A final benefit of investing in catastrophe bonds is that the likelihood of incurring extreme losses is far lower than the chance of benefitting from extreme returns [11].

10. ARGUMENTS AGAINST CATASTROPHE BONDS

A number of advantages of CAT bonds and ILS market have been mentioned earlier. Referring to CAT bonds as a source of systemic risk in the financial system is the fact that this kind of business operates in offshore areas where there are less strict regulations on capital requirements and discloser of financial information. As a result the investors find it difficult to monitor their risk exposure and they are concerned about lack of transparency. Investors in CAT bonds often do not consider the risk before investing as they do not have enough knowledge on climate change risk and are tempted by high returns. Another disadvantage for the investors in CAT bonds is that large sums of investments in these products may be lost unexpectedly as by under pricing the risks of climate disasters, the investors expect that they are getting high returns constantly. As a result of this loss the market will experience a crisis or even collapse [39].

Another concern is related to the catastrophe modeling and the pricing of cat bonds, The complexity of catastrophe models needs the contribution of meteorologists, geologists, structural engineers, and actuaries to create the models and as a result the final outcome may be unreliable and ineffective [27]. Insufficient data also may cause uncertainty of models. It is indispensable to improve the data quality and model techniques before using them for calculating their pricing accurately.

There are critics who do not agree on their ability to contribute in addressing climate change risk or increased systemic risk. It is argued that the least likely to be

insured through this system are the most vulnerable. The poorest regions are the most exposed to the risk of climate disasters and they have to pay the most for financial protection because of the climate insurance tools. Therefore it is the innocent parties co-finance the expenses of environmental risks, imposed on them by the rich countries [16].

Some critics address the argument that the insured agents may be exposed to moral hazard because of catastrophe bonds. As there is a possibility of insurance, the insurer may undertake construction in vulnerable regions or use dangerous techniques reflection of increased risky behavior. Another argument is that while the traditional insurance is characterized by a beneficial business relationship between the insurer and the reinsurer. This relationship enables the reinsurer to monitor the insurer resulting in reducing moral hazard. Whereas the cat bonds are more exposed to moral hazard as the investors of CAT bond do not have any relationship with the insured. As a result the surveillance ability is reduced and the insurers can not be encouraged to avoid riskier behaviors [45].

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