SMOKERS' DECISIONS TO QUIT SMOKING*

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Working Papers in Economics no 59
November 2001
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ABSTRACT
We investigate the effectiveness of different smoking policies on the decision to quit smoking using a choice experiment on a sample of habitual smokers. Our results indicate that restricted availability, increased cigarette prices, cessation subsidies and regulations at restaurants, bars and cafés increase the probability of smoking cessation. Regulations at work places do not seem to have any effect. The results also show the significant role of limited self-control; smokers who have the intent to quit smoking are more likely to quit smoking if a stricter regulation is implemented. Furthermore, smokers who have received advice from their children to quit smoking or who perceive the health risks as considerable, are more likely to quit smoking.

Key words: Choice experiments, cigarette consumption

JEL classification: D12, I18

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*Acknowledgements: We are grateful for comments and help from Francisco Alpízar, Kjell Asplund, Marcus Asplund, Lennart Flood, Olof Johansson-Stenman, Peter Martinsson, Thomas Sterner and seminar participants at the Department of Economics, Göteborg University. Financial support from the National Institute of Public Health, NIPH and the Bank of Sweden Tercentenary Foundation is gratefully acknowledged.

1. INTRODUCTION

A number of economic studies show that smokers respond to changes in prices and other factors such as smoking policies (see e.g. Chaloupka and Warner 2000 for an overview). At the same time, addictive consumption such as smoking is also influenced by factors such as limited self-control, social interaction and uncertainty. If the objective of a smoking policy is to make habitual smokers give up smoking, it is of interest to evaluate the relative effect of different policies. We therefore investigate the effect of different policies on the decision to quit smoking using a choice experiment. A smoking policy can have other objectives such as reduced cigarette consumption and a reduction of the number of individuals who start smoking, but these are not included in this study. The sample consists of cigarette smokers from Norrbottten and Västerbotten in the northern part of Sweden. The investigated policies are cigarette prices, cessation subsidies and different types of smoking prohibitions including restrictions of availability. In a choice experiment, respondents choose their preferred alternative among two or several hypothetical alternatives, where each alternative is described by different attributes. Respondents are asked to perform a sequence of such choices. Choice experiments have been used to elicit preferences for non-market goods such as environmental goods (see e.g. Layton and Brown 2000) and health-care (see e.g. Vick and Scott 1998). However, choice experiments can also be used to elicit preferences for attributes of market goods that do not exist today, for example new or stricter smoking policies. Although revealed preference data could be used for this type of analysis (at least for existing policies) there is seldom enough variation in prices in revealed preference data and it is difficult to isolate the effects of, for example, price increases. Further cross-section studies involving several countries involve the problem of correcting for country specific factors that might affect smoking behavior.[2] Therefore, a choice experiment can provide useful information that would have been more difficult to obtain with revealed preference data. As far as we know, this is the first application of choice experiments to the evaluation of smokers' responses to smoking regulations.

[2] Most revealed preference studies have used American data using the variation in prices resulting from different state taxes.

2. MODELING THE DECISION TO QUIT SMOKING

We focus the discussion on the decision to quit smoking, in particular the effects of different policies addressing smoking participation. The natural starting point is the Becker and Murphy (1998) model of rational addiction. This model was later applied to cigarette consumption by Chaloupka (1991), Keeler et al. (1993) and Becker et al. (1994). In Becker and Murphy's model, individuals are forward-looking and maximize lifetime utility subject to a budget constraint, where utility at any time depends on the stock of past addictive consumption. This does not imply that individuals have perfect foresight, for example in terms of rational expectations regarding policy changes. However, the model does imply that smokers are rational, in the sense that they consider the interdependence between past, current and future consumption when maximizing utility, and that they consider the future implications of their current behavior. As discussed in more detail in the following sections, a number of extensions of the rational addiction model can be made. In particular, we will discuss uncertainty regarding the harm (Orphanides and Zervos, 1995), endogenous time preferences (Becker and Mulligan, 1997; Orphanides and Zervos, 1999) and limited self-control (O'Donoghue and Rabin, 1999; Suranovic et al, 1999; Winston, 1980). In the traditional Becker and Murphy model, such factors would play no role. In the following sections we discuss a number of factors that are likely to affect the decision to quit, and the existing empirical evidence regarding the importance of these factors. The purposes of these sections are to summarize theoretical and empirical findings and to investigate which variables should be included in our econometric modeling of the decision to quit.

2.1 POLICIES

Policies decrease cigarette consumption by increasing the costs of smoking, where the cost of smoking includes both direct monetary costs and other costs such as effort. Different policies increase the cost of smoking in different ways. A cigarette tax increases the price of cigarettes, cessation subsidies lower the withdrawal cost and restricted availability and smoking bans increase the time costs. A smoker, when responding to the choice experiment, could be seen as maximizing lifetime utility, given the information regarding the smoking regulations. The smoker decides to quit smoking

if it results in a higher utility compared to smoking continuation. One problem with this formulation is that the respondent may not quit smoking immediately, but still decides to quit earlier than if the policy had not been introduced. This behavior is not covered in our experiment since it would have put too much of a cognitive burden on the respondents. Instead we focus on the instant decision on whether or not to continue, given the instant change of regulations. Another problem with this formulation is that a respondent can of course never be certain that he or she will not start smoking again sometime in the future.

Previous studies on the decision to quit smoking can be separated into different categories depending on focus, method and approach. There are cross-section studies that estimate smoking participation in the *whole* population.[3] These are not of primary interest in this study, since our focus is on smokers. Of more interest are the studies investigating the effects of policies on the decision to quit smoking. Tauras (1999), using a longitudinal data set of high school seniors, estimates price elasticities of smoking cessation ranging from 0.245 to 0.466 depending on model specification. Tauras and Chaloupka (1999) study the probability of cessation and estimate, depending on model specification, price elasticities to be between 1.07-1.17 for males, and between 1.17 and 1.21 for females. Using an American *National Health Interview Survey*, Douglas (1998) estimates cessation hazards of 1.07-1.32 with respect to *future* price, while current and past prices are not found to have a significant effect. Forster and Jones (2000) use time series retrospective data on smoking duration in a representative sample of individuals over aged 18 in the UK. Their estimated tax elasticity of the number of years of smoking before cessation is between -0.40 and -0.70.

There are also a number of studies on the effects of restrictions such as smoking bans in the workplace. Evans et al. (1999) show that smoking participation is lower in workplaces where there are smoking bans, and that the bans are likely to have caused the lower smoking participation. Several other studies (e.g. Wasserman et al., 1991; Chaloupka and Saffer, 1992; Ohsfeldt et al. 1999) show that stricter restrictions induce

[3] For example, Lewit and Coate (1982) estimate price elasticities for participation by age: -0.74 for individuals 20-25, -0.44 for individuals 26-35, -0.15 for individuals over 35 years; i.e. the younger the smoker, the more sensitive to price changes. Chaloupka and Wechsler (1997) estimate the average price elasticity of participation among college students to fall between –0.520 and –0.536.

lower smoking prevalence. To our knowledge, there has been no study on the effect of cessation subsidies on the decision to quit smoking. However, Tauras and Chaloupka (2001) estimate elasticities of demand for nicotine replacement products between -1.1 and -1.5 depending on brand. They also find that nicotine replacement products and cigarettes are substitutes in consumption. They estimate the average cross price elasticity of demand to lie between 0.68 and 0.81.

2.2 Social Interaction

Orphanides and Zervos (1995) develop the Becker and Murphy rational addiction model to include uncertainty regarding the harm associated with the addictive consumption. In this model, a smoker learns about the negative effects of smoking from his own and others' consumption of the addictive goods, and from general information regarding the harmful effects of smoking. This implies that factors such as awareness of health risks and social interaction are important determinants of smoker behavior.

Several studies have shown that social interaction matters in the decision to quit smoking (e.g. Jones 1989 and 1994). The actions in this context, and their theoretical relevance, can only be seen as proxies for a particular type of interaction.[4] We view the smoker as an individual who interacts and responds to actions from other individuals. In particular, we investigate the effect of the following on the probability of quitting: (i) the partner's smoking habits, (ii) the parent's smoking habits, (iii) the advice to quit smoking from the partner, a doctor or a child.

2.3 Health

In Becker and Murphy's model, an addicted smoker quits smoking if the adjustment costs are lower than the long-term benefits. Since the perceived individual health costs of smoking are important for the decision to quit (Kenkel, 1991), health status, measured in different forms, is often included as a determinant of smoker behavior. Jones (1994) includes measurements of self-assessed health, self-reported health and measured health, of which only the first two are applicable in mail questionnaires. The results in Blaylock and Blisard (1992) indicate that self-evaluated health status does not

[4] See Manski (2000) for a survey and assessment of social interactions in economics.

affect the probability of smoking cessation. Hsieh (1998) studies smokers above the age of 60, and finds that the probability of cessation is higher if perceived health risks from smoking are higher. Smith et al. (2000) examine the effect of health warnings on the decision to quit smoking, and find that smokers react differently to new health information compared to non-smokers. In particular, smokers put more weight on their own experiences of smoking related health problems and their ability to undertake physical activities. Using a stated preference approach, Johnson et al. (2000) analyze the preferences for longevity among smokers aged 50-64, and find that smokers will continue smoking if quitting only yields a low quality of life benefits. Gruber and Köszegi (2000) develop the theory of rational addiction by introducing present biased time inconsistent preferences, and point to the fact that internalities such as the importance of harm to one's own future health are not fully considered in the rational addiction model. If these were considered, it would motivate higher optimal tobacco taxes than the Becker-Murphy model.

2.4 Smoking Habits, Addiction, Intent and Self-Control

Cigarette consumption is addictive and forms habits. The longer the smoking history and the higher the daily cigarette consumption, the stronger the addiction and the habits, which implies higher withdrawal costs, and thereby an increased difficulty in quitting. However, a high consumption also implies higher health risks, which are expected to have the opposite effect on the probability of quitting. Orphanides and Zervos (1998) suggest a variant of the rational addiction approach where the individual's rate of time preference is endogenous, and increasing in past consumption. Jones (1994) finds that the higher the peak consumption, the less likely one is to succeed in cessation (even though the desire to quit might be the same). Due to the health risks and other costs of smoking, many smokers intend to quit smoking or reduce their consumption. However, even if a smoker has a stated intent to quit smoking, the withdrawal costs associated with cessation may lead to continued smoking (see Becker and Murphy 1988; Suranovic et al. 1999; Jones 1999).

An alternative explanation of the addiction is limited self-control or a weakness of will (Akerlof, 1991; Winston, 1980). In this perspective, smokers need some self-control or commitment device in order to quit smoking. There is therefore an interaction

between the intent to quit smoking and the level of the policy, e.g. a higher price on cigarettes coupled with a desire to quit smoking increases the probability of actually quitting compared to a case where there is no desire to give up smoking. The same would hold true for cessation subsidies or restrictions on where and when one is allowed to smoke, which then could play an important role for those that want to give up smoking. Social interaction through, for example, advice from doctors or relatives could also play an important role in explaining a smoker's behavior and success in quitting.

2.5 Attitudes towards Policies

Does it matter for policy effectiveness whether the individual is for or against a certain policy? If smokers have preferences, or attitudes, for a particular policy, will the probability of smoking cessation increase? The reasons for a particular attitude are manifold. First, heavily addicted smokers who have tried to quit but have failed, or do not want to give up smoking, are probably most negative to more stringent policies since they would face higher costs compared to other smokers. Second, most smokers - at least in Sweden today – are aware of health risks and many want to give up smoking or reduce their health risks from smoking.[5] In this context, a positive attitude towards stricter regulations is an indication of a demand for a paternalistic policy. We therefore expect smokers with a negative attitude to stricter policies to be less sensitive to the policies, and smokers with a positive attitude to be more sensitive to the policies. This is related to the concept of "naïve" and "sophisticated" smokers (O'Donoghue and Rabin, 1999), where the former do not perceive self-control problems in smoking cessation, while the latter does. Third, smokers may have a positive attitude towards restrictions on smoking because of a concern for non-smokers. In this case, the attitude should not affect the sensitivity to smoking policies. Even if we acknowledge the difficulties in interpreting the effect of attitudes towards polices on the probability of smoking cessation, it is still of interest to measure their effect. As far as we know there have not been any studies on the relationship between policy attitudes and the decision to quit.

[5] Only 2.5% of the respondents perceive no health risks from their own smoking, and only 18% want to maintain their present smoking pattern.

3. DESIGN OF SURVEY

3.1 DESIGN OF CHOICE EXPERIMENT[6]

The attributes in the choice experiment are policy variables, i.e. the levels *can* be changed by a policy maker. The number of attributes has to be limited, since we also need to take into consideration the complexity of the choice task. The attributes in our study are price, cessation subsidies and regulations. We decided not to include information campaigns since cigarette consumers today generally have an awareness of health risks associated with cigarette consumption. Consequently the effect on the cessation probability from information campaigns is likely to be small compared to the previous campaigns. Furthermore, it is cumbersome to include a "campaign" variable in the choice experiment due to uncertainty of what we actually are measuring.

Higher cigarette prices in Sweden create incentives for smuggling and cross-border shopping, and are hence a problem for the effectiveness of a tobacco control policy. If Sweden would significantly increase cigarette taxes while neighboring countries maintain their levels, we would expect an increase in cross-border shopping and smuggling.[7] Consequently, a realization of the higher cigarette prices used in the choice experiment would most likely lead to increased cross-border shopping and smuggling.

In the final design, the price attribute has 5 levels, the subsidy has 3 levels and the regulation attribute has 4 levels. The choice of the levels of the attributes is important since we wish to avoid lexicographic orderings of attributes and dominating choice alternatives. The levels of the attributes were chosen in two steps. First, focus groups were used in order to get a sense of the range of levels which should be used. Second, a pilot study with 150 respondents (all smokers) was conducted in order to test the questionnaire; in particular we wanted to test the choice experiment. Table 1 presents the levels used in the experiment.

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[6] The questionnaire consists of four parts: (i) questions on smoking habits, health risks, social context of the smoking behavior and attitudes towards anti-smoking policies, (ii) the choice experiment, (iii) a contingent valuation experiment on health risks associated with smoking and (iv) socio-economic questions.

[7] The 1st of January 1997 cigarette prices were increased by 18% (from SEK 31 to SEK 36 per packet of 20), and further increased by 22% (from SEK 36 to SEK 45) the 1st of August 1997, i.e. a total increase of

Table 1. Attributes and levels used in the choice experiment.

Attribute	**Levels**
Price (SEK)	35, 45, 55, 70, 100 per packet
Subsidy (SEK)	0, 1000, 2000 per month
Regulation	(i) As it is today (ii) Restricted availability by only allowing cigarettes to be sold at Systembolaget[8] (iii) Smoking prohibition in restaurants, bars and cafés (iv) Smoking prohibition in workplaces

The price attribute is the retail price per packet of 20 cigarettes. The subsidy attribute is the monthly amount of money used to subsidize cessation. Estimates in Apoteket (2001) show that by using nicotine medication (patches, chewing gums etc.), it takes roughly three months to quit smoking, acknowledging that a typical smoker has built up a habit, both psychological and physiological, during a long period. The total average cost amounts to SEK 1600, i.e. roughly SEK 500 per month.[9] In the experiment, the highest subsidy level amounts to SEK 2000 per month, which should roughly cover expenses other than pharmacy products (e.g. therapy, guidance, hypnosis etc.). The regulation attribute is the type of smoking regulation that is imposed. The first regulation is intended to restrict the availability, while the other two are intended to restrict where smoking is allowed.

The statistical design of the experiment is rather straightforward. Since each choice situation consists of only one alternative, we do not have to consider the creation of the choice sets in the design. From the full factorial design, which consists of 60 combinations, we create a linear D-optimal design consisting of 16 combinations (the final design is presented in the appendix). These combinations are then blocked into four sets, and each respondent answers four plus one choice situations (the current reference level).

In each of the five choice situations the respondent is presented with a certain combination of smoking policies, and given the policies the respondent is asked to state whether it is very likely that he/she will quit smoking or if he/she will continue to smoke. A natural question is whether the respondent is able to make a reasonable

44%. The 1st of August 1998, the tax was cut and the price fell by 24% to roughly SEK 34. This development was a reaction to an increase in smuggling.

[8] The state-controlled company for the sale of wine and spirits.

assessment of his/her behavior in the situation and whether the respondent will answer truthfully. We believe that smokers are highly aware of the difficulties associated with quitting, and many of them have tried several times to quit smoking. In this respect, they are therefore not likely to overestimate their likelihood of quitting. At the same time, they are faced with a new situation, with price levels and regulations they have not faced before. It is likely to expect that individuals tend to overestimate the importance of change, which in itself can result in an overestimation of the likelihood that they will quit smoking. It is difficult to actually test whether the answers in the choice experiment are biased or not. However, the responses could at any rate be interpreted as the smokers' expectations about their behavior after changes in smoking policies.

3.2 Sampling of Smokers

The sample consists of cigarette smokers from Norrbotten and Västerbotten in the northern part of Sweden.[10] The questionnaire was sent out to 935 believed smokers, out of which six were returned because the respondents had moved or were "unknown". The overall response rate was 57%, or 524 respondents - 59 of these had stopped smoking, six had never smoked, four were pipe-smokers and 68 of the questionnaires were incomplete due to item non-response, mainly on the question about household income, but also in the choice experiment. Nine respondents were inconsistent in the choice experiment and are hence dropped from the analysis. Hence, the final sample size is 378 individuals. There are two reasons why we cannot generalize our results to the entire smoker population. First, our population is biased towards habitual smokers. Consequently, they have a higher stock of addiction, and are therefore less likely to react to policy changes. At the same time, the health risks are higher for this population, and in this respect they would be more sensitive to policy changes. Second, the regulation attributes can have a different impact in the northern parts of Sweden compared to larger cities in more densely populated areas of southern Sweden. In northern Sweden there are fewer state-controlled shops for wine and spirits, i.e. the full

[9] Apoteket (2001) compares this cost with the consumption of 20 cigarettes per day. The physiological addiction can, to some degree, be adjusted by the nicotine content in the cessation products.
[10] The sample was identified in a study of the health effects from snuff. This study was conducted by Professor Kjell Asplund at Umeå University, from whom we obtained the sample register.

price of buying cigarettes would be higher compared to more densely populated areas.[11] Furthermore, banning of smoking at cafés, pubs, and restaurants is likely to affect smoking behavior to a larger extent in big cities, assuming a higher proportion of cigarette consumption at such places in big cities. The price attribute might be subject to problems as well, since smokers in the northern parts of Sweden may have a different perception of the relationship between price and smuggling.

4. RESULTS

4.1 DESCRIPTIVE STATISTICS

Descriptive statistics for the sample used in the estimations are presented in Table 2.

Table 2. Descriptive statistics observations included in the estimations.

Variable	Description	Mean	Std	Min	Max
Price	Price of one package of cigarettes (SEK)	57.66	24.23	35	100
Cessation sub.	Subsidy (SEK)	2575	2569	0	6000
Restricted availability	1 if cigarettes can only be purchased at Systembolaget	0.20	0.40	0	1
Prohibition at restaurant	1 if smoking is prohibited in restaurants, bars and cafés	0.20	0.40	0	1
Prohibition at workplace	1 if smoking is prohibited in workplaces	0.20	0.40	0	1
Quit with nicotine	Intent to quit with nicotine	0.32	0.46	0	1
Advice from doctor	1 if advice from doctor to quit	0.33	0.47	0	1
Advice from partner	1 if advice from partner to quit	0.43	0.49	0	1
Advice from child	1 if advice from own child to quit	0.60	0.49	0	1
Spouse is a smoker	1 if partner also smokes	0.35	0.48	0	1
Children	1 if respondent has at least one child	0.32	0.47	0	1
Own health risks are considerable	1 if own health risks are perceived as considerable	0.62	0.48	0	1
Cigarette consumption	Average number of cigarettes per day	12.79	6.35	0	40
Years smoking	Number of years respondent has been a smoker	35.58	10.32	2	64
Non-daily smoker	1 if respondent is a non-daily smoker	0.04	0.19	0	1
Age	Age of the respondent	52.40	10.15	21	77
Male	1 if male	0.41	0.49	0	1
University education	1 if at least one semester at university level	0.20	0.40	0	1
High school education	1 if passed upper secondary school education	0.44	0.50	0	1
Partner	1 if respondent has a partner	0.79	0.41	0	1
Household income	Household income, equivalence scaled (0.7 for each additional adult and 05 for each child)	10377	4383	385	36470

[11] However, there is also the possibility of having wine and spirits delivered to certified delivery stores, usually gas stations or grocery stores.

In our sample, 31% want to quit everything containing nicotine. The most commonly received advice regarding quitting comes from the children of the smokers (60%), followed by spouses (42%) and doctors (34%). 74% of the respondents are married or cohabitant (not shown in the table) and among these 35% have spouses who also smoke. Information on experienced smoking-related health problems (personal or in a person close to the respondent) was requested, along with a general self-assessment of health status (not shown in table) - 61% of the respondents perceive the health risks associated with their smoking as considerable. The average number of smoked cigarettes per day in the sample is slightly below 13, and ranges from zero (i.e. not a daily smoker) to 40. The average number of years of smoking is 36 years. The mean age of the respondents is almost 53 years, and very few are below 30. There are more women than men (41%), 79% of the respondents have a partner, 31% have at least one child in the household and 61% of the respondents have at least upper secondary school education. The mean equivalence scaled household income is 10377 SEK per month.

Regarding the behavior in the choice experiment, 22% of the respondents were lexicographic in the sense that they always chose to continue smoking. On average, the respondents chose to quit smoking in 53% of the choice situations. In the choice situation that contained the current reference level, 5% of the respondent stated that it is very likely that they will quit smoking. One interpretation of this response behavior is that the respondents intend to quit anyway, and are hence not affected by stricter policies. However, the respondents may also be portraying a certain identity when responding.[12] For example, those who have the intent to quit smoking may overestimate the probability of quitting since they have assumed the identity of being able to control their behavior. We present results both with and without these respondents.

Respondents were also asked to express how they would vote for different smoking policies. Table 3 clearly shows the general pattern that smokers are negative towards policies that increase the costs of smoking. The resistance is strongest against taxes and restricted availability, while subsidies receive the strongest support. It is also interesting that prohibition in cafés, bars and restaurants exhibits the strongest support among the policies that increase the cost of smoking.

[12] See Akerlof and Kranton (2000) for a general discussion on identity and behavior.

Table 3. Distribution of votes regarding different policies, in percentages.

Policy	**Vote against**	**Neutral**	**Vote for**	**Don't know**
Smoking ban in cafés, bars and restaurants	38	19	42	2
Increased cigarette prices via increased taxes	68	17	9	6
Increased cessation subsidies	8	14	71	8
Smoking ban in workplaces	62	18	16	4
Sales of cigarettes only at Systembolaget	74	10	10	6

In the econometric analysis, these attitude variables are interacted with the different policies in order to see how an attitude regarding a certain policy affects its impact on the probability of smoking cessation.

4.2 Econometric Analysis

We rely on the random utility approach (McFadden 1974) in the analysis of respondent behavior in the choice experiment. Let us define a latent indirect utility of quitting for individual *i* in choice situation *t* as

$$U_{it} = V_{it}(\beta x_{it}) + \varepsilon_{it} \tag{1}$$

where x_{it} is a vector of attributes and socio-economic characteristics interacting with these attributes and β is the corresponding parameter vector. The indirect utility function consists of a deterministic, $V_{it}(\beta x_{it})$, and a stochastic, ε_{it}, part. We concluded in Section 2 that not only should the attributes of the choice experiment and socio-economic characteristics be included in the parameter vector, but variables measuring the degree of social interaction, health status, addiction, attitudes towards policies etc. should also be included.

If the lifetime utility of giving up smoking today is higher than the lifetime utility of continuing, then the respondent will quit smoking. The utility function in (1) can thus be seen as a reduced form for this problem, and we assume that when utility is positive the respondent will quit smoking. In the experiment we only observe whether the respondent quits smoking or not. Let us define a binary variable, y_{it}, which is equal to 1 if the individual quits smoking. We then have the probability of an individual quitting expressed as

$$P[y_{it}=1]=P[\varepsilon_{it}>-V_{it}(\beta x_{it})]. \tag{2}$$

Since respondents make repeated choices, the assumption of independence between observations may be violated since the choices can be correlated. Following Butler and Moffitt (1982) we therefore specify the error term as

$$\varepsilon_{it}=u_i+v_{it};\ u_i\sim N(0,\sigma_u^2)\ ,\ v_{it}\sim N(0,\sigma_v^2) \tag{3}$$

where u_i denotes the unobservable individual specific effect and v_{it} denotes the remainder disturbance. The components of the error term are consequently independently distributed and we have

$$Corr[\varepsilon_{it},\varepsilon_{is}]=\rho=\frac{\sigma_u^2}{\sigma_u^2+\sigma_v^2}. \tag{4}$$

This is a standard random effects binary Probit model. The model is restrictive in the sense that it assumes equal correlation across periods for each individual. In the case of a choice experiment, this implies an assumption of stable preferences and/or no learning or fatigue effects over the course of the choice sets. Given the relatively simple choice experiment (few choice sets and few attributes), we believe that this is a plausible assumption.

The estimated marginal effects are reported in Table 4, while corresponding coefficients are presented in the appendix.[13] We present results for both the whole sample and for the whole sample excluding those respondents (restricted sample) stating they will quit smoking in all choice situations, including the current reference level.

[13] The marginal effect continuous variable, x_{it}, is calculated as (Arulampalam, 1999) $\frac{\partial P[y_{it}=1]}{\partial x_{it}}=f(\sqrt{(1-\rho)}\tilde{\beta}x_{it})\tilde{\beta}\sqrt{1-\rho}$, where $\tilde{\beta}=\beta/\sigma_v$ and $f(\circ)$ is the pdf for the normal distribution. For a dummy variable, x_{it}, the discrete effect is calculated as $P[y_{it}=1\mid x_{it}=1]-P[y_{it}=1\mid x_{it}=0]$. The associated covariance matrix is calculated with the Delta-method (see Greene, 2000).

Table 4. Estimated marginal effects for the Probit model on the decision to quit smoking.

		Whole sample		Restricted sample	
Variable		**Marginal effect**	**P-value**	**Marginal effect**	**P-value**
Price		0.007	0.00	0.008	0.00
Cessation sub.		0.00003	0.00	0.00004	0.00
Restricted availability		0.10	0.09	0.17	0.04
Prohibition at restaur.		0.05	0.18	0.12	0.03
Prohibition at workplace		0.008	0.85	0.05	0.37
Against tax (*)	Price	-0.002	0.00	-0.002	0.03
Pro subsidies (*)	Subsidy	0.00004	0.00	0.00005	0.00
Against restric. avail. (*)	Restricted	0.01	0.88	0.009	0.90
Against prohib. rest. (*)	Prohib. rest.	-0.03	0.52	-0.07	0.26
Against prohib. work (*)	Prohib. work	0.05	0.26	0.06	0.30
Quit with nicotine (*)	Price	0.003	0.00	0.0017	0.05
Quit with nicotine (*)	Subsidy	0.00002	0.03	0.00003	0.00
Quit with nicotine (*)	Restricted	0.07	0.34	0.09	0.36
Quit with nicotine (*)	Prohib. rest.	-0.02	0.71	-0.03	0.73
Quit with nicotine (*)	Prohib. work	-0.04	0.45	-0.10	0.08
Advice from doctor		-0.07	0.12	-0.07	0.11
Advice from partner		-0.07	0.13	-0.05	0.30
Advice from child		0.14	0.00	0.12	0.01
Spouse is a smoker		-0.008	0.89	-0.01	0.84
Children		-0.01	0.82	-0.06	0.30
Own health risks are considerable		0.17	0.00	0.08	0.11
Cigarette consumption		0.0009	0.82	0.004	0.25
Years smoking		-0.006	0.14	-0.005	0.23
Non-daily smoker		-0.34	0.00	-0.29	0.00
Age		0.007	0.08	0.002	0.65
Male		-0.02	0.70	-0.03	0.55
University education		-0.25	0.00	-0.17	0.00
High school education		-0.15	0.00	-0.13	0.01
Partner		0.008	0.90	0.06	0.33
Household income		0.000002	0.67	0.000004	0.43
Rho		0.787	0.000	0.587	0.000
Number of individuals		378		298	
Restricted log likelihood		-934		-635	
Log likelihood		-732		-569	

The estimated correlation between the error terms (Rho) is high and highly significant, which means that we cannot reject the random effects model in favor of a more restrictive model with no correlation between the error terms.

Naturally, the marginal effects of the attributes are larger when removing those respondents who quit in all choice situations, since they do not trade. However, the general pattern for both samples is that the attributes cigarette price and subsidies are both highly significant and have the expected signs, i.e. a higher price or increased subsidies increase the probability of smoking cessation. Restricted availability by

limiting sales to Systembolaget, is the only policy among the regulations that significantly increases the probability of smoking cessation in both samples. There are several possible interpretations of this finding. The respondents might feel that limiting availability increases the time costs sufficiently to affect the decision to quit smoking. Another possible explanation would be a reaction to the paternalistic dimension of only allowing sales in a state-owned and controlled store. Further, it might be easier to quit smoking successfully if availability were restricted. The parameter for prohibition at restaurants is only significant in the restricted sample.

The attitudes towards regulation policies only matter for the price and subsidy policies. Those respondents who are against increased cigarette taxes are also less likely to quit smoking in the choice experiment. A parallel pattern holds for subsidies. For respondents who vote for increased cessation subsidies, the probability of smoking cessation increases. For the regulation policies, the corresponding parameters for attitude variables are not significant. This result also holds for those who are in favor of these policies. The interpretation of these results is not straightforward. One explanation is that those who are against higher cigarette prices are so because of the potential effect on their budget, since they know that it is likely that they will continue to smoke. A similar interpretation can be made regarding the attitude towards subsidies. It is interesting that there is no significant interaction between the probability of quitting and the attitudes towards the different regulation policies. Smokers' attitudes towards these policies thus seem to be based on other considerations. It is, for example, likely that smokers support for smoking bans at restaurants and cafes can be explained by concern for non-smokers. There is of course a possibility of confounding between the attitudes and the responses in the choice experiment; for example, smokers who are against increased cigarette taxes may "refuse" to trade in the choice experiment for that simple reason.

In Table 5 below we present the price and subsidy elasticities for the probability of smoking cessation. We see that estimated elasticities are higher when removing those who quit in all choice situations. The price elasticities are estimated at 0.70 and 1.31, respectively. Those who are against increased cigarette taxes have, however, much lower elasticities, 0.46 and 1.04. The subsidy elasticities are estimated at 0.30 and 0.61, respectively. Further, those who are in favor of increased subsidies have higher

elasticities, 0.38 and 0.79. One explanation for the differences in price and subsidy elasticities is that the impact on their budget differs. An alternative explanation could be that it is easier for the respondent to perceive the direct costs of cigarette consumption, while the indirect costs of cessation are more difficult to perceive.

If a respondent has the intention, or desire, to give up with everything containing nicotine, the smoking policies are more effective since these smokers are likely to perceive higher costs of smoking and/or lower costs of giving up smoking. The results indicate that the effect of higher prices and increased subsidies on the probability of smoking cessation is significantly higher for those who have the intent to give up smoking. In the whole sample, respondents wanting to give up smoking have a subsidy elasticity of cessation of 0.39 compared to 0.28 for those without this desire. In the restricted sample the effect is even higher, 0.88 and 0.57 respectively. The price elasticity of cessation for those who want to give up smoking is 1.03, compared to 0.67 for the whole sample, while it is 1.60 and 1.29 for the restricted sample. We see no significant effects on the parameters for the other policies, other than that the parameter for prohibited smoking during work hours which interacted with intent to quit becomes significant but with a negative sign.

Table 5. Price and subsidy elasticities of the probability of smoking cessation, p-values in parentheses.

	Whole sample		**Restricted sample**	
	Price	Subsidy	Price	Subsidy
At sample mean	0.70 (0.00)	0.30 (0.00)	1.31 (0.00)	0.61 (0.00)
Against tax	0.46 (0.00)		1.04 (0.00)	
Not against tax	0.72 (0.00)		1.34 (0.00)	
Not pro subsidies		0.16 (0.00)		0.34 (0.00)
Pro subsidies		0.38 (0.00)		0.79 (0.00)
Intent to quit smoking	1.03 (0.00)	0.39 (0.00)	1.60 (0.00)	0.88 (0.00)
No intent to quit smoking	0.67 (0.00)	0.28 (0.00)	1.29 (0.00)	0.57 (0.00)

The price elasticities are reasonable compared to previous studies on revealed preference data. For the whole sample, our estimates lie below Douglas (1998) and Tauras and Chaloupka (1999), but slightly above Tauras (1999). In the restricted sample, our estimates are at the higher end of existing estimates. The subsidy elasticities

are naturally dependent on scale of measurement and must hence be seen in this perspective. They are only interesting if one think that our tested subsidy levels are reasonable.

Regarding social interaction, it is interesting to note that only the advice from one's own child affects the probability of quitting. This can be interpreted as a form of preference interaction, where the respondent does not *only* care about his or her own consumption. However, the parameter for the dummy variable for children in the household is insignificant, although this variable only indicates whether a child still lives in the household or not. Advice from a doctor, a partner or a friend does not have a significant effect on smoking behavior. Since the sample consists of habitual smokers, these results are expected, since we believe that most of these smokers are aware of the health hazards of smoking. Another test of the existence of preference interaction is if the spouse/cohabitant is also a smoker. However, this does not have any significance for the probability of quitting. The significant effect of advice from one's own child could be explained by endogeneity of the rate of time preference and limited self-control. Advice from one's own child reminds the smoker of the dangers, by implicitly and/or explicitly stressing that the length and quality of his/her life is affected by smoking.[14] On the other hand, if a respondent perceives his/her own health risks from smoking to be considerable, a higher probability of cessation is implied. This result is in line with previous research (e.g. Jones, 1994; Hsieh, 1998). However, own perceived health risks are insignificant in the smaller sample.

The number of cigarettes smoked per day does not exhibit any significant effect on the decision to quit smoking, but non-daily smokers are significantly less likely to quit. Peak consumption, as an alternative measure of addiction, was also tested for, but was also insignificant. On the other hand, the coefficient for the number of years the respondent has smoked is negative and significant, which supports the Orphanides and Zervos (1998) models of endogenous time preferences.

[14] Following Becker and Mulligan (1997), the individual faces an intertemporal budget constraint, where he/she can invest in "future oriented capital" at a price, and this capital affects the individual's discount rate. Hence, it could be argued that advice from a child lowers the price of "future oriented capital". It is intuitive that the ability to live long and see your children grow up and have their own children etc. creates an incentive to quit smoking in order to increase the probability of this experience, and advice to quit from one's own child to quit is definitely a reminder of this.

We also find that the older the respondent is, the higher the probability of quitting, which is consistent with Becker and Murphy (1998), i.e. the effect of discounting health effects decline with age. However, this effect disappears in the smaller sample. The gender of the respondent has no effect on the probability of quitting. Highly educated respondents are less likely to quit. It should be noted that in Sweden highly educated people are less likely to smoke. With this in mind, it should not be so surprising that in a sample of smokers, well-educated people are less likely to give up smoking since they might belong to the heavily addicted (in physiological terms) well-educated smokers. Further, those among the highly educated with less addictive potential, might have already stopped smoking.

5. CONCLUDING REMARKS

Given that one of the objectives is to make habitual smokers quit smoking, the relative effects of different smoking policies are of interest. We find that increasing cigarette taxes and subsidies will make smokers more likely to give up smoking. Restricting the availability of cigarettes by limiting sales of cigarettes to the state-controlled company of wine and spirits, despite being very unpopular, affects the probability of quitting. Smoking bans in restaurants, bars and cafés only have a significant effect on smoking cessation in the restricted sample, while a smoking ban at work does not seem to have a significant effect on the decision to quit smoking. The smoking policies are particularly more effective for those smokers who have an intent to give up smoking and for smokers with a positive attitude towards increased prices and subsidies. Among the negative impacts of subsidies is that they also, in principle, might affect the decision to begin smoking, and may also attract smokers who are not sufficiently motivated to quit use subsidies. The results also show the relevance of limited self-control; smokers intending to quit smoking are more sensitive to stricter regulations. Further, smokers who have received advice from their children to quit smoking or who perceive the health risks as considerable are also more likely to quit.

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APPENDIX

Table A1. Design of choice experiment (not including today's level)

Set	Block	Subsidy	Regulation	Cigarette price
1	1	1000 per month	Ban in restaurants, bars and cafés	70
2	1	2000 per month	No additional regulations	100
3	1	1000 per month	Restricted availability	35
4	1	No sub	Not allowed to smoke during work hours	45
5	2	2000 per month	No additional regulations	70
6	2	No sub	Ban in restaurants, bars and cafés	100
7	2	1000 per month	Restricted availability	55
8	2	2000 per month	Not allowed to smoke during work hours	35
9	3	No sub	No additional regulations	55
10	3	No sub	Restricted availability	70
11	3	1000 per month	Not allowed to smoke during work hours	100
12	3	2000 per month	Ban in restaurants, bars and cafés	45
13	4	No sub	Ban in restaurants, bars and cafés	35
14	4	2000 per month	Not allowed to smoke during work hours	55
15	4	2000 per month	Restricted availability	100
16	4	1000 per month	No additional regulations	45

Table A.2 Estimated coefficients for the Probit model on the decision to quit smoking.

		Whole sample		Restricted sample	
Variable		**Coefficient**	**P-value**	**Coefficient**	**P-value**
Intercept		-3.80	0.00	-3.24	0.00
Price		0.037	0.000	0.035	0.00
Cessation sub.		0.000	0.000	0.0002	0.00
Restricted availability		0.562	0.097	0.72	0.03
Prohibition in restaurants		0.294	0.177	0.51	0.03
Prohibition in workplace		0.044	0.848	0.21	0.36
Against tax (*)	Price	-0.010	0.005	-0.0065	0.03
Pro subsidies (*)	Subsidy	0.000	0.000	0.0002	0.00
Against restric. avail. (*)	Restricted	0.052	0.877	0.040	0.90
Against prohib. rest. (*)	Prohib. rest.	-0.177	0.519	-0.301	0.28
Against prohib. work (*)	Prohib. work	0.266	0.274	0.2559	0.29
Quit with nicotine (*)	Price	0.017	0.000	0.0072	0.05
Quit with nicotine (*)	Subsidy	0.000	0.027	0.0001	0.00
Quit with nicotine (*)	Restricted	0.381	0.351	0.3695	0.35
Quit with nicotine (*)	Prohib. rest.	-0.126	0.713	-0.1182	0.74
Quit with nicotine (*)	Prohib. work	-0.218	0.441	-0.4624	0.10
Advice from doctor		-0.402	0.119	-0.3273	0.12
Advice from partner		-0.402	0.127	-0.2234	0.31
Advice from child		0.776	0.003	0.5427	0.01
Spouse is a smoker		-0.042	0.887	-0.0447	0.84
Children		-0.074	0.819	-0.2569	0.30
Own health risks are considerable		0.941	0.001	0.3272	0.11
Cigarette consumption		0.005	0.820	0.0178	0.25
Years smoking		-0.032	0.139	-0.0204	0.23
Non-daily smoker		-2.013	0.003	-1.8645	0.00
Age		0.039	0.084	0.0073	0.65
Male		-0.100	0.703	-0.1232	0.55
University education		-1.369	0.000	-0.8094	0.01
High school education		-0.811	0.005	-0.5791	0.01
Partner		0.042	0.902	0.2557	0.34
Household income		0.00001	0.669	0.000002	0.43