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GAO

United States
General Accounting Office
Washington, D.C. 20548

Human Resources Division

B-236019

June 30, 1989

The Honorable Michael A. Andrews
House of Representatives

Dear Mr. Andrews:

This report responds to your request that we (1) describe the extent and consequences of smoking by teenagers and (2) assess the potential impact of an increase in the federal cigarette excise tax on the number of teenage smokers. We briefed your staff on this issue on February 28, 1989, and agreed to present our analysis in this report.

The Surgeon General of the United States has labeled smoking the most important preventable cause of death in our society. Because most adult smokers became addicted when they were teenagers, preventing teen smoking should, over time, substantially reduce the adult smoking population. Currently over 4 million teenagers smoke. Our assessment of the economic literature supports the prediction that increasing the federal excise tax on cigarettes should reduce the number of teenage smokers significantly. Although the size of the reduction is uncertain, we believe a reasonable estimate can be made. If, for example, excise taxes were raised by about 20 cents per pack in 1989, all other factors remaining unchanged, the likely result would be over 500,000 fewer smokers. This would lead, according to one estimate, to about 125,000 fewer premature deaths.

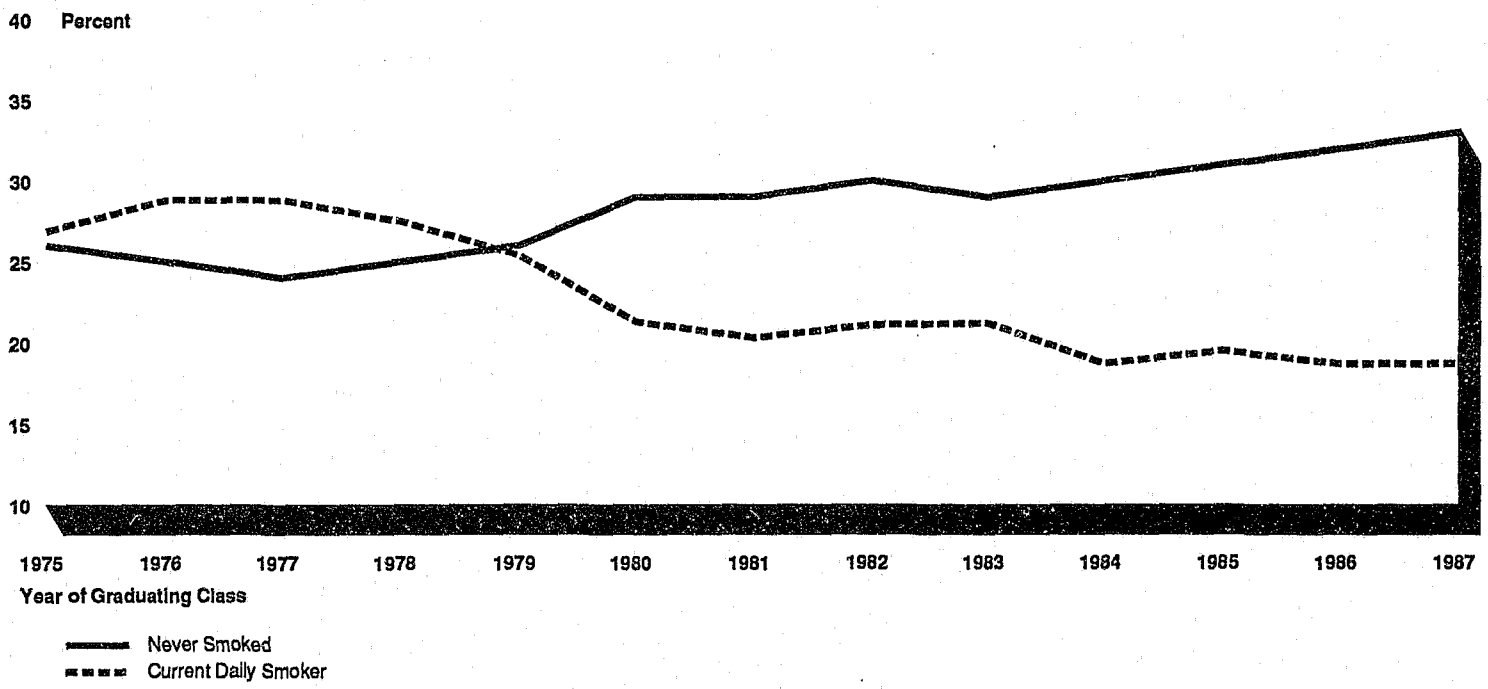
Background

For a quarter century, a major theme—perhaps the predominant theme—of U.S. public health policy has been the need to reduce the prevalence of cigarette smoking. Public health campaigns have tried to bring this message to all Americans, but particularly to teenagers. The reduction of teenage smoking is generally considered especially important for two reasons. First, teenagers are thought to be less capable than adults of making wise decisions about smoking. Second, reductions in teenage smoking should eventually reduce the number of adult smokers as well.

The 1970s saw a decline in the teenage smoking participation rate (the fraction of teenagers who smoke), which appears to have been largely caused by antismoking campaigns and related public health measures. By the 1980s, though, the decline apparently had stalled. To trigger a further decline, health experts and others have called for increases in the cigarette excise tax. Proponents of this policy have cited a study

that estimates that doubling this tax would reduce the number of teenage smokers by about 800,000.

Figure 1: Smoking Status of High School Seniors (1975-87)



Sources: NIDA, Illicit Drug Use, Smoking, and Drinking by America's High School Students, College Students, and Young Adults, 1975-87; 1989 Surgeon General's Report.

Objectives, Scope, and Methodology

You asked us to report on the evidence regarding the impact of cigarette excise taxes on teenage smoking. In response to this request, and based on discussions with your staff, we agreed to focus on two questions:

- What are the extent and consequences of teenage smoking?
- What are the likely effects of increases in cigarette excise taxes on the number of teenage smokers?

We did not examine other aspects of a cigarette tax, such as the impact that changes in the cigarette tax might have on the distribution of the federal tax burden among households or on U.S. agriculture.

We reviewed selected studies and articles in the public health, medical, and drug abuse literature. For data on the consequences of teenage smoking, we relied largely on the 1989 Surgeon General's Report. It provides a comprehensive synthesis and evaluation of the health-related literature on smoking.[1]

For recent information on all teenage smokers at a point in time, we relied on the 1982 and 1985 National Household Surveys on Drug Abuse conducted by the National Institute on Drug Abuse (NIDA). We obtained trend data on teenage smoking from the NIDA-sponsored High School Seniors Survey. Public health experts consider this survey to be the best available source of statistics on teenage smoking trends, despite its lack of information on younger teenagers and high school dropouts. Unlike other surveys that are more representative of all teenagers, the high school survey has been conducted each year since 1975 on a consistent and comparable basis. We also used the 1987 High School Seniors Survey for information on teenage smokers' characteristics. Appendix I discusses whether that survey has become less representative of all teenagers during the 1980s.

To assess the effects of increased taxes, we reviewed economic studies of smoking and, in particular, those that estimate the price responsiveness of teenagers' smoking behavior. We interviewed authors of the studies of teenage price responsiveness as well as officials of the National Center for Health Statistics and of the Office of Smoking and Health of the Department of Health and Human Services. Our review focused on the economic literature on teenage smoking. For part of our review, however, we analyzed data on smoking behavior (the high school surveys) and cigarette prices (published by the Tobacco Institute).

The economic studies of teenage smoking analyzed data from several major national surveys conducted in the late 1960s and the 1970s. We did not identify problems with these surveys that might raise major

[1]Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. DHHS Publication No. (CDC) 89-8411, (Prepublication version, Jan. 11, 1989).

questions about the economic analysis based on them. Appendix II discusses, however, the extent to which the survey information used to estimate teen price responsiveness remains relevant in the 1980s and 1990s.

A recent GAO report on federal excise taxes estimates the revenue potential of raising the cigarette excise tax.[2]

Our review, which was conducted between February and May 1989, was done in accordance with generally accepted government auditing standards. The following summarizes our findings, which are presented in more detail in appendixes I and II.

The Extent and Consequences of Teenage Smoking

Despite the decline in teenage smoking since 1975, smoking among teenagers continues to be widespread. According to National Institute on Drug Abuse surveys, almost one of every six teenagers smokes cigarettes. Other NIDA-sponsored surveys show that the proportion of high school seniors who smoke daily dropped by more than one-fourth in the 1970s, but seems to have stabilized at about 19 percent during the mid-1980s.[3] The prevalence of smoking among high school seniors is greater for those who are female, are white, are not planning to get a bachelor's degree, or live in the Northeast.

The health consequences of smoking are well known: greater risks of cancer, heart disease, and respiratory disease—all frequently fatal. Less well known is the extent to which many of these increased risks not only are borne by smokers but also are imposed on nonsmokers. In addition, smoking by pregnant women can do severe harm to fetuses, and smoking by parents can be especially harmful to infants. The high incidence of teenage pregnancy and parenthood makes this consequence of smoking particularly pertinent to the issue of teenage smoking.

According to the Surgeon General, smoking is not merely a habit that is hard to break—it is an addiction. That addiction begins early: the vast majority of adult smokers—between 75 and 85 percent, depending on age—began smoking before age 21. Many of these began by age 16.

[2]Tax Policy: Revenue Potential of Restoring Excise Taxes to Past Levels (GAO/GGD-89-52, May 9, 1989).

[3]Lloyd D. Johnson, Patrick M. O'Malley, and Jerald G. Bachman, Illicit Drug Use, Smoking, and Drinking by America's High School Students, College Students, and Young Adults, 1975-1987. National Institute on Drug Abuse (Washington, D.C., 1989), p. 51.

Because people who did not smoke as teenagers have tended not to become smokers as adults, it follows that preventing teenagers from smoking should, as successive generations become adults, reduce the adult population of smokers.

Reducing Smoking Through Higher Excise Taxes

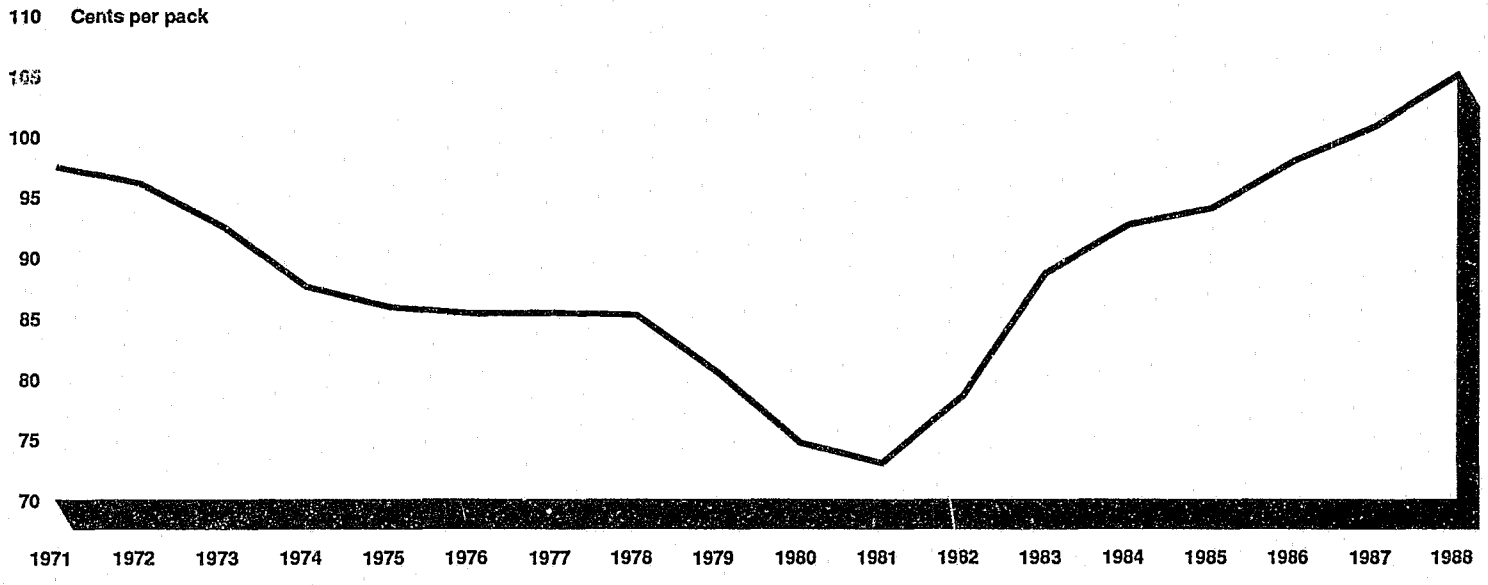
Raising the federal excise tax on cigarettes will reduce teenage smoking to the extent that teenage smokers respond to higher cigarette prices. The economic literature concludes that higher cigarette excise taxes are fully passed on in cigarette prices. The current federal excise tax on cigarettes is 16 cents per pack. Doubling it would raise the price of cigarettes by about 12 percent in 1989, and increasing the tax by 21 cents per pack would boost cigarette prices by about 15 percent. Several economic studies present evidence on how such price increases might affect teenage smokers.

The only three major studies on this topic were published by Eugene Lewit and his coauthors in the early 1980s. They find that teenagers are relatively responsive to changes in cigarette prices. Lewit analyzed two sets of data for younger teenagers, ages 12 to 17, as well as data for young adults, ages 20 to 25. Data on older teenagers, ages 18 and 19, are unavailable, so the young adults serve as a proxy for the older teenagers. The three data sets are drawn from three national surveys, conducted during the late 1960s and the 1970s. Researchers rely on these surveys, which provide detailed information on individuals.

Lewit and his coauthors used a standard economic model of cigarette consumption that attributes differences in smoking behavior to differences in cigarette prices across states and localities, the smoker's economic resources, and various individual and family characteristics (e.g., age, parents' education). Based on statistical analysis, Lewit and his coauthors found that increasing cigarette prices by 1 percent would lead to a roughly proportional reduction in the smoking participation rate of younger teenagers. The estimates of the reduction range from -0.76 percent to -1.2 percent for each percent increase in the price of cigarettes.

In 1985, another economist, Kenneth Warner, built upon the work of Lewit and his coauthors in order to translate their estimates of the teenage price responsiveness into estimates of the number of teenagers who might quit smoking or not start because of higher excise taxes. Using data on teenage smoking participation from 1982, Warner calculated that, if a federal excise tax increase raised cigarette prices by about 15 percent, 800,000 fewer teenagers would smoke. In 1989, it would require

Figure 2: Cigarette Prices in Constant Dollars (1971-88)



Note: Cigarette prices are deflated by the Consumer Price Index (base 1982-84).

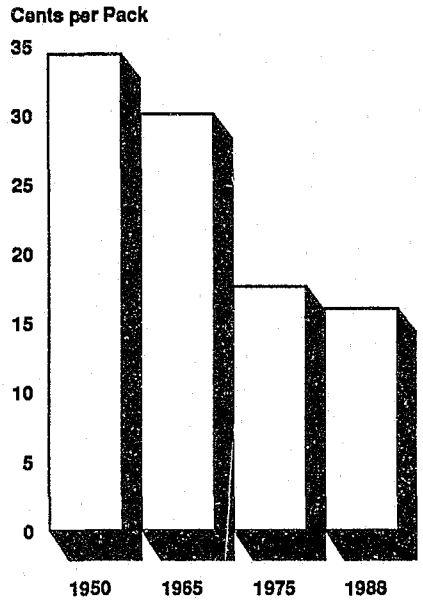
Sources: The Tobacco Institute, The Tax Burden on Tobacco: Historical Compilation, Volume 23, 1988; Council of Economic Advisors, Economic Report of the President, January 1989.

an increase in the federal excise tax of 21 cents per pack to raise cigarette prices by about 15 percent.

Warner also noted that the benefits of the tax increase—the reduction in teenage smoking—would shrink as inflation eroded the real value of the tax increase, unless the excise tax were indexed so that the nominal tax rate (expressed in cents per pack) would rise in step with prices. Indexing the federal cigarette excise tax to the consumer price index or the wholesale price of cigarettes would make the public health gains of higher excise taxes permanent.

The major problem with using the Lewit measurements to estimate teenagers' responsiveness in the early 1990s to changes in the cigarette excise tax is that the Lewit studies used data that by now are old. The

Figure 3: Federal Cigarette Excise Tax in Constant Dollars (Selected Years)



Note: Cigarette excise tax expressed in 1988 dollars, using the Consumer Price Index.

Sources: The Tobacco Institute, The Tax Burden on Tobacco: Historical Compilation, Volume 23, 1988; DRI/McGraw-Hill.

age of the data, gathered in surveys during the late 1960s and 1970s, might make the estimates less relevant today. We identified two reasons why the responsiveness of teens to changes in cigarette prices may have changed in the intervening years; these reasons work to offset each other, however.

First, antismoking campaigns and the shift in social norms against smoking may have decreased the price responsiveness of teenagers. The current pool of teenage smokers is more likely to contain people highly resistant to new health information and changes in price. Second, the increasing concentration of smokers among low-income people may have increased teenage price responsiveness. Price responsiveness of consumption tends to be higher among lower income people.

For the 1980s, we lack the comprehensive data and systematic studies similar to Lewit's that would resolve whether the responsiveness of teen smoking participation to cigarette prices has increased or decreased. To cast some light on the issue, we turn to information on high school seniors from 1983 to 1987. That information lends support to predictions about changes in participation based on the Lewit estimates of price responsiveness. In addition, evidence on young adults (20-24)—a proxy for older teens—conforms to the prediction based on the Lewit estimate.

Based on our review of the Lewit studies and their limitations, we conclude that it is likely that teenage smoking participation responds substantially to cigarette prices. As noted above, teenage price responsiveness might be smaller today than Lewit estimated for previous decades. Given this concern and the lack of definitive evidence, this would suggest relying on the smaller (-0.76) estimate of price responsiveness. The smaller estimate implies that a 21-cent-per-pack increase in the federal excise tax in 1989 would likely lead to a reduction of over 500,000 in the number of teenage smokers. This implies in turn that an increase in the cigarette excise tax would be an effective way to reduce teenage smoking.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to the Secretary of Health and Human Services as well as other interested parties and make copies available on request. A list of major contributors to this report is included as appendix III.

Sincerely yours,

Janet L. Shikles

Janet L. Shikles
Director of National and
Public Health Issues

Contents

Abbreviations

GAO	General Accounting Office
NIDA	National Institute on Drug Abuse

The Extent and Consequences of Teenage Smoking

Efforts to reduce teenage smoking have been stimulated by evidence on the numbers of teenagers who smoke and on the medical consequences of their smoking. Since 1976 smoking has become much less popular among teenagers, but it is still widespread: almost one out of six teenagers smokes cigarettes. Most adult smokers began as teenagers; their persistence in smoking confirms its classification as an addiction by the Surgeon General. By now it is well-known that smoking makes cancer, heart disease, and respiratory disease more likely. But less widely publicized is the research that indicates that a pregnant woman who smokes risks harming her baby, perhaps for life. This danger, combined with the numbers of pregnant teenagers and teenagers as parents, makes teenage smoking particularly serious.

Public health officials give priority to preventing smoking by teenagers because that is the time of life when most smokers start smoking. Given that smoking is addictive, it may be more effective to prevent the behavior than to try to stop it once it has taken hold. There are long-term benefits to a reduction in teenage smoking: for every three or four teenagers who quit smoking, one premature death is avoided.

The Extent of Teenage Smoking

Teenage Smoking Declining but Still Widespread

During the first half of the 1980s, over 4 million teenagers—roughly 15 percent—in any given year are estimated to have been smokers.[1] A 1982 National Institute on Drug Abuse-sponsored survey of younger teenagers, ages 12 to 17, estimated their smoking participation rate—the share of younger teenagers who are smokers—to be 14.7 percent.[2] This represents about 3.3 million younger teenagers. When 18- and 19-year-olds are added in, the total number of teenagers who smoked in 1982 is estimated to have been about 4.9 million. By 1985 (the latest year for which data are available), the estimated participation rate for teens, ages 12 through 17, had increased to 15.6 percent.

[1]Kenneth F. Warner, "Consumption Impacts of a Change in the Federal Cigarette Excise Tax," Smoking Behavior and Policy Conference Series: The Cigarette Excise Tax, Institute for the Study of Smoking Behavior and Policy, April 17, 1985, p. 95.

[2]These facts are drawn from the 1989 Surgeon General's Report. Throughout our report, information from surveys other than the NIDA-sponsored High School Seniors Survey is obtained from the Surgeon General's Report.

Public health experts and the public are interested in the trend of teenage smoking. Unfortunately, adequate data on smoking among all teenagers are available only in occasional snapshots. Trend data collected in a NIDA-sponsored survey for the period 1975 through 1987 are available, however, for high school seniors.[3] High school seniors are not representative of all teenagers, though, for two reasons: First, since high school seniors tend to be 17 to 19 years old, their behavior may differ from younger teenagers. Second, high school seniors behave differently than high school dropouts of the same age. Dropouts tend to have different social characteristics and to be more likely to smoke.

Despite these caveats, the data on high school seniors provide the only alternative for tracking trends in teenage smoking since 1975. Appendix II discusses questions about the representativeness of the high school data in the 1980s.

The share of high school seniors who smoke cigarettes daily followed a downward trend between 1975 and 1987. Beginning at 26.9 percent in 1975, the smoking participation rate of high school seniors fell to 18.7 percent by 1987. The data suggest that during the 1980s, teenagers' smoking participation continued to shrink, but at a noticeably slower pace. In fact, from 1984 through 1987, there was no downward trend.[4]

The high school senior data suggest that the decline in teenage smoking halted in 1984, but that conclusion may be wrong. The decline in their smoking should be compared with the trend in young adults' smoking. During the 1980s, substantially fewer young adults, ages 20 to 24, smoked; their smoking participation rate fell from 36.1 percent in 1980 to 29.5 percent in 1987. This drop of nearly 7 percentage points contrasts sharply with the almost flat trend during the same period among high school seniors. This discrepancy may reflect a tendency for changes in smoking participation among young adults to lag behind changes in teenage smoking. Alternatively, the data on high school seniors may have become less representative of teenagers during the 1980s. The conflict between explanations cannot be resolved, however, until new data become available.

[3]National Institute on Drug Abuse, Illicit Drug Use, Smoking and Drinking by America's High School Students, College Students, and Young Adults, 1975-1987, U.S. Department of Health and Human Services, 1988.

[4]The smoking participation rate of high school seniors averaged almost 21 percent during 1980-83, and about 2 percentage points less during 1984-87. In 1984 and in 1987, the rate was 18.7 percent.

The decline in smoking among high school seniors reflects both an increase in those who start but quit and an increase in those who never start. The share of high school seniors who never smoked increased from 24 percent in 1977—a low—to 33 percent in 1987. In public health terms, smoking cessation rose as smoking initiation fell—a consistent picture of teenagers shifting away from smoking.

Smoking initiation occurs early: adult smokers tend to have begun their habit or addiction as teenagers. In the 1978, 1979, and 1980 National Health Interview Surveys conducted by the Office of Smoking and Health, about three-quarters of adult "ever smokers," ages 41 to 65, reported initiation before age 21. This tendency to have started smoking as a teenager is stronger, the more recently an adult smoker was born. Of the group of 41- to 65-year-olds, almost half said they began before age 18. Clearly, the teen years were the most common time of beginning to smoke, and the initiation age may be even younger for today's teenagers. Among high school seniors who had ever smoked, in 1986 72.5 percent reported having their first cigarette by 9th grade; 94.3 percent had smoked their first cigarette by 11th grade.

Teenage Smoking Varies by Education and Other Social Traits

Smoking behavior among teenagers differs by their social characteristics, as illustrated by 1987 data from the NIDA-sponsored High School Seniors Survey. More female high school seniors (20.6 percent) reported using cigarettes daily than males (16.4 percent). Educational aspirations are linked to smoking behavior, too. Daily cigarette use was over twice as prevalent among those who did not intend to complete four years of college as among those who did plan to get a bachelor's degree (29.0 versus 13.3 percent). This difference in smoking behavior is mirrored among respondents one to four years beyond high school: 13.9 percent of full-time college students smoked daily, while 29.6 percent of those not attending college full time smoked daily.

High school seniors' use of cigarettes varies by region as well. Almost one-quarter of students in the Northeast (24.8 percent) smoked every day. By contrast, less than one-sixth of the students in the South and West were daily smokers. Students in the North Central region were an intermediate case: about one-fifth were smoking every day. Differences in smoking behavior among regions undoubtedly reflect a set of causal determinants of smoking behavior that themselves vary by region. For

example, there is regional variation in the prevalence of affiliation with religions that proscribe smoking.[5]

Racial differences in smoking behavior among high school seniors were relatively small in the late 1970s, but have widened substantially during the 1980s. For example, in 1976 daily smoking among blacks was only slightly less than among whites (26 versus 29 percent). By 1987, though, only 8 percent of blacks were daily smokers, while 20 percent of whites were. The data for less than daily smokers show similar though less dramatic changes. Although the two groups were equally likely to be "never smokers" in 1976, by 1987 black high school seniors had become much more likely than whites to be "never smokers" (45 versus 30 percent). These developments in racial differentials have not been explained.

In recent years, teenage smoking may have become more likely to be found among youths from less affluent backgrounds. As one public health expert has stated, ". . . smoking and its associated disease effects increasingly are becoming more class-based."[6] However, we did not identify recent, systematic socioeconomic data on teenage smokers—family income, parents' occupations, etc.

Teenage Smoking Associated With Substance Abuse

The teenage years are commonly seen as a period of experimentation and often rebellion by youth against adult rules for youth and adult social norms. Many teenagers experiment with various substances that most adults consider either undesirable under all circumstances—illegal drugs—or appropriate for use by adults only—alcohol and tobacco.[7] Among the 23 million younger teenagers, ages 12 to 17, in the United States, about 3.5 million use tobacco products, almost 3 million smoke marijuana, 6 million drink alcohol, and 1 million use various stimulants.[8]

[5]Gary Becker, Michael Grossman, and Kevin M. Murphy, "An Empirical Analysis of Cigarette Addiction," University of Chicago working paper, 1988, pp. 20-22.

[6]Kenneth E. Warner, "Smoking and Health Implications of a Change in the Federal Cigarette Excise Tax," Journal of the American Medical Association, Feb. 28, 1986, Vol. 255, No. 8, p. 1032. Warner refers to a 1985 Wall St. Journal article on the subject.

[7]Donald E. Greydanus, "Risk-Taking Behaviors in Adolescence," Journal of the American Medical Association, Oct. 16, 1987, Vol. 258, No. 15, p. 2110.

[8]R.B. Shearin and R.L. Jones, "Drug and Alcohol Abuse: Medical and Psychosocial Aspects," in A.D. Hofmann and D.E. Greydanus, eds., Adolescent Medicine, 2nd ed. (East Norwalk, Conn.: Appleton-Century-Crofts, 1989), pp. 401-430, cited in Donald E. Greydanus, "Routing a Modern Pied Piper of Hamelin," Journal of the American Medical Association, Jan. 6, 1989, Vol. 261, No. 1, p. 99.

Survey data on high school seniors reveal that cigarette smoking is associated with use of illegal drugs and alcohol, but the causal links among these behaviors or between them and other factors are unknown. The difference in use of illicit drugs (in the past 30 days) is dramatic between those who never smoked and those who smoke daily: Of high school seniors in 1985, 9.7 percent of those who never smoked had used illicit drugs, while 60.6 percent of "light daily smokers" (those who smoke less than a pack a day) had done so. The difference in the use of alcohol was less dramatic but still substantial: 42.4 percent of "never smokers" had used alcohol in the month preceding the survey, but over twice as many light daily smokers—86.1 percent—had done so.[9]

The Consequences of Teenage Smoking

Health Risks to Teenagers

The motivation for reducing teenage smoking stems largely from concern about the harm that smoking does to teenagers' health in both their teenage and adult years. That smoking harms health is widely understood. Even so, the following summary of specific medical effects of smoking highlights the medical benefits of preventing young people from smoking.

According to the 1988 Surgeon General's Report, smoking is an addictive activity—a fact of importance to public health policy. Nicotine is the drug in tobacco that causes addiction. After prolonged use of nicotine, smokers become physically dependent and, if they quit, suffer unpleasant physical and psychological symptoms of withdrawal. Although it seems clear that adult smokers are most likely to have a prolonged history of smoking and nicotine use, teenagers are not immunized against nicotine addiction by their youth. A recent study indicates that young smokers learn to inhale smoke early in their smoking careers; inhaling increases their nicotine intake, which promotes addiction.[10]

[9]National Institute on Drug Abuse, National Trends in Drug Use and Related Factors Among American High School Students and Young Adults, 1975-1986, U.S. Department of Health and Human Services, 1987, p. 254.

[10]Ann D. McNeill and others, "Nicotine Intake in Young Smokers: Longitudinal Study of Saliva Cotinine Concentrations," American Journal of Public Health, February 1989, Vol. 79, No. 2, pp. 172-175.

Teenagers who are unaware of the addictive nature of cigarettes or who underestimate the strength of a tobacco addiction may tend to experiment with smoking initially but, to their surprise, later become addicted. The 1974 and 1979 Teenage Smoking Surveys by the Department of Health, Education, and Welfare (predecessor of the Department of Health and Human Services) asked teenagers what the possibility was of them being cigarette smokers in 5 years; half of the regular smokers answered "definitely not" or "probably not." Surveys of young adult smokers suggest that, unfortunately, the teenagers' optimistic predictions tend to be wrong.

The linkage in the scientific literature of cigarette smoking to numerous illnesses and premature death has received wide publicity in the past two decades. The 1989 Surgeon General's Report states that about 390,000 deaths in 1985 were attributable to smoking. Smoking is considered to be the major cause of lung cancer—the leading cause of cancer death in men since the 1950s. Numerous other types of cancer are also attributed, at least in part, to cigarette smoking. In addition, smoking is a cause of coronary heart disease, cerebrovascular disease (stroke), chronic obstructive pulmonary disease (the permanent airflow blockage that smokers develop) and many other diseases. Finally, given the fact that cigarette smoking is associated with alcohol use by teenagers, it is significant that recent research suggests that cigarette smoking combined with the ingestion of alcohol may further increase the risk of cancer.

Smokers Harm Nonsmokers' Health and Economic Well-Being

Most of the severe health risks generated by smoking affect teenagers directly, but are usually manifested only in adulthood. Some of the health risks caused by teenagers smoking are borne, though, by nonsmokers. In particular, when teenagers who are parents smoke, they put their infants at greater risk. The prevalence of teenage pregnancy and teenagers as parents makes this a widespread problem.

Smoking by the mother during pregnancy has been linked to fetal and infant mortality. Low birthweight, often associated with mental retardation and other developmental and health problems, has been conclusively linked to the number of cigarettes smoked during pregnancy. Premature delivery, retardation in fetal growth, and diminished availability of oxygen to the fetus are also effects of smoking during pregnancy. The consequences of these problems may affect the child, often severely, throughout its lifetime. In addition, after a child is born, smoking by family members is likely to be harmful to the child. For example,

increased incidence of wheezy bronchitis in infants has been attributed to parental smoking.[11] The 1986 Surgeon General's Report concludes that children of smokers suffer from a higher rate of respiratory infection and a smaller rate of increase of lung function as the lung matures.

The public at large is affected by teenagers smoking much as it is by adults smoking. Smokers affect nonsmokers in several ways. First, smokers cause "involuntary (or passive) smoking"—the exposure of nonsmokers to tobacco smoke, particularly in indoor environments. As a result nonsmokers tend to face a greater risk of cancer and of becoming less healthy in general. (The details on the health consequences of involuntary smoking constitute the entire 1986 Surgeon General's Report on smoking.) In addition, nonsmokers often find it unpleasant to be exposed to passive smoking. Second, society as a whole bears a portion of the costs of providing health care to smokers, to the extent that health insurance premiums of smokers do not fully reflect the expected costs associated with smoking. However, costs of smoking to society as a whole are lowered because earlier deaths of smokers reduce private and public pension payments.[12,13]

Reasons for Targeting Teenagers for Smoking Prevention

Public health officials target teenagers for smoking prevention on both ethical and practical grounds. Adults may legitimately choose to smoke, many would argue, as long as the harmful consequences of smoking are confined to the smoker. Even if that argument is accepted for adults, it is usually rejected for teenagers and younger children. Minors are conventionally considered not sufficiently mature to make prudent decisions about using harmful substances like tobacco. This judgment presumably was a factor in most states restricting the sale of tobacco to younger teenagers.

[11]Daniel R. Neuspiel and others, "Parental Smoking and Post-Infancy Wheezing in Children: A Prospective Cohort Study," American Journal of Public Health, February 1989, Vol. 79, No. 2, pp. 168-171.

[12]See Willard G. Manning and others, "The Taxes of Sin: Do Smokers and Drinkers Pay Their Way?" The Journal of the American Medical Association, March 17, 1989. In addition, Manning and his coauthors consider the relationship between the costs of smoking borne by society as a whole and the size of the cigarette excise taxes paid by smokers.

[13]Smoking has a further potential economic effect: It may reduce national income directly, by making smokers less physically capable on the job (e.g., by reducing lung capacity), or indirectly, by increasing their absenteeism because of greater illness. Most of this loss in productivity is presumably reflected in lower earnings of smokers; therefore, nonsmokers would only suffer to the extent that a smoker's decreased productive effectiveness itself lowers the productivity of others.

Since smoking is addictive, it may be easier to reduce the prevalence of smoking by preventing a person from starting to smoke than by inducing him or her to stop. As noted earlier, most current adult smokers began smoking by age 20. (In fact, the percent of adult smokers who began as teens has been increasing among more recent birth cohorts.) The data suggest that if a person does not smoke regularly by age 20, he or she will be less likely to begin doing so as an adult. Moreover, an adult's smoking addiction is not easily broken. Many former smokers report several attempts to stop smoking before they are successful.

In addition, a relatively small reduction in teenage smokers, if sustained, can have a large effect in subsequent decades on the size of the adult smoking population. As aging carries successive cohorts of teenagers with lower participation rates into adulthood, the smoking rates of older, adult age groups should be reduced. To estimate the health effects of reduced smoking, Warner assumes that one of every four tax-induced quitters (or nonstarters) would have died from smoking.[14] Consequently, a 400,000 drop in the number of teenage smokers would reduce the number of premature deaths by as many as 100,000.

[14]Warner, "Smoking and Health ...," p. 1031. He suggests that the ratio of premature deaths to smokers could be as high as 1 to 3.

The Effect of Cigarette Excise Taxes on Teenage Smoking

Research indicates that substantially fewer teenagers smoke when cigarette prices increase, although the extent of the reduction is uncertain. Published estimates of the price responsiveness of teenage smoking participation indicate that if cigarette prices increased by 10 percent, the rate of smoking participation among younger teenagers is likely to decline by 7.6 to 12 percent. This appendix reviews these estimates and assesses their reliability.

Estimating the Effect of Raising Cigarette Excise Taxes

Despite the decline in teenage smoking since 1975, over 4 million teenagers still smoke cigarettes. This fact, coupled with the numerous harmful effects of smoking, has led public health experts to pay greater attention to the federal cigarette excise tax: Could an increase in the excise tax spark a further decline in teenage smoking? Interest in this nontraditional public health policy has been heightened by economist Kenneth Warner's estimate that doubling this tax would reduce the number of teenage smokers by roughly 800,000.

To determine whether fewer teenagers would smoke in response to an increase in the excise tax, one needs four pieces of information:

- First, the change in the real (inflation-adjusted) price of cigarettes.
- Second, the responsiveness of teenage smoking participation to higher prices.[1]
- Third, the teenage smoking participation rate.[2]
- Fourth, the size of the teenage population.

The product of these four items yields the change in the number of teenage smokers. The first item determines the size of the stimulus that is generated by the tax increase and impinges on teenagers. Depending on the size of the other three factors, the response by teenage smokers to the stimulus may be large or small.

Obtaining relatively good information on the first, third, and fourth items is straightforward. This is not so for the second item—teenagers' price responsiveness. The concept of responsiveness is measured usually by the price elasticity of the teenage smoking participation rate, defined

[1]Prices affect smoking through two channels: daily consumption of cigarettes (the decision to smoke one pack or two) and smoking participation (the decision to smoke at all). Of the two, the participation rate receives greater attention as a public health issue; this report reflects that emphasis.

[2]Because a census that attempts to count each teenage smoker is not available, the number of teenage smokers cannot be obtained directly. Rather, it must be calculated from applying an estimate of the teenage smoking participation rate to the size of the teenage population.

as the percentage change in the participation rate divided by the percentage change in cigarette prices. For example, if this elasticity is -1.2, then a 10-percent rise in cigarette prices will result in a 12-percent drop in the smoking participation rate.

Because the economic literature examines smoking in relation to cigarette prices, not cigarette taxes, proposals for higher cigarette excise taxes must be translated into the resulting change in cigarette prices. For example, in 1984, when cigarettes on average cost $0.98 per pack, a doubling of the federal cigarette excise tax from 16 to 32 cents would have raised cigarette prices by about 15 percent. In 1988, when cigarettes averaged $1.30 per pack, a 21-cent-per-pack increase would have been required to increase cigarette prices by the same 15 percent. Equivalently, doubling the federal excise tax in 1988 would have raised cigarette prices by about 12 percent.

The volume of research on this narrow topic—technically, the price elasticity of teenage smoking participation—is modest. Moreover, conflicting factors affect the reliability of the estimated elasticity and must be weighed before a conclusion can be reached. The following sections are devoted to reviewing the estimates of price elasticity and gauging their reliability.

Evidence on the Response of Teenage Smokers to Cigarette Prices

There are only two major economic studies of teenagers' smoking behavior, both by Eugene Lewit and his colleagues.[3] These examine younger teenagers, ages 12 to 17. Data on older teenagers (18 to 19) are lacking, but a third study by Lewit and Coate that examines young adults (20 to 25) provides a measure of the possible elasticity of older teenagers.[4] The three studies conclude that price increases would reduce teenage smoking. Table II.1 summarizes key information about the three studies.

[3]Eugene M. Lewit, Douglas Coate, and Michael Grossman, "The Effects of Government Regulation on Teenage Smoking," Journal of Law and Economics, Dec. 1981, Vol. 25, No. 3, pp. 545-569. Michael Grossman, Douglas Coate, and Eugene M. Lewit, "Economics and Other Factors in Youth Smoking," Final Report, Grant Number SES-8014959, National Science Foundation, December 1983, cited in Eugene M. Lewit, "Tobacco Excise Taxation," prepared for the 1989 Surgeon General's Report on Smoking and Health, revised January 19, 1989, p. 53.

Frank Chaloupka, "An Economic Analysis of Addiction: The Case of Cigarette Smoking," photocopy, University of Illinois at Chicago working paper, October 1988, contains several estimates of the price elasticity of teenage smoking, but has a different focus than the Lewit and Grossman papers and only treats teenagers in passing. The Chaloupka paper is briefly discussed in footnote 13.

[4]Eugene M. Lewit and Douglas Coate, "The Potential for Using Excise Taxes to Reduce Smoking," Journal of Health Economics, Vol. 1, 1982, pp. 121-145.

Table II.1: Estimates of Teenage Price Responsiveness

Authors	Population and survey period	Estimated elasticity[a]
Lewit, Coate, and Grossman	12- to 17-year-olds, 1966-70	−1.20
Grossman, Coate, and Lewit	12- to 17-year-olds, 1974,1976,1977,1979	−0.76
Lewit and Coate	20- to 25-year olds,[b] 1976	−0.74

[a]The percentage change in the smoking participation rate associated with a 1-percent change in cigarette prices.

[b]Used in constructing measure for 18- and 19-year olds.

The first study, by Lewit, Coate, and Grossman, uses older data but a larger sample than the others. It draws on Cycle III of the U.S. Health Examination Survey, which sampled 6,768 noninstitutionalized youth between March 1966 and March 1970. The second, by Grossman, Coate, and Lewit, employs more recent data from four smaller samples—the U.S. National Surveys on Drug Abuse conducted in 1974, 1976, 1977, and 1979. Grossman analyzed data from these surveys separately, because each survey defined the smoking rate differently.

The third study focuses on young adults. Smokers 18 and 19 years old have not been surveyed, which precludes estimating a price elasticity for them directly. However, Warner has calculated a proxy for these older teenagers' elasticity that averages an elasticity estimate for young adults with Lewit's estimate for younger teenagers. The estimate for young adults is part of the Lewit and Coate analysis of the 1976 Health Interview Survey. From this survey, they obtained a sample of 19,288 individuals, ages 20 through 74, of whom 1,492 were young adults.

Methodology Used to Explain Teenage Smoking

The three studies share a similar methodology. First, they develop a model of a typical individual's smoking behavior that contains both economic and noneconomic determinants. Then, using the survey data on individuals, they estimate statistically the impact of these determinants on smoking behavior. In particular, by accounting for the effect of the other determinants, the researchers isolate the degree to which higher cigarette prices are associated with less smoking.

Lewit and his coworkers base their model on conventional economic theory, which suggests that the higher the price of a commodity, the less a consumer will buy of it, if other determinants of consumer demand do not change. In addition to cigarette prices in the teenager's locality, the determinants of smoking used in the Lewit model include:

- Family characteristics (absent father, education of parents, etc.).
- Teenager's individual characteristics (age, sex, student status, etc.).
- Teenager's economic resources (family income, teenager's allowance).
- Prices of other commodities.

An economic model such as Lewit's recognizes differences in individual tastes and preferences, some of which are captured by the variables categorized as individual or family characteristics. Many of these variables are drawn from the clinical and epidemiological literature on teenage smoking.

For their study of adults, Lewit and Coate selected a set of smoking determinants that resembles closely that found in Lewit's earlier research on teenagers. The major differences are the exclusion of variables that are relevant only to teenagers and the inclusion of marriage-related variables (such as widowed, divorced, etc.) that tend to characterize adults, not teenagers.

The generic model of demand for a commodity that Lewit and his coworkers use has received strong empirical support in numerous other studies of cigarette consumption by all smokers.[5] Almost all of these studies confirm the major prediction of the generic model, namely that higher cigarette prices reduce cigarette consumption. It is also important to note that the generic model is not intended as a description of how every smoker (or every consumer) makes his or her decisions.[6] Instead, for the generic economic model to be useful, it suffices that some smokers (e.g., 500,000) respond to higher prices, more income, etc., even though most (4.5 million) may not.[7]

To identify the separate effect of each variable on smoking behavior, Lewit uses a conventional statistical technique, multiple regression. It provides an estimate of the change in smoking participation associated with, for example, a 25-cent-per-pack change in cigarette prices, after accounting for the influences of all other determinants of smoking that

[5]Lewit, "Tobacco Excise Taxation," provides references to this literature.

[6]The conflict between economic and other, more commonsensical views of smoking is more apparent than real. The economic view in effect focuses on individuals who are at the margin of decision: If a particular variable were to change, they would likely change their behavior. The commonsense view concentrates on individuals who are typical and who therefore, under prevailing circumstances, are less likely to change their behavior in response to the same stimulus.

[7]Economic theory predicts that the amount demanded of a commodity is negatively related to its price, but it makes no prediction about the strength of that relationship. In any case, the data may reveal strong or weak relationships between price and quantity.

the researchers selected. Under ideal circumstances, such estimates are unbiased—although based only on a sample, they do not differ systematically from the values that hold for the entire population (of teenagers, in this case).

Teenage Smokers Respond Substantially to Price Changes

Using this economic theory and statistical method, Lewit and his coworkers not only find that, as expected, teenage smoking participation falls when cigarette prices rise, but also that teenagers' price responsiveness is relatively strong, compared to adults' behavior. Estimates of the price elasticity of smoking participation among younger teenagers range from -0.76 to -1.20.[8] That is, a 10-percent increase in cigarette prices is predicted to reduce the smoking participation rate of younger teenagers by between 7.6 and 12.0 percent. By contrast, the same price increase is predicted (by Lewit and Coate) to reduce the participation rate of all adults (20 to 74) by 2.6 percent.

The larger teenage elasticity (in absolute value) was estimated on data from the late 1960s, while the smaller teenage elasticity is based on data from the mid and late 1970s. As discussed below, the smaller elasticity estimate might be preferred because it is derived from more recent data. Unfortunately, it has less statistical reliability than the larger elasticity estimate because the more recent samples are smaller.

Smoking participation (whether people smoke at all) responds more strongly to price, both studies find, than does the amount of daily cigarette consumption. In the 1981 study, Lewit found that for younger teenage smokers, the price elasticity of daily consumption equals -0.25: a 10-percent increase in cigarette prices is associated with a 2.5-percent decrease in the number of packs smoked per day. This response is quite modest, especially compared to the estimated 7.6- to 12-percent decrease in smoking participation that the same price increase is predicted to trigger.

[8]The estimate of -0.76 represents the central tendency of four estimates reported by Grossman based on the four National Surveys on Drug Abuse samples. Grossman excluded the highest and lowest estimates and averaged the remaining two.

Reliability of Estimates of Teenagers' Price Elasticity

Four factors provide support for the Lewit estimates of price elasticity of teenage smoking participation:

1. Teenage elasticity estimates conform to the pattern Lewit and Coate found in their study of adults: the younger the age group, the larger (in absolute value) its estimated elasticity. When cigarette prices change, young adult smokers respond considerably more than do older adult smokers (ages 26 and up). Likewise, teenagers are estimated to be more price sensitive than young adults; the teenage elasticity of -1.2 exceeds (in absolute value) the young adult elasticity of -0.74.

2. This pattern of younger individuals being more price responsive accords with the conventional concept of addiction: The addicted individual responds less to stimuli that would tend to divert a person from consuming the addictive commodity. Younger smokers, with less experience using cigarettes, would tend to be less addicted than older smokers.

3. Because the theoretical model for teenage smokers is so similar to Lewit and Coate's model for adults, confidence in the teenage model is enhanced when their adult model generates accurate forecasts. Specifically, the actual change in U.S. cigarette consumption between 1981 and 1988 is predicted very accurately by Lewit and Coate's estimate of the price elasticity of cigarette demand, given the actual change in cigarette prices over that period and assuming that nonprice determinants of smoking are unchanged.[9]

4. The estimates of the effects of noneconomic variables, such as student status and family characteristics, are consistent with the findings of clinical and epidemiological research.

The research on teenagers by Lewit and his colleagues also contains the following limitations:

- The data sets they used are by now 10 to 20 years out of date.
- Their model of cigarette demand did not reflect the addictive character of cigarettes.

We now consider critically each limitation.

[9]Per capita daily consumption of cigarettes for the U.S. population as a whole declined by about 20 percent between 1981 and 1988; the Lewit-Coate estimate of the price elasticity for cigarette consumption implied a drop of 23 percent—a rather accurate prediction. See Eugene M. Lewit, "U.S. Tobacco Taxes," photocopy, March 1989, pp. 19-20.

Age of Data

Major changes in public health campaigns and social attitudes toward smoking have occurred in the past two decades. Confidence that a specific estimate of price elasticity applies to teenagers in 1989 and the early 1990s would be greater if the estimate were based on survey data from the mid or late 1980s. Unfortunately, such estimates have not yet been made and would require a long, complex research effort. Although more recent data would probably result in different estimates of the teenage price elasticity, no clear presumption exists that estimates based on the surveys of today's teenagers would be drastically smaller than those based on older surveys.

Instead of being drastic, change affecting price responsiveness probably has been moderate, because two forces that tend to offset each other have been at work in recent decades. One tendency may have reduced teenage price responsiveness: Over the past 15 years, U.S. social norms have shifted against smoking, and public health campaigns have emphasized that smokers should quit. As a result, the pool of teenage smokers may contain only those individuals most resistant to new health information and social norms. These teenagers might also be least willing to change their behavior when prices rise.

During the same period, a second tendency may have strengthened teenage price responsiveness by altering the social and economic composition of teenage smokers. The fraction of middle and upper middle class youth that smoke is declining. Typical teenage smokers today are likely to belong to families with less income (relative to the median income) than the families of typical teenage smokers of 20 years ago.

This shift toward lower income youth becomes significant when the relationship of income and price responsiveness is considered. The larger the fraction of income devoted to a particular commodity, the more price elastic that demand for the commodity tends to be. The lower incomes of the youth from poorer strata should make them more responsive to price changes. Therefore, the change in social composition of teenage smokers should make their smoking behavior more price elastic today than in the past—other things being equal. This effect has been found in British data.[10] Unfortunately, the lack of data on Americans prevents determining which of these conflicting social tendencies is dominant in the United States.

[10]J. Townsend, "Cigarette Tax and Social Class Patterns of Smoking," presented at the Fifth World Conference on Smoking and Health, Winnipeg, July 1983, cited in Warner, 1985, p. 100.

There are, however, indications that teens in the 1980s are responding as predicted by the model. That is, the high school senior smoking participation rate has decreased in this decade as prices have increased. Data for young adults show a similar pattern.

Teenage smoking participation should drop noticeably, according to the Lewit elasticity estimates, if cigarette prices increase and if other determinants are unchanged. Cigarette prices did increase substantially during the 1980s, partly in response to the 1983 cigarette excise tax increase contained in the Tax Equity and Fiscal Responsibility Act. However, the data do not allow confident assessment of the precise response of teenagers to these increases.

The information available to us, however, does permit us to obtain a rough picture of the contemporary response of all teenagers to higher cigarette prices between 1982 and 1987. The only available data on teen smoking behavior for the 1980s is on high school seniors who, however, may not be representative of all teens. More importantly, the data do not allow us to apportion the observed change in participation between the effect of price changes and the effect of changes in nonprice factors. Overall, the smoking participation rate of high school seniors decreased as prices increased, although the size of the decrease was less than the studies would have predicted.[11] The participation rate for young adults (age 20-24) declined by substantially more than predicted. Between 1983 and 1987, for example, their participation rate dropped by about 20 percent, compared to a predicted decline of about 10 percent.

Effect of Addiction on Elasticity

Economic models of addiction to which Lewit and his coauthors had access a decade ago were relatively rudimentary. Recently, though, a sophisticated "rational theory of addiction" has been developed by economists Gary Becker and Kevin Murphy.[12] Their theory may alter future analysis of cigarettes and other addictive commodities significantly, but nonetheless it does not seem to imply that Lewit's estimates of teenage price responsiveness are too high. In fact, empirical work

[11]Using Warner's elasticity estimate for older teens ages 18 to 19 during the period 1983 to 1987, we predict a 13-percent decline in teenagers' smoking participation rate, if all nonprice determinants of teenage smoking are unchanged. In fact, the smoking participation rate of high school seniors dropped from 21.2 percent to 18.7 percent—a 12-percent decline. The difference between the actual and the predicted for a longer period, 1982 to 1987, is larger. The predicted decrease is 27 percent; the actual was 11 percent.

[12]Gary S. Becker and Kevin M. Murphy, "A Theory of Rational Addiction," Journal of Political Economy, Vol. 96, No. 4, December 1988, pp. 675-700.

based on the new theory creates a presumption that, other things being equal, the true teenage price elasticity may be larger than Lewit estimated.

In explaining addictive activities such as smoking, Becker and Murphy incorporate into their theoretical model many features of addiction, such as the tendency of past consumption to stimulate current consumption.[13] Analyzing smoking data with a model of cigarette demand that reflected addiction surely would affect the estimates of the teenage elasticity. Perhaps more important, rational addiction models, when properly applied to teenage data, probably would yield estimates of price elasticities that exceed those of Lewit. This presumption is based on empirical research by Becker, Grossman, and Murphy, who applied a rational addiction model to aggregate, state data on cigarette consumption.[14] Their estimate of the price elasticity of cigarette consumption is smaller in the short run, compared with estimates from a conventional generic model, but larger in the long run. This result awaits confirmation from analysis of data on individual teenagers.

Overall, our review of the positive and negative factors influencing the reliability of the teenage elasticity estimates reinforces the conclusion of Lewit and his coworkers that teenage smokers respond substantially to changes in cigarette prices. The range of estimates, from -0.76 to -1.2, encompasses defensible values for the price elasticity of younger teenagers, ages 12 to 17. Given the concern that these estimates may not reflect teenage behavior in the 1980s and 1990s, however, and lacking definitive evidence on this issue, we think it prudent to be conservative. That suggests relying on the smaller (-0.76) estimate of price responsiveness.

[13]Frank Chaloupka, "An Economic Analysis of Addiction: The Case of Cigarette Smoking," pp. 32-38, presents results based on the Becker-Murphy model that contradict the Lewit finding: his long-run price elasticity for teenagers is very small (in absolute value). Chaloupka's research represents a pioneering attempt at applying the rational addiction theory to survey data on individual smokers. His work raises several technical questions, however, that suggest his teenage estimates be discounted. The technical concerns include the statistical imprecision of the estimates, the anomalous positive effect on cigarette consumption attributed to current cigarette prices in some model specifications, and the failure to confirm Becker, Grossman, and Murphy's finding that estimates from the generic model fall between the short-run and long-run elasticities from the rational addiction model.

[14]Becker, Grossman, and Murphy, "An Empirical Analysis of Cigarette Addiction."

A 20-Cent Tax Increase Is Likely to Result in 500,000 Fewer Teen Smokers

Lewit and his coauthors provided estimates of the teenage price elasticity, from which they concluded that increasing the cigarette excise tax would be an effective policy for reducing teenage smoking. They did not, however, analyze concrete policy proposals, such as doubling the cigarette excise tax.

Kenneth Warner, an economist and public health expert, carried out such an analysis in 1985 and produced the 800,000 estimate of the reduction in teenage smoking caused by higher cigarette taxes.[15] To generate his results, he followed the approach described earlier (see p. 20) and, for the critical teenage elasticity assumption, relied on the research of Lewit and his coauthors. Thus, he assumed a price elasticity of smoking participation of -1.2 for younger teenagers and -.97 for older teenagers. (To obtain the estimate for older teenagers, he averaged the Lewit and Coate estimate for young adults and the estimate for younger teenagers.)

Warner assumed a doubling of the cigarette excise tax that, given cigarette prices in 1984, represents a 15.1-percent increase in the real (inflation-adjusted) cigarette price.[16] To estimate the number of teenage smokers, he used Bureau of the Census estimates of the total teenage population, to which he applied estimates of the smoking participation rates of two teenage subgroups: for 12- to 17-year-olds, an estimate based on a 1982 household survey by the National Institute on Drug Abuse, and for 18- and 19-year-olds, an estimate based on a 1984 NIDA survey of high school seniors' drug use.

Finally, Warner assumed that increases in the federal cigarette excise tax will be passed on, cent for cent, in higher cigarette prices. Economic theory and evidence suggest that this is, at the very least, a good first approximation. The burden of higher excise taxes does not appear to fall on cigarette companies but on smokers, through higher prices.[17]

The data used in Warner's calculations are shown in table II.2. He predicts a change of -594,000 for the younger teenagers and a change of

[15]Warner, "Consumption Impacts . . . ," p. 94.

[16]He calculates the increase as a percentage of the mean of the pre- and post-tax induced prices.

[17]Lewit, "Tobacco Excise Taxation," p. 25, reviews and assesses the relevant literature. Warner, "Smoking and Health ....," p. 1030, discusses possible qualifications to the "full pass-through" generalization described in this report. Yoram Barzel, "An Alternative Approach to the Analysis of Taxation," Journal of Political Economy, Dec. 1976, Vol. 84, No. 6, pp. 1177-1198, provides evidence that cigarette prices have risen more than proportionately in response to recent increases in excise taxes.

-231,000 for the older teenagers. The larger reduction for younger teenagers reflects both their greater price responsiveness and the larger size of that group. These calculations form the basis of Warner's estimate that about 800,000 fewer teenagers would smoke if the cigarette excise tax were increased by about 20 cents per pack (given 1989 prices).

Table II.2: Data Used in Deriving 800,000 Estimate

Age group	Number of smokers (millions)	Cigarette price change	Price elasticity	Change in smokers
12-17	3.279	15.1%	−1.20	−594,000
18-19	1.577	15.1%	−0.97[a]	−231,000

[a]Average of elasticities for 12-17 and 20-25-year-olds.

Source: Warner, 1985.

We can obtain different estimates of the reduction in the number of teenage smokers by altering Warner's assumptions. His use of the Lewit estimate of -1.20 for the younger teenagers' price elasticity is, in our opinion, the most plausible candidate for modification. If the smaller estimate of -0.76 (based on more recent data) were employed, the prediction for younger teenagers would be cut to roughly -375,000. If this adjustment were made, the prediction for older teenagers should be reduced to about -175,000. (That prediction is based on elasticity estimates of the same vintage as the alternative estimate for younger teenagers.) Consequently, use of the alternative estimates for younger teenagers (-375,000) and older teenagers (-175,000) yields an alternative total change in teenage smokers of about -550,000.[18] (There would still be, however, more than 3 million teen smokers.) This estimate assumes Warner's teenage population size and participation rates from the early and mid-1980s.

More recent data, of course, would change our estimate. Using Bureau of the Census estimates of the teenage population for 1987, combined with Warner's participation rates, we calculate changes of between -510,000 and -525,000 in the number of teenage smokers.[19] In light of these

[18]This implies a reduction of about 140,000 in the number of preventable deaths, assuming a one-to-four ratio of preventable deaths to smokers. See p. 19. The cigarette excise tax has other aspects that we did not examine. These include its regressivity and fairness. See the Tobacco Institute, The Tax Burden on Tobacco: Historical Compilation, Volume 23, 1988, p. iii, and the recent GAO report on tax policy (GAO/GGD-89-52), chapter 3.

[19]U.S. Bureau of the Census, Current Population Reports, P25, no. 1022, March 1988. Our 510,000 estimate assumes Warner's estimate for the 1982 younger teens' participation rate. Our 525,000 figure uses the 15.6-percent participation rate estimated for younger teens in 1985 (see p. 12); the calculation had to rely, like Warner, on his 1982 participation rate for older teenagers.

adjustments, we consider it reasonable to estimate that, given a 21-cent-per-pack increase in the excise tax, the number of teenage smokers would likely decline by over 500,000. This in turn implies an estimate of over 125,000 fewer preventable deaths.

Finally, Warner noted that the estimates apply to permanent changes in the real (inflation-adjusted) excise tax on cigarettes. For any reduction in teenage smoking to be sustained permanently, an increase in the real excise tax on cigarettes must itself be sustained permanently. If, however, the cigarette excise tax were increased by 16 cents per pack in one year but left unchanged thereafter, then a decade of 4-percent average annual inflation would cut the real value of the tax increase by about one-third. As a result, the initial effect of the tax increase on smoking would be eroded. This issue is not academic. The federal cigarette excise tax doubled in 1982, yet despite this increase, its real value (in 1988 dollars) fell from 31 cents per pack in 1964 to 15 cents in 1988.

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