HEDG

HEALTH, ECONOMETRICS AND DATA GROUP

THE UNIVERSITY of York

HEDG Working Paper 11/01

SELF CONTROL AND SUPPORT FOR ANTI SMOKING POLICIES AMONGSMOKERS, EX SMOKERS AND NON SMOKERS

LOURDES BADILLO AMADOR
ANGEL LÓPEZ NICOLÁSa,

February 2011

york.ac.uk/res/herc/hedgwp

SELF CONTROL AND SUPPORT FOR ANTI SMOKING POLICIES AMONG SMOKERS, EX SMOKERS AND NON SMOKERS

RUNING HEAD: **SELF CONTROL AND SUPPORT FOR ANTI SMOKING POLICIES**

LOURDES BADILLO AMADOR[a] and ANGEL LÓPEZ NICOLÁS[a,b,*]

[a] *Departamento de Economía. Universidad Politécnica de Cartagena. 30203-Cartagena, Spain.*

[b] *CRES (Centre de Recerca en Economia i Salut), Universitat Pompeu Fabra, 08005-Barcelona, Spain*

MANUSCRIPT WORD COUNT: 5,172

TABLE COUNT: 10

KEY WORDS: time inconsistencies; smoking bans; tobacco taxes; Spain

---

[*]Correspondence to: Departamento de Economía. Facultad de Ciencias de la Empresa. Universidad Politécnica de Cartagena. Calle Real, 3, 30201 Cartagena (Spain). Fax:+34 968325781 Tel. +34 968 325484. E-mail: angel.lopez@upct.es

ABSTRACT

In this paper we sustain that non smokers who might be at risk of starting to smoke or relapsing can benefit from anti smoking policies such as tax hikes and smoking bans because these are mechanisms that enhance their self control with regard to tobacco consumption. We formalise this conjecture by proposing a model where starting/relapsing might result from time inconsistent preferences in a way that mirrors the inability of some smokers to carry out the decision to quit. We test the implications of this model using rich information on smoking behaviour from the Catalan Health Survey of 2006. The empirical results support our hypothesis and suggest that the welfare gains derived from the reinforcement of self control caused by tax hikes and smoking bans will accrue not only to smokers but also to the rest of the population.

1. INTRODUCTION

The consideration of tobacco taxes and clean air laws as mechanisms enhancing the self control of smokers who wish to quit has gained popularity after recent theoretical and empirical results. On the theoretical side, time inconsistent preferences, often represented by means of hyperbolic discounting (Strotz, 1956; Phelps and Pollack, 1968; Laibson, 1997; O'Donoghue and Rabin, 1999) have been shown to generate conflicts between planned decisions and actual decisions. In the context of smoking, an individual might have resolved to quit and yet fail to do so when the actual decision has to be implemented. In the presence of such conflicts between planned and actual behavior, and in clear contrast with the normative implications of the rational addiction model of Becker and Murphy (1988), individuals can benefit from mechanisms of self control that aid to reconcile the divergence between planned for and actual decisions. Taxes and clean air laws could act as such mechanisms, as they reduce the current net utility of smoking by, respectively,

increasing its monetary cost and imposing the non monetary cost of having to exit the premises (Gruber and Köszegi, 2001, 2002, 2004).

On the empirical side, testing whether individuals benefit from these types of interventions has had to confront the fact that measures of self control, especially in the context of tobacco consumption, are difficult to observe. Nonetheless Herscht (2005), with US data, and Kan (2007), with data for Taiwan, have interpreted the reported desire to quit as an indicator of self control problems, and have found that such desire increases *ceteris paribus* the support for tax hikes and smoking bans among smokers. But self control problems regarding tobacco consumption might not only affect smokers. They may also be relevant for non smokers with a relatively high risk of smoking, e.g. people who are experiencing with tobacco or ex smokers who might relapse. The only empirical evidence suggesting that groups other than current smokers might benefit from these types of enhancers of self control has been obtained by Gruber and Mullainathan (2005), who find a positive response of reported happiness to the level of excise duties on tobacco among people with a propensity to smoke.

This study aims to contribute to the literature by arguing that the availability of self control enhancing mechanisms, in the form of clean air laws and high tobacco prices, is relevant not only for smokers but also for ex smokers and never smokers. This is an important political economy question because while a majority of the general population might support raising tobacco prices and enacting smoking bans, only a minority of smokers tends to do so. The case for taking into account the preferences of non smokers would be stronger if there is evidence suggesting that they benefit from such measures through ways other than avoiding negative externalities (be they in the form of second hand smoke or in the form of net financial transfers from the public sector to smokers).

In order to provide some formal insights, we first extend to non smokers (i.e. never smokers and ex smokers) the time-inconsistencies model which Kan (2007) proposed for smokers. Subsequently we test the predictions of this model using data from the Catalan Health Survey of 2006 where, as we will argue, there are possibilities to proxy the susceptibility to self control problems with respect to tobacco consumption of not only smokers but also non smokers. Our estimates confirm the results obtained by Kan (2007) and Herscht (2005) in the sense that smokers who wish to quit are more likely to support price rises and smoking bans. But, in addition, we find that ex smokers and never smokers who are susceptible to suffer self control problems with respect to smoking tend to support these measures substantially more than the rest of ex smokers and non smokers. This suggests that the welfare gains derived from the reinforcement of self control caused by tax hikes and smoking bans will accrue not only to smokers, a dwindling part of the population in many western countries, but also to the rest of the population.

In section 2 we present a brief theoretical discussion that illustrates our main argument. Section 3 discusses the data that we will use to test our conjecture. Section 4 presents our econometric specification and estimates. Finally, section 5 contains a discussion of the implications of our results.

2. TIME INCONSISTENCIES CAN AFFECT NON SMOKERS TOO

Our starting point is the model of time inconsistent smokers proposed by Kan (2007). Here, smokers with time inconsistent preferences represented by an intertemporal utility function with hyperbolic discounting will quit currently (at time t=0), accruing utility Q in the current period and utility N in subsequent periods, if this action generates a higher level of life time utility than smoking, which yields utility S in the current and subsequent periods. That is

$$Q + \beta \sum_{t=1}^{\infty} \delta^t N > S + \beta \sum_{t=1}^{\infty} \delta^t S$$

(1)

The cost of quitting is represented by Q-S<0, and the benefit of non-smoking is N-S>0. Time inconsistency is captured by the parameter β, and δ is the usual discount factor, with $1 \geq \{\delta, \beta\} > 0$.

Therefore the smoker will quit in the current period if the contemporary cost of quitting is less than the discounted benefit of not smoking.

$$S - Q < \frac{\beta\delta}{1-\delta}(N - S)$$

(2)

When the inequality above does not hold, the smoker might consider quitting in the next period. She will currently (at t=0) plan to quit next period if the following inequality holds

$$\beta Q + \beta \sum_{t=1}^{\infty} \delta^t N > \beta S + \beta \sum_{t=1}^{\infty} \delta^t S$$

(3)

That is

$$S - Q < \frac{\delta}{1-\delta}(N - S)$$

(4)

But when 1<β, the plan might not be realized when next period arrives because the next inequality is plausible

$$\frac{\beta\delta}{1-\delta}(N-S) < S-Q < \frac{\delta}{1-\delta}(N-S) \tag{5}$$

As pointed out by Kan (2007), mechanisms that reduce the cost of quitting (S-Q) by reducing S –the case of taxes and clean air laws[1]- can act as enhancers of self control. Thus, while (5) might hold, the introduction of a smoking cost C could avoid the indefinite procrastination of the plan to quit. This situation would be represented by inequality (6)

$$S-Q-C < \frac{\beta\delta}{1-\delta}(N-S) < S-Q \tag{6}$$

In his empirical application Kan argues that smokers who report that they wish to quit in the future are caught in the situation represented by equation 5, so they will benefit from tax hikes and smoking bans because these might help them to avoid procrastination. His empirical results support such hypothesis and therefore lend support to the model of time inconsistencies and its normative implications.

2.1. Extension of the model to non smokers and current smokers

We now present an extension of Kan's model outlined above to represent the cases of never smokers (or ex smokers) potentially at risk of starting (or relapsing). In this stylized model non smokers opt between continuing not smoking (N,N,N…) or starting/relapsing and smoking thereafter (R,S,S…). R is the utility yielded by starting/relapsing in the current period. The risk of starting/relapsing is represented by assuming that R>N. This risk might be greater for individuals who are experiencing with tobacco (Orphanides and Zervos,

[1] But note that this framework also highlights the potential of reducing the disutility of quitting, i.e. increasing Q, by means of quitting aids such as nicotine patches etc.

1995; Wang, 2007) and, specially, ex smokers. Indeed, our data shows that 46% of smokers have carried out a serious attempt to quit and have relapsed thereafter.

Contemporaneously (i.e. at t=0), non smokers plan that to stay off tobacco in the future if the following inequality holds

$$\beta R + \beta \sum_{t=1}^{\infty} \delta^t S < \beta N + \beta \sum_{t=1}^{\infty} \delta^t N \tag{7}$$

That is,

$$R - N < \frac{\delta}{1-\delta}(N - S) \tag{8}$$

However, the plan to stay a non smoker in future periods might not materialize because in the current period, the decision to stay off tobacco requires that the following inequality holds

$$R + \beta \sum_{t=1}^{\infty} \delta^t S < N + \beta \sum_{t=1}^{\infty} \delta^t N \tag{9}$$

That is

$$R - N < \frac{\beta\delta}{1-\delta}(N - S) \tag{10}$$

Therefore, the further from unity the value of β is located –i.e. the more severe the degree of time inconsistency in the preferences of the individual-, the more likely becomes the following inequality

$$\frac{\beta\delta}{1-\delta}(N-S) < R-N < \frac{\delta}{1-\delta}(N-S) \tag{11}$$

Inequality (11) represents a situation akin to that represented in inequality (5) for the case of smokers in Kan's model. It refers to the case of non smokers who, despite planning to stay off tobacco, are compelled to smoke presently. Likewise, in parallel to the situation represented in inequality (6), mechanisms that generate a cost C that diminishes the net benefits of starting/relapsing might have the capability of eliminating such compulsion, as represented by the following inequality

$$R-N-C < \frac{\beta\delta}{1-\delta}(N-S) < R-N \tag{12}$$

The main insight from this simple theoretical reasoning is that, to the extent that there is a risk of starting/relapsing among non smokers, the existence of mechanisms that reduce the net utility of smoking could benefit this group of the population in a manner that mirrors the benefits that smokers obtain from such mechanisms, and it is important to test empirically this conjecture.

3. DATA AND ECONOMETRIC MODELING

The *Enquesta de Salut de Catalunya* (ESCAT) is a representative survey of health status and health care utilization for the non-institutionalised population of individuals in Catalonia, one of the largest regions of Spain. In 2006 the population of Catalonia was 7,134,697, or 16% of the Spanish total. Catalonia has the same tax and tobacco regulations as the rest of Spain (excluding the special offshore territories of the Canary Islands and the autonomous cities of Ceuta and Melilla in the north of Africa). At the time of sampling, a partial clean air law had just been enacted (January 1st 2006). This law forbade smoking at work places, but bars and restaurants could opt out at no cost (except for large premises, where no smoking areas had to be delimited). As a consequence, only a tiny fraction of bars and restaurants premises became smoke free (Villalbí *et al.*, 2010). This regulatory set up lasted until the 1st of January of 2011, when the possibility of bars and restaurants opting out was abolished. As for tobacco prices, in 2006, the price of cigarettes in Spain, as represented by the Most Popular Price Category, fell below the average level for EU15 countries. This gap was due to a traditionally low level of taxation relative to the rest of EU15 countries. The enactment of the partial ban referred to above brought anti smoking policies to attention and, during 2006 and after, the degree of population support to smoking bans at restaurants and to tax hikes have been prominent policy questions.

The 2006 release of the ESCAT sampled 15,926 adults and 2,200 children. A representative subsample of 4,443 adults was interviewed with additional questions regarding smoking behavior. After deleting observations with incomplete data, we are able to use data on 4,143 individuals responding the tobacco module. Of these, 30% are current smokers, 20% are ex smokers and 50% report not to have smoked ever. Among current smokers, 48.5% report that they are very interested or quite interested in quitting, while the rest declare to have little or no interest at all.

In order to test whether individuals with self control problems regarding tobacco consumption can benefit from mechanisms that generate a reduction in the net benefit of contemporaneous smoking, we need an empirical measure of such self control. In the case of smokers considered by Kan (2007), the desire to quit is used as a proxy for the existence of time inconsistencies leading to lack of self control as represented by the model discussed above. Accordingly, we will use this indicator in our tests among smokers. Note however that, for obvious reasons, there is no such straightforward empirical marker of potential time inconsistencies among non smokers. Fortunately the ESCAT also elicits information that can act as a proxy for the susceptibility to self control problems with respect to smoking from all participants regardless of their smoking status. This information is derived from the following question ***"Tell me to what extent not smoking or quitting smoking is important as proof of independence and self control",*** to which interviewees may answer *very important, quite important, not so important* and *not important at all.*

It is reasonable to assume that these answers are correlated with the underlying individuals' degree of self control with respect to smoking behavior. To see this relationship more clearly, consider that those who reply that it is "important" (i.e. either "very important" or "quite important") believe that smoking is, if not always, at least sometimes, proof of lack of self control, that is, an unrealized desire to stay off smoking. Whether they smoke or not, this belief reflects awareness of the possibility of not being able to realize planned decisions with respect to smoking. In contrast, the rest of respondents, who do not view smoking as proof of a lack of self control, will tend to feel more confident about the ability to carry out planned decisions concerning tobacco use, regardless of their smoking status.

The indicators of policy support that we will analyze are derived from the following questions:

Do you agree or disagree with the following statements?

1) *Tobacco prices should increase much more*

2) *There should be a complete smoking ban in restaurants*

With the following possible 4 categorical answers:

Strongly agree, *agree*, *somehow disagree* and *strongly disagree*

If the hypothesis of time inconsistencies is correct we should find that individuals who reply "important" to the question about self control are, *ceteris paribus*, more likely to express support (i.e. respond *strongly agree* or *agree*) policies such as tax hikes or smoking bans, because they impose an additional cost on smoking that might help them to avoid the procrastination of quitting, in the case of smokers, or avoiding the compulsion to smoke, in the case of non smokers at risk of starting and relapsing. Interestingly, our consideration of two different types of anti smoking policies allows us to discriminate between the time inconsistencies hypothesis and another hypothesis of failure of the rational addiction model, namely the cue-triggered consumption theory of Bernheim and Rangel (2004). According to such theory individuals might smoke unwillingly upon entering a "hot" state that leads them to consume compulsively. In these circumstances, avoiding cues such as encountering smoking patrons at bars and restaurants is beneficial, so we might expect individuals who suffer this particular form of lack of self control to support bans at restaurants. However, Bernheim and Rangel (2004) argue that taxes cannot reduce compulsive use and therefore only add to the misery of those who enter the hot state and are compelled to smoke. Therefore, according to their model, we should expect individuals who reply "important" to the self control question discussed above are, *ceteris paribus*, more likely to support smoking bans, but not tax hikes, than the rest of individuals.

Non smokers might support policies aimed at reducing their exposure to second hand smoke. We will control for this by including information from the following question in

our econometric specification: *When you have to be in a smoky room for a while, do you experience nuisance,* with four possible categorical answers: *Strong nuisance, light nuisance, not much nuisance, no nuisance*. Likewise, non smokers might support policies that erect barriers to the consumption of tobacco of other people they care for, especially their children. We will therefore control for this by including an indicator of co-resident descendents.

For the subsequent analysis, we will dichotomize the policy support variables and some other explanatory variables. Thus, the binary variables *Pricerise* and *Restban* take the value 1 if the respondent states strong agreement or agreement with statements 1 and 2 above, respectively, and 0 otherwise. Similarly, the binary variable *Self control* takes the value 1 if the respondent answers very important or quite important to the question on self control discussed earlier. Table I presents and defines the rest of the variables that we use in the econometric analysis.

Table II contains basic descriptive statistics. Focusing first on the support to the preventive policies, we note that both price hikes and restaurant bans are supported by a comfortable majority of 58% and 62% respectively. The support is greatest among never smokers, followed by ex smokers. Not surprisingly, only a minority of smokers, 29% and 37% respectively, support these measures. However, the percentage of supporters is more than 10% greater for both policies among smokers who wish to quit. These unconditional means suggest evidence in favor of the time inconsistencies model, and accord to results in previous literature. Regarding our measure of self control problems in smoking behavior, note that three quarters of the sample consider them to be important. In fact, in all subgroups, more than half of the respondents consider them so. The greatest percentage is found among never smokers and ex smokers at 81% and 77% respectively. There is a striking difference between the responses of smokers who do not wish to quit and those

who do. Among the former, 55% consider self control problems important, while the figure shoots up to 73% for the latter.

Table III complements the descriptive evidence of Table II with cross tabulations of the indicators of policy support with the indicator *Self control* by smoking status. Note that the proportion of supporters to both policies is greater among those who consider self control problems important in all groups by a very wide margin.

4. ECONOMETRIC SPECIFICATIONS AND ESTIMATES

We now proceed to the estimation of models where the support for the two policies is conditioned on a wide set of controls. In particular, we estimate separate probit models for never smokers, ex smokers and current smokers. The specifications for the three groups share a set of explanatory variables including *Self control*, demographics, income and the control for dislike of smoky spaces discussed earlier. The specification for ex smokers includes, additionally, a control for how hard it was to quit (*Tries*), and a control for whether abstinence has lasted longer than 5 years, as a proxy for the otherwise unobservable risk of relapse. In the case of current smokers we add the variable *Quit*, the indicator for the wish to quit, an indicator for whether the smoker feels difficulty in abstaining in restricted areas (*Difficult to refrain*), and the number of years since starting to smoke (*Years smoking*). We expect these two latter variables to capture the degree of addiction to nicotine and therefore to be correlated with both the support to the policies, *Self control* and *Quit*.

Formally, for our baseline models we specify

$$y_{pi}^{*G} = \alpha_p^{'G} X_i^G + \epsilon_{pi}^G$$

$$y_{pi}^G = \boldsymbol{1}(y_{pi}^G > 0)$$

p=price rises, restaurant bans

G=Never smokers, Ex smokers, Current smokers

(13)

where y^{*G}_{pi} is a latent index of individual i's (belonging to population group G) support for policy p and y^{G}_{pi} is its observable binary counterpart, X^{G}_{i} is a vector of a explanatory variables for individual i, and α^{G}_{p} is a parameter vector specific to policy p and group G.

The stochastic terms ε^{G}_{pi} are assumed to follow a standard normal distribution and to be uncorrelated across individuals and policies.

Previous studies have considered the desire to quit as an endogenous variable in models for the support to anti smoking policies among current smokers (Kan, 2007). We allow for this possibility by means of bivariate probit models, where the equations for policy support among current smokers are accompanied by an equation for the desire to quit specified as

$$Quit_i^{*G} = +\lambda_{p1}^{'G} X_i^G + \lambda_{p2}^{'G} Z_{pi}^G \pi_{pi}^G$$

$$corr\left(\varepsilon_{pi}^G, \pi_{pi}^G\right) = \rho_p^G$$

p=price rises, restaurant bans

G=Never smokers, Ex smokers, Current smokers

(14)

where $Quit_i^{*G}$ is an unobservable latent variable and

$$Quit_i^G = \begin{cases} 1, & Quit_i^{*G} > 0 \\ 0, & Quit_i^{*G} \leq 0 \end{cases}$$

(15)

The vector Z_{pi}^{G} includes instrumental variables that allow the non parametric identification of the bivariate probit model. In the case of tax hikes, we have used three instrumental variables that are correlated with the desire to quit but can be argued not to affect the support for such policy otherwise. These variables are *Car*, *Failed* and *Never medical advice*. *Car* is an indicator for having travelled by car in the last month, which we take as a proxy for attitudes towards physical risk and therefore might have explanatory power for the wish to quit smoking. *Failed* is an indicator for a failed previous attempt to quit. And *Medical Advice* is an indicator for whether a doctor has advised the individual about the hazards of smoking, which we interpret as an indicator of knowledge about the risks posed to health by smoking. This latter instrumental variable is not used in the model for smoking bans, as knowledge about the hazards of smoke might affect the support to this policy over and above its effect on the desire to quit.

Following the statistical procedures applied by Kan (2007), we carry out tests for weak instruments based on the Staiger and Stock (1997) criterion, tests for overidentification based on Rashand and Kaestner (2004) and standard Hausman exogeneity tests.

4.1. Never smokers

Tables IV (probit coefficients) and V (average partial/marginal effects) present the estimates for the models of policy support among never smokers. Among the demographic controls we find that being employed and not reporting income are associated with a drop in the probability of supporting tax hikes of 5%. We also find that never smokers are more likely, by a margin of 6%, to support tax hikes if they live with children than otherwise. We find the expected effect for those who state to feel discomfort in a smoky atmosphere. The corresponding average partial effects are 14% and 10% increases in the probability of supporting tax hikes and smoking bans respectively. Our main variable of interest, *self*

control, is found to exert a significant and large effect, in the order of 16%, on the chances of supporting the two policies.

4.2. Ex smokers

Tables VI (probit coefficients) and VII (average partial/marginal effects) present the estimates for the models of policy support among ex smokers. Among ex smokers, males seem more likely to support the policies (by 6.5%, *ceteris paribus*) than females. Contrary to the effect found among never smokers, employed ex smokers are more likely to support the two policies (by about 8.5%, other factors held equal) than ex smokers in other labour states. Also, ex smokers in the two top brackets for observed income are about 12% more likely to support smoking bans than ex smokers in the bottom (omitted category) income bracket. We find that ex smokers who have abstained for longer than 5 years are 8.5% more likely to support smoking bans at restaurants than the rest of ex smokers. In concordance with what we have reported above for never smokers, we find that ex smokers are very much likely to support both policies if they state to feel discomfort in smoky places (12% and 23% for tax hikes and bans respectively) and if they state that not smoking is proof of self control (18% and 13% for tax hikes and bans respectively).

4.3. Smokers

Tables VIII and IX present the coefficient estimates for the two specifications of the models for support to tax hikes and smoking bans in restaurants. These treat the desire to quit alternatively as an exogenous or an endogenous variable. A general point about these alternative specifications is that our tests suggest that the choice of instruments for *Quit* is justified both on the grounds that these are not weak instruments and that they satisfy the exclusion restrictions. Although it is not the main concern in this paper, it is worth noting that the desire to quit is associated to the belief that not smoking is an important sign of to

physical risk, as measured by *Car*, the proxy for knowledge about the hazards of smoking, as measured by our variable *Never medical advice,* and previous failed attempts to quit, as measured by *Failed.*

For the two policies we obtain an estimate for the correlation coefficient between the error terms that is significantly different from zero, but its sign is negative, contrary to the expectation that unobserved factors increasing the propensity to desiring to quit would be positively correlated with unobserved factors that increase the propensity to support the policies. Nonetheless the Hausman tests suggest that there are no significant differences between the alternative specifications. Indeed, for both policies, we find that the same set of variables are significant in the exogenous and endogenous specifications, and that the size of the coefficient estimates do not differ substantially. For these reasons we focus on the marginal effects derived from the exogenous specification, which are presented in Table X.

Focusing first on demographics, note that, contrary to what we have found about employed ex smokers, employed smokers are less likely to support a ban in restaurants. Males and those whose maximum level of education is primary are also more likely to support bans at restaurants. Those living with children are more likely to support tax hikes.

We also find that the longer the smoking history, the less likely it is that smokers support either of the two policies. Similarly, those who report difficulty in abstaining at places where smoking is forbidden tend to be less supportive of the policies (partial effects of 8.6% and 14.4% for tax hikes and bans respectively).

In accordance with what we have found for never smokers and ex smokers, the stated dislike for smoky ambiances is positively associated to a greater probability of support for the policies (average partial effects of 6.5% and 13.1% respectively for tax hikes and bans).

Confirming results for other countries and Kan (2007) and Herscht (2005), those who express a desire to quit are more likely, *ceteris paribus*, to support both policies (average partial effects of 7.5% and 9.5% for tax hikes and bans at restaurants respectively). But, in addition, we find that our *Self control* indicator is a significant explanatory variable for the support of the policies, and that the corresponding average partial effects are large: 15.3% and 16.4% for tax hikes and smoking bans respectively.

5. DISCUSSION

There is a stable pattern in the set of estimates reported above. Those who believe that not smoking is a sign of independence and self control, i.e. our proxy for the presence of time inconsistency problems with regard to tobacco consumption, are substantially more likely to support tax hikes and smoking bans and restaurant than those who believe otherwise. This is consistent across the three population groups that we have considered: never smokers, ex smokers and current smokers.

In the case of smokers, the explanatory power of *Self control* is additional to that of the desire to quit, which has also been interpreted as a proxy for time inconsistencies in earlier literature. This result reinforces the critical view about the adequacy of the standard rational addiction model as a representation of smoking. Also reinforcing such view, and in line with results about the impact of tax hikes on reported happiness by potential smokers by Gruber and Mullainathan (2005), we find that our proxy for the presence of time inconsistencies with regard to smoking is also an important explanation for the two anti smoking policies among never smokers and ex smokers.

Therefore our results support the view that clean air laws generate welfare gains over and above the reduction of exposure to second hand smoke, for they act as mechanisms reinforcing the self control of, not only smokers who might wish to quit, but also non

smokers who are in risk of smoking. Moreover, because our evidence supports time inconsistencies as the cause for failure of the rational addiction model rather than alternatives like the cue-triggered model of Bernheim and Rangel (2004), a similar argument applies to taxes, which serve to internalize not just standard second hand smoke or financial externalities, but also aid in reconciling planned behavior with actual behavior.

In this sense, recent anti smoking measures applied in Spain, such as the extension of the smoking ban to bars and restaurants in 2011, the introduction of a minimum excise on cigarettes in 2006, and on fine cut tobacco in 2009, and their subsequent upwards revisions, are bound to generate important welfare gains. More generally, our results suggest that evaluating anti smoking policies requires considering their beneficial effects trough the enhancement of self control of not only smokers, a diminishing fraction of the population in most western countries, but also non smokers who might initiate/relapse smoking.

ACKNOWLEDGEMENTS

Support from Ministerio de Educación project ECO2008-06395-C05-04, co-funded by FEDER, and from Fundación Séneca through project 08646/PHCS/08 is gratefully acknowledged.

REFERENCES

Becker G, Murphy K. 1988. A theory of rational addiction. *Journal of Political Economy* **96**: 675-700.

Bernheim D, Rangel A. 2004. Addiction and cue-triggered decision processes. *American Economic Review* **94**(5): 1558-1590.

Gruber J, Köszegi B. 2001. Is addiction "rational"? Theory and evidence. *Quarterly Journal of Economics* **116**:1261-1303.

Gruber J, Köszegi B. 2002. A Theory of government regulation of addictive bads: optimal tax levels and tax incidence for cigarette taxation. *National Bureau of Economic Research Working Paper Series, 8777.*

Gruber J, Köszegi B. 2004. Tax incidence when individuals are time-inconsistent: the case of cigarette excise taxes. *Journal of Public Economics* **88**:1959-1987.

Gruber J, Mullainathan S. 2005. Do cigarette taxes make smokers happier?. *Advances in Economic Analysis and Policy* **5**(1): Article 4

Herscht J. 2005. Smoking restrictions as a self-control mechanism. *Journal of Risk and Uncertainty* **31**: 5-21.

Kan K. 2007. Cigarette smoking and self-control. *Journal of Health Economics* **26**: 61–81.

O'Donoghue T, Rabin M. 1999. Addiction and self-control. In: Elster J (Ed.), *Addiction: Entries and Exits. Russell Sage Foundation.* New York, pp. 169–206.

Orphanides A, Zervos D. 1995. Rational addiction with learning and regret. *Journal of Political Economy* **103**: 739-758.

Laibson, D. 1997. Golden eggs and hyperbolic discounting. *Quarterly Journal of Economics* **112**: 443 – 477.

Phelps ES, Pollak RA. 1968. On second best national saving and game—theoretic growth. *Review of Economic Studies* **35**: 185–199.

Rashad I, Kaestner R. 2004. Teenage sex, drugs and alcohol: problems identifying the cause of risky behaviors?. *Journal of Health Economics* **22**: 225–248.

Staiger D, Stock J.H. 1997. Instrumental variables regression with weak instruments. *Econometrica* **65**: 557–586.

Strotz, RH. 1956. Myopia and inconsistency in dynamic utility maximization. *Review of Economic Studies* **23**: 165–180.

Villalbí JR, Baranda L, Lopez MJ, Nebot M. 2010. El tabaco en los establecimientos de restauración y hostelería: estudio observacional en Barcelona. *Gaceta Sanitaria* **24**(1):72–74.

Wang R. 2007. The optimal consumption and the quitting of harmful addictive goods. *The B.E. Journal of Economic Analysis & Policy* **7**(1): Article 15.

Table I. Variable definition

Pricerise	1 if respondent supports the increase of the cigarette price, 0 otherwise
Restban	1 if respondent supports the smoking ban in restaurants, 0 otherwise
Child	1 if respondent lives with at least a child, 0 otherwise
Self control	1 if respondent considers that is important not to smoke for the independence and self-control, 0 otherwise
Male	1 if male, 0 female
Age	Age
Primary school	1 if respondent's highest education level is primary school, 0 otherwise
Employed	1 if respondent is employed, 0 otherwise
Income: 12001€ - 18000€	1 if annual household income is between 12001€ and 18000€, 0 otherwise
Income: >18000€	1 if annual household income is higher than 18000€, 0 otherwise
Income: missing	1 if annual household income is missing, 0 otherwise
Smoky atmosphere	1 if respondent feels discomfort in smoky atmosphere, 0 otherwise
Tries	1 if ex-smoker tried to quit smoking 3 or more times, 0 otherwise
Nonsmoking period	1 if ex-smoker has not smoked for more than 60 months, 0 otherwise
Quit	1 if smoker really wants to quit smoking, 0 otherswise
Difficult to refrain	1 if it is dificult for the smoker not to smoke in restricted areas, 0 otherwise
Years smoking	Years that smoker is smoking
Car	1 if smoker travelled by car last month, 0 otherwise
Never medical advice	1 if doctor has never told smoker about smoking habits and effects, 0 otherwise
Failed	1 if smoker has already failed at some time in his/her intention to quit smoking, 0 otherwise

Table II. Descriptive statistics

	Full sample		Non smokers						Smokers					
			All non smokers		Never smoker		Ex smoker		All smokers		Quit=0		Quit=1	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Pricerise	0.580	0.494	0.703	0.457	0.743	0.437	0.603	0.490	0.287	0.453	0.236	0.425	0.342	0.475
Restban	0.618	0.486	0.722	0.448	0.762	0.426	0.623	0.485	0.370	0.483	0.309	0.462	0.435	0.496
Child	0.435	0.496	0.433	0.496	0.403	0.491	0.507	0.500	0.441	0.497	0.437	0.496	0.445	0.497
Self control	0.754	0.431	0.803	0.398	0.815	0.388	0.773	0.419	0.638	0.481	0.554	0.497	0.727	0.446
Male	0.493	0.500	0.450	0.498	0.364	0.481	0.665	0.472	0.597	0.491	0.601	0.490	0.592	0.492
Age	47.047	18.633	50.485	19.247	50.187	20.035	51.230	17.105	38.858	14.026	39.557	14.886	38.113	13.019
Primary school	0.370	0.483	0.411	0.492	0.441	0.497	0.335	0.472	0.273	0.446	0.294	0.456	0.250	0.433
Employed	0.588	0.492	0.519	0.500	0.485	0.500	0.604	0.489	0.752	0.432	0.741	0.439	0.764	0.425
Income: 12001€ - 18000€	0.193	0.395	0.193	0.394	0.183	0.387	0.216	0.412	0.195	0.396	0.198	0.399	0.192	0.394
Income: >18000€	0.278	0.448	0.259	0.438	0.239	0.427	0.309	0.462	0.322	0.467	0.339	0.474	0.304	0.460
Income: missing	0.393	0.489	0.397	0.489	0.423	0.494	0.331	0.471	0.386	0.487	0.373	0.484	0.400	0.490
Smoky atmosphere	0.671	0.470	0.734	0.442	0.764	0.425	0.659	0.474	0.520	0.500	0.476	0.500	0.567	0.496
Tries							0.184	0.387						
Nonsmoking period							0.597	0.491						
Quit									0.484	0.500	0.000	0.000	1.000	0.000
Difficult to refrain									0.137	0.344	0.142	0.350	0.132	0.338
Years smoking									21.558	13.686	22.120	14.589	20.958	12.638
Car									0.918	0.275	0.934	0.249	0.901	0.300
Never medical advice									0.562	0.496	0.601	0.490	0.519	0.500
Failed									0.468	0.499	0.277	0.448	0.671	0.470
Sample size	4143		2918		2085		833		1225		632		593	

Table III. Proportion of those who support the anti-smoking policies by the variable Self control

	Pricerise=1		Restban=1	
	Self control=0	Self control=1	Self control=0	Self control=1
Non smokers	53.14	74.49	55.40	76.37
Never smoker	57.92	78.00	58.96	80.12
Ex smoker	43.39	65.22	48.15	66.46
Smokers	17.57	35.08	23.87	44.43
Smoker: quit=0	16.31	29.43	22.34	37.71
Smoker: quit=1	19.75	39.68	26.54	49.88
Total	37.62	64.64	41.65	68.38

Table IV. Never smokers' support for the anti smoking policies

	Pricerise			Restban		
	Coef.		Robust Std.	Coef.		Robust Std.
Child	0.188	***	0.064	0.108	*	0.065
Self control	0.492	***	0.075	0.527	***	0.075
Male	0.047		0.067	-0.057		0.066
Age	0.000		0.002	0.002		0.002
Primary school	0.065		0.080	0.089		0.080
Employed	-0.151	**	0.075	-0.099		0.075
Income: 12001€ - 18000€	-0.082		0.110	-0.108		0.113
Income: >18000€	-0.115		0.111	-0.263	**	0.113
Income: missing	-0.178	*	0.096	-0.078		0.100
Smoky atmosphere	0.445	***	0.069	0.330	***	0.071
Tries						
Nonsmoking period						
Constant	0.021		0.163	0.087		0.164
Loglike	-1127.359			-1083.629		
Observations	2,085			2,085		

*, **, *** indicate significant at 10%, 5% and 1% level respectively.

Table V. Average marginal effects for never smokers

	Pricerise	Restban
Child	**0.059**	0.033
Self control	**0.156**	**0.163**
Male	0.015	-0.018
Age	0.000	0.000
Primary school	0.021	0.028
Employed	**-0.048**	-0.031
Income: 12001€ - 18000€	-0.026	-0.034
Income: >18000€	-0.037	**-0.085**
Income: missing	**-0.057**	-0.024
Smoky atmosphere	**0.141**	**0.102**
Tries		
Nonsmoking period		

The bold numbers indicate that the average maginal effect it is significant at the usual levels.

Table VI. Ex smokers' support for the anti-smoking policies

	Pricerise			Restban		
	Coef.		Robust Std.	Coef.		Robust Std.
Child	-0.028		0.097	0.038		0.100
Self control	0.505	***	0.108	0.373	***	0.110
Male	0.176	*	0.104	0.187	*	0.108
Age	0.004		0.004	0.009	**	0.004
Primary school	0.119		0.112	0.110		0.113
Employed	0.232	*	0.124	0.259	**	0.128
Income: 12001€ - 18000€	-0.239		0.156	-0.335	**	0.162
Income: >18000€	0.028		0.158	-0.354	**	0.161
Income: missing	-0.298	**	0.150	-0.234		0.155
Smoky atmosphere	0.327	***	0.096	0.676	***	0.099
Tries	0.145		0.121	0.117		0.123
Nonsmoking period	0.039		0.103	0.245	**	0.105
Constant	-0.714	**	0.285	-1.100	***	0.302
Loglike	-528.028			-499.879		
Observations	833			833		

*, **, *** indicate significant at 10%, 5% and 1% level respectively.

Table VII. Average marginal effects for ex smokers

	Pricerise	Restban
Child	-0.010	0.013
Self control	**0.183**	**0.127**
Male	**0.064**	**0.065**
Age	0.001	**0.003**
Primary school	0.043	0.038
Employed	**0.084**	**0.088**
Income: 12001€ - 18000€	-0.088	**-0.116**
Income: >18000€	0.010	**-0.122**
Income: missing	**-0.109**	-0.080
Smoky atmosphere	**0.118**	**0.231**
Tries	0.053	0.040
Nonsmoking period	0.014	**0.084**

The bold numbers indicate that the average maginal effect it is significant at the usual levels.

Table VIII. Smokers' support for the increase in the cigarette price

	Endogenous specification						Exogenous specification					
	Pricerise			Quit			Pricerise			Quit		
	Coef.		Robust Std.	Coef.		Robust Std.	Coef.		Robust Std.	Coef.		Robust Std.
Quit	0.627	***	0.184				0.234	***	0.079			
Child	0.213	**	0.085	0.019		0.085	0.231	***	0.085	0.017		0.085
Self control	0.398	***	0.094	0.473	***	0.082	0.476	***	0.086	0.472	***	0.082
Male	0.038		0.083	0.006		0.083	0.047		0.084	0.010		0.083
Age	0.020	**	0.009	-0.007		0.009	0.019	**	0.009	-0.007		0.009
Primary school	0.025		0.096	-0.169	*	0.092	0.006		0.095	-0.169	*	0.093
Employed	-0.016		0.096	0.071		0.094	-0.006		0.096	0.070		0.094
Income: 12001€ - 18000€	0.116		0.158	-0.139		0.155	0.089		0.157	-0.143		0.156
Income: >18000€	0.040		0.152	-0.243		0.149	0.001		0.151	-0.247		0.150
Income: missing	0.063		0.145	-0.077		0.142	0.046		0.145	-0.082		0.143
Smoky atmosphere	0.178	**	0.082	0.078		0.081	0.202	**	0.081	0.078		0.081
Difficult to refrain	-0.257	**	0.117	-0.141		0.115	-0.267	**	0.119	-0.150		0.116
Years smoking	-0.021	**	0.009	-0.002		0.009	-0.020	**	0.009	-0.002		0.009
Car				-0.439	***	0.145				-0.422	***	0.147
Never medical advice				-0.214	***	0.079				-0.226	***	0.079
Failed				1.058	***	0.079				1.056	***	0.079
Constant	-1.716	***	0.264	0.095		0.275	-1.552	***	0.259	0.090		0.276
r	-0.287** [0.027]						0.000 [-]					
Loglike	-1407.066						-1409.690					
Observations	1225						1225					
Hausman test	0.52 [1.000]											
Weak instrument test	211.04*** [0.000]											
Overidentification test	5.36 [0.148]											

*, **, *** indicate significant at 10%, 5% and 1% level respectively.

P-values are in square brackets.

Table IX. Smokers' support for the smoking ban in restaurants

	Endogenous specification						Exogenous specification					
	Restban			Quit			Restban			Quit		
	Coef.		Robust Std.	Coef.		Robust Std.	Coef.		Robust Std.	Coef.		Robust Std.
Quit	0.537	***	0.191				0.279	***	0.078			
Child	0.027		0.084	0.032		0.085	0.035		0.084	0.027		0.085
Self control	0.435	***	0.092	0.454	***	0.082	0.483	***	0.084	0.456	***	0.082
Male	0.318	***	0.083	0.014		0.083	0.325	***	0.083	0.015		0.083
Age	0.037	***	0.009	-0.006		0.009	0.036	***	0.009	-0.006		0.009
Primary school	0.363	***	0.093	-0.164	*	0.092	0.352	***	0.093	-0.163	*	0.092
Employed	-0.163	*	0.094	0.076		0.094	-0.157	*	0.093	0.074		0.094
Income: 12001€ - 18000€	0.088		0.155	-0.135		0.155	0.072		0.154	-0.137		0.155
Income: >18000€	-0.026		0.148	-0.245		0.149	-0.050		0.147	-0.242		0.150
Income: missing	-0.017		0.142	-0.092		0.142	-0.028		0.142	-0.092		0.143
Smoky atmosphere	0.370	***	0.081	0.081		0.081	0.387	***	0.080	0.078		0.081
Difficult to refrain	-0.413	***	0.118	-0.141		0.117	-0.423	***	0.118	-0.142		0.117
Years smoking	-0.038	***	0.009	-0.002		0.009	-0.038	***	0.009	-0.002		0.009
Car				-0.422	***	0.146				-0.408	***	0.147
Failed				1.066	***	0.079				1.068	***	0.079
Constant	-1.834	***	0.260	-0.086		0.269	-1.721	***	0.250	-0.105		0.267
r	-0.186 [0.150]						0.000 [-]					
Loglike	-1449.860						-1450.948					
Observations	1225						1225					
Hausman test	2.72 [0.999]											
Weak instrument test	202.94*** [0.000]											
Overidentification test	3.07 [0.215]											

*, **, *** indicate significant at 10% level, 5% and 1% respectively.

P-values are in square brackets.

Table X. Average marginal effects for smokers

	Pricerise	Restban
Quit	**0.075**	**0.095**
Child	**0.075**	0.012
Self control	**0.153**	**0.164**
Male	0.015	**0.109**
Age	**0.006**	**0.012**
Primary school	0.002	**0.120**
Employed	-0.002	**-0.053**
Income: 12001€ - 18000€	0.029	0.025
Income: >18000€	0.000	-0.017
Income: missing	0.015	-0.010
Smoky atmosphere	**0.065**	**0.131**
Difficult to refrain	**-0.086**	**-0.144**
Years smoking	**-0.006**	**-0.013**

The bold numbers indicate that the average maginal effect it is significant at the usual levels.