

Risk & Rationality

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Is it possible to be rational about risk ?

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In the same way that 1 kilogram is always 1 kilogram and 1 hour is always 1 hour, risk can be measured, and a certain risk is always the same risk. Is it really like this? An object of 1 kilogram on earth has another weight on the moon. According to Einstein, even time is relative. For a young sportsman 1 kilogram is nothing, for an old lady 1 kilogram is heavy. Sometimes, for example when one is totally absorbed in something, an hour passes very quickly; another time, for example when one forces oneself to do something, one has perhaps the subjective feeling that the hour is endless. Also, risk is dependent on the reference system. Moreover, there is no objective physical measure for risk. Risk is a subjective construct and thus highly dependent on differences in individual perception and judgment. Is it possible for people to be rational about risk?

Article scope

Is it possible for people to be rational about risk? To be rational about something basically means that one handles it in an analytical and logical way. For that reason risk should be quantified and there should be a logarithm to calculate it. There should be an agreement about the rules of the measurement. It should be free of emotional issues or different world views. Do people handle risks in an analytical and logical way? Is there an agreement about the conceptualisation and the measurement of risk?

I will answer these questions in demonstrating firstly how the meaning and the use of the term 'risk' have changed with time. Secondly, I shall try to explain why it is difficult to give an ultimate definition of 'risk'. Thirdly, I will illustrate how people perceive and judge risk differently from normative solutions. Obviously, social processes and mechanisms also influence the risk perception. At the end, the conclusion will discuss as to how far it is possible to be rational about risk,

Risk Definition until 1970

The term 'risk' was used for the first time in the Italian commercial language of the 19th century (Rammstedt 1992: 1045-1050). The etymological roots point to the Greek language, whereby it can mean both root and also cliff : it means those cliffs around which a merchant ship should sail. The closer the ship sails around the cliffs, the faster it reaches the harbour, which certainly represents a gain. If the ship goes too near the cliff and is wrecked, then there is a loss. Up until the 19th century, the time of the developing industrial society, risk was understood as opportunity costs for the creation of prosperity and wealth (Dake 1992: 21-37). Blaise Pascal (1623-1662) was the first to describe how to measure probability. The risk theory of Laplace (1816) especially had a crucial influence on the risk conception and on the emerging insurance industry. The simple formula:

$$\text{risk} = \text{harm} \times \text{probability}$$

suggests a predictability and thus a controllability of the risk. Until the end of the 60's of the 20th century, a very limited risk concept was predominant. An extension and a differentiation of the term 'risk' seemed to be unnecessary due to a nearly unrestricted trust in the possibilities of science and technology.

Risk Definition since 1970

Since the 70's the term 'risk' has gained substantially in meaning and also in complexity. On the one hand, the obvious negative consequences of technology were certainly a reason for this development. On the other hand, the conception of the human was changing from a full rationality to a bounded rationality (Simon 1957). It became clear that humans cannot be fully rational like a computer, the cognitive capacity is limited, human beings make mistakes and they use simple heuristics, which are different to normative solutions (Kahneman & Tversky 1982: 3-20). This change of the conception of the human could also affect the unlimited trust in science and technology and therefore the concept of the risk. The risk concept is quite popular in today's society. Some authors (e.g., Ulrich Beck 1986) call the post-modern society even the risk society. In fact, the change of the meaning of risk and the risk conceptions and their dependency on cultural change and historical events make clear that risk is a subjective construct and not an objective given fact (Douglas & Wildavsky 1993: 113-137).

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Risk & Measurement

It is not that easy to come up with a clear definition of risk. Of course, it can be seen as the product of probability and harm. But it could also be defined by different logarithms. A risk function could focus on the probability of loss, the size of the loss, the maximal loss, a product of probability and loss, the variance of the consequences, the semi-variance of all possible losses, and so on. Some experts even use a second order probability. This is the probability, in the sense of uncertainty, in how far the proper probability is correct. But a definition of risk only based on a formula might be not sufficient. Different scientific disciplines and different industries work with different conceptualisations of risk. Risk is a widely used, disputed and multifaceted concept. The concept might include qualitative aspects, e.g. economic, psychological, social, cultural, environmental, or philosophical aspects. One might want, for example, that only the negative consequences are defined as a risk, or one may also include the favourable aspects in the risk definition. The former is called pure risk and the latter is called speculative risk (Brachinger & Weber 1997). However, it is easier to give a definition of the risk situation than of risk itself. A basic or minimal risk situation in the sense of a decision structure has always an alternative. At least one alternative has at least two outcomes. It is not sure what the outcome will be by choosing the alternative, but one might know the probability (Scholz & Tietje 2002: 176).

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Probabilistic Concepts

Some difficulties can be experienced in judging probabilities (Hansson 1989: 107-112). There are cultural differences in the perception of probabilities. Asian people such as the Chinese, Indonesians, and Malaysians think less in terms of risk and uncertainty than people of western countries do (Philips & Wright 1977: 507-515). Asians are more non-probabilistic thinkers. They either know or they do not know, for them an event will either occur or it will not. People in western countries are more probabilistic thinkers. They express their uncertainties in terms of probabilities. This is a cultural effect and not a cognitive deficit. In general, people tend to underestimate high probabilities and overestimate low probabilities, as is postulated in the Cumulative Prospect Theory (Kahmeman & Tversky 1992: 297-323).

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Prospect Theory & Heuristic

The Prospect Theory postulates an individual reference point, which determines if an outcome is perceived as a loss or as a gain (Kahnemann & Tversky 1979: 263-291). Depending on the cognitive framing of the situation consequences are either perceived as a gain or as a loss. Thereby, the gain function is different from the loss function. The utility function for gains is concave and the utility function for losses is convex. The prospect theory as an example of a subjective utility theory is a descriptive theory, which is based on empirical findings. It shows that people act differently from the normative solutions. Nevertheless, the fact that it is possible to describe decision making behaviour with a mathematical function proves that people use some rules and do not behave irrationally.

The availability heuristic and the base rate fallacy are examples of such biases. Following an aeroplane crash, the risk of travelling by aeroplane is rated higher because the negative event is still in mind and available.

People also use systematically some heuristics or biases in their decisions, which are also in conflict with the normative solution and are insofar not rational. The availability heuristic and the base rate fallacy are examples of such biases (Kahnemann & Tversky 1973, 207-232). For example, following an aeroplane crash, the risk of travelling by aeroplane is rated higher because the negative event is still in mind and available. People regularly ignore the base rate in their judgements, which contradicts the Bayes theorem (Scholz 1987). In some cases, for example when the decision has to be made within a short time and not all the necessary information is available, heuristics can be a quite good strategy (Gigerenzer 1997, 107-125). People act in an adaptive way which is, from an evolutionary point of view, "rational".

Psychometric Paradigm

Besides the quantitative description of risk as a product of probability and harm, people also use qualitative characteristics such as voluntariness, controllability, or catastrophic potential in their risk perception and judgements (Slovic et al. 1985). A risk source is perceived as being less risky if people are exposed to it voluntarily, feeling they have control over the risk, or they do not see the possibility of a catastrophe. In a factor-analytical approach - also called the psychometric paradigm in risk perception research - these qualitative characteristics could be reduced to the two main factors "dread risk" and "unknown risk" (Slovic 1987: 280-285; Slovic 1992).

Concluding Remarks

In conclusion, it is difficult to be rational about risk. Formulae about risk may give the impression that it could be treated objectively and rationally. But one should be aware that risk is a subjective construct. There are different conceptualisations about risk. People do differ in the way they perceive or judge a risk. They have different interests, different reference systems, they take different qualitative aspects into consideration. Firstly, human behaviour is generally adaptive as it is discussed with the concept of bounded rationality. Furthermore, rationality can be improved by giving instructions, defining methods, and using decision supporting instruments. Thirdly, different conceptualisations of risk and individual differences in risk perception must be considered.

To be rational in the context of the Modern Portfolio Theory, for example, means to accept that people differ in their risk aversion. Thus, client advisors specify the risk profile of the client and develop investment strategies in line with the profile. People can make better assessments of probability if they learn to think probabilistically and break down the situation in simple events. Changing the information format from a probability to a frequency format can reduce even the base-rate fallacy (Gigerenzer & Hoffrage 1995: 684–704). It is advantageous to present the information with visualised frequencies of possible events rather than stating abstract probabilities. There are also methods and instruments to improve the decision-making process, e.g. cost-benefit analysis or multi-attributed utility theory analysis. Concerning risk communication, when the risk affects persons other than the decision-maker, then it is necessary to start a risk dialogue. To optimise this risk dialogue all the affected acting persons must be involved and differences between them have to be accepted (Covello & Allen 1988; Jungermann et al. 1991). If people do so then they might act rationally - although it is difficult to be rational about risk.

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