

# Social Contexts and Responses to Risk Network (SCARR)

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## Literature Review: Economics and Risk

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**ESRC priority network ‘Social Contexts and Responses to Risk’ (SCARR)**

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The following overview of economic literature on risk seeks a middle course between a theoretical driven economic summary that would be less useful for an academic audience from other disciplines and an over-description which would not do justice to the massive theoretical and empirical work in economics.

Somebody may wonder whether this literature review is not restricted to questions how economics treat problems of hazards and dangers in society. The reason is that in economics risk has a central theoretical position. It is strongly linked to the question of how people decide in general. In this view, all decisions are more or less risky containing a positive side (chance) and a negative side (loss). Thus, the theoretical view on problems of risk-perception and risk responses is strongly linked to this fundamental position.

The literature review starts with some fundamental assumptions which are important in understanding the economic conception of risk and choice (see also Graham's paper at our previous meeting). The fundamental concept of rational choice is (despite its success) continuously criticised but also developed. Some of the key developments in the conceptualisation of single agent choice are influenced by the results of cognitive psychology on heuristics and biases in decision-making (Tversky/Kahneman 1974). There are also important developments in interactive decision-making. As a result of the difficulties in explaining co-operative action by 'rational egoists' there are some approaches which broaden the instrumental concept of rationality towards a concept of social rationality. In this context there is an increasing amount of literature on game theory concerned with evolutionary games and the development of rules and norms.

There is still a significant quantity of literature in the tradition of the risk communication approach among recent publications on risk in relevant economic journals. This interprets shortcomings in lay interpretations of risk as a flaw that has to be overcome by better information strategies.

In two additional sections the relevance of trust and emotion in economics is discussed. While trust is in some way a fundamental concept in economic theory there is no concept of emotion systematically developed in economics so far.

## **Economics and risk**

The commonly accepted advantage of the economic approach is that it "serves several vital functions in risk policies:

1. It provides techniques and instruments to measure and compare utility losses or gains from different decision options, thus enabling

- decision makers to make more informed choices (not necessarily better choices).
2. It enhances technical risk analysis by providing a broader definition of undesirable events, which include non-physical aspects of risk.
  3. Under the assumption that market prices (or shadow prices) represent social utilities, it provides techniques to measure distinctly different types of benefits and risks with the same unit.
  4. It includes a model for rational decision making, provided that the decision makers can reach agreement about the utilities associated with each option.” (Renn 1992, 63f.)

There are a range of problems which both give rise to constant critique and drive new efforts in economic research. The economic approach is based on the core concept of the rational actor and his/her subjective utility function. Thus, rational behaviour in economics means that individuals maximize some subjective (expected) utility under the constraints they face.

Some basic assumptions of the theory of subjective (expected) utility are that choices are made:

- among a given, fixed set of alternatives;
- with (subjectively) estimated probability distributions of outcomes for each alternative;
- in such a way as to maximize the expected value of a given utility function.

Economic research showed that these assumptions are convincing in some situations; however, they may not correspond empirically with many situations of economic choice. The limits of the ‘normative economic model’ lead to an extensive range of research activities:

- Strategies which try to preserve the normative concept of decision making develop more complex statistical models and focus on the outcomes and not on the processes of decision-making. As far as estimated outcomes correspond to the observable outcomes the models are accepted as sufficient. (However, this approach contains the problem that for specific measures accurate knowledge about the processes is also necessary in order to achieve policy objectives. Otherwise pseudo-correlations and the appearance of side effects are insufficiently controlled.)
- Other strategies seek to modify the core-concept by developing concepts of decision-making that take into account limitations encountered in the real world. In this context research referring to

“bounded rationality” (e.g. Simon 1987) examines empirical observable modes of decision-making. Such approaches are widespread in behavioural economics pursuing for the natural logic or observable ways of how people think and decide (e.g. Weber/Baron/Loomes 2000).

- Some researchers want to restrict the economic approach to specific areas where it seems useful to speak about rational decision-making and where it is accepted that there are other logics of decision-making which couldn't meaningfully described in the realm of utility-maximization (e.g. Jaeger et al. 2001, Renn et al. 2000).

## **Risk and uncertainty**

In order to understand the economic approach to risk it is helpful to clarify the concept of risk and uncertainty commonly used by economics (compare the helpful paper of Graham at the last meeting). Among many other definitions (Camerer/Weber 1992) the economic understanding of risk, uncertainty and ignorance has its origin in Knight (1921) and is employed, for example, by Tversky and Kahneman (1992). A risky decision is defined as a decision with a range of possible outcomes with a known probability for the occurrence of each state (e.g. a fair roulette game); or the probabilities are not precisely known and a decision has to be made under uncertainty (e.g. sport events, elections). In this sense decisions under risk can be seen as a specific case of decisions under uncertainty with precisely known probabilities. However, even if probabilities are not precisely calculable, people can and will develop ideas or beliefs about such probabilities. Only if it is not possible to form any expectations regarding the probability of available alternatives or future events does a decision have to be made under ignorance. Since full knowledge is seldom available and economic theory uses data from the past in order to estimate future events and to rank their likelihood, the future will – at least to some extent – remain uncertain.

The vast majority of economic literature sticks to the point that there is an objective (potentially) measurable risk and assumes that the decision on how to reduce this risk can be made rationally on the ground of statistical methods. Thus, the best or rational solution is typically interpreted as the objective statistical reduction of a risk.

## **Heuristics, biases and framing in decision making**

The notion of decision-making by single agents is a core concept of the economic approach. The following summary starts by considering

fundamental developments in theory on individual choice and recent developments in research. A second central question concerns interactive choice and co-operative decision-making. These questions are dealt with in a separate section on game theory.

The following remark of Tversky and Kahneman (1987) summarises earlier work on judgment and decision-making in economics and psychology. It notes the increasing quantity of empirical results that differ from the normative concept of decision-making and its statistical conceptualisation. Tversky and Kahneman argued,

“that the deviations of actual behaviour from the normative model are too widespread to be ignored, too systematic to be dismissed as random error, and too fundamental to be accommodated by relaxing the normative system. We conclude from these findings that the normative and descriptive analysis cannot be reconciled” (cit. in Renn et al. 2001, 43).

What were their findings? The central result of their research on decision strategies was that people systematically deviate from the assumed rational behaviour of economic theory. People use for example **simplified models of rationality** such as the **lexicographic approach** (which means to choose the option that will perform best on the most important attribute), the so-called ‘**elimination by aspects**’ scheme (to choose the option that meets the largest number of aspects deemed important), or the **satisfying strategy** (to choose the option that reaches a satisfactory standard on most decision criteria. All these are strategies of ‘bounded rationality’ with suboptimal outcomes (Simon 1976, Tversky 1972).

Tversky and Kahneman (1974, 35) showed that “people rely on a **limited number of heuristic principles** which reduce the complex tasks of assessing probabilities and predicting values to simpler judgemental operations.” Even though these heuristics are quite useful in general, they will sometimes lead to severe and systematic errors, which can be outlined as follows:

**“Representativeness”**: People compare issues with others by superficial indicators that are assumed to be sufficient to indicate the belonging of an issue to a specific group with corresponding characteristics. This is the logic of stereotypes. With a limited number of indicators certain characteristics are ascribed to a person, situation or thing (Tversky/Kahneman 1974, 36).

**“Availability”**: “There are situations in which people assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind. For example, one may assess the risk of heart attack among middle-aged people by recalling such occurrences among one’s acquaintances.” (ibid 42f.)

This means that “availability is a useful clue for assessing frequency or probability, because instances of large classes are usually recalled better and faster than instances of less frequent classes. However, availability is affected by factors other than frequency and probability. Consequently, the reliance on availability leads to predictable biases ...” (ibid 43)

For example, there is a bias due to the retrievability of instances. “Different lists were presented to different groups of subjects. In some of the lists the men were relatively more famous than the women, and in others the women were relatively more famous than the men. In each of the lists, the subjects erroneously judged that the class that had the more famous personalities was the more numerous” (ibid 43).

**“Adjustment and Anchoring”**: “In many situations, people make estimates by starting from an initial value that is adjusted to yield the final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typically insufficient. ... That is, different starting points yield different estimates, which are biased toward the initial values” (ibid 46).

For example “two groups of high school students estimated, within 5 seconds, a numerical expression that was written on the blackboard. One group estimated the product  $8*7*6*5*4*3*2*1$  while another group estimated the product  $1*2*3*4*5*6*7*8$ . To rapidly answer such questions, people may perform a few steps of computation and estimate the product by extrapolation or adjustment” (ibid 46). The results show the expected outcomes. The median of the extrapolation of the first row was higher than of the second row. Furthermore, the time pressures caused the estimation in both cases to be significantly lower than the correct answer.

This early work shows already, that the reliance on heuristics and the prevalence of biases are **not restricted to laymen** but are valid for the intuitive estimations of experienced researchers as well (Tversky/Kahneman 1974, 50).

Another central result in the field of decision-making is the **framing effect**. A framing effect is a change of preferences between options as a function of the variation of frames, for instance through variation of the formulation of the problem. This violates the assumption that people decide by referring to objective entities, such as those given in a task which needs to be solved in laboratory experiment. How decision makers frame a problem is partly influenced by the formulation of a given problem and by the norms, habits, and personal characteristics of the

decision maker. Thus it is often possible to frame a given decision problem in more than one way. For example, a problem can be presented as a gain (200 of 600 threatened people will be saved) or as a loss (400 of 600 threatened people will die), in the first case people tend to adopt a gain frame, generally leading to risk-aversion, and in the latter people tend to adopt a loss frame, generally leading to risk-seeking behaviour (Tversky/Kahneman 1981).

These and other results in behavioural economics contradict different assumptions of the normative theory (for example reflexivity, completeness, transitivity, preference ordering over prospects, Hargreaves Heap et al. 1992, 6, 9). Of greater interest than the statistical developments and discussions (see for example Starmer 2000) are the following research strategies.

One general critique points out that the theoretical models rely on a special laboratory situation in which the experiments have been carried out and the data was produced (Starmer 2000, 371f.). In common **real life situations**, so the argument runs, people have the opportunity to learn. Some of the anomalies observed in the laboratory would thus disappear as soon as the subjects would have the possibility of learning by repeated experiments or were observed in market settings.

Furthermore, the experiments that have been carried out in this area show no clear results. While some experiments indicate, that there is an approximation to rational decision making by **learning** (Plott 1996), repetition and group discussion could also decrease the deviation of behaviour from rationality (Bone et al. 1999). Starmer (2000, 372) concludes that “there is a good case for thinking that patterns of behaviour change in some environments involving markets and/or repetition, but as yet there is no sound empirical basis for asserting a general tendency towards expected utility preferences under ‘market conditions’. The evidence is at best mixed”.

There is a growing volume of work on **evolutionary models** in economics (Robson 2001, Nelson 1995). For example Karni and Schmeidler (1986) argue that the expected utility hypothesis may be derived from a principle of self-preservation. The research on models in which preferences evolve under the pressure of some selection mechanisms show quite different results. Tilman et al. (1996, 1997) argue that the selection mechanism is reinforced learning whereas Cubitt and Sugden (1998) suggest that it is imitation (Starmer 2000, 373).

Another stream of research applies to the idea of **stochastic preference**. In the 1990s a number of papers investigate models with a random factor

or error term in the model of preference (Hey/Orme 1994, Harless/Camerer 1994, Loomes/Sugden 1995). Such theories try to increase the explanatory power of the deterministic interpretation of preferences by a stochastic one. While Starmer (2000, 376) interprets this as an “extremely interesting avenue for future research” there are still no conclusive results available.

## Recent developments in game theory

Many scientists see game theory “as one of the cornerstones of the social sciences. No longer confined to economics it is spreading fast across each of the disciplines, accompanied by claims that it represents an opportunity to unify the social sciences by providing a foundation for a rational theory of society” (Hargreaves Heap/Varoufakis 1995).

It is quite interesting to see how the focus of game theory has changed since John von Neumann and Oskar Morgenstern have published *The Theory of Games and Economic Behaviour* (1944). From a rather static view which emphasises specific problem constellations and how they could be solved by (instrumental) rational actors, the focus has shifted towards theories of change and evolution, processes of learning referring to norms, and to a broader notion of (social) rationality. The following review describes some central aspects of these developments.

The question of how people choose between (risky) prospects becomes more complicated when it is not only a personal choice between (for example) whether to go by car or by aeroplane, but other persons have to be considered in the decision-process. This is the core question of game theory, where at least two players are involved in a game.

Economic game theory commonly assume at least six conditions (Hargreaves Heap/Varoufakis 1995, 10) that have to be satisfied by rational decision making that could be summarized as follows: There is a fixed amount of preferences which describe the whole preference structure of a person, the preferences are in a unequivocal relationship (it could be said whether a preference is equal or greater/smaller than another preference), these preferences increase with their probability, and they are independent from each other.

If these conditions are satisfied the theory of instrumentally rational choice implies that an individual will act in order to maximise his or her expected utility function. But there are a number of reasons why many theorists are unhappy with this assumption. (ibid 1995, 12)

A growing number of experiments have shown that the expected utility theory is, in many cases, unsuccessful. One of the reasons for these failures could be that people often act as part of the practices in society in which they are embedded. Reasoning then is something external not

mainly justified by the single actor, it is rather immanent in the act itself or the social context. Another well-known critique refers to the *ex post* rationalisation of our action rather than a prospective reasoning (Festinger 1957). Additionally important is the insight that “planning can never substitute for the market because it presupposes information regarding preferences which is in part created in markets when consumers choose” (Hargreaves Heap/Varoufakis 1995, 17-18). As a consequence a main part of theoretical and empirical work leads in the direction of a **richer notion of rationality**. It focuses on the processes of learning and the development of rules.

While the standard model of rational action (the rational egoist) is powerful in predicting the outcomes in auctions and competitive market situations (Kagel and Roth 1995), it is problematic in explaining the coordination of collective action. “Recent work in game theory – often in a symbiotic relationship with evidence from experimental studies – has set out to provide an alternative micro theory of individual behavior that begins to explain anomalous findings (McCabe/Rassenti/Smith 1996; Rabin 1993; Fehr/Schmidt 1999; Selten 1991; Bowles 1998)” (Ostrom 2000, 138).

“On the empirical side, considerable effort has gone into trying to identify the key factors that affect the likelihood of successful collective action (Feeny et al. 1990; Baland and Platteau 1996, Ostrom 2001). In public good experiments (see Davis/Holt 1993; Ledyard 1995; and Offerman 1997, for an overview), as well as in other types of social dilemmas, it becomes clear that **face-to-face communication** produces substantial increases in co-operation (Ostrom and Walker 1997). For instance, individuals who are initially the least trusting are more willing to contribute to sanctioning systems and are likely to be transformed into strong co-operators by the availability of a sanctioning mechanism (Fehr and Gächter). That face-to-face communication is more efficacious than computerised signalling could be explained by the richer language structure and the “intrinsic costs involved in hearing the intonation and seeing the body language of those who are genuinely angry at free riders” (Ostrom 2000, 141).

How people **contribute to a public good** is influenced by a range of contextual factors for example “framing of the situation and the rules used for assigning participants, increasing competition among them, allowing communication, authorizing sanctioning mechanisms, or allocating benefits” (Ostrom 2000, 141). Since it is difficult to explain these facts using the standard theory, additional assumptions have been made.

One useful assumption is that various types of **'norm-using' persons** with different characteristics exist (for example, 'conditional co-operators' and 'willing punishers'). Then, with the help of evolutionary game theory, it is possible to explain how and when multiple types of players in a population emerge and survive. For instance, in co-operative games with complete information it is not the 'rational egoist' but the conditional co-operator who plays a trustworthy strategy and will therefore receive a higher payoff than a rational egoist, since others will not trust him (145). Thus, only the trustworthy type would survive in an evolutionary process with complete information.

In recent evolutionary game theory it is assumed that participants in a collective action problem would start with **different preferences** and predispositions toward **norms** such as **reciprocity** and **trust**. During the game the participants would shift their behaviour due to the experiences with the behaviour of others and the objective payoffs received. Additionally norms by themselves could alter as a result of bad experiences.

An immense number of contextual variables are identified by field researchers as conducive or detrimental to endogenous collective action, for instance the type of production and allocation functions, the predictability of resource flows, the relative scarcity of the good, the size of the group and so on (Ostrom 2000, 148).

The advantage of the opening up of theory to more complex assumptions regarding the rationality of actors and their development during the game as well as their environment, is certainly the fact that richer descriptions of decision problems and their development in social situations have been generated. However, the explanations become more and more complex and to sort out the important factors in a certain case becomes difficult, so that the predictive capacity of such explanations may decrease.

## Risk communication

The risk communication approach is situated in the borderland between psychology and economics. For this reason articles on risk communication tend to be published in journals of different disciplines (sociology, psychology, economics etc.). The central notion of the approach encompasses the idea that risk problems are fundamentally problems of ensuring that the **right information is available** and that lay people are able to **use the information properly**. In this view, risk problems are mainly problems of sufficient information and therefore need to be solved by the improvement of communication strategies. From this perspective this approach is close to the concept of market and price in normative or classic economics.

The core argumentation is illustrated by Fischhoff, Bostrom and Quadrel (1993, 479):

“To make ... decisions wisely, individuals need to understand the risks and the benefits associated with alternative courses of action. They also need to understand the limits to their own knowledge and the limits to the advice proffered by various experts.”

While it is acknowledged that “emotions play a role, as do social processes. Nonetheless, it is important to get the cognitive part right, lest people’s ability to think their way to decisions be underestimated and underserved” (ibid 495).

In the same way Kunreuther and Pauly (2004, 18) in their article asking “Why Don’t People Insure Against Large Losses?” argue: “at a prescriptive level, we believe that better information about probabilities as well as about the level of insurer profits and their pricing decisions could help to motivate better insurance purchasing behaviour. At present, this kind of information is not generally available with ease. The insurance buying decision process can be so complex and confusing that people will eschew either searching for information or purchasing insurance for low probability high-consequence events.”

## Trust and risk

The core idea of trust in economics is quite fundamental. Trust is present in every economic exchange because the delivery of a good and the payment for it are rarely perfectly synchronized, which gives both the buyer and the seller the opportunity to cheat on the deal. In the view of many economists “laws and enforcement agencies” are the solution for this fundamental trust problem. Without such contextual securities no individual would be willing to enter into an economic transaction (Hargreaves Heap/Varoufakis 1995, 149). Because economic actions are in general affected by the atmosphere of trust in which they occur, some authors (for example, Knack/Keefer 1997) suggest that generalized trust is highly significant in increasing aggregate economic activity.

One approach to introducing the idea of trust into economic theory is through the notion of **social capital**. Putnam (1993, 167) defined social capital as “features of social organization, such as trust, norms and networks that can improve the efficiency of society by facilitating coordinated actions.” Thus, the problems organizations and governments encounter in “selling” their products or decisions could be described as lack of social capital. The concept to build up such trust by giving the right information (framing included) or the idea that trustful sources determine the risk perception of the public seems to be insufficient to describe the complex relationship between information sources and public (e.g. Frewer et al. 2003).

The theoretical idea of trust in economic literature is that of **rational trust** as formulated in the context of the rational choice approach by Coleman (1990). Trust in this meaning is the result of rational calculation. To trust someone is rationally sensible when the relation of the probability that the trustee will justify the trust (chance to win) to the probability that the trustee will disappoint the trust (chance to loose) is larger than the relation of the possible loss to the win.

“Rational trust” does not necessarily disregard the ubiquity of trust in an uncertain world. “Ineradicable deficiency of information, bounded rationality and time limitations at the disposal of agents prevent them from leaning on their knowledge and led them to utilizing trust as an argument for their actions” (Lascaux 2003).

“Trust begins where knowledge ends” (Lewis/Weigert 1985, 462). Thus, in the extreme cases of comprehensive knowledge or total ignorance, trust becomes an empty concept. For this reason in economic theory, limitations on knowledge as the basis of trust is emphasized.

## Emotion and risk

At the first glance, emotion seems to be the natural contradiction to rational decision- making. From this perspective, emotion is treated as something that disturbs and biases the otherwise rational decision.

This perspective on emotions as a **disturbing factor** could be illustrated by the problem of the elimination of risk-calculation as a whole as a result of strong emotions. For example, terrorism is an issue where strong emotions are involved. This will lead people to focus concern on a terrorist attack, which is in fact of low probability, rather than a statistically more serious risk such as a car-accident (Sunstein 2003).

Quite similar is the subjective anxiety people experience in flying compared with taxi driving. In this context it could be argued that subjective anxiety rather than objective risk should be the focus of research, since it, like any other mental or physical pain, is a real issue for those involved (Carlsson et al. 2004, 159).

In most examinations of risk-problems in economics, emotions are not considered. Even though it is often accepted that emotions are an important factor, the rational part is seen as something that has to be explained first. “Emotions play a role, as do social processes. Nonetheless, it is important to get the cognitive part right, lest people’s ability to think their way to decisions be underestimated and underserved” (Fischhoff et al. 2000, 495).

The economic literature in general is criticized for its lack of reference to emotions. Therefore Elster (1998, 72) started to arrange the different

ways some economics use emotion in their analysis. He concludes from his analysis that it is insufficient modeling **emotions** as **psychic costs** and **benefits** or as a **source of preferences**. Instead he supposes that emotions also **affect the ability to make rational choices** within the reward parameters of rational choice. Thus, Elster interprets as an urgent task in economics “to understand how emotions interact with other motivations to produce behavior”.

## Summary

Economic approaches are primarily based on rational actor models and the assumption that people make deliberative choices between alternatives. From this perspective, risk (where it is assumed that the alternatives can be understood as outcomes to which probabilities can be attached) is a special case of decision-making under uncertainty, where the probability of an event or the full range of outcomes is not known.

Evidence on the way in which people use heuristics, the influence of framing, the boundedness of rationality and the importance of trust and emotional factors in real life choices has led to interest in economic accounts which assume that actors are not simply or not always rational. This leads to examination of the influence of context, social practices and institutions and other factors, and to approaches which take learning, evolutionary developments and stochastic elements in preference into account. Game theory has provided a rapidly developing literature on the way in which choices in multi-actor interactions are made in the context of the awareness that other actors will also be seeking to pursue their separate interests. This provides further insights into reciprocity and trust.

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## Journals

- Games and Economic Behaviour  
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