

**Risk Denial and Neglect: Studies in  
Risk Perception**



# **Risk Denial and Neglect: Studies in Risk Perception**

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## ***PREFACE***

This report is a result of a research project carried out at the Center for Risk Research at the Economic Research Institute at the Stockholm School of Economics.

This volume is submitted as a doctor's thesis at the Stockholm School of Economics. As usual at the Economic Research Institute, the author has been entirely free to conduct and present her research in her own ways as an expression of her own ideas.

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## *Introduction*

In all stages of life, individuals are exposed to various risks. The risks can be related to lifestyles and health issues. It can be a question of economic risks such as choosing to invest in funds or stocks, or choosing between a fixed and floating interest rate for the mortgage, to name but a few examples. Many of the risks are optional and voluntary, albeit to a varying degree. Other risks in society are involuntary or at least not direct results of the choices made by the individual.

The present thesis studies societal and individual attention to risks and focuses especially on the issue of neglect. Some risks are ignored simply because they are new and unknown. Neglecting risks, on the other hand, implies that there is a certain degree of knowledge about the risk. Despite this knowledge, the necessary precautions to avoid the risk, or mitigate the consequences, are neglected. Unfortunately, it is not difficult to give examples of risks that have been neglected in the past. The catastrophes in New Orleans and the Indian Ocean tsunami are but two recent examples; neither of the risks were unknown or (in the long-run) unexpected. In fact, an article was published as late as November 2004, debating what would have happened if hurricane Ivan had not missed New Orleans in September 2004 (Laska, 2004). The author pointed at the inadequate levee system, the challenges that an evacuation would involve, as well as the problems of coming to the rescue of those that had stayed in New Orleans. In retrospect, it is easy to say that more precautionary measures should have been taken, in order to reduce the negative effects of the disasters. Obviously it is much more difficult to, in advance, decide what risks should be given priority in society. In this context it is of great importance to create an understanding for how risks end up on the political agenda. Who should decide what risks are tolerable, what risks are worthy of more or less attention, and who should bear those risks? These are important and difficult issues that need to be discussed and debated in society.

The identification and assessment of risks and the attention risks get in public debate is of great importance for policy making. Before risks are discussed on the political arena and appropriate actions can be taken, to either accept or try to mitigate the negative consequences of the risk sources, they have to be identified as risks. Although experts do have an important role in society in the assessment and debate of risks (SOU, 2000), experts' opinions and scientific discoveries are not the only way in which risks get attention. Other ways are when accidents happen or via lay whistleblowers (Lawless, 1974). In a democratic society risk perceptions of all the involved groups in society should ideally have an impact on the forming of risk policies and societal risk management. This is not to say that the aim should be for all groups in society to agree in their assessments of risk – societal convergence on risk is merely hypothetical and probably not even something to wish for (cf. Sjöberg, in press).

At some instances the risk issues are very obvious on the political agenda – e.g. the debate about nuclear power and how to store nuclear waste is very much focused on risks. The core issue is supply of cheap and environmentally friendly energy and alternative sources of energy are discussed, evaluated, and compared with nuclear power. The debate often seems to include a comparison of the involved risks. Other issues that are on the political agenda may not have such a direct and evident connection to the risk debate. However, the dimensions of risks, tolerable level of risk, and how risks are perceived are present in most decisions we make.

Individuals' risk perceptions are in many cases a result of social communication rather than a product of personal experience. Many risks can not be experienced by human senses – we do not personally experience and feel the negative consequences and therefore have to rely on the assertions of others (Rohrmann & Renn, 2000). Not only do experts have an important role in societal risk management, their opinions can also be assumed to have an effect on the attitudes, beliefs, and risk perceptions of laypeople. This might be particularly true with respect to the risk sources with which the individual has no direct experience. Influences also come from other sources in society, e.g. the media, friends and family.

Risk has been studied in many different fields of social science research and with various approaches. Risk perception research has its roots in cognitive psychology and the research on heuristics and biases was very influential to begin with, see e.g. Tversky and Kahneman (1974) and Gilovich et al. (2002a). More recognition is now given to the fact that cognitive biases only play a minor role in risk perception and the importance of morality, ideology, and affect is emphasized (Drott-Sjöberg & Sjöberg, 1991; Sjöberg, 1998; Slovic et al., 2004).

The present thesis studies societal and individual attention to risks and focuses especially on the issue of neglect. Why do some risks get more attention than other risks and how is this difference in attention related to experts' roles in society? What can explain people's tendency to perceive risks as more pertinent to other people? These are some of the issues that are discussed in the present thesis. The topics are of interest for, e.g., risk policies (Sjöberg, 2000a), risk management, and for designing campaigns aimed at minimizing risk-related behaviors (Löfstedt & Frewer, 1998). The research scope and the specific aims of the thesis are presented below and are followed by a section describing the outline of the remainder of the thesis.

### **Research scope and thesis aims**

The present thesis is written within the field of economic psychology, a research field that uses theories from psychological science in the study of economic behavior. Even though not all the risks under study in the dissertation are of an economic nature, individuals' perceptions of, and societal attention given to,

various risks often have economic consequences to society. For instance, people's attitudes towards using the Internet as a tool for communication or consumption and the perception of the related risks may have a noticeable effect on the success of companies investing in e-commerce. In addition, it may be consequential for the implementation the Swedish "24/7 Agency", the ambition that most public services should be available all around the clock via interactive services on the Internet (Statskontoret, 2000). Furthermore, social attention to risks is of great importance for the discussion about allocation of resources – what risks should be prioritized in society?

The present dissertation has a general aim of enhancing the understanding of the attention given to risks, and in particular the processes that lead to the neglect of risks. The attention given to risks in society is probably closely related to the perception individuals have of risks (cf. Sjöberg, 2001b). What influence laypeople's perceptions of risks should have on the design of risk policies in society has been discussed at length in the literature; see e.g. Pidgeon (1998). The perceptions of laypeople are often studied in relation to what biases influence their perception. However, it should not be forgotten that the judgments and evaluations of experts and decision-makers also are influenced by various heuristics and biases (Wright et al., 2002).

The dissertation comprises four separate papers. Papers I and II address issues of social attention to risk and the specific aims of these two papers are 1) what categories of risk are identified as neglected and over-emphasized in society and what actors in society are pointed out as responsible for inappropriate levels of attention; 2) what is the relation between identified risks and the experts' domain of expertise, a discussion that is related to the different roles of experts in society in terms of promoters of technology or protectors of people. Papers III and IV narrow down the discussion to individual processes of risk denial by studying optimistic biases in risk perceptions. The specific topics of these two papers are 1) how the risks related to the use of computers and online applications (Paper III) and the economic risks that the individual faces in his/her everyday life (Paper IV) are perceived; 2) what factors can help explain optimistic bias in economic risk perceptions.

## **Outline**

The thesis consists of two major sections – an introduction and a section including the four empirically based papers. The introduction aims at providing an overview of previous research and relevant literature, to discuss and highlight the central themes in the thesis, and to provide a summary and a discussion of the included papers.

The four papers are based on empirical research and are targeted at scientific journals and conferences. As such, they are free-standing pieces of research with

separate discussions of relevant literature and methodological issues at hand. Due to the format and space limitation of scientific journals, these literature and methodology discussions are rather brief.

### ***Conceptual framework***

As stated earlier, it is the purpose of the present thesis to study individual and societal attention to risks. The studies of individual attention to risk (Papers III and IV) concentrate on risk perceptions and denial of risks (in terms of optimistic biases), while societal attention is discussed both in terms of too much and too little attention (Papers I and II). It is particularly the neglect of risks that is of interest in the present thesis. Consequently, two concepts are of central importance for the present discussion, *risk* and *neglect*. In the following, the two concepts will be discussed to give a clearer picture of how the concepts of risk and neglect are used in the research literature and above all, in the present thesis.

### **Risk**

Although the term risk is often used in scientific literature as well as in people's everyday conversations there is no commonly accepted definition of the concept. In dictionaries one encounters the definition of risk as the "*possibility of meeting danger or suffering harm, loss, etc.*" (Hornby, 1989). This only captures part of the concept of risk as it is interpreted in scientific research – the probability of an event happening. An equally important part of risk is the outcome and the negative consequences associated with this outcome. These two parts constitute the core of many definitions of risks – an estimation of the likelihood of an event happening and the possible outcome of that event (Boyne, 2003). This represents a quantifiable definition of risk, or risk as something that is possible to define objectively, that is often used in natural sciences. Some argue that the only correct and meaningful definition of risk is this statistical expected value; for a critical discussion see Hansson (2005).

What one person perceives as risky may be viewed as free of risk by other people. Although risks, strictly speaking, can not be perceived, "risk perception" is the generally accepted term within this field of research (Rohrmann & Renn, 2000). It refers to people's subjective judgments and evaluations of hazards and dangers. What criteria the individual takes into consideration when evaluating different risks may vary between different individuals and situations. There are common denominators though – some of which are discussed in a later section of this thesis – and risk perception research aims at creating a better understanding of the processes of evaluating and tolerating risks. Although perceived likelihood and consequences are related to perceived risk, not only quantitative aspects of risk are of interest. Within social sciences risk is viewed as a more complex issue, incorporating both quantitative and qualitative aspects.

Risk perceptions of laypeople<sup>i</sup> have sometimes been characterized as irrational and based on emotions, without being rooted in any “real” or systematic evaluation of risks. In contrast, risk assessments made by experts are seen as representing objective and valid estimations of the risks. The claims that experts judge risks differently and are more correct in their risk assessments have, however, been rejected. Although there were differences in the accuracy of risk magnitude ratings, the differences were small and both experts and laypeople were biased in their ratings (Wright et al., 2002).

The use of terms like “real risk” or “actual risk” has been criticized for being inappropriate and creating problems in risk communication since it suggests that peoples’ subjective risk perceptions are not valid (Rohrmann & Renn, 2000). A more appropriate term would be “statistically estimated risk” or “predicted risk”. This is not to say that there is no such thing as “actual” or “real risk”, but the question remains whether or not this “real risk” can be captured by statistical estimations of probability and outcomes. Risks can be viewed as socially constructed but with real dangers underlying this constructed concept (Slovic, 1999). Statistical estimations of risks are influenced by what models are used and what factors are taken into consideration. These choices are influenced by subjective judgments and assumptions and the results might be very different. Although most social issues can be described in terms of risks the prevalence of discussions of risk in quantifiable and objective terms has brought along the tendency to treat social problems that are easy to quantify as risks more often than problems that are harder to quantify (Hansson, 1989).

Risk can refer to both positive and negative outcomes. Within financial theory, for instance, risk is usually defined as variance in the yield of the investment (Ricciardi, 2004). Taking higher risks in financial investment can also lead to higher potential gains. The papers included in the present thesis are limited to the study of the risk of negative events, the most common focus in risk perception research.

The position in the present thesis is that there are “real” risks or hazards. Most people may agree that some activities entail a certain element of risk<sup>ii</sup>, although there may be less agreement on the magnitude of risk. Calculations of the magnitude of the risk necessitate certain choices that might influence the statistical expected value. Truly objective statistical risk estimates are therefore impossible to capture. Risk is something more than a quantifiable concept of possibilities multiplied with the negative outcomes. Numerous factors influence how people perceive risks – and this perception is believed to have an influence on decision-making processes in everyday life. When the empirical data has been collected the concept of risk has not been defined – the respondents have made what can be called an “unconditional risk estimates” (van der Velde et al., 2002), i.e. their evaluations are based on whatever set of factors the individual takes into account.

## **Neglect**

When discussing the importance of risk neglect it is obviously important to know what is meant with “neglect”. In dictionaries it is defined as “to give little attention to” or “to leave undone or unattended to especially through carelessness” (Merriam-Webster, 2005). There are probably many risks or objects that are given little attention, simply due to the fact that there is no knowledge about them. It is therefore appropriate to make a differentiation between ignorance and neglect of risks. Some risks are ignored because people do not have any knowledge about their existence. Neglect on the other hand, implies a certain degree of knowledge. Furthermore, there is a difference between neglecting a risk and tolerating a risk. Not taking precautions to avoid risks does not have to imply that the risks are neglected – on the contrary the risks may have been recognized and tolerated. For instance, an owner of a house who is *fully aware* of the fact that without a home insurance, he/she has to bear all the costs alone if it would burn down can not be said to neglect the risks of fire. Instead, the owner has evaluated the situation and accepted the risks of owning a house without insurance. Another possibility, probably more common than this example, is that the risks are recognized and rejected – implying that the owner signs up for home insurance. In general there are at least four different levels in the relation between the individual and the risk: ignorance, neglect, tolerance or rejection.

Not only are there different levels in the relation between the individual and the risk, there are also different levels of actual neglect. On the first level, which is quite close to that of ignorance, the individual refuses to hear, think or reflect about the risk – he or she actively chooses to stay ignorant. The difference between this level and that of ignorance is this active choice of refusing information – information that is available. On the second level, the individual has some knowledge about the risk but denies it. This is associated with optimistic bias, where the individual has information about a risk but does not acknowledge that the risk applies to him/her. Optimistic bias is also related to the third level of neglect, a selective search for information. This bias in selection may either focus on information about the risk that is relevant to the own person or be biased in the sense that only information supporting the belief that the risk is low or irrelevant, regardless of whom it potentially affects.

So far I have only discussed neglect in relation to the individual – but risks can also be neglected on a societal level. Risks can be absent from the agenda of decision-makers in society for various reasons. One reason might be that the issue has not at all been taken into consideration. Another possibility is that, after careful consideration, it was decided not to give the issue priority. It is only in the first case that the term “neglect” is adequate. Risks get attention and end up on the political agenda mainly through three different channels: scientific discoveries, through accidents, and with the help of lay-whistleblowers. When a risk attracts



attention by new scientific discoveries it is not a case of prior neglect since the discovery was preceded by a lack of knowledge (a state of ignorance). However, if an accident happens and the related risks only then get attention this would be an obvious case of neglect. The necessary safeguards to prevent a negative event from happening have not been taken even though knowledge about the risk existed. A neglected risk is not any hazard that turns out to be dangerous once it has become a reality, but one where reasonable safeguards have been ignored. The third way a risk can get social attention is through lay whistle-blowers. Individuals may raise alarms about certain risks in society; see e.g. Lawless (1974) for a discussion.

In the present empirical studies of experts' opinions about what risks are neglected or exaggerated, no definition of the term neglect (or exaggeration) was given. Since we were interested in experts' spontaneous understanding and use of the concepts, it was simply asked what risk issues the respondents believed got too much and too little attention respectively in society. The empirical studies on individual attention to risk included in this dissertation focus on individual neglect in terms of optimistic biases. It will also be referred to as risk denial – people's tendency to mostly see risks as pertinent to other people.

### ***Risk perception research***

This section of the dissertation presents a brief overview of previous research that has been influential within the field of risk research, the different perspectives, and theoretical developments. It is followed by a presentation of some of the core findings related to perceptions of risk.

Within risk perception research there are two dominating schools of thought, the cultural theory with its roots in sociology and social anthropology (Douglas & Wildavsky, 1982) and the psychometric model (Fischhoff et al., 1978) based on theories from the disciplines of psychology and decision research. Both large scale societal risks (such as nuclear power and toxic chemicals) and personal risks (e.g. being victim of a crime or being injured in a traffic accident) have been under study.

The idea that risk is socially constructed is central in cultural theory and as a consequence it is claimed that each social group may have their own set of risks. The main thrust of cultural theory is to categorize people into one of four sets of cultural biases (or worldviews) which would, it is argued, help to predict their attitudes and perceptions of risks (Wildavsky & Dake, 1990). The four sets of cultural biases are: egalitarians, individualists, hierarchists, and fatalists. Which worldview category the individual belongs to, depends on what he/she values in life. Since the theory was launched it has received serious criticism boiling down to lack of empirical evidence, unclear and vague concepts, and questioning of why there should be only four worldviews and what would happen if an individual would identify with more than one worldview (Löfstedt & Frewer, 1998).

Empirical tests of the theory have only resulted in about five percent explained variance in risk judgments (Sjöberg, 1997) and only 32% of the respondents could be allocated to the four worldviews in one study (Marris et al., 1998). Furthermore, the theory has been criticized for circular argumentation (Boholm, 1996). The conclusions are already embraced in the pre-conditions of the theory. For instance, to state that a greedy person aims to put his or her hands on other people's wealth can not be considered a good hypothesis, since the behavior one aims to predict, greed, is semantically determined by stating that the person is greedy.

The other dominating theory within risk perception research is the psychometric model. It was introduced in the late 1970s (Fischhoff et al., 1978) and has since then been followed by a number of studies (for an overview see Boholm, 1998). The theory has been described as a "landmark in research about public attitudes to risk" (Marris et al., 1997, p 313) and has had a large impact on both academic researchers and policy makers. The aim of the psychometric model is to create cognitive maps of risk attitudes and perceptions (Slovic, 1987; Slovic et al., 1982). By using nine explanatory scales<sup>iii</sup> (that have been extended to eighteen with time) risk characteristics were created forming what has been referred to as "personality profiles" of the risks; see e.g. Marris et al. (1998) for a discussion. The characteristics of the risks are intercorrelated and factor analysis has narrowed them down to three factors<sup>iv</sup> that are claimed to explain variance in how different risks are perceived: dread, unknown risks, and a third factor related to the number of people that are exposed to the risk (Slovic, 1987).

Several objections to the model have been raised. A first objection is concerned with the treatment of the qualitative risk characteristic as inherent attributes to the risks themselves, thereby excluding the influence social, cultural, and institutional processes may have on people's perceptions of risk (Marris et al., 1998). Another problem with the model is that it, at least initially, did not differentiate between groups of individuals – the only distinction recognized was that between "laypeople" and "experts". The choice and definition of experts have met with criticism – a small, heterogeneous sample of experts rated risks mainly outside their own domain of expertise (Rowe & Wright, 2001). Critique has also been directed at the use of analyses on aggregate data – the use of hazard as unit of analysis instead of the individual fails to recognize any differences between groups of individuals. Advocators of the paradigm claim that analyses at the aggregate still reflect tendencies in the individual responses (Bronfman & Cifuentes, 2003), a claim that is refuted by findings of significant differences between individuals that have not appeared in aggregate analysis (Gardner & Gould, 1989). In addition, analyses on aggregate data tend to elevate the level of explained variance and critics argue that the model explains much less variance than the advocates claim. When analyses with aggregate data show a level of explained variance of about 60-70%, at times even claimed to be 80% (Bronfman & Cifuentes, 2003), using the

individuals as unit of analysis only give about 10-20% of explained variance (Sjöberg, 2000a).

### **Core findings within risk perception research**

Tversky and Kahneman's (1974) work on heuristics and biases was initially very influential in risk perception research. In line with this work people's risk perceptions were seen as the results of faulty information processing and the focus was on cognitive explanations. In recent years other aspects have been brought up on the risk research agenda and more emphasis has been placed on the interplay between affective responses and cognitive judgments; see e.g. Rundmo (2002), Slovic et al. (2004), and Loewenstein et al. (2001). The importance of attitudes and moral values has also been stressed. Moral value of a risky activity has been found to be positively related to the acceptability of the risk (Sjöberg & Winroth, 1986). In the following I will discuss some of the core findings in risk perception research and what factors have been found to influence individuals' risk perceptions.

There seems to be a difference in perception of man-made versus natural risks, see e.g. Renn and Rohrmann (2000) for a discussion, and risks that the individual take themselves (voluntary risks) or risks that are imposed on them (involuntary risks). A morality dimension (tampering with nature), related to the discussion of man-made risks, has been found to contribute a great deal to level of explained variance (Sjöberg & Wåhlberg, 2002). "Tampering with nature" relates to the consequences human actions may have on the environment, i.e. whether or not the risky activities are interfering with natural processes. When used in a psychometric model, this new dimension turned out to be a much stronger predictor of perceived risk than the traditional dimensions in the psychometric model (Sjöberg, 2000b). Other factors relating to the risk source that have been found to affect perceptions of risk are level of perceived control over the risk (e.g. Flynn et al., 1992; Kasperson et al., 1988; Slovic, 1999) and (in relation to technological risks) whether or not the technology is replaceable (Sjöberg, 2002b). The level of perceived control is also important in the discussion of people's tendency to believe that risks will not happen to them (optimistic bias) that is discussed later on in this introductory section of the thesis.

A very robust finding is that women rate risks as higher than men do; see e.g. Flynn et al. (1994), Truedsson and Sjöberg (2000), and Wester-Herber and Warg (2002). Differences have also been found between ethnic groups. Overall, white males tend to give the lowest estimates of risks, which has led to the concept "the white male effect" (Finucane et al., 2000). Explanations have been sought in sociopolitical factors, e.g. that white males constitute a powerful group in society and thereby have a more advantageous position in society. Recent studies have looked for explanations in the subjective perceptions of social vulnerability and discrimination as well as sociopolitical beliefs of environmental injustice, showing

that there are differences within the groups (Satterfield et al., 2004). Not all white males rated the risks as lower. In addition, analyses of Swedish data suggest that “the white male effect” may be a phenomenon specific to the US (Sjöberg, 2003). Although economic vulnerability (measured by annual income) was related to perceptions of risk, no interaction between economic vulnerability and gender was found in Swedish data.

Whereas the psychometric paradigm has looked at characteristics of the risk, in order to explain risk perceptions, cultural theory has focused more on the individual and his/her worldviews as explanations to what risks get attention. Part of the problem, and the appeal, of these models is their simplicity – variation between people can not readily be characterized into four different stereotypes or the factors influencing risk perception boiled down to dread and whether or not the risk is unknown. Research shows that people’s perceptions of risk are far more complex and that they are influenced by a combination of factors, pertaining both to the risk source and to the individual. It can be concluded that research on risks need to incorporate variables on the level of the individual (Gardner & Gould, 1989).

### ***Optimistic bias***

Another very robust finding in risk research is people’s tendency to rate their own risks as lower than the risks to their peers. This tendency to deny personal risk is usually referred to as unrealistic optimism or optimistic bias (Weinstein, 1980). The discussion has mainly focused on health-related risks and behavior, so-called lifestyle risks<sup>v</sup>, see e.g. Schwarzer and Renner (2000) and Weinstein and Klein (1995). However, there are examples from other areas – for example, studies of optimistic bias in relation to environmental hazards (Hatfield & Job, 2001). In the present section, an overview is given on some methodological issues related to research on optimistic biases, followed by a summary of important findings on explanatory factors.

People not only tend to regard themselves to be less at risk than other people. They also rate positive events to be more likely to happen to them than to their peers and believe that they to a greater extent possess positive features or characteristics, i.e. risk-decreasing attributes (Weinstein & Klein, 2002). Students have been found to believe that they will receive higher grades on their exams than they actually get – particularly exams that are some time away, optimism tends to decrease as the time of the exam gets closer (Shepperd et al., 1996). Driving skills is another domain in which it has been found that drivers are optimistically biased. People have tendency to believe that they are more skillful and safer as drivers than other people (Svenson, 1981). In addition, a majority also believed their personal risk of being involved in a traffic accident was smaller than for other people (Svenson et al., 1985). A perception of superior driver skills has also been

found among expert and novice<sup>vi</sup> drivers (Waylen et al., 2004), showing that experts also have a tendency to be overly optimistic about their own skills. In short, the results show that people tend to believe that their future looks much brighter than for people in general.

The empirical studies included in the present dissertation focus exclusively on optimistic bias in relation to negative events. However, since much research has been done on optimistic bias in relation to positive events this literature is also, to some extent, included in this overview. In addition, the related issue of overconfidence is briefly discussed in another section of this introductory chapter.

Optimistic bias can be measured either by a direct or an indirect method. In the direct comparison format the respondent is asked to rate their own risk compared to that of their peers, or to people in general – is their own risk smaller, greater or equal to that of their peers? In contrast, the indirect format asks for separate estimates for personal and general risk. Optimistic bias is calculated as the difference between general risk and personal risk and is the method of choice in Papers III and IV. The reasons for choosing this format is that the direct format of estimating risks may reveal a higher degree of optimistic bias than the indirect format (Otten & van der Pligt, 1996). Part of the explanation for this result may be the differences in scale-ends. Stating that the risk for oneself is “very much lower/higher” than for the comparative target (direct format) may come easier than stating that the risk is “certainly/certainly not likely to happen” (indirect format).

Another advantage of the indirect format is that it allows for a differentiation between factors that affect optimistic bias through the personal risk estimate and those that affect it through variations in general risk. A meta-analysis on moderators of optimistic bias concluded that moderators associated with negative affect and control had an effect on personal risk estimates, whereas moderators associated with positive mood had an effect on target risk estimates (Helweg-Larsen & Shepperd, 2001).

An important methodological issue in research on individuals' denial of risks is the choice of unit of analysis. Quite often the event or hazard is used as a unit and analyses are made on aggregated data instead of using individual data (Harris, 1996) (compare with the discussion related to the findings of the psychometric paradigm). Advocators motivate this choice with the difficulty to determine whether the optimism in a specific judgment of risk is justified or not (Harris, 1996). However, the use of analyses on aggregated data has been questioned (Rohrmann & Renn, 2000; Sjöberg, 1999a). It is the individual processes of attention to risks that is of interest and analysis on aggregated data would reduce the search of explanatory factors to characteristics of the risks. The attitudes, expectations, and perceptions of the individuals that might contribute to variations in the level of optimistic bias are overlooked. Analyses on the individual level

furthermore constitutes a more conservative test of the associations between optimistic bias and the explanatory variables since it does not reduce the error variance to the same extent as analyses using the hazard as unit of analysis (Harris, 1996).

A common approach in research on optimistic bias is to use a peer group as the comparison target. For instance, if the sample is one consisting of college students, the respondents may be asked to compare their own risk to that of an average student at their college of the same age and sex as themselves (cf. Chua & Job, 1999). Research shows that comparison targets that are psychologically close to the respondent reduce the level of optimistic bias. For instance, when the comparison target is a friend or a family member (Harris & Middleton, 1994), or a concrete person within the group (Klar et al., 1996) levels of optimistic biases have been reduced. An explanation offered for this tendency is that people base their judgments of others people's risk (when the target is generalized) on base-rates and statistical information. When the target is concrete or familiar, or when the own risk is judged, the judgment is based on singular and personal information (Klar et al., 1996). In the included empirical papers the comparison target has been defined as "people in general" (Papers I to III) or as "people in general of the same age and gender as yourself" (Paper IV).

The importance of the specificity of the risk has also been pointed out (Armor & Taylor, 2002). In their study on environmental risks, Hatfield and Job (2001) hypothesized that the level of optimism would increase when the risks were phrased in more specific and personally relevant terms. For instance, when the respondents were asked to rate the risk of noise pollution (general frame), the subjects in the specific-frame were asked to rate the risk to "suffer psychological problems due to noise pollution" (Hatfield & Job, 2001, p. 24). Whereas no optimistic bias was found for environmental hazards phrased in general terms, risk judgments of specific consequences of these hazards were optimistically biased. This might help to explain the optimistic bias in relation to the use of information technology (see Paper III) since these risks were more specified than is usually the case for technological risks.

### **Explanatory factors**

A great number of studies have been made on unrealistic optimism in the search for explanatory factors. However, the results are not consistent and have been difficult to replicate. Few factors apart from perceived control have emerged as explanatory factors over many studies. Therefore, there is a need to continue to search for explanations behind optimistic bias. The factors that have been suggested to cause optimistic biases can be divided into two groups – motivational factors and cognitive biases (Lee & Job, 1995; van der Pligt, 1994). These are sometimes referred to as "why" and "how" explanations for optimistic bias

(Hoorens, 1994) – the motivational factors explain why unrealistic optimism occurs, while the cognitive mechanisms can explain how they occur.

The motivational explanations are primarily focused on the need to reduce fear and anxiety (van der Pligt, 1994). One such explanation is defensive denial which refers to an underestimation of the risk in order to reduce the anxiety related to that risk. If this assumption would be correct, perceptions of risk with serious consequences would elicit more optimistic bias since the need to reduce anxiety would be greater. No such relation has been found when ratings of severity of the consequences have been included in studies on optimistic bias (Eiser et al., 1993; Job et al., 1995). Other motivational accounts to optimistic bias have been suggested, e.g. safeguarding one's self-esteem, but the various explanations have not found very much support in research (Lee & Job, 1995).

Cognitive explanations to optimistic bias are related to various cognitive heuristics, a tradition that has its roots in research by Tversky and Kahneman (1974). Their work on heuristic principles, used by individuals to simplify complex judgment tasks, has had a huge impact across the social sciences (Laibson & Zeckhauser, 1998). Cognitive explanations related to optimistic biases include egocentrism, downward comparison, and errors in data collection.

Egocentrism refers to the tendency people have to focus on what precautions they take themselves to avoid risks and their particular points of advantage related to the risk source. Less attention is given to the precautions taken by, and the positive attributes of, other people with the result that the own risk is perceived as comparatively lower. The egocentrism account has found support in several studies (e.g. Hatfield & Job, 2001; Lee & Job, 1995). It may be related to the availability heuristic (Tversky & Kahneman, 1974) – the availability of memory contents and the ease with which it can be brought to mind affects the judged probabilities. The things we do ourselves to prevent risks or the attributes we possess that act in our favor may come easier to mind than the behavior and characteristics of other people. Another explanation that has been supported in research is the idea that people often compare themselves with less favorable stereotypes, rather than their peers (downward comparison) (e.g. Harris & Middleton, 1994; Weinstein & Klein, 2002). As mentioned above, decreasing the social and psychological distance to the comparison target, by defining it as a friend, family-member or a concrete person in the group, has lowered the level of optimistic bias (Harris & Middleton, 1994; Klar et al., 1996). However, attempts to reduce the level of optimistic bias by prompting the respondents to compare themselves with targets at low risk instead of with stereotypes, failed – on the contrary, the intervention strengthened optimistic bias (Weinstein & Klein, 2002).

The absent/exempt error is yet another cognitive explanation to optimistic bias – if a negative event has not happen so far, it is perceived as less likely to happen in the future (Chua & Job, 1999). In the estimation of future risk, extrapolations are

made from prior experiences (Weinstein, 1987). This finding can be compared to what is sometimes referred to as the “hot hand effect” – the belief that success or failure breeds itself (Gilovich, 1991). The term hot-hand refers to the common expectation in basketball that if a player has made a few lucky shots he/she will become more relaxed and more confident rendering future success more likely. Studies show that streak shots do not exist; successive shots are independent, but the belief remains and can be explained by a general misconception of chance events (Gilovich et al., 2002b).

The level of optimistic bias has also been found to be related to people’s prior negative experiences with the risk source (Moen & Rundmo, 2005; Parry et al., 2004), even though the effects of prior experience are not long-lasting. This finding has been related to the discussion of perceived control, which in a number of studies has been found to influence optimistic bias; see e.g. Harris (1996) and Helweg-Larsen and Shepperd (2001). The higher the level of perceived personal control, the stronger the optimistic bias (Kos & Clarke, 2001; Svenson et al., 1985). The operationalization of control varies between studies. Control can be assessed by comparing events with varying degrees of control, e.g. the risk of getting hurt in a traffic accident as a driver or as a passenger (cf. McKenna, 1993; Svenson et al., 1985). The cited studies show that there is a tendency to judge the risk of being hurt in an accident as a passenger as higher, than being hurt in an accident as a driver. Or, in other words, a situation which was more under the respondents’ personal control elicited more optimistic bias. Another way of measuring control is to let the participants rate the perceived controllability of the hazard. In addition, general control beliefs can be assessed through an individual difference measure, such as the locus of control scale (cf. Moen & Rundmo, 2005).

Past experiences with problems represent intrusions of reality (Langer, 1975), and as such may lessen the perception of control. The importance of intrusions of reality is also supported by the findings that optimistic bias correlated negatively with likelihood ratings (Eiser et al., 1993) – the more likely the risk, the lower the level of optimistic bias. A recent study among Israelis of their perceptions of the risk of being the victim of a terrorist attack even showed a lack of optimistic bias (Klar et al., 2002). The study was made after a wave of terrorist attacks had struck the country and the findings were explained by the fact that the risks were very “real” – the risk no longer represented a hypothetical risk that might happen, but something that had happened repeatedly in the recent past. In addition, the risks were perceived to be beyond control (Klar et al., 2002).

The cultural context and its importance on optimistic bias have been suggested as an area that merits further investigation (Helweg-Larsen & Shepperd, 2001). The studies that have been made indicate that cultures emphasizing individualism instead of collectivism among the citizens have higher levels of optimistic bias (e.g. Chang & Asakawa, 2003; Heine & Lehman, 1995). The importance of group belongingness has been emphasized in other contexts. A recent study on



optimistic biases among risk takers found that four variables explained 29% of the variance in the level of optimistic bias: safety attitudes, control, anxiety, and sub-sample<sup>vii</sup> (Moen & Rundmo, 2005). Safety attitudes and sample were the most important predictors of optimistic bias. It should be noted that the effect of control on optimistic bias was statistically significant, but low. Anxiety only had an indirect effect on optimistic bias through control. The results of the study highlight the importance of interdependence in the group as well as the nature of the risk taking.

The three groups of risk takers included in the study were skydivers, soldiers, and fire fighters. Differences were found between the three groups, both with respect to level of optimistic bias, and with respect to the degree of dependence within the groups. The group of skydivers was most optimistically biased, and, in addition, the group with the most independent members. Fire fighters (who were realistic) and soldiers (who were pessimistically biased) were more characterized by collectivism and interdependence; taking personal risks would result in an increased danger for all the group members. This finding suggests that group differences and level of interdependence in a group is something that merits further investigation in relation to optimistic bias (Moen & Rundmo, 2005). Another important conclusion is the importance of the nature of the risk. People who take risks voluntarily (in this case skydivers) were more optimistic than people who take occupational risks (fire fighters and soldiers).

Research on unrealistic optimism is often motivated by the hampering effect it is presumed to have on precautionary behavior (van der Pligt, 1994; Weinstein, 1987). Despite the common claim that optimistic biases would have detrimental effects on people's behavior and lead them to take more risks, very little research has confirmed these claims. It has been suggested that the claim itself seems so intuitively plausible that researchers do not find it worthwhile testing it (Armor & Taylor, 2002). In their overview of studies on optimistic bias, Armor and Taylor (2002) concluded that the concerns raised about the negative effects of optimistic bias were exaggerated and that optimism may even have some positive effects. Most of the studies reviewed concerned optimistic biases in relation to positive events where the outcomes were under the control of the subjects, like the outcome on exam results or completion time to fulfill a task. It is less likely that optimistic biases for negative events, such as the perception of risks, would bring with them positive effects in terms of the outcome. They may lessen the anxiety of the individual (Lee & Job, 1995) but without having any specific effects on the outcome. It seems more likely that too much optimism may prevent the individual from taking precautions to avoid the negative outcomes. Even though more research is needed to establish what consequences, negative or positive, optimistic biases may have, it is still important to find out more about the biases per se and the reasons behind them.

To conclude, there is much evidence of the existence of optimistic bias in many different fields, although much of the research has been done on health-related risks. A long list of explanatory factors to optimistic bias has been presented in the literature. Quite a few studies have been made and support has been presented for many of the suggested factors – while other studies have found no support for the same factors. In the end, the evidence on possible explanatory factors is not very consistent. Perceived control is one of the factors that has emerged in many studies as related to optimistic bias. Other factors that have emerged in many studies are perceived frequency of the event and prior experiences (although the effect may wear off quickly). To some extent these factors are related to perceived control since both prior experience and higher frequency of the event represent intrusions of reality and may lessen the perception of control. The risks are then known to happen and not just hypothetical risks that may occur. Furthermore, people have a tendency to focus on their own behavior and positive attributes and give less attention to that of others. Although there already is an extensive literature in the area, there is still a need to conduct further studies as the phenomenon of unrealistic optimism has not yet been explained to any large extent.

### ***Experts***

The four papers of the present thesis focus on two major groups – experts and laypeople. Some core findings relating to factors influencing lay people's perceptions of risks have been summarized in a previous section of this introductory chapter. The present section reviews research pertaining to experts and to differences between experts' and laypeople's risk perceptions. It is followed by a few words on a phenomenon, topical in the discussion about both experts' and laypeople's perceptions, closely related to optimistic biases – overconfidence.

For a long time a main assumption has been that experts' risk assessments are simpler in structure and based only on statistical estimations of annual fatalities while the structure of laypeople's risk assessments are complex and to a larger extent based on qualitative aspects. These assumptions are mainly based on early research made within the psychometric paradigm (see e.g. Slovic, 1985; Slovic et al., 1979). As was mentioned earlier, this particular study on experts has been criticized for the use of a heterogeneous and small sample of non-topical experts assessing risks mainly outside their own domain (Sjöberg, 2002a). Critics furthermore claim that the conclusion that experts' base their risk assessments mainly on expected annual fatalities do not follow logically on the results of the study (Rowe & Wright, 2001).

Sjöberg (2002a) showed that while there are differences between the ratings of experts and laypeople, these differences are related to level of perceived risks – experts tend to rate risks within their own domain of expertise as lower than the

public. However, the explanatory factors behind risk assessments made by the two groups were similar. Other studies have also shown that there are differences in level of perceived risks between experts and the public (e.g. Gutteling & Kuttschreuter, 2002; Savadori et al., 2004). However, in an overview of nine studies comparing risk assessments made by experts and the public, Rowe and Wright (2001) argued that it could not be ruled out that the differences in ratings between the two groups were caused by differences in background and demographic variables, rather than expertise. The samples of experts were quite often made up of well-educated white-males, variables that have been found to correlate with risk perception ratings. To ensure that the observed differences pertain to expertise and not background variables, future studies need to match the groups with respect to the relevant background factors. This may be easier said than done if one at the same time wants to compare experts with a representative sample of the general population.

One such attempt to match the samples has been made, albeit comparing novices and experts (Thomson et al., 2004). For over a third of the risks, experts rated the risks as lower than the novices. The study provides support for previous findings that expertise in an area may lead to lower estimates of the risks in that particular domain. It has been suggested that it is responsibility within a domain, rather than the knowledge per se, that is decisive for the lower ratings by experts (cf. Sjöberg et al., 1997). It is of central importance to recognize this limitation of expertise – that experts are topical experts within a limited domain of expertise. Hence, the effect of their expertise on the risk ratings can not be expected to extend to other domains – if this is the case, other confounding variables can be expected to explain these differences. Rowe and Wright (2001) discuss this in terms of *ecological validity*. Experts should be asked to make judgments within their own specific domain.

Who can be considered an expert? Generally, experts are expected to have special skills and knowledge that enable them to make more accurate predictions and to perform at a higher level than non-experts. A common definition used in research on expertise is peer consensus, or nomination (Shanteau et al., 2002) as well as number of years of professional experience (Andersson, 2004a). These definitions can be seen as estimations of expertise, since the actual performance of the individuals is not evaluated. Number of years of experience within the relevant field has been shown to be only weakly correlated with performance (Ericsson et al., 1993). Defining what should be regarded as “expert performance” is not always an easy task – it requires that the performance is easily observed and can be compared with some standard. Sometimes experts are socially recognized depending on their position in society or in an organization, rather than on the excellence of their performance or the accuracy of their judgments; see Ericsson and Charness (1994) and Rowe and Wright (2001). Several studies have pointed to the poor performance of financial analysts, for instance Törngren and

Montgomery (2004) who found that financial analysts even performed worse than chance. However, many experts do excel in their performance. How certain individuals reach this exceptional level of performance has been debated. The importance of innate talents of the individual has been emphasized (Gardner, 1995) while others reject this assumption and instead focus on the importance of deliberate practice (Ericsson & Charness, 1994). The focus on deliberate practice does not disregard the importance of individual differences and predispositions, but emphasizes motivation and access to support in early years from, for example, parents and teachers. Deliberate practice is characterized by being highly focused and guided by some sort of instructor in order to get constant feedback that is relevant for the improvement of the performance. The same level of improvement can not be reached through ordinary work or play, since they both lack the focus and the determination to make certain improvements. Studies within a variety of domains show that it takes at least 10 years of deliberate practice before expert performance can be expected – which can not necessarily be equated with ten years of professional experience (Ericsson & Charness, 1994; Ericsson & Lehmann, 1996).

There are people performing at expert levels – but it is not always certain that socially recognized experts excel in their performances. Once a person has been socially acknowledged as an expert (based on excellence in performance or other criteria) – will that person maintain the status of an expert for an indefinite period of time, or is there any expiration date on the label? To maintain expert performance, the person would have to engage in deliberate practice in order to keep up-to-date with the current methods and knowledge. If this deliberate practice is not undertaken, the level of performance would be expected to decrease with time – but would the “socially applied” label of expert disappear with it?

It is a central problem to define tasks that capture the essence of expertise in a specific domain. When those tasks are pinpointed and expert performance is defined, deliberate practice can help people raise the level of their performance. It should also be recognized that there probably are significant differences between various domains – both with respect to identifying expert performance and to reach that level of expert performance. In certain areas the deliberate practice needs to be initiated very early while a later entry into the domain does not constitute a problem in other areas.

### **Overconfidence**

Both experts and laypeople are overly optimistic in many of their predictions. Not only do people tend to be optimistically biased about the risks they face, they also tend to be overconfident with respect to the accuracy of the predictions they make. Some suggest that this overconfidence in predictions tends to increase with the difficulty of the task (McClelland & Bolger, 1994), while others claim that it is more related to the particular domain (Klayman et al., 1999). Studies on

overconfidence have primarily been done on experts and the accuracy of their predictions. Several factors have been identified as contributing to the degree of overconfidence among experts. For example, the time between the prediction is made and the outcome, how quickly the expert receives feed-back on their decisions, and how clear this feed-back is (Allwood & Granhag, 1999). As mentioned above, the importance of continuous and relevant feed-back has also been pointed out as important ingredients in deliberate practice. It thus seems that when individuals get relevant and specific feed-back, they will not only be able to increase their level of performance, but also get a more realistic opinion about the accuracy of their predictions.

Access to information has proved to increase the level of (over)confidence in predictions, although the information per se did nothing to improve the accuracy of the predictions (Andersson et al., 2005). A distinguishing characteristic of experts is that they have orderly and efficient access to the knowledge and information; based on their knowledge and previous experience they have the ability to reason, plan, and evaluate consequences of possible actions (Ericsson & Charness, 1994). In other words, even if the information itself does not necessarily improve the predictions, individuals performing at expert level have an efficient and successful way of dealing with that particular information. This ability is acquired through deliberate practice.

In the interplay between experts and non-experts, it is not only the experts' confidence in their own predictions that is of importance. Of equally great importance are the beliefs laypeople and decision-makers have about the experts' ability to perform and to make accurate predictions. Experts' role in society and organizations, and the impact they have on risk policies and risk management, are dependent upon their knowledge, performance, and ability to make accurate predictions. Their key to competitiveness lies in their competence. When this competence is questioned, it is often followed by the question "why do we need experts?" Experts disagree and scientific "truths" tend to change over time, reflecting developments and new discoveries in science. Trust has often been stressed as a necessary pre-requisite for risk communication and also as a predictor of risk perceptions; see e.g. Slovic (1993). Although no absolute definition of what constitutes trust has been agreed upon, it is commonly acknowledged that the two dimensions of competence and general trustworthiness (or honesty) are important (cf. Poortinga & Pidgeon, 2003). More trust in scientists and regulators is said to lead to less challenge of technological developments among the public (Gaskell et al., 2004). Others disagree with the idea that trust is important for risk perceptions, and have shown that this influence has been overrated within risk research (Sjöberg, 2001a).

Even if trust is necessary for a successful risk communication and dialogue, it is by no means a guarantee for the tolerance of risks in society. A key factor seems to be the disagreement between experts and the limits of science. Even though experts

are believed to tell the truth and can be regarded as honest and competent, they are only telling the truth as they know it. There may be hazards that have not yet been discovered (Sjöberg, 2002b).

The appointment of experts in society is often based on approximations, such as years of professional experience or social recognition based on the individuals' position in society or an organization, instead of evaluations of their actual performance. Previous research suggests that experts are by no means immune to biases in their perceptions. The view of experts as providers of objective and valid accounts of risks can therefore be questioned. Both experts and laypeople tend to be overly optimistic, with respect to the perceptions of personal risks and the accuracy of their predictions. It is of great interest to study how these biases and this tendency to optimism affect what attention risks get in society at large, as well as on the individual level. What risks end up on the risk policy agenda, can be assumed have a great influence on the allocation of resources in society. Therefore it is necessary to obtain a better understanding of the processes underlying societal and individual attention to risks.

## ***Methodology***

The empirical data of the four papers included in the present thesis was gathered at three different occasions. The first two papers discuss societal attention to risks, while the following two papers concentrate on individuals' risk perceptions and risk denial. Next follows a discussion of some of the key methodological issues of the empirical studies.

## **Respondents**

The first two papers of the thesis are based on data from the same study, aimed at experts in Swedish society. The respondents had been nominated as experts by colleagues or superiors in their field of work. Defining experts based on nomination incorporates several aspects of expertise that were regarded as important for the study – education, practical experience, and role in the organization. Consequently, the names of the respondents were obtained through contacts with a large number of government agencies, regulatory bodies, and a few non-government organizations that had risk and safety issues within their domain of authority or interest. Since one of the purposes of the study was to get an overview of what risks in society get too much and too little attention, respondents came from a broad spectrum of risk-related areas (such as public health, public safety, and technological areas). Names of over 600 experts in risk domains were obtained, and in the end, close to 400 questionnaires were returned.

The studies of the perceptions of laypeople aimed at investigating a representative sample of the Swedish public. In the study reported in Paper III addresses to the 1250 respondents were obtained from SPAR (Statens Person- och Adressregister)

– an official register including basic data of Swedish citizens and residents. SPAR is commonly used to produce samples for, e.g., research and direct advertising aimed at Swedish consumers. The respondents who answered the questionnaire had a somewhat higher level of education than people in general in Sweden, a common result in postal surveys. The higher level of education was not considered to constitute a bias with respect to risk perception – since level of education did not correlate with perceived risks. However, level of education was positively correlated with attitudes towards the Internet and e-mail. The reported attitudes may therefore be somewhat too positive to be representative of the Swedish population.

The second study on laypeople (Paper IV) used a questionnaire which was sent to people who had taken part in previous studies at the Center for Risk Research and then indicated that they would like to take part in future studies. Just like the first sample from the public, this group of respondents had a somewhat higher level of education than the population at large. Since level of education did not correlate with perceived risk, the higher level of education in the sample was not assumed to constitute a bias. In addition, earlier research shows that higher levels of education in a sample is relatively unimportant (Sjöberg & Drottz-Sjöberg, 2001).

One common problem with mail surveys is the existence of non-response errors – the possibility that those in the sample that did not answer the questionnaire differ in substantial and important ways from the respondents (Dillman, 1991). Response latency was used to assess non-response error. Response latency was measured as number of days it took before the questionnaire was submitted, counted from the first day the respondents received it. There is reason to believe that non-respondents have more in common with late respondents than early respondents since late responders quite often require more persuasion and larger incentives before the questionnaire is submitted. A response latency that does not correlate with central measures investigated in the studies would suggest that non-respondents do not differ very much from the respondents. Correlations with risk perceptions (Papers III and IV) and optimistic bias (Paper IV) were close to zero suggesting that non-response error was not an important issue.

### **Focus groups**

The questionnaires of Papers III and IV were discussed in focus groups before they were mailed to the respondents. The purpose with this exercise was to improve the questionnaires and to learn more about the respondents' way of thinking and reasoning – which is one way of many of using the method of focus groups (Morgan, 1988; Stewart & Shamdasani, 1990). In the study made in 1999 (Paper III), eight people took part in the focus group discussions. They were selected from a pool of respondents that had taken part in earlier studies done at the Center for Risk Research and that had stated that they were willing to take part in focus groups. Although the intention of the study was to investigate the attitudes and

risk perceptions of the general public towards the use of information technology it was regarded as fruitful to include two students of computer science in the focus group. Their prior experience of using the Internet and computers was useful in the discussions of the design of the questionnaire.

The last study, carried out in the spring of 2004, investigating economic risk perceptions and optimistic bias, was also preceded by a focus group discussion. The nine participants of the focus groups were in this case also recruited among respondents who had taken part in prior studies at the Center for Risk Research, and indicated that they were willing to part-take in further studies.

On both occasions, the participants of the focus group received the questionnaire some time before the group discussion. They were asked to read it thoroughly and respond to it in order to be able to give comments on the content. In the group discussion all of the respondents were given the opportunity to give feedback on the questionnaire. The changes which followed mainly pertained to structure and wording and were made in order to make the questionnaires easier to understand. Some minor revisions were also made with respect to content – some questions were excluded as they were regarded as superfluous and a couple of items were added. After revision the questionnaires were sent out to the respondents.

## **Questionnaires**

All the empirical data that constitute the basis of the present dissertation were gathered by the means of mailed surveys. The arguments for using mailed surveys is the ability to obtain information at low costs from a relatively large group of respondents and still be able to make inferences about the general public (or whatever group is in focus) (Dillman, 1991).

Several methods to improve the response rate have been discussed in the literature, such as ensuring the anonymity of the respondents, length of the questionnaire, follow-up reminders, and material incentives (Dillman, 1991). Despite the fact that all three questionnaires were quite lengthy (approximately 20 pages) the response rates were very satisfactory (between 66% and 69%). Cover letters were enclosed with the questionnaires explaining why the respondents had been chosen as participants in the study. The cover letters also included brief instructions on how to fill out the questionnaire (some of which were repeated in the questionnaire booklet) and ensuring the respondents' anonymity of their responses. As a further incentive to respond to the questionnaire the respondents (Papers III and IV) were offered a lottery ticket (a "Trisslott") and a diploma when they returned the questionnaire. Respondents who had not returned the questionnaire within about a week also received a follow-up reminder to return the completed form. The experts did not receive any material incentives for answering the questionnaire.



*Included items in the questionnaire for Papers I and II*

The questionnaire consisted of 21 pages (A5 format) and started off with the main focus of the survey – two open-ended questions asking the respondents to state up to five risks that in his/her opinion received too much/too little attention. The open-ended questions were given without any specific instructions – e.g. regarding domain of risks or the definition of society. This was done intentionally in order not to direct the respondents in their answers. As a follow-up the respondents were asked what actors they believed were responsible for the inappropriate level of attention for the respective risks. This question was designed as a closed format question with a predefined list of actors: viz. media, government agencies, the public, politicians, private companies, and researchers. In addition, the respondents were asked to rate a list of diverse risks on two dimensions: personal risk as well as general risk (risk to people in general). The risks were rated on a seven point Likert-type scale verbally anchored at “non-existent” and “very large”. A “do not know” response alternative was also available. The questionnaire concluded with background questions (e.g. academic qualifications and expert credentials) and an evaluation of the questionnaire.

*Included items in the questionnaire for Paper III*

The questionnaire began with questions concerning the respondent’s general attitude towards the use of computers, the Internet, and e-mail. It also included direct questions about the respondents’ use of various off- and online computer applications. Two sets of risk were included in the questionnaire – risks of information technology (IT-risks) and other risks, not related to the use of computers or information technology. This was done in order to compare IT-risks ratings with the ratings of non-IT risks. Both sets of risks were rated on 7-point Likert-type scales. The respondents rated the risks both for themselves personally (personal risk) and for people in general (general risk). Questions regarding trust and demand for risk mitigation were also included. The questionnaire also included 128 attitude statements, related to the use of computers and online applications.

*Included items in the questionnaire for Paper IV*

Twenty-two economic risks were included in the questionnaire. The risks were rated on six dimensions: personal risk, general risk, perceived frequency, perceived consequences if the negative events were to happen, perceived personal control, and perceived general control<sup>ix</sup>. Responses to the risk questions were recorded on an 8-point Likert type scale and optimistic bias was defined as the difference between general and personal risk.

The questionnaire included measures of perceived self-efficacy. General self-efficacy was measured by using Schwarzer’s and Jerusalem’s (1995) general self-

efficacy scale in the translation of Källmén (2000). The scale included ten items, rated on a 4-point scale verbally anchored at “strongly disagree” to “strongly agree”. Specific measures of self-efficacy have more predictive power (Bandura, 1997) and therefore a specific measure of self-efficacy (16 items) was included, with responses recorded on an 11-point scale verbally anchored at “I can not handle this” to “I am certain I could handle this”.

Attitudes to money and willingness to take financial risks were measured by Yamauchi’s and Templer’s Money Attitude Scale (1982) and Wärneryd’s Investment Risk Attitude Scale (1996). The Money Attitude Scale included 29 items relating to four different dimensions: Power Prestige (9 items), Retention Time (7 items), Distrust (7 items), and Anxiety (6 items). The Investment Risk Attitude scale included six items measuring preferences for risk taking in financial investments. Responses to both of the attitude scales were recorded on a 7-point Likert type scale. A list of nine items measuring what precautions the respondents took to avoid economic risks was included in the questionnaire. The respondents were also asked to indicate to what extent they believed people in general took precautions to avoid risks. In addition, background questions were included in the questionnaire (e.g. age, gender, and education) as were questions related to saving and information habits, and prior experience with economic risks.

### **Statistical analyses**

All statistical analyses were made in SPSS for Windows (the latest version used was SPSS 12.0.1). Various statistical methods were used for analyzing the data, e.g. multiple regression models, factor analysis, *t*-test, and correlations. These are commonly performed analyses in risk perception research (Rohrman & Renn, 2000).

As has been discussed in relation to previous research on risk perception and optimistic bias, the choice of unit of analysis is very important. Aggregate data (with means ratings over hazards) can be deceptive in the sense that reliance on such data results in exaggerated strength in relations between concepts – results that will probably not hold for analysis on individual data (Rohrman & Renn, 2000; Sjöberg, 1999a). All analyses in the included papers were made on individual observations (with mean ratings calculated for the individual observations), rather than on aggregated data. When the focus is on the individual, his/her attitudes and perceptions and the possible effects on decision-making, choosing the individual as unit of analysis is the natural option.

### ***Summary of the contributing papers***

The four empirical papers, included in the dissertation, study different aspects of attention to and neglect of risks. Papers I and II focus on the attention given to risks on a societal level. These papers investigate the views of risks professionals,

regarding what risks in society receive too much and too little attention – and by what actors in society. Papers III and IV focus on individual risk perception and risk denial. The papers are based on two empirical studies, using examples of risks that the individual meets in his/her daily life: risks with the Internet and electronic communication (Paper III) and economic risks (Paper IV). The four papers are summarized below.

### **Paper I: Neglected and over-emphasized risks: The opinions of risk professionals**

Giving a risk inappropriate level of attention in society is often claimed to result in suboptimal allocation of resources in society. Research on risks has mainly been devoted to analyses of such risks that are subject to public debate and policy decision making. However, many if not most of the risks that are now the subject of regulation were once neglected. Experts in conjunction with regulators have a crucial role in putting risks on the policy agenda and their opinions are often seen as a standard with which the perceptions of the public are compared. But what views do experts have on the matter of attention to risks? In order to answer this question Swedish risk assessment experts were asked to list the risks they considered to be over-emphasized and neglected in Swedish society.

Data was collected by the means of a mail survey in the autumn 2000. The respondents were 639 experienced professionals whose names were obtained from governmental agencies, regulatory bodies etc., with risk and safety issues within their domain of responsibility. The experts were asked, in two open-ended questions, to state up to five risks they believed got too much and too little attention respectively. In a follow-up question, the respondents were instructed to indicate which actors (on a predefined list) they considered were responsible for the inappropriate level of attention.

The answers to the open-ended questions were categorized in thirteen different main categories. Neglect ratios<sup>x</sup> were calculated to estimate to which extent different risks were considered neglected and over-emphasized. The higher the neglect ratio, the more often the risk had been mentioned as neglected. For instance, lifestyle risks had a neglect ratio of 0.83 whereas radiation risks had a neglect ratio of 0.21.

As the neglect ratio suggests, radiation risks were primarily defined as over-emphasized and constituted the largest category of risks reported to be over-emphasized. Other risks often reported to get too much attention were BSE<sup>xi</sup>, GMOs<sup>xii</sup>, amalgam, and air traffic. An exception within the radiation category was radon risks that were considered to merit more attention (radon risks had a neglect ratio of 0.80). Lifestyle risks, such as the risks of drinking alcohol or smoking, dominated among the neglected risks. Road traffic risks, socio-economic

risks, and risk related to energy production (excluding nuclear power) are examples of other risks the experts believed got too little attention in society.

One of the leading journals in the field, *Risk Analysis*, was used for a comparison with the results from the study to see what topics were discussed in the scientific literature. The articles published in *Risk Analysis* between 1991 and 2000 were categorized into the same risk categories that were used for the questionnaire. The comparison showed that risk areas the respondents primarily had defined as neglected (i.e. lifestyle risks and socio-economic risks) were represented by only a few articles in *Risk Analysis*. In contrast, the issue of nuclear power was much discussed in the journal which can be compared with the neglect ratio of 0.10. Chemical risks were treated to a great extent in the journal – over a third of the articles were related to chemicals – a category mentioned by the respondents about equally often as neglected and over-emphasized.

In the questionnaire the respondents were also asked to rate a number of predefined risks, both personal risk and the risk for people in general. Neglect ratios were calculated for these risks and plotted against the risk ratings of the respondents. Results showed that there was a strong correlation between perceived risk and neglect (particularly so between general risk and neglect). Risks considered to be neglected were also judged as larger.

The findings thus showed that lifestyle risks were the ones, which experts considered to be most often neglected, while some technology oriented risks such as radiation hazards were considered to be most often over-emphasized. At the same time, the activities of those working on risk research published in the journal *Risk Analysis* tended to focus on those very hazards which experts considered to be over-emphasized.

## **Paper II: Experts' views on societal risk attention**

While the public often has been portrayed as irrational and biased, experts have traditionally been viewed as rational, basing their beliefs and opinions on knowledge. However, research has found that experts tend to perceive risks within their own domain of expertise as smaller than the public does. Given the assumed influence experts have on risk policies in society it is not only of interest to study what risks they consider merit more, or less, attention. It is also of great importance to investigate if there are any connections between identified risks and domain of expertise. The discussion in Paper II related to the different roles experts can assume in society – that of promoters and protectors.

The second paper was based on the same empirical data as Paper I but emphasized other aspects of the survey. Identified risks were discussed in relation to the respondents' domain of expertise, and the actors identified as responsible for the inappropriate levels of attention. It was hypothesized that experts not only

identify risks within their own domain of expertise, but that they to a greater extent perceive these risks as over-emphasized.

The hypothesis found support as an analysis of the responses to the open-ended questions showed that the experts were not limited to their own field of work in their identification of risks. Risks within a wide array of domains were identified. There was also a tendency to identify risks with the own area of expertise as over-emphasized rather than neglected. On the average, 40% of the identified over-emphasized risks were within the experts' own domain, compared to only 32% for the neglected risks. About a third of the respondents only identified over-emphasized risks outside their own domain of expertise, and the number was even higher for neglected risks (about 42% of the respondents).

To a large extent men and women identified the same risks but some gender differences were found with respect to over-emphasized risks. Men tended to identify risks within the fields of radiation and environment more often, while women were more focused on health-related risks as over-emphasized.

The respondents were divided into four groups, depending on whether or not they had identified risks within their own domain of expertise or not. *Promoters* were those who only identified risks within their own area as over-emphasized (18 % of the sample). Those who identified risks within their own domain as neglected were denominated *protectors* (12% of the sample). The other two groups consisted of respondents who identified risks within their area as both over-emphasized and neglected and respondents who only identified risks outside of their own domain. Differences between promoters and protectors were analyzed. Comparisons of background data and expert credentials showed that promoters were more oriented towards technology and natural sciences than protectors. Over a third of the promoters were experts within the field of radiation. Furthermore, the group of experts labeled promoters had a somewhat higher level of education than protectors.

A comparison of risk ratings of the two groups showed that protectors overall rated risks as higher, both personal and general risks. Many of the risks displaying significant differences in ratings between promoters and protectors were related to radiation. To some extent this could be explained by the dominance of radiation experts within the group of promoters, but some differences remained when radiation experts were excluded from the comparisons. Domain of expertise seemed to explain part of the differences in risk ratings between promoters of protectors, even if the differences need to be studied closer to gain further insights.

Overall, more actors were identified as responsible for the neglect of risks. This may be explained by a desire to elevate the importance of the risk by having many actors paying attention to it. Media was the actor most frequently pointed out as being responsible for giving risks too much attention. Politicians were most

frequently identified as responsible for neglecting risks. There seemed to be no relation between which actors were identified and the respondents' domain of expertise or organizational belonging.

Taken together, the findings of Paper II suggested that experts indeed are biased in their opinions about risks and that they are more prone to act as promoters than protectors. However, the experts did not only identify risks within their own domain of expertise – about 40% of the identified over-emphasized risks were within the own area of expertise. When risks were acknowledged as neglected, more actors in society were identified as responsible for this neglect.

### **Paper III: Neglecting the risks of information technology?**

The third paper in the present thesis was based on a study made in 1999. The purpose was to investigate people's perceptions of risks of information technology (IT-risks) and also to study the attitudes related to the use of computers, the Internet, and e-mail. The results are discussed in light of the developments since the empirical data was collected.

A questionnaire was sent out to a representative sample of the Swedish public and a response rate of 66% was obtained (844 questionnaires were returned). The questionnaire contained ratings of IT-risks and a number of non-IT risks (e.g. the risk to be injured by smoking, the risk to be involved in a serious traffic accident). All risks were rated on two dimensions, personal risk and risk for people in general (general risk). Questions regarding trust and demand for risk mitigation were also included, as were 128 attitude statements.

The respondents had positive attitudes to the use of computers, the Internet, and e-mail – especially professional use. The 128 attitude statements were subjected to factor analysis – eight factors accounted for 33% of the variance (e.g. Skepticism about the use of computers, Risk of privacy intrusion)<sup>xiii</sup>. These factors were used in a regression analysis to explain attitudes to the use of computers for professional and private use. Five blocks of predictors were used in the analysis. The attitudes towards using the Internet and e-mail privately and professionally were well explained by computer interest and experience and the possibility to promote social contacts with e-mail. Neither risk nor trust was important in explaining the attitude. In terms of risks and benefits it was concluded that the benefits (e.g. the possibility to promote social contacts) were perceived to outweigh the risks, which were perceived to be very low.

Social and psychological risks related to the use of online applications were the lowest rated risks. The risks of getting viruses via the Internet or e-mail, as well as risks related to personal integrity, obtained the highest ratings. There was a clear tendency toward optimistic bias since personal risks overall were perceived as lower than the risks to people in general. As the survey was sent to a representative sample of the Swedish population, it included both users and non-

users of information technology. Independent samples *t*-test on users and non-users showed that the latter group was significantly more optimistic than the group of users. The bias among the non-users of information technology is perhaps best described as realistic optimism, rather than unrealistic optimism. Since they are not users of the technology, they are not exposed to many of the risks in the same way as frequent users of the Internet. Consequently, they can not be said to deny their personal risks – they are merely making realistic risk estimates.

Users of information technology were also biased in their perceptions of personal risks. Optimistic bias for IT-risks correlated negatively with age (younger people were more prone to deny personal risks). Women were more optimistically biased than men with respect to IT-risks. In addition, respondents who used services provided on the Internet more frequently (used as measure of exposure) were less optimistically biased.

Many technology risks are not associated with optimistic bias, for instance risk perceptions of nuclear power. Therefore it was quite surprising to find that the perceptions of IT-risks were optimistically biased. However, information technology risks have some unique properties that differentiate them from other technology risks. Some of these properties that were discussed in Paper III are the immediacy of the benefits with the technology, and the irreplaceability of information technology.

#### **Paper IV: Optimistic bias and economic risks**

Paper IV aimed to investigate whether economic risks perceptions were optimistically biased and, if so, what factors could help explain this bias. Results from an empirical study on perceptions of everyday economic risks were reported.

In 2004 a questionnaire was sent out to a sample of 178 people and a response rate of 69% was obtained. The respondents were asked to rate the 22 included economic risks on two dimensions – general risk and personal risk. Optimistic bias was calculated as the difference between these two ratings. Attitudes were measured by the Investment Risk Attitude scale (Wärneryd, 1996), and the Money Attitude scale (Yamauchi & Templer, 1982). The questionnaire also included ratings of general self-efficacy as well as a specific self-efficacy scale developed to measure the respondents' beliefs about their economic capacities. Scales measuring perceived personal and general control were included in the questionnaire, as were ratings on self-reported precautionary behavior. The respondents were also asked to rate to what extent they believed people in general took certain precautions to avoid economic risks, and to state what prior experience they had with some economic risks.

On a personal level, macro-level risks dominated the top-three rated risks – suffering economically due to inflation or an economic crisis in the country. The risk of economic damages due to insufficient insurance was also rated as high. For

people in general, the risk of possessions breaking down, losing money invested on the stock market and being the victim of economic crime were the highest rated risks. Results supported the overall hypothesis that economic risk perceptions are optimistically biased – general risk was rated higher than personal risk on all the included economic risks. Correlations were calculated between the individual OB-scores and various variables. Power Prestige and age were the two variables that, on most occasions, correlated significantly with optimistic bias. Both Power Prestige and age were positively related to optimistic bias. The higher the age of the respondent and the more importance he/she placed on money, the stronger the optimistic bias. Insurance was negatively related to optimistic bias, the better the insurance coverage (in terms of number of insurance the respondent had signed up for) the weaker the optimistic bias. Contrary to prior research on optimistic bias, perceived personal control did not emerge as an explanatory factor.

Paper IV included a discussion about the importance of the choice of unit of analysis. All analyses in Paper IV were made with the individual as the unit of analysis, and no significant correlation was found between optimistic bias and control. When the analyses were made on aggregated data instead, strong and significant correlations between perceived control and optimistic bias were obtained. The use of aggregated data in previous research on risk perceptions and optimistic bias has been questioned as it tends to exaggerate correlations and to make analyses of individual differences impossible. When individual processes are of interest, the natural choice is to make the analyses on individual data.

Prior research has often emphasized the influence of optimistic bias on precautionary behavior. Results from Paper IV showed that people believed that other people were less prone to take precautions to economic risks than they were themselves. For two thirds of the items included on this list there were significant differences between personal and general precautions. To sum up, people believed they were less at risk than their peers, only marginally more in control but believed that they made more of an effort to avoid economic risks.



Table 1: Main findings of the contributing studies

<b>Paper I</b>	<p>Sjöberg, L., Peterson, M., Fromm, J., et al. (in press) Neglected and over-emphasized risks: The opinions of risk professionals, <i>Journal of Risk Research</i></p> <ul style="list-style-type: none"> <li>• Overall, radiation risks seen as over-emphasized, while lifestyle risks perceived as neglected</li> <li>• Correlations between perceived risk and neglect – neglected risks rated as higher</li> <li>• Comparison with articles in <i>Risk Analysis</i> show over-emphasized risks often topics for articles in the journal</li> </ul>
<b>Paper II</b>	<p>Fromm, J., (2005) Experts' views on societal risk attention, <i>Journal of Risk Research</i>, (in press)</p> <ul style="list-style-type: none"> <li>• Experts did not exclusively identify risks within their own domain, although a tendency to perceive risks within own domain as over-emphasized rather than neglected</li> <li>• About 40% of the identified over-emphasized risks were within own domain of expertise – compared to about a third (32%) for the neglected risks</li> <li>• The existence of promoters and protectors among professionals</li> <li>• Media major culprit for over-emphasizing risks, while politicians were most often mentioned as responsible for neglecting risks</li> </ul>
<b>Paper III</b>	<p>Fromm, J. (2005) Neglecting the risks of information technology? (revision of two previously published papers)</p> <ul style="list-style-type: none"> <li>• Attitudes to the use of e-mail and the Internet best explained by computer interest</li> <li>• Risks related to computers and online applications perceived as relatively small – highest ratings for risks of virus infections and threats to the personal integrity</li> <li>• Denial of risks for oneself – higher ratings of risks for other people</li> <li>• Risk denial related to gender and age: women/younger people were more optimistically biased than men/older people</li> <li>• Risk denial negatively correlated with exposure to risk (weak effects) – less frequent use of online services related to stronger optimistic bias</li> </ul>
<b>Paper IV</b>	<p>Fromm, J., (2004) Optimistic bias and economic risks (submitted paper)</p> <ul style="list-style-type: none"> <li>• Optimistic bias for all the rated economic risks</li> <li>• Importance placed on money was positively correlated with optimistic bias</li> <li>• Perceived control did not contribute to explaining variation in optimistic bias</li> <li>• Stronger economic self-efficacy related to lower ratings of economic risks</li> </ul>

## ***General discussion of the empirical findings***

Two dimensions of attention to risks are discussed in the empirical studies, *viz.* societal and individual attention to risks. The two dimensions are naturally interconnected as individuals' attitudes and perceptions of risk constitute the basis of how risks are discussed and managed in society. Many risks are not personally experienced and the input from, e.g., experts and decision-makers, is important. Individuals' judgments of risks can therefore be described as meta-judgments of risks (Hansson, 1999) in the sense that they to a large extent are judgments of what experts say about risks. Influences also come from other sources like family members and friends who might have personal experience related to the risk source. Experts and laypeople have frequently been polarized in the discussions about risks in society – experts representing an alleged rational view on risks while laypeople are portrayed as more irrational and emotional in their evaluations of risks. Experts are seen to hold the objective truth about the real levels of risk.

Both groups are represented in the empirical studies included in this thesis, and the results suggest that reality is more nuanced and complex than such polarization would suggest. Although the experts are used as a reference point in suggesting what risks merit more or less attention in society, this is by no means regarded as a definite solution or an objective truth. To some extent, all individuals are influenced by various biases, values, and emotions in their evaluations of risks – whether they assess risk in their professional lives or as laypeople. Scientific knowledge also evolves, and what is held to be true today may not be valid in ten years time. Nevertheless, the experts included in the study (Papers I and II) have long experience of managing risks and, above all, can be assumed to exert influence on risk policy debates in Swedish society. Therefore, their opinions about “appropriate” levels of attention to risks are of great interest and can be used as a point of departure. Discussions about risk always contain an element of uncertainty (without which there would be no “risks” – only certain negative events) and what is known today must be used as a starting point in debates.

Results showed that a man-made technological risk (risks related to nuclear power and radiation) was most often mentioned as over-emphasized. In contrast, lifestyle risks (of a more voluntary and self-imposed nature) was the number one neglected risk. Risks judged by the experts as over-emphasized were also covered more often in the scientific journal used for comparison (*Risk Analysis*).

In Paper II the findings were discussed in relation to experts' roles as promoters (of technology) or protectors (of people) – a typology established in prior research (Sjöberg, 1999b). Promoters believe people are too concerned about the risks within their domain of expertise, and their work aims to reduce these too high perceptions of the risks. To make their point, they might make comparisons

between risks related to the technology they represent and the alternatives. Promoters' attention to the risks is probably qualitatively different from the attention given by experts acting as protectors. Protectors believe that risks have received too little attention and that people are ignorant of the risks, or are neglecting them. The attention protectors give to risks is focused on increasing the awareness of the risks, and to alter the too low (or non-existent) perceptions of the risks. The empirical findings of Paper II suggested that the experts were more prone to act as promoters, i.e. to view the risks within their own field of expertise as over-emphasized. It should be noted, however, that some experts that to a larger extent might be characterized as protectors, have probably not been included in the sample of the present study. The names of the experts were obtained through contacts with government agencies and regulatory bodies. Therefore, the names of experts associated with, for example, environmental non-government organizations (NGOs) or lobby organizations, may not have been captured by this sampling procedure. Had experts from NGOs been included in the sample, it is possible that there would have been a larger share of protectors in the sample. Yet, it is interesting to note that there were so many promoters in the sample (18%), despite the inclusion of many experts from government organizations.

The distinction between promoters and protectors is a topic that merits further investigation since it can be assumed to have great influence on the forming of risk policies in society. If the risk perceptions of laypeople (and decision-makers) are indeed meta-judgments of experts' assessments of risks, the role the expert assumes (that of promoter or protector) is central. Are the risks down-played or emphasized?

The findings of the study are congruent with the typology of "promoters of technology" and "protectors of people" in another aspect. As mentioned, a man-made technological risk (related to nuclear power) was acknowledged as the number one over-emphasized risk. This point of view rather seems to focus on the benefits of the technology and promote it. Another radiation risk (radon risks), not related to any technology but existing naturally, was overall judged as a neglected risk; a risk that the people needed to be protected from. Other neglected risks were lifestyle risks that the individual impose on him-/herself voluntarily by his/her chosen way of life. These people need protection, not primarily against a technology, but against themselves and their habits.

Traditionally, experts have been portrayed as objective and their opinions regarded as representing the real levels of risk. The distinction between promoters and protectors points at the fallacy of such argumentation. Groups of experts have conflicting and contradicting opinions, and they are affected by various biases in their judgments. In line with previous research, experts rated risks related to their own domain as lower than other risks. In addition, the group of promoters gave somewhat lower risk estimates than did protectors. Findings from other areas also

show that experts have an exaggerated belief in their own competence – they believe that they can make more accurate predictions than they in fact do, see e.g. Andersson (2004b).

The competence and knowledge of experts are needed in several stages in the decision-making processes in society (SOU, 2000) – in risk assessments that are foundations of many decisions and in the evaluations of risk management, to mention only a few examples. Ericsson and Charness (1994) claim that most employees spend very little time on deliberate practice aimed at improving their performance, in their view rendering number of years of professional experience a poor estimate of expertise. In many areas it is very difficult to establish what constitutes expert performance. Hence, it may be difficult to ascertain what is needed for deliberate practice, what skills need to be improved, and against what standards these skills should be compared. The selection of experts for our study (Papers I and II) was not done on the basis of any pre-established expert performance, no evaluations of their professional performances was made in relation to the study. Instead they were selected on account of their socially recognized roles as experts, a criterion that was regarded as more relevant for the purposes of our study. It can be assumed that people who are socially recognized as experts at some point have been evaluated with respect to their performance. However, the aim of the study was not to evaluate the accuracy of their predictions or opinions, but to get an idea about what risks in society get too much or too little attention in the eyes of people with an insight in and an influence on the current risk debate.

As mentioned above, lifestyle risk was the category that most often was identified as neglected by the experts. Although only a few articles in *Risk Analysis* covered the topic, lifestyle risks have been under thorough investigation in more health oriented journals. Research has mainly focused on individuals' perception of lifestyle risks and the consequences it may have for their precautionary behavior. The attention given to lifestyle risks in that context has been *as* neglected risks – empirical studies aimed to understand why people tend to deny that lifestyle risks as relevant to themselves and not only pertinent to their peers. This kind of attention is probably qualitatively different from other types of attention, and in future research it could be valuable to make a clearer distinction between what type of attention a risk gets – is the actor giving the risk attention as a neglected or as an over-emphasized risk?

The issue of lifestyle risks highlights the importance of *individual* attention to risks. Much of what has been written about lifestyle risks has focused on individuals' perceptions of the risks and the consequences they may have for their precautionary behavior. To some extent lifestyle risks may be neglected on a societal level, although the risks are well known and debated, and many regulations are implemented to minimize the exposure to some of the risks. However, there are limitations to what societal risk management can accomplish.

Information and legislation about lifestyle risks is not always effective, to a large extent due to people's beliefs that risks are not pertinent to them. Why take precautions if the negative events will not happen to me? Risk information, or risk communication, may be seen as directed at someone else – at others that can not control their eating, their speculations at the stock market, or whatever the issue at hand is. When communicating with the public on risk issues it is important to acknowledge that the public is not one homogenous group, communication needs to be adapted accordingly and the public should be involved in the discussions (Wester-Herber, 2004). In addition, information about risks and necessary precautions may be disregarded for other reasons. The individual may have evaluated the risks and the precautions that are available, but decided that the risk is well worth taking. In other words, societal attention to risks is not sufficient – in many cases it is the individuals' recognition of and attention to risks that is decisive.

Papers III and IV focused on individuals' perception of the risks, and whether or not those perceptions were optimistically biased. A distinction was made between general and personal risk and optimistic bias defined as the difference between the two. Previous research has found that while general risk is more important for policy issues, such as demand for societal risk mitigation, perceptions of personal risks has more relevance for precautionary behavior, see Sjöberg (2003). People can not be expected to take precautions based on the judgments they make about other people's risk. Their own perceived control, personal attributes of importance to the risk, and their own behavior are more important aspects. Even though people believe they can control their own behavior, they might still believe that others do not make the same efforts and that more regulations are required in society. In cases where personal and general risks are on the same level (i.e. there is an absence of optimistic bias) both dimensions of risk have been shown to be equally important for demand for risk mitigation (Sjöberg, 2003).

Contrary to the perceptions of risk with many other technologies, the perceptions of computer risks were optimistically biased – the respondents believed others were more likely to experience the negative consequences of computer use than themselves. This was true both for users and non-users of online applications. Social and psychological risks with the use of online applications were the ones that elicited the highest level of optimistic bias. Getting computer viruses via e-mail or Internet was the risk most respondents reported having experienced while using online services. In addition, the risk of getting computer viruses resulted in low levels of optimistic bias. It thus seems that direct experience with risks do have an influence on the level of optimistic bias – what can be referred to as an intrusion of reality in the overall illusion of control (Langer, 1975). Prior experience with risks has proven to lower the levels of optimistic bias (Parry et al., 2004; Weinstein, 1987), although the effect tends to wear off in time. However, new forms of viruses constantly appear on the Internet – and without constantly

updated firewalls and anti-virus programs, the user is bound to have some experience with computer viruses, or know of someone who has experienced virus-infected computers.

Paper III also investigated people's attitudes to computers and the use of online applications such as the Internet and e-mail. In contrast to previous findings that risk is a potent explanatory factor for technology attitudes, perceived risk was not very important in explaining attitudes to the use of computers and online applications. Perceived benefits seemed to outweigh perceived risks with information technology – which has been suggested as a pre-requisite for public acceptance of technologies in society. Computer interest was the most important factor in explaining attitudes to the use of online applications. Since the study was made in 1999, information technology and the use of online applications on the Internet have been even more embraced by the public and become highly integrated in society. The low levels of perceived risks, that to a large extent were perceived to be pertinent mostly to others, coupled with the many benefits of the technology have probably contributed a great deal to this acceptance. An important factor that can not be disregarded is the irreplaceability of the technology. The Internet represents such a huge technological development that once people have gotten used to the speed, immediacy, and the low costs of the Internet, there is really no substitute that could replace the technology. These technological advantages may make people ready to tolerate higher risks – as long as they are outweighed by the benefits.

The study of economic risks (Paper IV) facing the individual in his/her daily life showed that these risks also elicited optimistic bias. Ratings on general risk remained fairly stable while variations in personal risk estimates seemed to be more important for changes in optimistic bias. This is in line with the importance of an “egocentric focus”: in assessing the risks, people are more focused on the positive attributes they have and what efforts they make to avoid risks. Interestingly, personal control was not important in explaining optimistic bias. The respondents only believed they were marginally more in control than their peers. However, people in general were assumed to exert less of this control, i.e. not make the same effort to avoid the risks. People believed they were less at risk, only slightly more in control but made more of an effort to avoid the risks.

The low level of explained variance of optimistic bias was discussed in terms of some methodological issues. All analyses in the paper were made on individual data instead of, as is sometimes done, on an aggregate level. The use of event as the unit of analysis, for example by comparing hazards with different degrees of control, has been shown to enhance the association between control and optimistic bias. In addition, too much focus is often given to significance levels, while effect sizes are disregarded. It should not suffice to say that there are significant correlations between control and optimistic bias. Significant but low correlations are obviously less interesting than significant and strong correlations.

No strong correlations have been found between optimistic bias and explanatory factors on an individual level. Hence, the search needs to continue in order to be able to explain the phenomenon of optimistic bias.

Optimistic biases have frequently been observed in relation to health behavior and lifestyle issues; technological risks like that of nuclear power are generally viewed as pertinent to both oneself and others. Information technology risks are an exception, to some extent perhaps depending on the specificity of the risks with online applications. Another explanation might be that the use of computers and online applications, like the behavior related to many of the economic risks included in Paper IV, are closely related to a persons' way of life. Maybe this is true even more so today than when the study was made in 1999, since the Internet has become such an integrated part of everyday life for many people. The commonplaceness of the activities related to the IT and the economic risks implies that people have own personal experiences of the activities, and in some cases also of the risk (many of which can happen repeatedly). This experience makes them less dependent upon the opinions of experts and decision-makers whose input may become less influential on the perceptions. The risk judgments are not "meta-judgments of risks" to the same extent, since they are more based on personal experiences than other risks. This quality may also contribute to the difficulties of communicating these risks so that they feel pertinent to oneself, and not only to others, and to the persistence of optimistic biases.

### ***Limitations***

One limitation of the empirical findings is the quasi-representative sample used in the study on economic risk perceptions (Paper IV). It was not a random sample but a convenience sample taken from a pool of individuals that had taken part in prior studies at the Center for Risk Research. However, comparisons of background data (education, age, unemployment, etc.) showed that the sample was a good match to the Swedish population at large. One exception was the somewhat higher level of education of the sample, a common result in mail surveys. It has been concluded that this type of bias does not constitute a serious bias with respect to risk perceptions (Sjöberg & Drottz-Sjöberg, 2001), but still the results should be considered with this in mind.

Research on optimistic bias has usually been based on correlational evidence from observations emanating from, e.g., questionnaires. One limitation with this type of data is the difficulty to draw any conclusions about the causality between the included factors (Hoorens, 1996; Weinstein & Klein, 1996). Correlational evidence can be used to establish whether or not there are any important relations between the included variables and optimistic bias. Causal directions can be further analyzed in studies of an experimental design. The experiments that have been made on optimistic bias include attempts to manipulate the level of

optimistic bias, e.g. by encouraging comparison with a particular target or affecting the mood of the respondent (Chua & Job, 1999). Since it is not my intention to establish any causal links, but only to find possible explanatory factors, the work in the thesis only included correlational studies and evidence. Obviously, this does not exclude the possibility to do studies of a more experimental nature in the future.

### ***Concluding remarks and future directions***

The roles of experts in society in the process of identifying risks, and the biases that affect the judgments of both experts and laypeople, have been discussed in the present dissertation. Biases in experts' judgments were discussed in terms of the tendency to perceive risks within the own domain of expertise as over-emphasized (i.e. a belief that the risks are not as large as society present them to be). Laypeople's perceptions of risks were studied and discussed from the perspective of optimistic biases – the tendency to see hazards as more pertinent to other people. Many risks are not experienced personally, but learned socially (Rohrmann & Renn, 2000). To a great extent, information and knowledge about risks comes from experts within, for example, government agencies and private corporations. The opinions and beliefs of experts can therefore be assumed to have a great influence on the decision-making processes of laypeople. It was also suggested that the everyday quality of many of the risks related to the use of information technology and economic behavior may render this input less influential – people are more focused on their own personal experiences in forming judgments about the risks.

In future studies it would be interesting to study what negative (and positive) consequences risk denial has. Although it is often claimed that optimistic biases have negative consequences on precautionary behavior, very little research has been done in order to test this claim (Armor & Taylor, 2002). The findings from Paper IV suggested that optimistic bias did not have the expected negative effects on precautionary behavior. It would therefore be interesting to study the outcome of economic decision-making and how it is influenced by the perceptions of economic risks and optimistic biases – is the quality of these decisions damaged by optimistic bias?

Future studies on the effects of optimistic biases on economic decision-making could also benefit from making connections to experts' tendency to be overconfident. When private investors are taking advice from financial analysts or economic advisors – how is the relation affected by the respective biases? Research has shown that stock recommendations from financial analysts seldom are better than the stock market index; for an overview, see Andersson (2004b). It is therefore reasonable to assume that private investors that engage financial advisors may get unrealistic expectations on their investments, compared to if they would



invest the money on their own. Coupled with the general tendency of optimistic bias, this could have negative effects on the economic decision-making of private investors causing them to take higher risks than they otherwise would. It could be interesting to apply the discussion about promoters and protectors on experts within the financial sector. Would they be characterized as promoters of financial high-risk investments or protectors of the private investors – or does it depend on the market and customer segment in which they operate? Or is the determining factor rather what position they hold within the financial market?

When social attention to risks was studied in the present thesis no differentiation was made between what kind of attention was given to the risks. It can be expected that the attention given to risks by various actors and in differing circumstances are qualitatively different – e.g. with respect to the discussion about promoters and protectors. Future studies looking at societal attention should therefore gain from making a differentiation in the quality of the attention – is the risk discussed in terms of downplaying the risks (promoting a technology or an activity), or is it more the case of increasing the awareness about the risk, persuading people to take more precautions?

The purpose of this thesis has been to study societal and individual attention to risks, the roles experts assume in society, and people's tendency to be optimistically biased about the risks they face. The results show that experts in the present study tended to rate risks within their own domain as lower than other risks, and that they were more prone to act as promoters than protectors. The robust tendency of optimistic bias has been shown to exist also for technological risks (related to the use of computers) and economic risks. However, further studies need to be made as the phenomenon, despite all the research done, still is poorly understood. The results of the present thesis suggest that the relevance of prior experience and the commonplaceness of the risk sources is an area that merits further investigation. The availability of personal experiences may render the input from experts less influential, which may help explain the persistence of optimistic biases.

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## *Notes*

<sup>i</sup> Terms like “laypeople”, “the public” and “the general public” will all be used interchangeably in the present thesis.

<sup>ii</sup> Then again, it is more difficult to say with certainty that there is no risk. Activities or technologies where it is difficult or impossible to detect negative effects might actually have substantive negative effects on human health. The conclusion that there is “no risk”, based on the absence of known risks, might be misleading; for a discussion see Hansson (2005).

<sup>iii</sup> The nine scales have been termed: “dread”, “severity”, “delayed effects”, “harm to future generations”, “catastrophic potential”, “involuntariness”, “unfairness”, “lack of knowledge to scientists”, and finally, “lack of knowledge to those exposed”.

<sup>iv</sup> The first models focused on only two factors – “dread” and “unknown risk”.

<sup>v</sup> Lifestyle risks are those risks that are related to the individuals’ way of life, such as the risk of a diet leading to obesity and risks related to the use of nicotine and alcohol.

<sup>vi</sup> A novice is a person that has recently started out in a field of activity – a beginner. Hence, he/she does not yet qualify as an expert, but has more knowledge about, and experience from, the field than laypeople do.

<sup>vii</sup> Three groups, or sub-samples, were included in the study: fire fighters, soldiers, and skydivers.

<sup>viii</sup> However, respondents in the third study (Paper IV) received the lottery ticket with the questionnaire and the cover letter. No reminders were sent out to increase the response rate. Despite this, a response rate of 69% was obtained. In the IT-risks study a total of three reminders were sent out and a response rate of 66% was obtained.

<sup>ix</sup> Perceived general control refers the how the respondents rated other people’s possibilities to control the risks.

<sup>x</sup> Neglect ratio (R) =

<sup>xi</sup> Bovine spongiform encephalopathy.

<sup>xii</sup> Genetically modified organisms.

<sup>xiii</sup> For a complete list of the eight factors, see Paper III in the thesis.

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# PAPER I:

## Neglected and over-emphasized risks: The opinions of risk professionals<sup>1</sup>

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### Abstract

Research on risks has mainly been devoted to detailed analyses of such risks that are subject to public debate and policy decision making. However, many if not most of the risks that are now the subject of regulation were once neglected. Experts in conjunction with regulators have a crucial role in putting risks on the policy agenda. But what views do experts have on the matter of attention to risks? In order to answer this question Swedish risk assessment experts were asked to list the risks they considered to be over-emphasized, respectively neglected. Radiation risks constituted the largest category of risks reported to be over-emphasized. Other risks often reported to be over-emphasized included BSE, GMOs, amalgam, and air traffic. Lifestyle risks were the largest category of risks reported to be neglected. Other risks often listed as neglected included radon (as an exception within the radiation category), road traffic, socio-economic risks, energy production excluding nuclear power, and local accidents (including fires and workplace accidents). Risks mentioned about equally often as neglected and over-emphasized included chemicals and crime. There was a correlation between perceived risk and neglect: risks considered to be neglected were also judged as larger. For a comparison, the subjects of articles in the journal *Risk Analysis* from 1991-2000 were categorized into the same risk categories that were used for the questionnaire. The risks most commonly treated in the journal (chemicals and cancer) coincided with the risks which experts in our survey consider to be over-emphasized rather than neglected.

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## ***Introduction***

It is often claimed that certain risks receive too much or too little attention. The result, according to some authors, is that society allocates resources in a sub-optimal manner (Ramsberg & Sjöberg, 1997; Sunstein, 2002). The US Environmental Protection Agency showed, in its analysis of “unfinished business” that experts and the public had quite different views as to which environmental risks needed attention and regulation, and that the Agency had tended to follow the views of the public (US Environmental Protection Agency, 1987). Sjöberg found, in a study of local politicians specializing in health and the environment, that they had risk perceptions and priorities quite similar to those of the public (1996), a finding agreeing with the EPA work if it can be assumed that EPA decisions were made by politicians rather than experts. Rothstein (2003) investigated institutional attenuation of attention to risks, i.e. a tendency to neglect risks caused by organizational dynamics in regulatory authorities.

There has been no previous attempt, to our knowledge, to screen more broadly for which risks are neglected and which are receiving too much attention. Clearly, the priorities set by society in risk management need to be further analyzed. The research reported in the present paper focuses on processes of attention or lack of attention to issues of risk in the various contexts of political institutions, industry, the media, voluntary organizations, domestic settings, and workplaces. It does so by investigating the views of risk management professionals in various fields. We believe such a study to be potentially useful in the further debate about societal risk management priorities.

The issue of attention is many-dimensional.<sup>1</sup> Three major distinctions need be taken into account in an analysis of social attention to risk:

1. Probably most social issues can be described as issues of risk in the general sense of being concerned with uncertain, undesirable events, but only some of them are actually *discussed* in terms of risk. Hence, issues such as traffic accidents and toxic exposure are commonly discussed in terms of risk and subjected to risk analysis, whereas issues such as social segregation and drug smuggling are mostly not. It is therefore important to distinguish between the case when a particular social problem receives attention *as* an issue of risk and the case when it receives attention but is not treated as a risk. Since the concept of risk is commonly interpreted as a quantifiable concept, there is a tendency for social problems that are easy to quantify to be more often treated as risks than those social problems that are less easily quantified (Hansson, 1989). There may also be a tendency for technological or otherwise man-made problems to be more often categorized as risks than those problems that are conceived to emanate from the vicissitudes of nature.

2. Public awareness and discussion of an issue must be distinguished from willingness to support risk regulation. It is in principle possible for a risk to be salient on the public agenda (either as a risk or in some other guise) although there is little or no serious action aimed at reducing it. The opposite is also possible. The safety of non-nuclear pressure vessels is a case in point; this issue is seldom publicly discussed but is certainly on the decision-maker's agenda.

3. The absence of a risk issue from social discussion or from the agenda of decision-makers may have different reasons. One possibility is simply that the issue has not been taken at all into consideration. Another possibility is that the issue has been carefully considered, and that the conclusion was not to give it priority. It is only in the first case that the term "neglect" is fully adequate.

The concept of risk neglect can be further clarified by means of a few examples.<sup>ii</sup> There are different routes for a risk to enter the agenda of societal concerns and risk management. One is through scientific discovery. A recent example is that of Acrylamide, a carcinogenic substance, found in many common staple foods such as bread or potato chips<sup>iii</sup>. The recent discovery of totally unexpected elevated levels of Acrylamide, in such types of common food, stimulated information activities of the Swedish Food Safety Administration, research and rapid revision of certain food production technologies. After only a few months, levels of Acrylamide dropped considerably in at least some kinds of food. Media attention caused consumers to decrease their consumption of potato chips by some 10 percent at least temporarily. In this case, we cannot speak of risk neglect since the risk was simply not known before these scientific results were published<sup>iv</sup>.

In other cases major accidents have brought a risk to the agenda. The car-ferry *Estonia* disaster in 1994 killed 852 people (Analysgruppen för granskning av Estoniakatastrofen och dess följder, 1999; Svensen & Vassalos, 1998). There was nothing new about a ship-wreck, of course. Yet, the fact that so few major accidents like this had happened in the Baltic probably was the cause of certain complacency among authorities charged with monitoring safety, as well as among firms doing the practical inspection work. Many improvements of safety were implemented following the disaster.

The *Estonia* case is clearly one of a neglected risk. In still other cases, a lay whistleblower has been successful in placing a risk on the agenda. A famous example in Sweden is that of BT Kemi, in the south of Sweden, where a woman who had no expert knowledge became suspicious about possible toxic pollution and associated illness in her community (Lalander, 1995; Nilsson & Larsson, 1978). The corporation which was eventually found to have been the perpetrator of a serious environmental crime, and their experts, first denied vehemently all accusations. The woman persisted, and the media caught on to the story. It was finally found that she had been right. Lawless described a number of alarms where experts first

denied any validity to such lay claims about pollution and similar problems, later had to detract their denials (1974).

How can attention to risks be understood by means of current theoretical analysis? The most influential approach to the problem area of attention or inattention to risk is the social amplification theory of Kasperson et al. (1988).<sup>v</sup> Their general thesis is that hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or risk event. It is argued that the social amplification of risk occurs in two stages: in the transfer of information about the risk, and in the response mechanisms of society. Signals about risk are processed by individual and social “amplification stations” that include the scientists who communicate the risk assessment, the news media, cultural groups, and interpersonal networks. Key steps of amplification can be identified at each stage. The amplified risk leads to social responses which, in turn, result in social activities to manage and control the processes or entities defined as risks. These secondary impacts may increase or decrease the initial risk in question, and potentially evoke protective measures. In essence, as defined by Kasperson and co-authors, the social amplification of risk is a general phenomenon composed of the social structures and processes of risk experience, the resulting repercussions on individual and group perceptions, and the effects that these responses have on community, society, and economy. In our view, The Theory of the social amplification of risk provides a useful terminological framework for studies of the general process determining social attention to risk. It remains, however, to further develop this theoretical framework and formulate more specific theories that give rise to precise, testable hypotheses. For this, more empirical data are needed.

The present approach to the study of societal priorities of risk regulation, is to ask respondents what types of risk issues they consider to be too much, or too little, attended to.<sup>vi</sup> Experts should be expected to have some opinion about what, if any, hitherto neglected risks they would prefer the public, the media and decision-makers to pay more attention to. At the same time, experts’ risk perceptions and attitudes seem to exhibit much the same dynamics as those of members of the public (Sjöberg, 2002a), and a study of the properties of experts’ judgments is therefore considerably more interesting than would have been the case if experts are simply assumed to make “objective” risk judgments (Rowe & Wright, 2001).

Who is an expert professional and how can expertise be determined operationally? One approach is that of the study of excellence in performance (Ericsson & Charness, 1994). Another type of definition is based on nomination (Shanteau et al., 2002). A person regarded as an expert need not be a skilled performer, and therefore the mere recognition of somebody as an expert is no guarantee of a high level of skill. However, being nominated or recognized as an expert entails several relevant dimensions: education, practical experience and organizational role. A person nominated as an expert on such grounds can be expected to have extensive

knowledge of the field of expertise and would therefore be the appropriate type of expert for the present study. For the purposes of the present paper we will define expertise on the basis of nomination; a person will be counted as an expert if his or her colleagues or superiors make that nomination. This is, to our knowledge, the only type of expert definition which has been used in risk research; see e.g. Rowe and Wright (2001).

Summing up, the purpose of the present study was to investigate which risks are neglected and which are overly emphasized in Swedish society, based on the views of a large sample of experts who had been nominated by authorities as risk assessment experts.

### ***Method***

Data were collected with a questionnaire, consisting of 21 pages (A5 format). The questionnaire started with two questions, asking the respondent to state up to five risks that he or she felt were neglected or over-emphasized. A follow-up then asked what actors in Swedish society he or she believed had neglected or over-emphasized these risks. For this question a closed format was used with predefined alternatives, *viz.* media, government agencies, the public, politicians, private companies, and researchers. The questionnaire further contained a number of questions dealing with various judgments of specific risks and benefits, using Likert-type scales, including personal risk and risk to others (general risk). Finally, there were some questions dealing with the respondent's background (e.g. academic qualifications and expert credentials) and an evaluation of the questionnaire.

Table 1: Orientation of the respondents' education

Orientation of studies	%
Health & biology	30.9
Technology & engineering	19.7
Mathematics & natural sciences (excl. biology)	17.9
Social sciences	15.8
Humanities	3.4
Administration & law	3.4
Economics and/or business and advertising	2.6
Computers & information	2.1
Military & police	1.0
Other	3.1

The respondents represented a selection of experts in a wide array of risk-related areas including public health, environmental protection, public safety, technological safety, and infrastructure reliability. This broad selection was done

to cover as wide a range as possible of risk issues in Swedish society. The experts to whom we sent the questionnaire were selected by contacting (on telephone) governmental national agencies and regulatory bodies that had risk and safety matters within their authority and asking for the names of risk experts in their respective areas of competence. In this way we obtained several hundred names of experts in a wide variety of fields. In addition we also sent questionnaires to the Swedish members of the Society for Risk Analysis (SRA) and to all members of the Swedish Risk Academy (Riskkollegiet). The total numbers of Swedish risk experts on our list was 639. The Academy and SRA members constituted a minor part of the entire sample. Since 54 of the envelopes were returned unopened due to incorrect addresses and changes of jobs the number of respondents who actually received the questionnaire was 585. After two reminders 393 of these had responded, corresponding to a response rate of 67.2%.

Table 2: Orientation of the respondents' current field of work

Orientation of current field of work	%
Health & biology	34.0
Technology & engineering	16.6
Social sciences	13.8
Mathematics & natural sciences (excl. biology)	12.7
Administration & law	7.0
Other	6.8
Computers & information	2.9
Military & police	2.9
Humanities	2.6
Economics and/or business and advertising	0.8

A majority of the respondents were men (77.5%), the median age was 55 years. About half of the respondents had postgraduate education (50.1%) and almost all (94%) had university education. The four most common orientations of their studies were, in descending order, health, technology, natural sciences, and social sciences, together amounting to 84.3% of the respondents; see Table 1. The distribution of their current fields of work was approximately the same; see Table 2. Overall, the respondents had extensive experience within their areas of expertise; the median number of years the respondents had been active within their respective field was 25. Table 3 gives the proportion of the respondents who assessed the questionnaire favorably. As can be seen, it was on the whole well received by the respondents.



Table 3: Proportion of respondents who gave positive assessments of the questionnaire

Question	%
Questionnaire did not increase worry about risks	91.4
Questionnaire did not try to influence responses	81.3
Response alternatives were clearly formulated	80.0
The text was easy to read and the design comprehensive	79.3
Questionnaire dealt with important topics in this context	78.4
The questions were clearly formulated	69.4
The study was meaningful	63.4
Interesting task to fill out the questionnaire	46.2
Increased interest in the area due to the questionnaire	12.9

## Results

### Neglected and over-emphasized risks

The respondents together listed 1546 entries of risks that they felt were neglected in society, and 1387 entries of risks that they considered to be over-emphasized. These 2933 entries were divided into thirteen main categories (plus one for "other risks"): Radiation, Lifestyle, Transportation, Environment, Society/economy, Health problems, Chemicals, Food, Crime, Media, Natural Disasters, Energy Production, and Local Accidents. Fig. 1 shows the relative frequencies for each category and each attitude (neglected/over-emphasized).

In order to compare the degree to which different risks were regarded as neglected, respectively over-emphasized, we introduce the concept of a *neglect ratio* (R):

$$R = \frac{\text{Number of neglected risks in category}}{\text{Total number of risks in category}}$$

Theoretically, R can vary between 0 and 1. A high value of R means that the risk in question is more often regarded as neglected than as over-emphasized. For statistical reasons, we have not considered it to be meaningful to report neglect ratios for categories comprising less than 40 entries. Fig. 2 shows the neglect ratios for the 13 main categories.

Figure 1: Distribution of risks reported as neglected, respectively over-emphasized, into major categories

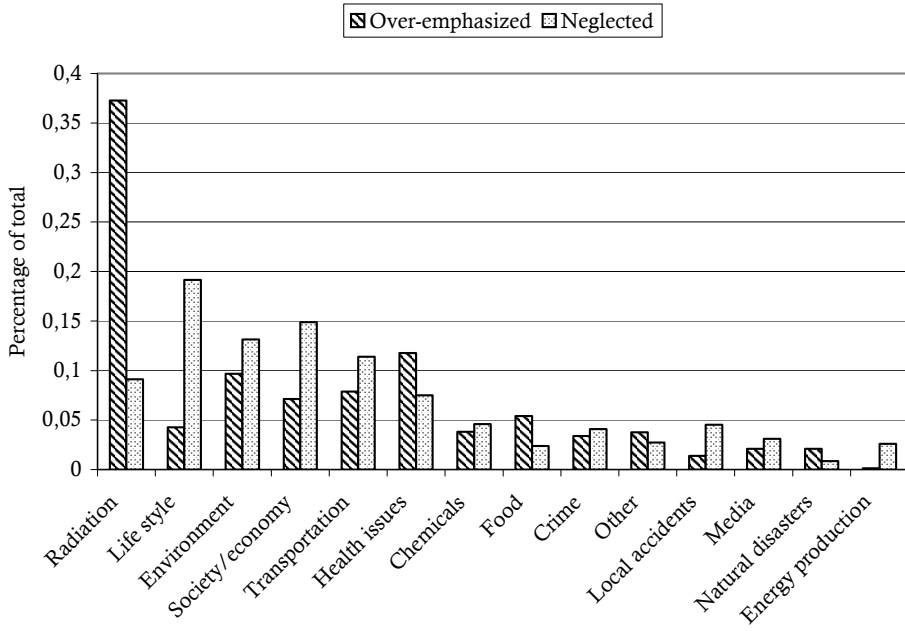
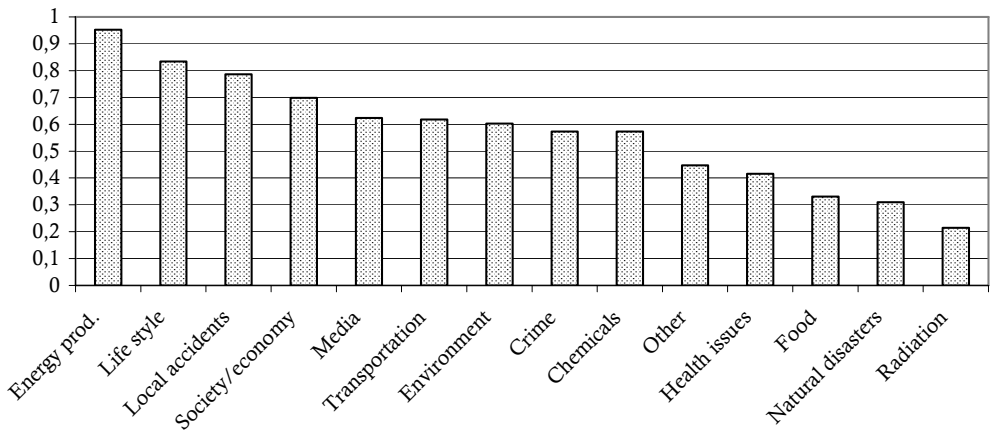


Figure 2: Neglect ratios for the major categories of risk



### *Radiation*

Among the risks that experts considered to be over-emphasized, radiation was by far the largest category – 37% of the risks. About 9% of all risks claimed to be neglected were radiation risks. The neglect ratio for all radiation risks is  $R=0.21$ . However, this should not be taken to mean that the experts considered radiation risks to be generally over-emphasized. On the contrary, by dividing radiation risks into a number of sub-categories, such as e.g. *nuclear power, natural background radiation, radon, electromagnetic radiation from cellular phones, and X-rays*, it can be shown that some radiation risks were considered to be neglected to a fairly high degree. For instance, 56 respondents reported that radon was a neglected risk, but only 14 that radon was over-emphasized. This corresponds to a neglect ratio of  $R=0.80$ , a value which should be compared to the neglect ratio for nuclear power, which was  $R=0.10$ . For oversensitivity to electricity  $R=0.08$ , and for electromagnetic radiation from cellular phones  $R=0.17$ .

Some radiation risks were mentioned by only a few respondents. For instance, only three respondents reported that they considered radioactive waste (not including waste from nuclear power plants) to be an over-emphasized risk and no one claimed that it was neglected. Only three respondents considered natural background radiation to be an over-emphasized risk, and two respondents that it was neglected.

### *Lifestyle*

Among the 13 main categories, lifestyle was the second largest. Nineteen percent of all neglected risks were lifestyle risks, but only 4% of the over-emphasized risks belonged to this category. The neglect ratio for the entire lifestyle category was  $R=0.83$ . This indicates that lifestyle risks were considered by the experts to be clearly among the most neglected risks. The lifestyle risks were divided into thirteen sub-categories, of which (active) smoking was the one most often mentioned ( $n=87$ ). The neglect ratio for (active) smoking was 0.99. Since the health effects of tobacco are well-known this figure is a bit surprising. For food habits  $R=0.89$ , for stress  $R=0.76$  and for alcohol  $R=0.72$ . All other sub-categories, such as moist-snuff (a form of tobacco that is widely used in Sweden), comprise less than 40 entries each. Three considered this risk to be over-emphasized and three considered it to be neglected. Obesity was mentioned by only eight experts, of which seven considered this risk to be neglected.

### *Transportation, environment, and society/economics*

Next to the two most frequently mentioned categories discussed above, transportation, environment, and society/economy were also prominent categories. Eleven percent of the neglected risks were transportation risks, and so were 8% of the over-emphasized risks. The corresponding figures for

environmental risks are 13% respectively 10%, and for society/economy 15% respectively 7%.

The transportation risks were divided into eight sub-categories, of which road traffic is the largest (n=148). The neglect ratio for road traffic was  $R=0.78$ . However, since the neglect ratios for the other sub-categories, e.g. air traffic ( $R=0.13$ ), train transportation (n<40), and shipping (n<40) were fairly low, the neglect ratio for the entire category of transportation was  $R=0.62$ . This suggests that experts believed that society should pay increased attention to road traffic risks.

Examples of risks included in the environment category are the greenhouse effect, air pollution, ozone, and genetically modified organisms (excluding genetically engineered food). The neglect ratio for the environment category was  $R=0.60$ . However, this category contained sub-categories that differed widely in their neglect ratios. For instance, for the greenhouse effect  $R=0.68$ , but for GMOs  $R=0.23$ .

The society/economics category is multi-faceted. Examples of risks within this category are unemployment, stock market collapse, social segregation, low quality of education, political risks, and conflicts, such as war. The neglect ratio for the entire society/economy category was 0.70. Since this category contained many sub-categories with just a few entries, it was not meaningful to calculate neglect ratios for each sub-category. However, 28 respondents claimed that education-related risks were neglected and 4 that they were over-emphasized. Twenty respondents reported that social segregation was a neglected risk, but only 2 that it was over-emphasized. Equally many respondents (14) considered war to be a neglected, respectively an over-emphasized risk.

### *Health, chemicals and food*

Many respondents mentioned health issues such as e.g. BSE, cancer, Aids/HIV, lack of resources in health care, infectious diseases, etc. Among the neglected risks 8% were health issues, and among the over-emphasized risks 12%. The neglect ratio for this category is  $R=0.42$ . This indicates that on a general level, risks resulting from diseases were equally often considered to be neglected and over-emphasized. However, when this category is divided into sub-categories the picture changes dramatically. Most notably, 59 respondents considered BSE to be an over-emphasized risk, but only two said that it is neglected. This yields a neglect ratio for BSE of  $R=0.03$ , which is extremely low. Clearly, these experts believe that society should pay less attention to BSE than has recently been the case.

For all other diseases n<40. However, 35 experts considered amalgam to be an over-emphasized risk, and only one said that it is neglected. Ten reported that Aids/HIV is a neglected risk, and 22 that it is over-emphasized. To some degree,

the results for chemical risks resemble those for diseases. About 5% of the neglected risks were categorized as chemical risks, compared to 4% of the over-emphasized risks. The neglect ratio for chemical risks was 0.57. Consequently, chemical risks in general were neither considered to be neglected nor over-emphasized. However, unlike the category of health problems where there were several main sub-categories, the category of chemical risks did not contain any specific chemical substance that the experts pointed out to be neglected or over-emphasized.

About 2% of the neglected risks were food-related, as compared to 5% of the over-emphasized risks. The neglect ratio for the entire food category was 0.33. For genetically modified food products, which is by far the largest sub-category of food risks, the neglect ratio was 0.22. This indicates that the respondents consider the risks associated with genetically modified food products to be over-emphasized to some degree, but not as extremely over-emphasized as e.g. BSE. For all other sub-categories of food risks,  $n < 40$ .

#### *Crime and media*

Crime and media are two rather small categories. About 4% of the neglected risks belonged to the crime category, and 3% of the over-emphasized risks. The corresponding figure for media risks (including IT-related risks) are 3% respectively 2%. The neglect ratio for crime was 0.58 and for media  $R = 0.62$ . The largest sub-category of crime was violence. The neglect ratio for violence is  $R = 0.41$ . For all other sub-categories of crime  $n < 40$ .

The largest sub-category of media risks was that of IT-related risks. For this sub-category  $R = 0.64$ . However, among the 22 respondents who explicitly mentioned the Internet, 15 said that Internet-related risks were over-emphasized and 7 that they were neglected. Of the 33 risks that were classified as IT-related-risks with no explicit relation to the Internet, 28 were neglected, but only 5 over-emphasized. This indicates that – according to these experts – IT-related risks in general were neglected, even though it was not the Internet that presents the biggest problem.

#### *Natural disasters, energy production, and local accidents*

Natural disasters comprised the smallest of the thirteen main categories. Less than 1% of the neglected risks were related to natural disasters. For the over-emphasized risks this figure was about 2%. These low frequencies can be explained by the fact that natural disasters are less common in Sweden than in many other countries. The neglect ratio for natural disasters was 0.31.

Energy production (excluding nuclear power) was another minor category. About 3% of the neglected risks were classified as belonging to this category, and close to zero of the over-emphasized risks. The neglect ratio was 0.95, which is very high. The category of energy production was divided into four sub-categories: *Firewood*

*heating* was reported as a neglected risk by six experts, while no one considered this risk to be over-emphasized. The corresponding figures for *power failure* was 12 respectively 1. Collapses of *water dams* (in the technological contexts of mining or hydropower) was considered to be a neglected risk by 14 experts, and to be over-emphasized by only 1 respondent.

Local accidents such as slip and fall accidents, fires, work hazards etc., constituted about five percent of the neglected risks, and close to one percent of the over-emphasized risks. The neglect ratio for local accidents was 0.79. For all sub-categories of local accidents  $n < 40$ . However, among the most frequently mentioned categories of local accidents we find fire (11 neglected, 2 over-emphasized), and workplace accidents (17 neglected, 2 over-emphasized).

*Who is responsible?*

The experts were also asked to state which actor(s) they believed to neglect or over-emphasize the risks they named. Table 4 gives the proportion of the cases in which each of the actors was mentioned. It turns out that the experts considered politicians to bear a large responsibility for the improper attention or lack of attention paid to different risks. Many experts, many of whom are employed by various government agencies, also believed these agencies to be responsible for improper inattention to risks. The reason may be that the respondents think that some *other* government agency than their own is responsible for paying too much or too little attention to the risks in question.<sup>viii</sup>

Table 4: Answers to the question: “Who gives too much/too little attention to the risks?” (Proportion of the cases in which the actor was mentioned)

	Too little (%)	Too much (%)	Diff (%)
Politicians	67.8	46.7	21.1
Government agencies	55.5	24.0	31.5
The public	53.0	48.3	4.7
Media	51.8	75.4	-23.6
Private companies/corporations	36.2	6.0	30.2
Researchers	28.2	17.3	10.9

In Table 4 we also report the difference between the proportion of neglected and over-emphasized risks. Interestingly, government agencies, politicians as well as researchers were believed to neglect more risks than they over-emphasized, whereas media were believed to over-emphasize more risks than they neglected.

## A comparison with risk topics in one of the professional journals

How do the risks, listed by these experts as neglected or over-emphasized, relate to the risks discussed in the scientific literature on risk? An answer to this question was obtained by categorizing the type of risks discussed in all articles published in *Risk Analysis* from 1991 to 2000 in the same categories that we used in our analysis of the questionnaires. This categorization was performed by the same person (Peterson) who categorized the answers obtained to our questionnaire. *Risk Analysis* was chosen because it is one of the leading journals in its field, and has been published long enough to provide a sufficiently large number of articles for statistical analysis. Table 5 shows the number of articles in *Risk Analysis* devoted to each of our thirteen main categories of risks as well as the two largest sub-categories, viz. cancer and nuclear power.<sup>ix</sup>

Table 5: Comparison with topics in Risk Analysis

	Survey		Risk Analysis
	Neglected	Over-emphasized	
Chemicals	71 (4.7%)	53 (4.0%)	176 (35%)
Crime	63 (4.2%)	47 (3.5%)	1 (0.2%)
Energy production (excl. nuclear power)	40 (2.7%)	2 (0.1%)	2 (0.4%)
Environment	203 (13.5%)	134 (10.0%)	65 (13.0%)
Food	37 (2.5%)	75 (5.6%)	20 (4.0%)
Health issues (excl. cancer)	116 (7.7%)	156 (11.7%)	4 (0.8%)
Cancer	0 (0.0%)	7 (0.5%)	83 (16.7%)
Lifestyle	296 (19.7%)	59 (4.4%)	10 (2.0%)
Local accidents (incl. work hazards)	70 (4.7%)	19 (14.2%)	22 (4.4%)
Media	48 (3.2%)	29 (2.2%)	4 (0.8%)
Natural disasters	13 (8.6%)	29 (2.2%)	7 (1.4%)
Radiation (excl. nuclear power)	117 (7.8%)	292 (21.9%)	15 (3%)
Nuclear power	24 (1.6%)	225 (16.9%)	59 (11.8%)
Soc., Edu & Econ.	230 (15.3%)	99 (7.4%)	3 (0.6%)
Transportation	176 (11.7%)	109 (8.2%)	28 (5.6%)
Total	1504 <sup>1</sup>	1335	499 <sup>2</sup>

<sup>1</sup> As mentioned above, the respondents together listed 1546 risks that they felt were being neglected. However, 42 of these risks were categorized as "other risks". Therefore the total number of neglected risks reported here is 1504, and not 1546. (For the same reason, the total number of over-emphasized risk in this table is 1335 and not 1387)

<sup>2</sup> The total number of articles published in *Risk Analysis* from 1991-2000 exceeds 499. However, some articles deal with methodological issues etc., rather than particular risks. Those articles are not included here.

It is particularly interesting to highlight those risks that our respondents considered to be neglected. A striking example is that of lifestyle risks, which were considered to be neglected by 296 experts (and over-emphasized by 59), whereas only 10 (of 499) articles in *Risk Analysis* dealt with such risks. Risks belonging to the society/economics category were considered to be neglected by 230 experts (and over-emphasized by 99), but only 2 articles in *Risk Analysis* dealt with those risks. For energy production (exclusive of nuclear power) the corresponding figures are 40 neglected, 2 over-emphasized and 1 article in *Risk Analysis*.

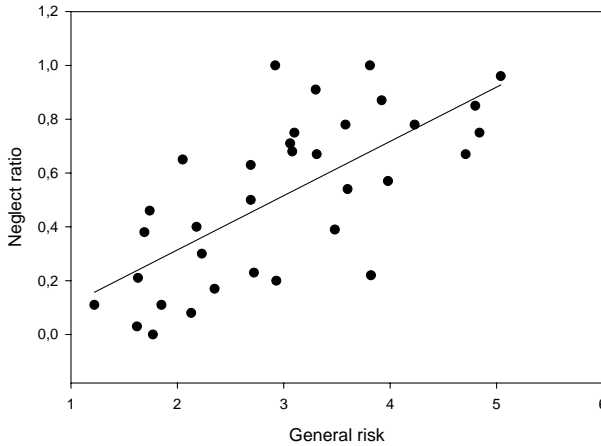
The difference between a risk category's proportion among neglected and over-emphasized risks (e.g., 4.7% – 4.0% = 0.7% for chemicals) can be taken as a rough indicator of attendance deficit according to these experts. It is interesting to note that the three categories for which this number is highest, namely Lifestyle, Natural Disaster, and Society/Economics all score very low in terms of coverage in *Risk Analysis*. In contrast, whereas 52% of the journal articles were concerned with chemicals or with cancer, these two categories comprised only 5% of the neglected risks listed by our respondents.

### **Neglect and perceived risk**

In the questionnaire the respondents were asked to estimate the personal and the general risk (Sjöberg, 2003b) for a list of predefined risks. By computing neglect ratios for these risks we found that there was a positive relation between the degree to which a risk is considered to be neglected and the estimated magnitude, on the average, of both the personal and the general risk. (See Fig. 3 for the case of general risk where the correlation was as high as  $r = 0.69$ ,  $p < 0.01$ ). It is plausible that considering a risk to be neglected also causes it to be perceived as large. Is there also a correlation between perceived risk and the number of articles in *Risk Analysis* discussing that type of risk? This is a complex issue. Some risks that are perceived to be high, e.g. smoking, are also much discussed in *Risk Analysis* (39 articles from 1991-2000). But other risks that are perceived to be high, e.g. stress, have been discussed to a much smaller extent in *Risk Analysis* (only 2 articles from the time period 1991-2000). On the other hand, most risks that were judged as small by the respondents have also been little discussed in *Risk Analysis* (e.g. radiation from cellphones, 0 articles from 1991-2000). As one could have expected, there are no examples of risks that were judged as small by the experts but much discussed in *Risk Analysis*.



Figure 3: A plot of neglect ratios against perceived general risk



## ***Discussion***

The responses of the experts reflect an amazing variety of risks, which experts considered to be either neglected or over-emphasized. This finding agrees with the notion that modern societies are much oriented towards risk discourse (Beck, 1992): the discovery and assessment of new risks, discussions about how to mitigate some of them, issues of blame in cases where accidents have happened (Douglas, 1992), etc. A study of Swedish parliamentarians showed that their active interest in risk matters had tripled from the 1960's to the 1990's (Sjöberg et al., 1998). Thus, matters of risk occupy an important position in media and policy debates.

Neglect or exaggeration of risks are terms with varying interpretations. We did not attempt to specify them further because we were interested in experts' spontaneous understanding and use of the concepts. In addition, we did not expect, nor did we encounter, any great difficulties among the respondents to understand or use the concepts. They also rated the questionnaire as reasonably clear, at the level usually achieved with these kinds of survey studies of risk perception and related issues. Yet, it would be of interest in future work to investigate more in-depth the way respondents interpret such concepts.

Since we approached experts who had been nominated as active and knowledgeable in some risk management field, it can be assumed that they were people with a special interest in risk assessment. This may have contributed both to their willingness to respond at all, and to their suggestions of so many interesting risk issues. The role of interest in risk management should be studied in

future work. Interest in a given field of technology is probably negatively correlated with perceived risk of the area, as found by Drottz-Sjöberg and Sjöberg in a study of adolescents (1991). Yet, interest in a risk seemed in another study to be positively related to perceived size of the risk (Sjöberg, 1999). It is only natural that an expert working in a field is most interested in risks which are, if not large, at least important in some sense of being possible threats.

Expertise in risk assessment is limited to a given area of contents, such as radiation, food, smoking etc. At the same time, work on risk analysis and management in any given area provides experience that should be of value in considering risks in other areas as well. Risk analysts therefore are likely to have knowledge and experience which should be helpful in general, not only in their own field of expertise. In the present study, we assumed that such generalized competence was present; making it interesting to investigate experts' opinions about risks in general, not only their own area of specialized knowledge.

Following the pioneering work on heuristics and biases by Tversky and Kahneman (1973), it has sometimes been concluded that people are heavily influenced by availability of memory contents, rather than actual frequency of events they have encountered. In our study, availability could have interfered with results in at least two ways. First, the initial list of experts could have been made up of "available" experts, i.e. people who were salient for some reason other than their expertise. Second, what experts reported as neglected or overly emphasized risks could also have been influenced by the salience of hazards rather than their actual properties as neglected or overly emphasized. Indeed, any open question format could be criticized in this manner. However, more recent work on availability tells a more complex story (Schwarz, 1998; Sedlmeier et al., 1998). There is no compelling evidence that people are strongly influenced by availability rather than factual information such as frequency of past encounters. The widely spread initial work was misleading and based on limited empirical evidence. The present results are therefore unlikely to have been influenced by this alleged biasing factor.

Lifestyle risks were clearly judged to be the most important type of neglected risk. The question is what implications follow from this finding. Take smoking as an example. The fact that smoking is a risky type of behavior is sure to be known to almost all members of the public. Yet, many people smoke. They apparently take a risk quite consciously – or do they? To answer the question we must consider the difference between personal risk, risk to oneself, and general risk, risk to others. There is usually a difference between how these two types of risk are perceived, personal risk being smaller. For lifestyle risks, the difference is especially large (Sjöberg, 2003b). Weinstein has discussed this type of behavior under the heading unrealistic optimism (1989). People seem to believe that they can exert control over lifestyle risks, and that may be a primary factor in accounting for unrealistic optimism or denial of the personal risks (Harris, 1996). Simply informing people

about a lifestyle risk is likely to be ineffective, since people do not believe that the risk is pertinent to them, and since they usually know that it exists (to others), anyway. Should risk managers in society still try to find ways of influencing individual risk taking behavior – and what is a reasonable level of intervention and regulation? This is not just an ethical or psychological problem – but also a legal and political one. Sweden's entry into the European Union has brought with it a higher level of lifestyle risk taking, in particular with regard to alcohol. Since the beginning of the 20<sup>th</sup> century, alcohol was managed by very strong regulations in Sweden, only now to be sacrificed to the requirement of European harmonization of legislation and demands for free trade. A fast increase of alcohol consumption is now observed, and it is expected to gain even more momentum in the near future, when restrictions gradually are phased out and prices and taxes are lowered.

The contrast between lifestyle risks and most other risks mentioned by the experts is striking. We see here, to some extent, a rhetorical stance among the risk assessment experts. They subscribe to the view that society's resources are not optimally allocated to risk regulation, if the goal is to promote over-all safety. We do not deny the validity of such a conclusion, but note that the design of the study may have invited more policy-oriented thinking than we had intended. After all, lifestyle risks are well known even if they are to some extent neglected, for various reasons. Neglected risks known only to topical experts are therefore of special interest in work on these matters in the future.

Radiation risks was the category most frequently mentioned as over-emphasized (about 37%). Looking at the background of the respondents who identified these risks it becomes clear that they represent a wide field of expertise. That is to say, not only experts on radiation claimed that radiation risks were over-emphasized. Analyzing the relationship between risks and expertise in general, we find about half of the respondents identified at least one neglected risks within their own field of work.<sup>x</sup> When it comes to the over-emphasized risks the number was slightly higher. Overall, then, the experts were very diversified in the identification of neglected and over-emphasized risks and not only identified risks related to their own field of work. The question whether there is any correlation between the respondents' area of expertise and the risks identified as neglected respectively over-emphasized is analyzed in more detail in Fromm (in press).

One of the more remarkable findings of our study was that experts gave only a low assessment of the Aids risk, another lifestyle risk. A geographical factor may have been involved. These Swedish experts simply may not have had the global situation in mind with regard to Aids. There must be other reasons as well, however, because they surely did not assess all risks in an exclusively Swedish perspective. Aids being a lifestyle risk could not be the reason for the low assessment of the Aids risk. Other lifestyle risks were judged as neglected

The societal risk management process involves a number of different actors, such as the media and politicians as well as concerned members of the public, but experts undoubtedly play a key role. Experts sometimes disagree sharply over risk assessments, and our data illustrate several cases where this is the case. Neglect ratios around 0.5 occur when experts are most divided: about half say a certain risk is over-emphasized, and half that it is neglected. It would be interesting, in future work, to inquire into the reasons for diversity in some of the cases we have observed.

In previous work, it has been proposed that experts may assume one of two roles: promoter or protector (Sjöberg, 1991). The protector typically is motivated to warn people about some risks, usually lifestyle risks. The promoter, on the other hand, is motivated to reassure people that a risk they find to be serious is really so small that it can be dismissed. Thereby, the promoter helps to formulate arguments in favor of the technology generating the risk. Other factors, such as who is the employer of the expert, may also enter the picture (Barke & Jenkins-Smith, 1993). The roles that experts adopt are another important issue to cover in future work.

Our findings thus show that lifestyle risks are the ones, which experts considered to be most often neglected, while some technology oriented risks such as radiation hazards were considered to be most often over-emphasized. At the same time, the activities of those working on risk research, and publishing in the journal *Risk Analysis* tend to be focused on those very hazards which experts consider to be over-emphasized. What could be the reason for this paradoxical finding?

The allocation of research efforts is of course dependent on economic factors. Research projects need funding, most often public funding. Which projects get funded is decided in a complex interplay between the scientific community and administrators or politicians. The latter group can be expected to favor work on topics where they feel there is pressure from the public that research must be carried out. In addition, politicians are likely to have risk perceptions similar to those of the public. Who decides the outcome of the funding process? Politicians and administrators do, since work is carried out mostly in areas they presumably consider to be important.

Who applies for funding is also an important issue. There are research institutes which have been set up for partly the same reasons which lie behind decisions about funding. Many jobs have been created in those areas, e.g. in radiation protection. Those people compete for funds, some of them are successful and the result is research papers which they then publish, e.g. in *Risk Analysis*. We therefore suggest that two factors are behind the fact that hazards which experts consider too much attended to also tend to be overly represented in the experts' own work: political input in the process of funding of research projects, and political decisions creating research jobs in the same areas.

It is possible that the actual distribution of research resources differs from what we found in our study or *Risk Analysis*. There are many journals dealing with risk issues and some are especially oriented toward lifestyle risks. However, if such research attracts a lot of attention it is hard to understand why our expert sample gave the responses they did. In addition, the journal *Risk Analysis* is not intended to be restricted in what kinds of hazards it covers. It is stated<sup>xi</sup>, under “Objectives” that

“It deals with health risks, engineering, mathematical, and theoretical aspects of risks, and social and psychological aspects of risk such as risk perception, acceptability, economics, and ethics.”

Given a situation where experts work on risk issues that they do not consider to be the most important ones in society, it is interesting to inquire more deeply into the repercussions of this situation. One possibility is that expert roles become unclear. The fact that society wants research and risk management on risks that could be dismissed, in the eyes of the expert, may tempt him or her to become socially and politically active. There is nothing wrong with that, of course, but the stage is set for some difficult problems of democratic decision-making. Should the public’s risk perception at all have an influence on societal risk management? A special issue of the journal *Reliability Engineering and Systems Safety* was devoted to discussions of that and related questions (vol. 59, no. 1, 1998). In spite of a wide range of topics being covered, the simple argument that democracy makes it imperative that the public’s concerns should influence the process (Sjöberg, 2002b) was not stressed. It is more common to hear that “stakeholders” should be heard, and that may be reasonable, but one should be aware that stakeholders constitute a very specific group (Sjöberg, 2003a). Their influence may be out of proportion with their size.

Many cases of previously neglected risks surface after a major accident or disaster has happened; risk management becomes reactive rather than proactive. The *Estonia* disaster is a case in point (Wang, 2002). Maybe risk management has to be reactive to a large extent, because there are so many potential risks and trying to monitor or mitigate them all would be an overwhelming task. Take the events of September 11, 2001, as an example. The scenario of suicidal terrorists hijacking an airliner and running it into a high-rise building was not unknown, it had been used in movies and in fiction, yet it had not happened before, and the authorities and airlines were not prepared. Malevolent acts of various kinds can never be excluded, but to be on guard against them all would be impossible. A neglected risk is one where reasonable safeguards have been ignored, not any hazard that turns out to be dangerous once it has become a reality.

By way of conclusion, many issues of neglect and exaggeration of risk were brought up in our study. We have pointed to some methodological problems in need of further work. We do not believe, however, that the major trends of the

present study will be changed by such further work. Experts were found to stress lifestyle risks as examples of neglect, and several technology and environment risks as over-emphasized. Their own work tended to be in the over-emphasized rather than the neglected areas, and that seems to be a general trend internationally, to judge from one of the most important journals in the field.

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## *Notes*

<sup>i</sup> Cf. Bromberger (1988) and Zimmerman (1986). See also Hansson (2001).

<sup>ii</sup> The concept of risk neglect is closely related to the concept of *de minimis* risk. See (Peterson, 2002).

<sup>iii</sup> See <http://www.mindfully.org/Food/Acrylamide-Heat-Processed-Foods26apr02.htm>

<sup>iv</sup> See the WHO website at <http://www.who.int/foodsafety/chem/chemicals/acrylamide/en/>

<sup>v</sup> For a slightly modified version of this theory, see Renn et al (1992).

<sup>vi</sup> The concepts of negligence and ignorance about risks are analysed from a philosophical point of view by Smith (1983) and Severdlik (1993).

<sup>vii</sup> The questionnaire is available at [www.dynam-it.com/institute](http://www.dynam-it.com/institute)

<sup>viii</sup> For a discussion on related issues, see e.g. Smithson (1985).

<sup>ix</sup> The term 'article' has here been extended as to include: regular articles, comments on regular articles, published workshop papers, letters to the editor, as well as editorial articles.

<sup>x</sup> We exclude social scientists as well as respondents whose expertise do not fit into our categorization of risks.

<sup>xi</sup> See <http://www.sra.org/journal.htm>

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# **PAPER II:**

## **Experts' views on societal risk attention<sup>1</sup>**

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### **Abstract**

In the public debate about risks and in the making of risk policies, experts and professionals within governmental agencies, as well as academic researchers, play important roles. It is therefore of interest to study what risks these actors believed deserve more attention and what risks they regard as overly emphasized. The present paper considers the attention to risks in society, the connection between identified risks and domain of expertise and the different roles of experts in society; do they act as promoters or protectors? The article is based on a questionnaire sent to 639 Swedish professionals in risk-related fields. The response rate was 67% and the respondents' domain of expertise covered a wide range of fields. It was hypothesized that experts to a greater extent regard risks within their own domain as over-emphasized rather than as neglected and that the respondents will indicate other actors than those within their own organization as giving risks inappropriate levels of attention. The results showed that the experts identified risks in very diverse fields and not exclusively within their own domain. Relationships between identified risks and domain of expertise could be documented – experts were more inclined to indicate risks within their own domain as over-emphasized rather than as neglected.

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## ***Introduction***

Prior research has established that people tend to rate risks to themselves personally as lower than risks to people in general, see e.g. Weinstein (1980; 1984; 1987). This optimistic bias is assumed to have a hampering effect on the attention individuals give these risks, or rather their precautionary behavior (van der Pligt, 1994; 1996; Weinstein, 1988). Another bias that has been found (Sjöberg et al., 2000a) is that experts tend to rate risks within their own domain as lower, compared to ratings by the public. The process of making risks visible on the political agenda involves several different actors. Although the issue of who should make the decisions regarding risk policies and what these decisions should be based upon has been much debated (see e.g. Belzer, 2001; Freudenburg, 2001; Sjöberg, 2001) it remains clear that decision-makers and regulatory bodies have to consider information and opinions from a variety of sources. One influential group is that of experts within risk-related domains, in part due to the role they play in advisory bodies and councils. Their opinions are often seen as a standard with which the perceptions of the public are compared. Consequently, the beliefs, opinions, and perceptions of risk assessment experts can be assumed to play a significant role in decision-making on risk policies in society, and it is therefore of interest to know more about the risk perceptions of experts.

The risk perceptions of the public are at times portrayed as irrational and biased, whereas the experts are viewed as more rational, basing their perceptions on vast knowledge and far more information than the public. However, it can be expected that biases and perhaps also vested interests influence the perceptions of experts, as well as other actors taking part in the risk regulation process. There is a line of research looking at the influences on risk regulation and regulatory officials' risk perception (Rothstein et al., 2000; Rothstein, 2003), for example the importance of institutional factors. Furthermore, there are numerous studies made on the risk perceptions of experts and the public (see e.g. Finucane et al., 2000; Slovic, 1987) – and also studies comparing the two groups. For an overview see Rowe and Wright (2001). Given the assumed influence risk assessment experts have on risk policies, (see e.g. Rothstein, 2003), it is necessary to find out more about what risks they believe need more, or less, attention and, perhaps more importantly so, how this is connected with their own domain of expertise.

The present paper<sup>1</sup> considers the attention to risks in society, the connection between identified risks and domain of expertise and the different roles of experts in society. Do experts identify risks within other domains than that of their own expertise? It is hypothesized that they are not that exclusive in their identification of risks, but also identify risks outside of their expertise. In addition, given the assumption that experts rate risks within their own domain as lower, it is anticipated that the experts to a greater extent will view risks within their own domain as over-emphasized rather than as neglected.

The discussion of attention to risks in society is related to the social amplification of risk framework (Kasperson et al., 1988). Within this framework it is argued that risks can be amplified or attenuated in the risk communication process. Signals, which intensify or attenuate the risk, can come either through personal experience or via information from actors in society. These actors, or amplification stations, using the terminology of Kasperson et al (1988), include scientists, the news media, opinion leaders, and public agencies to mention a few. However, there is but scarce empirical evidence for the effects of media contents on risk perception (af Wählberg & Sjöberg, 2000; Nilsson et al., 1997; Pidgeon, 1999; Rowe et al., 2000). Since the experts in their roles as scientists or representatives of governmental agencies also function as amplification stations, they themselves are part of the process of attenuation or amplification. The assumption that experts rate risks within their own area as lower than the public does also suggests that the experts might regard actors within their own sphere of work (e.g. research institutes or governmental agencies) as giving the risks an appropriate level of attention. As a consequence, it can be assumed that the respondents to a larger extent will indicate actors outside their own organizational belonging as responsible for neglecting or over-emphasizing risks.

Accordingly, a secondary purpose of the paper is to study the actors pointed out as neglecting or over-emphasizing the risks. Can any patterns be distinguished, e.g. are certain actors seen as neglecting particular types of risks and is the identification of responsible actors related to organizational belonging? The anticipated result is that the experts mainly will identify actors other than those with whom they are associated.

Finally, it was also the purpose to study a distinction between promoters and protectors, as suggested by Sjöberg (1991; 1999). According to this typology, experts can have two different roles; that of promoters or that of protectors. A promoter tends to be of the opinion that people are too concerned about risks, i.e. give them too much attention, and aims to reduce these high perceptions of risks. A promoter might compare the risks within his or her domain of competence with alternatives to that particular technology or risk object – by emphasizing the risks with the alternative, his or her own domain is depicted as less risky. Protectors, on the other hand, assume the role of warning people about risks within their field of work – their aim is to make people more attentive to the risks at hand. Which role a group of experts within a particular domain assumes, that of a promoter or that of a protector, might be of great importance for the overall risk assessment and consequently the forming of risk policies in society.

If a domain is dominated by experts acting as protectors, these experts will act to focus the attention in society towards these risks, to direct resources to research on these particular risks and in other ways act to mitigate the risks and increase the awareness of them. One example of a group of experts acting together as a community of protectors is the occupational radon case. In the UK, policy-making

has been very much influenced by the community of nuclear experts (Rothstein, 2003), pointing out the potential threat of radon to human health. This case provides an example of a situation when the opinions of the expert community can have a major influence on the forming of risk policies and risk communication.

In theory it ought to be possible to distinguish various domains that are dominated by either promoters or protectors, e.g. health domains might be seen as dominated by protectors while technological areas are more dominated by promoters. Reality is however more complex and the differences between promoters and protectors are more subtle than this and it is not only a case of experts protecting people versus promoting technologies. Quite frequently controversies and differences in opinions can be found among experts within one and the same domain. Even though experts have the same knowledge and access to the same data they may reach diverging conclusions. This may be due to different approaches to the risk assessments – what factors should be taken into consideration? Another reason may be different evaluations of the benefits that are associated with the risk object. If the benefits are seen to outweigh the risks, an expert (in this case a promoter) may put more focus on them and play down the actual risks.

Furthermore, the position of an expert (of promoting or protecting) may also depend on his or her organizational belonging. An expert on pesticides, for instance, may assume the role of protecting people against the pesticides and informing about the side-effects if he or she is an associate of Environmental Protection Industry. As an employee of a producer of pesticides the situation might be different – still trying to minimize risks and side effects the expert may promote the use of the pesticide and put more emphasis on the benefits of its use. Which group of experts, promoters or protectors, dominates a certain field is likely to influence the debate on risks in society.

## ***Method***

### **Questionnaire**

Data were collected by means of a questionnaire sent to a group of about 600 professionals in the autumn of 2000. The respondents were given two open-ended questions<sup>ii</sup> asking them to state up to five risks in society that in their opinion received too much and too little attention respectively. These questions were given without any particular instructions – e.g. regarding domain of risks or the definition of society – and this was done intentionally in order not to direct the respondents too much in their answers.

As a follow-up to the open-ended questions, the respondents were also asked which actor(s) they believed were responsible for the inappropriate level of attention given to each of the identified risks. They could choose one or more

actor(s) from a list of alternatives (the media, government agencies, the public, politicians, private corporations, and researchers) for each of the risks they had identified in the open-ended questions. The purpose with this question was to get an overview of which actors were identified as neglecting or over-emphasizing the risks and to enable an analysis of differences between categories of risks. Furthermore, the purpose was to test the assumption that experts above all would regard actors outside their own organizational belonging as responsible for the inappropriate levels of attention.

Using a questionnaire for this type of study is only one of many possible ways to study risk perception – other methods that have been used, e.g., to generate ideas about possible future risks and threats, are hearings, informal meetings, and scenario exercises (Eriksson, 2001). Naturally the various methods have their advantages and disadvantages (Sjöberg, 2000b). The present study aimed to reach a large number of respondents and representatives from a large variety of domains and, in addition to the questions mentioned above, the survey contained risk perception ratings measured on scales that have been used in a large number of earlier studies carried out at the Center for Risk Research, see e.g. Sjöberg and Fromm (2001). With this in mind, a questionnaire was the method best suited for these purposes of the present paper.

## **Respondents**

Determining whether or not someone is an expert is an issue that has been frequently discussed in literature. In prior research on experts and expertise, various approaches have been used to identify experts, e.g. on the basis of the number of years of experience within the relevant field, discrimination ability, and consistency, see e.g. Shanteau et al. (2002). It was considered more fruitful, for the purposes of the present study, to approach the issue of expertise more broadly. The method used is most similar to that of social acclamation (Shanteau et al., 2002) where identification of experts depends on people working in the field, i.e. who do they consider being an expert? In the selection of respondents only one criterion was used, namely that the expert, or maybe more appropriately the experienced professional, was considered as such within a major official organization. The names of the experts were obtained by contacting, over the phone, governmental agencies, regulatory bodies, and non-government organizations (e.g. the Swedish Risk Academy) who had risk and safety issues within their domain of authority or interest. The people contacted were given information about the purpose of the study and asked to provide names of people in their domain whom they considered as being an expert.

The questionnaire was sent to a total of 639 respondents. A response rate of 67.2% was achieved after two reminders.<sup>iii</sup> Among the respondents, 77.5% were male and the median age was 55 years. The four most common orientations of the respondents' domains of expertise were health and biology (31%), technology and

engineering (20%), natural sciences and mathematics (18%), and social sciences (16%) across the whole sample. Whereas male respondents were most often oriented towards natural sciences and technology in their education, women were more often oriented towards health and social sciences.

One measure of expertise that is frequently used is number of years of working experience within the relevant domain; see e.g. Andersson (2001) and Shanteau et al (2002). The respondents in the present study had extensive experience within their respective domains – the median number of years of working experience was 25. Almost all of the respondents had university education (94%) and half of the sample (50%) had postgraduate education – there were no major gender differences in this respect.

### **Categorization of identified risks and domain of expertise**

The risks given in the open-ended questions were categorized into thirteen different categories: chemicals, crime, energy production, environment, food, health issues, lifestyle, local accidents, the media, natural disasters, radiation, society/economy, and transportation. There was also a fourteenth category labeled “other”, for risks not fitting into any of the above mentioned categories. The work of categorizing the identified risks was mainly done in connection with the work on a co-authored article (Sjöberg et al., in press). Discussions were held about the resulting categories and any disagreements were solved until everyone was satisfied with the result. The categories are based on the sources of the risks, and to some extent its primary effects, and can be said to correspond to a common sense notion of to which categories the identified risks belong. For example, radiation risks constitute a separate category, but the risks are also relevant for health and environmental issues. The risks are entangled into many different areas and there probably are as many ways to categorize the risks as there are identified risks. However, the method used was deemed most appropriate for purposes of the present study.

A few of the main categories require some clarification as to what risks they include. The categories lifestyle risks and health issues are closely related. The former category consists of risks that can be related to a person’s way of life – the use of alcohol and nicotine to give a couple of examples. These risks are of a more voluntary nature than risks categorized as health risks – most people are aware of the risks of alcohol and cigarettes but still choose to take these risks. Health risks on the other hand, can be risks related to the use of pharmaceuticals, deficiencies in the health care system, or the risks of catching infectious diseases just to mention a few examples. Hence, they are not in the same way related to a certain lifestyle. Another category that calls for an explanation is the category of local accidents. Local accident risks include risks the individuals face in their homes or at their workplace, e.g. fires and falling accidents. The category of media risks



include risks posed by the Internet and electronic communication as well as the influence of television and the papers.

The thirteen main categories also have a varying number of sub-categories, e.g. the category radiation includes risks related to Swedish and foreign nuclear power, domestic and foreign nuclear waste, natural background radiation, and radon, just to give a few examples. For reasons of clarity and simplicity, only the main categories will be used in the analysis of the results. The respondents were coded according to domain of expertise based on their professional affiliations. To the extent possible, the categorization was done in accordance with the categories used for the coding of the identified risks. However, two new categories had to be created (research councils and social science research) since the expertise of the respondents in these categories could not easily be translated into any of the other thirteen domains, but rather touches upon many of the different domains.

Linking the identified risks with the domains of expertise presented some minor problems. It is not always self-evident with which domain a certain risk should be associated – they may in fact be relevant for risk assessments in various domains. For instance, when a risk categorized as radiation is mentioned, e.g. radon risks, it is not only risk experts within the domain of radiation who need to be considered. Radon also relates to other domains of expertise, e.g. health care, as people might get sick when exposed to radon, or as a risk to be taken into account for construction firms – building houses requires taking the issue of radon into consideration. The problem was circumvented by adding an alternative analysis. The identified risks of the respondents were then, on a case by case basis, reviewed to decide whether or not they were within the domain of expertise of the respondent.

## ***Results***

### **Identified risks**

A total of 1248 risks were brought up by the respondents in the open-ended question about over-emphasized risks – and only a few more, 1331, were mentioned when asked about neglected risks. Among the over-emphasized risks (see Table 1), three categories accounted for over half (59%) of the total – these categories were radiation, health issues, and environment. Adding three more categories (transportation, food, and socio-economic risks) to this list results in a total of 81% of all the risks regarded as over-emphasized.

Table 1: Identified risk categories\*

Over-emphasized risks	%	Neglected risks	%
Radiation	37	Lifestyle risks	19
Health issues	12	Socio-economic risks	15
Environment	10	Environment	13
Transportation	8	Transportation	12
Food	7	Radiation	9
Socio-economic risks	7	Health issues	8
		Chemicals	5

\*The table gives the most common identified risk categories, as a percentage of the total number of identified risks.

Four risk categories accounted for 59% of all the risks identified as neglected risks (see Table 1). The categories were lifestyle, society/economy, environment, and transportation. Incorporating three more categories (radiation, health issues, and chemicals) results in a total of 81% of the risks mentioned. A comparison between the top-halves of the two groups (over-emphasized and neglected risks) showed that only one category appeared in both groups – environment risks. However, a comparison between the top 80% in the two groups showed that the risk categories were, with a few exceptions, identical. Nonetheless, the category of food risks was unique for over-emphasized risks, while lifestyle risks and chemicals only appeared in the top 80% of the neglected risks.

Even though a generic category was identified as both neglected and over-emphasized there were in many cases differences on a more detailed level. For example, radiation risk was the number one risk category mentioned as an over-emphasized risk. At the same time, it quite frequently appeared on the list of identified neglected risks. This can be explained by differences among the various subcategories – the individual subcategories were primarily defined as *either* over-emphasized *or* neglected. For instance, radon risks were mentioned about four times as often as a neglected risk than as an over-emphasized risk. For a more detailed discussion, see Sjöberg et al (in press).

### Domain of expertise

It was hypothesized that experts to a greater extent would identify risks within their own domain as over-emphasized rather than as neglected. This hypothesis is based on the assumption that experts rate risks within their own domain of expertise and responsibility as lower than lay-people – a finding reported in prior studies, for instance Sjöberg et al (2000).

The most common field of expertise was radiation (16% of the respondents belonged to this category) while health issues (15%) and social science research (15%) were second-most common. Other large groups were experts within the domains of environment (11%), local accidents (7%), transportation (7%), and

chemicals (6%). Gender differences could be observed as men were more represented in the areas of radiation (18% compared with 8% for women) and transportation (8% compared to 1%). Women on the other hand were more represented in domains related to health and lifestyle issues (24% and 7% compared with 12% and close to 0% for men in the areas of health and lifestyle).

To assess whether or not the respondents had identified risks mostly within their own domain of expertise, or if they had been more diversified, cross-tabulations of all the identified risks and the categorizations of expertise were analyzed.

Radiation risk was the category most respondents believed had received too much attention – it was the number one over-emphasized risk across all domains of expertise. A large majority of the respondents mentioned risks within their own domain, although to a varying extent – between 13% and 58% of the risks they identified as over-emphasized were within their own domain of competence. The only exception was experts within the fields of lifestyle risks, local accidents, the media, and energy production (the two categories of lifestyle risks and the media consisted of fewer than 10 respondents each). In addition, although the respondents working within a field related to lifestyle risks did not mention risks within this particular category, they often did mention health issues that in many cases are closely related to lifestyle risks.

There was no particular risk category that dominated the identified neglected risks. The risk category that was mentioned most often was that of lifestyle risks – a total of 18% of the neglected risks belonged to this category. It was not, however, the number one mentioned risk across all domains of expertise, even if it in most cases was placed among the top three risks. The results show that, as was anticipated, the respondents identified risks within a wide array of domains and not above all within their own sphere of expertise.

A comparison of the identified risks by men and women showed some differences, although to a large extent they identified the same risks. Regarding the over-emphasized risks the most striking differences were that men identified radiation risks and environment risks more frequently than women did. In contrast, women identified health-related risks more frequently as over-emphasized. With regard to the neglected risks, the gender differences were smaller and it was above all socio-economic risks that differed – a category men indicated more frequently as neglected.

To circumvent a possible problem of risks overlapping several domains, an alternative approach was used in addition to the cross-tabulations. On a case by case basis it was decided whether or not a risk was within the domain of expertise of the respondent. With this approach, the results showed that, overall, as many as 69% of the identified neglected risks and 58% of the identified over-emphasized risks were unrelated to the respondents' domain of expertise. On the average, 40%

(median 40%) of the risks a respondent identified as over-emphasized fell within his or her domain of expertise, compared to only 32% (median 20%) for risks identified as neglected. The big difference between the mean (32%) and the median (20%) for the neglected risks may be worthy of a comment. The difference is due to the many cases of respondents not identifying a single risk within their own domain of expertise as neglected which resulted in a skewed distribution – hence the difference between median and mean. Overall, 17% of the experts did not identify a single risk within their own domain of competence (neither as neglected nor as over-emphasized). Distinguishing between over-emphasized and neglected risks, 33% of the respondents identified over-emphasized risks exclusively in domains *other* than their field of work compared to 42% for the neglected risks. These results are in line with the more coarse analysis of risks and domain of expertise according to categories and show that the respondents did not identify risks exclusively within their own domain of expertise. Furthermore, the results suggest that the respondents were more inclined to indicate risks within their own domain as over-emphasized rather than as neglected, supporting the proposed hypothesis.

The finding that respondents indicated, albeit to a very limited extent, that risks related to *alternatives* to the risk object within their domain were neglected, is in line with this argument. For instance, experts within the field of air transportation might identify risks related to train transportation as neglected. The observation of identifications of risks within one's own domain as over-emphasized and related risks as neglected could reflect a wish from the experts to promote the technology or domain for which he or she is a representative. To continue with the hypothetical example of the expert on air transportation emphasizing risks of train transportation and/or suggesting that risks related to aviation are getting too much attention – this can be seen as a way to promote air transports, to stress the advantages and play down the risks of this particular technology. A more detailed discussion of promoters and protectors follows.

### **Promoters and protectors**

In order to examine the differences between promoters and protectors in the sample of the present study, the respondents were divided into four different groups based on which risks they had identified. The first group consisted of the respondents who indicated risks within their own domain only as over-emphasized (and not as neglected) and the second group consisted of those who identified risks within the own domain only as neglected. The third group was made up of respondents identifying risks within their own field of work both as over-emphasized and neglected and the fourth group was made up of those who only identified risks outside their own domain, both as neglected and over-emphasized. For some groups of professionals it was more difficult to determine which risks fell within their own field of work and hence, they might to a greater

extent have been placed in the fourth group, identifying risks outside their domain of expertise. This is true for both over-emphasized and neglected risks though, and can be assumed to have had an equal effect on both promoters and protectors. Speaking in terms of promoters and protectors, the first group will be denominated promoters and the second group protectors. This is a somewhat rough and simplified version of the categories of promoters and protectors, but will be sufficient for the purposes of the present paper.

One difference between the two groups was the orientation of the respondents' studies (see Table 2 for background data of the experts). The group of promoters was more oriented towards technology and natural sciences, and less oriented towards social sciences than the group of protectors. With respect to age, gender, and number of years of working experience within the relevant domain the two groups were quite similar. Another difference was found regarding the level of education, as the promoters had a slightly higher level of education.

Table 2: Demographics of the respondents

	Entire sample (n = 393)	Promoters (n = 72)	Protectors (n = 47)
Age	55 years	55 years	56 years
Men	77.5%	77.5%	76.6%
Women	22.5%	22.5%	23.4%
Years of work	25	25	25
University education	94%	92%	87%
Postgraduate education	50%	46%	45%
Orientation of studies			
Health & biology	31%	30%	30%
Technology & engineering	20%	23%	13%
Natural sciences	18%	32%	19%
Social sciences	16%	7%	17%
Domain of expertise			
Radiation	16%	38%	-
Environment	11%	15%	17%
Transportation	7%	6%	17%
Local accidents	7%	6%	15%
Society/economy	5%	3%	9%

Approximately 38% of the promoters were radiation experts, compared with about 16% in the whole sample and none in the group of protectors. The protectors were, on the other hand, more represented in the domains of transportation (17%), local accidents (15%), and society/economy (5%) – compared to 6% (transportation), 6% (local accidents), and 3% (society/economy) for the promoters.

The experts were also coded in accordance with which of the six actors they were associated with. Among the promoters, 59% were associated with government

agencies, 13% with private corporations, and 28% were researchers. In this respect there were noticeable differences between the groups, as 22% of the protectors were researchers, as many as 74% worked within government agencies and only 4% were associated with private corporations.

### **Risk perception ratings**

The notion of promoters and protectors suggests that there might be differences in the way the two groups perceive risks in general. The promoters can be expected to give risks lower ratings than the public – they point at the advantages of the technology within their own domain of work and play down the risks. The protectors on the other hand are of the opinion that the risks related to their field of expertise have not been given enough attention, implying that they would rate these risks higher than lay-people. A comparison between promoters and protectors can be hypothesized to result in higher ratings given by the protectors. In order to test the validity of this assumption, the risk judgments given in the survey for a wide array of risks (including, e.g., smoking, drinking alcohol, nuclear power, and crime) by protectors and promoters respectively were compared.

In the survey the respondents were asked to rate a number of risks both for themselves personally and for people in general. Prior studies have found that women tend to rate risks as higher than men do (Finucane et al., 2000; Flynn et al., 1994; Sjöberg & Drottz-Sjöberg, 1993). Comparisons between the risk ratings by men and women in the whole sample showed that although there were some gender differences in line with prior research, only a few of these differences were significant. However, the gender distributions among the protectors and the promoters were very similar, and the small gender differences found can not be assumed to have any major effect on a comparison between the risk ratings by these two groups.

The risk ratings of the protectors and the promoters were compared and overall, with but a few exceptions, the protectors gave somewhat higher risk ratings than the promoters both for personal and general risk. Since the tendencies were the same for personal and general risks the focus will, in the following, be on the latter. See Figure 1 for the general risk ratings of the promoters and protectors on selected risk. An independent sample *t*-test of the standardized values compared the two groups' ratings and it was found that some of the ratings were significantly different (see Table 3).

Figure 1: Selected risk ratings of the promoters and the protectors

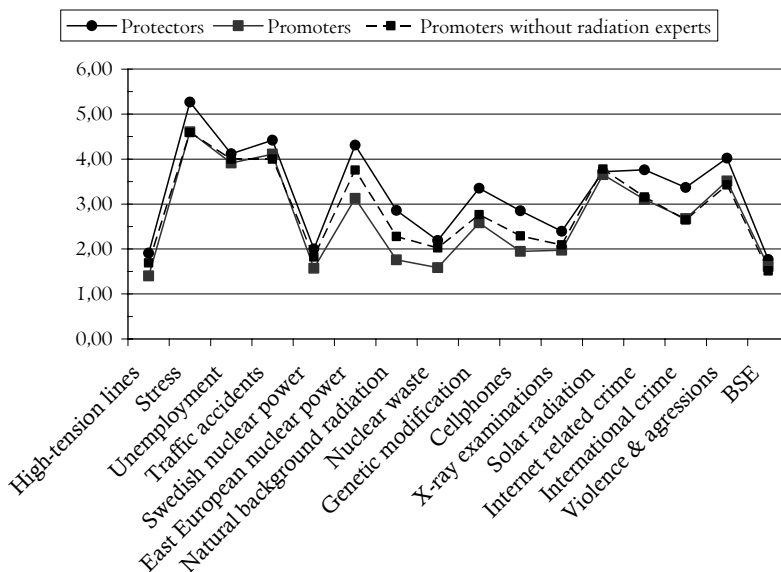


Table 3: Mean differences in risk ratings

	t (df)	p	Mean differences*	Std. error of variance*
High voltage lines	-2.28 (114)	0.024	-0.43	0.19
Stress	-3.09 (114)	0.003	-0.59	0.19
East European nuclear power	-3.64 (115)	0.000	-0.72	0.19
Natural background radiation	-3.43 (110)	0.001	-0.73	0.21
Nuclear waste	-2.11 (112)	0.037	-0.42	0.20
Genetic modification	-2.12 (101)	0.037	-0.46	0.22
Cellular telephones	-3.26 (116)	0.001	-0.62	0.19
Internet related crime	-2.54 (115)	0.013	-0.45	0.18
International crime	-2.56 (115)	0.012	-0.49	0.19
Violence	-2.11 (116)	0.037	-0.38	0.18

\*Standardized values are reported.

Many of the risks with significant differences in mean ratings were related to the area of radiation. An explanation that is close at hand is that almost 38% of the promoters were radiation experts (compared to no radiation experts among the protectors) coupled with what is known from prior studies (Sjöberg, 2000a; Sjöberg & Drottz-Sjöberg, 1994), that radiation experts tend to give lower ratings of risks within their own sphere of work. To test the assumption that the

differences in mean ratings of radiation risks depended on the presence of radiation experts, these were excluded from the group of promoters and the risk ratings were again compared with *t*-tests. This time only four risks displayed significant differences in means: stress, Internet related crime, international crime, and violence (see table 4). The result confirms that domain of expertise was part of the explanation of the differences in risk ratings between promoters and protectors. This element does not, however, explain all the differences in the risk ratings between the two groups. These differences need to be explored further, with a more explicit distinction between promoters and protectors.

Table 4: Mean differences in risk ratings

	t (df)	p	Mean differences*	Std. error difference*
Stress	-3.04 (87)	0.003	-0.61	0.20
Internet related crime	-2.04 (89)	0.044	-0.41	0.20
International crime	-2.57 (89)	0.012	-0.51	0.20
Violence	-2.37 (89)	0.020	-0.45	0.19

\* Standardized values are reported.

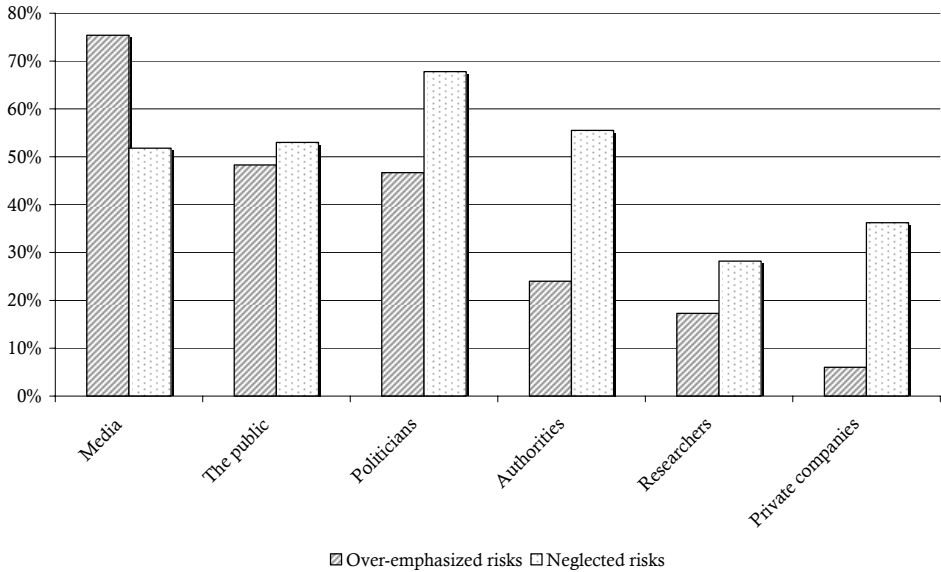
## Actors

The social amplification of risk framework discusses the roles of amplification stations (Kasperson et al., 1988), actors in society whose acts may attenuate or amplify the social awareness of risks. In line with this framework, the respondents in the present study were asked to associate each risk identified with one or more actors in society they believed were responsible for the inappropriate level of attention. The respondents could choose from a list of six actors (politicians, government agencies, the public, the media, researchers, and private companies) and were asked to indicate one or more of the actors as responsible for the inappropriate level of attention.

The actor mentioned most frequently in connection with over-emphasized risk was that of the media, which was mentioned in about three quarters of the cases, see Figure 2. Politicians (47%) and the public (48%) were other actors mentioned frequently. At the same time, politicians were the group of actors mentioned most frequently to be neglecting the risks; they were mentioned in 68% of the cases. Governmental agencies, the public and the media were seen to be responsible for neglecting the risks in about half of the cases. Private corporations were not seen to be over-emphasizing the risks (only mentioned in about 6% of cases), but were mentioned for over one third of the neglected risks. Researchers were also mentioned to a higher extent when looking at neglected rather than over-emphasized risks (28% as compared to 17% for the over-emphasized risks).



Figure 2: Identified actors (% of cases)



In order to analyze whether the identified actors varied over categories of risks, cross-tabulations between identified risks and actors have been analyzed. On the whole, the pattern among the individual risk categories was similar to that on the general level – the media was the actor most frequently mentioned while the public in almost all cases was the first runner-up.

For the neglected risks, there was no actor that stood out as the media did with respect to the over-emphasized risks. Lifestyle risks was the category most frequently mentioned as being neglected – in this particular case the public was mentioned in about 62% of the cases, while politicians (57%) and governmental agencies (49%) came close behind.

The identification of responsible actors did not seem to be related to the respondents' domain of expertise since there were no major differences among the various groups of experts as to which actors they identified. All experts irrespective of their domain of competence identified more or less the same actors as responsible for the inappropriate attention.

It was hypothesized that the respondents would identify other actors as responsible for the inappropriate level of attention, rather than the actors with which they themselves were associated. In other words, that, e.g., experts within governmental agencies would indicate above all the other five types of actors

(politicians, the public, the media, researchers, and private companies) as responsible for the inappropriate level of attention rather than giving governmental agencies the blame.

In order to test the assumption that the experts identified actors other than those within their own organizational belonging, the respondents were coded in accordance with which actor it was associated. The outcome was that 53% were associated with governmental agencies, 10% with private corporations, and 37% were researchers. The three groups did not differ very much with respect to which actors they identified. In almost all cases, however, they did not identify the organization with which they were associated quite as frequently as the other experts. These differences were very small however, and the hypothesis found only little support. There were no major differences between the over-emphasized and the neglected risks.

## ***Discussion***

In the forming of risk policies and risk regulation input comes both from, among others, the technical expertise and representatives from the public. Rothstein discusses the possibility of an opinion-responsive government (2000) – a government that strives to act in accordance with public opinion. Whenever there is a gap between the opinions of the public and the preferences of technical and policy experts, the government has to focus attention on managing this gap.

The traditional view on experts' risk perception is that it is rational and more accurate than the perceptions of the public – a view that is now being challenged. Studies show that with respect to veracity, experts are only slightly more accurate than the public in their judgments of magnitudes of risk (Sjöberg, 2002; Wright et al., 2002). The perceptions of experts are also affected by various biases and vested interests. Studies within regulatory toxicology show that in risk assessments of chemicals, domestic epidemiological results were given more influence than foreign results (Rudén, 2001). The present paper provides further development of the studies on biases in experts' risk perceptions, attention to risk and the different roles of experts in society.

The results show that the respondents identified risks within quite diverse domains and not exclusively within their own domain of competence. The number one over-emphasized risk was radiation risks across all domains of expertise – followed by risks related to health issues and the environment. Among the neglected risks lifestyle risks were mentioned most often, followed by socio-economic and environment risks. A closer look at the list of neglected and over-emphasized risks showed that there were some similarities between the lists. Not only can this be due to differences on a more detailed level of categorization – the similarities may also be explained by differences in opinions among experts. It is possible that whereas one expert believes a risk deserves more attention, another

expert within the same domain is of the opinion that it has already been given too much attention.

How experts within the same domain with, supposedly, the same knowledge and information at hand can come to opposite, or at least strongly diverging, conclusions is not only an intriguing but an important question. Recent studies within the field of regulatory toxicology show that there are differences in how risk assessors interpret the same primary data (Rudén, 2001), differences that are quite small but that may have major influence on the overall risk assessment of the chemical substance in question. This is but one example of the different roles experts can assume and the importance this may have on risk policies in society.

The expertise of the respondents in the present study covered a wide range of different domains. Hence, another plausible explanation of the similarities between the list of over-emphasized and neglected risks may be that experts have identified risks that are not related their own domain of expertise. If this is the case it is less surprising that the respondents have differences of opinions regarding what risks deserve more or less attention. Then it would not have to be the case that experts within the same domain have diverging opinions about risks, but rather that the respondents view risks outside their domain of expertise as neglected or over-emphasized. The differences in evaluations of the attention to the risks by the various experts could then, to some extent, be explained by variations in knowledge and access to data.

In our previous paper (Sjöberg et al., in press), the identified risks were also compared with risks covered in the scientific literature – the journal *Risk Analysis* was used for comparison. In short, the comparison showed that the risk categories judged by respondents to be neglected (primarily lifestyle and socio-economic risks) in the present study were but seldom discussed in the articles in *Risk Analysis*. The risks regarded as over-emphasized (radiation, health issues, and environment) were quite well covered in the journal, although the focus was more on chemicals and one specific health issue, cancer.

The hypothesis that experts identify risks within their own domain mainly as over-emphasized rather than neglected found some support – on the average, 40% (median 40%) of the risks a respondent identified as over-emphasized fell within his or her domain of expertise, compared to only 32% (median 20%) of the neglected risks. This result is in line with prior studies showing that experts rate risks within their own domain as lower than the public.

Another result of the study pertained to the distinction between promoters and protectors – the different roles an expert can assume. The promoters were identified as respondents who classified risks within their own domain as over-emphasized, and not as neglected. The protectors on the other hand identified risks within their own field of work exclusively as neglected. Comparisons

between the two groups showed that there were some differences regarding orientation of studies, field of work, and organizational belonging. The promoters were more oriented towards technology and natural sciences whereas the protectors were more represented in areas of social sciences. The group of promoters consisted of 38% radiation experts – a group that was not represented among the protectors. In addition, there was a larger share of experts within private corporations among the group of promoters, while the protectors to a greater extent were associated with government agencies. Some differences in risk perceptions could be observed between the groups of promoters and protectors, with a few cases of significantly higher risk ratings among the protectors.

The results warrant further research focused on investigating differences in risk perceptions and processes of risk identification between promoters and protectors. One approach is to focus on a smaller group of experts, within just a few domains of expertise, giving them the task of rating risks mainly within these domains. The experts would then be faced with more specific risks that were clearly related or unrelated to their domain of expertise – risks with high or low ecological validity. Choosing domains, and experts, within markedly separated domains might facilitate the obtainment of more manifest differences between the groups of protectors and promoters. Are certain domains dominated by promoters or protectors, or are both roles present within the represented domains? More explicit boundaries between domains and risks might also help to avoid, to a certain extent, the entanglement of risks into various different fields.

Choosing only a few markedly separated domains and securing an even distribution of experts within these domains will also help to avoid the problem of overrepresentation of specific occupational groups. In the present study 16% of the sample were experts within the domain of radiation and 15% experts on health issues. However, analyses showed that the experts identified risks within various domains so the sampling of the experts in this case did not present a major problem.

In the present study, the question of neglected and over-emphasized risks was followed by a question of which actors in society were responsible for this negligence or over-emphasis. All actors were indicated quite frequently for all the various risk categories but on the whole, more actors were implicated for the neglected risks. A reason for this might be that if you believe a risk is neglected you would rather see that all, or at least a large part, of the actors would pay more attention to the risk. It may be seen as a way to enhance the importance of the neglect. To identify a risk as neglected and not indicate a certain actor as responsible for this neglect, on the other hand, may be regarded as diminishing the importance of the risk or the neglect of the risk. As a contrast, the over-emphasized risks are per se not regarded as that important – and abstaining from indicating an actor may not seem to be as decisive. In addition, there were no differences among the various categories as to who was neglecting or over-

emphasizing the risks. The only actor that did stand out was the media, which in many cases was implicated as giving risks too much attention.

One could raise the question of whether or not the media is the originator of the risk messages, or only act as a mediator for other actors. In the present study the question posed did not allow for a dissection of the different interpretations of the role of the media in the risk communication process. However, it seems likely that in most cases it would be the case that the media is only an agent bringing forward another actor's message, although the message is represented in the way the media chooses. Prior research shows that risk assessors are dissatisfied with the way media portrays risk – that there is a discrepancy between the way risks are reported in the media and the scientifically-based estimates of risks (Belzer, 2001). There is also the issue of what makes a good story that needs to be taken into account. Stories about spectacular risks probably sell more copies than stories refuting the existence of risks. Regardless of the motives and the way in which media portrays risks, it remains clear that they were regarded as the major offender when it comes to over-emphasizing risks. Future studies might take a closer look at the possible interpretations and meanings of over- and underattention – in what ways are the actors giving the risks too much and too little attention? Can distinctions be made between positive and negative attention?

The finding that the attention or neglect of the public was rated on a level close to that of the other actors in society is somewhat surprising, especially with respect to some of the identified risks. Lifestyle risks are of major concern for the individual and a risk that to a great extent can be controlled by him or her. However, risks often come to the attention of the public via the media, politicians, and governmental agencies. If the public neglects certain risks, in a sense this could be due to other actors failing to give the risks the “appropriate” level of attention. The public is not without responsibility or initiative in this respect. There are many examples when members of the public have brought neglected risks to the attention of decision makers, (see e.g. Hood et al., 1999; Lawless, 1977) or pointed at flaws in the risk analyses made by experts (see e.g. Wynne, 1989).

Another result of the study was that the identification of responsible actors was not related to the respondents' domain of expertise. Regardless of their domain of expertise the respondents identified more or less the same actors. In addition, the hypothesis that experts would above all identify actors outside of their own organizational belonging found very little support in the data. As a consequence, the experts have, in a sense, identified themselves, or their own community, as responsible for the neglect or over-emphasis of risks.

This can be related to the comparison with Risk Analysis. The risk issues covered in the journal show that the risks regarded as over-emphasized were well covered in the journal, while the neglected risks were rarely in focus (Sjöberg et al., in press). Do the experts disregard their own personal role in the process of attracting

attention to risks, and believe that other scientists or representatives of governmental agencies are focusing on the wrong risks, while they themselves have a focus on the important issues? The situation is probably more complex than this and it might also be necessary to distinguish what kind of attention a risk gets to increase the understanding of this issue. Both promoters and protectors may publish scientific articles about risks within their domain, or in other ways pay attention to the risk, but the focus and contents would probably be markedly different. In one case they would be playing down the risk, and in the other trying to raise the awareness about the risk.

The present study focused the attention on the community of risk assessment experts. The respondents were above all employed by government organizations and private corporations or active as researchers. Another approach that might be used in future research is to look at promoters and protectors within other communities and organizational belongings than was the case in the present study. Potential groups might be politicians or people active within lobby groups and non-government organizations. These groups and actors may also serve the purpose of broadening the spectrum of actors pointed out as responsible for putting too much or too little emphasis on certain risks in society. This issue could then be connected to the question of importance of organizational belonging. The results of the present study showed that organizational belonging had only limited importance for which actors were pointed out as responsible for the neglect or over-emphasis on risks. The issue might warrant further studies with the aim to investigate whether or not the situation is different in other professional communities or organizations.

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## *Notes*

<sup>i</sup> The study is a part of an interdisciplinary research project with the aim to study neglected and over-emphasized risks in society. A thorough review and analysis of the inventory of neglected and over-emphasized risks is treated in a co-authored article, see Sjöberg, L., Peterson, M., Fromm, J., Boholm, Å., & Hansson, S.-O. (2004). Neglected and over-emphasized risks: The opinions of risk professionals. *Journal of Risk Research*, (in press).

<sup>ii</sup> “State up to five risks that in your opinion have received too much attention” and “State up to five risks that in your opinion have received too little attention.”

<sup>iii</sup> Due to faulty addresses etc., only 585 respondents actually did receive the questionnaire.

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# **PAPER III:**

## **Neglecting the risks of information technology?<sup>1</sup>**

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### **Abstract**

The Internet and electronic communication is increasing in importance in society, and like most activities and technologies, the use of information technology is not free of risk. The present paper focuses on the risk perceptions of the Swedish population concerning the use of computers and, in particular, the use of online computer applications. The results of an extensive empirical study, made in the spring of 1999, are reported and discussed in light of the developments since the study was made. The study showed that attitudes to the use of computers and online applications were very positive. The most pertinent factor in explaining the variance in attitudes was computer interest, but experience also played an important role. A tendency to neglect the risks for one-self was found. Throughout, personal risks were perceived as lower than general risks. Results from the present study show that women were more optimistically biased than men, and risk denial was also negatively correlated with age (i.e. younger people were more optimistically biased). Non-users of online applications were more optimistically biased than users (who still showed optimistic bias). Non-users are described as realistically optimistic, as they are less exposed to the risks on the Internet than the users. Among the users of online applications, level of experience of the use of the Internet and e-mail was not related to the level of optimistic bias. Exposure to risks on the Internet, measured by how often various applications were used on the Internet, was correlated with risk denial – less frequent use of services on the Internet was related to stronger optimistic bias.

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<sup>1</sup> This is a revised version of two previous papers; Sjöberg, L., & Fromm, J. (2001). Information technology risks as seen by the public. *Risk Analysis*, 21, 427-441; and Truedsson, J., & Sjöberg, L. (2000). Information technology and risk perception in Swedish society. In M. P. Cottam, D. W. Harvey, R. P. Pape & J. Tait (Eds.), *Foresight and precaution* (pp. 49-56). Rotterdam: Brookfield: A.A. Balkema.

## ***Introduction***

When the 1990s drew to an end, Sweden was one of the most “connected” countries – measured as the share of users of personal computers, the Internet, and mobile telephones in the population (Holst, 2001). In the late 1990s, when the data of the present paper was gathered, about half of the Swedish population had access to a computer in their homes (Statskontoret, 1999). Online access (at work or in their homes) was reported by 51% of the Swedes – almost a third had access to the Internet in their homes (Statskontoret, 1999). Today computers and Internet access is available in about 80% of the Swedish homes (SCB, 2004).

Information technology has become an integrated part of the everyday life of many people. Communicating with friends and new acquaintances, ordering consumer goods, and doing one’s bank errands over the Internet is no longer anything extraordinary. Lately, the gap between different groups in society has decreased with respect to online access: the growth rates have been highest in groups that previously had a low portion with Internet access (IT-kommissionen, 2002). However, there are still differences between different groups in society. Internet access was most common among the younger age groups (16-24 years), where 90% had access to the Internet. In the oldest age group (55-74 years) about 60% had online access. The increased level of Internet access among the Swedes also entails an increasing importance of electronic communication. Nowadays, it is possible for citizens to manage their contacts with many governmental agencies over the Internet. Within the public administration there is a discussion of the “24/7 Agency” (Statskontoret, 2000) – a vision that rests upon the value of e-governance and an ambition of making the most of the new technologies. For example, it is possible to submit an electronic tax return form over the Internet. In 2005 over two million Swedes submitted their tax return forms electronically, an increase with almost 100% compared to the previous year (Andersson, 2005b).

Like most activities and technologies, the use of information technology is not free of risk. There are concerns about how the increased level of “e-communication” between citizens and governmental agencies will affect the provision of “traditional services” with physical/personal services (Olsson, 2003). In this respect, not only users of online computer applications are at risk. Several of the other risks related to the increased importance of electronic communication and the Internet can affect both users and non-users, e.g. the publication of personal information on the Internet can pose a threat to personal integrity. With this in mind, it is of interest to study the attitudes and risk perceptions of both users and non-users of computers and the Internet. Risk perception has been proved to have some influence on technology attitudes. Prior research shows that technology attitudes to a larger extent are explained by the perception of the related risks rather than its benefits (Sjöberg, 1999; Viklund, 1999). This does not indicate that

people are not aware of the benefits, although it is not the major force forming the attitude towards the technology.

For risk policy, e.g. the demand for risk mitigation, risk to others has been found to be more important than risk to oneself (Sjöberg, 1996b). Although people readily acknowledge that other people are at risk, the tendency to neglect or underestimate risks for oneself is well-documented, see e.g. Weinstein (1980) and McKenna (1993). People are optimistically biased about their own future in comparison to the future of their peers. Denial of personal risk may be detrimental to precautionary actions taken to mitigate risks – why try to reduce a risk if not applicable to oneself? Optimistic bias is often assumed to be related to perceived control over the actions (McKenna, 1993) and has mainly been studied in relation to health-related risk, e.g. smoking and consumption of alcohol.

Since the importance of information technology is likely to increase even more in the future, it is important to look at the perception of risks related to this field. It is the purpose of the present paper to look into attitudes and the perceptions of risks related to computer use and, especially, online applications. What role does perceived risk play in determining attitude towards the use of the Internet and e-mail? Are there any differences in the perception of risks to others and risks to oneself? These are some of the questions that will be discussed in the present paper. The central theme of the paper is an empirical study that investigated the attitudes and perceptions of the Swedish public.

## ***The risks of information technology***

### **Risks of electronic communication**

E-mail and other forms of computer-mediated communication replace spoken communication more often than they replace written communication. Spoken and written language have certain differences (Edenius, 1997) which may pose a risk of unclear communication when replacing spoken communication with, e.g., e-mail (Kiesler, 1986; Weisband & Reinig, 1995). In short, these differences amount to dramaturgical differences and a lack of feedback in verbal messages – neither facial expressions nor the tone of a person's voice can be interpreted and, hence, misconceptions are much harder to correct (Adrianson, 1987; Kiesler et al., 1984). While using the technology a sense of privacy can often be created, since the user is normally alone with the computer. Social conventions might be forgotten and misunderstandings in communication come as a result. The sense of privacy may be treacherous in another sense. The same issues regarding electronic communication were discussed as early as the 1980's. The results from an early Swedish study of computer-mediated communication (Adrianson & Sjöberg, 1980) demonstrated both the above-mentioned threats to personal integrity as well as the risk of hurting remarks and misunderstandings caused by written

communication. The difference with the current situation is that electronic communication now is available to a much greater number of people.

### **Social and psychological risks**

There are many possibilities to meet other individuals in social interaction on the Internet, e.g. chat rooms, news groups, and Multi-users Dungeons. What they all have in common is the fact that people who use them have the choice to appear without real social presence and they do not have to reveal their true identity (Murray, 1996; Turkle, 1997). In these social arenas the participants can create their own characters, environments, and realities without having to deal with the consequences of their actions in real life. In the mid 1990s, Young introduced the concept of Internet addiction (Young, 1999). Data showed that individuals addicted to the Internet, to a larger extent than other users, communicated in arenas providing anonymity (Young, 1996, 1998). Young suggested that in the cases when the user becomes addicted to the Internet, there is a risk that the Internet will replace real-life relationships. Use of the Internet has also been related to inter-personal skills and emotional intelligence. In a recent study, frequent users of the Internet were found to be lonelier than low-frequency users and to express more deviant values (Engelberg & Sjöberg, 2004). In addition, high-frequency users had less balance between work and leisure and somewhat lower emotional intelligence – although these effects were weaker than for loneliness and values.

Another study pointed at an additional side effect of Internet use, namely depression (Kraut et al., 1998). Results from the study, based on the use of the Internet of 93 families, indicated that greater use of the Internet may lead to a deteriorating social involvement, as well as an increase in loneliness and depression. However, the study is not uncontroversial, and it has received some critical comments regarding both the methods used and the conclusions inferred from it (Rierdan, 1999; Shapiro, 1999; Silverman, 1999).

### **Technical risks with online applications**

The possibility of attaching computer files to electronic messages also puts the user at risk of infecting the computer with various computer viruses (Appelgren, 1995) which can do varying degrees of damage, from allowing unauthorized access to files on the infected computer to destroying the entire hard-drive. There have been major changes and new developments concerning computer viruses since the birth of the Internet. In the beginning, the viruses spread via, e.g. floppy discs (boot viruses). In 1999 the viruses started to spread via e-mail messages (so called e-mail worms) with the result that the virus could travel around the world within a day compared to about one year for boot viruses (Hyppönen, 2005). This was the situation when the present study was made – the papers were full of reports of computer viruses traveling across the world, even forcing major corporations to

close down their networks (Ollevik, 1999; Wahrén, 1999). Since then the Internet has seen the development of the Network worms – viruses spreading via web-sites, reducing the time for a global outbreak to around one hour (Hyppönen, 2005).

A major change in the situation today as compared to the late 1990s is the characteristics and purposes of the creators of viruses and spam. In the early days of the Internet, the hackers used to be teenagers with a huge interest in computers, creating virus and hacking computers system mostly as a pastime and challenge. Today, hackers are not merely motivated by the challenges of getting into computer systems. Hackers also have economic incentives for creating viruses (Danielsson, 2004). There is a lot of money involved in commercial spam and a majority of the spammers are professionals making a living on these activities.

Using e-mail and other Internet applications puts the user at risk of privacy intrusions. While surfing the Internet so-called “cookies” register what sites the user visits. Although not originally created for this purpose, cookies can help companies map out the preferences of the user on the Internet and adapt their marketing services accordingly. In addition to cookies, there has been a development of spyware in recent years – programs that are secretly downloaded from the Internet. When installed on the users’ computer, the spyware gathers information about the users’ Internet habits and forwards this information to external recipients.

Another threat to personal integrity is that the Internet facilitates dissemination of intimate and confidential information as well as unauthorized access to information on the computer and on local area networks (Arnesjö et al., 1998; Neumann, 1995). The existence of servers providing anonymity enhances the risks of criminal activities on the Internet – not only the unauthorized access to information but also illegal copying of computer programs, dissemination of child pornography etc. (Olsson, 1996). Criminal activities quite regularly involve computers and servers in many different countries. The fact that Internet crime is global – using servers and computers worldwide – makes it more difficult for law enforcement to prosecute and convict criminals operating on the Internet.

Since the present study was carried out, the problem with hi-jacked computers (sometimes referred to as “zombies”) has become topical. Computers are infected with a malicious code via e-mail, web-sites, or directly via other computers. This allows the author of the malicious code full access to the computer – often without the owner having any knowledge about the takeover. Groups of hi-jacked computers are assembled in a network which is then used to, for example, launch virus attacks, send spam, or to store illegal material. The network of zombie computers gives the spam or virus attack a much greater impact than if a single computer would be used to launch the attack (Andersson, 2005a).

Shopping on the Internet is becoming increasingly popular (van den Poel & Leunis, 1999), although it involves other risks for the consumer compared with shopping directly in the stores. For example, there is the issue of secure payments and credit frauds on the Internet. The possibility to tap in on electronically transferred information puts the consumer at risk for someone picking up their credit card number (Eller, 1997). A study showed that Internet shoppers were less risk averse than the Internet non-shoppers, were seeking more convenience, and appreciated the freedom of shopping on the Internet (Donthu & Garcia, 1999). Moreover, consumers switching from traditional to online retail channels, perceived lower risks with Internet consumption (Gupta et al., 2004). Both perceived risk and perceived benefit have been shown to be related to the amount and frequency of purchases made on the Internet (Doolin et al., 2005).

Since 1999, new risks have appeared (a few of which have been discussed above) – while others have vanished (like the “millennium risk”<sup>i</sup> – the threat of computers collapsing as 1999 drew to an end). In May 2005 a national campaign was launched in Sweden aimed at enhancing the awareness of the risks with Internet surfing.<sup>ii</sup> The campaign primarily targeted youths (age 10 to 18), private users of the Internet, and small companies. The campaign not only aimed at changing the attitudes, but also to change the behaviors of the Internet surfers in order to create a safer Internet environment. The background of the campaign was the increased level of use of online applications in combination with new risks appearing. One of the risks that has received a lot of attention is “phishing” which can appear in the form of scam e-mails or faked web-sites (Post & Telestyrelsen, 2005). The main purpose of “phishing” is to obtain private and confidential information from the Internet user, such as credit card numbers, or to carry out a theft of identities. Apart from the development of technical risks, frauds and criminal behavior, the importance of the technical development for personal integrity issues has been discussed. Concerns have been expressed that the “war against terrorism” that escalated after September 11 has contributed to the threats to personal integrity and that the constant development of information technology brings about new ways to monitor the citizens (Olsson, 2003).

To sum up, a review of the literature suggests that the use of the Internet and e-mail can expose the Internet user to a number of different risks. These risks can be classified as risks of fraud, privacy intrusion and criminal behavior, technical problems (e.g. viruses), and social and psychological problems (e.g. depression and addiction). It does not seem that the risks facing the users of information technology, and the bystanders, have decreased since 1999 – quite the opposite. Along with an increased use of the Internet with more commercial interests involved – and consequently more economic incentives – the threats have if anything become both more numerous and more sophisticated.



## ***Risk perception and new technology***

It has been claimed that the novelty of a technology is an important factor in the overall perceived risk (Fischhoff et al., 1978), but later work has found that novelty is of marginal importance (Sjöberg, 2000). Factors influencing risk perceptions are specific for each technology and should be studied in their own right. However, perceived risks of a technology have been proved to be more important in forming the attitude than the benefits (Sjöberg, 1999; Viklund, 1999). Hence, it is not hard to understand why new technologies being introduced in society are often met by resistance – people are more focused on the risks than the benefits. A British study showed that technologies associated with high risks were perceived to be low in benefit, and vice versa (Frewer et al., 1998). It was suggested that technologies where the associated risks are outweighed by benefits are more likely to be accepted by the public. The results from the study also showed that the perceived benefits of information technology were rather high compared to other technologies, and the risks were also quite low; hence, according to that line of arguing, public acceptance is more likely. In a recent study, the possibility of replacing a technology turned out as an important predictor for attitudes towards technologies, especially for gene technology where the possibilities to replace the technology were seen as high (Sjöberg, 2002).

Another suggestion to why people resist new technologies is that the resistance is related to the control an individual believes she has over her life (Spacapan & Oskamp, 1990). That is, the more control an individual believes will be lost to the technology, the more negative an attitude will she have. Regarding attitudes towards information technology, a study showed that experience was not, as one might expect, related to perceived control of the computer (Gutek & Winter, 1990). Computer skills, on the other hand, were negatively (although weakly) related to perceived control of computers, i.e. the higher skills a person had the lower the level of perceived control. One explanation is that as the users' skills and experiences increase, the tasks performed on the computer also become more complicated. These more complicated tasks also contribute to a feeling of lost control over the computer. Maybe also increased knowledge brings about increased insights about, for example, the frequent bugs in commercial software which nobody seems to be able to handle. It is questionable, however, if these more skilled users, with a lower level of perceived control, actually had a more negative attitude towards the computers as the findings of Spacapan and Oskamp (1990) would suggest. It could be that influence of perceived control on attitude is more important in the initial phases of accepting a new technology. As a user is becoming better acquainted with the technology, the perception of control may have decreased in importance – as long as the perception of lost control is outweighed by the importance of the benefits.

## **Method**

### **Questionnaire**

In the present study, the Swedish public's attitude towards the use of information technology (specifically the Internet and e-mail) and their perception of the related risks were of interest. For this purpose, a questionnaire was constructed starting off with some questions about the respondents' general attitude towards and experience of the use of computers, the Internet, and e-mail. The survey contained both questions about risks related to the use of information technology and other, non-IT-related risks (e.g. the risks of injuries related to alcohol consumption and smoking). In both cases, the respondents were asked to give ratings of both personal risk and risk to other people (general risk). The risks were rated on 7-point Likert type scales verbally anchored at "non-existent" and "extremely high". Questions regarding trust and demand for risk mitigation were also included. The questionnaire included 128 attitude statements, which were later subjected to factor analysis.

The questionnaire was sent out to a random sample of 1250 people from the Swedish public in March 1999. After three reminders, 844 responses had been received – corresponding to a response rate of 66%. Respondents that indicated they were not the person to whom the questionnaire had originally been sent were deleted and not analyzed, they are consequently not among the 844 respondents. The answers to the questionnaire were anonymous.

### **Respondents**

The distribution of men and women was even, 50% were men, and the median age was 47 years. The respondents had a higher level of education than the Swedish public in general – 28% of the respondents reported having a college education (about 10% higher than the population). However, perceived IT-risks did not correlate substantially with level of education. Correlations between combined indices of personal and general IT-risks were only  $-0.05$  and  $-0.15$  respectively. Hence, the higher level of education in the sample probably does not constitute a serious bias. Correlations between educational level and attitude towards the use of the Internet and e-mail were around 0.3. This finding suggests that the data presented showed a somewhat too positive attitude to be strictly representative of the Swedish population. Overall however, the sample was similar to the population regarding demographics and can therefore be assumed to be representative of the population.

The median time to respond to the questionnaire was 40 minutes. On the whole, the respondents gave the questionnaire a favorable assessment.

## **Results**

### **Prior experience of computers and information about risks**

A majority of the respondents reported having access to a computer, either at their place of work or in their homes. Overall, quite a large number of people had at least some experience of using computers. Almost two thirds of the respondents had used e-mail and the most commonly experienced applications of the Internet were searching for information (59%) and reading daily newspapers (34%). The level of experience was higher for offline use of computers than for online applications. This is not surprising since online applications had been available for a shorter period of time.

A combined index of the respondents' experience with online applications was created and correlated with age and gender. Results showed that both age ( $r = -0.52$ ,  $p < 0.001$ ) and gender ( $r = -0.20$ ,  $p < 0.001$ ) were negatively correlated with online experience. Younger people were more experienced in using the Internet and e-mail, as were men in comparison with women.

The two most common sources of IT risk information were TV (55%) and the daily newspapers (48%). A majority had received some information about the risks, only 18% were uninformed (and only 12% of those with access to a computer).

The respondents were also asked to rate their confidence and trust in IT risk information from various sources. The information from actors without commercial interests (*viz.* commercial interests related specifically to IT) were rated highest in confidence, e.g. TV and radio. The most common sources of information (TV, radio, daily newspapers, and friends) were also among the most trusted ones. Only 14% of the respondents had received information from the most trusted sources – the specialized magazines. Actors with commercial interests, e.g. program and computer vendors, were not common as suppliers of IT-risk information. In addition, they received low ratings in confidence in the information they provided.

The respondents also rated their confidence in the competence of various actors regarding IT-risks. The same pattern is visible here as regarding confidence in the information – actors with commercial interests were less trusted than were the other actors. Program producers were an exception as they received a higher rating of confidence in competence than the Swedish government agencies.

### **Attitudes towards computers**

Over 80% of the respondents held a positive attitude towards the use of computers at work. The attitude to the use of online applications was only slightly less

positive – 70% reported a positive attitude. Respondents were also positive to the private use of computers, both offline and online applications.

In addition to the direct questions of attitude towards computers, the questionnaire also contained 128 attitude statements regarding the use of computers.<sup>iii</sup> These statements were subjected to factor analysis and after using principal axis factoring as initial solution, 13 factors could be retained for rotation (direct oblimin). The factors were selected based on their eigenvalue and amount of variance accounted for (a total of 40%). Among these thirteen factors, eight could be interpreted and measured with sufficient reliability (Cronbach's alpha). The eight factors, listed in Table 1, accounted for 33% of variance.

Table 1: Attitude factors

Factor	Alpha
Computer interest and attitude (14 items) <sup>iv</sup>	0.92
Risk of privacy intrusion (5 items)	0.78
Safety of money transactions on the Internet (6 items)	0.84
Risk of becoming addicted to the Internet (7 items)	0.85
Millennium risks (3 items)	0.70
Skepticism about the general use of computers (6 items)	0.86
E-mail as an instrument for promoting social contacts (5 items)	0.84
Computers socially useful (4 items)	0.67

The factors were estimated by calculating the mean ratings for the included items. The eight factors were then used in regression analyses, in order to attempt to explain variation in the attitude towards the professional and private use of the Internet and e-mail. One set of regression analysis was run for each of the four dependent variables: attitude towards the use of the Internet and e-mail for professional and private use, respectively. Five blocks of predictors were used:

- Demographics (gender, age, educational level, access to computer)
- Risk (combined index of personal IT-risks, combined index of general IT-risks, own risk perception compared to friends, belief about how friends perceived IT-risks)
- Trust (in competence of and risk information from various actors)
- Experience (amount of experience of the use of information technology, own negative experiences of the use of Internet and e-mail)
- Attitudes (the eight factors reported above)

As can be seen from Table 2 below, the five blocks of predictors produced a quite high level of explained variance in attitudes towards the use of the Internet and e-mail, ranging from 0.58 to 0.61. The level of explained variance was about the

same for all four attitudes. All of the five blocks of predictor variables seemed to add new information.

The most important explanatory variable was one of attitude factors, *viz.* computer interest and attitude, which was positively related to the over-all attitudes. The factor had a  $\beta$ -weight ranging from 0.47 to 0.58 and was strongest for the attitude towards the use of the Internet at work. Experience of using IT was also an important explanatory variable, positively related to attitudes to the Internet and e-mail (with a  $\beta$ -value ranging from 0.12 to 0.22). The possibility to promote social contacts through the use of e-mail was positively related to attitude towards the use of e-mail ( $\beta$ -value 0.10). This factor was not an important explanatory variable for the other attitudes.

Table 2: Regression analysis (cumulated  $R^2_{adj}$  values)

Predictors	Dependent variables			
	Internet at work	Internet, private use	E-mail at work	E-mail private use
Demographics	0.235	0.257	0.281	0.293
Risk	0.288	0.346	0.337	0.368
Trust	0.312	0.370	0.355	0.375
Experience	0.394	0.433	0.447	0.444
Attitudes	0.581	0.611	0.589	0.595

Educational level was positively related to attitudes to the Internet and e-mail, although it was not important in the final over-all analysis (except in the case of attitude towards the use of e-mail at work with a  $\beta$ -value of 0.12). Likewise, age was negatively related to the attitudes towards the Internet and e-mail, but was not an important factor in the final over-all analysis. Neither risk nor trust distinguished themselves as important predictors in the final over-all analysis.

### Perception of risk

Overall the mean ratings for IT-risks were relatively low, especially when regarded as personal risks. The risks that got the highest ratings were the risks of getting viruses, via the Internet and e-mail. Then came risks related to personal integrity, monitoring of activities on the Internet and having private and confidential information disseminated via the Internet. The risks of becoming addicted to, or depressed, by the Internet were seen as very small, especially the risk of depression.

Risk research has shown that women tend to perceive risks as higher than men do, see e.g. Flynn et al. (1994) and Sjöberg & Drottz-Sjöberg (1993). Independent samples *t*-tests were made in the present study to test for gender differences. Ratings of general risk were compared and the results showed that women rated

both non-IT risks [ $t = 7.08$  (824),  $p < 0.001$ ] and IT-risks [ $t = 2.95$  (825),  $p < 0.01$ ] higher than men did. Gender differences were greater for non-IT risks.

The top priorities, in the eyes of the respondents, with respect to risk mitigation were to prevent criminal activities on Internet. To minimize the risk of Internet facilitating criminal activities in general received the highest ratings followed by the risks of credit card frauds. The users' personal integrity and risks related to privacy intrusion, e.g. the risk of e-mail messages being distorted and the risk of unauthorized reading of e-mail, was another prioritized area of risk mitigation. It was regarded as less important to mitigate risks related to psychological and social hazards, such as depression and addiction caused by the use of online applications.

The results from the present study support the findings from prior research (Sjöberg, 2003a) that demand for risk mitigation to a higher extent is explained by general risk than personal risk. In all cases general risk ratings had higher  $\beta$ -values than personal risk ratings. However, the level of explained variance in risk mitigation was not very high (a mean  $R^2_{\text{adj}}$  of 0.05). Highest levels of explained variance were obtained for the demand for mitigation of risks of Internet addiction and depression due to online applications ( $R^2_{\text{adj}}$  of 0.12 and 0.11 respectively). Obviously, there are other factors than risk perception influencing the demands for risk mitigation. Other research has given similar results (Sjöberg et al., 2000).

When asked about prior negative experiences related to the use of computers and online applications, 11% reported having some kind of negative experience. The most commonly reported problem was related to general use of computers; experiencing pain in the wrist after frequent use of computers. Apart from this, the most common negative experiences were having the computer infected with viruses via the Internet or e-mail.

Measured across all respondents the most frequent means of avoiding risks with the Internet and e-mail were "passive actions": refraining from using credit cards on the Internet (51%) or refraining from using the Internet (40%) and e-mail (40%) all together. It is difficult to say whether these actions were taken in order to avoid the risks, or mere consequences of the respondents having no experience of, nor being interested in using, online applications. When respondents without experience of e-mail or the Internet were excluded, refraining from paying with credit cards on the Internet (74%) remained the most common means of risk-avoidance. This is in line with the reported priorities of mitigating the risks of criminal activities on the Internet. The second most common measure used to avoid risks among respondents with online experience was using antivirus programs (63%). Not opening unknown files attached with e-mails was another common measure (38%).

A regression analysis was run with a combined index of general IT-risks (i.e. the perception of IT-risks for people in general) in an attempt to explain perceptions of IT-risks. Four blocks of predictors were used:

- Demographics (gender, age, educational level, and computer access)
- Trust (in competence and risk information from various actors)
- Experience (amount of experience of the use of information technology, exposure to risks on the Internet<sup>v</sup>, own negative experiences of the use of the Internet and e-mail)
- Attitudes (the eight factors reported above)

Table 3 shows that the five blocks produced a fairly high level of explained variance in perception of IT-risks. In addition, all the blocks seem to have contributed with some new information, but the most powerful block was by far that of attitudes.

Table 3: Regression analyses for risk (cumulated  $R^2_{adj}$  values)

Predictors	Dependent variable General IT-risks
Demographics	0.021
Trust	0.048
Experience	0.056
Attitudes	0.361

Looking at the  $\beta$ -values and significance for the separate variables, the attitude towards the risk of becoming addicted to the Internet emerged as the most powerful variable. It was positively related to perceived IT-risk ( $\beta$ -value 0.32). Other explanatory variables of interest were attitudes towards the safety of money transactions ( $\beta$ -value  $-0.20$ ), privacy intrusion ( $\beta$ -value 0.15) and millennium risk ( $\beta$ -value 0.12). These variables were significant, but not very strong.

### Risk denial

Overall the personal risks were seen as smaller than the general risk – a finding which has been common in previous research; see e.g. Harris (1994) and Weinstein (1989). This tendency of neglecting personal risk was found for both IT-related risks and for the non-IT risks included in the questionnaire.

As noted above, comparisons of risk ratings between men and women showed that gender differences were smaller with respect to IT-risks. Independent samples  $t$ -tests of optimistic bias showed that women's ratings of both IT-risks [ $t = 4.76$

(821),  $p < 0.001$ ] and non-IT risks [ $t = 6.35$  (822),  $p < 0.001$ ] were more optimistically biased than those of men.

The present survey was sent out to a representative sample of the Swedish population and, hence, it included both users and non-users of information technology. For respondents who never used online applications of computers, or never used computers at all, it is logical that some of the IT-risks were not applicable to them and consequently rated as low or non-existent. They were not as exposed to many of the risks to the same extent as the more frequent users of online applications. However, the ratings of risk for other people ought to be the same, independently of the respondent being a user or a non-user of information technology. Hence, non-users ought to be more optimistically biased in their ratings of IT-risks. Perhaps a more adequate terminology, in this case, would be realistic optimism. Non-users of information technology are less exposed to the risks, in most cases their exposure is probably non-existent. The lower exposure to the IT risks will probably be reflected in their personal risk ratings.

Table 4: Rankings of optimistically biased IT-risks for users and non-users

Users of online applications		Non-users of online applications	
	OB-level		OB-level
Credit card frauds	0.65	Credit card frauds	0.72
Internet-induced depression	0.52	Unauthorized reading of e-mail	0.68
Internet addiction	0.50	E-mail distorted	0.62
E-mail distorted	0.33	Internet addiction	0.60
Unauthorized reading of e-mail	0.31	Misunderstandings in e-communication	0.58
Personal information spread on the Internet	0.29	Mislead information on the Internet	0.57
Mislead information on the Internet	0.23	Personal information spread on the Internet	0.55
E-mail virus	0.21	Internet-induced depression	0.54
Surveillance of Internet activities	0.21	E-mail virus	0.54
Internet virus	0.19	Surveillance of Internet activities	0.53
Misunderstandings in e-communication	0.18	Internet virus	0.52

The sample was divided in two groups based on their use of online applications of computers. Respondents who had indicated that they never used either the Internet or e-mail were coded as non-users ( $n=297$ ). The rest of the sample ( $n=547$ ) were considered users of online applications of computers – although the use of the Internet and e-mail probably varied considerably within this group. The distribution of men and women in the groups of users and non-users was roughly



the same. Independent samples *t*-test between users and non-users showed that the group of non-users had significantly greater optimism than the group of users, both for IT-risks [ $t = 6.39$  (830),  $p < 0.001$ ] and non-IT risks [ $t = 2.91$  (831),  $p < 0.005$ ]. Nonetheless, users of online applications were still optimistically biased in their perceptions of the risks. For both groups the risks with highest level of optimistic bias was the risk of experiencing credit card frauds on the Internet, see Table 4. For non-users of online applications the level of optimistic bias was relatively even over all the risks. However, a somewhat lower level of optimistic bias for the risk of having personal information spread on the Internet may reflect an awareness that personal integrity on the Internet is not only an issue for users of online applications. Even non-users of information technology may be exposed to this type of risk.

The users were most biased concerning credit card frauds, followed by social and psychological risks of online applications. Risk related to personal integrity also displayed an optimistic bias, whereas risk related to technical problems had lower levels of risk denial. Bear in mind that having experienced some form of computer virus was not too unusual among the users of online applications. A recent study on Internet users supports the findings of optimism in the present study. Internet users' perceptions of both positive and negative Internet events were optimistically biased (Campbell et al., in press). However, no bias was found for virus risks. Users were even pessimistically biased about the risks of getting spam or being misled by information on the Internet.

Correlations between level of optimistic bias (for users of online applications) and various variables were computed. Prior negative experiences, level of education, and level of experience of using online applications did not show any significant correlations with risk denial. Age was negatively correlated with optimistic bias of IT-risks ( $r = -0.12$ ,  $p < 0.01$ ) and gender positively correlated with risk denial ( $r = 0.16$ ,  $p < 0.001$ ). A weaker correlation was found between exposure to risks on the Internet (measured by to what extent online applications were used and how often) and risk denial ( $r = -0.09$ ,  $p < 0.05$ )<sup>vi</sup>. Users of online applications tended to be less optimistically biased, the more often they used online applications – or, in other words, the more exposed they were to the risks on the Internet. What measures the individual took to avoid IT-risks did not correlate with levels of optimistic bias for IT-risks (measured as number of reported precautions taken).

## ***Discussion***

The results from the present study showed that the respondents had positive attitudes towards the use of computers, the Internet, and e-mail. Attitude towards using online applications professionally and privately was well explained by computer interest, experience of using information technology, and the possibility to promote social contacts with e-mail. Neither risk nor trust entered as very

important explanatory variables. This result runs counter to prior research referred to earlier which showed that risk is a potent explanatory variable when it comes to attitudes. Public acceptance of a technology has been suggested to be dependent on perceived benefits outweighing the perceived risks (Frewer et al., 1998). That study emphasized the importance of the benefits being tangible to the individual. This notion could help explain why the benefits of information technology seem to be so important in explaining attitudes to use of online applications in the present study. The positive aspects of using the Internet and e-mail (e.g. the possibility to promote social contacts) are not only perceived to outweigh the risks, but are also more tangible and immediate to the user. The immediacy of the benefits is compared to non-tangible negative events that might, or might not, happen in the future.

The existence of acceptable alternatives or replacements is also of importance. Some technologies are replaceable while it is more difficult to replace others. In the case of energy, for example, electricity can be produced by many alternative sources: nuclear energy, solar energy, and wind power to give just a few examples. Electronic devices work equally well with energy from all three sources. Contrary to many other technologies, the use of online computer applications is direct and immediate. Even though the information is the same whether or not it is downloaded from the Internet, or retrieved from a journal in the library, the process of retrieving the information is very different. The Internet involves considerable benefits of speed and immediacy, advantages that the alternative routes of information cannot compete with. In addition, the technology does not only offer applications within one single area – the applications are plentiful and the Internet attracts users with very different requests. Once people have gotten used to the speed and immediacy of using the Internet and e-mail, is there anything that can substitute this technology? Probably not, since it represents such a huge technological development – it has increased the speed and the ease at which information and communication alternatives are available, and at much lower costs. Information processing and communication have been made much easier.

Another difference between the risks of information technology and other technological risks is the level of specificity of the risks. In a study on environmental hazards (Hatfield & Job, 2001), it was found that risks phrased in more specific and personally relevant terms elicited optimistic bias, whereas more generally phrased hazards did not. This might help to explain the optimistic bias in relation to the use of information technology. The possible negative consequences of using the Internet and e-mail were perhaps more specific than is usually the case for technological risks.

The development in the years that have passed since the data for the present paper was gathered has strengthened the picture of general public acceptance of the Internet. Research has been presented that supports the notion that e-mail and, in

particular, the Internet, are seen as difficult to replace (Sjöberg, 2002). Today more people are connected to the Internet and ever more services and features are made available on the Internet. The risks continue to get attention, though, and the list of risks facing the users of online applications does not seem to get shorter, quite the opposite. New risks are constantly appearing – if not in the form of new types of viruses, then in other shapes and forms. In the present study, the risks related to the use of computers and its online applications were not perceived as very high, especially not the social and psychological risks. Electronic viruses contaminating the computer, via the Internet or e-mail, were rated as quite high though, along with risk related to personal integrity.

The demand for risk mitigation was highest for the risk of criminal activities being facilitated by the Internet, such as the risk of credit card frauds. In line with earlier research, general risk proved to be a more important explanatory variable than personal risk. Respondents' precautionary actions were primarily aimed at reducing the risks of credit card frauds and virus infections. It was not prioritized to reduce the risks to personal integrity (i.e. not allowing cookies or using pseudonyms) which is somewhat surprising since these risks were perceived as quite high. One explanation can be that it is quite easy to avoid using credit cards, not opening files attached with e-mails, or to install anti-virus programs. It requires more of an effort from the user to take precautions to decrease the risks of surveillance and other threats to personal integrity. For an inexperienced user it may seem difficult to take precautions to prevent the computer from accepting cookies, or to use special programs that make messages impossible to read for unauthorized people to name a few examples. In addition, it is not possible to safeguard against all risks posed to personal integrity, e.g. preventing others to distribute personal and private information about one-self on the Internet.

Measures to reduce psychological and social risks were taken only to a very small extent. These risks were perceived to be much higher for other people, whereas the risk to oneself was seen as small or even non-existent. Hence, there would be no reason for the individual to protect him- or herself against these particular threats. The tendency to deny risks to oneself, usually called optimistic bias or unrealistic optimism, has often been observed in relation to lifestyle risks such as smoking and consumption of alcohol. It is surprising that perceptions of information technology risks are optimistically biased, since the tendency of unrealistic optimism is usually not observed in relation to technology risks.

The largest difference in general and personal risk ratings was found for the risk of credit cards fraud on the Internet. It is interesting to note that the risk of credit card fraud was the most prioritized risk with respect to risk mitigation and personal measures taken to avoid the risks. This demand for risk mitigation may reflect a belief that it is mainly one's peers that need protection, e.g., in the form of regulations. Over half of the respondents reported that they did not use their credit cards as means of payment on the Internet (and over 70% of the users reported

taking this measure to avoid the risk of credit card fraud). No question was included in the study about what the respondents believed their peers did to avoid the risks of information technology, but previous research has shown that people tend to focus mostly on their own precautions (Hatfield & Job, 2001). The respondents may have failed to consider other people's preventive actions when they rated the risks, which could be one explanation to the lower ratings on personal risk. Failing to acknowledge the precautionary measures other people take may be related to a belief that others are more exposed to the risks and need more protection in the form of risk regulation.

Denial of IT-risks correlated with gender (women being more optimistically biased than men) and negatively with age; younger people were more optimistically biased. In addition, optimistic bias correlated negatively with exposure to risks (measured by how frequently various services and applications of the Internet were used). Quite contrary, recent research on experienced users found that exposure was positively related to optimism (Campbell et al, in press). It should be recognized, however, that no distinction was made between optimism for positive or negative events in that study. Research on optimism and traffic safety has shown that whereas exposure (measured as annual distance on the road) was positively related to perceptions of personal driving skill, there was no significant relation to optimism about negative events (Svenson et al, 1985). This led the authors to conclude that increased exposure, although being related to enhanced feelings of superior driving skill, reduced the respondents' feelings of immunity to accidents.

In the present study, respondents reporting less frequent use of the services provided on the Internet were more optimistically biased. The increased optimism is in line with their lower exposure to the risks. This can be compared to the finding that smokers often are optimistically biased when they compare their personal risks of smoking with other smokers (Waltenbaugh & Zagummy, 2004), although they may not deny that they are more at risk than non-smokers. With the same way of reasoning, users of online applications may acknowledge that their personal risk increases with a more frequent use of services on the Internet. Still, others are perceived to be more at risk, perhaps because of a belief that others are more frequent users of the Internet, and hence more exposed to the risks, and/or not being as prudent with taking precautionary measures as they are themselves.

The non-users of information technology are perhaps best described as realistically optimistic. Although some of the risks with the increased importance of information technology apply to them, their exposure to the risks is much lower than that of the users. They are not exposed at all to some of the risks. Consequently, they are not denying their personal risks; they are merely making realistic risk estimates. Studies on consumption of alcohol and cigarettes confirm this element of realism even when risk estimates per se were optimistically biased (Sjöberg, 1996a). Personal risk estimates increased with increased exposure (an increased level of consumption). Nevertheless, the personal risk estimates were

never much higher than the general risk estimates, illustrating the persistence of optimism.

Attempts to explain variance in the perception of IT-risks resulted in 36% explained variance in the present study. Attitude towards Internet addiction emerged as a fairly important explanatory variable, but the explanatory power of this variable, and the other variables, can be questioned, since they all are closely related to other risks of information technology. In risk perception research, proximal factors have been more common and successful as explanatory factors – more distal factors have only been found to explain very little of the variance (Sjöberg, 2003b). More distal factors tend to be more interesting as explanatory factors, however, and in order to get a better picture of the perceptions of risk of information technology these factors would need to be studied in further detail.

It will be interesting to follow the future developments in the use of information technologies and the related attitudes and risk perceptions. If the present study had been made today, there would probably have been dramatic differences in, e.g., the number of users and reported frequency of use of services on the Internet. Current research is mainly done exclusively on users, often through Web-based surveys; see e.g. Gupta et al. (2004). The present study thus provides a unique contribution as it is was done in a time when many Swedes were still not that familiar with the Internet. Future research will have more difficulties in capturing the perceptions of non-users. It will be interesting to see if the increased use of the Internet and e-mail will be reflected in the perceptions of the related risks. Will the perceived risks of computers and online applications continue to be outweighed by the perceived benefits in the future? Recent research suggests that users of the Internet and e-mail continue to hang on to their beliefs that the risks are other people's concerns – it simply won't happen to them.

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## *Notes*

<sup>i</sup> At the end of the 1990s there was much debate about and preparation for the shift to the 21st century. Concerns were raised about if the computers would survive or simply crash down and the failure of important functions in society would follow, see e.g. (Yourdon & Yourdon, 1997). The problem with computers and microprocessors was the use of six-digit dates (e.g., dates in the format MM/DD/YY) and the expected difficulty in recognizing and processing date information when the year 2000 rolled around. Large amounts of money were spent on preventing the problems, and as the year 2000 came very few incidents were reported.

<sup>ii</sup> See [www.surfalugnt.se](http://www.surfalugnt.se) for more information.

<sup>iii</sup> For example, "There is always a risk that unauthorized people get access to the computer", "The use of e-mail is a time-saver", and "I would never do my bank errands over the Internet as I believe the risks are too high."

<sup>iv</sup> In the analyses below, two items measuring general attitude to computers were added, after standardizing to  $M = 0$  and  $SD = 1$ .

<sup>v</sup> Exposure to risks on the Internet was a combined index of items related to what services the respondent used on the Internet, and how frequently these applications were used.

<sup>vi</sup> When all respondents (both users and non-users of online applications) were included in the analysis, the correlation between exposure and optimistic bias in IT-risks was even stronger ( $r = -0.16$ ,  $p < 0.001$ ).

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# **PAPER IV:**

## **Optimistic bias and economic risks**

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### **Abstract**

This is a study of the perception of economic risks that the individual faces in the course of everyday life. The purpose of the study was to analyze and explain optimistic bias or risk denial in relation to risk perceptions. It is important to gain a better understanding of economic risk denial since it can be assumed to have an influence on economic decision-making and the preventive actions taken by individuals to avoid risks. If economic risk perceptions are optimistically biased and personal risks are denied, what factors can help explain this bias? Participants rated a number of economic risks, both how they perceived the risk to themselves and to other people. Results showed that the perception of all the risks was optimistically biased – in all cases personal risk was, on the average, rated lower than general risk. The respondents believed they were only slightly more in control than other people but that they exerted more of this control, i.e. that they took more precautions to avoid economic risks. Significant correlations were found between optimistic bias and the importance placed on money and age. Changes in the level of level of optimistic bias seemed to be primarily due to variance in personal risk, while general risk ratings were more stable.

## ***Introduction***

Many things that happen in everyday life have economic consequences for the individual – whether it is possessions breaking down or separating from your spouse – creating economic risks and changing the conditions for economic decision-making. Today almost 50% of the savings of Swedish households are invested in stocks, directly or through savings in mutual funds (SCB, 2004). The introduction of the Premium Pension system in 2000, allowing Swedish employees to decide for themselves on how part of state-issued national pension is invested further emphasized the importance of financial markets and instruments to the individual household. This increased responsibility of the individuals also serves as an illustration of the shift that has taken place in many European countries – a shift of risks in the economy from the state and institutional level to the personal level (Lunt, 1996).

The tendency to rate personal risk as lower than general risk, usually referred to as optimistic bias or unrealistic optimism (Weinstein, 1980), has been a consistent finding in risk perception research (Svenson et al., 1985; Weinstein, 1989). Individuals might of course be correct when they estimate their own personal risk as lower than the risks to their peers, and it is difficult to establish whether or not a specific estimate is unrealistic. It would require that the actual risk to an individual is known and compared to his or her risk estimate. Because this is usually very difficult to accomplish, optimistic bias is defined on a group-level (Harris & Middleton, 1994; Hoorens, 1996). It is said to exist in a sample when a majority of the respondents have indicated that their own personal risk is lower than the risk to the comparative target.

The discussion of optimistic bias has mainly focused on health-related risks and behavior; see e.g. Schwarzer & Renner (2000) and Weinstein & Klein (1995). Studies have shown that optimistic bias is present for other risks as well, e.g. the use of Internet and e-mail (Sjöberg & Fromm, 2001) and certain environmental hazards (Hatfield & Job, 2001). However, research on optimistic bias has so far not focused on economic risks. Since private households control a large part of the financial resources in a country, household decision-making processes have important effects on the national economy (Kirchler, 1995). Given that economic decision-making is probably influenced by how people perceive economic risks, it is of interest to study how these risks are perceived. The overall hypothesis of the present paper is that individuals' perceptions of economic risks are optimistically biased.

Research on optimistic bias is often motivated by the hampering effect optimistic bias is presumed to have on precautionary behavior (van der Pligt, 1994). People's perceptions of risks are presumably important for how these risks are managed – optimistic biases can have negative effects on economic decision-making.

Individuals who do not expect negative events to happen to them may engage in risky activities and value economic investments without fully appreciating their risks. Why take personal precautions to avoid a risk if it will only happen to other people?

It has been found that the higher the level of perceived control, the stronger the optimistic bias (Kos & Clarke, 2001; McKenna, 1993; Svenson et al., 1985). People have a tendency to focus on their own behavior and possibilities to exercise control. They are less aware of the actions other people take to avoid risks. Few factors apart from perceived control have emerged as explanatory factors of optimistic bias; see e.g. Harris (1996) and Helweg-Larsen and Shepperd (2001).

Perceived control was included in the present study as a possible explanatory factor to optimistic bias in economic risk perception. Since people have been found to focus more on their own possibilities to exercise control than on control exerted by others, perceived control was rated on two dimensions – personal and general control. Another dimension of perceived control is how this control is managed. The study therefore included a question about what precautionary measures the respondents took, and what measures they believed that other people take.

Extrapolation from the past has also been suggested as a source of optimistic bias – if the negative event has not occurred in the past, it may seem less likely that it will happen in the future. Research has found that prior experience and exposure to risks could weaken optimistic bias (Parry et al., 2004; Weinstein, 1987) although the effect is probably not long lasting. Prior experience was therefore included in the present study.

Economic decision-making is influenced by the beliefs about the economic environment, the expectations and attitudes of the individuals, and their degree of decision freedom (van Veldhoven & Groenland, 1993). Individuals' general economic beliefs also incorporate their beliefs about money – money is clearly not only seen as a means of expressing prices and paying for goods. It carries different meanings for different people (Furnham & Argyle, 1998). Attitudes to money affect how people use money and make economic decisions. There is a large body of research on attitudes to money and several scales have been developed to measure these attitudes, see e.g. Yamauchi and Templer (1982) and Tang (1992). The scales are usually focused on three dimensions: obsession with money, concern over retaining it, and money as a source of power (Furnham & Argyle, 1998).

Risk perception is related to attitudes and both are associated with risk behavior. Attitudes to money have been found to be related to individuals' risk perception; individuals concerned with money rated personal risks as higher (Engelberg & Sjöberg, in press). Hence, attitudes to money and financial risk taking can be

expected to be related to optimistic bias regarding economic risks. Two scales were included in the present study to measure attitudes to money and to financial risk taking: the Money attitude scale by Yamauchi & Templer (1982) and Wärneryd's Investment Risk Attitude scale (1996).

Without a sense of strong self-efficacy many situations may appear as scary and risky (Bandura, 1997). If, on the other hand, the individual has acquired a strong sense of self-efficacy he/she may be better equipped to distinguish between risky and safe situations. General self-efficacy has been related to risk perception in prior research (Källmén, 2000). That study hypothesized that subjects with low perceived self-efficacy would have high perceptions of personal and general risks. No significant differences in risk perception levels were found, however. It is well-known that particularized efficacy beliefs, specific for a certain domain, have more predictive power than general self-efficacy beliefs; see e.g. Bandura (1997). Hence, a scale measuring economic self-efficacy was developed for the present study.

Optimistic bias can be studied using two different formats: direct and indirect. Many studies have used a direct format for measuring optimistic bias, asking the respondents to rate the risks to themselves compared to the risks to their peers. The alternative (the indirect format) is to ask for separate ratings of personal and general risk. Optimistic bias is defined as the difference between these risk ratings and is the method of choice in the present paper. Using the direct method to assess optimistic bias is said to yield stronger optimistic bias (Otten & van der Pligt, 1996). Part of the explanation is the difference in scale-ends between the direct and indirect formats – it might be easier to state that the risk is “very much lower/higher” (direct format) than stating that the risk is “certainly/certainly not likely to happen” (indirect format). Moreover, the direct format also makes it more difficult to find the sources behind the bias (Helweg-Larsen & Shepperd, 2001).

Summing up, the present study aimed to investigate people's perceptions of economic risks and examine if they are optimistically biased – do the respondents have a tendency to deny personal risk? Based on the findings from previous research on optimistic biases a number of hypotheses were formulated.

- H1. Economic risk perceptions are optimistically biased.
- H2. Optimistic bias is positively related to perceived personal control and negatively related to prior experiences.
- H3. People believe they are more in control than other people and that they make more of an effort to avoid economic risks.
- H4. A stronger sense of economic self-efficacy is related to lower ratings of economic risks and stronger optimistic bias.
- H5. Optimistic bias is negatively related to precautionary behavior.

H6. Individuals placing more importance on money rate economic risks higher and are less optimistically biased.

## ***Method***

### **Questionnaire**

A mail survey was used as a means of collecting data. The questionnaire was pre-tested in a focus group. The participants were asked to read the questionnaire thoroughly and respond to it in order to be able to give comments on the content. In the group discussion everyone was given the opportunity to give feedback on the questionnaire and to suggest revisions. The changes following the group discussions mainly pertained to structure and wording. However, minor revisions were also made with respect to content; some superfluous questions were excluded and a couple of items were added. In the final version of the questionnaire, the respondents were asked to rate twenty-two economic risks<sup>i</sup> (such as the risks of unemployment, the risk of losing invested money, and the risk of being the victim of fraud or other economical crimes) on a number of dimensions. Responses to the risk questions were recorded on an 8-point Likert type scale. The respondents were asked to judge the risks to them personally, to people in general (of the same gender and age as themselves), and the perceived control over the risks (both personal and general).

The questionnaire also included Schwarzer's and Jerusalem's (1995) general self-efficacy scale in the translation by Källmén (2000) as well as a scale aimed at measuring economic self-efficacy. General self-efficacy items were rated on a 4-point (1-4) scale ranging from "strongly disagree" to "strongly agree". Ten items were included. The total score for a respondent thus had a potential range between 10 and 40. The internal reliability, measured with Cronbach's alpha, of the scale was high (0.86). The specific self-efficacy scale focused on matters related to the economic risks included in the present study. The respondents were asked to indicate to what extent they believed they had the capacity (ability and knowledge) to handle the various situations or tasks (e.g. "Get a new job if I am unemployed" or "Prepare and follow a detailed household budget"). The scale included sixteen items. Responses were recorded on an 11-point scale ranging from "I cannot handle this" to "I am certain I could handle this", based on the recommendations by Bandura (1997). The internal reliability of the scale was high (Cronbach's alpha = 0.89).

To measure the respondents' attitudes towards investments and their willingness to take economic risks, a scale developed by Wärneryd (1996) (Investment Risk Attitudes) was used in the Swedish translation by Flink et al. (1999). The scale included 6 items measuring preferences for risk taking in financial investments (e.g. "I want to be sure my investments are without risk") on a scale ranging from

1 to 7. The lower the mean, the more willing a person is to take risks with his/her investments. Yamauchi's and Templer's (1982) Money Attitude Scale with its 29 items, was also used in the present study, in translation by Engelberg and Sjöberg (in press). The Money Attitude Scale, MAS, measures four different factors: Power Prestige (9 items), Retention Time (7 items), Distrust (7 items), and Anxiety (6 items). Responses to the attitude scales were recorded on a 7-point Likert type scale.

Respondents furthermore indicated to what extent they took precautions to avoid economic risks (a list of 9 items was included) – and to what extent they believed other people took the same precautions. The questionnaire also included some questions related to saving and information habits, and prior experience with economic risks. The form concluded with some background questions (age, gender, etc.) as well as an evaluation of the questionnaire.

The order of the risk ratings, personal and general, has sometimes been found to be related to the magnitude of optimistic bias (Hoorens & Buunk, 1993; Miles & Frewer, 2000). Therefore, two versions of the questionnaire were prepared. Half of the sample was given the version of the questionnaire with the personal judgments before the general judgments, and the other half of the sample was given the second version of the questionnaire with the opposite order.

## **Respondents**

The questionnaire was mailed to a quasi-representative sample of the Swedish population. A group of 178 people who had taken part in prior studies at the Center for Risk Research, and had then indicated that they would like to participate in further studies, received the questionnaire. The questionnaire was sent out together with a lottery ticket ("Trisslott") worth SEK 25. A letter thanking the addressee for their cooperation and stating the purpose of the study was also included. Without any reminders, 123 responses were received, corresponding to a response rate of 69%. There was an even distribution of men and women, 48% of the respondents were men. The median age was in the range 45-54 years. About two-thirds of the respondents (68%) were co-habitants or married. One-third (34%) had children under the age of 18 in the household.

Almost 65% of the sample worked full-, half-, or part time. About 3% were unemployed and 23% were retired. The level of education among the respondents, 24% reported having a university degree, was higher than the Swedish population in general (about 10% higher), which is quite common in this type of study. Since level of education did not correlate with combined indices of personal (-0.03, n.s.) and general risk (-0.01, n.s.), the higher level of education in the sample is not assumed to constitute a bias.



## Results

### Optimistic bias and perceptions of economic risks

The risk of suffering economic damage due to inflation received the highest ratings on the personal level (mean 4.08), followed by the risk of having insufficient insurance (mean 3.83) and economic crisis in the country (mean 3.82). For people in general, having a possession breaking down (e.g. a car), resulting in heavy expenses for repairs, received the highest risk ratings (4.55), followed by the risk of losing money invested in stocks and/or mutual funds (4.52) and being the victim of economic crime (4.48). A consistent finding in prior research is that women rate risks as higher than men do; see e.g. Finucane et al (2000). This tendency was also found in the present study. Independent samples *t*-tests on combined indices of personal and general risk showed that the gender difference was more pronounced for general [ $t(117) = -4.55, p < 0.001$ ] than for personal risks [ $t(119) = -3.28, p = 0.001$ ], which is in line with prior research (Sjöberg, 2003a).

Optimistic bias was measured as the difference between the ratings of general and personal risk – a positive score indicating optimistic bias, i.e. the general risk was seen as larger than the personal risk. A paired samples *t*-test between personal and general risk ratings showed that all differences were significant at the 0.05-level. In all cases, general risks were rated higher than personal risks, providing strong support for the hypothesis that economic risk perceptions are optimistically biased. A combined index of Optimistic Bias (OB) was computed based on all the difference scores (Cronbach's alpha = 0.90, 22 items). The median of this combined index was 1.05 – representing more than one scale-step of difference between ratings of general and personal risk. Independent samples *t*-tests [ $t(112) = 1.56, p = 0.12$ ] showed that there were no differences in Optimistic Bias between the two types of questionnaires (personal or general risk ratings first). Hence, no distinction was made in the following between the two conditions.

As can be seen from Table 1, optimistic bias was most pronounced for the risks of having to pay collection fees due to late payments of bills, suffering economic damages due to changes in the family situation, and receiving a note of non-payment of debt. No gender differences were found with respect to level of optimistic bias.

In order to test the hypotheses, correlations were calculated between the combined index Optimistic Bias and the following variables: age, gender, prior experience with economic risk, Insurance<sup>ii</sup>, information habits<sup>iii</sup>, self-efficacy beliefs (general and economic self-efficacy), attitudes (Investment Risk Attitudes and the four factors of the Money Attitude Scale), and personal control. In addition, correlations were calculated between each of the separate OB-scores for the 22 risk items and the variables above.

Table 1: Ranking of risks in terms of optimistic bias

Risk	OB-score
Collection fees	1.72
Change in family situation	1.59
Note of non-payment of debt	1.58
Long-term unemployment	1.53
Loan matures prior to expected date	1.45
Losing interest in work	1.33
Short-term unemployment	1.32
Income declaration not approved	1.30
Reduced income	1.13
Possession breaks down	0.99
Possessions decrease in value	0.93
Losing money invested in stocks/mutual funds	0.93
Increased costs of living	0.92
Long-term sick-leave	0.89
Losing ability to handle money	0.89
Crime	0.75
Increased taxes/decreases subsidies	0.71
Economic planning ruined due to new tax laws	0.70
Unforeseen expenses	0.68
Insufficient insurance in case of accident	0.64
Inflation	0.26
Economic crisis in country	0.14

The combined index Optimistic bias was only significantly correlated with the variable Power Prestige, ( $r = 0.18$ ,  $p < 0.05$ ), but not negatively as was hypothesized. Significant correlations were found for all but six of the separate OB-scores. The variables that correlated significantly on most occasions with the individual OB-scores were Power Prestige (positive correlation) and age (positive correlation), see Table 2 for further details.

Table 2: Correlations between the separate OB-scores and explanatory variables

OB-score	Explanatory variable
Short-term unemployment	–
Long-term unemployment	Information habits, Economic self- efficacy
Reduced income	Information habits, Economic self- efficacy
Long-term sick-leave	Age, Information habits, Economic self- efficacy
Losing interest in work	Power Prestige
Losing invested money	Power Prestige
Possessions decrease in value	Prior experience
Increased costs of living	Power Prestige
Change in family situation	Age
Unforeseen expenses	Insurance
Losing ability to handle money	Anxiety,
Economic crisis in country	–
Inflation	Age, Prior experience
Insufficient insurance	–
Crime	Power Prestige, Anxiety
Note of non-payment of debt	General self-efficacy
Increased taxes/decreased subsidies	–
Collection fees	–
Loan matures prior to expected date	Power Prestige
Income declaration not approved	Age, Insurance
Possessions break down	–
Economic planning ruined due to new tax laws	Insurance, Power Prestige, Control

Overall, the significant r-values varied between -0.23 and 0.31. However, the mean values were lower and varied between -0.04 and 0.11; see Table 3. As mentioned above, both Power Prestige and age were positively related to optimistic bias. The higher the age of the respondent and the more importance he or she placed on money, the stronger the optimistic bias. The hypothesis that an individual placing more importance on money would be less optimistically biased found no support in the data. Insurance was negatively related to optimistic bias. The better the insurance coverage (in terms of number of insurance the respondent had signed up for) the weaker the optimistic bias. The hypothesis about economic self-efficacy did find limited support. Economic self-efficacy was significantly correlated with optimistic bias, in the hypothesized direction, for three economic hazards; stronger economic self-efficacy was related to higher levels of optimistic bias. Other variables that were significantly correlated with some of the individual OB-scores were prior experience of negative events and Information habits. Individuals with prior experience of negative events were less optimistically biased, as was hypothesized. However, since prior experience was only significant for two of the rated risks, the hypothesis found only limited support.

Table 3: Significant variables

Variable	Mean r-value*	No of times significant	Correlation with Personal Risk***	Correlation with General Risk***
Power Prestige	0.11	6	(-0.10)	(0.03)
Age	0.10	4	-0.33	-0.36
Insurance	-0.10	3	(0.16)	(0.08)
Information habits	0.10	3	-0.31	-0.28
Economic self-efficacy	0.06	3	-0.38	-0.32
Prior experience	0.04**	2	(-0.16)	(-0.15)
Personal Control	0.07	1	(-0.14)	(-0.06)
Anxiety	0.02	2	(0.17)	0.25
General self-efficacy	0.07	1	-0.22	(-0.13)
Distrust	-0.05	1	0.20	0.19
Gender	-	-	0.28	0.39
Investment Risk Attitude	-	-	(0.13)	(0.12)
Retention Time	-	-	-0.21	-0.23
Anxiety	-	-	(0.17)	0.26

\* Mean over all correlations (at the 0.05-level), calculated on Pearsons' r-values transformed to Fisher's z-values.

\*\* A high value on prior experience indicated less experience with economic risks. Hence, the positive correlation suggests a stronger optimistic bias for respondents without prior experience.

\*\*\* Correlations between the variables and the combined indices of Personal and General Risk. Non-significant correlations within parenthesis.

Perceived control, which has been an important explanatory factor in prior research, was only significantly correlated with a single OB-score, albeit in the hypothesized direction – more control was related to stronger optimistic bias. The hypothesis that high levels of personal control would be related to stronger optimistic bias was therefore not supported.

In the present study, perceived control was measured by the respondents' ratings of the possibilities of protection against the risks, both personally and for people in general. Overall, the perceived level of control was quite moderate. Paired samples *t*-test showed that perceived personal and general control were significantly different only in about a third of the cases. In one case (suffering economic damages due to increased taxes or reduced subsidies) other people were even perceived to have more control than the respondents themselves. The hypothesis of higher levels of perceived personal control hence found only little support. Personal and general control were highly correlated, in the range between 0.37 and 0.67, for all the rated risk – (the average correlation was 0.57,  $p < 0.001$ ).

*Regression models on personal and general risk*

One of the advantages of using the indirect method of measuring optimistic bias is the possibility it gives of studying which risk dimension – personal or general risk – that causes variations in optimistic bias. Correlational analyses showed that important variables were the importance placed on money, age, insurance, information habits, and economic self-efficacy. In order to specify which risk dimension was most strongly related to the explanatory variables, multiple regressions were carried out on combined indices of Personal Risk (Cronbach's alpha = 0.94, 22 items) and General Risk (Cronbach's alpha = 0.92, 22 items). Five blocks of predictors were used: demographic and socio-economic factors (gender, age, education, annual income, existence of social safety net), prior experience with economic risk, Insurance and information habits, self-efficacy beliefs (general and economic self-efficacy), and attitudes (Investment Risk Attitudes and the four factors of the Money Attitude Scale). Both perceived Personal Risk and General Risk were fairly well explained by the models – 33% of the variance in Personal Risk ( $R^2_{adj} = 0.33$ ,  $p < 0.001$ ) and 27% of the variance in General Risk ( $R^2_{adj} = 0.27$ ,  $p < 0.001$ ).

Perception of one's own capacity to handle various economic tasks and negative events (perceived economic self-efficacy) turned out to be a potent explanatory variable for both Personal and General Risk. A stronger sense of self-efficacy was related to lower ratings of risk, supporting the hypothesis of the present study. Gender and age also explained variance in both Personal and General risk – see Table 4 below for standardized  $\beta$ -values. Age was only slightly more important for Personal than for General Risk. Power Prestige and Insurance also contributed to explaining variance in Personal risk ratings. Even though Power Prestige turned out to be a significant explanatory variable of personal risk, it did not provide support for the hypothesis of the thesis, as the variable was negatively related to personal risk ratings.

Table 4: Significant explanatory variables for Personal and General Risk

Explanatory variable	Personal Risk	General Risk
	Standardized $\beta$ -value	Standardized $\beta$ -value
Gender	0.18*	0.29***
Age	-0.28**	-0.27**
Insurance	0.27**	-
Economic self-efficacy	-0.38***	-0.26**
Power prestige	-0.23**	-

\*\*\* Significant at the 0.001-level \*\* Significant at the 0.01-level \* Significant at the 0.05-level

Since optimistic bias is defined as the difference between general and personal risk, it will by default be positively correlated with general risk ( $r = 0.18$ ,  $p = 0.05$ ) and negatively correlated with personal risk ( $r = -0.47$ ,  $p < 0.001$ ). In addition, the personal risk estimates had a higher variance (1.52) than the general risk estimates (1.01). It therefore seems that level of optimistic bias in economic risk perceptions is primarily caused by variations in the level of Personal risk – while General Risk is fairly stable.

### **Avoiding economic risks**

Whereas perceived control measures the possibilities to control the outcomes of future events, precautionary measures to avoid risks focus on how these possibilities are managed – to what extent people choose to exert this influence. A question about what precautionary measures the respondents took, and what measures they believed other people took, was included in the questionnaire. It involved both actions (e.g. keeping up to date with economic news) and more passive behavior, or choices (e.g. choosing not to invest in stocks, or not using credit cards). The items measured four dimensions of precautionary measures:

- 1) Planning in advance and keeping up to date with economic events
- 2) Using professional advice for investments and income tax returns
- 3) Use of credit
- 4) Insurance coverage.

A paired samples *t*-test showed that in all but three cases there were significant differences between ratings for personal and general risk avoidance<sup>iv</sup>. It was hypothesized that people would believe that they made more of an effort to avoid economic risks than their peers. The results of the present study supported this hypothesis. Overall, personal ratings were higher than general ratings, reflecting a belief that people in general do less to avoid economic risks. A combined index was created for the scale measuring personal risk avoidance, Personal Avoidance (Cronbach's alpha = 0.50, 9 items).

Optimistic bias was included as a predictor in a regression of precautionary measures. In all, three blocks of predictors were used:

- Demographic and socio-economic factors (gender, age, education, annual income, existence of social safety net)
- Optimistic bias and economic self-efficacy
- The Money Attitude Scale and Investment Risk Attitudes

The model explained 24% of the variance in self-reported avoidance of economic risks ( $R^2_{\text{adj}} = 0.24$ ,  $p < 0.001$ ). All three blocks added new information, although demographic and socio-economic factors seemed to be of little importance.

Table 5: Important explanatory variables for avoidance of economic risks

Explanatory variable	Standardized $\beta$ -value
Age	0.20*
Optimistic bias	0.24**
Economic self-efficacy	0.31***
Investment Risk Attitude	0.34***
Retention Time	0.20*

\*\*\* Significant at the 0.001-level \*\* Significant at the 0.01-level \* Significant at the 0.05-level

Optimistic bias is often said to hamper precautionary behavior, the stronger the optimistic bias the less incentive for taking necessary precautions to avoid the risks. Such a hampering effect would result in a negative relation. Contrary to what was hypothesized, the present data showed a positive relation between Optimistic bias and precautionary behavior. The finding may reflect a perception of lower exposure to risks when the precautions are taken.

Economic self-efficacy, a significant predictor of personal and general risk perceptions, turned out to be important also for self-reported risk behavior. A strong sense of economic self-efficacy was positively related to taking necessary precautions to avoid economic risks. The same was true for attitudes to financial risk taking and Retention Time (a positive score indicates that the individual has a positive attitude towards economic planning): both were positively related to precautionary behavior.

## *Discussion*

The purpose of the present paper was to study optimistic biases in relation to perceptions of economic risks. Results showed that in all cases general risk ratings were higher than personal risk ratings, supporting the overall hypothesis that perceptions of economic risks are optimistically biased.

All the separate OB-scores were correlated with a number of variables. One of the variables that correlated with many of the individual OB-scores was Power Prestige – the importance placed on money by the individual. Power Prestige had a mean  $r$ -value of 0.11 and correlated significantly with six individual OB-scores. In addition, Power Prestige was significantly correlated with the combined index Optimistic Bias ( $r = 0.18$ ). However, the hypothesis related to the importance

placed in money could not be supported, as Power Prestige was expected to be negatively related to optimistic bias. The regression analyses on Personal and General Risk indicated that Power Prestige was related to optimistic bias through personal risk estimates. There was no relation between level of general risk level and the importance placed on money.

The factor Power Prestige included items such as “I seem to find that I show more respect to people with more money than I have”, “I use money to influence other people to do things for me”, and “I behave as if money were the ultimate symbol of success” (Yamauchi & Templer, 1982). Previous studies on attitudes to money found a link between money obsession (where Power Prestige was one of many included factors) and risk perception – individuals more obsessed with money rated personal risks as higher (Engelberg & Sjöberg, in press). In the present study, individuals with higher ratings on the Power-Prestige factor rated their personal economic risks as lower, contrary to what was hypothesized. This is quite surprising since people placing a high value on money would be expected to be more likely to view a possible loss of money as more serious. Perceived consequences are, however, only one factor influencing ratings of perceived risks – perceived likelihood is another important factor. Even though consequences might be perceived as more serious for individuals placing more importance on money, it does not follow that the risks need to be perceived as more likely.

The relation between perceived risks and importance placed on money may be explained by wishful thinking. Research on wishful thinking focuses on the relation between perceived likelihood of an event happening and the perceived value of that event (Sjöberg, 2003b). Values and probabilities are positively correlated, although the opposite relation ought to be more likely – more attractive alternatives are often more difficult to get access to (i.e. less probable). Desirable and highly valued events are perceived to be more probable to occur, while effects that are less valued are perceived to be less likely to happen. Wishful thinking could thus lead to events with serious consequences being perceived to be less likely to happen. In the present study individuals placing a high value on money rated the personal risks as lower and were more optimistically biased – i.e. the most favorable option (that they will not suffer the economic risks) was rated as more probable.

Age has been suggested as an explanatory factor for optimistic bias in prior research, but the results have not been consistent. In the present paper, age was an important explanatory factor for both personal and general risk (older respondents rated risks as lower). Age correlated positively with optimistic bias in four cases. The hypothesis that prior negative experiences with the risk sources would be related to lower levels of optimistic bias found only limited support. Prior experience correlated significantly with optimistic bias in only a few cases. Insurance (measured as number of insurance policies the respondent had signed



up for) correlated negatively with optimistic bias – the fewer insurance policies the respondent had signed up for, the stronger the optimistic bias.

It is interesting to note that the results from the present study did not support the hypothesis that more personal control would be related to stronger optimistic bias, a robust finding in prior research. In the present study, Personal Control was only significantly correlated with one single OB-score, albeit in the hypothesized direction. Various measures of control have been used in previous research (Helweg-Larsen & Shepperd, 2001). Control can be assessed by comparing events with varying degrees of control, e.g. the risk of getting hurt in a traffic accident as a driver or as a passenger (cf. McKenna, 1993). Another way, used in the present study, is to let the participants rate the perceived controllability of the hazard. This measure can then be related either to a direct or an indirect measure of optimism. In addition, general control beliefs can be assessed through an individual difference measure, such as the locus of control scale (cf. Moen & Rundmo, 2005).

A methodological question that can have a considerable effect on the results is the choice of unit of analysis. There are many examples in risk perception research where analyses have been made on the level of means across hazards, rather than on differences across individuals; see e.g. Fischhoff et al. (1978). In research on optimistic bias as well, the event is often used as the unit of analysis instead of the individual (cf. Campbell et al., in press; Harris, 1996). When the importance of perceived control has been documented in prior research, it has mainly been through studies using events as the unit of analysis and with a direct measure of optimistic bias, both of which have been shown to enhance the association between control and optimistic bias. Applying this type of analysis to the present study, with the event as unit of analysis, resulted in a very strong correlation between Optimistic Bias and Personal Control ( $r = 0.714$ ,  $p < 0.001$ ) or an explained variance of 53% using only personal control as explanatory variable. However, the use of this type of analyses when individual processes are of interest has been questioned (Rohrman & Renn, 2000; Sjöberg, 2003c). In a meta-analysis Harris (1996) pointed out that using the individual as the unit of analysis often resulted in weaker association between control and optimistic bias since this method provides a more conservative test (it does not reduce the error variance the same way the other type of analysis does). Studies using the individual as the unit of analysis has, at the most, found correlations of about 0.30 between optimistic bias and control (measured as locus of control) (Hoorens & Buunk, 1993). These are not very strong correlations and neither were any strong correlations were found on individual data in the present study. This leads to the conclusion that much is left to explain about optimistic bias. In many cases, however, studies only establish that there is a significant difference in optimistic bias between events that are controllable vs. uncontrollable, or that significant correlations between optimistic bias and control exist. Effect sizes unfortunately seem to have been less interesting.

When differences across individuals were studied in the present study, the correlation between control and the combined index Optimistic bias was low and non-significant ( $r = 0.10$ , n.s.). The argument for using the hazard as unit of analysis is the difficulty to determine whether the optimism in a specific judgment of risk is justified or not (Harris, 1996). Using hazard as unit of analysis would however reduce the search of explanatory factors to characteristics of the risks, to compare various risks and see what type of hazards that elicit strongest optimistic biases. It disables a focus on the individual and on what attitudes, expectations, and perceptions might contribute to higher or lower levels of optimistic bias. When focus is on the effect of optimistic bias on individuals' economic decision-making, choosing the individual as unit of analysis is the natural choice.

Previous research relating risk perception to exposure indicates that individual risk estimates may contain elements of realism and yet be optimistic. Studies on the perception of the risks of consuming alcohol and cigarettes showed that personal risk estimates increased with an increased consumption level (Sjöberg, 1996). The increased exposure to the risk was, in other words, reflected in the personal risk ratings. General risk estimates, however, remained fairly stable independent of the respondent's consumption level. Thus, even heavy consumers of alcohol were optimistic about their personal risk, even though they were less optimistic than light consumers. Women smoking more than twenty cigarettes a day even rated their personal risks as higher than the risk for people in general (Sjöberg, 1996). These results, showing that there is an element of realism even in optimistically biased perceptions, support the use of analysis on the level of the individual.

As was discussed in the introduction, two different formats can be used to measure optimistic bias: a direct or an indirect format. In the indirect format, used in the present study, optimism is defined as the difference between ratings of general risk and ratings of personal risk. Thus, the correlation between optimistic bias and other variables is dependent on the differences in covariance between other variables and the separate risk ratings (personal and general risk). If, for example, the covariance between control and personal risk ratings is equal to that between control and general risk ratings, there will be no correlation between control and optimistic bias. The same is not true when the correlation between a *direct* measure of optimistic bias and, for instance, control is calculated. A direct measure of optimistic bias is probably anchored in either personal risk or general risk, depending on how the question is framed. To continue with the example of perceived control, correlations between a direct measure of optimistic bias and perceived control would probably capture correlations between control and the risk estimate per se, not only the optimism dimension. This would probably result in higher correlations. The question is if it would actually capture influences on optimism.

How a direct question of optimism is framed, if the optimism rating is anchored in personal or general risk, could also influence the direction of the correlation. Since

an indirect measure of optimistic bias is defined as the difference between general and personal risk, it will by definition be positively correlated with general risk and negatively with personal risk. Variables that are positively correlated with personal risk will thus be negatively correlated with optimistic bias (if there is a difference in covariances for personal and general risk). A direct measure of optimism anchored in personal risk estimates would probably be correlated in the opposite direction to that of an indirect measure. These are important methodological issues that need to be taken into consideration when studying optimistic bias. These questions only surface when effect sizes are of interest, instead of merely focusing on significance levels.

Obviously the characteristics of the risks are not without interest, and an important point may be what distinguishes economic risks from, e.g. health risks. While the consequences of many health risks, e.g. smoking, will not be experienced in close temporal proximity to the actual behavior, many of the economic risks included in the present study have a quicker process of feed-back and may also be experienced on several occasions. If bills are not paid in time it will not take too long until a note of non-payment appears. The quick feed-back on inappropriate behavior, or rather an actual experience of getting a note of non-payment, may increase the motivation to change one's behavior in order to avoid risks in the future. Optimistic bias has been found to decrease for (positive) events, as the events get closer in time (Shepperd et al., 1996).

Another side of the story is the everyday characteristics of the economic risks – even if the respondents did not have personal experience with the negative events it is likely that they have people in their near surroundings that have experienced many of them. In addition, most of the negative events included in the study can happen repeatedly. Still there was a clear tendency towards optimistic bias; negative economic events were perceived to happen more often to others. Could it be that the everyday characteristic of the risks lessens the perceived importance of personal control without reducing the bias per se? The negative events are known to happen; even if the individuals do not have personal experiences, they are likely to know of someone who has. These “intrusions of reality” have been suggested to lower the degree of perceived control (Langer, 1975). The economic risks are not only perceived of as hypothetical events that might, or might not, occur, but they are events that are known to happen – at least to other people who might not be as prudent as the respondents are.

Overall, the level of perceived control was moderate and the differences between personal and general control were only significant in about a third of the cases. In one case, general control was even higher than personal control (increased taxes or decreased subsidies). The respondents felt less at risk than their peers, but only marginally more in control, providing limited support for the hypothesis that people feel more in control than their peers. In this sense the respondents were not biased – they perceived that other people had approximately the same possibilities

to influence and control the outcome of certain events as they did themselves. However, the hypothesis that respondents believed they personally did more to avoid economic risks than their peers found support – personal and general ratings of precautionary behavior were significantly different. Even though other people were perceived to have roughly the same control over the risks, they were not perceived to exert this control to the same extent as the respondents did.

A regression analysis, aimed at finding what factors influence to what extent individuals took precautions, resulted in 24% explained variance. Perceptions of own capacity and attitudes to money and investments turned out to be important contributors to explained variance.

Contrary to what was hypothesized in the present study, optimistic bias was positively related to precautionary behavior. This can probably best be explained by a tendency to take own precautions into consideration when judging personal risks, and reflect a perception of lower exposure to risks when the included measures to avoid risks were taken. In addition, other people were perceived to take less precaution to avoid risks or limit the negative consequences, which would further enhance optimistic bias. An alternative explanation would be that a high level of optimistic bias would actually lead to more precautions being taken, but that seems unlikely.

The hypothesis that a strong sense of economic self-efficacy would be related to lower ratings of risk found strong support while the support for the correlation with optimistic bias was weaker. In addition, a strong belief in one's own capacity to handle economic tasks and situations was positively related to precautionary behavior, as was the Retention Time factor. The factor Retention Time measures the attitude towards budgeting and careful use of money and include items such as "I do financial planning for the future" and "I am very prudent with money" (Yamauchi & Templer, 1982). The attitude to risk-taking in financial investments was also related to precaution. A positive attitude to taking risks was positively related to taking precautions in order to avoid economic risks. This might at first seem counter-intuitive, since avoiding high-risk financial investments would be a certain way to reduce the risk to lose invested money. However, avoiding risky investments only reflects one aspect of precautionary economic behavior. The precautionary measures included four dimensions (planning for the future, taking professional advice, use of credit, and insurance coverage). Taking advice from financial advisors might be perceived as allowing for higher financial risks – the expert knowledge of the advisors might be seen as a guarantee for financial success. In financial theory, risk and return on investments are positively related (Ricciardi, 2004) – if an investor wants a higher potential return it usually involves taking greater risks. Contrary to other economic risks included in the study (such as the risk of losing one's employment), financial risks have the positive effect of potentially leading to higher return on investments.

To conclude, results of the present study supported the overall hypothesis of economic risk perceptions being optimistically biased but did not support the importance of perceived control. Age, Insurance and the importance placed by the individual on money proved to be of some importance for optimistic bias. Results further showed that the differences in the level of optimistic bias mainly pertained to variance in the level of personal risk estimates. General risk estimates were fairly stable. In short, the respondents felt less at risk, marginally more in control than their peers, but believed that they made more of an effort to take precautions to avoid the risks. Contrary to what was hypothesized, precautionary behavior was not negatively related to optimistic bias. In this respect, the assumed negative relation between optimistic bias and economic decision-making did not appear. In future studies, it would be interesting to study if there is any truth to the argument that optimistic biases can be detrimental to decision-making. What are the positive and negative consequences of being optimistically biased about economic risks?

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### *Notes*

<sup>i</sup> A copy of the questionnaire has been posted on the Internet, see <http://www.hhs.se/CFR/People/Fromm.htm>.

<sup>ii</sup> A measure of the total number of insurance policies the respondent had signed up for.

<sup>iii</sup> A measure of how often respondent read economic news in the morning press, the evening press, and how often they watch economic news on TV.

<sup>iv</sup> The exceptions being “Do not invest in stocks/mutual funds”, “Do not invest without professional advice”, and “Prepare and follow a detailed household budget”.

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