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Gender, risk perceptions, and smoking behavior

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ABSTRACT

The underlying reasons for gender differences in smoking behavior, and thus for the recent trends, are not well understood. Using a sample of 8592 Swedish adolescents aged 15–18, this paper contributes to the literature by exploring gender differences in smoking risk perceptions and in the responses to the latter. The results show significant gender differences in the perception of smoking mortality risk and in the perception of the addictiveness of smoking. Girls perceive the mortality risk of smoking as significantly greater than boys do, but they also perceive the addictiveness of cigarettes as less. These results persist after controlling for a wide range of background characteristics, including smoking risk information sources. Moreover, the findings suggest that while smoking information from sources such as teachers, pals, and own search, affect smoking mortality perceptions in a significant and positive manner among boys, no such effects are obtained among girls. Finally, our results show that both boys and girls take both the addictiveness and mortality risk of smoking into account when making their smoking decision. Moreover, the magnitude of the response is similar among boys and girls. This is in contrast to the general belief that females dislike risks to a greater extent than males.

1. Introduction

It is currently estimated that roughly 435,000 deaths per year in the US are related to smoking, making it the number one preventable cause of death (Mokdad et al., 2004). Traditionally, males have suffered the most, as their smoking rate have exceeded that of their female counterparts. Recent decades have shown diverging trends in smoking rates among men and women, however. Among younger cohorts, the smoking rate of females has surpassed that of males in many western countries (CAN, 2004). Among adults, the gender gap is narrowing and in some countries, such as Sweden, the female smoking rate has even surpassed the one of males. This is now showing up in mortality and morbidity statistics, where the gender gap in smoking-related deaths has substantially narrowed (Pampel, 2002).

The underlying reasons for gender differences in smoking behavior are not well understood. A higher smoking rate among young women, for instance, is a departure from the common observation that males engage more frequently in risky behaviors. In this paper, we aim to add to the general understanding of gender differences in the perception of smoking risks and in the responses to such risks.

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Previous economic research on smoking behavior has focused mainly on price and income elasticities of smoking and the effects of various anti-smoking policies, such as clean indoor air restrictions and minimum age purchase laws (see Chaloupka and Pacula, 1999, for an overview). To the extent that gender differences have been examined, the literature has focused on gender differences in the responsiveness to price and various anti-smoking policies (Chaloupka and Pacula, 1999; Hersch, 2000; Yen, 2005). From an economic point of view, however, the monetary price of smoking constitutes only a fraction of the full cost of smoking, the latter including, among other things, the cost of smoking-related morbidity and mortality. Consequently, even though studies of price elasticities are useful, they are unlikely to provide the full answer to the observed gender differences.

While the perceived risks of experiencing smoking-related morbidity or mortality are important components of most economic models of smoking behavior, only a small literature has empirically examined how the perception of such risks actually affect smoking (e.g., Viscusi, 1990; Liu and Hsieh, 1995; Lundborg and Lindgren, 2004; Lundborg, 2007). Moreover, the decision to smoke not only involves considering the potential adverse health effects, but also the addictiveness of cigarettes. The latter is related to both the probability of getting addicted, as an early experimenter with cigarettes, as well as the cost of changing one's behavior as a smoker (Orphanides and Zervos, 1995). Understanding gender differences in smoking behavior thus require knowledge to what extent males and females perceive and weigh these risks differently. Evidence suggests, for instance, that females have a harder time trying to quit smoking, both due to biological and psychological factors, suggesting that the addictiveness of smoking may be greater for females (Benowitz and Jacob, 1984; Perkins et al., 1994).

This paper makes a number of contributions to the analysis of gender differences in risky behaviors. First, we analyse gender differences in both the perception of addictiveness of smoking as well as in the perceived mortality risk of smoking. To assess perceived risks, we use quantitative measures of perceived risks that make interpersonal comparisons possible and that have been found to predict smoking behavior in previous studies. To our best knowledge, no previous study has focused on gender differences in both the perceived addictiveness and mortality risk of smoking.

Second, we contribute to the understanding of the sources for gender differences in risk perceptions. In addition to factors such as age and family characteristics, which have been considered in some previous studies, we also examine how various smoking information sources may affect risk perceptions differently by gender.

Third, we analyze whether the perceived addictiveness and mortality risk of smoking affect smoking behavior differently by gender. A common belief is that females dislike risks to a greater extent than males. Such patterns have also been found in the area of financial decision-making. No previous study has investigated these issues using quantitative estimates for both the perceived addictiveness and mortality risk of smoking.

To address these issues, we use a unique data set on about 9,000 Swedish adolescents aged 15–18, with extensive information on smoking behavior, risk perceptions, and smoking information sources.

The outline of the paper is as follows: Section 2.1 contains a review of the empirical findings in the literature. In Section 2.2, we introduce some of the most important policies and regulations regarding smoking in Sweden, in order to put the results of this paper in a context, and to facilitate comparisons with results obtained in other countries. Section 3 contains our analytical framework, while Section 4 describes our sample. This is followed by a description of our empirical strategy in Section 5. Next, in Section 6.1, we compare risk perceptions by gender. The risk perceptions considered are the perceived risk of smoking-related mortality and the perceived addictiveness of smoking. In Section 6.2 we turn to multiple regression analysis to test for gender differences in the formation of risk perceptions. In Section 6.3, using regression analysis, we analyze whether boys and girls react differently to their risk perceptions when making their decision on whether or not to smoke. Finally, Section 7 summarizes the results and some conclusions are drawn.

2. Background

2.1. Gender and risk perceptions

Females are commonly found to perceive the risks of various activities and events as greater than males do. Such results have been obtained for risks as varied as aviation accidents, house fires, stomach cancer, and nuclear power (Savage, 1993; Flynn et al., 1994). For sure, gender differences in perceived risks must not necessarily indicate the presence of any bias in the perceived risks. For some risks, such as road-traffic accidents, the risks do actually differ by gender (Andersson and Lundborg, 2007). In such cases, we would expect this to be reflected in the risk perceptions of well-informed females and males. When it comes to smoking, however, few studies have explicitly considered gender differences in the perceived risks. So, is there evidence suggesting that smoking risks may actually differ by gender?

Starting with the risk of addiction, previous economic literature on smoking has, as mentioned in the introduction, mainly focused on how smoking behavior is affected by prices and various anti-smoking policies. The results from this literature may, however, reveal something about the addictiveness of smoking, in the cases where quitting behavior is examined. In general, the responses to anti-smoking policies and price increases have been substantial, as revealed by the declining smoking rates in most western countries. Some evidence suggest, however, that males have responded more to these measures than females, since the gender gap in smoking has closed in many countries. In line with this, some evidence suggests that relapse rates following quitting attempts are actually significantly higher among females than males (Nides et al., 1995; Bjornson et al., 1995).

While the evidence cited above could indicate stronger addiction among females, it could also simply reflect that the costs and benefits of smoking differ across males and females. For instance, since quitting smoking may lead to weight gain, some research suggests that women are less likely to quit smoking because of fear of gaining weight. It should be noted, though, that even though there is evidence of short run weight gain following quitting, there is little evidence that show a link between smoking and steady-state weight (Gruber and Frakes, 2006). Moreover, results have shown that people with depression are especially prone to nicotine addiction, and since the incidence of depression is normally higher among women than men, this may explain why fewer females quit smoking (Hughes et al., 1986; Glassman et al., 1990).

While factors such as weight gain and depression may induce differential costs and benefits of smoking by gender, some evidence suggests that there also exist physiological gender differences in the effects of nicotine that may lead to greater addictiveness among females. Studies have shown, for instance, that clearance of nicotine is significantly faster among males than females, also after controlling for body weight. Other studies report gender differences in both the severity and type of withdrawal symptoms, with depression occurring more frequently among females (Svikis et al., 1986).

Regarding gender differences in smoking-related mortality, there are some evidence that women are more sensitive to the damaging effects of smoking (Risch et al., 1993; Xu et al., 1994). Here, the evidence is more mixed, however, since some large recent studies have produced contradictory results (e.g., Marang-van de Mheen et al., 2001).

Regarding gender differences in the behavioral responses to risk perceptions, we note that females are commonly found to dislike risks to a greater extent than males. In the area of financial decision-making, for instance, females have been found to be less willing to take risks (Powell and Ansic, 1997; Jianakoplos and Bernasek, 1998). Regarding health, it has been found that women are paid a higher compensating wage differential for accepting a given job-injury risk compared to men (Hersch, 1998). If anything, we would therefore expect the same pattern in smoking behavior, since smoking is one of the most health-damaging behaviors one can engage in.

2.2. Smoking and smoking regulations in Sweden

In Sweden, tobacco regulation is governed by the Swedish Tobacco Act. The act contains provisions for restrictions on smoking in certain indoor premises and indoor areas, smoke-free work environments, warning texts and contents declarations on the packaging of tobacco products, and restrictions on the marketing of tobacco products. The law was introduced in 1994 and replaced and strengthened earlier legislation.

One of the most common sources of smoking risk information are the government mandated warnings that appear on cigarette packages and in cigarette advertising. Compared to the US, where mandatory on-product warnings on cigarette packages were introduced in 1965, it was not until 1977 that similar warnings were introduced in Sweden. The overwhelming majority of warning texts during the period 1977–1994 concerned smoking-related morbidity and mortality to the smoker him/herself. To a lesser extent the texts concerned the risks of smoking during pregnancy and passive smoking. Interestingly, none of the texts during the period concerned the addictiveness of smoking. Since 1994, the Tobacco Act stipulates that two separate warning texts have to be included on every pack. The new texts closely follow the European Unions directives.

The Tobacco Act forbids smoking in all school facilities as well as smoking in the schoolyard, but smoking may be permitted in designated rooms or areas, provided that children and young people do not have access to them. Similar rules apply for other public premises, e.g., those in which cultural or sporting events take place.

Prior to 1997, no age limit for the buying or selling of cigarettes was in place. In 1997, however, the tobacco law was modified and the selling of tobacco products to anyone below 18 years of age was forbidden. It should be noted that the law forbid selling to people below the age of 18, but did not forbid buying of cigarettes by people below 18. The observance of the law has been limited, however, and many young people are still able to buy cigarettes. In 2003, for instance, 60% of the smokers aged 15–16 stated that they bought the cigarettes themselves, mainly at the local corner shop (CAN, 2004). The law of 1997 also required that all sales of tobacco products to consumers shall be conducted in such a way that it is possible to determine the age of the recipient, which also apply to vending machines, etc.

The tobacco law of 1994 put further restrictions on the possibilities to market tobacco products. All marketing in any periodical publications and radio or television was forbidden. In all other cases the law stipulated that marketing should exercise special moderation, meaning that advertising may not be obtrusive or soliciting, or encourage the use of tobacco products. In practice this has meant a ban also on outdoor advertising campaigns and direct marketing through mail, etc.

Information about the health risks of smoking towards teenagers has been communicated by various actors. At school, education about alcohol, narcotics, and tobacco (ANT) is a compulsory subject. Traditionally, the education has been focused on facts, risks, and medical and social damage created by alcohol, narcotics, and tobacco (Skolverket, 2000). In addition, both government bodies and independent organizations have over the years conducted various campaigns aimed at reducing smoking among teenagers. In 2004, for instance, a large quit-smoking campaign was launched by the National Cancer Society, with financial support from, among others, the National Institute of Public Health. The most controversial campaigns have been launched by the independent organization A Non-Smoking-Generation. In 1994 they launched a large advertising campaign against Philip Morris, with pictures of gravestones accompanied by the text “Welcome to Marlboro”. Other campaigns by the organization that yielded massive attention was the “Raped by a Prince” campaign, alluding to the effect of smoking on the bodies of young women, and a campaign showing up dead bodies and cigarette packs, coupled with the message “Why?”. Several campaigns have been directed at girls and young women. Between 1996 and 2000, for instance,

Miss Sweden contestants were involved in non-smoking educational campaigns for young girls in co-operation with popular women's magazines.

3. Analytical framework

The formation of smoking risk perceptions may be viewed as a learning process, where information about the harmfulness and addictiveness of smoking is gathered from a number of different information sources, such as education at school, anti-smoking campaigns, and parents. From this constant flow of information, the individual will update his/her perceptions about the risks, to the extent that these sources convey new information and is perceived to be credible. In other words, the individual will put different weights to different sources, depending on their informational content and their perceived credibility. Individuals may also differ in their ability to incorporate the new information, i.e., there may exist differences in the efficiency of learning about risks. The latter mechanism has been proposed as an explanation for the observed educational gradient in health (Cutler and Lleras-Muney, 2006).

In the economics literature, such a learning process has been described as an outcome of a Bayesian updating process (Viscusi, 1990; Lundborg and Lindgren, 2002, 2004). We will follow this tradition and assume that the individual has three sources of risk information. First, the individual has a prior risk belief p, with an associated informational content ω_0. This correspond to a hypothetical baseline risk belief, not yet affected by any information sources. The second source consists of direct information transfer from teachers, parents, media, pals etc. Let r denote the risk that is described by direct information transfer, and let ζ_0 be the associated informational content. Third, the individual has his or her own experience regarding smoking. The individual may be a smoker, thereby having formed risk perceptions based on the observed health effects of his or her smoking. This mechanism appears less likely for young smokers but experience of smoking may also have been gained from observing the health effects on other smokers. Individual experience will, thus, also be affected by factors such as age, gender, and family structure, since those factors may be related to exposure to smoking. The risk perception derived from experience is denoted q, and γ_0 is the associated informational content of experience. The learning process is assumed to follow a beta distribution and the functional form that arises can be written as

$$\pi = \frac{\omega_0 p + \gamma_0 q + \zeta_0 r}{\omega_0 + \gamma_0 + \zeta_0}. \tag{1}$$

Stated as above, the individual perception of risks associated with smoking is a weighted average of the different sources of information. An increase in the level of risk communicated by media, for instance will increase the perceived risk according to:

$$\frac{\partial \pi}{\partial r} = \frac{\zeta_0}{\omega_0 + \gamma_0 + \zeta_0} > 0. \tag{2}$$

This shows that the increase in risk perception following an increase in r is normally not proportional. Thus, learning is partial and depend on the weight put on the various sources.

In this framework, gender differences in smoking risk perceptions may exist for several reasons. First, they may result from gender differences in exposure to various information sources. For instance, anti-smoking campaigns may have targeted media that attracts boys and girls to a differential extent. Moreover, boys and girls may in principle attach different weights to the various information sources, even though, to the knowledge of the authors, evidence for this is lacking. Finally, gender differences in risk perceptions may also stem from differences in the risk levels communicated, since boys and girls may have different risks. In the end, it is an empirical question whether there exists differences in the weights that boys and girls attach to various information sources.

Individual risk perceptions are important since they influence the smoking decision. Focusing on the mortality risk of smoking, the smoking decision can be described as a lottery with the probabilities of two payoffs; life and death. In deciding whether to smoke or not, a rational individual will compare the expected utility of smoking with the expected utility of not smoking and decide to become a smoker if the perceived benefits of smoking exceed the perceived expected costs of smoking.

It is straightforward to assume that the adverse health effects of smoking will occur only once addicted to smoking. A rational individual will therefore jointly consider both the perceived probability of addiction and the probability of smoking-related harm when making his/her smoking decision. An increase in either of those will decrease the expected utility of smoking and, consequently, we hypothesize that both the perceived addictiveness and the perceived risk of premature death are negatively related to smoking. Moreover, based on the general finding in the literature that females have been found to dislike risks to a greater extent than males, we hypothesize that perceived risks will affect smoking among women to a greater extent than among men.

Other factors that can be assumed to have an impact on the costs and benefits of smoking are, for instance, age, income, parents' education, ethnicity, and marital status of parents. These are factors that have been shown to affect both smoking risk perceptions and smoking behavior in prior studies (Viscusi, 1990, 1991; Liu and Hsieh, 1995; Antoñanzas et al., 2000; Lundborg and Lindgren, 2004). Finally, having received smoking risk information from various information sources may have an effect on smoking over and above its immediate effect on risk perceptions. For instance, such information may be targeted at describing the outcomes of smoking related illnesses, rather than affecting the perception of their likelihood of occurring.

4. Data

We use data from an alcohol and drug survey, conducted in schools in the county of Scania in the south of Sweden in 2003. The survey was administered by CERUM, a consultative support team for the municipalities of Scania, which is funded by the Ministry of Health and the County of Scania. The questionnaires were handed out to the pupils in the classrooms and were to be completed anonymously under the supervision of a teacher. In total, 9963 individuals aged 12–18 participated in the survey, where 9272 were aged 15–18. We used this latter age group for the analyzes. In addition to data on risk perceptions, the survey collected extensive socio-economic and demographic information as well as detailed information on consumption of addictive substances, such as alcohol, tobacco, and illicit drugs.[1]

The questions on smoking behavior began with a question about the current smoking status of the respondent. Following previous studies, we defined a smoker as someone who reported smoking every or almost every day (Lundborg and Lindgren, 2004; Lundborg, 2006). Former smokers and individuals reporting that they don't smoke, almost never smokes, only smoke at parties, or only at week-ends were consequently defined as non-smokers. Using this definition, about 13% of the sample was defined as smokers. Among girls, 16% were smokers, whereas among boys 10% smoked.

Turning to risk perceptions, and the perceived smoking mortality risk, we used a format similar to the one used in Viscusi (2002). The question was framed as:

> "In a group of 100 smokers, how many do you think will die from diseases caused by their smoking?"

The responses were then divided by 100 in order to obtain the perceived probability of dying from smoking-related diseases.[2] Next, the perceived addictiveness of smoking was assessed. This question was framed as follows:

> "In a group of 100 smokers who try to quit, how many do you think will succeed?"

The format of the question certainly resembles that used by Viscusi (1991) and Lundborg and Lindgren (2004), since it uses a 0–100 scale. It was also used in Lundborg (2007). A similar question, let alone with a different denominator, was used in the Annenberg Surveys (Jamieson and Romer, 2001). Its usefulness will be assessed by examining its relationship with actual smoking behavior. The responses were divided by 100 to obtain the perceived probability of quitting smoking, denoted Q. Next, the perceived addictiveness was calculated as $1 - Q$, indicating the probability of not being able to quit.

We have chosen the specific format for assessing risks described above for a number of reasons. First, qualitative measures about smoking risks, which are commonly used in surveys, makes it difficult to make interpersonal comparisons and to examine the extent of any potential bias in risk perceptions. The interpretation of wordings like "risky" or "very risky" may greatly vary between individuals and individuals may have different thresholds as to what constitutes a risky product. It has been found that college-educated workers, for instance, are more likely to rate a given job risks as being "dangerous" than are less educated workers (Viscusi, 2002). Quantitative measures, such as the one above, are better suited for these matters, since they allow for comparison with scientific estimates of risks and thus allow us to examine whether perceived risks are accurate or biased in any direction. Second, results from prior studies suggest that responses to questions such as the ones above also generate responses to risk in a manner that one would expect if individuals believed that the risks actually affected themselves. This has been found both regarding smoking behavior and other behaviors (Viscusi and O'Connor, 1984).

In order to assess from which information sources the respondent had received smoking-risk information, a number of alternatives were given. They were: (1) own information search, (2) teachers at school, (3) other adult at school, (4) parents, (5) siblings, (6) pals, (7) other adults, (8) television, (9) newspapers or magazines, (10) radio, (11) other sources. The respondent was asked to mark from which of these sources he/she had received information. The three variables reflecting media sources, i.e., television, newspapers and/or magazines, and radio, were merged into one variable labelled media. Thus, 9 information-source variables were used in the regressions.

As additional explanatory variables, gender, grade, whether born in Sweden or not, income, parents' education and whether living with both parents were used. In the sample, individuals were either in grade 9 in compulsory school or grade 2 in upper secondary school. The former students were 15–16 years old, whereas the latter students were 17–18 years old.

The education of the respondent's parents was assessed by asking the respondent to mark the relevant category for his/her mother and father, respectively. A dummy variable was created, indicating whether the respondent's mother/father had a university education. We also tried regressions dividing the non-university category into two separate categories, indicating elementary school education only and secondary school education. However, with elementary school as the omitted reference category, the indicator for secondary school was never significant. A separate dummy variable was also created for those who answered that they didn't know the education of their father/mother. This strategy was chosen, since dropping missing responses would incur a loss of roughly 20% of the sample.

Income was assessed by asking the respondent: "How much money are you able to spend each month (monthly pocket money + other income)?". The respondent was then asked to mark the relevant category out of 7 (see Table 1).

[1] Due to missing responses to various variables, the number of observations used for the analysis was further reduced to 8592. Regarding risk perceptions, 479 individuals had missing responses.

[2] For a discussion of the question format see Viscusi (2002). The question used by Viscusi was somewhat different: "Among 100 smokers, how many of them do you think will die from lung cancer, heart disease, throat cancer, and all other illnesses because they smoke?".

Table 1
Descriptive statistics

Variable	Full sample	Females	Males
Smoker	0.13 (0.34)	0.16 (0.37)	0.10 (0.30)
Smoking mortality risk perception	0.46 (0.27)	0.47 (0.26)	0.44 (0.28)
Quitting smoking perception	0.68 (0.22)	0.66 (0.21)	0.69 (0.22)
Ages 15–16	0.59 (0.49)	0.59 (0.49)	0.59 (0.49)
Ages 17–18	0.41 (0.49)	0.41 (0.49)	0.41 (0.49)
Born in Sweden	0.91 (0.29)	0.91 (0.29)	0.90 (0.29)
Father has university education	0.29 (0.45)	0.27 (0.44)	0.31 (0.46)
Mother has university education	0.31 (0.46)	0.30 (0.46)	0.31 (0.46)
Don't know father's education	0.24 (0.43)	0.24 (0.43)	0.23 (0.42)
Don't know mother's education	0.21 (0.41)	0.19 (0.39)	0.23 (0.42)
Living with both parents	0.70 (0.46)	0.69 (0.46)	0.71 (0.45)
Income < 500 SEK	0.20 (0.40)	0.18 (0.39)	0.19 (0.39)
Income 500–799 SEK	0.22 (0.42)	0.24 (0.43)	0.21 (0.41)
Income 800–1099 SEK	0.35 (0.48)	0.36 (0.48)	0.34 (0.47)
Income 1100–1399 SEK	0.09 (0.29)	0.09 (0.29)	0.09 (0.29)
Income 1400–1699 SEK	0.04 (0.20)	0.04 (0.20)	0.04 (0.20)
Income 1700–1999 SEK	0.02 (0.16)	0.02 (0.15)	0.03 (0.16)
Income 2000 SEK or more	0.08 (0.27)	0.06 (0.24)	0.09 (0.29)
Information searched by the respondent him/herself	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)
Information by teacher	0.67 (0.47)	0.70 (0.46)	0.64 (0.48)
Information by other person at school	0.31 (0.46)	0.30 (0.46)	0.32 (0.47)
Information by parents	0.47 (0.50)	0.53 (0.50)	0.42 (0.49)
Information by siblings	0.09 (0.28)	0.09 (0.28)	0.08 (0.28)
Information by pals	0.15 (0.36)	0.17 (0.37)	0.13 (0.34)
Information by other adults	0.18 (0.39)	0.19 (0.39)	0.18 (0.38)
Information by media	0.63 (0.48)	0.68 (0.47)	0.57 (0.50)
Information from other sources	0.06 (0.23)	0.06 (0.24)	0.05 (0.22)

Standard deviations in parentheses.

In Table 1, the descriptive statistics are shown. In many respects the sample resembles the characteristics of the average Swedish teenager of the same age. A comparison with the results from the nationally representative surveys on alcohol and drug habits of young people in Sweden reveals, however, that the smoking rates are somewhat higher in our sample. Among 15–16-year-old girls, the smoking rate in our sample is 14.5%, whereas the corresponding rate at the national level is 13% (CAN, 2004). Among 15–16-year-old boys, the corresponding rates are 9% and 7%, respectively. For the age group 17–18, national smoking rates were assessed in 2004, but not in 2003, allowing only an imperfect comparison with our sample (CAN, 2004). Among the girls aged 17–18 in our sample 19% were smokers, whereas 17% were smokers at the national level. For boys at the same age, the corresponding rates were 11% and 10%, respectively.

The fraction of females and the fraction born in Sweden in our sample are similar to the corresponding fraction at the national level (50% vs. 49% and 90.5% vs. 90.1%, respectively). For the income, the education of parents, and the fraction living with a single parent there are no comparable rates from adolescent surveys at the national level. It could be noted though that the fraction of divorced adults is roughly the same in the county of Scania as in Sweden as a whole (9.7% vs. 9.2%). The average income is slightly lower in Scania compared to the average income at the national level (204,441 vs. 215,971) and the fraction of individuals with a university education is roughly similar (10.7 vs. 10.4).

5. Methods

From Eq. (1) we have learned that the formation of risk perception can be stated as a weighted average of different sources of information. Let π_i denote individual i's risk perception, both in the cases of perceived addictiveness and perceived smoking mortality risk. The risk-perception equation may then be written as

$$\pi_i = \alpha_0 + \alpha_1 X_{1i} + \alpha_2 X_{2i} + u_i, \tag{3}$$

where X_{ji} represents a vector of variables pertaining to each source of information, $j \in \{1, 2\}$, for individual i, α_j is the associated vector of coefficients, and u_i is a random term. Variables included in X_{1i} are the smoking risk information variables, whereas X_{2i} contains variables of individual experience, i.e., gender, whether or not the individual was born in Sweden, age, income, parents' education, and whether the individual lives in a single-parent household (see Table 1). Since our data is cross-sectional, prior risk perception is not observable. Direct information transfer is measured through the various smoking information sources described in the data section. Variables that are assumed to affect individuals' experience of smoking are the socio-economic and demographic variables.

For a number of reasons, we do not include smoking status in Eq. (3). Again, consider the Bayesian learning model outlined above, where own experience regarding the health effects of smoking may lead the individual to revise his/her prior risk perceptions. For young smokers, however, this mechanism appears weak, since the health effects are not likely to have occurred. Smoking status is therefore unlikely to affect smoking mortality risk perceptions by this mechanism.

Table 2
Variations in mean smoking mortality and addictiveness risk perception with age, sex and smoking status

	Full sample		Smokers		Non-smokers	
	Mortality	Quitting	Mortality	Quitting	Mortality	Quitting
Ages 15–16	0.471[a](0.269)	0.680 (0.219)	0.425[a,c](0.275)	0.639[c](0.244)	0.477[a](0.269)	0.686 (0.214)
Ages 17–18	0.435 (0.273)	0.672 (0.217)	0.384[c](0.264)	0.643[c](0.232)	0.444 (0.273)	0.677 (0.214)
All ages	0.456 (0.272)	0.677 (0.218)	0.406[c](0.270)	0.641[c](0.238)	0.464 (0.271)	0.683 (0.214)
Men, all ages	0.439[b](0.283)	0.691[b](0.224)	0.376[b,c](0.282)	0.647[c](0.250)	0.446[b](0.282)	0.697[b](0.226)
Women, all ages	0.474 (0.260)	0.663 (0.211)	0.425[c](0.261)	0.637[c](0.232)	0.483 (0.258)	0.668 (0.206)
Observation	8592	8576	1113	1113	7398	7398

Standard deviations in parentheses.
[a] Ages 15–16 statistically significantly different from ages 17–18 at 0.01 level.
[b] Men statistically significantly different from women at 0.01 level.
[c] Smokers statistically significantly different from non-smokers at 0.01 level.

An alternative mechanism would be rationalizing behavior, i.e., a psychological mechanism where the individual downplays the risks to him/herself, in order to motivate continued smoking. This would give rise a negative correlation between smoking and risk perceptions, which would be impossible to distinguish from a correlation due to reverse causality. In any case, smoking would be endogenous and some exogenous variation in smoking would be needed in order to identify its effect on risk perception. Finding a good instrument for smoking, i.e., one that predicts smoking but is unrelated to risk perceptions is a difficult task, however. Instead of using some questionable instrument, we therefore choose to proceed by excluding smoking status from the risk perception equation. Eq. (3) is estimated using ordinary least squares regression.

The smoking-decision equation to be estimated can be written as

$$s_i = s(\beta_0, \pi_i, X_{1i}, X_{2i}, \varepsilon_i), \tag{4}$$

where s_i denotes a dummy variable, taking the value 1 if individual i is a smoker and 0 otherwise. Here, π_i denotes the risk perception variables, X_{ji} the vectors of variables from Eq. (3), and ε_i is a random term. Since s_i is a binary variable, Eq. (4) is estimated using a probit-model. In order to test for differential effects by gender, we also run regressions where gender is interacted with all the other explanatory variables.

Certainly, the possibility remain that some omitted third variable affects both smoking and risk perceptions, giving raise to a spurious relation between the two. We experimented by instrumenting risk perceptions with the information source variables. The argument would be that the information sources only affect smoking through their effect on risk perceptions. This is a strong assumption, however, and in order to test it we ran an over identification test on the information source variables, in the regression where they were used as instruments. The test strongly rejected the exogeneity of the instruments, yielding a Sargan statistic of 52.5 with an associated p-value of < 0.01.[3] We therefore proceeded by including the information source variables in the smoking regression. Since no other suitable instruments could be found, we did not proceed with instrumental variables methods.

6. Results

6.1. Gender differences in risk perceptions

In Table 2, smoking mortality risk perceptions are broken down by gender and the results for the full sample are shown in the first column.[4] The results for the sub-samples of smokers and non-smokers are shown in columns three to six. In all three cases, the results follow the well-known pattern that females perceive the risks as greater. For the full sample, the mean perceived probability is 0.439 among boys, while the corresponding figure for girls is 0.474. The difference is statistically significant at the 1% level. The sub-sample of smokers has lower risk perceptions; the results in the third column of Table 2 show that the average boy has a perceived probability of 0.376, whereas the corresponding figure for the average girl is 0.425. Finally, the greatest perceived probability is obtained for non-smoking girls; 0.483. The corresponding figure for non-smoking boys is 0.446. The differences by gender and age are also similar to those commonly found in studies on smoking risk perceptions (e.g., Viscusi, 1991; Lundborg and Lindgren, 2004; Liu and Hsieh, 1995).

The "true" mortality risk of smoking is unknown, but current estimates may serve as a reference point to assess the bias in the perceived mortality risk. Since there is to date mixed evidence as to whether or not the risk is greater for females vs. males, we will use the same reference point for both genders. Using estimates based on studies reported by the US surgeon general, Viscusi (2002) presents a smoking mortality risk of 0.18–0.36. Using this interval as our measure of objective risk, we can examine the potential bias in our subjective risk perceptions. Table 3 shows the distribution of smoking mortality risk for

[3] We implemented the test by running a linear probability IV model.
[4] Due to the fact that some individuals have missing values for gender, the number of individuals when analyzing males and females separately do not sum up to the number of individuals when analyzing males and females together.

Table 3
Distribution of smoking mortality-risk and addictiveness perceptions

	Mortality risk					Addictiveness				
	Full sample	Females	Males	Female smokers	Male smokers	Full sample	Females	Males	Female smokers	Male smokers
Risk < 0.05	0.036	0.022	0.050	0.042	0.100	0.011	0.006	0.016	0.022	0.031
$0.05 \leq$ Risk < 0.10	0.043	0.033	0.053	0.038	0.071	0.002	0.002	0.002	0.001	0.007
$0.10 \leq$ Risk < 0.20	0.108	0.095	0.120	0.125	0.140	0.016	0.018	0.015	0.022	0.021
$0.20 \leq$ Risk < 0.30	0.120	0.120	0.120	0.132	0.117	0.031	0.033	0.028	0.036	0.036
$0.30 \leq$ Risk < 0.40	0.095	0.092	0.098	0.096	0.110	0.030	0.032	0.028	0.038	0.029
$0.40 \leq$ Risk < 0.50	0.085	0.092	0.076	0.094	0.062	0.041	0.040	0.042	0.039	0.055
$0.50 \leq$ Risk < 0.60	0.169	0.186	0.153	0.193	0.157	0.170	0.194	0.145	0.224	0.188
$0.60 \leq$ Risk < 0.70	0.082	0.093	0.071	0.068	0.060	0.100	0.109	0.091	0.094	0.081
$0.70 \leq$ Risk < 0.80	0.113	0.118	0.108	0.098	0.074	0.173	0.186	0.162	0.166	0.124
$0.80 \leq$ Risk < 0.90	0.070	0.075	0.066	0.061	0.043	0.205	0.197	0.212	0.171	0.195
$0.90 \leq$ Risk < 1	0.062	0.064	0.060	0.039	0.036	0.215	0.179	0.251	0.177	0.214
Risk $= 1$	0.017	0.010	0.023	0.016	0.031	0.007	0.005	0.009	0.010	0.012
Observations	8592	4292	4284	691	420	8592	4292	4284	691	420

the full sample and by gender. The table shows the percentage of the sample at different intervals of risk beliefs. First, for the full sample, the results show that more than 60% believes that the risk is higher than the upper boundary of 0.36. Moreover, less than 20% believe that the risk is lower than 0.20, suggesting that the overwhelming majority of sample respondents either have correct beliefs or overestimate the risk. There are, however, some marked gender differences. Among females, 15% of the sample believes that the risk is below 0.20, while the corresponding fraction among males is 22%. The difference is even more marked when comparing female and male smokers. Here, 31% of male smokers believe the risk to be less than 0.2, whereas only 20% believe so among female smokers. The fraction believing the risk to be greater than 0.36, i.e., our upper limit for objective risk, is more than 63% among females and 56% among males.

Next, we turn to the perceived addictiveness of smoking. The results are shown in columns 2, 4, and 6 of Table 2, again broken down by gender and shown separately for the full sample and the samples of smokers and non-smokers. Surprisingly, and in contrast to the general notion that females perceive things as riskier, girls perceive the addictiveness as less than the boys do. For the full sample, girls on average believe that 66% of smokers trying to quit will not be able to do so, while the corresponding figure among boys is 69%. The difference is significant for both the full sample and for the sample of non-smokers. For smokers, however, the gender difference is small and insignificant; the average boy respondent has a perceived probability of 0.647, whereas the corresponding figure among girls is 0.637.

In order to assess the accuracy of the perceived addictiveness some "objective" reference point is needed. Such information is difficult to gather, however. Some indication is given by the quit ratio, i.e., the ratio of former smokers to ever-smokers. In our sample, former smokers constitute 37% of the ever smoker group. Using the quit ratio as a measure of addictiveness is problematic, however, since it does not tell use how many percent of smokers that have tried to quit that are actually successful.

In order to get a picture of the addictiveness of smoking, it may therefore be more useful to examine data on quitting and quitting attempts. In Hymowitz et al. (1997) a sample of adult smokers were followed for 5 years. During this period, 67% of the smokers made at least one serious attempt to stop smoking and at the follow-up 33% of these had quit smoking. Recent evidence is presented in Hyland et al. (1997), following smokers making quit attempts in 4 countries. Between waves 1 and 2, conducted 8–10 months apart, 36% of smokers made at least one attempt to quit. At the follow-up, 25% of those who made a quit attempt had stopped smoking. The rates were rather similar in UK, US, Canada, and Australia. Tucker et al. (2005) followed smokers aged 23 until age 29. At age 29, 76% expressed that they had made an attempt to quit, since the last assessment at age 23. Out of these, 26% had quit for 6 months or longer between ages 23–29.

The evidence cited above concerned quitting and quitting attempts during limited periods. Future relapses into smoking were therefore not accounted for. It is well known, however, that during their lifetime most smokers make multiple attempts to quit and it has been estimated that about 50% of smokers trying to quit eventually succeed (Hughes, 2003).

Table 3 shows the distribution of perceptions of addictiveness in our sample. Given an "objective" quitting prevalence of 50%, our sample seems to be well aware of the addictiveness of smoking. For the full sample, only about 12% believed that less than half of smokers trying to quit would fail to do so. The proportion was the same for females and males. Among smokers, the proportion was 16 and 18% for males and females, respectively. About 60% of the sample believed that 70% of more percent of smokers trying to quit would fail.

It is difficult to compare the results obtained in the present study with previous results, since quantitative estimates of addictiveness perceptions are rare in the literature. An exception is the Annenberg Survey, where a similar question as the one used in this study was asked, let alone with a different denominator (Jamieson and Romer, 2001). In the latter study, the average respondent believed that 3.2 smokers out of 10 attempting to quit would succeed, which is very similar to our results that the average respondent believed that 68 out of 100 smokers attempting to quit would not succeed.

6.2. Formation of risk perceptions

Next, we perform multiple regression analysis on smoking risk perceptions to further analyze gender differences in risk perceptions. Table 4 contains the results for perceived smoking mortality risk. The first column shows the results of the regression where girls and boys are pooled. In these regressions we are able to examine whether gender differences in risk perceptions persist after controlling for information sources and socio-economic and demographic factors. Controlling for such factors, girls still perceive the risks of smoking-related mortality as 3% points higher than boys. As to information sources, having received information from a teacher at school and having searched for information on one's own are positively and significantly associated with mortality risk perceptions. Having received information from another adult at school, however, shows a negative and significant correlation with risk perceptions. None of the other information source variables are significant.[5] Regarding the socio-economic and demographic variables, it can be noted that younger age and living with a single-parent household are associated with significantly higher smoking mortality risks. Furthermore, higher income is negatively correlated with risk beliefs.

The second and third columns of Table 4 report the results of the regressions where boys and girls are analyzed separately, relaxing the restriction of equal coefficients across gender. The fourth column of Table 4 then shows whether or not the differences between the coefficients of boys and girls are significant. These results were obtained in a regression were all variables were interacted with the gender variable (full results available upon request). A striking result is that none of the information source variables significantly affect the risk perception of girls, while several of them affected the risk perception of boys. Only in the cases of having received information from friends and from other adults are the effect significantly different by gender, however, as suggested by a significant interaction effect. In the case of father's education, living with both parents, and one of the income categories, the interaction variables are also significant, suggesting differential effects by gender. In the former case, the interaction effect suggest that having a father with university education have a greater positive effect on mortality risk perception among males than females.

Next, we turn to the perceived addictiveness of smoking. The second part of Table 4 shows the results of both the pooled regression and the separate regressions by gender. From the pooled regression, we see that girls perceive the addictiveness of smoking as significantly smaller than boys, also after controlling for socio-economic and demographic factors, as well as information sources. Moreover, none of the information source variables are significant. Among the other results, it could be noted that living with both parents showed a significant and negative correlation with the perceived addictiveness of smoking.

Turning to the separate regressions by gender, the results show that most variables strike girls and boys in a similar manner. Only in the case of grade is the interaction effect significant, suggesting that the negative effect of being younger on perceived addictiveness is significantly greater among boys than among girls. None of the information source variables are significant when analyzing girls and boys separately.

In sum, the results suggest substantial gender differences in the perceptions of smoking risks. Moreover, the results suggest that even though girls are more likely to have received various types of smoking related information, they respond less to this than boys. In fact, the results suggest that the risk perceptions of girls are not at all affected by the various information sources, whereas those for boys are. The explanation may be that the information sources convey no new information to girls, whereas boys update their prior beliefs in response to these types of information sources. Alternatively, girls may attach little or no importance to the types of information sources considered in the analysis.

6.3. Risk perceptions and smoking behavior

The results of the regressions on smoking behavior are shown in Table 5. The dependent variable is whether or not the respondent is a smoker. In the first column of the table, we show the results of men and women analyzed together. As expected, a greater perceived mortality risk is associated with a reduction in the probability of smoking. The effect is significant at the 1% level. Columns 2 and 3 of Table 5, show separate estimates for boys and girls. Even though the magnitude of the effect is greater among girls, the difference is too small to be statistically significant. The effect is significant for both boys and girls.

Turning to the perceived addictiveness of smoking, an increase in it is associated with a lower probability of smoking. The effect differs only to a small extent between boys and girls and the difference in effect is not statistically significant. Overall, the results suggest that boys and girls react substantially to the perceived addictiveness and mortality risk of smoking and do so in a similar manner.

Regarding the variables indicating various information sources, some significant gender differences are obtained. While having received smoking risk information from a teacher or other adult in school is associated with a lower probability of being a smoker both for girls and boys, having received information from parents or friends is associated with an increase in

[5] Note that one should be careful in interpreting the coefficients of the information source variables as representing causal effects. The information sources are not randomly allocated to different individuals, but may rather be related to unobserved factors, leading to a potential endogeneity problem. Addressing such potential endogeneity would require some source of exogenous variation, which was not available in the present study.

Table 4
OLS regressions on perceived mortality risk and addictiveness

Variable	Mortality risk				Addictiveness			
	Full sample	Females	Males	IE	Full sample	Females	Males	IE
Female	0.030*** (0.006)	–	–	–	-0.027*** (0.005)	–	–	–
Grade 9	0.023*** (0.008)	0.032*** (0.010)	0.014 (0.011)	NS	0.009 (0.006)	0.026*** (0.008)	−0.009 (0.008)	1%
Born in Sweden	−0.007 (0.012)	−0.007 (0.017)	−0.008 (0.016)	NS	−0.009 (0.009)	−0.004 (0.011)	−0.013 (0.013)	NS
Living with both parents	0.023*** (0.007)	0.036*** (0.009)	0.010 (0.010)	10%	−0.010* (0.005)	−0.013* (0.007)	−0.006 (0.008)	NS
Mother university educated	0.006 (0.008)	0.011 (0.011)	0.003 (0.012)	NS	−0.002 (0.006)	0.004 (0.009)	−0.009 (0.009)	NS
Don't know mother's education	0.016 (0.011)	0.018 (0.016)	0.012 (0.015)	NS	0.007 (0.009)	0.014 (0.013)	3×10^{-4} (0.013)	NS
Father university educated	0.013 (0.008)	−0.014 (0.011)	0.037*** (0.012)	1%	−0.001 (0.006)	−0.001 (0.009)	−0.003 (0.009)	NS
Don't know father's education	−0.007 (0.011)	−0.017 (0.015)	0.006 (0.016)	NS	−0.014* (0.009)	−0.010 (0.012)	−0.019 (0.013)	NS
Income category 2	−0.022** (0.009)	−0.010 (0.012)	−0.032** (0.014)	NS	−0.009 (0.007)	−0.014 (0.009)	−0.005 (0.010)	NS
Income category 3	−0.040*** (0.009)	−0.033*** (0.012)	−0.045*** (0.014)	NS	−0.007 (0.007)	−0.007 (0.009)	−0.009 (0.010)	NS
Income category 4	−0.052*** (0.013)	−0.038** (0.018)	−0.063*** (0.019)	NS	−0.010 (0.010)	−0.001 (0.013)	−0.019 (0.014)	NS
Income category 5	−0.077*** (0.017)	−0.032 (0.023)	−0.120*** (0.025)	5%	−0.025* (0.013)	−0.020 (0.018)	−0.029 (0.020)	NS
Income category 6	−0.055** (0.021)	−0.038 (0.033)	−0.073*** (0.028)	NS	0.006 (0.015)	−0.002 (0.024)	0.014 (0.021)	NS
Income category 7	−0.049*** (0.014)	−0.035* (0.020)	−0.059*** (0.019)	NS	0.013 (0.011)	0.025 (0.016)	0.004 (0.016)	NS
Own information search	0.032*** (0.010)	0.021 (0.014)	0.045*** (0.015)	NS	−0.010 (0.008)	−0.018 (0.011)	−0.003 (0.013)	NS
Information from teacher	0.016** (0.007)	0.015 (0.010)	0.017* (0.010)	NS	−0.005 (0.006)	−0.010 (0.008)	-5×10^{-4} (0.009)	NS
Information from person at school	−0.012* (0.007)	−0.012 (0.009)	−0.012 (0.010)	NS	−0.002 (0.005)	0.003 (0.007)	−0.006 (0.008)	NS
Information from parents	0.011 (0.007)	0.013 (0.009)	0.010 (0.010)	NS	−0.005 (0.005)	−0.001 (0.007)	−0.011 (0.008)	NS
Information from siblings	−0.010 (0.012)	0.003 (0.016)	−0.025 (0.018)	NS	−0.009 (0.011)	−0.012 (0.015)	−0.008 (0.014)	NS
Information from friends	0.013 (0.010)	−0.001 (0.013)	0.034** (0.016)	10%	−0.009 (0.007)	−0.016 (0.010)	0.002 (0.012)	NS
Information from other adults	−0.002 (0.008)	0.015 (0.012) (0.014)	−0.025* (0.007)	5%	0.009 (0.009)	0.007	0.008	NS
Information from media	0.005 (0.007)	−0.004 (0.009)	0.013 (0.010)	NS	0.002 (0.005)	−0.001 (0.007)	0.006 (0.008)	NS
Other information	0.019 (0.012)	0.017 (0.016)	0.018 (0.019)	NS	0.015 (0.010)	0.017 (0.014)	0.012 (0.016)	NS
Constant	0.421*** (0.016)	0.441*** (0.023)	0.433*** (0.024)		0.715*** (0.013)	0.674*** (0.015)	0.730*** (0.019)	
Observations	8304	4158	4146		8304	4158	4146	
R^2	0.02	0.02	0.02		0.01	0.01	0.00	

Robust standard errors in parentheses. IE refers to interaction effects, where NS refers to not significant.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Table 5
Probit regressions on smoking decision

Variable	Full sample	Females	Males	IE
Female	0.058 (0.007)***	–	–	–
Mortality risk	−0.076 (0.013)***	−0.057 (0.015)***	−0.095 (0.021)***	NS
Addictiveness	−0.088 (0.015)***	−0.077 (0.018)***	−0.098 (0.025)***	NS
Grade 9	−0.022 (0.008)***	−0.011 (0.010)	−0.034 (0.013)***	NS
Born in Sweden	−0.042 (0.013)***	−0.066 (0.018)***	−0.015 (0.019)	NS
Living with both parents	−0.095 (0.009)***	−0.081 (0.011)***	−0.113 (0.013)***	5%
Mother university educated	−0.015 (0.009)*	0.003 (0.011)	−0.033 (0.014)**	5%
Don't know mother's education	0.006 (0.012)	0.013 (0.016)	0.004 (0.020)	NS
Father university educated	−0.019 (0.009)**	−0.008 (0.011)	−0.033 (0.015)**	NS
Don't know father's education	0.041 (0.013)***	0.024 (0.017)	0.054 (0.020)***	NS
Income category 2	0.017 (0.013)	0.019 (0.017)	0.014 (0.019)	NS
Income category 3	0.055 (0.012)***	0.051 (0.016)***	0.059 (0.018)***	NS
Income category 4	0.081 (0.020)***	0.065 (0.025)***	0.096 (0.030)***	NS
Income category 5	0.111 (0.028)***	0.153 (0.041)***	0.066 (0.038)*	5%
Income category 6	0.067 (0.032)**	0.046 (0.039)	0.076 (0.049)	NS
Income category 7	0.154 (0.024)***	0.133 (0.030)***	0.160 (0.038)***	NS
Own information search	−0.002 (0.011)	−0.000 (0.014)	0.002 (0.018)	NS
Information from teacher	−0.031 (0.008)***	−0.030 (0.010)***	−0.031 (0.013)**	NS
Information from person at school	−0.051 (0.007)***	−0.029 (0.009)***	−0.072 (0.011)***	NS
Information from parents	0.024 (0.008)***	0.005 (0.010)	0.043 (0.012)***	10%
Information from siblings	0.013 (0.014)	0.032 (0.020)	−0.002 (0.020)	NS
Information from friends	0.059 (0.013)***	0.025 (0.017)	0.087 (0.019)***	NS
Information from other adults	0.007 (0.010)	−0.005 (0.013)	0.020 (0.016)	NS
Information from media	−0.001 (0.008)	−0.004 (0.010)	0.007 (0.013)	NS
Other information	0.001 (0.015)	0.013 (0.020)	−0.010 (0.022)	NS
Observations	8231	4094	4137	
R^2	0.10	0.09	0.09	

Marginal effects shown. Standard errors in parentheses. IE refers to interaction effects, where NS refers to not significant.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

the probability of being a smoker among boys only. The positive effect of receiving information from parents or pals may to some extent reflect reverse causality; i.e., that male smokers are more likely to receive smoking information from worried parents and friends than their non-smoking counterparts.

7. Conclusions

In this paper we investigated gender differences in smoking risk perceptions and gender differences in their relationship with actual smoking behavior. The results confirm the existence of significant gender differences in the perception of smoking mortality risk and in the perceived addictiveness of smoking, even after controlling for a wide range of background characteristics, including information sources. Girls perceived the addictiveness of smoking as lesser than males, even though most evidence suggest that addictiveness is greater among females than males. This may explain some of the observed gender smoking gap, since fewer females than males have quit smoking.

Our results suggest that young people do take risks into account when deciding upon risky consumption. Both the perceived addictiveness and mortality risk of smoking showed a significant association with smoking behavior. Interestingly, the response was as large among boys as among girls. This run counter to the notion that females dislike risks to a greater extent than males. Accordingly, policies affecting the perceived risks of smoking may have similar effects on males and females.

A number of different explanation have been put forward for the general finding that women often perceive risks as larger. Some of these, like the suggestion that they originate from a lack of knowledge of science and technology among females, have been rejected. Female scientists in field of psychics and toxicology have been found to judge nuclear risks and societal risks, respectively, as higher than their males colleagues (Barke et al., 1997; Slovic et al., 1997). Other explanations focus on biological and social factors, for instance that women traditionally have been more concerned with human health and safety, since they give birth to and are socialized to nurture and maintain life (Steger and Witt, 1989).

Risk perceptions have been elicited in various ways. We opted for a quantitative measure that made interpersonal comparisons possible and that has been found to predict smoking behavior in previous studies. A relevant question is whether our findings are specific to the measure used. Similar results have, however, been obtained in studies using alternative measures. Antoñanzas et al. (2000) and Viscusi (2002) used questions about the life-expectancy loss due to smoking. In both studies, both males and females overestimated the losses, but females overestimated the loss to a greater extent. Schoenbaum (1997) analyzed the perceived chance of reaching the age of 75 among a sample of adults aged 50–62. The results showed that heavy smokers on average overestimated their chances of reaching 75, while light smokers, former

smokers, and non-smokers either had accurate perceptions or underestimated their chances. These results are not necessarily at odds with ours. First of all, it should be noted that Schoenbaum (1997) defined light smoking as smoking less than 25 cigarettes a day and, by definition, light smokers accounted for the majority of smokers in the sample. Most smokers, thus underestimated or held correct beliefs. Second, Schoenbaum (1997) was not able to assess how much of the overestimation that could be attributed to incorrect smoking risk perceptions. Finally, Schoenbaum (1997) considered only smokers aged 50 and over, whereas both this study and Antoñanzas et al. (2000) and Viscusi (2002) considered much younger smokers. If smokers with higher risk perceptions are more likely to quit, one would also expect that people who are still smokers at older ages to have lower-than-average risk perceptions. This is in line with the results from several studies, including the present one, who have found that younger individuals overestimate the risks to a greater extent than older people.

This paper is the first, to our knowledge, to explicitly analyze gender differences in smoking risk perceptions, and in the response to the latter, using quantitative estimates of both the perceived addictiveness and mortality risk of smoking. Such knowledge should be useful when designing policies targeting girls and boys separately. More generally, such knowledge contributes to the general understanding of gender differences in risk-taking behaviors.

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