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ECONOMIC DETERMINANTS OF SMOKING INITIATION AND CESSATION

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1. Introduction - Theoretical Background

The empirical models of smoking initiation and cessation are based on the economic theory of demand assuming existence of an individual's utility function. An individual utility from consuming cigarettes depends on the number of cigarettes, utility derived from other goods, and individual tastes. An individual maximizes his or her utility subject to a budget constraint, which is comprised of the price of cigarettes, income, and the prices of all other goods. This constrained maximization determines the demand function for cigarettes where cigarette consumption is related to the price of cigarettes, prices of related goods (including NTR products), income, and individual's tastes.

Economists use a broad definition of price that includes not only monetary value of a product, but also the time and other costs associated with the purchase and the use of a product. For example, restrictions on smoking impose additional costs on smokers in the form of discomfort, limitations, and a possibility of fines for smoking in restricted areas. Similarly, limits on youth access to tobacco may raise the time and potential legal costs associated with smoking by minors, and new information on the health consequences of tobacco consumption can raise the perceived long-term costs of smoking.

2. Research Based Evidence

2.1. Smoking Behavior and Economic Incentives

It was previously believed that cigarette smoking was addictive, irrational behavior and therefore not suitable for conventional economic analysis (Elster, 1979; Schelling, 1984). However, the following economic research demonstrates that the demand for cigarettes responds to changes in prices and other factors, as confirmed by both traditional models of cigarette demand and models explicitly accounting for the

addictive nature of smoking¹. Even though there are differences in the magnitude of the response to price (measured by the price elasticity estimates, which range from -0.20 to -0.50 for adults), this variation can be attributed to differences in data, theoretical modeling, estimation techniques, and possibly to the price level and magnitude of the price shock a consumer is exposed to.

2.2. Economic Determinants of Smoking Trajectories

The economic studies of smoking trajectories drew upon health psychology research, which has substantially advanced understanding of smoking escalation and regression. For example, Pierce and colleagues (Pierce, 1995; Choi, 2001) developed and validated a smoking uptake continuum with five categories of progression towards smoking addiction. Prochaska and DiClemente (1983 and 1991) examined smoking regression as a process of moving between five different stages of motivational readiness to quit smoking over time. Results of health psychology research helped to improve the design of intervention strategies making them specific for different stages of smoking initiation or cessation.

Economists focus on economic determinants of smoking trajectories and model two specific smoking pathways: smoking initiation and smoking cessation.

2.2.1. The effect of cigarette prices and taxes

Numerous studies used cross-sectional data to evaluate the effect of price and taxes on smoking behavior.

Douglas and Hariharan (1994) were the first to model smoking initiation using advanced econometric techniques (a split population duration model). They concluded that increases in cigarette excise taxes (which increase the price of cigarettes) had no influence on individuals' decisions to start smoking.

Expanding on the original study, Douglas (1998) investigated the determinants of the decisions to start and quit smoking in the context of an economic model of addiction. He concluded that current, future, and past prices of cigarettes had an insignificant effect on the probability of initiation. Likewise, current and past prices were found to be statistically insignificant in the probability of quitting. However, he found higher future cigarette prices to significantly increase quitting rates. Douglas estimated that a 10% permanent increase in the future price of cigarettes would reduce the average duration of smoking by 11%-13%. In addition, the spread of health information on the adverse consequences of smoking, bans on cigarette advertising, and state level regulations significantly increased the probability of quitting.

Forster and Jones (1999) tested the theory of economic determinants of smoking initiation and cessation on British data. They found that cigarette taxes do not affect smoking initiation, but can improve the probability of quitting - a 5% increase in tax would lead to a reduction in smoking of approximately 6 to 9.5 months. However, recall bias on the part of survey participants had limited impact on the parameter estimates.

¹ For a comprehensive review of these studies see "The Economics of Smoking" in [The Handbook of Health Economics](#) (North-Holland, Elsevier Science, 2000) and the Surgeon General's reports (USDHHS, 1989, 1994, and 2000).

Liang et al. (2001) studied differential effects of cigarette price on stages of smoking uptake using a threshold of change model. They found that higher prices can discourage youth from reaching a higher stage of cigarette smoking uptake and that price is more important determinant of smoking behavior in later stages of smoking trajectory. The authors also suggested that initiation and experimentation might not respond to the price incentives because these smokers often get cigarettes from different sources.

Ross et al. (2001) examined how cigarette prices, smoking restrictions, and limits on youth access to tobacco can affect smoking uptake among adolescents. They applied a generalized ordered logit model and concluded that higher cigarette prices are related to lower smoking uptake stages and that higher prices have an increasing impact as an individual faces larger risk of becoming an established smoker. The study provided the first evidence that compliance with youth access laws can slow down smoking uptake progress among youth, particularly among those who are approaching addiction stage of their smoking habit.

Levy and Romano (2002) applied chi-square analyses to distinguish within-group differences in quitting behavior followed by multivariate logistic equations that isolated the contribution of socio-demographic factors, smoking intensity and selected tobacco control policies on smoking cessation. Data from the 1998/9 Current Population Survey data revealed that higher cigarette prices are related to more quit attempts and quit success (a 10% increase in cigarette prices increases the percentage of successful cessation by 8.5% and quit attempts by 2.8% in one year).

While the above mentioned studies made a significant contribution to the existing literature by modeling the decision to start and quit smoking, several of their findings, particularly insignificant price/tax effects on smoking initiation, are at odds with the majority of economic research on determinants of smoking behavior conducted over the past several decades. One possible explanation is their use of cross-sectional data with retrospective information on smoking initiation, which can suffer of imperfect recall by respondents. A second reason is a difficulty to match cigarette price at certain point in time with a respondent facing that price, because s/he is assumed to live in his/her current location during entire lifetime. If he/she moved, he/she would have been matched with an incorrect cigarette price/tax. In addition, if the timing of initiation and cessation is incorrect due to imperfect recall, then the prices at the time of initiation and cessation will be incorrect as well. These measurement errors in both the dependent and independent variables will lead to bias estimates of the effect of economic determinants of smoking initiation and cessation.

Only few economic studies have employed longitudinal data to examine the impact economic factors such as prices and taxes have on either smoking initiation or cessation.

DeCicca, Kenkel, and Mathios (2001) used US panel data and concluded that both cigarette prices and excise taxes are insignificant determinants of smoking onset between 8th and 12th grade. Their results also suggested that both cigarette prices and excise taxes had no influence on adolescent smoking initiation. However, the limitation of this study is that it uses only three observations on an individual. If this constraint was taken into account (by excluding state fixed effects from the model), both prices and taxes had significant and negative impacts on smoking initiation.

Tauras and Chaloupka (1999) employed data from the Monitoring the Future Surveys (MTFS) to study economic factors of smoking cessation separately among young adult men and women. The authors found that price has a positive and significant impact on the probability of first-time cessation among both young adult males and females.

Tauras (1999) continued to evaluate multiple smoking cessation attempts among young adults using again the MTFS data. His estimates indicated that higher cigarette prices would increase the probability of initial smoking cessation as well as subsequent cessation for those individuals who were unable to remain smoke-free after at least one prior cessation attempt. According to this study, a 10% increase in cigarette price will increase the probability of smoking cessation by 3.4%. In addition, stronger restrictions on smoking in private worksites and public places other than restaurants also increased the probability of young adult smoking cessation.

Tauras, Johnston, and O'Malley (2000) applied the same methodology as DeCicca et al. (2001) using much stronger MTFS data, which covered cohorts over a longer period and during time when prices in the US were rapidly changing in both directions (as opposed to the DeCicca et al.'s single cohort over 4 years period when prices were relatively stable). This data revealed that cigarette prices were very important determinant of youth and young adult smoking initiation. Individuals who have initiated smoking with more cigarettes consumed per day were more price responsive (price elasticities of initiation -0.95) than individuals who have initiated smoking with fewer cigarettes (price elasticities of initiation -0.3). This finding suggests that prices have an effect particularly on initiation of daily and heavy daily smoking. The study further proposed that minimum purchase age laws, restrictions on smoking in public schools and restrictions on distribution of free tobacco samples could be effective tools in preventing youth from smoking initiation. The overall measure of limits on youth access to tobacco had an insignificant impact on smoking initiation, but some individual policies (e.g. minimum purchasing age, restrictions on smoking in public schools, free cigarette samples) showed negative and significant impact on the decision to start smoking.

To summarize, studies using cross-sectional data provide conflicting results on the effect of price and/or cigarette tax on smoking initiation. Some findings suggest that higher cigarette prices and excise taxes do not affect smoking initiation, some offer evidence to the contrary. The studies usually agree on positive price/tax effect on smoking cessation. However, cross-sectional data suffer from the following limitations:

- a. Under reporting and recall bias among survey participants.
- b. Possible incorrect match between cigarette prices in the time of smoking initiation or cessation.
- c. Attempt to measure a dynamic process with information from one point in time.
- d. Social sources of cigarettes may disguise the effect of price on smoking initiation and experimentation.

Most studies using longitudinal data concluded that higher cigarette prices/taxes decrease the probability of smoking initiation and increase the probability of smoking cessation.

2.2.2. The effect of anti-smoking media campaigns

Anti-tobacco media campaigns target primary adolescent and young adults. The existing studies evaluating these interventions have shown varying results.

Hu et al. (1995) reported that both higher taxes and an anti-smoking media campaign had an independent and significant impact on overall cigarette consumption in California from 1990 to 1992. However, this study could not distinguish between the effects of the anti-smoking media campaign and the effects of other tobacco control measures.

Korhonen et al. (1999) evaluated Quit and Win campaigns repeated in North Karelia and rest of Finland based on repeated comparisons of participation rates, abstinence rates and other measures. North Karelia with more intensive campaign activities recorded higher participation rates, more quitting attempts and higher abstinence rates. The authors concluded that long-term community-wide programs were a feasible cessation method.

Pierce and Gilpin (2001) studied whether changes in news media coverage of smoking and health issues were associated with changes in smoking behavior in the USA. They found that cessation among both middle aged smokers and younger adults is sensitive to news media coverage of smoking and health. Declining rates of smoking initiation among young adults were associated with the beginning of the public health campaign against smoking in the 1960s; adolescents' decline in smoking initiation began in the 1970s after the broadcast ban on cigarette advertising. The authors concluded that level of coverage of smoking and health in the news media might play an important role for smoking cessation, but not for initiation.

Douglas (1998) also suggested that the spread of health information on the adverse consequences of smoking significantly increased the probability of quitting.

Sly et al. (2001) evaluated the Florida “truth” campaign prior the launch of a complementary community wide program and found that an aggressive and/or well funded media campaign alone may be sufficient to affect youth smoking including smoking initiation.

Levy and Romano (2002) concluded that media/comprehensive campaigns are related to more quit attempts and quit success. Further, the existence of cessation program was related to higher percentage of ex-smokers in their sample and to successful cessation.

The literature suggests that mass media interventions increase their chance of having an impact if the following conditions are met: (1) the campaign strategies are based on sound social marketing principles; (2) the effort is large and intense enough; (3) target groups are carefully differentiated; (4) messages for specific target groups are based on empirical findings regarding the needs and interests of the group; (5) the campaign is of sufficient duration (USDHHS, 1994; Aguirre-Molina, 1996); and (6) it is complemented by other tobacco control measures and/or school- or community-based programs (Farrelly, Niederdeppe and Yarsevich, 2002).

2.2.3. The effect of tobacco advertising and marketing practices

Empirical studies of the effect of tobacco advertising showed that smoking initiation among females (but not males) could be encouraged by large-scale marketing campaigns aimed at women (Pierce and Gilpin, 1995). This implies that marketing effort of tobacco companies is successful if it is targeted on particular sex group. Thus, there is indirect evidence that youth smoking initiation is linked to industry advertising and marketing. Altman et al. (1996) suggested that youth awareness of tobacco marketing campaigns, receipt of free tobacco samples, and receipt of direct mail promotional items were associated with susceptibility to tobacco use. Pierce et al. (1998) supported Altman's findings when they found that adolescents who had a tobacco promotional item and/or had an interest in tobacco advertising (that is, had a favorite advertisement) were significantly more likely to initiate smoking in the following three years. The study further concluded that a significant portion of youth experimentation with smoking could be attributed to tobacco promotional activities. However, because these promotional items are not randomly distributed, selection bias could also explain this finding.

Holman et al. (1997) evaluated the replacement of Western Australian tobacco sponsorship with health promotion sponsorship (known as "Healthway") during sport events, racing, and arts venues, which occurred after Australia adopted the Tobacco Control Act in 1990. Their results showed that a comprehensive ban on tobacco sponsorship linked to health promotion activities may be more effective than just prohibition of tobacco sponsorship alone. Venues where former tobacco promotion was present offer opportunities for environmental modification, promotion of anti-smoking messages, and targeting groups that are hard to reach.

The evidence with respect to the effects of cigarette advertising bans is mixed, as different statistical analyses have come to opposite conclusions about whether bans reduce cigarette consumption. Saffer and Chaloupka (2000) suggested that a partial ban had little effect because it allows the tobacco manufacturers to use more intensively other media and promotional methods. The authors concluded that complete bans could reduce tobacco consumption by approximately 6%. Douglas (1998) also suggested that bans on cigarette advertising significantly increased the probability of quitting.

The findings with respect to tobacco advertising and promotion contradict the claim of tobacco industry that advertising does not impact overall cigarette consumption and that its only role is to improve advertiser's market share.

2.2.4. The effect of youth access restrictions

The issue of youth access to tobacco products has received a lot of attention in the US since the mid-1990's. Numerous public policies focusing on the distribution and sale of tobacco products to young people has been adopted including regulation of sellers and buyers (e.g. by licensing permits), restrictions on the distribution of free products or samples, and regulation or ban of vending machines. Forster and Wolfson (1998) argued that laws banning adolescent purchase or possession of cigarettes are more difficult to enforce than restrictions on sellers, and are part of an effort to shift responsibility for tobacco sales from retailers to minors. Jacobson and Wasserman (1997) concluded that ongoing enforcement is the key to reducing illegal sales to minors. However, there is



limited evidence that youth access restrictions affect tobacco consumption among the target population. The reason may be the failure of many studies to take into account the actual enforcement of youth access laws. Chaloupka and Grossman (1996) found that limits on youth access to tobacco had very little effect, but the authors hypothesized that weak enforcement might be to blame. Jason et al. (1991) found that active enforcement of the law by regular compliance checking led to substantial reduction in cigarette sales to youth (sales rate dropped from 70 to 5 percent), to reduction of experimentation and regular smoking among junior high school students (by over 50 percent), and to increased community awareness of the problem of adolescent smoking.

Tauras, Johnston, and O'Malley (2000) showed that minimum purchase age laws, restrictions on smoking in public schools and restrictions on distribution of free tobacco samples could possibly be effective tools in decreasing smoking initiation. However, the overall measure of limits on youth access to tobacco had an insignificant impact on the decision to start smoking.

Ross et al. (2001) suggested that compliance with youth access laws can slow down smoking uptake progress among youth, particularly among those who are approaching addiction stage of their smoking habit.

2.2.5. The effect of smoking restrictions

There is some evidence that clean indoor air laws can reduce cigarette consumption.

Chaloupka and Grossman (1996) found that restricting smoking in public places significantly reduced the prevalence of youth smoking, and that restricting smoking in schools, in particular, reduced the average number of cigarettes smoked by young smokers. Similarly, Chaloupka and Wechsler (1997) found that laws restricting smoking in restaurants and schools significantly lowered college students' smoking rates.

Farkas et al. (1999) assessed whether household and workplace smoking restrictions were associated with quit attempts, six-month cessation, and light smoking. They applied logistic regression on a large sample of US population and concluded that both workplace and household smoking restrictions were associated with higher rates of cessation attempts, lower rates of relapse in smokers who attempt to quit, and higher rates of light smoking among current daily smokers.

Wakefield et al. (2000) studied the relation between extent of restrictions on smoking at home, at school, and in public places and smoking uptake and smoking prevalence among US high school students. They found that more restrictive arrangements on smoking at home were associated with a greater likelihood of being in an earlier stage of smoking uptake and a lower 30-day prevalence. The same was true for more pervasive restrictions on smoking in public places. School smoking bans has the similar effect on smoking uptake and smoking prevalence only when the ban was strongly enforced.

However, Ross et al. (2001) found insignificant effect of smoking restrictions in public places (represented by an index) on youth smoking uptake progress using the same data as Wakefield et al. (2000), but applying a different model of smoking uptake.

Longoa et al. (2001) examined the long-term impact of workplace smoking bans on employee smoking cessation and relapse. They compared employees in smoke-free hospitals with those working in non-smoke-free workplaces in a natural experiment designed as a prospective cohort study. They found that employees in workplaces with smoking bans had higher rates of smoking cessation than employees where smoking was permitted, but relapse was similar between the two employees' groups.

Tauras (1999) showed that stronger restrictions on smoking in private worksites and public places other than restaurants could increase the probability of young adult smoking cessation.

Levy and Romano (2002) found work site bans to be associated with being an ex-smoker, but their effect on quit attempts were not statistically significant. The existence of the clean indoor air law increased the probability of successful quitting in the last year.

Laws restricting smoking affect smoking initiation and cessation because they reduce the opportunities to consume tobacco. Alternatively, these laws may also affect cultural norms turning smoking into socially unacceptable behavior.

2.2.6. The effect of nicotine replacement therapy (NRT)

Hu et al. (2000) studied the effect of nicotine replacement therapy (NRT) sales on cigarette consumption. They found that NRT products play a significant role in decreasing per capita cigarette sales and concluded that the promotion of NRT products could be used to discourage cigarette sales.

Tauras and Chaloupka (2001) studied the determinants of the NRT demand using high quality scanner data from the US. They showed that higher cigarette prices and lower NRT prices increased the sale of NRT products (own price elasticity for NRT product was between -1.1 and -1.5; cross price elasticity for cigarette prices was between 0.81 and 0.68). The authors suggested that lower cost of obtaining NRT would increase the use of NRT, likely leading to decreased cigarette smoking and to reduction in the future public health burden caused by tobacco use.

Schaufflera et al. (2001) assessed the impact and costs of coverage for NRT with no patient cost sharing for smokers. They found that full coverage of a tobacco dependence treatment benefit was an effective and relatively low cost strategy for significantly increasing quit rates and quit attempts among adult smokers.

There is only limited economic evidence on the effect of NRT on smoking cessation. However, the existing studies suggest that the availability of NRT can reduce per capita cigarette sales, that the sale of NRT products increases with higher cigarette prices and declines with an increase in its own price, and that lower cost of obtaining NRT will likely lead to more quitting attempts.

3. Summary



| Intervention | Initiation | Cessation |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Price/tax increases | <ul style="list-style-type: none"> • Evidence of both negative and zero effects • Higher effect on initiation of regular smoking then on experimentation (social sources) • 10% increase in price: 3% - 9.5% lower probability of smoking initiation | <ul style="list-style-type: none"> • Evidence supports positive effect on # attempts and on the success • 10% increase in price: 11% - 13% shorter smoking duration; or 3.4% higher probability of cessation • 5% increase in tax: 6-9.5 months shorter smoking duration |
| Anti-smoking media campaigns | <ul style="list-style-type: none"> • Some evidence of negative effects of aggressive and well funded campaigns; more effective in complemented with school- or community based programs | <ul style="list-style-type: none"> • Positive effect of health information on # attempts and on the success • Positive effect of comprehensive campaigns on # attempts and on the success • Existence of cessation program improves success • Positive effect of community level interventions |
| Tobacco advertising & marketing | <ul style="list-style-type: none"> • Positive effect on female initiation • Positive effect on susceptibility to smoking and experimentation • Total ban reduces initiation | <ul style="list-style-type: none"> • Total ban has positive effect (6% reduced consumption) • Partial ban not effective |
| Youth access restrictions | <ul style="list-style-type: none"> • Weak evidence of negative effect on uptake progress, initiation and experimentation | <ul style="list-style-type: none"> • No evidence of an effect, perhaps due to weak enforcement |
| Smoking restrictions | <ul style="list-style-type: none"> • Negative effect of school and household restrictions if enforced and relatively strong • Mixed results for public places restrictions | <ul style="list-style-type: none"> • Positive effect (particularly work and household restrictions) • Clean indoor air laws improve probability of successful quitting |
| NRT | <ul style="list-style-type: none"> • No evidence | <ul style="list-style-type: none"> • Positive effect on the efficacy of quit attempts • Positive effect on # of attempts |



It is of eminent importance that the public health community focuses on both ends of the smoking trajectory - smoking initiation and smoking cessation. Preventing young people from experimentation, or from progressing from experimentation to higher stages of smoking uptake, can be crucial in curbing smoking prevalence among the next generation. On the other hand, given the projected aging of the population, the medical and economic consequences of smoking will become a greater burden in the next decades. Therefore, focusing attention on cessation among current smokers is also immediate and urgent priority for public health professionals and clinicians.



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