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Smoking in Spain: Analysis of Initiation and Cessation*

by
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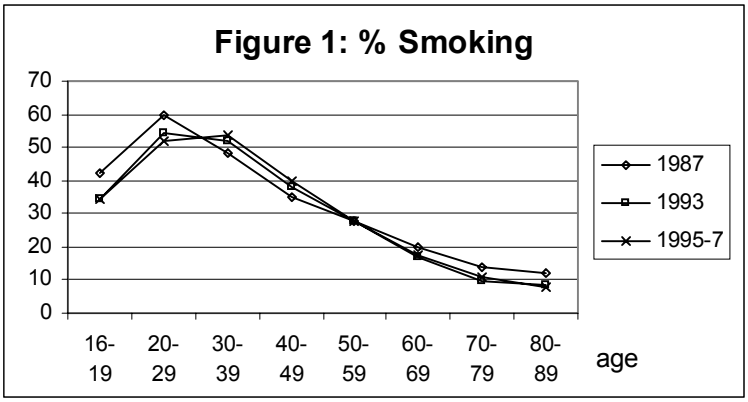
Abstract

We investigate dynamic aspects of smoking behavior by analyzing the initiation and the cessation of smoking habit in Spain. Some interesting results can be distinguished. First, age at smoking initiation is highly concentrated between 14 and 20: once people reach their early 20s without having smoked, the probability of ever smoking is extremely low. Second, in the probability of entry (or age at smoking initiation), education is not a significant factor for men but it is a dominant factor for women, higher education higher probability of initiation of smoking habit. Third, among those who have ever smoked smoking duration decreases (or quit rate increases) substantially with education level for men but does not so for women. Finally, age at initiation increases the quit rate for men while it has no significant effect for women, and addiction (quantity of daily consumption) reduces the quit rate substantially for women but not so for men. *In conclusion, the higher smoking rates among high educated women are due to higher entry rates, while the lower smoking rates among high educated men are due to higher exit rates*.

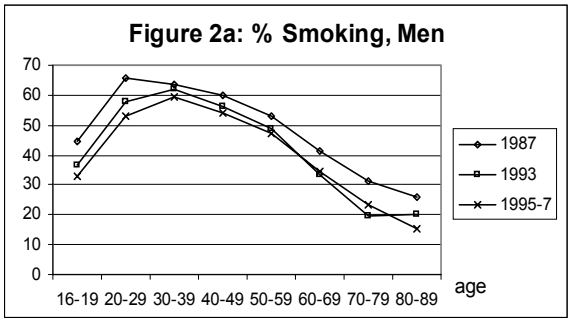
1. Introduction

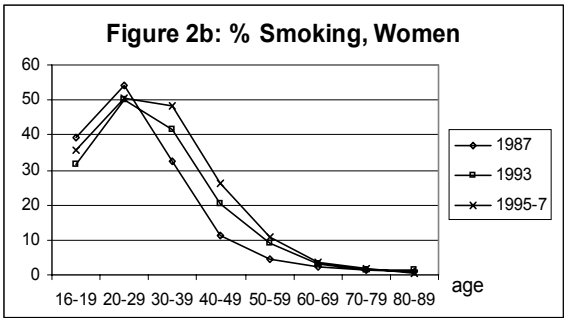
Smoking has important implications on many socio-economic aspects, from mortality and health problems to the health care expenditures. For the case of the US, it is estimated that tobacco use is responsible for more than 430,000 deaths each year, or 1 in every 5 deaths, and for more than 50 billion dollars in medical expenditures. Data for Spain shows that tobacco consumption causes 45,000 deaths each year, 1 in every 6 deaths, and the hospital costs attributable to smoking each year are 41,000 million pesetas. These numbers, along with the fact that tobacco consumption per capita is greater in Spain than in the US warrants the importance of the issue.

The proportion of smokers among the Spanish population has hardly changed during the last 10 years, which contrasts the substantial decrease in the case of the US. The participation rate among the population over 15 years of age was 37% in 1987 and 36% in 1997 according to the Spanish National Health Survey (1987, 1993, 1995, and 1997). Although the aggregate rate of participation has not changed, the participation profile has undergone substantial changes by three important socio-demographic characteristics, age, gender and education level. The proportion of smokers have decreased for the teen-agers and those in their 20s while it has increased among the middle aged (30s and 40s) population. The participation rate has also declined among the elderly population of over 60 years.



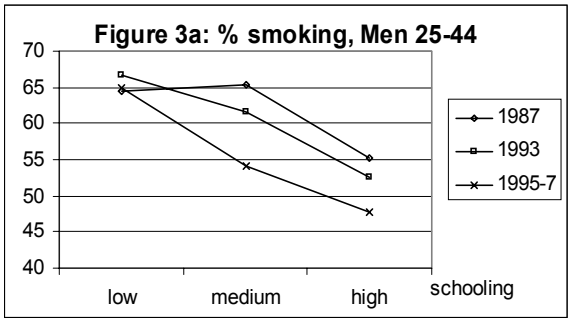
Between men and women there exist widely different patterns. While the proportion of smokers has decreased among men by 9 percentage points during the last 10 years, the smoker proportion among women has increased by more than 5 percentage points, thus reducing the gender gap in the participation rate by 14 percentage points from 32 percentage points (54% vs. 22%) in 1987 to 18 percentage points (45% vs. 27%) in 1997. More interestingly, there have been wide differences in temporal changes of smoking behavior between age groups and by gender. For men, the participation rate has decreased for all age groups. For women, it has decreased slightly among young women while it has increased substantially among middle-aged women. Therefore, there is a clear tendency of convergence between men and women in their age profiles of smoking participation.

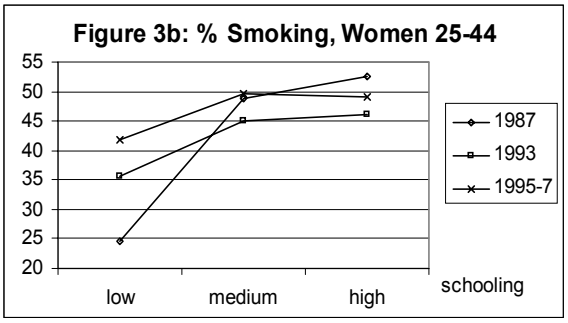




Another socio-demographic characteristics which underlines the smoking pattern in Spain is education. Here again there exist wide differences by gender. For men aged 25-44[1] in 1987 only those with university education had a lower participation rate by about 10 percentage points than those with lower levels of education. In 1997, the participation rate for the low educated is virtually same as in 1987 at 65% while the rates for the medium and high educated have declined by about 10 percentage points. Consequently, in 1997 the participation rate shows a monotonically declining pattern by education. For women, in 1987 the smoking participation schedule showed a clear increasing pattern by education where the increase was largest between the low and medium education levels. Over time, the slope has become flatter as the participation rate increased among the low educated while it decreased among the high educated. Gender gap has completely disappeared for the high educated while it is narrowing for the low educated.

[1] This age restriction is imposed since among the older population there is small variation in their education level with low education predominant





The main purpose of this study is to understand these differences in the smoking participation rates and their differential dynamics by gender, age and education. We investigate dynamic aspects of smoking behavior by analyzing the initiation and the cessation of smoking habit. This will be indispensable for any policy design regarding tobacco use and socio-economic costs.

2. Previous Studies

Previous studies of tobacco use have concentrated on the participation rate and the consumption quantity conditional on participation. Previous Spanish studies are confined to two categories, namely those, which employ aggregate time-series and others, which analyze smoking behavior using individual data. With respect to the former, Valdés (1993) and Escario and Molina (2000), use a partial adjustment model and an intertemporal model of rational addiction, respectively, to conclude the rational addiction character of tobacco consumption with current price elasticities around 0.60. As for the latter, Labeaga (1993, 1999), García and Labeaga (1996) and Jiménez et al. (1998) estimate tobacco demand equations emphasizing the usefulness of double-hurdle models. Their results confirm that cigarette smoking is addictive, but with lower elasticities than found in time-series studies; and

that increasing public knowledge about the harmful effects of smoking could be effective instruments to reduce this risky behavior.

The participation rate at a point in time is the proportion ever smoked multiplied by the proportion who continue smoking at that point in time. Therefore, the participation rate in any time is determined by both the past entry rates to and the past exit rates from smoking. Higher participation rates may result from either higher entry rates or lower exit rates, or both. If smoking is totally addictive (implying a zero exit rate), then the participation rate will be equal to the accumulated entry rate, or the proportion ever smoked. Smoking is indeed addictive but not totally. There are many smokers abandoning successfully smoking habit. Therefore, it is useful to know who and at what age start smoking and who and at what age (if ever do) quit smoking. It is important to know which individual and family characteristics and what kind of social environment encourages or discourages the entry to and the exit from smoking habit.

To our knowledge only two published studies have analyzed smoking initiation or smoking cessation using a duration model. Douglas and Harihanan (1994) investigate the determinants of the decision to start smoking among teenagers using a duration model. The study finds that economic variables such as taxes have no impact on the decisions of teenagers to start smoking, whereas non-economic factors such as lifetime educational attainment, marital status, race and gender do play a significant role in reducing the probability that teenagers will initiate smoking. Douglas (1998), as an extension of the previous study, investigates the determinants of the decisions to start and quit smoking using different functional forms (log-

logistic, Weibull, and Schmidt and Witte Split Population) to model the starting and quitting hazard functions. The author concludes that current, future and past prices of cigarettes have no significant effects on the probability of initiation. Likewise, current and past prices were found to be insignificant in the probability of quitting, whilst increases in future prices significantly increase quitting rates. In addition, the study indicates that information dissemination regarding the adverse health consequences of smoking, bans on cigarette advertising and state regulations significantly increase the probability of quitting. However, the insignificant current and past price effects obtained from these two articles are at odds with the majority of research on the determinants of smoking, which have established that the demand for cigarettes is responsive to the price. In a related research Jones (1994) estimates a double-hurdle probit model of the two steps of trying to quit and succeeding. He finds that addiction, social interaction and current health status have significant effects on the probability of abandoning smoking habit successfully.

In this paper, we estimate age at smoking initiation and the duration until ever-smokers quit smoking in Spain. Due to data limitation we cannot estimate the effects of price or income on smoking behavior. Although some previous papers attempt to estimate these effects, their results, which are based on short time series data, are questionable due to the difficulties in disentangling the effects of price or income changes from the effects of other concurrent secular changes, which are not controlled for. Instead, we focus on some important individual characteristics, such as age, sex, and education.

3. Empirical Analysis

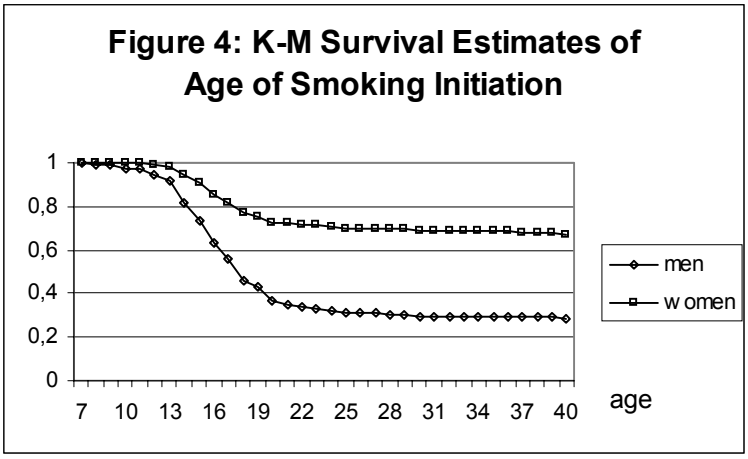
For our analyses, we use the public data set from the four available waves of the Spanish National Health Surveys (SNHS) corresponding to 1987, 1993, 1995 and 1997, conducted by the General Directorate for Public Health of the Spanish Ministry of Health. These large nationally representative cross-sections on individuals' health contain information on a rich set of background socioeconomic characteristics, making them an excellent source for trying to comprehensively model the determinants of smoking. The SNHS collects data by household interview, with the objective of determining the health status of Spanish adults over 15 years of age.

For the analysis of age at smoking initiation we estimate the Kaplan-Meier survival rates which are the probability that an individual have not smoked up to each age. Therefore, one minus the survival rates are the probability of having ever smoked up to each age. The duration until smoking cessation is similarly estimated for ever smokers. The results from multivariate discrete-time proportional hazard regression models (Allison, 1982) were similar to those from bivariate Kaplan-Meier survival rate estimates. For clarity of interpretation we present only the Kaplan-Meier estimates.

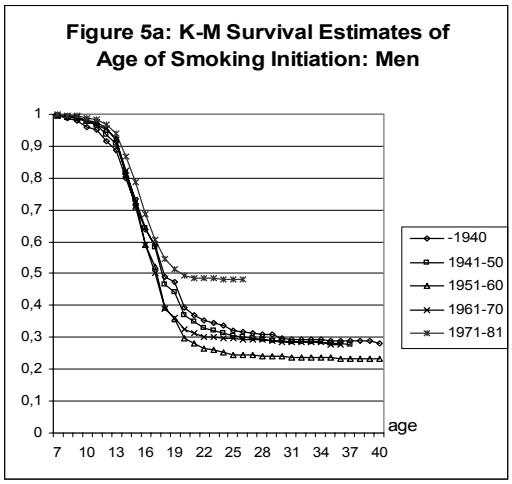
Smoking Initiation

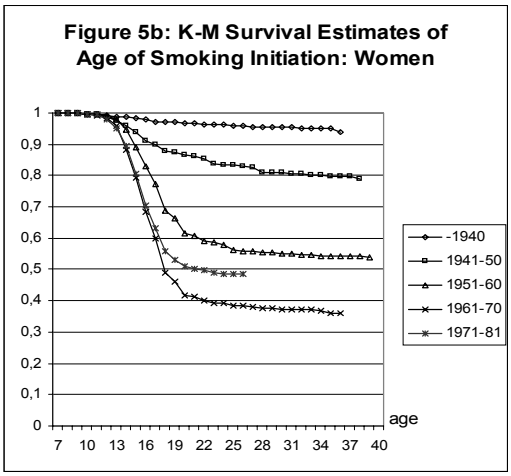
The first thing to notice is that age at smoking initiation is very concentrated between 14 and 20: about 80% of smokers initiate smoking habit in this age interval. This fact suggests that "prevention is best cure". Once people reach their early 20s without having smoked, the probability of ever

smoking is extremely low. Women start smoking much later than men. Less than 30% of women have ever smoked by age 20 while more than 60% of men have done so.

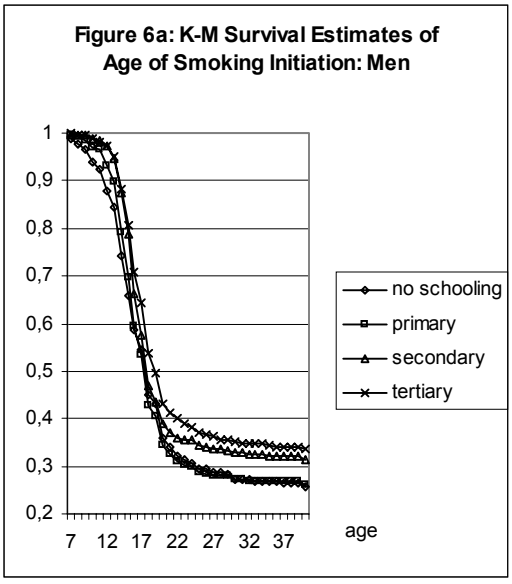


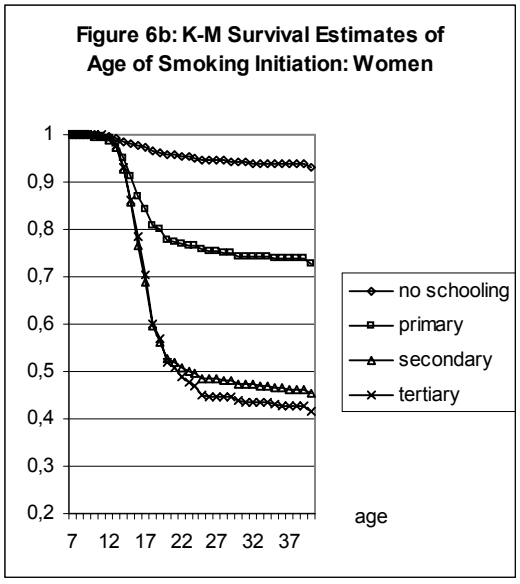
By cohort there are large differences, especially among women. For women, up to the cohorts born during the1960s the smoking experience had increased rapidly, from less than 20% to 60% by ages of mid 20s. However, most recent cohorts (born in the 1970s) show some reduction in smoking experience. Among men, smoking experience had increased slightly for the cohorts born in the 1940s and 1950s, but since then it has decreased substantially, especially for the cohorts born in the 1970s. Consequently, the differences between men and women in smoking experience have completely disappeared for the youngest cohorts.



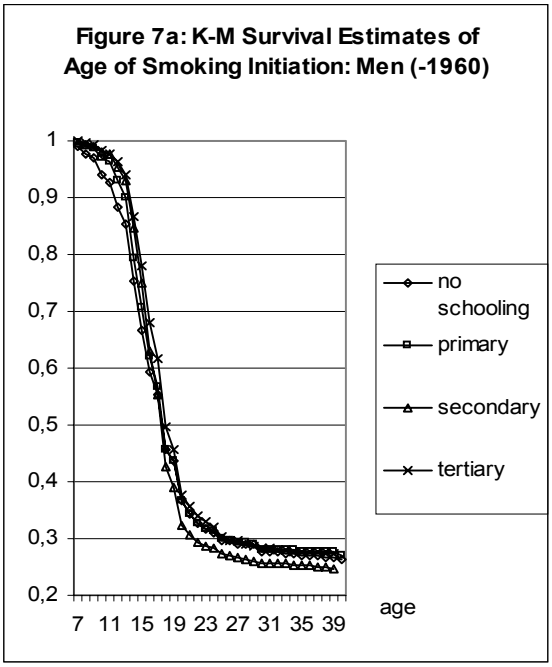


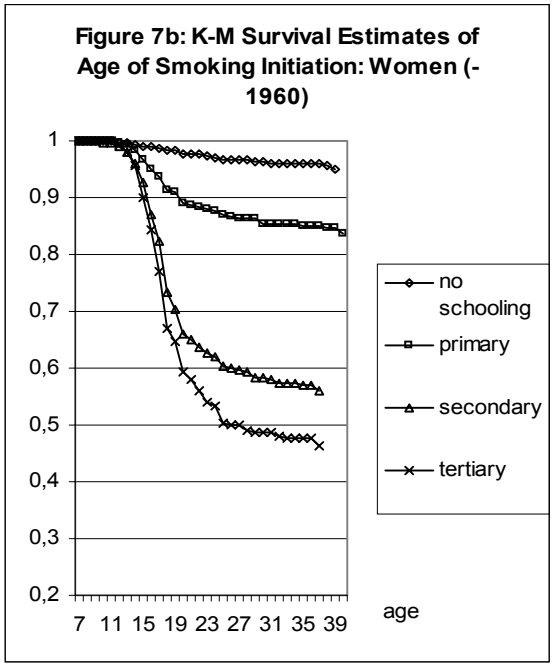
By education there are small differences for men while the differences for women are enormous. The probability of ever having smoked at any given age increases substantially by education for women, while it decreases slightly for men. However, the differences among women are likely to be due to the cohort differences as the education attainment is highly correlated with the year of birth. Interesting patterns emerge when we compare smoking experience by education for each birth cohort.

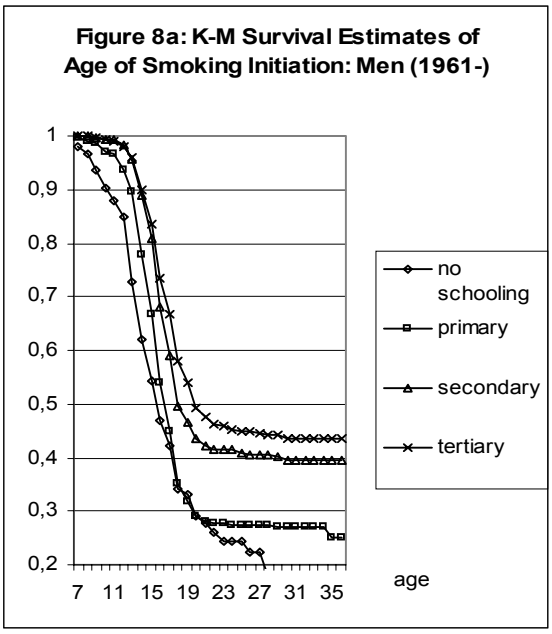


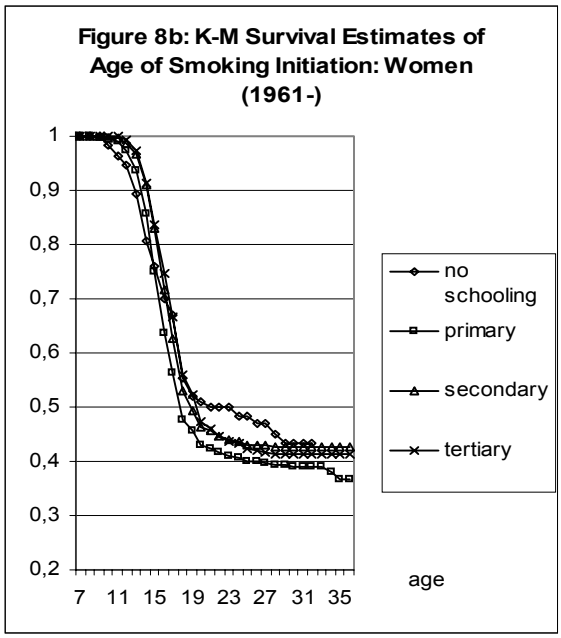


For the birth cohorts up to 1960 education level is a decisive factor for smoking initiation for women while it has no effect for men. The pattern is completely reversed for the cohorts born after 1960. While education decreases substantially the probability of smoking initiation among men, it has no significant effect among women. In fact, among the university educated the probability of smoking initiation at given age is higher for women than men. One thing to keep in mind in interpreting the differentials by education is the endogeneity of education in smoking initiation. Given that smoking initiation is concentrated in rather early ages, the differences by educational attainment can be due to either other characteristics correlated with education or a reverse causation; that is, smoking affects negatively on educational attainment. The results suggest that this might be the case for men.





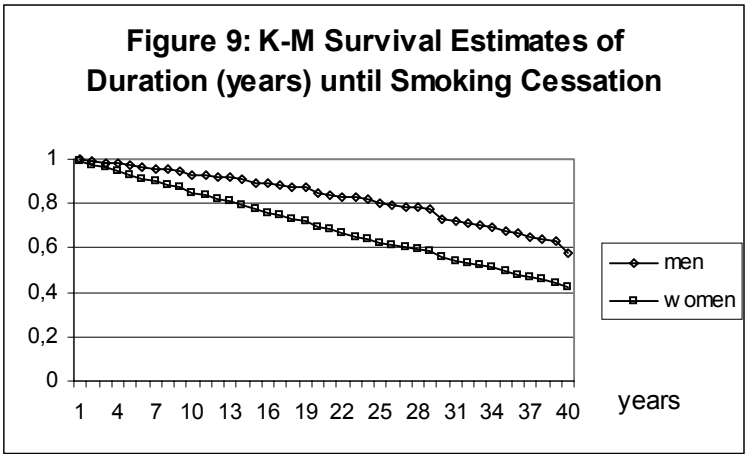


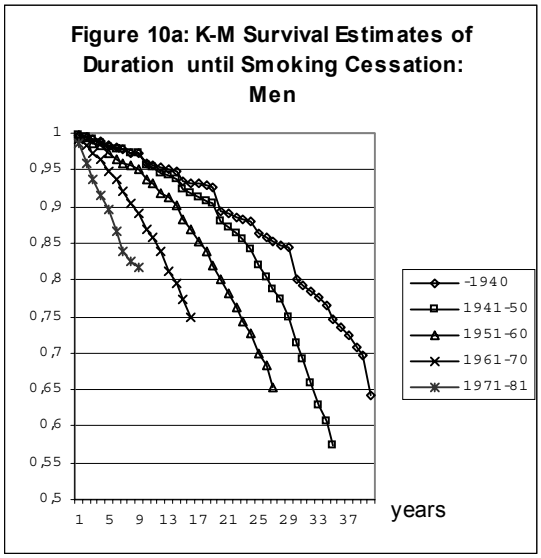


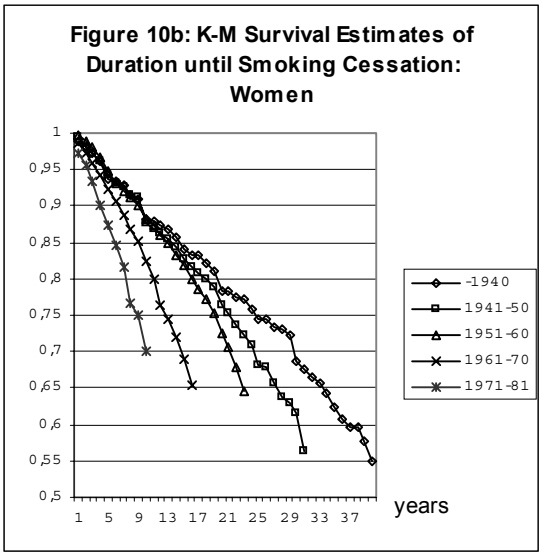
Smoking Cessation

We estimate the smoking duration (or the duration until a smoker quits smoking) by gender, cohort, education, and by age at smoking initiation using Kaplan-Meier survival rates. The sample here consists of ever-smokers and one minus the estimated survival rate at duration t (in years) is the probability of smoking cessation after having smoked at most t years.

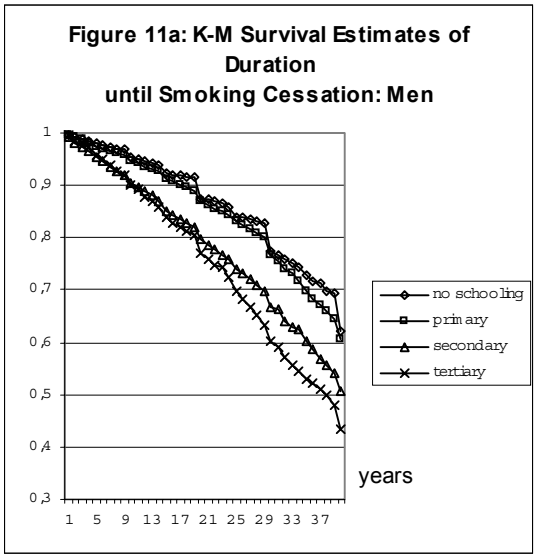
About 15% male smokers and 30% of female smokers abandon their smoking habit by 20 years since the initiation of the habit, and by 40 years about 40% of male smokers and 60% of female smokers do so. A similar pattern of increasing quit rates (steeper sloped survival rates) for more recent cohorts is shown for both men and women. For example, the probability of abandoning smoking within 15 years of duration is higher by almost 20 percentage points among those born in the 1960s than those born in the 40s.

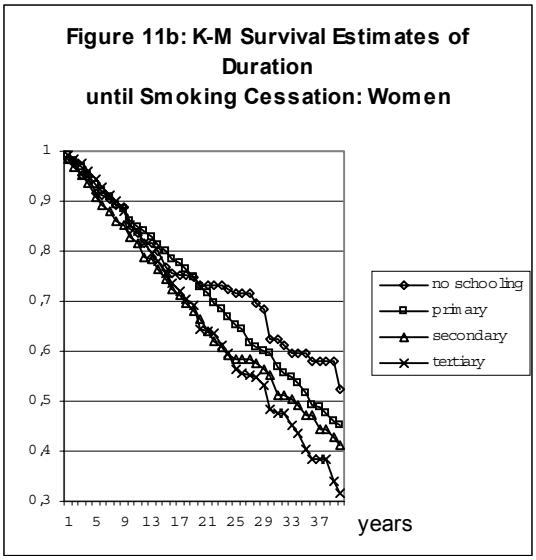


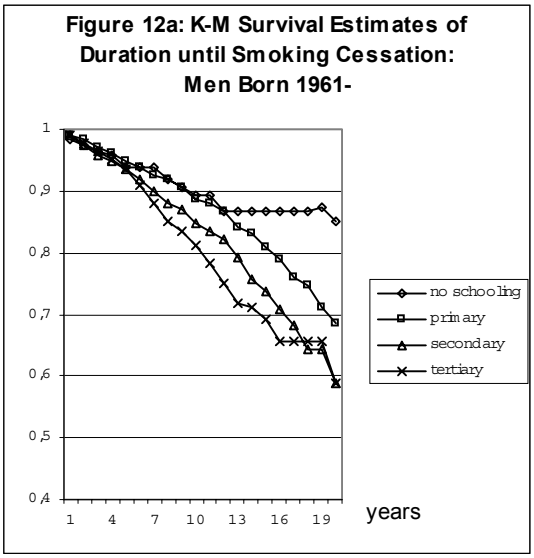


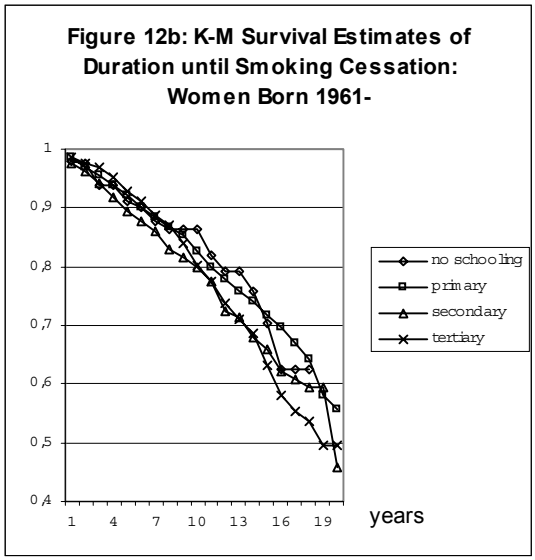


By education, quit rates are higher the higher the education level for both genders. Among the younger cohorts (born after 1960) the difference by education is larger for men than for women.

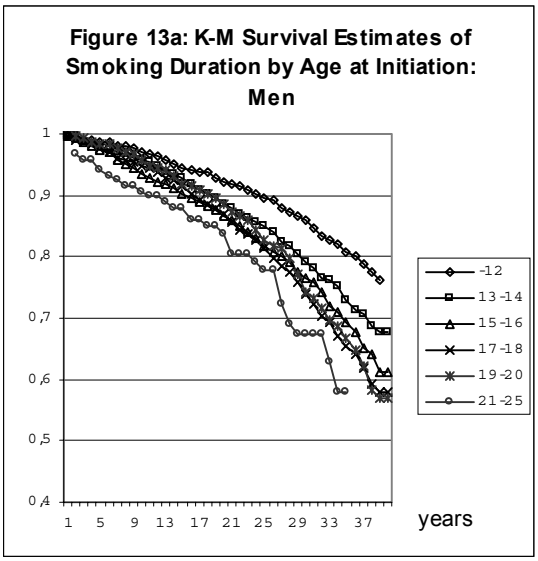


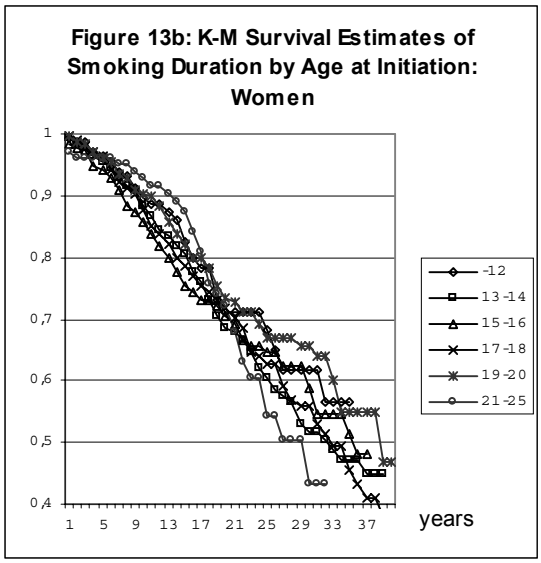






Another variable, which affect the quit rate from smoking, is the age of the initiation of the habit. For men the quit rates increase monotonically with the age of smoking initiation; the later the initiation the higher the quit rates. For example, those who started smoking at ages 21-25 have more than 10 percentage points higher probability of abandoning smoking within 20 years of smoking duration. Therefore, the lifetime duration of smoking is likely to be much shorter among those who start smoking later. For women, there is no clear pattern in quit rates by the age of smoking initiation.





The amount of tobacco use, both in terms of per-day consumption and the years of smoking, represents the degree of addiction, which in theory is supposed to affect the probability of abandoning smoking habit successfully. In our regression analysis we find that per-day consumption amount has a positive effect on quitting probability for men but a negative effect for women. This contradictory result by sex cannot be explored further in this paper due to a lack of data and remains as a future research agenda.

4. Final Remarks

Our main results are: (1) Age at smoking initiation is highly concentrated between 14 and 20: once people reach their early 20s without having smoked, the probability of ever smoking is extremely low. This suggests, in terms of anti-smoking policy, "prevention is best cure". (2) In the probability of entry (or age at smoking initiation), education is not a significant factor for men but it is a dominant factor for women, higher

education higher probability of initiation of smoking habit. Over time, there is a slightly decreasing tendency of entry rate for men, but a substantially increasing tendency for women. (3) Age at entry is very concentrated between 14 and 20. Education delays entry age for men but shortens substantially entry age for women. (4) Among those who have ever smoked smoking duration decreases (or quit rate increases) substantially with education level for men but does not so for women. Two other gender differences are noteworthy. One is that age at initiation increases the quit rate for men while it has no significant effect for women, and the other is that the addiction (quantity of daily consumption) reduces the quit rate substantially for women but not so for men.

The higher participation rates among high educated women are due to higher entry rates, while the lower participation rates among high educated men is due to higher exit rates.

Education level of the Spanish adult population (more so for female population) has increased and will increase for many more decades. This, along with our results, implies that the future smoker population will be more and more female dominant.

References

Allison, P.D. (1982) "Discrete-time methods for the analysis of events histories", *Sociological Methodology* 12: 61-98.

Douglas, S. (1998) "The duration of smoking habit", *Economic Inquiry* 36: 49-64.

Douglas S., and G. Harihanan (1994) "The hazard of starting smoking: estimates from split population duration model", *Journal of Health Economics* 13: 213-230.

Escario, J.J. and J.A. Molina (2000) "Do tobacco taxes reduce lung cancer mortality?" FEDEA Documento de Trabajo 2000-17.

García, J. And J.M. Labeaga (1996) "Alternative approaches to modeling zero expenditure: An application to Spanish demand for tobacco", *Oxford Bulletin of Economics and Statistics* 58: 489-506.

Jiménez, S., Labeaga, J.M. and A. López (1998) "Participation, heterogeneity and dynamics in tobacco consumption: evidence from cohort data", *Health Economics* 7: 401-414.

Jones, A. (1994) "Health, addiction, social interaction and the decisión to quit smoking", *Journal of Health Economics* 13: 93-110.

Labeaga, J.M. (1993) "Individual behaviour and tobacco consumption: a panel data approach", *Health Economics* 2:103-112.

Labeaga, J.M. (1999) "A dynamic panel data model with limited dependent variables: an application to demand for tobacco", *Journal of Econometrics* 93: 49-72.

Valdés (1993) "Cigarette consumption in Spain: empirical evidence and implications for public health policy", *Applied Economics* 25:149-156.

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