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Chapter 1

Risk, Information and Insurance

After a brief overview of the traditional functioning of the insurance and reinsurance mechanisms, this chapter introduces the general issue of insurability of environment-related risks. It describes the different types of attitudes towards risks and provides a synthesis of the criteria of insurability, which could be summed up under the following headings: assessability, randomness, mutuality and economic feasibility. Against this backdrop, it is argued that two major factors influence in practice the provision of insurance policies for a particular risk: generalized uncertainty, which largely depends on the legal framework, and informational asymmetries, which may lead to adverse selection and moral hazard problems. As underlined by the author, the assessment of these two factors is of paramount importance in order to establish appropriate insurance mechanisms to cover environment risks.

1. Different attitudes towards risk and the traditional functioning of insurance and reinsurance mechanisms

Economic actors have different attitudes towards risks. It depends on several factors, including the nature of the risk, the probability of loss, the potential magnitude of the loss and the ability to absorb its economic consequences. Assuming rationality and perfect information, economic actors are able to calculate the actual value (present discounted value) of a given risk by discounting the magnitude of the loss by the probability of its occurrence ($P \times L$).

Once the risk is properly identified and evaluated, however, risk management decisions still need to be taken. In this perspective, economic actors may be:

- **Risk averse:** if they are willing to pay even more than the discounted value of the risk in order to transfer its harmful consequences to someone else.
- **Risk preferring:** if they prefer to retain the risk of loss, rather than transferring it by paying upfront an amount equal to its discounted value.
- **Risk neutral:** if they are indifferent with respect to the alternative between (a) retaining the risk and (b) transferring it to someone else by paying upfront an amount equal to its discounted value.

Risk aversion, therefore, generates demand for insurance. Insurance companies, in turn, are willing to undertake the risk in exchange for an amount of money relatively close to its discounted value (the insurance premium), because the law of large numbers makes them able to manage such risks effectively, by making predictable, with reasonable accuracy, the claims they will pay from year to year. According to this mathematical law, the larger the number of exposures considered, the more closely the losses reported will match the underlying probability of loss. This means that insurance companies need to pool together a rather **large number of homogeneous but independent risks** in order to become risk neutral.

Against such background, the functioning of the traditional insurance mechanism can be divided into four phases:

- **Risk assessment** (i.e. the overall evaluation of risk, which is usually performed through statistical and probabilistic analyses).
- **Risk transfer** (i.e. the shifting of its harmful consequences by way of the insurance contract).

- **Risk pooling** (i.e. the placement of the risk in a pool of homogeneous but independent risks allows the insurer to spread the risk and to benefit from the law of large numbers).
- **Risk allocation** (i.e. the pricing of the risk through premium setting techniques).

As the magnitude of expected losses increases, **the insurers' financial ability to absorb them can be severely jeopardized**. In other words, insurance capacity is limited, since over and above certain levels of financial exposure insurers themselves tend to be **risk averse**. In this context, **coinsurance** and **reinsurance** are viable options for primary carriers who are willing to cede part of the risk they undertook, in exchange for the payment of a fraction of the premiums they collected.

Reinsurance agreements may be of different types, among which:

- **Quota share (proportional) treaties** (by which the reinsurer undertakes a quota of the risk transferred to the primary carrier).
- **Excess of loss (or stop loss) treaties** (by which the reinsurer undertakes the upper layer of the risk, after a certain attachment point).

2. Risks predictability, generalized uncertainty and informational asymmetries

The briefly described insurance mechanism is able to perform its functions correctly under specific conditions of risk and uncertainty.¹ In a well-known contribution, Frank Knight distinguished between risk (predictable probabilities) and uncertainty (unpredictable probability of loss) and argued that insurance works best with the former.²

In other words, the basic argument is that the insurer must possess *ex ante* accurate information on the probability that the insured event will occur, as well as on the magnitude of its economic consequences: without such information, the insurer is not able to adequately calculate the premium.

In the past decades, several **criteria for insurability** of risks have been identified and discussed by the literature.³ Baruch Berliner,⁴ for instance, proposed the following nine criteria against which evaluate any risk:

1. Randomness (of the loss occurrence).
2. Maximum possible loss.
3. Average loss amount upon occurrence.
4. Average period of time between two loss occurrences (i.e. loss frequency).
5. Insurance premium.
6. Moral hazard.
7. Public policy.

8. Legal restriction.

9. Cover limits.

The author maintained that the above set of criteria forms a concise and almost complete evaluation system, in the sense that its use allows professional risk carriers to determine whether or not a risk is **subjectively insurable**.⁵ In fact, the insurability of a risk depends on calculations made based on insurance techniques, but also a complex decision-making process by each individual insurer who takes several considerations into account. Such criteria contain subjective as well as objective aspects and they are not independent from one another; if only one of them is not fully satisfied with respect to the position of a professional risk carrier, then the risk may be considered subjectively uninsurable.

The intersection of all subjective domains of uninsurability forms the **objective domain of uninsurability**, while the intersection of all subjective domains of insurability constitutes the objective domain of insurability. Between these two domains, lies an area of separation, consisting of all risks that are insurable for some professional risk carriers and uninsurable for others.

A more concise set of criteria for evaluating the insurability of risks in general has been recently restated⁶ and it consists of the following four elements:

- a) **ASSESSIBILITY:** the probability and severity of losses must be quantifiable.
- b) **RANDOMNESS:** the time at which the insured event occurs must be unpredictable and the occurrence itself must be independent of the will of the insured.
- c) **MUTUALITY:** numerous persons exposed to a given hazard must join together to form a risk community within which the risk is shared and diversified.
- d) **ECONOMIC FEASIBILITY:** private insurers must be able to charge a premium commensurate with the risk.

Risks that do not readily satisfy all of these criteria may be considered by professional risk carriers as uninsurable and, therefore, coverage may become unavailable on the market. It is worth noting that, the actual availability of insurance coverage for a certain risk does not merely depend on its insurability, but also on its attractiveness in comparison to risks from other branches that are competing for the available insurance capacity. With respect to the above issues, severe problems are posed by:

- a) generalized uncertainty; and
- b) informational asymmetries.

a) **Generalized uncertainty** – A condition of uncertainty is said to be generalized when both the insurer and the prospective insureds are equally affected by it. It is important to note that **generalized uncertainty** depends on both **factual and legal circumstances**; it means that the general level of uncertainty and ambiguity concerning a certain risk is often influenced by the underlying legal regime.

As said, in order to be insurable, a risk must be predictable *ex ante* to a certain extent, at least by means of past experience and statistic calculations.⁷ the insurance company must possess sufficient information about the probability and magnitude of the expected loss, in order to properly assess the risk undertaken and to calculate the so-called **actuarially fair premium**. A severe condition of generalized uncertainty about the features of a certain risk may hinder its insurability. Even if uncertainty is not so critical to impede risk insurability, it still has an impact on the cost of insurance, since the premium charged to the insured contains a series of loadings, some of which (*e.g.* safety and fluctuation loadings) are precisely aimed at covering the residual level of unpredictability that characterizes every risk.

As this report will discuss in more details *infra*, since several features of the underlying legal framework greatly affect uncertainty, ambiguity and insurability of environment-related risks, **choices made by legislators and policy makers very often play a determinant role in this field**.

b) **Informational asymmetries** – Whenever the insured possesses more information than the insurer about the risk (asymmetrical uncertainty), problems of **adverse selection** and **moral hazard** may occur.

The notion of **adverse selection** identifies the tendency of poorer-than-average risks to buy and maintain insurance. Adverse selection occurs when insureds select only those coverages that are most likely to have losses.⁸

Moral hazard, instead, refers to the increase in probability of loss that results from a decrease in the preventive measures adopted by the insured following the purchase of insurance coverage. In other words, it identifies the hazard arising out of an insured's indifference to loss because of the existence of insurance.⁹

These informational asymmetries generate **agency costs**¹⁰ and, in order to cure these problems, risk carriers are forced to employ a variety of **monitoring** and **bonding devices**. Monitoring devices are mainly aimed at controlling the insured's behavior, thereby leveling the information asymmetry, while bonding devices provide incentives meant to realign the otherwise diverging interests of insurer and insureds. Common examples of these devices are the use of complex application screening processes, risk differentiation techniques, feature and experience ratings, exclusions of coverage, co-insurance clauses and deductibles.

With respect to asymmetrical uncertainty as well, choices made by legislators and regulators are extremely relevant. A legal rule that mandates compulsory coverage for a certain risk, for example, may help reducing the problem of adverse selection. Conversely, a creative interpretation of insurance policy terms (especially: exclusions and conditions of coverage drafted to prevent moral hazard) made by courts in order to favor the insured parties in the short run, may ultimately lead to unavailability of coverage for such risk.

In summary, therefore, both generalized and asymmetrical uncertainty influence **risk insurability**, since they have the potential to reduce: **(1)** the ability of risk carriers to undertake certain risks, **(2)** the scope and availability of insurance coverage on the market and **(3)** the willingness of prospective insureds to purchase coverage, which might be perceived as too costly.

With respect to uncertainty and insurability, this report will address some of the problems and difficulties that the traditional insurance and reinsurance mechanisms face when dealing with:

- the **environmental pollution risk** (Chapter 2) and
- the **natural catastrophe risk** (Chapter 3).

Environmental pollution risk is tightly connected with the **underlying legal and regulatory framework**, whose **features may generate uncertainty, or otherwise limit risk insurability**. On the contrary, well drafted and defined environmental rules and regulations yield predictable losses and may foster the development of an effective pollution insurance market. The **factual uncertainty** associated with gradual pollution risk and the effects of environmental contamination on human beings and biodiversity, however, are also problematic. Long-tail environmental risks are extremely challenging for insurers because they must be able to establish a realistic and reliable estimate of compensation to be paid over a period of a specific and reasonable duration. Relevant obstacles, moreover, are posed in this field by severe **information asymmetries**.

The traditional insurance and reinsurance mechanisms may also encounter problems in coping with the natural catastrophe risk, since **risk predictability**, the ability to **spread the risk both geographically and over time** and the **financial capacity** of the market are severely limited for such type of risks.

In both cases, moreover, the **magnitude of expected losses** and the **information problems** affecting risk predictability and assessment require joint efforts (e.g. pooling) by several insurers and reinsurers.

It is worth noting that the highlighted need for **information sharing practices** and **market concentration** – in order to increase capacity – suggests a careful approach to antitrust regulations and **competition policies** in this area¹¹. Furthermore, regulatory barriers to the free determination of premium

levels and conditions of coverage may hinder the willingness and ability of insurance carriers to enter the market for environment-related risks.

In light of the above, this report suggests that all institutional actors, including legislators, governments, regulators and courts, may play a crucial role in addressing and solving the problems of predictability and insurability of environment-related risks.

Notes

1. See: Abraham, K.S. (1986), *Distributing Risk: Insurance, Legal Theory and Public Policy*, New Haven: Yale University Press.
2. Knight, Frank H. (1921), *Risk, Uncertainty, and Profit*, Boston: Houghton Mifflin Company.
3. See: Berliner, B. (1982), *Limits of Insurability of Risks*. Englewood Cliffs, NJ, Prentice-Hall, Inc.; Faure, M.G., *The Limits to Insurability from a Law and Economics Perspective*, Geneva Papers on Risk and Insurance, 1995, 454-462; Skogh, G. (1998), *Development risks, strict liability and the insurability of industrial hazards*, Geneva Papers on Risk and Insurance, 87, 247.
4. Berliner, B. (1982), *Limits of Insurability of Risks*. Englewood Cliffs, NJ, Prentice-Hall, Inc.
5. See also: Berliner, B., Spühler, J. (1990), *Insurability issues associated with managing existing hazardous waste sites*, in "Integrating Insurance and Risk Management for Hazardous Waste", edited by Howard Kunreuther and Rajeev Gowda, Kluwer Academic Publishers, 134 ff.
6. Swiss Reinsurance Company (2002), *Natural Catastrophes and man-made disasters in 2001*, Swiss Re SIGMA series 1/2002. Zurich, Swiss Reinsurance Company, 18.
7. Skogh, G. (1998), *Development risks, strict liability and the insurability of industrial hazards*, Geneva Papers on Risk and Insurance, 87, 247.
8. "This problem may arise when the policyholder has some hidden information that is not in the possession of the insurer. Assume, for illustrative purposes, that there are two types of policyholders according to the insurer's point of view: 'good' risks and 'bad' risks. The insurer cannot distinguish between them and the policyholders do not reveal their nature – both maintain that they are good risks. In that case the market may break down. The logic is as follows: initially, the insurer charges the same premium for the two. The premium is based on the average actuarially expected costs. Insurance will then be a good affair for the bad risk and a relatively poor affair for the good risk. Consequently, many bad risks and few good risks will purchase insurance and the insurer will incur a loss on average. It will, then, be necessary to increase the premium the next round, thus discouraging good risks, attracting bad risks and precipitating a new loss. The cycle will repeat itself. In the end there may be no market left." Skogh, G. (2000), *Mandatory Insurance: Transaction Costs Analysis of Insurance*, in Bouckaert, B. and De Geest, G. (eds), *Encyclopedia of Law and Economics*, Volume II. Civil Law and Economics, Cheltenham, Edward Elgar.
9. See: Shavell S. (1979), *On Moral Hazard and Insurance*, *Quarterly Journal of Economics* (QJE), 541-562.

10. See: Abraham, K. S. (1988), *Environmental Liability and the Limits of Insurance*, 88 *Columbia L. Rev.* 946.
11. As for the application of EU competition policies to the insurance sector, see: Commission Regulation 358/2003 of 27 February 2003 (OJ L53/8 of 28 February 2003) which replaces Commission Regulation 3932/92 of 21 December 1992 (OJ L398 of 31 December 1992, p. 7). See also: "Report to the European Parliament and to the Council on the Operation of Commission Regulation No. 3932/92 concerning the application of Article 81 (Ex-Article 85), Paragraph 3, of the Treaty to certain categories of agreements, decisions and concerted practices in the field of insurance", issued by the Commission on 12 May 1999, COM (1999) 192 final.

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