Limiting Youth Access to Tobacco:

The Early Impact of the Synar Amendment on Youth Smoking

Frank J. Chaloupka[a]

Rosalie Liccardo Pacula[b]

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[a] Department of Economics, University of Illinois at Chicago, 601 South Morgan St., Chicago, IL 60607-7121, and Health Economics Program, National Bureau of Economic Research; phone: (312) 413-2367; fax: (312) 996-3344; e-mail: fjc@uic.edu

[b] School of Business Administration, University of San Diego and Health Economics Program, National Bureau of Economic Research; e-mail: rpacula@uic.edu

ABSTRACT

Background: Cigarette smoking among youth has risen sharply during the 1990s. About 3,000 youths begin smoking each day and are becoming regular smokers earlier in adolescence. To counter this trend, policymakers have sought limits on youth access to tobacco through policies such as the Synar Amendment and FDA regulation. The purpose of this study is to evaluate the effectiveness of these limits in reducing youth cigarette smoking.

Methods: Previous studies employed small community data sets that ignore issues such as nonrandom sample design, the potential for border-crossing, and statewide initiatives that can reinforce or counter local initiatives. This study examines the effects of limits on youth access on smoking behavior among a nationally representative sample of youths from the 1994 Monitoring the Future Project. Measures of cigarette prices, state and local tobacco control policies, retailer compliance, and the relative aggressiveness of state monitoring activities are added to the data to measure the availability of tobacco to youth. A two-part model of youth cigarette demand is estimated.

Results: This study finds that teens are less likely to smoke and smoke fewer cigarettes where: prices are higher; states earmark cigarette excise tax revenues for tobacco control activities; there are stronger restrictions on smoking in public places; and states adopt comprehensive and aggressive approaches to measuring retailer compliance with youth access laws.

Conclusions: The study suggests that aggressive and comprehensive approaches to limiting youth access will lead to significant reductions in youth smoking.

I.   Introduction

Cigarette smoking among youth rose sharply throughout the 1990s. Data from the Monitoring the Future surveys show increases in daily smoking prevalence between 1992 and 1996 of 48.6 percent, 48.8 percent and 23.3 percent among eighth graders, tenth graders and high school seniors, respectively [1]. Approximately 3,000 youth begin smoking each day, while the average age at which smokers begin smoking regularly has been falling [2]. Consequently, much of the recent emphasis of tobacco control activities has focused on reducing youth smoking [2] [3] [4]. Given that cigarette smoking is addictive, that nearly all smokers begin as teens, and that the health risks are higher the earlier one begins [2], reducing initiation among youth may be the most effective way to achieve long run reductions in the health costs and other negative consequences associated with smoking.

Much of the recent Federal, state, and local policy targeting youth smoking emphasizes reducing youth access to tobacco through minimum legal purchasing ages, restricting sales through vending machines, bans on self-service cigarette displays, and more.[1] Examples of recent and proposed policies include the Synar Amendment to the 1992 Federal Alcohol, Drug Abuse, and Mental Health Administration Reorganization Act, the FDA's 1996 final rule on "Regulations Restricting the Sale and Distribution of Cigarettes and Smokeless Tobacco to Protect Children and Adolescents," and the 1997 state Attorneys General proposed settlement with the tobacco industry.

Despite the increased emphasis of policymakers on limiting youth access, there has been little research evaluating the effectiveness of these limits in reducing youth cigarette smoking and other tobacco use. Most of the research has remained focused on whether or not the laws actually decrease youth access. For example, the 1994 Surgeon General's Report [2] reviewed a

number of studies conducted since 1987 that examine youth access to tobacco. The weighted average illegal sales rate from 13 studies of over-the-counter sales to minors was approximately 67 percent, while the comparable rate from nine studies that looked at vending machine sales was about 88 percent. The high availability of tobacco products to youth is found despite the fact that nearly all the states had laws banning the sale of tobacco to minors during the time periods studied. Much of this can be attributed to the poor enforcement of these laws [6]. The Inspector General, for example, reported that although 47 states officially banned the sale of tobacco products to youth under the age of 18 in 1990, only two states were actively enforcing these laws [7].

The importance of active enforcement in deterring youth smoking is highlighted by two recent studies. Wasserman, et al.[11] found that state minimum purchase age laws for tobacco products by themselves did not have a significant impact on youth cigarette smoking. Chaloupka and Grossman [12] came to a similar conclusion. They examined the impact of minimum legal purchase ages, signage requirements, limits on the distribution of free samples to youth, restrictions on vending machine sales, and retailer licensing provisions on youth smoking and found little impact of these laws on cigarette smoking.

Those studies that have examined the impact of enforcement of youth access laws on youth smoking have mixed findings. Jason, et al. [8] provided some evidence that increased compliance with the limits on youth access does lead to significant reductions in youth smoking. After their education and enforcement intervention in Woodridge, IL, they estimated a 69 percent decline in regular smoking among adolescents. Similarly, DiFranza, Carlson and Caisse [13] found sharp reductions in youth smoking, albeit not always statistically significant, after

implementing a somewhat less aggressively enforced program in Leominster, Massachusetts. Neither study, however, includes a comparison community.

Rigotti et al [10] have conducted the most scientifically rigorous study of youth access laws on youth smoking to date. In their two year study, they found that regular compliance checks accompanied by escalating warnings and penalties raised compliance significantly faster in three experimental communities than it rose in three control communities. Despite achieving 82 percent compliance in the intervention communities, however, they found no significant impact of their enforcement program on youth smoking.

A major shortcoming of the studies examining the effects of compliance on youth smoking done this far is that they limit their analysis to one or just a few communities. They, therefore, suffer from shortcomings associated with nonrandom sample design, purchase attempts in bordering communities not represented in the experiment, and concurrent statewide initiatives that reinforce or counter local initiatives. This paper improves upon previous research by examining the impact of retailer compliance on youth smoking using a large nationally representative sample of youths. Measures of both local and state initiatives are included. Further, measures of the relative aggressiveness of state monitoring activities are included. Previous research suggests that failing to control for state approaches to monitoring compliance can lead to misleading estimates of the effects of actual compliance on youth smoking since states using passive monitoring techniques report significantly higher compliance rates than states that monitor compliance more aggressively [14].

II.   Data and Methods

Data on youth smoking come from the 1994 Monitoring the Future surveys of eighth, tenth, and twelfth grade students conducted by the Institute for Social Research (ISR) at the University of Michigan. Every year since 1975, ISR has collected data on tobacco, alcohol, and other drug use from a nationally representative sample of 15,000 to 19,000 high school seniors. In 1991, comparable surveys of eighth and tenth grade students were added. Given the sensitive nature of the information collected, great care is taken to ensure that the data collected are informative [15]. For example, parents are not present during the completion of the surveys and are not informed of their child's responses.

Two measures of youth cigarette smoking are constructed from the survey data. The first is a dichotomous indicator of smoking participation that is equal to one for youth reporting any cigarette consumption in the 30 days prior to the survey and zero otherwise. The second is a "continuous" measure of average daily cigarette consumption, constructed from categorical data by assigning the midpoint of the categorical responses to each youth.[2] While not ideal, this measure is useful in gauging the impact of retailer compliance on average cigarette consumption by young smokers.

Several other variables reflecting socioeconomic and demographic determinants of smoking are constructed from the survey data and included in this analysis. These include: gender (male or female), race (white, African-American, and other), age, average weekly income from all sources (employment, allowances and other), current grade (eighth, tenth or twelfth), marital status (married/engaged or single), parental education (less than high school graduate, high school graduate, more than high school graduate), family structure (live alone, only mother present, only father present, both parents present, live with other(s)), mother's work status while

the youth was growing up (not employed, employed part-time, employed full-time), existence of siblings, average number of hours worked weekly, living in rural/urban area, and frequency of participation in religious services (no participation, infrequent participation and frequent participation).

Based on each youth's county of residence, measures of cigarette price, state and local tobacco control policies, and state monitoring activities with respect to the limits on youth access are added to the survey data. The cigarette price measure reflects the average state level price for a pack of 20 cigarettes and is taken from the Tobacco Institute's annual Tax Burden on Tobacco [16]. It is a weighted average of the prices of single packs, cartons, and vending machine sales and includes state level excise taxes and the price of generics. [3] To capture potential cross-border shopping for cigarettes that, if excluded, may bias estimates of price towards zero, three additional variables are included. The first is the largest price difference between the youth's state of residence and states within 25 miles of the youth's county of residence. This is defined as zero for youth living in states with lower prices than nearby states and for youth living in counties more than 25 miles from another state. The final two measures are dichotomous indicators defined as one for youth living in counties within 25 miles of Mexico and Canada and zero otherwise.

To capture the general state and local environment toward tobacco and youth access, six additional variables capturing state and local tobacco-related policies are included. These include an index of state and local restrictions on smoking in public places and private work sites, state preemption of stricter local ordinances pertaining to youth access, state and local bans on the distribution of free samples of tobacco products to youths, state and local licensing requirements for tobacco products, earmarking of cigarette tax revenues, and the existence of

smoker protection legislation. The data on state level policies were taken from the Coalition on Smoking OR Health's (CSH) annual State Legislated Actions on Tobacco Issues [17]. Similar information on county and city level restrictions was obtained from the National Cancer Institute's [18] monograph summarizing major local control policies, updated with information from CSH.

The data on state monitoring activities related to the Synar amendment provisions concerning youth access to tobacco products are taken from Downey and Gardiner's Reducing Youth Access to Tobacco: A Partial Inventory of State Initiatives [14]. This monograph contains detailed information on state-level tobacco control policies, the implementation of these policies, and other related activities. It includes summaries of each state's Attachment 6, which were submitted to the Center for Substance Abuse Prevention (CSAP) in Spring of 1995 by states applying for Substance Abuse Prevention and Treatment block grants as required by the Synar Amendment. These reports contain information on each state's approach to monitoring compliance with limits on youth access as well as the reported compliance rates. A series of variables are constructed from these data. First, a dichotomous indicator is set equal to one for states that conducted mock over-the-counter purchase attempts ("stings") and zero for states that only observe retailers.[4] A second dichotomous variable equals one for states that use statewide sampling methods to monitor compliance instead of local convenience samples and zero otherwise. Three additional dichotomous indicators are constructed to reflect states with active enforcement of restrictions on vending machines, states with vending machine restrictions that are not actively enforced, and states with no restrictions on vending machine sales. Finally, continuous measures of state-reported compliance rates for over-the-counter sales and vending machine sales are constructed.

After eliminating respondents with missing or inconsistent data, a sample of 37,217 youths is obtained. Brief definitions and descriptive statistics for all variables employed in the analysis are contained in Table One.

Given the limited nature of the dependent variables, ordinary least squares techniques are inappropriate. Instead, a two-part model is employed to estimate youth cigarette demand, based on the methods developed by Cragg [19]. This involves estimating the smoking participation equation using probit techniques in the first step and then using log-linear least squares methods to estimate the conditional average daily cigarette consumption equation. The same set of independent variables is included in both equations. Standard errors are corrected for clustering due to multiple observations in each state.

III.   Results

Coefficient estimates from the two-part model of youth cigarette demand are contained in Table Two. The first column contains the estimates for the impact of the independent variables on the probability that a youth smokes, while the second column contains the comparable estimates on the average daily cigarette consumption of smokers.

As found in recent studies on youth smoking [12] cigarette prices have a negative and significant impact on both the probability of youth smoking and the average daily cigarette consumption. Based on these estimates, the price elasticity of youth smoking participation is -0.618 and the conditional price elasticity of demand is -0.523, for a total price elasticity of youth cigarette demand of -1.141. This implies that a ten percent increase in cigarette prices would reduce the number of young smokers by approximately 6.2 percent, while lowering overall youth smoking by almost 12 percent. Living near states or countries with lower cigarette prices does

not significantly raise either the probability that a youth will smoke or average daily cigarette consumption.

Other state and local tobacco-related policies are also found to influence youth smoking, although most are not individually significant at conventional levels. Stronger restrictions on smoking in public places and private work sites reduce the probability of youth smoking, but have little impact on cigarette consumption. Similarly, teens are less likely to smoke in states that earmark a portion of their cigarette tax revenues for tobacco control activities. Both the probability of smoking and average cigarette consumption are significantly higher in states that preempt localities from adopting stronger limits on youth access. The other three measures of state and local policies, bans on the distribution of free samples to youth, licensing requirements, and an indicator for state smoker protection laws, however, do not have a significant impact on either measure of youth smoking.

The next seven variables together capture the aggressiveness and comprehensiveness of state monitoring activities of compliance with laws limiting youth access. Since the individual measures of compliance capture only one dimension of a state's overall strategy, it is not surprising that only a couple of these measures significantly influence youth smoking. Adolescents are significantly less likely to smoke in states using stings to measure compliance than in states that simply observe retailers. Similarly, average cigarette consumption is lower in states conducting stings although the difference is not statistically significant. Youth smoking prevalence is also lower in states that use statewide samples for measuring compliance instead of local samples, an indication of a more comprehensive approach to monitoring compliance. With respect to the presence and enforcement of vending machine restrictions, however, there are no statistically significant differences in either measure of youth smoking between states with no

restrictions, states with restrictions that are not actively enforced, and states with actively enforced restrictions. Likewise, actual over-the-counter and vending machine compliance rates have no significant effect on either the probability of smoking or the average daily cigarette consumption. The insignificance of these last two variables is not surprising since it has been shown elsewhere that states that passively monitor compliance report higher compliance rates than states that actively monitor compliance [14]. A likelihood ratio test for the joint significance of all seven measures reveals that aggressive, statewide approaches to measuring compliance coupled with high retailer compliance with the limits on youth access do lead to reductions in the likelihood that youths smoke.[5]

The findings with respect to socioeconomic and demographic variables are generally consistent with those from other recent studies of youth and young adult cigarette demand [12] [20], [21].

IV.   Discussion

These estimates are consistent with recent studies that suggest that a variety of tobacco control policies, including higher cigarette excise taxes and stronger restrictions on smoking, can produce significant reductions in youth smoking. They further suggest that an aggressive stance toward enforcing retailer compliance coupled with increased compliance can also lead to reductions in youth smoking. This contradicts findings from the Rigotti, et al. [10] study. Their study, however, is limited by an inability to randomly select communities and to control for a variety of other state and local tobacco control policies and activities that may also influence the effectiveness of their intervention. This study addresses some of these limitations by using nationally representative data and controlling for a variety of state and local influences on

tobacco use. However, this study also has several limitations, including its reliance on cross-sectional data and the use of state level measures of monitoring and compliance rates that may not accurately reflect what is happening in each youth's community. More evidence is clearly needed before strong conclusions can be drawn concerning the appropriateness of emphasizing limits on youth access as a priority among alternative policies.

Acknowledging these limitations, it is still useful to evaluate the relative effectiveness of alternative policies given the estimates presented in Table Two. We first consider the impact of an "ideal" implementation of the Synar Amendment, which would involve the uniform use of stings in statewide samples, active enforcement of vending machine restrictions, and 80 percent compliance rates for both over-the-counter sales and vending machine sales. Under this scenario, the prevalence of youth smoking falls by nearly 17.7 percent. By comparison, a 28.7 percent price increase would produce approximately the same reduction in youth smoking. Given a current average price of about $2.00 per pack, this could be achieved by a 58-cent price increase.

An alternative policy would be the uniform adoption of strong restrictions on smoking in public places and private work sites. According to our estimates, this type of policy would produce a relatively small reduction of 3.58 percent in youth smoking prevalence. The same reduction could be achieved by an increase in the current price of about 6 cents.

Neither the "ideal" implementation of the Synar Amendment nor the uniform adoption of strong restrictions on smoking produces the minimum 50 percent reduction in youth smoking called for in most proposed national tobacco legislation. A third alternative is a substantial increase in the price of cigarettes, which can be achieved by raising cigarette taxes sharply, assessing a sizable license fee for each package of cigarettes sold, or by requiring cigarette

producers to raise prices. Many of the recent tobacco legislative proposals recommend a sustained real increase in cigarette prices of $1.50 per pack. This 75 percent increase in price, based on an estimated price elasticity of youth smoking participation of -0.618, would reduce youth smoking by 46.4 percent. While this sizable increase in price alone can produce large reductions in youth smoking, a more comprehensive approach that includes other tobacco-control policies is likely to produce the sustained reductions in youth smoking that are currently advocated.

Although these findings suggest that limiting youth access to tobacco products may be an effective approach to reducing youth cigarette smoking, they also imply that reductions in access alone are not sufficient to produce the decline in youth smoking called for in the proposed national tobacco legislation.

Literature Cited

1. University of Michigan News and Information Service, "Cigarette Smoking Rates may have Peaked Among Younger Teens," Press Release, University of Michigan, Ann Arbor, MI, December 18, 1997.

2. U.S. Department of Health and Human Services. Preventing tobacco use among young people: A report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1994.

3. Center for Disease Control. Restricting access and appeal of tobacco products to children and adolescents: Information resource and referral guide. Atlanta: Centers for Disease Control and Prevention, Office on Smoking and Health, 1995.

4. Food and Drug Administration. Regulations Restricting the Sale and Distribution of Cigarettes and Smokeless Tobacco to Protect Children and Adolescents; Final Rule. Federal Register. Washington, D.C.: U.S. Department of Health and Human Services, Food and Drug Administration, August 28, 1996.

5. DiFranza JR, Brown LJ. The Tobacco Institute's "It's the Law" Campaign: Has it Halted Illegal Sales of Tobacco to Children? Amer J of Pub Health 1992; 82:1-2.

6. DiFranza JR, Norwood BD, Garner DW, Tye JB. Legislative efforts to protect children from tobacco. JAMA 1987; 257:3387-3389.

7. U.S. Department of Health and Human Services. Youth access to cigarettes. Washington, D.C.: U.S. Department of Health and Human Services, Office of Inspector General, Office of Evaluations and Inspections, 1992.

8. Jason LA, Ji PA, Anes MD, and Birkhead SH. Active enforcement of cigarette control laws in the prevention of cigarette sales to minors. JAMA 1991; 266: 3159-3161.

9. Jason LA, Billows WD, Schnopp-Wyatt DL, King C. Long-term findings from Woodridge in reducing illegal cigarette sales to older minors. Evaluation and the Health Professions 1996; 19: 3-13.

10. Rigotti, NA, DiFranza JR, Chang Y., Tisdale T., Kemp B., Singer DE. The effect of enforcing tobacco-sales laws on adolescents' access to tobacco and smoking behavior. N Engl J Med 1997; 337: 1044-1051.

11. Wasserman, J., Manning WG, Newhouse JP, Winkler JD. The effects of excise taxes and regulations on cigarette smoking. J Health Econ 1991; 10: 43-64.

12. Chaloupka FJ, Grossman M. Price, tobacco control policies, and youth smoking. National Bureau of Economic Research Working Paper Number 5740 1996.

13. DiFranza JR, Carlson RR, Caisse RE. Reducing youth access to tobacco. Tobacco Control 1992; 1:58.

14. Downey LA, Gardiner JA. Reducing youth access to tobacco: A partial inventory of state initiatives. Chicago, IL: University of Illinois at Chicago, Office of Social Science Research, 1996.

15. Johnston LD, O'Malley PM, Bachman JD. National survey results from the Monitoring the Future Study, 1975-1992. NIH Publication Number 93-3597/98. Washington, D.C.: U.S. Government Printing Office, 1993.

16. Tobacco Institute, The Tax Burden on Tobacco, Washington D.C.: Tobacco Institute, 1995.

17. Coalition on Smoking OR Health. State Legislated Actions on Tobacco Issues. Washington, D.C.: Coalition on Smoking OR Health, various years.

18. National Cancer Institute, <u>Major Local Tobacco Control Ordinances in the United States, Monograph 3</u>, Bethesda, Maryland: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, 1993.

19. Cragg JG. Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods," Econometrica 1971; 39: 829-44.

20. Evans WN, Farrelly MC. The Compensating Behavior of Smokers: Taxes, Tar and Nicotine. Working Paper, Department of Economics, University of Maryland, 1996.

21. Chaloupka FJ, Wechsler H. Price, Tobacco Control Policies, and Smoking Among Young Adults. Journal Health Economics 1997; 16: 359-373.

Endnotes

[1] The "It's the Law" program sponsored by the Tobacco Institute also targets youth access to tobacco. The stated purpose of this program is to encourage merchant compliance with state laws prohibiting the sale of tobacco products to minors. Under the program, the Tobacco Institute distributes a variety of educational materials, window stickers, buttons, and other materials to merchants who can then choose to display them in their stores. DiFranza and Brown [5] found that few Massachusetts retailers participated in this program in 1991, and that nearly all of these were willing to sell cigarettes to underage youth.

[2] The categorical responses for average daily cigarette consumption by smokers (and the assigned values) include: less than one cigarette per day (0.5); one to five cigarettes per day (3); about one-half pack per day (10); about one pack per day (20); about one and one-half packs per day (30); and two packs or more per day (45). Alternative approaches were used with no appreciable impact on the estimates.

[3] Chaloupka and Grossman [12] experimented with two other measures of cigarette prices - one excluding generic cigarettes and a city-specific measure for a carton of Winston king-sized cigarettes. These alternatives produced comparable results to those obtained using the measure of price employed here.

[4] Several states did not report the method used to measure compliance. For these states, the indicators of state approaches to measuring compliance take on values of zero and a third indicator is defined as one for states that did not report the methods used to measure compliance and zero for states that do report the methods used.

[5] The LR calculated test statistic is 34.43 and is significant at the 1% level.

Table One

Variable Definitions and Descriptive Statistics

Variable	Definition, Mean, and Standard Deviation
Smoking Participation	Dichotomous indicator equal to one if youth reports smoking in the past month, equal to zero otherwise; mean=0.247; s.d.=0.431
Cigarette Consumption by Smokers	Natural logarithm of average daily cigarette consumption (for smokers only); mean=0.742; s.d.=1.446
Cigarette Price	Average price for a pack of 20 cigarettes, in 1982-84 cents, including state excise taxes; mean=118.230; s.d.=14.036
Border Price Differential	Maximum positive price difference, in 1982-84 cents, between the price in the youth's state of residence and the prices in states within 25 miles of the youth's state of residence; mean=4.644; s.d.=8.320
Live Near Mexico	Dichotomous indicator equal to one if youth resides in a county within 25 miles of Mexico, equal to zero otherwise; mean=0.012; s.d.=0.107
Live Near Canada	Dichotomous indicator equal to one if youth resides in a county within 25 miles of Canada, equal to zero otherwise; mean=0.006; s.d.=0.080
Index of Smoking Restrictions	Sum of five variables reflecting the fraction of the population in the youth's county of residence subject to state or local restrictions on smoking in private worksites, restaurants, retail stores, schools, or other public places; mean=3.825; s.d.=1.363
Preemption	Dichotomous indicator equal to one if youth resides in a state that preempts stronger local limits on youth access to tobacco, equal to zero otherwise; mean=0.157; s.d.=0.363
Limits on Free Sample Distribution	Fraction of the population in the youth's county of residence subject to state or local restrictions on the distribution of free samples of tobacco products; mean=0.577; s.d.=0.491
Tobacco Licensing Provisions	Fraction of the population in the youth's county of residence in places in which a license is required to sell tobacco products; mean=0.878; s.d.=0.328
Cigarette Tax Earmarking	Dichotomous indicator equal to one if youth resides in a state that earmarks a portion of its cigarette tax revenues for other tobacco control activities, equal to zero otherwise; mean=0.271; s.d.=0.445
Smoker Protection	Dichotomous indicator equal to one if youth resides in a state with some form of smoker protection legislation, equal to zero otherwise; mean=0.469; s.d.=0.499
Over-the-Counter Stings	Dichotomous indicator equal to one if youth resides in a state that uses mock purchase attempts to measure retailer compliance with limits on youth access to tobacco products, equal to zero otherwise; mean=0.775; s.d.=0.418

Variable	Definition, Mean, and Standard Deviation
Over-the-Counter Not Reported	Dichotomous indicator equal to one if youth resides in a state that did not report the methods used to measure retailer compliance with limits on youth access to tobacco products, equal to zero otherwise; mean=0.160; s.d.=0.367
Over-the-Counter State	Dichotomous indicator equal to one if youth resides in a state that uses state-level samples to measure retailer compliance with limits on youth access to tobacco products, equal to zero otherwise; mean=0.594; s.d.=0.491
Over-the-Counter Compliance Rate	State-level reported over-the-counter sales compliance rate with limits on youth access to tobacco products; mean=42.734; s.d.=28.448
Vending Machine Compliance Rate	State-level reported vending machine sales compliance rate with limits on youth access to tobacco products; mean=8.814; s.d.=20.003
Active Vending Machine Enforcement	Dichotomous indicator equal to one if youth resides in a state that reports active enforcement of restrictions on vending machine sales of tobacco products, equal to zero otherwise; mean=0.306; s.d.=0.461
No Active Vending Machine Enforcement	Dichotomous indicator equal to one if youth resides in a state that reports having restrictions on vending machine sales of tobacco products that are not actively enforced, equal to zero otherwise; mean=0.450; s.d.=0.498
Male	Dichotomous indicator equal to one if youth is male and zero for females; mean=0.481; s.d.=0.500
African-American	Dichotomous indicator equal to one if youth is African-American and zero otherwise; mean=0.105; s.d.=0.308
Other Race	Dichotomous indicator equal to one if youth is not white or African-American and zero otherwise; mean=0.224; s.d.-0.417
Age	Age, in years; mean=16.298; s.d.=1.674
Eighth or Tenth Grade	Dichotomous indicator equal to one for youth in eighth or tenth grade and zero for twelfth graders; mean=0.697; s.d.=0.460
Average Hours	Average hours worked for pay each week; mean=7.257; s.d.=9.841
Weekly Income	Average weekly income, in 1982-84 dollars, from employment and all other sources; mean=31.756; s.d.=35.174
Infrequent Religious Service Attendance	Dichotomous indicator equal to one for youth who attend religious services infrequently and zero otherwise; mean=0.486; s.d.=0.500
Frequent Religious Service Attendance	Dichotomous indicator equal to one for youth who attend religious services frequently and zero otherwise; mean=0.373; s.d.=0.484
Rural	Dichotomous indicator equal to one for youth residing in rural areas and zero otherwise; mean==2.64; s.d.=0.441
Live Alone	Dichotomous indicator equal to one for youth who live alone and zero otherwise; mean=0.004; s.d.=0.065

Variable	Definition, Mean, and Standard Deviation
Live with Father Only	Dichotomous indicator equal to one for youth in families with the father the only parent present and zero otherwise; mean=0.034; s.d.=0.182
Live with Mother Only	Dichotomous indicator equal to one for your in families with the mother the only parent present and zero otherwise; mean=0.152; s.d.=0.359
Other Family Structure	Dichotomous indicator equal to one for youth in families with neither parent present and zero otherwise; mean=0.027; s.d.=0.161
Siblings	Dichotomous indicator equal to one for youth with at least one sibling and zero otherwise; mean=0.763; s.d.=0.425
Father Less than High School Graduate	Dichotomous indicator equal to one for youth with fathers who did not graduate from high school and zero otherwise; mean=0.130; s.d.=0.336
Father More than High School Graduate	Dichotomous indicator equal to one for youth with fathers who have more than a high school education and zero otherwise; mean=0.586; s.d.=0.492
Mother Less than High School Graduate	Dichotomous indicator equal to one for youth with mothers who did not graduate from high school and zero otherwise; mean=0.118; s.d.=0.322
Mother More than High School Graduate	Dichotomous indicator equal to one for youth with mothers who have more than a high school education and zero otherwise; mean=0.568; s.d.=0.495
Married or Engaged	Dichotomous indicator equal to one for youth who are either married or engaged and zero otherwise; mean=0.022; s.d.=0.148
Mother Worked Part-Time	Dichotomous indicator equal to one for youths whose mothers worked part-time while they were growing up and zero otherwise; mean=0.216; s.d.=0.411
Mother Worked Full-Time	Dichotomous indicator equal to one for youths whose mothers worked full-time while they were growing up and zero otherwise; mean=0.589; s.d.=0.492

Table Two

Estimates of Two-Part Model of Youth Cigarette Demand

Variable	Smoking Participation	Average Daily Cigarette Consumption
Cigarette Price	-0.004	-0.004
	(-2.623)	(-2.058)
Border Price Differential	0.0003	0.002
	(0.287)	(0.938)
Live Near Mexico	-0.096	-0.387
	(-1.162)	(-2.984)
Live Near Canada	0.009	-0.165
	(0.048)	(-0.776)
Index of Smoking Restrictions	-0.023	-0.019
	(-1.465)	(-1.084)
Preemption	0.096	0.129
	(1.788)	(2.326)
Limits on Free Sample Distribution	-0.015	0.062
	(-0.381)	(1.172)
Tobacco Licensing Provisions	0.020	-0.045
	(0.361)	(-0.565)
Cigarette Tax Earmarking	-0.068	-0.050
	(-1.475)	(-0.604)
Smoker Protection	-0.017	0.024
	(-0.388)	(0.424)
Over-the-Counter Stings	-0.131	-0.094
	(-1.798)	(-0.806)
Over-the-Counter Not Reported	-0.250	-0.250
	(-2.254)	(-1.472)
Over-the-Counter State	-0.057	-0.017
	(-1.489)	(-0.321)
Active Vending Machine Enforcement	-0.036	-0.063
	(-0.729)	(-0.900)
No Active Vending Machine Enforcement	0.010	-0.062
	(0.280)	(-1.114)
Over-the-Counter Compliance Rate	-0.0008	-0.001
	(-0.908)	(-0.814)
Vending Machine Compliance Rate	-0.001	-0.0004
	(-1.032)	(-0.282)
Male	0.001	0.042
	(0.031)	(1.443)
African-American	-0.801	-0.777
	(-24.235)	(-11.787)
Other Race	-0.010	-0.195
	(-4.334)	(-4.450)

Variable	Smoking Participation	Average Daily Cigarette Consumption
Age	0.064	0.111
	(5.404)	(5.927)
Eighth or Tenth Grade	0.072	0.186
	(1.763)	(3.119)
Average Hours	0.006	0.009
	(5.868)	(5.056)
Weekly Income	0.004	0.004
	(13.029)	(8.359)
Infrequent Religious Service Attendance	-0.145	-0.377
	(-5.324)	(-9.480)
Frequent Religious Service Attendance	-0.478	-0.650
	(-14.579)	(-15.574)
Rural	-0.035	-0.062
	(-1.305)	(-1.736)
Live Alone	0.205	0.414
	(1.826)	(2.177)
Live with Father Only	0.216	0.172
	(6.14)	(2.876)
Live with Mother Only	0.131	0.198
	(4.196)	(4.148)
Other Family Structure	0.213	0.365
	(4.935)	(3.874)
Siblings	-0.075	-0.073
	(-4.15)	(-2.881)
Father Less than High School Graduate	0.053	0.064
	(1.719)	(0.982)
Father More than High School Graduate	-0.024	-0.161
	(-1.105)	(-4.773)
Mother Less than High School Graduate	0.051	0.053
	(1.399)	(0.839)
Mother More than High School Graduate	-0.003	-0.063
	(-0.107)	(-1.747)
Married or Engaged	0.002	0.460
	(0.047)	(4.274)
Mother Worked Part-Time	0.015	-0.067
	(0.624)	(-1.64)
Mother Worked Full-Time	0.039	0.002
	(1.853)	(0.056)

Notes to Table Two: t-ratios are in parentheses. The predicted probability of smoking cigarettes obtained from this model is 0.230. Critical values are 2.58 (2.33), 1.96 (1.64) and 1.64 (1.28) at the 1, 5 and 10 percent significance levels, respectively, based on a two-tailed (one-tailed) test.