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SMOKING RISKS IN SPAIN: PART II - PERCEPTIONS OF ENVIRONMENTAL TOBACCO SMOKE EXTERNALITIES

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Abstract

Previous studies of smoking risk beliefs have focused almost exclusively on risks to the smoker. Using an original set of survey data from Spain, we examine the public's perceived risks from exposures to environmental tobacco smoke. The risk categories considered included lung cancer, heart disease, life expectancy loss, and low birth weight for children of smoking mothers. Risk beliefs were quite high, often dwarfing scientific estimates of the risk. The results are consistent with overestimation of risks from highly publicized, low probability events.

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Smoking Risks in Spain:
Part II – Perceptions of Environmental Tobacco Smoke Externalities

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1. Introduction

For years cigarettes have been viewed as posing a risk to the smoker, but nonsmokers have viewed their exposure to tobacco smoke as largely being a smelly annoyance. Matters changed substantially in recent years as the potential health hazards associated with environmental tobacco smoke (ETS) began to receive increased scrutiny. Chief among these sources of information have been the report of the U.S. Surgeon

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General (1986) on The Health Consequences of Involuntary Smoking and the report by the U.S. Environmental Protection Agency that labeled environmental tobacco smoke as a group A carcinogen. With cigarette smoke viewed as a major threat to the health of others, the impetus for smoking restrictions to prevent these hazards greatly increased.

These efforts have not been restricted to the United States, but have also been reflected in policies undertaken in Spain. Much of the public pressure that led to these policies stems from how the public perceives the environmental tobacco smoke risks to their health. Are these perceptions accurate? Does the general public properly assess passive smoking risk, or do they commit major error in their risk judgments, which in turn would create political pressures from an uninformed citizenry?

While much is known about people's perceptions of the risks of smoking to themselves should they choose to smoke, considerably less is known about the perception of the risks to others posed by smoking behavior.[1] Some surveys have included questions asking whether they believe that environmental tobacco smoke is risky, to which most respondents respond that it is, but little can be concluded concerning the extent of the risk associated with these judgments. In addition, there is survey evidence pertaining to popular attitudes with respect to restrictions on smoking behavior. For example, the Gallup polls in 1977 indicated that the public's preferences regarding smoking policies in public places such as airplanes and restaurants was that 10 percent favored no restrictions, 68 percent favored specified areas set aside for smoking, and 16 percent favored no smoking permitted at all. These attitudes in the United States changed

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substantially over time as 55 percent favored a complete ban on smoking in all public places by 1987, with this figure rising to 60 percent by 1988.[2] This dramatic shift in the public's attitude toward policies to address the external risks of smoking suggests that risk beliefs no doubt have also increased over time.

This article explores the public attitudes toward environmental tobacco risks based on original survey evidence for Spain. There is no comparable evidence in the literature for any country with respect to environmental tobacco smoking risks so that these results should be particularly instructive in indicating how the public views the passive risks associated with smoking. The measures we will explore are quite diverse, including lung cancer, heart disease, life expectancy loss, and the risks of low birth weight babies born to smoking mothers. Moreover, by comparing the results for perceptions of environmental tobacco risks with those for the risk to smokers themselves it will be possible to get a sense both of the relationship between these two measures for Spain as well as the likely relationships that may prevail on other countries as well.

The levels of the perceptions of environmental tobacco risks are of broad methodological interest as well. There is a substantial literature in psychology and economics documenting the overperception of low probability mortality risks.[3] Notwithstanding the substantial attention that the risks of passive smoking have received, these hazards tend to be relatively small compared to other major sources of mortality. They are, for example, dwarfed by the primary risks of cigarette smoking to the smokers

[1] For evidence on the risks to smokers, see Antoñanzas et al. (2000) in this issue, as well as Viscusi (1990, 1991, 1992, 1998) and Zweifel (1999). Behavioral responses to risks in Spain are the subject of Viscusi et al. (2000).
[2] These statistics are summarized in Viscusi (1992), p. 52.
[3] See Lichtenstein et al. (1978), Morgan (1983), Viscusi (1998b), Viscusi, Hakes, and Carlin (1997), Viscusi and Hakes (1997), and Antoñanzas et al. (2000).

themselves. Other major risks to the public, such as the chance of dying in an automobile accident, are also much greater. Based on evidence in the literature with respect to the overestimation of low probability risks to our lives, one would expect substantial overperception of the risks posed by environmental tobacco smoke.

A related factor is that highly publicized risks often are overestimated as well. The risks of smoking to the general public have received substantial attention internationally, far more than other mortality risks of comparable magnitude. Because this publicity highlights the presence of the risk but does not indicate a risk probability, one would also predict that there would be overestimation of the hazard because of the considerable public attention devoted to the risk of environmental tobacco smoke.

A third potential influence is that the character of the risks is involuntary. We hypothesize that individuals will be particularly likely to overestimate risks that are imposed on them as opposed to risks that are the result of voluntary decisions. To the extent that our conjecture is true, there will also tend to be overperception of the risks associated with passive smoking.

Whereas previous survey questions have elicited simply a general sense of whether environmental tobacco smoke is risky, our focus will be more precise in that it will enable us to determine the quantitative risk perceptions of the respondents. Thus, it will be possible to assess whether risk beliefs are in line with the estimated risk levels or whether they are too high or too low.

In Section 2 we provide some background regarding smoking policies in Spain, particularly as they relate to environmental tobacco smoke. That section also provides a brief review of the scientific evidence regarding the level of the hazards posed by passive

smoking. In Section 3 we explore a series of risk measures for the public risk perceptions regarding several types of risk posed by environmental tobacco smoke, and in Section 4 we compare these perceptions of passive smoking risks to the individual perceptions of risk to themselves from smoking. Section 5 presents a regression analysis that explores the demographic determinants of passive smoking risk beliefs as well as the linkage between the perceived risks to the smoker and the perceived environmental tobacco smoke risks. These results yield the striking conclusion that for almost all risk measures the public believes that environmental tobacco smoke exposure is roughly half as dangerous as is the risk of being a smoker. These estimates are wildly out of line with the available scientific evidence and are suggestive of a substantial overestimation of these hazards.

2. Passive Smoking Policies and Evidence

Most formal warnings policies have focused on the risks to the smoker. Indeed, all cigarette warnings in the United States have addressed only risks to the smoker, not passive smoking risks. Other informational efforts, such as reports by the U.S. Surgeon General and public health campaigns have addressed the hazards posed by environmental tobacco smoke. Moreover, to the extent that hazard warnings indicate that cigarette smoke itself is dangerous, that warning would pertain to environmental tobacco smoke as well as to risks to the smoker.

This informational environment is similar in Spain as was documented in Antoñanzas et al. (2000). However, in Spain there are also explicit warnings that pertained only to the hazards of environmental tobacco smoke. The warnings following

the initial regulation of smoking by the Spanish government in 1978 pertain only to the hazards to smokers. However, in 1988 the General Law on Advertising (34/1988, November 11) introduced a variety of restrictions on tobacco advertising which augmented the voluntary advertising restrictions that emerged based on the voluntary agreement of the tobacco companies with the Ministry of Health on March 3, 1988. In addition to warnings concerning risks to the smoker, the on product warnings required in Spain in 1988 specifically noted the birth defect risks of smoking: "Health authorities warn that smoking during pregnancy harms your baby." This birth defect risk is one of the externalities from smoking that will be the focus of this paper. While it differs from environmental tobacco smoke in that the risk is not to a possibly unrelated third party, it bears a similarity in that it is an external effect on someone other than the smoker. This warning concerning birth defect risks parallels that in the United States, which instituted as part of the four rotating warnings in 1984 the on product warning: "SURGEON GENERAL'S WARNING: Smoking by Pregnant Women May Result in Fetal Injury, Premature Birth, and Low Birth Weight."

The 1992 directive (92/41/CEE) of May 15, 1992 on the labeling of tobacco products and a royal decree (1185/1994, June 3) transmitted to the Spanish legislature amended the warnings. There was now a rotating warning concerning the birth defect risk: "Smoking during pregnancy harms your baby." In addition, there were two additional warnings that specifically highlighted the hazards of environmental tobacco smoke. The first pertained to the risks to children: "Protect your children: do not allow them to breathe tobacco smoke." The other warning pertained to the risk to other people without specific mentioning their identity, as it warned: "Smoking harms those around

you." In each case these phrases were preceded by the warning "Health authorities warn that." Moreover, there was another warning also on the pack alerting consumers to the fact that "Health authorities warn that smoking seriously endangers health."

2.1. The Hazards Posed by Environmental Tobacco Smoke

These various warnings indicate that environmental tobacco smoke is risky but do not give a sense of the magnitude of the risk. However, it is essential to obtain some perspective on the risk level in order to make a determination of whether risk beliefs are accurate or are biased in any particular direction. While cigarette smoking clearly poses substantial risks to the smoker, the extent of the risks posed by environmental tobacco smoke remain a matter of considerable debate. In part the difficulty is that the probabilities involved are much lower than the risks to the smokers themselves. When this aspect of environmental tobacco smoke risks is combined with the substantial latency period as well as the fact that most smoking-related ailments are not signature diseases, the result is that it is very difficult to determine precisely just how risky environmental tobacco smoke is. Some scientists suggest that there may be no risk at all, whereas other project more dire scenarios.

Rather that engage in any debate over the scientific evidence, the approach that will be adopted here will be to use estimates generated by various U.S. government agencies, which in turn are based on the scientific literature. Even within governmental bodies there is no consensus regarding the level of passive smoking risks. Most notably, the study by the U.S. Environmental Protection Agency that focused on the lung cancer risks from smoking has been thrown out by the U.S. courts for two reasons. First, in the

view of the court, the study "cherry picked" the data by focusing only on the studies that provided the strongest evidence of nonzero risks of environmental tobacco smoke rather than providing a comprehensive perspective of the scientific literature. For example, the EPA analysis ignored a major new study performed by scientists at the United States National Cancer Institute, which failed to indicate any statistically significant relationship between environmental tobacco smoke exposures and lung cancer. The second shortcoming noted by the U.S. courts is that the statistical tests applied in interpreting the studies do not meet the usual standards for statistical significance. Because none of the underlying studies met the test of finding a statistically significant risk at the 95% confidence level, EPA chose instead to use a 90% confidence level, which is a point we will return to below.

Consider first the risks posed by environmental tobacco smoke exposures to lung cancer. These hazards include risks to the smoker's spouse, the smoker's children, coworkers, and other people exposed to the hazard.[4] Estimates of the total number of people who died from lung cancer due to environmental tobacco smoke (ETS) exposures inside the home are 800. However, these estimates do not adjust for the changing tar content of cigarettes. If the hazards are proportional to the tar content, the number of deaths is 553. Deaths outside the home are somewhat greater. The EPA estimates that this death total is 1,694 deaths, though with a tar adjustment the death total drops to 1,171. Thus, the total number of lung cancer deaths estimated by EPA for deaths attributable to ETS exposure is 2,596, but if the risks are proportional to the tar level the

[4] The various governmental sources of these estimates as well as a detailed review of the underlying scientific evidence is presented in Viscusi (1995).

death total is 1,931. In either case, the annual probability of lung cancer due to passive smoking as estimated by the U.S. EPA is approximately 1/100,000.

Even this estimate may be too high. The U.S. Occupational Safety and Health Administration (OSHA) reviewed the same set of studies considered by EPA and came up with a different, but lower, estimate of deaths outside the home. The tar adjusted estimates based on the OSHA statistics have a lower bound value of 374 deaths outside the home and an upper bound value of 970 deaths outside the home, so that even the upper bound OSHA estimate is below the estimate presented by EPA. As one would expect, most of these deaths outside the home have been linked to workplace exposures.

Even estimated low lung cancer risk levels from ETS on the order of 1/100,000 or less may overstate the actual risk based on the available scientific evidence. In making its case for the carcinogenicity of ETS, EPA selected what it viewed as the eleven strongest studies providing evidence of a hazard. However, in no case did any of these studies indicate a risk that was statistically significant at the usual 95 percent confidence level. Moreover, by applying the less demanding test of using a 90 percent confidence level, only one of the eleven studies analyzed by EPA indicated a relative risk resulting from environmental tobacco smoke exposures in excess of 1.0. It should be noted, however, that a 90 percent confidence level two-tailed test is equivalent to a 95 percent confidence level one-tailed test. Thus, while a point estimate of 1/100,000 may be correct, there is no solid evidence in the literature of a statistically significant linkage at all.

While the greatest public debate has been over the lung cancer risks estimated for ETS exposures, the greater hazard appears to be attributable to the heart disease-ETS

linkage. While the estimates discussed below are based only on one study,[5] the findings nevertheless indicate both a larger risk level as well as a risk that passed the usual tests of statistical significance. Estimates by the EPA indicate that the heart disease risk for those inside the home ranges from 3,240-6,480 (assuming 27 percent of exposures are at home). Risks outside the home range from 8,760-17,520 (assuming 73 percent of exposures are outside the home). As before, estimates using the same data by OSHA are lower. Taking the EPA estimates at face value implies an ETS-heart disease death risk ranging from 12,000-24,000. This death total is roughly an order of magnitude greater than that for lung cancer, which makes the annual heart disease-ETS risk based on these government estimates a figure such as 1/10,000.

The survey questions below will not distinguish annual risks but instead will be focusing on lifetime risks. However, even if one assumed lifetime risks over a 50 year period with perhaps a 70 year period of exposure and a two decade latency period, then the estimated lifetime risk from lung cancer would be on the order of 1/2,000 and the estimated lifetime risk from ETS exposures and heart disease would be on the order of 1/200. Each of these estimates, which are likely to be high given the character of the studies generating them, will turn out to be dwarfed by the general public's perception of these risks, which is many magnitudes greater than the estimated levels.[6]

3. Passive Smoking Risk Beliefs

[5] See Viscusi (1995) for a review and critique.

[6] These results have parallels in the evidence for Spain regarding environmental tobacco smoke. For evidence on the European literature considering smoking risks as well as the risk of environmental tobacco smoke, see the survey of 37 studies on lung cancer and environmental tobacco smoke in Hackshaw, Law and Wald (1997), which reports an average relative risk of lung cancer of 1.53, with 95% confidence intervals covering 1.21 up to 1.94.

While the risks posed by environmental tobacco smoke are quite small, the public attention to these risks has been considerable. As a consequence, one might expect the existence of some potential for overestimation of these low probability risks.

To assess the accuracy of risk beliefs, the 1997 Spain survey described in Antoñanzas et al. (2000) also included ETS questions that paralleled those for risks to smokers. Thus, it is possible to obtain meaningful quantitative assessments of the perception of ETS risks. Moreover, by having comparable questions for each risk variable one can compare the public's perception of how dangerous ETS is as compared with primary tobacco smoke. The questions asked pertained to the lung cancer risk, heart disease risk, and life expectancy loss for passive smokers. In addition, the survey elicited information regarding the risk of having a low birth weight baby.

The sample consisted of 2,571 respondents who were contacted by telephone in Spain in 1997. The sample was broadly representative of the Spanish population overall. The mean age of the sample was 44, of whom 47 percent were males. The sample averaged 10 years of schooling. Overall, 33 percent of the sample consisted of people who currently smoke.

3.1. Lung Cancer Risks

The lung cancer risk question paralleled that for the lung cancer risk to smokers. Instead of asking about the lung cancer risk one would incur to one's self, this question asked about the lung cancer risk to others because of smoking behavior. As in the case of the question pertaining to the primary smoke risk, the formulation of the question asked respondents to estimate the risk per 100 population. This denominator is a convenient

way to ask such questions in a manner that can be readily understood within the context of a telephone interview. The mean value of the responses by smoking status appears in Table 1, and the question text in Spanish and in English appears in Table 2.

The responses are somewhat higher for respondents who have never smoked, but they are fairly similar overall. Current smokers rate the lung cancer risk of ETS as being 0.21, nonsmokers believe it is 0.28, former smokers are in the middle, as is the sample average of 0.23. These passive smoking risks are roughly half the magnitude of the primary risk to smokers as is estimated for the same sample and reported in Antoñanzas et al. (2000). In particular, the mean lung cancer risk to smokers was 0.50, which is almost exactly double the passive smoking risk estimate.

This pattern will prove to be borne out by the subsequent analysis as well, as respondents tend to assess the ETS risk as being approximately half as large as the primary risk to smokers. Thus, there is considerable distortion in the public's beliefs concerning the relative risks of secondhand smoke as compared to primary smoke. Whereas the public overestimates the lung cancer risk by less than an order of magnitude, the public overestimates the ETS lung cancer risk. The estimated risk level of 0.25 dwarfs the lifetime exposure risk, which is well below 0.001.

Table 3 presents the distribution of the lung cancer risk beliefs for passive smoking as a function of smoking behavior. There is at least some portion of the population that realizes that these risks are small as 15 percent of the sample believes that the passive smoking risk probability is below 0.05. However, more than 85 percent of the sample believes that the risk is at least 0.05. Even more strikingly, over 20 percent of the population believes that death from exposures to environmental tobacco smoke is at

least a 50/50 proposition. Estimates such as these are incredibly out of line with any reasonable estimate of the risk and suggest that the public has done very little to distinguish the relative risks of primary smoking and environmental tobacco smoke. Rather, there is a tendency to view these risks as being of comparable magnitude, which they certainly are not.

3.2. Heart Disease Passive Smoking Risks

The survey asked respondents about the heart disease risks associated with passive smoking. As is indicated in Table 2, the wording of this question was identical to that of lung cancer, with the substitution of the phrase "heart disease" for "lung cancer" in the survey question. As the mean value of responses in Table 1 indicate, the assessment of the lung cancer risk is almost identical to that for the heart disease risk. In each case, the average risk perception for the sample is 0.25, and there is negligible variation within different smoking categories in the perception of the lung cancer risk and heart disease risk from passive smoking.

Table 4 summarizes the distribution of the heart disease risk perceptions from ETS. The findings closely parallel those from lung cancer, as 15 percent of the sample believes that the heart disease mortality rate from ETS is below 0.05, whereas just over 85% of the sample believes that it is at least 0.05. As with the lung cancer risk beliefs, 20 percent of the sample believes that the heart disease death risk from ETS is a 50/50 proposition. While the performance of these risk measures will show some distinctive difference between lung cancer and heart disease in the subsequent analysis, the overall magnitudes of the risk assessment are very comparable.

3.3. Life Expectancy Loss

Given the lower probabilities of death associated with passive smoking as opposed to primary smoking, one would expect the life expectancy loss to be reduced similarly. The wording of the life expectancy loss question for ETS parallels that for primary smoke reported for the same sample in Antoñanzas et al. (2000). As is indicated in Table 2, the life expectancy loss question asks smokers to compare two twin brothers, one of whom is exposed to ETS and one of whom is not, and then to assess their loss of life expectancy. Thus, the formulation of this question delineates specifically the character of the exposure and its duration, enabling respondents to obtain some sense of the character of the risk that is the subject of the question.

The mean life expectancy loss estimates reported in Table 1 are similar to estimates reported for primary smoking. Current smokers believe the life expectancy loss from ETS is 4.1 years, those who never smoked believe that it is 6.6 years, and the sample average is that there will be 5.6 years of life expectancy loss. However, the actual life expectancy loss from passive smoking is many orders of magnitude smaller than the life expectancy loss due to smoking. These estimates are consequently inordinately high and are a better reflection of the life expectancy loss experienced by smokers.

The differences across gender are noteworthy as well. Women live longer than men, and one might expect that women responding to the question would give a higher life expectancy loss due to passive smoking exposures than do their male counterparts. This pattern is borne out by the estimates within each smoking group as well as for the

sample average for which women overall believe that there will be a 6.2 year loss of life expectancy, and men believe there will be a 4.8 year loss of life expectancy.

The distribution of estimated lost life expectancy from ETS in Table 5 indicates some surprising patterns. Six percent of the sample believes that rather than shortening life, exposure to ETS will lengthen life. Current smokers are most likely to believe that this is the case, as 11 percent of the current smokers believe that there will be a boost in life expectancy. While these respondents will be taken at face value for the subsequent statistical analysis, they also may reflect a misunderstanding of the question and a confusion in thinking about the trajectories of the lifetime for those exposed to ETS and the lifetime of those who are not exposed. A total of 14 percent of the sample believes that the life expectancy loss associated with ETS exposures is less than one year. Current smokers are most likely to be accurate in this respect, as 25 percent of current smokers believe that the life expectancy loss from passive smoking is under 1 year. Nevertheless, even for current smokers, 55 percent of them believe that the life expectancy loss generated by passive smoking is at least 10 years.

While estimates may appear to be extreme, they are much more accurate than those who have never smoked at all. Only 26 percent of that group believes that the life expectancy loss due to exposures to environmental tobacco smoke is under 10 years, and 42 percent of them believe that the life expectancy loss is 15 years or more due to exposure to environmental tobacco smoke.

What these finding suggest is that the current informational regime has generated enormous public alarm with respect to a risk that is in fact extremely small based on the best scientific estimates. Even a massive epidemic in the Spanish population would not

have the kind of dire consequences as people project for exposures to environmental tobacco smoke.

3.4. Low Birth Weight Babies

The survey also inquired regarding the risk of low birth weight for children of the smoking mother. A review of five studies cited by the U.S. Surgeon General (1989, p. 72) indicated that 21-39 percent of the incidence of low birth weight could be traced to cigarette smoking. Increasing the risk of a low birth weight baby by one-fifth to two-fifths does not, however, imply a high probability of a low birth weight baby since the incidence of low birth weight babies among nonsmokers is not great. Risk of fetal injury and perinatal mortality also appear to be present, but are of substantially small magnitude.

The responses to the low birth weight question overstate even the incremental proportional increase in the risk of a low birth weight baby, where the base proportion in necessarily below 1. The evidence in Table 1 indicates that overall people believe that there will be a 0.37 probability of a low birth weight baby if one smokes. Moreover, smokers have quite similar beliefs as they believe the risk of a low birth weight baby is 0.34.

Mothers' attitudes are particularly important since they are the ones who must make the decision to smoke, which in turn will affect the risk of a low birth weight baby. The evidence presented in Table 1 indicates that females have a higher perception of the low birth weight risk than do all respondents, as they may be more attuned to the low

birth weight risk information since they are the ones who have babies and are most directly involved in smoking decisions that will affect babies' health.

The distribution of responses in Table 6 indicates that only a third of the sample believes that the risk of a low birth weight baby is below 0.2, and just under half the sample believes that the risk of a low birth weight baby due to ETS exposures is below 0.3. As with the previous results, these findings indicate a dramatic overestimation of the actual level of the risk. Moreover, the pattern of responses across the different distributions of current smokers, former smokers, and never smokers, also is reasonably similar, with the principal difference being that current smokers are more concentrated in the low risk groups.

3.5. Linkages Across Risks

To the extent that people believe that there is a risk from passive smoking, presumably their assessments of the passive smoking risks are correlated. Thus, if people believe that ETS causes lung cancer, they may also believe that it causes heart disease, life expectancy loss, and low birth weight babies.

To explore such linkages, Table 7 shows the mean levels of risk belief for various lung cancer risk levels. Because lung cancer is the most salient risk associated with smoking, we have used this as a reference point for analyzing the level of other risk beliefs, given the particular levels of the lung cancer risk assessment. The heart disease risks are most similar. For people who believe that lung cancer risk is below .05, their mean assessed heart disease risk is .06. Similarly, for people who believe the lung cancer risk is at least 0.20 but below 0.30, the heart disease risk is 0.24. In the very high risk

levels, the heart disease risk estimate lies below that for lung cancer, but one would expect such regression toward the mean effects when dealing with very large lung cancer risk levels.

The next column of statistics shows that life expectancy loss is broadly correlated with the lung cancer risk in that in most instances the life expectancy loss increases as one moves to the higher lung cancer risk categories. This pattern of steady increase, however, becomes interrupted once the lung cancer risk level reaches 0.70. At such high risk levels there are comparatively few respondents, and as in the case of the heart disease risk estimates there may be some regression toward the mean driving these findings.

By far the most surprising results in Table 7 pertain to the low birth weight baby risk estimates. These estimates are considerably different from those for lung cancer and appear to be reflecting the fact that respondents did in fact distinguish the low birth weight exposure mechanism from ETS risks of heart disease and lung cancer to others. Thus, even for those who believe the lung cancer risk from smoking is below 0.05, that group believes that the risk of a low birth weight baby is 0.37. Indeed, for every category of responses, the estimated low birth weight risk is roughly comparable to that figure or higher. The overall patterns of increase are plausible, as those who assess the lung cancer risk as being extremely high also assess a very high low birth weight risk of 0.64 and 0.75 in the two highest categories shown.

4. Primary Smoking Risks Versus Secondhand Smoke Risks

Just as there is expected to be a correlation between the various kinds of risk externality beliefs among respondents, there is also likely to be a correlation of the

respondent's assessment of the risk to smokers themselves with the risks of passive smoking. In this section we utilize the primary smoking risk responses reported in Antoñanzas et al. (2000). Conditional upon these responses, we analyze the perceptions of the comparable passive smoking risk. While primary and secondary risk beliefs are not identical and do not follow any exact pattern of proportionality, there is a strong relationship between the two. Table 8 presents the mean lung cancer risk levels for passive smoking conditional upon the respondent's perceived lung cancer risk faced by the smokers themselves. The first column of Table 8 presents the primary lung cancer risk range, and the subsequent columns present the mean risk levels for passive smoking for the different categories of smoking status. The patterns displayed by the different smoking groups are quite similar so, for simplicity, consider only the total sample responses. In every instance the perceived passive smoking risk increases as the perceived primary lung cancer risk to smokers increases. Moreover, the magnitudes of the passive smoking risk estimate are consistently just under half the size of the midpoint of the lung cancer risk range to smokers. For example, for those who believe the lung cancer risk to smokers is at least 0.7 but below 0.8, their assessed passive smoking lung cancer risk is 0.35. There is throughout every risk range an extremely strong correlation of the passive smoking risk beliefs that appear to be just under half the perceived risk to smokers.

Table 9 presents the matrix in which the passive smoking risk levels are indicated in the columns and the own risk to smokers comprises the rows. If respondents gave answers in the same risk range for the own risk as for passive risks, the responses would lie along the diagonal. For those who believe the passive risk exceeds the own risk to

smokers, the responses will lie above the diagonal. And similarly, for those who believe the risk of passive smoking is less than the own risk, the responses will lie below the diagonal in Table 9.

Only for the initial risk category of risk not exceeding 0.25 is there an extremely large concentration of assessments for passive smoking and primary smoking as being in the same risk range. Since the passive smoking risk cannot be assessed at any lower value than this risk range, this is not an unexpected result. For the different quartiles of risk shown in Table 9 it is noteworthy that for the very high risk levels of risk posed to the smoker, at least three quarters of the respondents dropped down to the first two risk quartiles. Thus, in many cases the passive risk assessment is considerably less than half the assessed risk to smokers, especially for the extremely high risk range for the smoking risks.

A very small portion of the sample believes that the passive smoking risk exceeds the risk to smokers themselves. For each category of risks to the smoker there are fewer than three percent of the sample who believe the passive risk is greater. These differences may not reflect actual differences in belief but rather a failure to achieve consistency across responses within an interview. If the respondents had in fact confronted the passive smoking risk and the primary smoking risk together rather than having them separated in the survey, then the responses would have been more consistent. However, there also would have been a diminished incentive for respondents to think carefully about the passive risk response as opposed to the risk to smokers themselves so that the current survey approach seems preferable rather than asking respondents to assess the lung cancer risk to smokers and passive smokers as a pair.

Tables 10 and 11 present the comparable results for heart disease risks to passive smokers. For the very low risk ranges with a primary heart disease risk to smokers below 0.5 and below .10, the assessed passive smoking risk is higher than the comparable risk value for lung cancer. In the subsequent risk ranges it also appears to be the case in many instances that the assessed heart disease risk for passive smokers is greater or approximately equal to half of the value of the assessed risk range for smokers themselves.

Table 11 provides the distribution for passive risk assessments as a function of the own risk category, whereas in the case of Table 9 the risk assessment groups are divided into the four quartiles of potential responses. There appear to be slightly more respondents who believe the heart disease risk to passive smokers is greater than the risk to smokers themselves, which may reflect a somewhat greater error in thinking in a consistent manner about these questions. There also appears to be less of a tendency to dramatically reduce one's passive risk assessment in light of one's assessment of the risk to smokers. For example, the percentage of respondents who assess the passive heart disease risk as being 0.25 or less is smaller than the comparable for lung cancer for every entry in the first column of Table 11 as compared to the first column in Table 9. The overall pattern of reducing the passive risk assessment relative to that for the primary smoking risk is, however, borne out in these results as for the lung cancer risk values. In the case of the risk of low birth weight babies due to passive smoking exposures, there is no counterpart risk value for the primary risk to smokers.

The results in Tables 12 and 13 for the comparison of the life expectancy loss from passive smoking to the life expectancy loss to smokers are particularly intriguing

with respect to the apparent consistency in the responses. For each smoking category it is noteworthy that whenever the respondent believes that smoking enhances life expectancy for the smoker on average the respondents believe also that exposures to environmental tobacco smoke enhance life expectancy. As indicated in Table 13, 55.6 percent of those who believe that cigarette smoke lengthens the life expectancy of the smoker also believe that it lengthens the life expectancy of those exposed to environmental tobacco smoke. These results could be due either to an actual belief that smoking enhances one's health, or instead may be attributable to a consistent misunderstanding of the life expectancy question that involved a comparison of two lifetime trajectories. However, the results are very reassuring in that they indicate that respondents tended to view the life expectancy consequences in similar directions for both smokers and those exposed to ETS.

For the other risk ranges in the tables, it is clear that respondents assess the life expectancy consequences for passive smoking as being considerably below the midpoint of the risk range for smokers themselves. Indeed, for all but the lowest life expectancy category, the mean assessed life expectancy loss for passive smoking is substantially below the lower bound of the life expectancy loss for smokers. The consistent pattern is that the mean assessed life expectancy loss to smokers is more than double the assessed value derived from passive smoking.

5. Regression Estimates for Passive Smoking Risk Assessments

What factors influence the assessed value of the ETS risks, and do they follow the same kind of pattern as for the assessed risk to smokers? One salient pattern found for risks to smokers based on the Spanish sample and U.S. estimates is that young people

tended to assess higher lung cancer risks. The surprising finding yielded in the analysis of the primary smoking risk beliefs is that the better educated respondents had lower lung cancer and heart disease risk beliefs for the Spanish sample. However, since these risk beliefs were more accurate as they reflected less of an overperception of the risk, the results are quite reasonable though contrary to view that the better educated people tend to view smoking risks as being greater and as a consequence are less likely to smoke because of that.

Table 14 presents various regression estimates in which we analyze the determinants of the various passive smoking risk beliefs as a function of various personal characteristics. These variables are described more fully in Antoñanzas et al. (2000), but they are largely self explanatory. All variables included are dummy variables with the exception of the total number of years of schooling. Because the principal purpose of this exploration is to test hypotheses with respect to the determinants of passive smoking risk beliefs rather than to have equations to predict these values, the relatively low explanatory power of these equations is not disturbing.

The patterns are quite consistent across categories. The youngest age group of those 18-25 has a higher assessed risk of lung cancer and heart disease, and for those age 25-50 this effect carries over to lung cancer as well, but not for the other ailments. These effects hold for each of the three equations estimated, which include an initial equation in which the variable for whether the respondent believes that smoking is a diabetes risk factor is included, where this variable should capture responses that are erroneous. The second equation includes smoking status, which is potentially endogenous. Since the dependent variable in these equations pertains to the external effects of smoking rather

than to the effects on the smokers themselves, one would expect a smaller problem of endogeneity than in the case of the responses with respect to the primary smoking risk to smokers themselves. The third equation in each case includes both the diabetes risk factor variable as well as smoking status.

Whether the respondent is male is even more influential on a consistent basis than is the age variable. In every specification for each of the risks, male respondents have lower risk beliefs than their female counterparts. Thus, they are less likely to believe that smoking is dangerous to others than are women. The difference between male and female assessments for low birth weight risks is especially noteworthy as it indicates that women have an assessed low birth weight risk probability of 0.05 greater than that for men controlling for the other influences in the equation. Women who must make the decision with respect to smoking and its consequences on babies consequently have a higher perceived risk of this hazard.

The years of schooling variable also has a consistent negative effect on risk beliefs in every instance. For a respondent with 10 years of schooling, which is approximately the sample average, the lung cancer risk probability will be .08 lower and the heart disease risk assessed probability will be .09 lower. The other estimates are reduced comparably, as this variable has a strong negative influence on risk beliefs, pushing them much closer to their true value as estimated in the scientific literature. The other variables including those pertaining to risk taking tastes with respect to whiskey, beer, and coffee are not especially influential.

The final two variables do prove to be consequential. People who believe that smoking causes diabetes, which is a relationship for which there is no scientific evidence, believe that all the ETS risks listed are greater.

Smokers, as one would expect, have consistently lower risk beliefs, but not dramatically so. Even after controlling for all the other personal characteristics in the equation, the risk beliefs of smokers are only .04 lower for lung cancer risks and .03 for heart disease risks.

Table 15 explores the determinant of the lung cancer risk beliefs including the various demographic factors in Table 14 but also including the respondents' assessed risk to smokers themselves. Thus, the passive lung cancer risk equation now includes the respondents' assessed lung cancer risk to smokers. The pattern of the equations is similar for heart disease and life expectancy loss. Moreover, in each case there is a second specification that includes an interaction of being a current smoker with the primary risk variable as well as the inclusion of current smoker as a discrete variable.

It is noteworthy that the inclusion of the risk assessment variable for the primary risk to smokers eliminates the influence of the age variables in the passive smoking risk equations. Male respondents still give significantly lower risk assessments for lung cancer and heart disease risks of passive smoking, as do those who are better educated. However, neither of these differences is statistically significant in the life expectancy loss equation for passive smoking.

Although neither the smoking variable nor the interaction of smoking status with the assessed risk to smokers variables is ever statistically significant, the primary smoking risk variables are very powerful in every instance. Moreover, it is striking that

in every case the magnitude of the coefficients is around 0.5. Focusing on the second set of estimates in each case, the influence of the primary smoking risk variable for smokers on the passive smoking risk estimate has a coefficient of 0.48 for lung cancer, 0.48 for heart disease, and 0.53 for life expectancy loss. In every instance the respondents believe that the risk to others from environmental tobacco smoke is approximately half the risk to the smokers themselves.

It is also striking that inclusion of the estimated risk values to the smokers themselves greatly boosts the explanatory power of the passive risk assessment equations in Table 15 as compared to those in Table 14. However, in every instance the R^2 value is 0.41 or less, so that the relationship is not exact. Respondents did not, for example, simply divide their estimated risk value to smokers by 2 in order to obtain the estimated risk from passive smoking. Otherwise, the explanatory power of these equations would be considerably higher than those indicated. Rather, there is an expected influence of the estimated risk to smokers on the estimated passive smoking risk of that type, but there is considerable variation that remains. The linkage that does exist is, however, at such an extremely high level that the resulting estimated risk beliefs greatly distort the actual risks of environmental tobacco smoke as they have been estimated in the scientific literature.

6. Conclusion

Analysis of the public's perceptions of the hazards of environmental tobacco smoke provides an interesting case study of how people view different component risks of a hazardous product. The risks to smokers are clearly substantial and among the

highest estimated risks that most consumers will incur. The scientific estimates of the hazards posed by environmental tobacco smoke are many orders of magnitude less. Even if one were to use the high end estimates for the potential risks of environmental tobacco smoke, the level of the risks would be quite small and would be dwarfed by the risks incurred by smokers themselves.

Examination of the public's perception of the risks of passive smoking suggest that these risk beliefs differ little by smoking status. The perceptions of the lung cancer risk, heart disease risk, and life expectancy loss are consistently just under half the individual's perception of the primary risks to smokers themselves. The estimated risks of a low birth weight baby for a smoking mother are also considerable and exceed scientific estimates of the level of the risk. What these results suggest is that there is enormous overperception of the hazards of passive smoking as the general public in Spain equates these risks as being roughly comparable to the actual risks of being a smoker.

This result suggests that the public is not able to distinguish between the different levels of risk posed by a potentially hazardous product. The fact that smoking is extremely hazardous to smokers themselves leads people to believe that passive smoking generates comparable risks. Thus, people seem to be unable to unbundle the two component hazards and properly assess the much smaller risks of passive smoking.

There appear to be multiple sources that contribute to the overperception of the passive smoking risks. The risks themselves are small and are prone to overestimation. They are also highly publicized, which will also make them more salient and more likely to be overestimated. The ETS warnings in Spain have included on product warnings.

The risk communication mechanisms and hazard warnings program used for passive smoking are comparable to those for the primary risks to smokers themselves. Nowhere in this informational provision effort is there any effort to distinguish the relative magnitudes of the risk involved. Thus, it is not at all irrational for the pubic to believe that the risks of passive smoking are comparable to the hazards posed by being a smoker. When operating within an informational environment in which there are no distinctions drawn between passive smoking and primary smoking, the failure to properly distinguish the risk levels can be traced in part to the shortcomings in the character of the information provision effort rather than underlying irrationality on part of the Spanish population.

To the extent that smoking restriction policies are the result of public pressure, these errant beliefs will lead to excessive pressures for smoking restrictions. Ideally, one would want to base such policies on a comparison of the costs and benefits of smoking restrictions, where these benefits are assessed using the scientific estimates of the level of the hazards. In practice, political policies emerge as a result of public pressure rather than a careful balancing of the economic merits of policy actions. To the extent that the public is misinformed regarding the level of the risk, these pressures will potentially push policies in an efficient direction. From an economic standpoint, the objective of smoking policies should be to promote informed and rational choice, both with respect to smoking decisions and exposures to cigarette smoke. At present, there seems to be a considerable information gap that is much greater for passive smoking than for the risks to smokers themselves.

A particularly important result from the standpoint of policy targeting is that women have a much higher assessment of the risks of low birth weight babies due to

smoking than do men. The principal target group who should in fact be concerned with the risks of smoking to the newborn appear to be very much aware of these hazards and in fact assess these risks as being greater than is indicated in the scientific literature. Current information efforts in Spain consequently have been successful in conveying the distinctive birth defect risk to the target population of women who must make the smoking decision that is potentially dangerous to their offspring.

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Table 1. Summary of Passive Smoking Risk Beliefs

	Mean (Standard Error of Mean)			
	Current Smoker	Former Smoker	Never Smoked	Total
Lung Cancer Risk for Passive Smokers x 100	21.32 (0.72)	22.65 (0.96)	27.84 (0.65)	24.66 (0.44)
Heart Disease Risk for Passive Smokers x 100	21.74 (0.75)	23.04 (0.98)	27.67 (0.67)	24.77 (0.45)
Life Expectancy Loss for Passive Smokers x 100	4.06 (0.24)	5.66 (0.33)	6.57 (0.22)	5.56 (0.15)
Males	3.69 (0.30)	5.42 (0.38)	5.65 (0.30)	4.83 (0.19)
Females	4.52 (0.39)	6.11 (0.61)	7.03 (0.29)	6.21 (0.22)
Low Birth Weight for Children of Smoker Mother	33.91 (1.15)	35.22 (1.36)	39.63 (0.90)	36.90 (0.63)
Females	37.75 (1.77)	40.25 (2.32)	41.67 (1.13)	40.39 (0.88)
Observations	844	513	1214	2571

(*) Number of smokers out of 100 who get lung cancer during their lifetime because they smoke.
(**) Reported ratio of the risk for smokers and non-smokers of getting lung cancer during their lifetime.
(***) Number of smokers out of 100 who get heart disease during their lifetime because they smoke.

Table 2. Summary of English translation of the text of survey questions pertaining to passive smoking risks

	Spanish Text	English Translation
8e.	De cada 100 no fumadores que conviven o trabajan con fumadores o en ambiente con humo de tabaco, ¿cuántos piensa usted que acabarán teniendo cáncer de pulmón? De 0 a 100.	For every 100 nonsmokers that live or work with smokers or in an environment containing tobacco smoke, how many do you think will get **lung cancer**? From 0 to 100.
8f.	Dígame la cifra que espontáneamente le parezca más lógica. De 0 a 100.	[*If answer "don't know" to question 8e*.] Tell me which number spontaneously seems more logical. From 0 to 100.

Note: Question 9e is the same as 8e but for the term in bold letters, which is **heart disease** for this question.

Table 3. The Distribution of Lung Cancer Risk for Passive Smokers as a Function of Smoking Behavior

Lung Cancer Risk for Passive Smokers x 100	Cumulative Percentage			
	Current Smoker	Former Smoker	Never Smoked	Total
0≤Risk<5	19.98	16.05	10.36	14.66
0≤Risk<10	33.46	26.96	20.02	25.83
0≤Risk<20	52.06	51.03	37.43	44.96
0≤Risk<30	69.66	69.55	59.88	65.03
0≤Risk<40	77.90	76.55	67.54	72.75
0≤Risk<50	83.89	83.55	75.02	79.65
0≤Risk<60	94.25	93.02	89.55	91.80
0≤Risk<70	96.00	95.08	93.47	94.63
0≤Risk<80	97.25	97.14	96.69	96.97
0≤Risk<90	98.87	98.37	98.17	98.45
0≤Risk<100	99.87	98.99	99.21	99.39
0≤Risk≤100	100.00	100.00	100.00	100.00
Total Number in Group	801	486	1149	2436

Table 4. The Distribution of Heart Disease Risk for Passive Smokers as a Function of Smoking Behavior

Heart Disease Risk for Passive Smokers x 100	Cumulative Percentage			
	Current Smoker	Former Smoker	Never Smoked	Total
0≤Risk<5	19.35	15.14	10.92	14.56
0≤Risk<10	31.30	26.23	21.65	25.77
0≤Risk<20	52.08	49.90	38.53	45.31
0≤Risk<30	69.35	67.38	58.35	63.82
0≤Risk<40	77.27	77.40	68.35	73.14
0≤Risk<50	84.41	83.58	75.51	80.10
0≤Risk<60	93.24	92.11	89.45	91.26
0≤Risk<70	95.71	95.52	93.58	94.69
0≤Risk<80	97.53	97.23	96.52	97.01
0≤Risk<90	98.70	97.87	98.26	98.34
0≤Risk<100	99.87	99.15	99.45	99.54
0≤Risk≤100	100.00	100.00	100.00	100.00
Total	770	469	1090	2329

Table 5. The Distribution of Life Expectancy Loss For Passive Smokers as a Function of Smoking Behavior

Life Expectancy Loss For Passive Smokers	Cumulative Percentage			
	Current Smoker	Former Smoker	Never Smoked	Total
Risk<0	11.30	4.03	3.38	6.15
Risk<1	25.25	11.49	8.07	14.40
Risk<3	27.26	12.27	8.98	15.64
Risk<5	28.33	13.44	9.72	16.57
Risk<10	45.04	30.01	25.62	32.87
Risk<15	75.37	64.71	58.32	65.19
Risk≥15	100.00	100.00	100.00	100.00
Total	844	513	1214	2571

Table 6. The Distribution of Low Birth Weight Risk

Low Birth Weight Risk for Children of Smoker Mothers x 100	Cumulative Percentage			
	Current Smoker	Former Smoker	Never Smoked	Total
Panel A: Full Sample				
0≤Risk<5	16.69	10.56	7.85	11.26
0≤Risk<10	25.45	19.10	14.77	19.10
0≤Risk<20	40.77	34.16	27.67	33.21
0≤Risk<30	54.86	50.12	43.28	48.39
0≤Risk<40	60.06	56.86	51.78	55.47
0≤Risk<50	65.67	63.15	57.95	61.48
0≤Risk<60	75.93	77.31	72.53	74.57
0≤Risk<70	79.62	83.83	77.39	79.38
0≤Risk<80	84.68	87.43	85.15	85.44
0≤Risk<90	90.97	92.60	90.57	91.09
0≤Risk<100	95.62	96.20	95.15	95.50
0≤Risk≤100	100.00	100.02	100.00	100.00
Total	731	445	1070	2246
Panel B: Female Respondents Only				
0≤Risk<5	14.76	6.79	6.90	9.05
0≤Risk<10	21.39	12.96	14.36	16.11
0≤Risk<20	36.45	29.01	25.91	29.23
0≤Risk<30	49.70	42.59	41.40	43.85
0≤Risk<40	54.22	50.00	48.72	50.41
0≤Risk<50	60.55	55.56	54.35	56.22
0≤Risk<60	72.00	71.61	70.12	70.84
0≤Risk<70	75.31	79.02	74.91	75.57
0≤Risk<80	81.94	82.72	82.37	82.30
0≤Risk<90	87.96	90.13	88.85	88.78
0≤Risk<100	94.59	95.69	94.20	94.51

0≤Risk≤100	100.00	100.00	100.00	100.00
Total	378	176	806	1360

Table 7. The Distribution of Smoking-Related Risk Assessments Risks for Passive Smokers, Conditional on Passive Lung Cancer Risk

	(Cumulative Percentage)		
Lung Cancer Risk x 100	Heart Disease Risk x 100	Life Expectancy Loss	Low Birth Weight Risk x 100
0≤Risk<5	5.91	2.72	36.54
5≤Risk<10	10.89	4.76	36.26
10≤Risk<20	15.42	4.93	39.06
20≤Risk<30	23.83	5.67	42.72
30≤Risk<40	30.28	6.83	41.93
40≤Risk<50	35.44	6.97	51.17
50≤Risk<60	44.99	7.55	55.14
60≤Risk<70	49.84	9.58	58.86
70≤Risk<80	54.02	9.49	56.91
80≤Risk<90	69.55	6.89	59.75
90≤Risk<100	61.43	9.78	63.52
Risk==100	74.85	7.27	75.00

Table 8. Mean Lung Cancer Risk For Passive Smokers, Conditional on Lung Cancer Risk for Smokers

Lung Cancer Risk To Smokers x 100	Mean Risk Level For Passive Smoking x 100			
	Current Smoker	Former Smoker	Never Smoked	Total
0≤Risk<5	1.37	1.94	1.27	1.52
5≤Risk<10	2.57	1.70	4.52	3.18
10≤Risk<20	5.96	6.95	7.19	6.59
20≤Risk<30	10.30	10.71	11.53	10.90
30≤Risk<40	14.03	16.03	18.22	16.41
40≤Risk<50	17.12	19.18	18.87	18.41
50≤Risk<60	23.97	23.75	28.76	26.30
60≤Risk<70	29.98	26.00	32.56	30.56
70≤Risk<80	30.73	34.13	37.86	35.27
80≤Risk<90	36.50	35.68	38.05	37.17
90≤Risk<100	42.33	45.76	45.92	44.84
Risk=100	42.31	61.33	50.38	50.90

*Table 9***.** Own Risk and Passive Risk of Lung Cancer

Own Lung Cancer Risk Interval x 100	Passive Lung Cancer Risk Interval x 100			
	Risk<=25	25<Risk<=50	50<Risk<=75	75<Risk<=100
Risk≤25	96.8	2.9	0.3	0.0
25<Risk≤50	72.8	24.7	1.6	0.9
50<Risk≤75	44.3	42.3	11.7	1.6
75<Risk≤100	32.8	43.3	11.9	11.9

Table 10. Mean Assessments of Heart Disease Risk For Passive Smokers, Conditional on Levels of Heart Disease Risk for Smokers

	Mean Risk Levels for Passive Smokers x 100			
Heart Disease Risk for Smokers x 100	Current Smoker	Former Smoker	Never Smoked	Total
0≤Risk<5	1.40	8.25	6.85	4.97
5≤Risk<10	4.11	3.43	9.18	6.00
10≤Risk<20	6.16	9.58	8.06	7.70
20≤Risk<30	12.14	11.83	13.30	12.55
30≤Risk<40	17.14	16.90	18.39	17.65
40≤Risk<50	20.84	21.40	24.67	22.51
50≤Risk<60	25.88	23.32	32.54	28.84
60≤Risk<70	30.98	28.67	36.09	33.55
70≤Risk<80	37.02	35.56	38.57	37.50
80≤Risk<90	40.76	35.81	42.44	40.74
90≤Risk<100	48.92	55.06	50.66	51.23
Risk=100	35.00	70.00	42.71	45.18

Table 11. Own Risk and Passive Risk of Heart Disease

Own Heart Disease Risk Interval x 100	Passive Heart Disease Risk Interval x 100			
	Risk≤25	25<Risk≤50	50<Risk≤75	75<Risk≤100
Risk≤25	94.5	4.8	0.3	0.4
25<Risk≤50	65.6	29.6	4.1	0.8
50<Risk≤75	35.3	49.2	15.0	0.5
75<Risk≤100	27.7	43.4	12.0	16.9

Table 12. Mean Assessments of Life Expectancy Losses for Passive Smokers, Conditional on Levels of Life Expectancy Losses for Smokers and Smoking Behavior

Life Expectancy Loss for Smokers	Years of Life Expectancy Loss			
	Current Smoker	Former Smoker	Never Smoked	Total
Risk<0	-9.73	-3.00	-6.44	-7.97
0≤Risk<1	0.16	0.56	0.25	0.25
1≤Risk<3	0.12	2.75	1.18	0.81
3≤Risk<5	1.89	0.67	1.56	1.46
5≤Risk<10	2.34	2.44	2.66	2.51
10≤Risk<15	4.91	4.46	5.62	5.15
Risk≥15	9.63	10.34	10.35	10.18

Table 13. Own and Passive Life Expectancy Loss

Own Life Expectancy Loss Risk Interval	Passive Life Expectancy Loss Risk Interval			
	Risk≤0	0<Risk≤5	5<Risk≤10	10<x
Risk≤0	55.6	33.3	0.0	11.1
0<Risk≤5	3.1	92.6	1.8	2.6
5<Risk≤10	3.3	63.5	27.5	5.7
10<Risk	1.7	22.4	32.6	43.3

Table 14. The Passive Risk Assessment Equation

	Coefficient (Standard Error)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Passive Lung Cancer Risk			Passive Heart Disease Risk			Life Expectancy Loss Passive Smokers			Low Birth Weight Risk		
Constant	35.301	37.480	35.669	36.563	38.926	36.828	9.321	9.760	9.425	42.118	44.089	42.276
	(1.908)**	(1.842)**	(1.904)**	(1.967)**	(1.899)**	(1.966)**	(0.646)**	(0.624)**	(0.644)**	(2.885)**	(2.783)**	(2.881)**
Age 18-25	4.680	5.500	5.683	3.977	4.477	4.699	-0.525	-0.210	-0.179	1.220	1.689	1.776
	(1.710)**	(1.724)**	(1.721)**	(1.743)*	(1.761)*	(1.757)**	(0.585)	(0.589)	(0.588)	(2.923)	(2.929)	(2.926)
Age 25-50	1.977	2.736	3.016	0.420	0.888	1.200	-1.028	-0.716	-0.668	4.061	4.450	4.694
	(1.132)	(1.156)*	(1.155)**	(1.160)	(1.188)	(1.186)	(0.382)**	(0.389)	(0.390)	(2.178)	(2.188)*	(2.188)*
Male	-6.447	-6.122	-6.211	-6.173	-5.923	-6.018	-0.896	-0.808	-0.825	-8.241	-7.531	-7.567
	(1.038)**	(1.039)**	(1.036)**	(1.067)**	(1.070)**	(1.067)**	(0.353)*	(0.353)*	(0.353)*	(2.427)**	(2.439)**	(2.436)**
Years of schooling	-0.817	-0.905	-0.848	-0.899	-0.990	-0.921	-0.137	-0.156	-0.146	-0.230	-0.320	-0.265
	(0.144)**	(0.143)**	(0.143)**	(0.148)**	(0.147)**	(0.148)**	(0.048)**	(0.048)**	(0.048)**	(0.211)	(0.210)	(0.211)
Head of household	-2.092	-2.157	-2.024	-1.682	-1.757	-1.585	-0.277	-0.272	-0.240	-1.552	-1.612	-1.519
	(1.095)	(1.093)*	(1.091)	(1.132)	(1.133)	(1.130)	(0.371)	(0.370)	(0.370)	(1.640)	(1.639)	(1.638)
Prefers whiskey to beer	1.113	1.486	1.550	1.478	1.685	1.755	-0.421	-0.279	-0.269	3.023	3.431	3.512
	(1.197)	(1.200)	(1.198)	(1.229)	(1.234)	(1.230)	(0.410)	(0.410)	(0.410)	(1.767)	(1.775)	(1.774)*
Not a whiskey or beer drinker	0.329	0.163	0.175	0.118	-0.073	-0.028	0.204	0.137	0.143	0.543	0.353	0.391
	(1.036)	(1.036)	(1.033)	(1.058)	(1.061)	(1.057)	(0.352)	(0.352)	(0.351)	(1.529)	(1.530)	(1.528)
Coffee drinker	-1.356	-0.987	-0.858	-0.579	-0.346	-0.211	-1.301	-1.138	-1.114	-2.469	-2.048	-1.947
	(1.133)	(1.137)	(1.135)	(1.157)	(1.165)	(1.162)	(0.388)**	(0.389)**	(0.389)**	(1.664)	(1.674)	(1.673)
No habit, maybe smoking	-0.344	-0.212	-0.476	-0.472	-0.177	-0.550	-0.406	-0.398	-0.445	0.767	0.981	0.742
	(1.957)	(1.954)	(1.950)	(2.008)	(2.009)	(2.005)	(0.655)	(0.653)	(0.653)	(2.845)	(2.843)	(2.841)
Believes smoking is diabetes risk factor	4.077		3.733	4.376		4.125	0.838		0.722	3.887		3.571
	(1.025)**		(1.025)**	(1.045)**		(1.046)**	(0.351)*		(0.351)*	(1.491)**		(1.494)*
Smoker		-4.344	-4.060		-3.321	-3.009		-1.473	-1.421		-4.162	-3.891
		(0.969)**	(0.970)**		(0.995)**	(0.995)**		(0.330)**	(0.330)**		(1.443)**	(1.446)**
Female x age 18-50										-1.894	-1.341	-1.222
										(2.619)	(2.629)	(2.627)
R^2	0.07	0.07	0.07	0.07	0.07	0.07	0.04	0.04	0.05	0.03	0.03	0.03
Observations	2435	2435	2435	2328	2328	2328	2569	2569	2569	2245	2245	2245

Notes: significant at 5% level; ** significant at 1% level. All tests are two-tailed tests. Coefficients on indicators for living in a city with more than 100k, but less than 1 million inhabitants, living in a city with more than 1 million inhabitants, blue-collar job and living in a metropolitan area are not reported.

Table 15. The Determination of Risk Assessment for Passive Smokers as a Function of Risk Assessment for Smokers

	Coefficient (Standard Error)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Passive Lung Cancer Risk		Passive Heart Disease Risk		Passive Life Expectancy Loss	
Constant	10.678	10.179	13.973	13.950	1.462	1.500
	(1.682)**	(1.750)**	(1.677)**	(1.725)**	(0.533)**	(0.550)**
Age 18-25	2.166	2.599	1.760	2.061	-0.148	-0.181
	(1.395)	(1.409)	(1.407)	(1.422)	(0.459)	(0.465)
Age 25-50	0.934	1.309	-0.263	0.046	-0.407	-0.431
	(0.924)	(0.947)	(0.936)	(0.962)	(0.300)	(0.307)
Male	-4.469	-4.425	-4.289	-4.250	-0.484	-0.490
	(0.851)**	(0.851)**	(0.864)**	(0.865)**	(0.278)	(0.278)
Years of schooling	-0.659	-0.669	-0.710	-0.719	-0.035	-0.034
	(0.117)**	(0.117)**	(0.119)**	(0.119)**	(0.038)	(0.038)
Head of household	0.111	0.163	-0.075	-0.039	-0.179	-0.182
	(0.897)	(0.897)	(0.917)	(0.917)	(0.291)	(0.292)
Prefers whiskey to beer	-0.060	0.133	0.414	0.519	-0.411	-0.419
	(0.977)	(0.981)	(0.990)	(0.993)	(0.322)	(0.323)
Not a whiskey or beer drinker	0.207	0.098	0.000	-0.064	-0.225	-0.221
	(0.847)	(0.848)	(0.856)	(0.857)	(0.277)	(0.277)
Coffee drinker	-0.798	-0.586	-0.584	-0.439	-0.623	-0.635
	(0.923)	(0.927)	(0.933)	(0.939)	(0.305)*	(0.307)*
No habit, maybe smoking	0.466	0.432	0.467	0.430	0.116	0.119
	(1.602)	(1.602)	(1.624)	(1.624)	(0.514)	(0.515)
Lung cancer risk 1/100 for smokers	0.463	0.475				
	(0.013)**	(0.016)**				
Heart disease risk 1/100 smokers			0.481	0.483		
			(0.013)**	(0.016)**		
Loss in life expectancy due to smoking					0.529	0.525
					(0.013)**	(0.017)**
(Smoker=1)*lung cancer risk		-0.041				
		(0.027)				
(Smoker=1)*heart disease risk				-0.010		
				(0.028)		
(Smoker=1)*life expectancy loss						0.011
						(0.028)
Smoker=1		0.380		-0.690		-0.022
		(1.536)		(1.466)		(0.374)
R^2	0.38	0.39	0.40	0.40	0.41	0.41
Observations	2408	2408	2299	2299	2569	2569

Notes: significant at 5% level; ** significant at 1% level. All tests are two-tailed tests. Coefficients on indicators for living in a city with more than 100k, but less than 1 million inhabitants, living in a city with more than 1 million inhabitants, blue collar job and living in a metropolitan area are not reported.