AN ANALYSIS OF THE FACTORS INFLUENCING THE DEMAND FOR CATASTROPHE INSURANCE

Cristina CIUMAŞ

Department of Finance, Faculty of Economics and Business Administration, Babeş-Bolyai University
Cluj Napoca, România Country
cristina.ciumas@econ.ubbcluj.ro

Ramona Alexandrina COCA

Department of Finance, Faculty of Economics and Business Administration, Babeş-Bolyai University
Cluj Napoca, România Country
ramona.coca@econ.ubbcluj.ro

Abstract: *This paper approaches the issue of insurance demand for catastrophic risks. Given the impact of these extreme events, the upward trend both in terms of frequency and severity a low level of the degree of insurance coverage can be observed. This is not a characteristic for Romania but rather a global problem. Our goal is to identify the main factors that influence a person's decision to switch from uninsured to insured based on the analysis of the models already developed. Then we will focus on the Romania's situation when it comes to regulations of covering the three catastrophic risks: earthquake, flood and landslides. Based on data regarding compulsory household insurance, through a regression analysis we'll identify the factors that are taken into account by the clients when they decide to transfer the risk by buying an insurance policy. Furthermore we'll present some elements that can lead to a higher insurance coverage. An important aspect is a different premium for the compulsory insurance by considering the exposure to risk.*

Keywords: *Catastrophe insurance, PAID, insurance coverage, CRESTA zone, relativity factors*

INTRODUCTION

Catastrophes are also known as extreme events characterized by a low frequency but high severity. When such an event occurs it causes a deviation from normality, in a short period of time a large number of people being affected (dead, injured, missing). At the same time the financial capacity of the area is exceeded, the financial impact being significant and often in these situations financial support from Government and Public Authorities is needed. There are cases when a state that has been affected by a catastrophe needs financial aid from other countries, for example at the European Union level has been established the European Solidarity Fund, these amounts being used for disaster relief for affected Member States.

Depending on the trigger factor there are two main groups of catastrophes: natural catastrophes generated by nature force and technological catastrophes caused by human actions. In this paper we will focus only on the first category-natural catastrophes.

The records show that we are facing an increasing number of catastrophic events. After 1970 we can observe an upward trend of catastrophes frequency. Before the mid of

80s there were moderate fluctuations of the events number but after this period we witnessed a higher growth. Also, before 1970 the value of losses didn't exceeded 30 billion USD but after this year the situation was different, new records for the losses being observed due to major events that have occurred. These situations can't be considered isolated cases but rather a new trend: for example hurricanes Ivan, Charley and Frances in 2004 generated losses in amount of 45 billion USD. In 2005 the level of losses increased again to a new record of 80 billion USD after the hurricanes Katrina, Rita and Wilma. The peak was reached in 2011 when insured losses were in amount of 110 billion USD after New Zeeland earthquakes and Thailand floods. This year was the most expensive in history if we take into account the value of losses generated by earthquakes in a single year, only the Japan earthquake generated 35 billion USD losses and also losses caused by floods in Thailand have been the highest ever registered.

In the figure below the evolution of the ratio between insured losses and total losses caused by catastrophes worldwide can be observed. The average degree of insurance coverage is 32.79%, a relative low value contrary to the high impact and great exposure of households to catastrophes. We note that only in two years, 2009 and 2012 the percentage of insured losses in total losses exceeded 40%. The explanation for these cases can be people reaction after occurrence of significant events in 2008 and 2011 when catastrophes generated extremely high level of losses.

Fig. 1 Evolution of the insured losses and total losses caused by catastrophic events
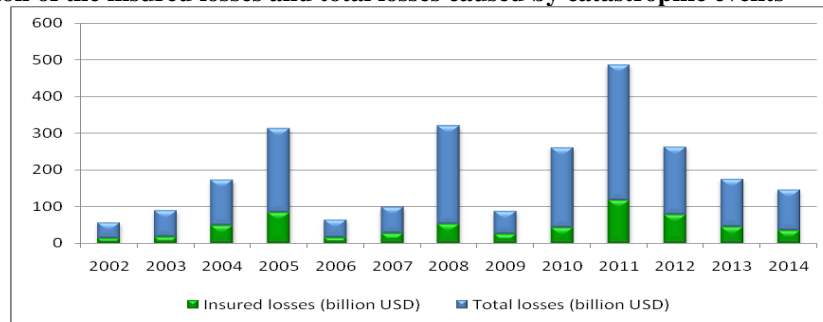
Source: Authors'processing based on Natural catastrophes and man-made disaser Reports, Swiss Re, 2002-2014

When it comes to catastrophes that threaten Romania statistics show that two major risks can be considered: earthquakes and floods. Even if floods are more frequent the largest losses have been generated by earthquakes. For example the earthquake of March 4, 1977 caused damages of 2 billion USD.

From a seismic point of view Romania is characterized by a medium to high level of risk. However, if we make a comparison to Japan the energy released is about 400 times lower. Vrancea is the main seismic zone, with a clearly defined seismic activity form Europe. Earthquakes in this area occur at intermediate depth and affects 50% of the whole territory of the country.

Floods are the second risk that Romania is exposed to. If we refer to losses caused by these events we have to mention 2005 as a reference point, three major floods occurred in a single year and caused losses in amount of 1.3 billion USD.

Although the exposure to catastrophic events of Romania is significant the insurance coverage of households has a low value. Consequently, our purpose is to identify and analyse those factors that influence the consumer decision to conclude an insurance policy that cover catastrophic risks.

In order to analyse the demand for catastrophe insurance the starting point should be represented by objects exposed to risk.

Some of the reasons for a low insurance coverage of households are (Ionică M., et al 2009):

- Economic reasons: low income, the poverty rate in each country;
- Lack of education of people regarding insurance products and risks, the intangibility that characterizes financial services;
- Lack of actions and measures in order to sustain the implementation of legal regulation. Although household insurance became mandatory since 2009 no control actions were taken to monitor how this type of product functions. In addition a series of legislative changes have created some confusion among the population and a message of decision instability has been sent.

Aid for disaster relief in case of extreme events paid by Government also discourages the conclusion of insurance policies.

We also need to take into account the Romanian insurance market characteristics: a market dominated by motor insurance. To achieve the goal of a higher insurance coverage of properties a change of mentality is needed through people education, awareness campaign of risks and also different price of the insurance policy based on the exposure to risk.

REGULATION ON THE NATURAL DISASTER INSURANCE

At present household insurance is mandatory, the law being in force since July 15, 2009. The decision of introducing as a compulsory policy is based on a number of determining factors such as:

- Romania's high exposure to extreme weather events;
- Low level of insurance coverage through facultative policies, only 10% of total households being covered;
- Allocation of important amounts from the Intervention Fund at the disposal of the Government after floods in 2007: the initial value established has been increased about 50 times during the year, from 3.6 billion Euro to 174.9 Euro.

Once the law has been adopted a series of discussions regarding insurance companies that will issue such policies followed. Finally it was decided the constitution of Natural Disaster Insurance Pool (PAID) starting with September 23, 2009. At the beginning the shareholder structure consisted of 13 companies authorised by the Insurance Supervisory Commission even if 16 companies were interested to be part of the pool. Quite strict conditions have been imposed by the Insurance Supervisory Commission and in this situation three companies have been rejected because these failed to meet all the requirements imposed.

The role of the PAID was to decrease social and financial pressure on the Government and public authorities when a natural catastrophe occurs.

Compulsory insurance policies cover three risks: earthquake, flood ad landslides. Numerous amendments have been issued in case of this law in order to stipulate how the compulsory insurance and the facultative policy works together in case of the same insured object. The last update was introduced by Law 191 of July 2, 2015: the main change is represented by the fact that insurance companies can issue a facultative policy for a household only if that one is covered by a PAD compulsory insurance.

Currently the level of insurance coverage through compulsory household policies is about 17%, still quite low. Even if in the figure below a rising trend can be observed a number of measures are needed in order to be achieved the purpose for constituting PAID.

Fig. 2 Evolution of the number of PAD policies during 2010-2014
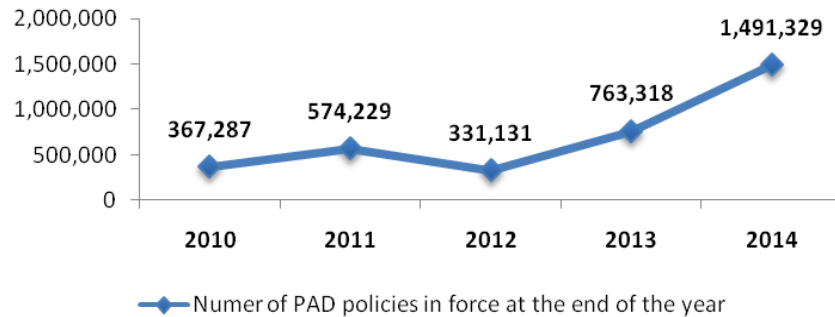
Source: Authors'processing based on public data offered by PAID

Next we will focus on several possible explanations for the relatively low value of the insurance coverage:

- Many legislative changes that have created some misunderstanding among the population;
- Lack of functional measures for those people that have no insurance policy against natural catastrophes. In addition the financial aid offered by the Government to affected people discourages the insured people because they consider that could have received the value associated to damage without paying the insurance premium. On the opposite site those persons that have received different amounts without having an insurance policy can be encouraged to act in the same manner in the future;
- The unique value of the insurance premium regardless the exposure to risk. For example a person that has an apartment in Bucharest has a higher exposure to risk in comparison with one having an apartment in Cluj, but they pay the same premium for being covered if an event occurs;
- The three catastrophic risks are covered by a single insurance policy, even if in some areas of the country the exposure is insignificant to all these risks. A policy for each catastrophic risk may lead to a higher degree of insurance coverage depending on the exposure of each zone.
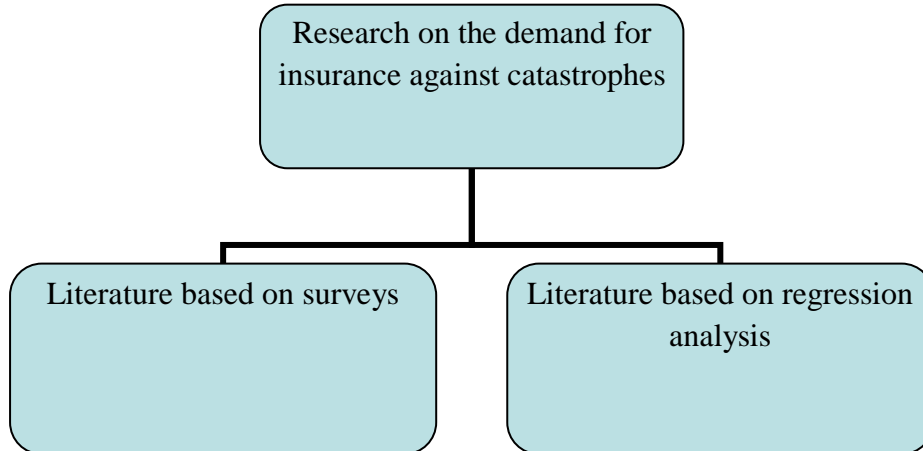
In the next section the main research studies regarding the demand for insurance coverage for catastrophic risks will be presented. Also the results obtained about the factors that influence the decision of a person to conclude or not an insurance policy will be discussed.

LITERATURE REVIEW

A large part of the literature addresses separately the factors influencing the insurance demand based on the policy type, covered risk (for example earthquake, flood). Results not give clues about some major differences in terms of approach. In this context, taking into account that in Romania the three catastrophic risks are included on the same policy we will address them together.

The low level of insurance demand for policies that cover catastrophic risks is not characteristic only for the Romanian insurance market but rather a global issue, so specialists form various areas such as economics, statistics, seismology, meteorology, geology addressed this theme in their research studies.

The research studies realised can be divided into two main parts:

```
┌──────────────────────────────┐
│   Research on the demand for │
│ insurance against catastrophes│
└──────────────────────────────┘
            │
    ┌───────┴────────┐
┌───────────────┐  ┌───────────────────┐
│ Literature    │  │ Literature based  │
│ based on      │  │ on regression     │
│ surveys       │  │ analysis          │
└───────────────┘  └───────────────────┘
```

The first studies developed had as central element questionnaire, and then being developed studies where the research method was regression analysis.

In the studies completed several factors that influence the demand for insurance against natural catastrophes have been identified:
- Political factors

In the first studies done in 1960 when the research on natural catastrophes started the problem of public policy and their implications has been addressed. The reference studies were elaborated by Kunreuther (1978), Camerer şi Kunreuther (1989), Kunreuther (1990). One of the main themes discussed was about the aid granted by the state in case a major event occurs. This action has a positive effect if we refer to help that population receive to return to the situation before the event but on the other hand when it comes to insurance demand we can talk about a negative effect because people are discouraged to buy protection through insurance policies. For example, after the 1964 Alaska earthquake the owners of affected houses could get loans on advantageous terms in order to rebuild their homes, amounts that otherwise could not have accessed in these conditions. Then,

these advantages have been replaced by an insurance granted by state for those areas that have taken some measures to limit the flood risk.

- Psychological factors

Psychological factors are important and these relate primarily to people's tendency to estimate the occurrence probability of an event through their memory. As we know catastrophes are rare events and as a consequence people have two approaches: assigning a zero probability of occurrence or a positive value but underestimated compared to an objective assessment.

- Social factors

The social networks of each person play an extremely important role, people being more responsive and influenced by the behaviour and the decisions taken by their friends. This factor is considered to be a critical one that makes the difference between an insured and uninsured person. Also it controls factors like income, education, and risk aversion of a person.

- Economic factors

In this category we can talk about income, unemployment rate, and insurance premium. If in case of consumer goods we can talk about a positive relation between income and demand, when it comes to insurance policies the situation is different. It was observed that as income increases the demand for insurance falls. A possible explanation for this situation is that when individual have certain welfare they consider unnecessary ceding the risk. The results on the relation between income and insurance demand are ambiguous, Browne and Hoyt (2000) identifying a positive relation but Grace et. al (2004) said that there is an ambiguous relation between these two variables.

- Risk perception factors

No relation between an objective assessment of the risk and the perception of individuals has been identified.

One thing is clear and supported through numerous surveys conducted by Kunreuther (1978) and others conducted by Risa Palm in 1989, 1990 and 1993: the insurance demand increases after a major event occurs. Furthermore households affected by such an event will be insured in the future. It was also noted that some aspects that objective capture the seismic risk, such as ground motion couldn't have been analyzed because these concepts are not familiar to property owners.

The results of surveys conduct us to conclude that clients' decision to buy an insurance policy is not based on calculations but the public policy had an influence on the long term insurance demand.

In studies based on regression analysis the endogenous variable it is considered to be the series of the number of policies issued, or the value of insured amount. As explanatory variables it has been considered: the income, the insurance premiums, the household value, damages in the previous year, the exposure to risk. If there were available information about education, the existence of mortgages, construction year of the house these also were taken into account and analyzed.

DATA AND METHODOLOGY

The data used in this study are obtained from several sources: Natural Disaster Insurance Pool (PAID), National Institute of Statistics, Solvency II Directive especially for the relativity factors of CRESTA zones.

Data will be grouped on CRESTA zones which represent a standard for the insurance industry in terms of associated risk. In Romania a number 41 CRESTA zones exists, these being in fact the counties. For each zone a relativity factor for earthquake and one for floods will be considered. In the table below the highest values for each type of relativity factor is presented:

Table 1 Extreme value on risk exposure

CRESTA Zone	Earthquake relativity factor	CRESTA Zone	Floods relativity factor
1.Vrancea	5.2	1.Braila	11.9
2.Buzau	4	2.Tulcea	7.9
3.Bucureşti	2.5	3.Ialomita	4.6
4.Calarasi	2.2	4.Teleorman	4.6
5.Prahova	2.1	5.Galati	4.6

Source: Annex Solvency II Directive

In the table above we can see which areas are most exposed to earthquakes and floods. In these circumstances we expect to have the largest number of issued policies in these areas, this being a truth in case of an objective assessment of the risk and not influenced by psychological factors. For example we have analyzed the areas with the highest insurance coverage through compulsory household insurance and these counties are: Bucharest (36%), Timiş (30%), Braşov (27%), Prahova (24%), Constanţa (23%). Areas that have been often affected by floods in recent years as Teleroman, Olt, and Vaslui are on the last positions. This fact can be explained by the aids received from the Intervention Fund at the disposal of the Government after major events and also by the relative low level of the income of the individuals in these areas.

Starting from the studies developed we'll test what factors influence the decision of an individual when he conclude an insurance policy covering catastrophic risk. An econometric linear model will be estimated:

$$y_i = b_0 + b_1 x_1 + b_2 x_2 + ... + b_k x_k$$

The coefficients will be determined through OLS method.

ESTIMATION AND RESULTS

Next we will perform a regression analysis using cross-sectional data considering all CRESTA zones and one single year.

Variables considered:

The dependent variable is the insurance demand and consists of the total number of PAD policies issued for the CRESTA zone i for natural persons. It gives us information on the number of individuals that have an insurance policy but we don't have

information on the extent of coverage. Another option was to consider the insured amount per capita but taking into account that in case of compulsory insurance we have the same insured amount for all homes we decided to use the number of issued policies.

The independent variables are:
- Income, taking into account the average wage for each CRESTA zone i;
- Earthquake risk associated to CRESTA zone i, expressed by earthquake relativity factors defined by Solvency II Directive;
- Flood risk associated to CRESTA zone i, expressed by flood relativity factors defined by Solvency II Directive;

In 2014 a number of 1.491.239 PAD policies have been issued, in the table below the distribution on CRESTA zones can be observed, being presented the first and the last 5 positions. The biggest percentage in total policies issued is in Bucharest, the capital having a major exposure to earthquake risk, various actions being carried out for risk awareness of the population.

Table 2 Distribution of PAD policies on CRESTA zones

CRESTA Zone	% PAD CRESTAi zone in total PAD policies issued	CRESTA Zone	% PAD CRESTAi zone in total PAD policies issued
1.Bucureşti	24%	37.Călăraşi	1%
2.Timiş	6%	38.Gorj	1%
3.Prahova	5%	39.Mehedinţi	1%
4.Constanţa	4%	40.Bistriţa Năsăsud	1%
5.Brasov	4%	41.Sălaj	1%

Source: Authors' processing based on public data offered by PAID

The model is:

$$Ln(Demand_i)=b0+b1Ln(Income_i)+b2EqRisk+b3FloodRisk$$

Table 3 The results of the model describing insurance demand for catastrophe insurance

Variable	Coefficient	Standard deviation	t-Statistic	Prob.
Constant	-17.28	3.94	-4.3816	0.0012
Income	3.80	0.54	6.9766	0.0000
EqRisk	0.09	0.06	1.4036	0.1688
FloodRisk	-0.02	0.03	-0.6478	0.5211

R-squared=0.5959
Source: Authors' processing

Although the household insurance is compulsory we started to analyze the factors influencing consumers based on the low level on insurance coverage. The results show a positive relationship between the insurance demand and the level of income. At the same time in zones where we have observed the highest level of insurance coverage: Bucharest (36%) and Timiş (30%) we also find the highest values for the average wage. We have to note that an objective assessment of the risk has no influence on the buying decision of the consumer.

CONCLUSIONS

We can conclude that the demand for catastrophe insurance is influenced by relative factors, those psychological and social having a great impact on de consumers' decision. In addition we have observed that some factors have a different influence form one person to another. For example, a higher disposable income can determine a greater willingness for an insurance policy but at the same time for another person can lead to risk-taking, in this situation the person considering that has the capability to return to the situation before the event with his own resources. Additional factors interfere, like risk aversion, education and the confidence in insurance companies.

At the same time the reduced frequency of these events lead to underestimation of the risk. If we hear every day about accidents, we see such events on the road, when it comes to earthquake not many prospective policyholders have passed through an experience of such an event. Nevertheless lately the effects of floods cannot be neglected, and this upward tendency may be transposed into a better risk awareness.

In the future we consider that the stability of regulation will play an important role. Also the collaboration between PAID, the insurance companies and public authorities (local and central) in order to establish an efficient and functional flow for identifying those uninsured households and acting in consequence will be important. All these entities should action in order to increase the level of insurance coverage but at the same time an open view and willingness to improve this compulsory insurance policy is needed.

The study can be developed in the future by also taking into account other variables that can influence the insurance demand: the value of compensation paid in the previous year, the amounts allocated form the intervention Fund at the disposal of the Government.

Also, an important aspect regarding compulsory household insurance is establishing a different value of the insurance premiums based on the exposure to risk, the insured value. Being a compulsory insurance product probably it was considered that it has to be a simple one. We do not consider to be a complicated pricing method but adding some elements could lead to a positive effect on the perception about this insurance type among population.

In terms of exposure to risk, for example in case of earthquake risk, an important step will be considering peak ground acceleration (PGA) as a factor of risk. This is a measure of the ground motion and an important parameter influencing the damages in case of an earthquake.

Such a study would be useful for insurance companies to attract new clients by analysing the behaviour of the existing customers. According to factors that influence the insurance demand a customer categorization can be done in order to be carried some risk awareness campaigns, providing public information sessions.

References

[1]   Athavale M., Avila S., (2011) An Analysis Of The Demand For Earthquake Insurance, Risk Management and Insurance Review, Vol. 14, No. 2, 233-246;

[2]   Browne M., Hoyt R., (2000) The Demand For Flood Insurance: Empirical Evidence, Journal of Risk and Uncertainty, 20:3, 291-306;

[3]   Dragos S., Dragos C., (2013) The role of institutional factors over the national insurance demand: theoretical approach and econometric estimations, Transylvanian Review of Administrative Sciences, pp. 32-45;

[4]   Kerjan E., Kousky C., (2010) Come Rain or Shine: Evidence on Flood Inaurance Purchases in Florida; The Jounral of Risk and Insurance, Vol. 77, No. 2, 369-397;

[5]   Ionică M., Petrescu E., et al. (2009) The main characteristics of supply and demand of the Romanian insurance market, The Annals of the University of Oradea

[6]   Longwell T., (2013) An Empirical Examination of Demand for Earthquake Insurance in California, Unversity of Minesota;

[7]   Petkovski M., Jordan C., (2014) An Analysis of Non-Life Insurance Determinants for Selected Countries in Central and South Eastern Europe: A Co-Integration Approach; Romanian Journal of Economic Forecasting, XVII (3)

[8]   Swiss Re, Natural Catastrophes and man-made disasters, 2002-2014

[9]   https://www.paidromania.ro/

[10]   https://eiopa.europa.eu/regulation-supervision/insurance/solvency-ii/solvency-ii-technical-specifications