

Economics of Insurance against Natural Catastrophes: Over-Burdened Arab Insurers

Abdel-Raheem F. Fares (Correspondence Author)

College of Economics and Business Administration, Department of Banking and Finance
Al-Zaytoonah University, P.O.Box 130, Airport Road, Amman 11723, JORDAN
Mobile: +96-279-960-3556 E-mail: af_fares@live.com

Eid Ahmad Abou-Bakr

Faculty of Commerce, Beni-Suif University, EGYPT
Mobile: +20-100-200-7402 E-mail: prof_eideg@yahoo.com

Abstract: Natural catastrophes increased over time in numbers and in economic losses. This trend is expected to continue. Reinsurers operating in high risk areas attempted to transfer part of their huge losses to the financial markets or to less risky areas domestically or internationally, including Arab countries.

Statistics show relatively low number of events and low economic losses resulting from natural catastrophes in Arab countries. The risk transfers over-burdened Arab insurance companies. These transfers did not receive serious academic attention. The present paper studies aspects of insurance and reinsurance against natural catastrophes, studies risk transfers and presents suggestions to reduce the extra burden that transfers inflict upon Arab insurers.

JEL Classifications: F01, G22, G18

Keywords: Insurance and reinsurance against natural catastrophes, Protecting Arab insurers, Risk transfers in insurance, Demand and supply for insurance against natural catastrophes

1. Introduction

Catastrophes are two types: man-made and natural. Man-made catastrophes are a consequence of human actions e.g., fires and automobile accidents. Natural catastrophes result from the forces of nature e.g., earthquakes, floods, and volcanoes. The present paper studies only natural catastrophes.

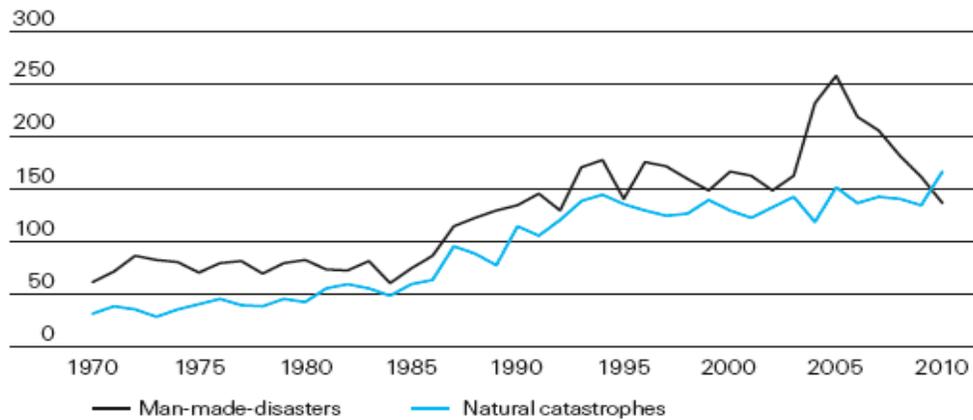
An event is catastrophic if it resulted in large scale physical losses or victims. In terms of insurance losses, the Property and Claims Service, a division of the Insurance Services Office in the United States, defines catastrophes as “event that causes \$25 million or more in direct insured losses to property that affect a significant number of policy holders and insurers” (Born and Viscusi, 2006). The damage caused by natural catastrophes includes homes, offices, factories, roads, railroads, airports and human lives. Reconstruction work after the catastrophes consumes large amounts of capital and raises the cost of borrowing.

The size and frequency of natural catastrophes rose over time and are expected to continue to rise for two reasons:

First, climate change is expected to raise the size and frequency of major events. An important reason for climate change is global warming. A large part of this warming is attributed to human activities. For example, greenhouse gases such as carbon dioxide resulting from fossil fires cause global warming.

Climate change and natural disasters started appearing in literature as a security issue in the nineties of the twentieth century reminding us of the Malthusian thinking. Neo Malthusians, talk about degradation, congestion and economic slowdown in the developing world, which could start domestic violence and cause waves of international immigration and dangerous military conflicts (See Grove, 2010). Is the “Arab Rabie” a manifestation of this prophesy? Second, the increase in world population and economic activities increase catastrophic risks. Buildings are costlier and the production processes are more complex and raise the possibilities of business interruptions after hurricanes and floods (Swiss Re, 2008).

Figure 1 shows the increase in the number of catastrophic events for the 1970-2010 period (Swiss Re, Sigma, 2011). The loss resulting from natural catastrophes increased by a 12% (7% adjusted for inflation) annual rate. This translates into doubling the nominal cost every six years (Swiss Re, 2008).



Source: Swiss Re Economic Research & Consulting

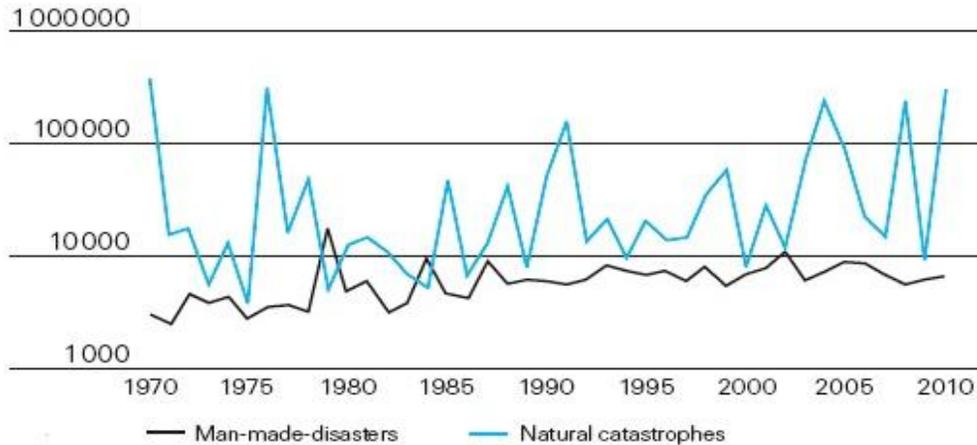
Figure1. Number of events 1970 – 2010

Economic losses resulting from natural catastrophes differ in number and costs from one country to another. And although developed countries faced huge economic losses in absolute terms, the losses faced by developing and emerging countries as a percentage of gross domestic product (GDP) are much greater (Swiss Re, 2008).

Figure 2 shows the number of victims resulted from man-made and natural catastrophes (Swiss Re, Sigma, 2011). The number of victims resulted from natural catastrophes has been higher and much more volatile compared to man-made victims. The trend in both cases is not dramatic compared with the number of events in figure 1.

To forecast natural catastrophes two methods are employed:

The traditional method: In this method an insurance company uses historical data for periods ranging from 30 to 40 years, isolating catastrophic elements (e.g., property) and compares losses emanating from these elements with total losses. If losses resulting from the catastrophic elements in a particular area during this period accounted for 1% of total losses (claims), the raters add 1% of catastrophe loading to the rate. The area may not experience major events for years and yet continue paying the extra 1%. Afterwards if the area is hit by a major catastrophe, the company subtracts losses from the total policy year and adjusts catastrophes’ premiums to account for the last catastrophe. This method does not apply only to the area that witnessed the event, other areas are included. e.g., if a hurricane hits the state of Mississippi, additional premiums are added to the states in southwest the United States (Hunter, 1994).



Source: Swiss Re Economic Research & Consulting

Figure 2. Number of victims 1970 – 2010

The Modern method: Huge catastrophes such as Andrew and Hugo alerted insurance companies; they started looking for advanced ways to deal with these catastrophes. In recent years analysts started using advanced forecasting models that depend on computers to forecast losses resulting from natural catastrophes. These models can forecast events for 10, 100 or more years. Different groups of analysts use different methods. Several of them including insurance companies offer models for sale. These models surpass traditional methods. But each model could be formulated in a way that serve the interests of the insurance company that used them (Hunter, 1994).

Arab countries have relatively experienced few natural catastrophes resulting in low economic losses. Insurers in Arab countries do not offer insurance against natural catastrophes and Arab citizens do not apply for them. However, Arab insurers face an important challenge. International reinsurers operating in risky areas attempt to compensate their losses by transferring part of these losses to Arab insurance markets. Previous ‘academic’ literature did not address this point. The present paper discusses the motives and practices of reinsurers operating in high risk areas and their attempts to transfer risk to Arab insurers and introduces suggestions to deal with these attempts.

After the introduction the paper is organized as follows: demand and supply for insurance against natural catastrophes, reinsurance, risk transfer, natural catastrophes in Arab countries and insurance against them, protecting Arab insurers, finally an end conclusion is presented.

2. Insurance against Natural Catastrophes: Demand and Supply

Insurance against catastrophes has a demand side and a supply side. When a prospective victim buys an insurance policy, the insurance company agrees to compensate policy holders for any losses or injuries, given they are covered by the policy. It is assumed that the insuring party applies for insurance if he believes that the premiums he pays are justifiable compared to the risks involved and he does not expect the government to give satisfactory relief if a catastrophe does occur. However, monetary compensation is not the only reason. Buying an insurance policy could be for sentimental reasons. e.g., regret, worry or to satisfy official or legal requirements (Faure and Breggeman, 2008).

Previous research (see for example: Zechhauser, 1996 and Kunreuther, 1996) found little interest in voluntary insurance against natural catastrophes. Most property owners in Germany did not buy insurance against natural catastrophes (such as floods or earthquakes). The same could be said about the United States. The city of New Orleans, a city under continued threat of floods, only 40% of its residents bought insurance against floods. In coastal cities of the State of Mississippi, less than 20% of residents bought insurance policies (Faure and Breggeman, 2008)

From the supply side, insurance companies are reluctant to sell insurance against natural catastrophes. They consider them uninsurable, for several reasons. First, information and data about natural catastrophes are scarce and inaccurate and the analytical methods do not allow reliable forecasts of these events. Second, the costs are extremely high and may cause bankruptcy (Faure and Hartlief, 2003). Third, if insurance companies raise premiums, demand would decline. Legal requirement may also prohibit raising premiums. Fourth, insurance companies may not have the financial resources needed to cover huge losses (Doherty, 2008).

3. Reinsurance

Reinsurance is a tool employed by insurance companies to protect them from huge catastrophic losses. Natural catastrophes are small in number, cause huge losses and happen in distant and irregular periods of time. A characteristic complicates forecasting. This is contrary to man-made catastrophes which destroy particular objects. Man-made catastrophes are consistent overtime and can be forecast with great accuracy, given the presence of the necessary expertise. These characteristics of man-made catastrophes make possible the gathering of the necessary information and its analysis using statistical methods such as 'cost burning'.

Natural catastrophes are affected by changing conditions over time. Their geographical distribution changes and is spread over large areas which changes the probabilities of occurrence. Therefore when assessing the risks of natural catastrophes all factors should be taken in consideration.

An insurance company can protect itself against catastrophic losses by (Swiss Re, 2009):

1. Controlling the accumulation of losses by setting limits to their covers.
2. Diversifying the portfolio to become less vulnerable to catastrophes.
3. Holding excess capital to pay for catastrophes losses.
4. Securitizing exposure to catastrophic risks via financial market tools (to be discussed).
5. Lastly, buying reinsurance.

There are two types of catastrophe reinsurance agreements:

First, proportional agreements: These are suitable for all insurance markets. Proportional reinsurance covers a specific percentage of losses.

Second, non-proportional or catastrophe excess of loss treaties (CatXL treaties): In a CatXL treaty the reinsurer agrees to compensate the insurance company (the insurer) for part of losses that exceeds a specified amount. This type is being increasingly used and is specifically designed for natural catastrophes. Losses are divided into three layers. First is the retention layer. Losses within this layer are paid entirely by the insurance company. Second, losses higher than the retention layer but less than the upper limit are paid by the reinsurance company. Third, losses above the upper limit are paid by the insurance company, unless otherwise agreed upon.

Figure 3 shows a CatXL treaty covering loss layers for three events ranging from 50 to 75 million dollars per event. i.e.: the treaty covers 25 million dollars in excess of 50 million dollar loss for each event. In event A, insurance companies cover all losses. In event B, reinsurance companies

pay amounts in excess of 50 million dollars and less than 75 million dollars. In event C, reinsurers cover 25 million dollars. Amounts in excess of 75 million dollars are paid by insurance companies (Swiss Re, 2003).

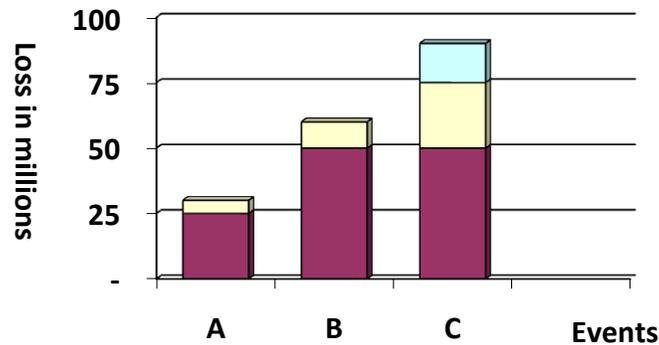


Figure 3. CatXL Treaty

Components of the technical reinsurance premium for a CatXL treaty are as follows:

$$\text{Technical reinsurance} = \text{expected annual loss} + \text{administrative costs} + \text{Capital costs} + \text{Profit margin}$$

Pricing catastrophe reinsurance premium

Assuming no commission fee, the reinsurer's premium is set as follows (Abdel-Hamid and Ashree, 2000).

$$\text{Premium} = f(\text{Expected Lost Distribution}) / [(1 - EL)(1 - TER)]$$

Where: $f(\text{Expected Loss Distribution})$ is a function combining the mean and variance of expected loss distribution; EL is the reinsurer's expenses as a percentage of the premium; and TER is the insurer's expected return.

Estimation error that faces the pricing process of a reinsurance contract includes:

1. process risk: a risk resulting from using a specific loss distribution to describe and predict future losses incurred by an event, e.g., building covered by the insurance policy
2. parameter risk: associated with estimating a loss distribution
3. timing risk: associated with the timing of loss payment

These three types are important because natural catastrophes have low frequencies and have huge losses. Estimates are as well sensitive to changes in information, experience and parameter estimation.

4. Risk Transfer

Losses resulting from natural catastrophes have been on the rise in number of events and in insured losses (Munich Re, 2012). In 2010 losses attributed to natural catastrophes were 194 billion dollars (Swiss Re, Sigma, 2011). Insurance companies could not cover such huge losses and reinsurance treaties covered only a part- up to a certain ceiling. Therefore insurance companies started looking for alternatives that included:

1. Transfer of losses to other areas or countries. To face the huge financial responsibilities, insurance companies utilized the “law of large numbers.” The larger the number of policy holders the lower the premium per individual and more financial resources become available for insurance companies. For example insurance companies operating in risky coastal areas in Mississippi and Louisiana, USA added natural catastrophes coverage to areas or states distant from the risky coastal areas.
2. Transfers to financial markets. Different types of securities have been used including catastrophe bonds (CatBonds) and CatSwaps. These are investment tools that create funds that can be used to finance large losses. These financial tools make it possible to benefit from huge financial assets available in the international financial market which are in excess of 150 trillion dollars (World Bank, 2011). CatBonds are becoming more popular. Their value has increased from usd 0.7 billion in 1997 to 15 billion dollars in 2007, a 35% annual rate of growth. CatBonds are, in fact, a securitization process that transfers natural catastrophes risks to the capital market. Buyers of these bonds (investors) receive above normal returns, to compensate for the loss of principal under the condition that they accept certain indices that trigger payments for insurance loss. These indices are published, accurate, transparent, and objective (for more about these tools please refer to Swiss RE sigma no. 7/ 2006). CatBonds require payments in advance before catastrophes occur.

Multicat bonds are other tools issued by the World Bank. The first time they were used was in the year 2007. They are recognized as after catastrophe recovery bonds. Multicat bonds offer short-term liquidity after the catastrophe and give the government time to start recovery efforts, at a time the catastrophe has shut down all economic activities. Multicat bonds are sold to investors in a manner similar to catBonds. They were first used by the government of Mexico in 2009(World Bank, 2011).

3. Mandatory insurance: Several philosophies address the issue of government intervention in natural catastrophes. Slovic et al., (1997) said that if people prefer insurance against events with high probability and low losses, they would accept insurance against low probability catastrophes if this insurance is sold for extra cost added to insurance against highly probable events. Faure and Bruggeman (2008) found that this method of insurance to have several advantages. First, mandatory insurance protects insurance companies from going bankrupt. The larger the number of insurance holders the greater the spread of risk over a large area. Second, if the extra premiums for the added mandatory insurance were on the basis of specific risks, the insurance policy holders would pay only against expected risks. Therefore the client would be informed about the risks involved and he would not feel paying against risks that may not happen. One of the objections raised against obligatory insurance is that it may reduce the level of public welfare. Are the benefits realized from obligatory insurance big enough to justify government intervention? Some individuals may not want to pay insurance premiums against events with very low probability of occurrence. Some individuals refrain from insuring against catastrophes because they don't have the necessary information. Therefore, instead of forcing people to buy obligatory insurance, the government should educate them about the risks involved and subsequently they would voluntarily buy insurance. Finally, those who pay insurance premiums and do not face

catastrophic risks are in fact only helping those who face real catastrophes. Therefore, obligatory insurance ignores the fact that demand for insurance depends on the risks that individuals face.

However, mandatory insurance reduces the pressures on the government to provide shelter, drugs, and other types of relief services. Mandatory insurance also reduces social pressures if a large number of people are affected by the catastrophe.

5. Natural Catastrophes in Arab Countries and Insurance against Them

Natural catastrophes in Arab countries have been few in numbers and relatively low in losses. Worldwide statistics show that total economic losses resulting from catastrophes (natural and man-made) for 2010 were 218 billion dollars, a 0.31% of world GDP. Natural catastrophes caused 194 billion dollars or 89% of total losses. The regions that were affected the most were Latin America and the Caribbean region by 1.10% of GDP, Oceania and Australia by 0.95% of GDP, Asia by 0.28% of GDP and Europe by 0.19% of GDP (Swiss Re Sigma, No. 1/2011). According to the US Geological Survey, more than three million earthquakes occur annually in the world. Most of these earthquakes were of 3.9 or less magnitude. More than 900 earthquakes are of 5.0 magnitudes or higher. About 81% of earthquakes occur in circumference Pacific seismic-built (Chili, South American Cost, Central America, Mexico, and west cost of the US).

Tables of the forty most costly insurance losses (Natural and man-made) for the period 1970 - 2010 did not include any Arab country (Swiss Re Sigma 2011, pp.32 and 33). Arab countries losses were relatively small. The deadliest was a 779 million dollar loss jointly for Pakistan and Oman. However, Pakistan is a large and populous country and it has a history with major catastrophes (the numbers in the previous tables did not show economic losses in Pakistan as no insurance against natural catastrophes existed (Miller, 2010)

Insurance companies in Arab countries do not offer independent insurance policies against natural catastrophes nor do they offer added coverage to other types of insurance, such as auto insurance. In Jordan, for example, health insurance policies are explicit in excluding losses and injuries resulting from natural catastrophes from coverage. People, on their part, do not apply for insurance against natural catastrophes. There is neither supply nor demand. Simply market for insurance against natural catastrophes does not exist in Arab countries. If a natural catastrophe occurs, the victims depend on the governments and international aid for relief. Governments do not use obligatory insurance against natural catastrophes. The major reasons for the total absence of insurance against natural catastrophes in Arab countries include:

- (1) Very low probability of natural catastrophes occurrence.
- (2) Relatively low losses.
- (3) Uneven spread of catastrophes, make residents of low possibilities areas reluctant to buy insurance policies.
- (4) People are not well-informed about the risks and other characteristics of natural catastrophes.
- (5) The vast majority is low income people and its major concern is how to provide basics to own families.

6. Protecting Arab Insurers

Arab insurance companies seek protection against large losses by signing treaties with international reinsurers. Arab reinsurers were excluded because they:

- (1) Do not have sufficient financial resources to cover large unpredictable losses caused by natural catastrophes.
- (2) Do not have acceptable international ratings required by the Boards of Inspection and Control.
- (3) The political atmosphere in the Arab region is not quite conducive for pan-Arab economic cooperation. The Arab Common Market has been on paper for many years and yet to achieve credible results.

Therefore, Arab insurance companies had to sign treaties with international reinsurers. The most important challenge facing Arab insurance companies in their relationship with international reinsurers is the attempts made by international reinsurers to compensate their international losses by transferring part of these losses to Arab insurance companies and ultimately to Arab policy holders.

The authors of the present paper paid several visits to insurance companies in Jordan and Egypt asking for details about the transfers; they all denied access to such information on the basis of confidentiality. However, international reinsurers have the experience and motives (discussed earlier) to transfer losses from highly risky to less risky regions. They are doing it in Arab countries. Haideh (2007) contends that after the huge losses of natural catastrophes in 2005, all of which in the United States, the Caribbean Islands and the Gulf of Mexico; international reinsurers demanded higher prices and imposed stricter terms on Arab insurance companies. They reduced commissions and tied them to a stepwise average loss method instead of fixed commissions. Reinsurers also imposed constraints such as session limits (maximum amount that can be added to the treaty of total insurance value covering natural catastrophes). International reinsurers also imposed limits on total compensations paid per event. Rauf (2006) emphasized the exaggerated terms and prices imposed by international reinsurers on Arab insurance companies, to compensate for their huge losses resulting from natural catastrophes in other regions.

It becomes, therefore, imperative for Arab insurance companies to look for a way out. The authors present few suggestions. These suggestions are brief and in need of more research.

The first suggestion concerns Arab government. Arab governments can and should play an important role in protecting Arab insurers and create assurance and stability in Arab economies. Arab governments can contribute in several ways including:

- a. Obligatory insurance. There are different views concerning the intervention of governments by imposing obligatory insurance against natural catastrophes -a point discussed earlier. However, it is reaffirmed that those who pay for insurance against risks that may not occur, are in fact only helping those facing real risks. Therefore, obligatory insurance should not ignore the fact that demand for insurance depends on the risks individuals face. i.e., obligatory insurance should recognize risk differences in different regions.
- b. Modifying forecasting models. When insurance and reinsurance companies build models to forecast catastrophes, their assumptions lead to conclusions that serve their own interests-their models are biased. To correct their bias, the government employs experts who use neutral assumptions. In this manner the government safeguards free competition and makes sure that precautionary measures are taken before catastrophes occur.
- c. Public reinsurance: the governments can play an active role in the reinsurance business. Lewis and Murdock (1996) proposed a U.S Federal reinsurance that can spread natural catastrophic losses over time and, at the same time, limit the Federal government exposure

to losses. The government sells the increase in losses ex ante to insurance and reinsurance companies. The coverage and compensation depend on the insurance industries' losses and are not tied to losses of a specific insurance company. In other words, the Federal government sells call options related to earthquakes, volcanos and storms to the insurance industry covering catastrophic losses in the range 25-50 billion dollars. A reinsurance treaty is the difference between the "call option" and the "put option" covering the insured event. According to this plan the government accepts responsibility and reinsures excess losses within a specific range.

Similar to the proposal made by Lewis and Murdock (1996), a reinsurance treaty is proposed for Arab countries, taking in consideration the size of expected losses. The purpose is to provide protection to insurance companies against total loss (L) in excess of a certain level called trigger loss (T) which depends on financial capabilities of insurance companies. If the loss resulting from an event is in excess of the trigger loss (T), the government pays a fixed ratio of the total loss (L) up to a maximum (C) cover cap to volume exposure. If the loss is less than the trigger value, the insurer pays all losses. If loss lies between (T) and (C), the government according to the treaty pays (C-T). If the loss is in excess of (C), this excess is paid by the insurers.

Reinsurer's (the government's) payment can be expressed mathematically as follows (for details refer, for example, to Cummins et al., 1999):

$$P = \text{Max} [0, \text{Min} (L-T, C-T)] \quad (1)$$

$$P = \text{Max} [0, (L-T) - \text{Max} [0, (L-C)]] \quad (2)$$

Equation (2) says that the reinsurance treaty is the difference between the call option and the put option.

The government, therefore, carries part of the loss, the difference between the call option and put option. The government sells prospective compensation directly on the basis of event and risk. These prospective losses are called excess loss treaties (XoL) that are available to qualified insurance companies and reinsurers in the maximum contracted amount covered by the treaty. The government can use contracts covering multiple risks or single-risks against hurricanes and earthquakes.

Finally, the government can play an important role by working with the private sector, to be discussed in the next section.

7. Conclusions

Small insurers and reinsurers are reluctant to insure against natural catastrophes because these are difficult to predict and could cause huge losses. Governments can help and set up a mechanism involving insurers, reinsurers and the government joined together in a collective administration and under government supervision. A legal framework governing this relationship should be put in place. Part of the financing could include using financial market tools such as CatBonds and CatOptions. The financing burden could further be reduced by proper information and marketing and assuring citizens of the security of the program and, thereby, induce them to voluntarily buy insurance against natural catastrophes- added to other types of insurance. Larger numbers of policy holders mean lower and affordable premiums. The government would also require safer building requirements and better engineering designs capable of withstanding certain levels of earthquakes. And it would not hurt if

- More and serious cooperation among Arab countries in the areas of insurance and reinsurance to extend geographical coverage and to support financial resources for insurance and reinsurance against natural catastrophes.
- Arab Boards of Inspection and Control ease ratings requirements to enable Arab reinsurance companies take an active part in reinsurance against natural catastrophes.

To conclude, the increase in the frequency of natural catastrophes and the huge insurance losses resulting from them, forced reinsurance companies to attempt transfer part of these losses to the financial markets or to less risky areas, including Arab countries. This transfer over-burdened Arab insurers. The present paper analyzed aspects of insurance against natural catastrophes and presented suggestions to deal with the extra burden. The suggestions included the possible roles of the Arab governments and the private sectors.

References

- [1] Abdel-Hamid A'del M. and Ali S. Al-Ashree (2000), "Evaluating Mathematical Methods in Calculating Reinsurance Extra Loss Premiums", *Scientific Journal of the Faculty of Commerce*, University of Assiut, No 29.
- [2] Born, Patricia H. and W. Kip Viscusi (2006), "The Catastrophic Effects of Natural Disasters on Insurance Markets", *Journal of Risk and Uncertainty*, 33(1): 55-72.
- [3] Crichton, David (2008), "Toward a Comparison of Public and Private Insurance Responses to Flooding Risks", *Water Resources Development*, 24(4): 583-592.
- [4] Cummins, David, Lewis Christopher M., Phillips Richard D. (1997), "Pricing Excess-of-Loss Reinsurance Contracts Against Catastrophic Loss", *Working Papers 98-09*, Wharton School Center for Financial Institutions, University of Pennsylvania.
- [5] Doherty, Neal A., Grace Martin F., Klein Robert W. , et al. (2008), "Managing Large-Scale Risks in a New Era of Catastrophes" (Wharton Risk Management and Decision Processes Center in Conjunction with the Georgia State University and the Insurance Information Institute), In: Faure and Bruggeman (2008) , p. 15.
- [6] Faure, Michael and Ton Hartlief (2003), "Insurance and Expanding Systematic Risks 84-85", In: Faure and Brugman (2008), OECD Publishing, p. 28.
- [7] Faure, Michael and Veronique Bruggeman (2008), "Catastrophic Risks and First-Party Insurance", *Connecticut Insurance Law Journal*, 15(1): 1-52.
- [8] Grove, Kevin J. (2010), "Insuring Our Common Future", *Dangerous Climate Change and the Bio-politics of Environmental Security*, Routledge: Taylor and Francis Group, pp. 536-563.
- [9] Haideh, Samia (2007), "Variables Expected to Face Insurance Companies when Renewing Treaties", A paper presented at the Conference of Insurance and Reinsurance Companies to discuss the renewal of reinsurance treaties, 11-17 June, 2007, Amman, Jordan. Ms. Haideh is member of the Board of Directors, Egypt Reinsurance Company.
- [10] Hoop, T. and R. Ruben (2010), "Insuring Against Earthquakes: Simulating the Cost-Effectiveness of Disaster Preparedness," *Disaster*, 34(2): 509-523.
- [11] Hunter, J. Robert (1994), "Insuring Against Natural Disasters: Prevention, Planning and Panaceas", *Journal of Insurance Regulation*, Symposium on Financing Catastrophe Losses in the Property and Casualty Insurance Industry, pp. 467-485.
- [12] Insurance Information Institute (2010), "Catastrophes: Insurance Issues", [On-line] Available at www.iii.org/issue_updates/earthquakes-risk-and-insurance-issues.hotmail , November 2010.

- [13] Insurance Information Institute (2010), "Earthquakes: Risk and Insurance Issues", [On-line] Available at www.iii.org/issue_updates/earthquakes-risk-and-insurance-issues.hotmail, November, 2010.
- [14] Kunreuther Howard (1996), "Mitigating Disaster Losses through Insurance", *Journal of Risk and Uncertainty*, 12(2-3): 171-187.
- [15] Lewis, Christopher and Kevin C. Murdock (1996), "The Role of Government Contracts in Discretionary Reinsurance Markets for Natural Disasters", *The Journal of Risk and Insurance*, 63(4): 567-597.
- [16] Miller, Jonathan (2010), "Assessing the Devastation of the Pakistan Floods", *Channel 4 News*, [On-line] Available at www.channel4/news/assessing-the-devastation-of-the-pakistan-floods, August 7, 2010.
- [17] Munich Re (2012), "Natural Catastrophes Worldwide 1980-2011," [On-line] Available at www.munichre.com/app_pages
- [18] Rauf, Abdul-Kaliq (2006), A paper presented at the International Conference on Insurance against Earthquakes and Catastrophic Risks, Amman, Jordan, 17-19 September, 2006. Mr. Rauf in 2006 was Secretary General of Arab Insurers Union.
- [19] Slovic, P., Fischhoff B., Lichtenstein S., et al. (1977), "Preference for Insurance against Probable Small Losses: Insurance Implications", *Journal of Risk and Insurance*, 44(2): 237-258.
- [20] Swiss Re, Sigma (2011), "Natural Catastrophes and Man-made Disaster in 2010: a Year of Devastating and Costly Events", No.1, 2011, 36 pages.
- [21] Swiss Re (2008), "Disaster Risk Financing: Reducing the Burden on Public Budgets", *Focus Report: Disaster Risk Financing*: 1-8.
- [22] Swiss Re, Sigma (2008), "Natural Catastrophes and Man-made Disasters in 2007: High Losses in Europe", No.1, 2008.
- [23] Swiss Re (2003), "Natural Catastrophes and Reinsurance: Risk Perception Series", [On-line] Available at www.ct.gov/cid/lib/cid/app4_natcaten2006.pdf
- [24] World Bank (2011), "Insurance against Natural Catastrophes", A New Program for Catbonds. [On-line] Available at www.preventionweb.net/english/professional/news/v.php?id=11715
- [25] World Bank (2011), "News and Broadcast: Insurance Against Natural Catastrophes", [On-line] Available at <http://go.worldbank.org/DL34CYHJ40>.
- [26] Zekhauser. R. (1996), "The Economics of Catastrophes", *Journal of Risk and Uncertainty*, 12(2-3): 113-140.