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The determination of the Exceedance Probability curve by the insurance company within contractual cases against natural hazards

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ABSTRACT

The scientific contribution highlights, first of all, the insurance situation tout court in relation to catastrophic emergencies, outlining a brief framework of the ways in which insurance companies come into contact with the insured parties (contractors), and through which techniques they define, from time to time, specific contractual drafts and cases.

Secondly, the text focuses on one of the most important insurance parameters for the determination of the insurance premium and possible indemnity in relation to the risk related to natural hazards, namely the so-called Exceedance Probability (EP) curve.

Outlining the first two parts, the article turns to the main one of the analysis, i.e. the legal consequences, both civil and criminal, according to EU and Italian legal system, of the conduct of the insurance company on the stipulation of a contract with the omission and / or commission of a fraudulent determination of the aforementioned curve. In particular, the authors focus on the substantive and procedural determinations of the aforementioned case before the criminal and civil court, highlighting its subsidiarity or alternativeness.

The conclusions concern the position of the consumer in the European Union in relation to the conduct of the insurance companies, whose imputation, negligent and / or fraudulent, often determines the stipulation of a contract rather than another about the inherent risk of natural hazards.

Keywords: insurance company, fraud, liability, natural hazard

1. INTRODUCTION

In recent years, the insurance industry has undergone considerable losses due to extreme weather events. 2011 is considered to be a record year for natural disasters, with insured claims that have cost the industry more than 127 billion dollars. Moreover, according to one of the latest reports on Europe, it has been showed that EU has experienced a global amount of $33 billion of losses, which about 50 % have been paid by insurance companies. [1]

A series of catastrophes in the late eighties and early nineties of the last century has put the insurance industry faced with a great challenge.

Looking towards the case of a European State prone to hazard, like Italy, the data provided by the Italian Statistical Bureau ISTAT revealed that in 2015, 19.61% of the Italian population was exposed to flood risk (with peaks of 53.16% in the North-East), 4.10% to landslides, while in 2016 about 8.92% of the territorial area of the Italian peninsula has been classified as a high seismic area. In front of such data some doubts inevitably arise: what can community do against the elements of nature that affect our territory?

If the dynamics, in terms of prevention on the territory, can and must be left to government and administrative management, the role of insurance, clearly in terms of limiting damage and mitigating the consequences of "weak contractors", is certainly paramount. The insurance industry over the years has implemented some so-called catastrophe models (CAT-MODELS) to mitigate and, within limits, control catastrophe-derived damages. The adoption of models for natural catastrophe scenarios, since the 1990s, has

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allowed the industry to analyse and measure risk more accurately.

Today, the use of these models became the norm. In particular, one of the most important models and which concerns the resilience and mitigation of risk against natural hazards corresponds to the drafting of the ep curve. In brief, as explained below infra, the curve ep allows the insurance company to verify and outline 1) the probability that a given hazard affects one or more portfolios of buildings or immovable assets 2) the maximum loss borne by the insurance company in relation to the occurrence of a specific hazard 3) the fee charged to the insured person with regard to the data processed by the system. [2]

Given the prevalence of templates for catastrophic scenarios in insurance and increasing costs of extreme weather events, the accuracy of the results of modelling is a primary concern for insurers. [3]

It is worth noting and adding that the cost to be charged to the insurance in the event of a catastrophic natural event implies a considerable disbursement by the company itself, and also for this reason, as well as avoiding the physiological insolvency, the phenomenon of so-called reinsurance in recent years has grown considerably. [4]

The possibility that climate change might facilitate changes in gravity and probability of extreme weather events could affect the accuracy of the models for natural catastrophe scenarios. [5] This scientific paper assesses whether and how these models take into account climate change through a series of case studies contributed by various providers to both academic and commercial models. [6]

Catastrophe modelling approach contains a specific view of the operators for the hazards, risks and the vulnerability of the insured goods. This view has been designed using the observed data as a base. [7] The above approach facilitates the application of this risk to view records of a particular customer, in order to quantify the probability and magnitude of the potential loss. This is achieved by reducing the complexity inherent in the physical interaction between hazards and vulnerability, by parameterizing the features in a limited set of measurable unit. [8] These units are applied systematically, consistently and repeatedly in a custom set of exposure data. Financial characteristics related to the insurance sector can then be superimposed to calculate a net loss tailored to the client using the tool. Use of the above approach is however only a small fraction of what is needed to optimize the use of catastrophe modelling within an activity. [9]

This study wants to highlight the unfavourable position, contractually speaking, of the insured subject against the company in order to denounce the disparity in the knowledge of the two parties involved in the contractual dynamics and to propose a constructive approach towards the total sharing of the data that insurance companies benefit from the very first draft of the contract de quo.

In particular, the insured person does not know the process that leads the insurance company to draft and draw up the contract. With regard to the focal point of the paper, i.e. the EP curve, the insured subject is not aware of the inherent and innate variables, such as the probabilities connected to the occurrence of an event, the maximum tolerable loss threshold of the insurance company or even the algorithmic dynamics referred to in the definition of the consideration to be charged to the insured party.

The study was motivated by the increasingly pressing need, as well as by the obligation, to date not yet respected, to provide the "weak" contractor with a complete picture of the dynamics that involve the contract itself with the aim of contributing to highlighting the responsibilities and duties attributable to the insurance company, as well as, consequently, the rights, continuously injured and limited, of the insured subject according to a civil and criminal perspective to sensitize the mass media and the subjects involved to build the basis of a new systematic approach to defining and drafting insurance contracts against natural hazards..

2. PAPER STRUCTURE

2.1 Research methodology

The methodology applied to the paper can be divided into three areas of study. The first one concerns the historical analysis of data referred to natural disasters mostly in the Italian context. This analysis consists of research on specialized websites in data processing, in particular, with regard to the Italian theme, the authors are focused on the latest ISTAT [10] (Italian Statistical Bureau) data.

The second methodological step was particularly addressed in the systematic study of insurance dynamics from the point of view of the company, in the elaboration of the contract and, above all, the fulcrum of the paper, in the drafting of the EP curve.

The third methodological step was an analytical study of the criminal case of fraud, with repercussions

also in the civil field, relating it and interfacing it with the present case.

2.2 The EP curve as tool for insurance company for risk reduction within a contractual case against a natural hazard

Catastrophe scenarios, here specifically in order to natural hazards, can provide different financial results, the most common of which are the curve of average annual loss (Annual Average Loss, AAL) and curve of probability of exceedance (Exceedance Probability, EP). [11] The AAL is sometimes called "pure" or "claims report award/Awards" and can be incorporated into the pricing together with an allowance for expenses and the return on capital. [12] The curve EP is commonly described as a graphical representation of the probability that a loss produced by possible events, namely here natural hazards, exceeds a certain amount. [13] Reading points on the curve offer different interpretations in the frequency and severity of losses for the books the modelling object. These curves are very useful to insurers and reinsurers to determine the size and distribution of potential losses of their portfolios. The curve EP allows insurers to determine the probable maximum loss (hereafter referred to as PML = Probable Maximum Loss) for a portfolio of buildings in a certain time frame due to natural hazards occurrence. The insurer determines first the percentage risk it deems acceptable then check on the curve EP the total loss amount for that specific probability level. [14]

It appears absolutely essential for the continuation of the discussion the authors conduct and deal with the theoretical questions described above in a table and a graph so that the way in which the insurance companies determine the risk and the price starting from a numerical base is, partially, clarified, i.e. the determination of the percentage of exceedance probability.

The practical example is the assumption that there is a set of catastrophic events (E_i) that can jeopardize an immovable assets portfolio. Each event has an annual probability that it occurs (p_i) and a loss associated with it (L_i). Furthermore, it must be taken into account that it exists the possibility that more than one event might occur the same year. The table below [15] takes as assumption eight events which are ordered for decreasing total losses (L). The sum of the probabilities of all events must be equal to 1.

E_i	p_i [%]	L_i [€]	$EP(L_i)$ [%]	$E[L] = p_i{}^{*}L_i$ [€]
1	0,005	1000000	0,00500	5000
2	0,015	750000	0,01993	11250
3	0,02	500000	0,03953	10000
4	0,05	300000	0,08755	15000
5	0,1	200000	0,17880	20000
6	0,2	100000	0,34304	20000
7	0,25	50000	0,50728	12500
8	0,36	10000	0,68466	3600
Total	1			97350
$\sum_{i=0}^{n} p_i = 1$		Average annual Loss (AAL) =97350		

Table 1. Example of economic losses determination of a specific hazard

The totality of the events underlies the assumption that it is itself a multitude of random independent variables, whose the probabilistic function is defined as follows.

$$P(E_i \text{ that event occurs}) = p_i \quad (1)$$

$$P(E_i \text{ that event does not occur}) = (1-p_i) \quad (2)$$

It goes without saying that in case of an event (E_i) has not occurred the loss is equal to 0. The expected or predicted loss in relation to a given event (E_i) over a time frame equal to a year is $E[L] = p_i L_i$. The total expected losses for the entire set of events, namely the average annual loss (hereinafter AAL, as also reported in table), is substantiated by the weighted sum of expected losses for each event and the probability that that event will occur. AAL is defined as below:

$$AAL = \sum_{i=0}^{n} p_i L_i \quad (3)$$

If only one event takes place during the year, it is possible to determine the EP curve, i.e. the expressed loss value, as it follows

$$EP(L_i) = P(L > L_i) = 1 - P(L < L_i) \quad (4)$$

$$EP(L_i) = 1 - \prod_{j=1}^{i}(1 - p_j) \quad (5)$$

From the equation Nr. 4 it can be deduced that the EP as shown in Figure 1 curve is the annual probability that a loss exceeds a certain value, which is equal to 1 the probability that all other natural hazards below this value will not occur.

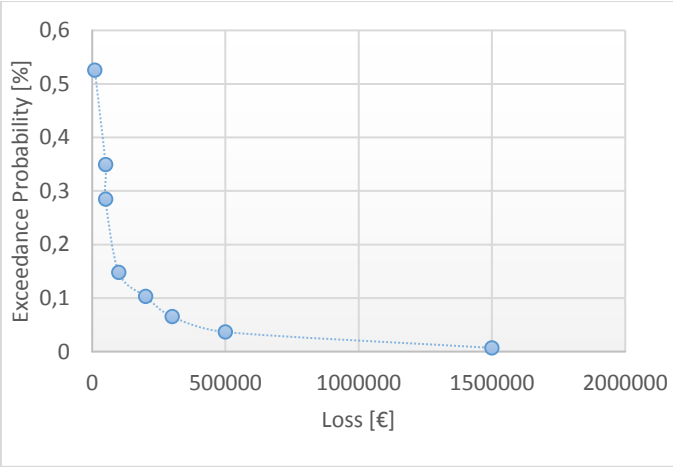

Figure 1. Theoretical EP curve draft according to Table 1 data.

2.3 A theoretical case study

At this point let us in front of the case in which a certain insurance company has sponsored and sold a policy based entirely on drivers who went to determine a curve EP incorrect. Will a client, who suffered serious damage caused by any natural hazard due to incorrect study of that curve, retaliate against the insurer to advance the legitimate claim for damages?

And if this study were well concealed by the insurance company knowingly wrong, could the latter be liable of the offence of fraud of contract under art. 640 criminal code (hereinafter codice penale or c.p.)? The Italian criminal legislature provides for the punishment of the crime of art. 640 scam c.p., inserting it between the crimes against property by fraud, thus emphasizing the offending conduct unlawfulness– "antigiuridicità" - as likely to cause harm at the same assets of the taxable person so unjustified and fraudulent. The entire discipline pursuant to article 640 c.p. seems to be guided by the respect of the will of the subject of self-determination in free economic choices without suffering unlawful distortion as part of the process of volition. On the other hand, the setting of the constitutional array, to safeguard the full personal freedom in all its aspects (not to mention the development of the human person ex art. 2), is based in civil law discipline. [16, 17]

In fact, the "ratio" of the criminality of the scam is discovered by the doctrine in the interest of the individual asset deduced, latu sensu, from civil contracts and discipline, second part of the case-law, in the interest public lets both marred the freedom of consent of the parties, having good faith, pursuant to art. 1337 Civil Code (hereinafter c.c.), preside over the Constitution, regulation and dissolution of legal relationships having the character sheet and not be violated by the implementation of artifice and deception (Italian Supreme Court, hereinafter Cass., 30/08/1995 # 9157; Cass. 3/04/1990, # 2623). [18] In this sense, then, the legislature seems to have wanted to protect the national economy and the public interest.

On the other hand, in a constitutional context based on the principle of solidarity (art. 2 Italian Constitution), it was necessary to pursue the conduct under art. 640 c.p., in order to enhance the value and credibility of contracts and not to betray a basic guarantee of any bargaining, which is undoubtedly freedom of determination and above all do not protect the triumph of oppression on others intellectual personality. [19] In this sense, then, the good assets should be considered relevant to the development of personality and, in the light of the guiding principles of the Constitution, it is necessary to give priority to the development needs of personality (art. 2) with respect to the protection of individual economic positions; in this respect, it is argued, the fact considered art. 640 c.p. would reveal a higher disvalue, because the same capital bases appears functional to the needs of the subject as a person. [20]

It can be understood, then, as the case may be called multi-offensive -"plurioffensiva" -, and its interpretation requires to bear in mind social developments. According to a compliant reading of the provision, the artifice and deception in place must be suitable to achieve the crime in question and such entitlement. According to this setting, it can be evaluated on the level of proof only keeping in mind the cultural evolution of the society, since, unlike arguing, you might go contrary to the principle of causality, ex art. 40. Moreover, the c.p. the fact that the legislature has classified this offence (pursuant to article 640 of the Criminal Code) as a crime against property does not override the Office not conducive to the fact to the human person, but simply shows the interpreter via evidence to follow based on unjust enrichment of a subject resulting in "deminutio patrimonii" from another. [21]

With reference to the structure of the offence, then, the scam is realized within the framework of the formation of asset report, and represents a dynamic phase, giving an address unfairly advantageous to one party and carrying out an offence to heritage through an offense against the freedom of consent. The pitfall in the swing phase of the legal relationship established between the parties is carried out in particular through tricks and deception, that creeping into the soul of the taxable person led him to a new psychic representation of ratio conform to reality, so as to acquire an effective motivator. [22] Moreover, the structure of the offence of fraud requires the interpreter to take into consideration the causative link between artifice and deception in place by an active subject and induction to the error of the taxable person, as is clearly illustrated by the same ratio legis. In this sense, then, any artifice or deception would be criminal if specifically not medically fit to cause induction in error and if this were not a result of artifice or deception. [23] Under this approach, therefore, the same failed induction seems to brand themselves to additional items in the sense not to be just an expression typically describe the etiological link between conduct and event, but rather seems to represent the actual purpose of the conduct, the essential element for the realization of the event. On the evidence, therefore, is necessary to the existence of a causal connection between artifice and deception and error induction, to be verified in practice and not merely potential, constituting the offence concerned legal circumstances of damage. In this sense, then, do you explain the irrelevance of those conducted inappropriate to artificially affect the educational process of another's will; the reference is to those actions that would come to be excluded from the riverbed of acts which are punishable by way of cheating ex art. 640 c.p., in full compliance with, among other things, art. 40 c.p. and without emptying of meaning the letter of the law. [24] In other words, according to the case-law (Cass., section II, 7/02/1978, # 693; Cass. 2/02/1998, # 985), in legal relations that are established between two or more dogs would always need to check the loads affecting the induction in error, identifying the existence of artifice and deception of unlawful nature such as to affect significantly on the process of formation of the will, because, otherwise, it would have a negative impact and excessively on any bargaining, greatly limiting freedom, intending also praises and/or meaningful evaluations of their goods by the seller to the purchaser. [25] For the above reasons, therefore, appears quite evident to classify the type of behaviour of the insurance company that, knowing the wrong data of the curve EP, induces anyway the customer to conclude the policy as those "artifice and deception" which are structural element of crime of fraud and in particular the contract scam. It seems evident that the study of combined all the elements of art. 640 c.p. The offence occurs as legal interests: not only a crime against property but especially against the freedom of self-determination. The induction to underwrite a policy enacts data voluntarily which constitute the basic study cannot be accessed if not in the sense of a real ball of self-determination of each individual injury. [26]

The natural corollary of the above case concerns the connection that the pathological situation described above has with the determination of the EP curves. In practice, such a situation hardly allows the insured subject the full awareness of the variables as well as of the data that lead the insurance company to envisage a specific contract. The fragility of the private contractor, the insured subject, emerges once again in all its clarity. The EP curve, even if fraudulently determined, can be unmasked only ex post, [27] when the event takes place or when a pathological situation overwhelms the contract. But the damage, strictly related to the scam, and therefore the time span in which it perpetuates, causing economic loss, without an ex ante control, appears to be difficult to circumvent. [28]

If, therefore, at the state of the art, and for the functions attributed to them, insurance companies control the data, variables, statistics and related calculations in relation to a specific natural event to be correlated with a contract, a regulatory gap as well as conceptual emerges clearly. [29]

The insurance company, in this regulatory context, in the case in which the curve is determined, remains unpunished due to the absence of protection, the absence of verification and the absence of transparency. [30] Even today, a famous Latin phrase dominates the insurance world: Quis custodiet ipsos custodes?.

2.4 Discussion and conclusions

The conclusions of this paper, including even a natural scope of discussion, mainly inserted in the Italian regulatory context, run along two main lines.

The first concerns, therefore, the proven liability in both civil and criminal cases of the insurance company when it was aware of the erroneous, we would say fraudulent drafting of the EP curve, prodromal to the drafting of the contract against the catastrophic risk taken into consideration.

It is worth pointing out that although the insurance contract is "ex se" a contract with an "alea" inherent in the nature of the agreement itself, the parties, given what has been said above, must operate along the constitutional provisions as well as those referred to in the penal code and civil. The assumption according to which the catastrophe event does not depend on the insurance company does not in any way justify the latter on the drafting of a contract on a fraudulent basis and subsequent procurement of customers for the conclusion of the legal transaction.

The second conclusion involves the less obvious visual angle and concerns the legal and contractual position of the consumer, i.e. the insured subject. Since always, except for very rare exceptions, the insurance contract is seen as a “unilateral” contract in the sense that is written in its entirety by the insurance company that composes it on bases and studies of its own derivation leaving the subject assured the mere possibility of outlining the risk, the prize and the object to be insured. Therefore, the preparatory and editorial phase is always the responsibility of the insurance company, with all the consequences that this entails. In fact, what are the protections granted to the insured?

Surely, according to the current regulations, the information sheet consists of legal specifications regarding the nature and effects of the contract as well as the termination of the same, but the preparatory, study, calculation phase is impossible to verify for the insured.

This study shows that there is a deficiency, a lack in the insurance sphere, this time delineating the incapacity of the subject assured to accurately verify the real composition of the EP curve. It seems absolutely prodromal and necessary, for the implementation of insurance tools, that companies adopt dynamic and digital methodologies that guarantee transparency, clarity and truthfulness of the proposed data. [31] The possibility, to this day granted, that the insurance companies can profit fraudulently on the life of people at risk [32] and natural disasters is, more than ever, absolutely anachronistic, unconstitutional and anti-juridical.

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