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THE EFFECTS OF GOVERNMENT REGULATION ON TEENAGE SMOKING*

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SINCE the issuance of the first Surgeon General's Report on Smoking and Health in 1964,[1] the federal government has been involved in a sporadic campaign to discourage cigarette smoking. This campaign has consisted primarily of policies designed to increase public knowledge of the harmful effects of cigarette smoking and to restrict advertising by cigarette manufacturers. The major elements of this campaign have been the Fairness Doctrine of the Federal Communications Commission, which resulted in the airing of antismoking messages on radio and television from July 1, 1967, to January 1, 1971, and the Public Health Cigarette Smoking Act of 1970, which banned prosmoking cigarette advertising on radio and television after January 1, 1971.[2]

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[1] The 1964 surgeon general's report officially was entitled "Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service."

[2] Other federal government policies designed to discourage smoking included the requirement, beginning in July 1966, of a health warning in all cigarette advertising and on every package and the strengthening of this warning at the time of the imposition of the advertising ban in 1971. In addition, the Federal Trade Commission began monitoring the tar

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In 1968, the first full calendar year of antismoking messages, 1,300 antismoking messages were aired by the three major networks. In 1970, 1,560 messages were aired with a market value of $75 million, about one-third of the value of the prosmoking commercials.[3] The ban on broadcast cigarette advertising in 1971, however, greatly reduced the airing of antismoking messages, relegating them to the same status as other public service advertising. This has caused a number of observers to question the substitution of the broadcast advertising ban for the active antismoking campaign mounted under the Fairness Doctrine.[4]

In this paper we present the first set of estimates of the impact of the Fairness Doctrine and advertising ban policies on the demand for cigarettes by teenagers in the United States. In addition, we examine the extent to which an increase in the federal excise tax on cigarettes would reduce teenage smoking.[5] Excise tax changes are reflected in cigarette prices and comprise an additional public policy that influences cigarette demand.[6]

Previous evaluations of the effects of government policies to discourage smoking have examined the impact of these policies on per capita cigarette consumption.[7] Fluctuations in per capita cigarette consumption reflect

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and nicotine content of various brands of cigarettes in 1967. Subsequently, the cigarette industry voluntarily agreed to include the FTC measurements in all advertising. Finally, federal agencies have required the separation of smokers and nonsmokers on vehicles in interstate passenger transportation, and many state and local governments have required the provision of no smoking areas in public places.

[3] Irving Rimer, The Impact of Broadcasting, in Second World Conference on Smoking and Health (R. G. Richardson ed. 1972); Gideon Doran, The Smoking Paradox (1979).

[4] For example, James L. Hamilton, The Demand for Cigarettes: Advertising, the Health Scare, and the Cigarette Advertising Ban, 54 Rev. Econ. & Stat. 401 (1972); Doran, *supra* note 3; Kenneth E. Warner, The Effects of the Anti-Smoking Campaign on Cigarette Consumption, 67 Am. J. Pub. Health 645 (1977).

[5] Arguments for government intervention in the cigarette market are derived from the assumptions of externalities in consumption (the health of some persons enters the utility function of others); externalities in production (smoking by some may harm the health of others); lack of complete information about the health effects of smoking, particularly among youth; and moral hazard in the markets for life and health insurance (premiums paid by smokers do not fully reflect their higher probabilities of illness and death). In this paper we do not evaluate these assumptions.

[6] Although the federal excise tax on cigarettes has remained at eight cents per pack for the last twenty-five years, there have been several attempts to increase it in recent years because of the concern over the health effects of cigarette smoking. Moreover, there is evidence that some states increased their cigarette taxes as a result of the antismoking publicity that followed the issuance of the surgeon general's report in 1964. In 1965 there were twenty-three state and local cigarette tax increases compared with no more than a dozen in any of the preceding fourteen years. I. L. Kellner, The American Cigarette Industry: A Reexamination (1973) (unpublished Ph.D. dissertation, New School for Social Research).

[7] Hamilton, *supra* note 4; Warner, *supra* note 4; Doran, *supra* note 3; Richard A. Ippolito, R. Dennis Murphy, & Donald Sant, Consumer Responses to Cigarette Health Information (FTC, Bureau Econ. Staff Report, 1979).

primarily changes in adult smoking participation rates and in the average amount of cigarettes consumed by each adult smoker. Accordingly, these studies shed little light on the impact of these policies on teenage smoking. Yet, cigarette smoking is, in part, a habitual behavior that begins early in life. Therefore, changes in teenage smoking behavior in response to government regulatory actions can have a substantial and sustained impact on aggregate smoking in the long run.[8] Moreover, age at onset of smoking is negatively correlated with the amount smoked and the incidence of negative health effects.[9]

Recent trends in smoking participation rates of teenagers are presented in table 1. Comparable trends for the adult cohorts that comprise the parents of these teenagers are presented in table 2. Note that the percentage of teenagers who smoke increased between 1968 and 1970, and the percentage of girls who smoke rose between 1970 and 1974. On the other hand, the percentage of adults who smoke declined between 1966 and 1970 and between 1970 and 1975.[10] These trends underscore another reason for studying teenagers in the context of the antismoking campaign. Supporters of the advertising ban have pointed to the increase in teenage smoking rates between 1968 and 1970 as evidence that, whatever the impact of the Fairness Doctrine on aggregate cigarette consumption, the doctrine was not effective in the case of teenagers.[11] Ignored in this argu-

[8] Among adults who smoke, 95 percent began to smoke between the ages of twelve and twenty-one (Center for Disease Control and National Cancer Institute, Adult Use of Tobacco—1975 [1976]).

[9] For example, see E. Cuyler Hammond, Smoking in Relation to the Death Rates of 7 Million Men and Women (Nat'l Cancer Inst. Monograph No. 19, 1966); and Ippolito, Murphy, & Sant, *supra* note 7.

[10] The 1979 figures in table 1 reveal dramatic reductions in teenage smoking between 1974 and 1979. When the data are examined by age and sex, smoking participation rates for boys declined by almost 25 percent for twelve- to sixteen-year-olds and by 38 percent for seventeen- to eighteen-year-olds. For girls, participation rates between 1974 and 1979 increased slightly for those seventeen to eighteen years old and declined slightly for those twelve to fourteen years old. Smoking by girls ages fifteen to sixteen fell, however, by almost 42 percent after rising by almost 110 percent between 1968 and 1974. The extent to which these dramatic trend reversals and inconsistencies are due to sampling variability, an increase in underreporting over time, or other factors is not known. Teenage smoking rates from the U.S. National Surveys on Drug Abuse conducted by the National Institute on Drug Abuse (NIDA) in 1974, 1976, and 1977 suggest that smoking rates have not fallen as rapidly as the figures in table 1 suggest. The NIDA surveys also show that the rates tend to fluctuate somewhat from year to year. See Herbert I. Abelson, Patricia M. Fishburne, & Ira Cisin, The National Survey on Drug Abuse: 1977, Volume I, Main Findings (Nat'l Inst. on Drug Abuse, HEW Pub. No. [ADM] 78-618, 1977); Ira Cisin, Judith Miller, & Adele Harrell, Highlights from the National Survey on Drug Abuse: 1977 (HEW Pub. No. [ADM] 78-620, 1978).

[11] For example, Richard I. Evans, Smoking in Children: Developing a Social Psychological Strategy of Deterrence, 5 Preventive Medicine 122 (1976); Ellen R. Gritz, Smoking: The Prevention of Onset, in Research on Smoking Behavior (Murray E. Jarvik *et al.* eds.) (Nat'l Inst. on Drug Abuse Research Monograph 17, 1977).

TABLE 1
PERCENTAGE OF YOUTHS AGES TWELVE TO EIGHTEEN WHO ARE CURRENT REGULAR SMOKERS, 1968–79

Year	Both Sexes	Boys	Girls
1968	11.5	14.7	8.4
1970	15.2	18.5	11.9
1972	14.4	15.7	13.3
1974	15.6	15.8	15.3
1979	11.7	10.7	12.7

SOURCES.—Data are from the National Clearinghouse for Smoking and Health and National Institute of Education, as reported in Dorothy E. Green, Teenage Smoking: Immediate and Long-Term Patterns (1979).

ment is the important point that the Fairness Doctrine went into effect on July 1, 1967. Therefore, smoking rates in 1968 pertain to rates in the second half of the first year and first half of the second year of the doctrine. Thus, the data in table 1 do not allow one to compare teenage smoking in the period *before* the Fairness Doctrine to smoking *during* the doctrine.

Our empirical research in this paper is based on Cycle III of the U.S. Health Examination Survey (HES III). This is a national sample of 6,768 noninstitutionalized youths aged twelve to seventeen conducted in the period 1966–70.[12] Since one-third of the sample was interviewed before the period of the Fairness Doctrine (March 1, 1966–June 30, 1967), while two-thirds of the sample were interviewed during the period of the doctrine (July 1, 1967–March 31, 1970),[13] we are able to present the first

TABLE 2
PERCENTAGE OF ADULTS WHO ARE CURRENT REGULAR SMOKERS BY AGE AND SEX, 1966–75

	MALES			FEMALES		
YEAR	25–34	35–44	45–54	25–34	35–44	45–54
1966	59.9	59.0	53.8	45.1	40.6	42.0
1970	46.7	48.6	43.1	40.3	38.8	36.1
1975	43.9	47.1	41.1	35.4	36.4	32.8

SOURCES.—Data are from the National Clearinghouse for Smoking and Health, as reported in Jeffrey E. Harris, Cigarette Smoking in the United States, 1950–1978, in Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service (1979).

[12] A full description of the sample, the sampling technique, and the data collection is presented in Plan and Operation of a Health Examination Survey of U.S. Youths 12–17 Years of Age (National Center for Health Statistics, 1974).

[13] HES III ended after the first quarter of 1970. Hence it has no data on teenage smoking in the last three quarters of the last year of the Fairness Doctrine.

multivariate evaluation of the Fairness Doctrine on teenage smoking. In addition, since some of our estimated equations include the number of pro- and antismoking messages seen by each youth, we are able to make predictions about the potential impacts of the advertising ban.

Previous studies have examined the effects of the Fairness Doctrine and the advertising ban on per capita cigarette consumption in the context of time-series cigarette demand functions.[14] Hamilton, Warner, and Doran conclude that the Fairness Doctrine had a significant negative effect on per capita consumption. Hamilton and Doran also find that the advertising ban may actually have encouraged consumption because the airing of antismoking messages fell dramatically after 1970. On the other hand, Ippolito, Murphy, and Sant conclude that the effects reported in the other studies can be attributed solely to a lagged response to the surgeon general's report of 1964.[15]

Not only do these four time-series studies present conflicting conclusions regarding the effects of the Fairness Doctrine and the advertising ban, but their conclusions are somewhat suspect because in all the studies the Fairness Doctrine is modeled as a dichotomous variable. In addition, Warner and Ippolito, Murphy, and Sant exclude procigarette advertising in their empirical work. In this paper, we develop and include in our estimated demand functions a time series on the number of antismoking messages aired on television between the last half of 1967 and first quarter of 1970.[16] We also incorporate measures of procigarette advertising in our pooled time-series cross-section demand functions. Moreover, we focus on a group, teenagers, who might be most susceptible to both types of mass persuasion.

We also present the first estimates of the responsiveness of smoking by teenagers to variations in the price of cigarettes. This is possible because of cross-sectional differences in the price of cigarettes, primarily due to differences in state excise tax rates. Interstate variations in cigarette prices are substantial—retail cigarette prices are approximately 50 percent higher in the high-tax states than in the low-tax states (Tobacco Tax Council, various years).

As summarized by Lewit and Coate, estimates of the price elasticity of demand for cigarettes by adults range from $-.1$ to -1.5, with the best estimate being approximately $-.4$.[17] We investigate the price elasticity of

[14] Hamilton, *supra* note 4; Warner, *supra* note 4; Doran, *supra* note 3; and Ippolito, Murphy, & Sant, *supra* note 7.

[15] Warner does not consider explicitly the effect of the advertising ban.

[16] In research in progress, we are estimating time-series cigarette demand functions that include the number of antismoking messages aired on television between the last half of 1967 and 1979.

[17] Eugene M. Lewit & Douglas Coate, The Potential for Using Excise Taxes to Reduce

demand for cigarettes by teenagers, in part, because these previous estimates primarily reflect adult smoking behavior. Given the habitual nature of smoking, adult users, who almost always will have been users for longer periods of time than youths, might be much less sensitive to price than youths. In addition, bandwagon or peer effects (discussed in more detail below) are believed to be much more important in the case of youth smoking than in the case of adult smoking. As shown by Leibenstein, the presence of these effects increases the price elasticity of demand in absolute value.[18]

I. METHODOLOGY

To examine the effects of the price of cigarettes and the Fairness Doctrine on teenage smoking, we use Cycle III of the Health Examination Survey (HES III) to estimate demand functions for cigarette smoking by teenagers. The HES III is a random sample of 6,768 youths between the ages of twelve and seventeen that was conducted between March 1966 and March 1970 by the National Center for Health Statistics. It contains complete medical and health behavior histories of the youths provided by the youths and their parents, information on family socioeconomic characteristics, birth certificate information, a school report with data on school performance and classroom behavior provided by teachers and other school officials, scores on psychological (including IQ and achievement) tests, and objective measures of health from physical examinations. The physical examinations and the psychological tests were administered by the Public Health Service. Information on cigarette smoking was ob-

Smoking (Sept. 1980) (paper presented at annual meeting of Allied Social Science Ass'ns, Denver, Colo.).

[18] For a discussion of bandwagon effects, see Harvey Liebenstein, Bandwagon, Snob, and Veblen Effects in the Theory of Consumer Demand, 64 Q. J. Econ. 183 (1950). In addition, note that price effects are not unrelated to the antismoking campaign because price may be interpreted broadly to incorporate both the nominal price of cigarettes and the indirect cost of consuming them. The latter pertains to the perceived cost of the health hazards associated with smoking. Developments such as the antismoking campaign presumably raise the perceived cost. The interaction between the money price of a package of cigarettes (p) and the perceived cost of the health risks of smoking (z) in the demand function for cigarettes is highlighted by specifying the quantity smoked (y) as a function of the "full" price of cigarettes ($\pi = p + z$): $y = g(\pi) = g(p + z)$. Note that an increase in the perceived cost of smoking alters the elasticity of smoking with respect to money price, although the direction of the effect is ambiguous. For example, suppose that the elasticity of smoking with respect to full price is constant. Then $\ln y = \alpha - \epsilon \ln \pi$, $-(\partial \ln y/\partial \ln p) \equiv e = p(p + z)^{-1}\epsilon$; and $(\partial e/\partial z) = -p(p + z)^{-1}\epsilon$; and $(\partial e/\partial z) = -p(p + z)^{-2}\epsilon < 0$. On the other hand, if the demand function has a constant slope, rather than a constant elasticity, e rises in absolute value as z rises: $y = \beta - \beta_1\pi = \beta - \beta_1 p - \beta_1 z$, $e = \beta_1 p y^{-1}$, $(\partial e/\partial z) = -\beta_1 p y^{-2}(\partial y/\partial z) = \beta_1^2 p y^{-2} > 0$. If neither the slope nor the elasticity is constant, the impact of an increase in z on the money price elasticity is indeterminant.

tained directly from the youths as part of the health behavior questionnaire. Parents were not present during the interviews with the youths and were not informed about the smoking responses of their children.

Information on the date of the examination enables us to divide the sample into youths interviewed before the Fairness Doctrine and youths interviewed during the Fairness Doctrine. Information on the city and state of residence of each youth and on the date of the examination enables us to add a measure of the price of cigarettes to the data set. The resulting series incorporates variations in price due to variations in state and municipal excise and retail sales tax rates. It also incorporates variations in price due to trends over time between 1966 and 1970.

Within the context of the HES sample, the most general way to specify a demand function for smoking by teenagers is

$$y_{ijt} = a_0 + a_1 p_{jt} + a_2 d_{jt} + a_3 x_{ijt} + a_4 s_{ijt} + a_5 \bar{y}_{jt} + a_6 f_t + a_7 t + \epsilon_{ijt}. \quad (1)$$

The dependent variable in equation (1) can be either the amount smoked by the ith youth in the jth locality in period t or the probability that the youth smokes. The independent variables include two measures of the price of cigarettes: the actual retail price of cigarettes (p_{jt}) and the difference between the "own price" of cigarettes and the "low price" (d_{jt}), which is described below. Additional independent variables are a vector of family and youth characteristics (x_{ijt}) such as family income, family size, mother's labor force status, absence of father from the household, parents' schooling, age of youth, sex of youth, and race of youth; parents' smoking (s_{ijt}); the mean smoking participation rate or the mean quantity smoked by all youths in the jth locality ($\bar{y}_{jt}$); a vector of variables pertaining to the Fairness Doctrine (f_t); time (t); and a random disturbance term (ϵ_{ijt}).

The definition and measurement of the variables in equation (1) are discussed in the next section. Here we make a few general comments on the roles of certain variables. Lewit and Coate have pointed out that difficulties arise in defining the relevant measure of the price of cigarettes in a cross section because smokers in a high-price area might purchase cigarettes in border areas with lower prices.[19] This phenomenon arises because cross-sectional variations in cigarette prices reflect primarily variations in state and municipal excise and sales taxes. To deal with this problem, we have added two price series to the HES: own price (price in city and state of residence) and low price.[20] If a youth lives within twenty

[19] Lewit & Coate, *supra* note 17.

[20] The low-price border area may lie within the state of residence because cigarettes are

miles of a lower-price area, low price equals the price in that area. If a youth does not reside within twenty miles of such a border area, low price is set equal to own price.

The incentive to travel to lower-price border areas to buy cigarettes is greater the greater is the difference between own price and low price. Therefore, the most flexible method to control for the border phenomenon (out-of-area purchases) is to enter own price and the difference between own and low price as separate independent variables in the demand functions. With the own-area price held constant, an increase in the price differential reflects a reduction in the border-area price and should cause cigarette smoking to increase. Note that the twenty-mile distance is selected to compute the low price of cigarettes because the purchase of cigarettes within twenty miles of residence is likely to be incidental to the purpose of travel. Although the incentive to make purchases or to have friends or fellow employees make purchases is positively related to the difference between own price and low price, the lack of direct data on travel costs presents no problem if purchases of cigarettes are incidental to the main purpose of the trip.

Although Lewit and Coate find that the border phenomenon is an important consideration in estimating the price elasticity of demand for adult smokers,[21] there is less reason to believe that it presents a problem in the case of teenagers. This is because the quantity of cigarettes smoked by teenagers generally is very small, so that the incentive to search for low-priced cigarettes is reduced. Moreover, the amount of incidental travel by teenagers in the HES sample is likely to be small because most of them are below minimum legal driving ages. In our estimated equations, however, we enter both own price and the difference between own and low price to minimize measurement error problems and determine empirically the importance of border crossing by teenagers.

Both time (t) and specific variables pertaining to the Fairness Doctrine, such as the number of antismoking messages aired on television in a given year (f_t), enter the demand function. This is because there may be underlying trends in teenage smoking that are unrelated to the Fairness Doctrine. In practice, since the HES spans a short period of time, these underlying trends cannot be estimated and t must be omitted from the equation. This means that the impact of the Fairness Doctrine variables

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subject to municipal excise taxes and municipal retail sales taxes at different rates (some zero) within the same state. All of these are included in the own- and low-price variables.

[21] Lewit & Coate, *supra* note 17. For a similar finding in the context of alcohol consumption, see Rodney T. Smith, The Legal and Illegal Markets for Taxed Goods: Pure Theory and an Application to State Government Taxation of Distilled Spirits, 19 J. Law & Econ. 393 (1976).

may reflect in part developments not related to the doctrine. Given the plausible assumption of an underlying upward trend, the omission of time biases the coefficients of the Fairness Doctrine variables toward zero.[22]

The main empirical regularity in youth smoking research by sociologists and psychologists is that youths are more likely to smoke if their parents, siblings, and peers also smoke.[23] Hence, the demand curve for youth smoking is subject to "bandwagon effects," to use the term coined by Leibenstein.[24] An alternative explanation of these effects is that youths obtain cigarettes "free of charge" or at reduced rates from their parents, older silbings, and peers.

In the demand function specified by equation (1), the mean smoking rate in the locality ($\bar{y}_{jt}$) is a proxy for sibling and peer smoking. We refer to it as the "smoking environment" of a particular youth and treat its impact in the context of a well-known model of externalities in consumption.[25] To be specific, aggregation of equation (1) over the n_j youths in the jth locality yields

$$\begin{aligned}\bar{y}_{jt} = {} & \left(\frac{a_0}{1-a_5}\right) + \left(\frac{a_1}{1-a_5}\right) p_{jt} + \left(\frac{a_2}{1-a_5}\right) d_{jt} \\ & + \left(\frac{a_3}{1-a_5}\right) \bar{x}_{jt} + \left(\frac{a_4}{1-a_5}\right) \bar{s}_{jt} + \left(\frac{a_6}{1-a_5}\right) f_t \\ & + \left(\frac{a_7}{1-a_5}\right) t + \left(\frac{1}{1-a_5}\right) \bar{\epsilon}_{jt},\end{aligned} \tag{2}$$

where bars over variables denote means.

Equation (1) is a structural demand function, while equation (2) is a reduced form. Since a_5 is assumed to be positive and smaller than one, the absolute value of a given reduced-form coefficient exceeds the absolute value of the corresponding structural coefficient.[26] Clearly, the reduced-

[22] Smoking participation by adult males increased dramatically during World War II. The diffusion of the smoking habit among females has lagged behind that of males. Between 1955 and 1966, smoking rates of males who were eligible for military service in World War II declined. On the other hand, smoking rates by females in the same age cohorts as these males increased. Jeffrey E. Harris, Cigarette Smoking in the United States, 1950–1978, in Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service (1979).

[23] See, for example, Joseph D. Matarazzo & Ruth G. Matarazzo, Smoking, in Int'l Encyclopedia of Soc. Sci. 335 (1968); Richard R. Lanese, Franklin R. Banks, & Martin D. Keller, Smoking Behavior in a Teenage Population: A Multivariate Conceptual Approach, 62 Am. J. Pub. Health 807 (1972); Dorothy E. Green, Teenage Smoking: Immediate and Long-Term Patterns (1979) (prepared for Nat'l Inst. of Education).

[24] Leibenstein, *supra* note 18.

[25] *Id.*; and Gary S. Becker, Economic Theory (1971).

[26] If a_5 exceeds one, cigarette smoking is a bandwagon good with an upward-sloping

form coefficients are more relevant than the structural coefficients in assessing the impact on youth smoking of price and the Fairness Doctrine. Since we have no independent measure of $\bar{y}_{jt}$, we estimate equation (1) with this variable omitted. We interpret the resulting coefficients as reduced-form effects.[27]

In addition to omitting $\bar{y}_{jt}$ from equation (1), we omit parents' smoking because there is no information on this variable in the data. If parents' smoking has no trend, its exclusion presents no problems. As in the case of peer smoking, the coefficients of the price and Fairness Doctrine variables in the teenage demand function can be interpreted as reduced-form effects. Put differently, a policy to curb youth smoking by raising the federal excise tax rate on cigarettes would raise the price of cigarettes paid by youths and their parents, which would discourage smoking by both groups. Therefore, in evaluating the impact of such a policy, parents' smoking should not be held constant (included in the regression).

The situation is somewhat different if there is a trend in parents' smoking. To see this, write the parents' demand function as

$$s_{ijt} = b_0 + b_1 p_{jt} + b_2 d_{jt} + b_3 z_{ijt} + b_4 f_t + b_5 t, \tag{3}$$

where z_{ijt} is a vector of parents' characteristics and the disturbance term is suppressed. Substitute equation (3) into equation (1) and ignore variables other than p_{jt}, f_t, and t:

$$\begin{aligned} y_{ijt} = {} & a_0 + (a_1 + b_1 a_4)\, p_{jt} + (a_6 + b_4 a_4) f_t \\ & + (a_7 + b_5 a_4) t. \end{aligned} \tag{4}$$

If equation (4) is fitted with t omitted, the parameter estimate of f_t is biased. But the direction of the bias is indeterminant if a_7 is positive while b_5 is negative. Given these signs, estimation problems may not be serious because biases due to the omission of time are mitigated by biases due to the omission of parents' smoking.

II. Empirical Implementation

Equation (1) with s_{ijt}, t, and $\bar{y}_{jt}$ omitted is estimated using Cycle III data for white or black youths who live with either both of their parents or with their mothers only. Youths of other races and from other kinds of families

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market demand curve. This is inconsistent with a stable equilibrium because the supply function is assumed to be infinitely elastic in the estimation procedure.

[27] Empirically, $\bar{y}_{jt}$ could be obtained by computing means for each sampling site in the HES. This procedure was not adopted because the means would be based on a small number of observations in a significant percentage of the sites. Essentially, with $\bar{y}_{jt}$ omitted, the coefficients of (1) can differ from those of (2) only in the sense that the solved and estimated-reduced form differ due to sampling variability.

TABLE 3
SAMPLE MEANS OF SELECTED VARIABLES

Variable	Total Sample (N = 5,308)	Before Fairness Doctrine (N = 1,814)	During Fairness Doctrine (N = 3,494)
SMOKEP	.131	.146	.124
QSMOKE	.068	.070	.067
PRICE	31.298	29.817	32.067
PDIF	.816	.809	.820
FAIR	.658	...	...
T1	.243	...	.369
T2	.252	...	.383
T3	.163	...	.248
TV	2.860	2.685	2.951
TV × FAIR	1.942	...	2.951
TV × T1	.698	...	1.061
TV × T2	.760	...	1.553
TV × T3	.484	...	.735
PROTV	212,889.514	200,605.088	219,267.290
ANTITV	2,127.631	...	3,309.724
ANTITVS	12,354,502.896	...	18,768,658.000
PRTVFAIR	144,333.065	...	219,267.290

are eliminated in order to produce a more homogeneous sample. The omitted observations account for a small percentage of the total sample. Observations are also deleted if there are missing data. The final sample size is 5,308. Table 3 contains means of the dependent and selected independent variables for the whole sample, for the sample interviewed before the Fairness Doctrine went into effect, and for the sample interviewed during the period of the Fairness Doctrine.

Two measures of smoking behavior are examined: whether or not the youth is a current smoker (SMOKEP) and the number of packs of cigarettes smoked per day (QSMOKE). Of these two measures, we believe that smoking participation is the more important. As indicated previously, most youthful smokers will remain smokers as adults, and age at onset of smoking is negatively correlated with the amount smoked in adulthood and the incidence of negative health effects. Smoking participation is a dichotomous variable that assumes the value of one for current smokers. The number of packs of cigarettes smoked per day assumes one of five possible values: 0, .25, .75, 1.50, or 2.50. In spite of this, the method of estimation is ordinary least squares. Previous research with the HES sample by Grossman revealed almost no differences between ordinary least-squares estimates and logit estimates obtained by the method of maximum likelihood.

Our smoking variables are obtained directly from youths. Because

youths may underreport their cigarette use,[28] our smoking measures may be inaccurate. If any such response error is uncorrelated with the independent variables in the demand function for cigarettes, coefficients will be unbiased, although their standard errors will be inflated. If all youths underreport smoking by a constant factor of proportionality, slope coefficients and their standard errors are biased downward by this factor, leaving statistical tests of significance and elasticities unaffected.

In the two models outlined above, the existence of response error essentially presents no problems for the statistical analysis. Response error only becomes a problem if it is systematic or correlated with some or all of the independent variables in the demand function. To be specific, Warner argues that underreporting has increased over time "due to increases in the perceived personal threat or social stigma associated with smoking."[29] Given this argument, one would expect reported teenage smoking rates to have fallen continuously during the period of the Fairness Doctrine. In fact, the trends in table 1 and our own empirical results presented in Section III indicate that this was not the case.

The Tax Burden on Tobacco, published by the Tobacco Tax Council, is the source for annual state-specific price series on cigarettes. Price is measured in cents per pack adjusted for municipal excise and retail sales taxes. The own price of cigarettes is deflated by a state- and time-specific cost-of-living index to obtain the own relative price of cigarettes (PRICE). Similarly, the difference between the own price and the low price is divided by the cost-of-living index to obtain the relative price difference (PDIF). The interstate price index was developed for the year 1967 by Fuchs, Michael, and Scott.[30] Cross-sectional price indexes for years covered by the HES other than 1967 are developed by assuming that year-to-year percentage changes for each state equal the year-to-year percentage change in the Bureau of Labor Statistics' Consumer Price Index for the United States as a whole.[31]

Family background characteristics included in the demand functions are real family income (money family income divided by the cost-of-living index), the number of persons in the household twenty years of age or less

[28] See, for example, Richard I. Evans, William B. Hansen, & Maurice B. Mittlemark, Increasing the Validity of Self-Reports of Smoking Behavior in Children, 62 J. Applied Psychology 521 (1977).

[29] Kenneth E. Warner, Possible Increases in the Underreporting of Cigarette Consumption, 73 J. Am. Stat. Ass'n 314 (1978).

[30] Victor R. Fuchs, Robert T. Michael, & Sharon R. Scott, A State Price Index (Nat'l Bureau Econ. Research Working Paper No. 320, Feb. 1979).

[31] Demand functions estimated with a cost-of-living index that varies over time but not among states (not shown) do not differ significantly from those presented in Section III.

(a proxy for the number of children in the family), mother's schooling, father's schooling, absence of father from the household,[32] whether or not the mother works full time, and whether or not the mother works part time. Youth characteristics included in the demand functions are age, race, sex, student status, whether the youth works for pay during the school year, the number of hours worked per week during the school year, whether or not the youth works part time during school vacations, whether or not the youth works full time during school vacations, whether or not the youth receives an allowance, region of residence, and size of place of residence.

Some of the above variables indicate the youth's command over real resources, others are determinants of parents' smoking, and others have been shown to be important determinants of youth smoking in studies by psychologists and sociologists.[33] It is important to control for region and size of place of residence because the HES is a nationally representative sample for the period 1966–70 but not for each year of this period. In addition, the inclusion of size of place of residence controls for cross-sectional differences in the cost of living that are not reflected in the state price index. We do not present or discuss the effects of parental and youth characteristics on youth smoking in Section III. But it should be realized that all estimated price and Fairness Doctrine effects control for (hold constant) the effects of these variables.[34]

A number of alternative specifications and variables are used to estimate the impacts of the Fairness Doctrine. The simplest specification is one with a dichotomous variable that identifies youths who were interviewed during the period of the doctrine (FAIR). A second specification distinguishes among four groups of youths: those interviewed during the first year of the Fairness Doctrine (T1 = 1), those interviewed during the second year of the doctrine (T2 = 1), those interviewed during the third

[32] For youths who are not currently living with their fathers, the father's schooling is coded at the race-specific mean of the sample for which the father's schooling is reported. Alternative coding schemes would alter the regression coefficient of absence of father but not alter the coefficients of the other independent variables.

[33] See, for example, Matarazzo & Matarazzo, *supra* note 23; Lanese, Banks, & Keller, *supra* note 23; and Green, *supra* note 23.

[34] In general, our findings with respect to the impacts of family and youth characteristics are consistent with those of other studies. In particular, smoking is negatively related to mother's and father's schooling and positively related to the number of persons in the family twenty years of age or less. Moreover, a youth is more likely to smoke and to smoke larger amounts if he is not a student, if he works during the school year, if he works during school vacations, if his mother works full time, and if his father is absent from the household. Boys smoke more than girls, whites smoke more than blacks, and older youths smoke more than younger youths. These results strengthen our confidence in the validity and reliability of the HES smoking measures.

year of the doctrine (T3 = 1), and those interviewed before the doctrine went into effect (the omitted category).[35]

Our other specifications capitalize in various ways on information on the number of hours per day that the youth reports he spends watching television (TV). Advertising on television was the main source of exposure of youths to cigarette advertising prior to the banning of such advertisements on January 1, 1971. Most other cigarette advertising occurs in the adult print media and via sample cigarettes. Youths have only limited exposure to these sources.

Based on time-series analysis, Hamilton, Schmalensee, and Doran have shown procigarette advertising to have at best a weak positive impact on per capita consumption of cigarettes in the aggregate.[36] These findings do not conflict with the contention of the cigarette industry that most advertising is directed toward interbrand competition and little at stimulating total consumption per se. It is reasonable to suppose, however, that procigarette advertising may have a different and perhaps larger effect on a youth who does not currently smoke or who has been experimenting with this behavior than it does on an adult. In particular, even if advertisements are directed toward interbrand competition, they may give youths the impression that smoking is an "attractive adult behavior." Presumably, the antismoking messages aired on television during the Fairness Doctrine, which stressed the health hazards posed by smoking, should work against the impact of procigarette advertising on teenage smoking.

To test the above notions, we estimate a multiple regression in which two of the independent variables are the amount of time spent watching television per day (TV) and the product of this variable and the Fairness Doctrine dummy (TV × FAIR). According to our hypotheses, the coefficient of TV should be positive, and the coefficient of TV × FAIR should be negative.[37] In a modification of this specification, TV × FAIR is replaced by interactions between TV and each of the three years of the Fairness Doctrine (TV × T1, TV × T2, TV × T3).

Our final specifications of the Fairness Doctrine combine the individual data on TV watching reported by each youth with aggregate time series on the number of prosmoking and antismoking messages aired on television for the years 1965–70. To be specific, let PRO be the number of pro-

[35] The first year of the Fairness Doctrine is July 1, 1967–June 30, 1968. The second year is July 1, 1968–June 30, 1969. The third year is July 1, 1969–March 31, 1970. Since the HES ended in March 1970, we have no data for the last quarter of the third year.

[36] Hamilton, *supra* note 4; Richard Schmalensee, The Economics of Advertising (1972); and Doran, *supra* note 3.

[37] It should be noted that the relationship between TV watching and smoking may reflect causality in both directions. In part, it also may reflect the role of omitted "third variables."

smoking messages aired on television in the twelve months preceding the data on which a given youth was interviewed. Similarly, let ANTI be the number of antismoking messages aired on television in the same twelve-month period.[38] Then we compute the product of PRO and TV (PROTV) and the product of ANTI and TV (ANTITV). These variables are proxies for the number of pro- or antismoking messages that a youth saw as opposed to the number aired. The rationale is that the ratio of messages seen to messages aired is positively related to the amount of time spent watching television. We estimate cigarette demand functions with PROTV and ANTITV as two of the independent variables. Nonlinear specifications are explored in which the square of ANTITV (ANTITVS) and the product of PROTV and the Fairness Doctrine dummy (PRTVFAIR) are included. These are discussed in more detail when the results are presented.

The time series on antismoking messages is taken from Rimer.[39] These are based on reports made by the three networks (NBC, ABC, and CBS) to the producers of the antismoking messages: the American Heart Association, the American Cancer Society, the American Lung Association, and the U.S. Public Health Service. Undeflated outlays on TV advertising by cigarette companies are taken from Doran.[40] This series is deflated by the median price (cost) of a twenty-second spot announcement on network owned and operated TV stations, which was obtained from Standard Rate and Data, Incorporated.

III. Results

Estimated effects of the responsiveness of teenage smoking to the price of cigarettes and to the Fairness Doctrine are discussed in this section. Before presenting the full set of estimates, we explore the appropriateness of our specification of the border phenomenon (the purchase of cigarettes at a price lower than the own locality price), which relies on the use of the difference between the own price and the low price (if it is positive) as an independent variable. Three alternative price effects from smoking par-

[38] Time series for PRO and ANTI are available on an annual rather than on a monthly basis. Therefore, if a youth was interviewed, for example, on April 1, 1966, PRO for that youth equals three-fourths of its 1965 value plus one-fourth of its 1966 value. A similar weighting scheme is used to compute ANTI. Clearly, ANTI equals zero for all youths who were interviewed before the Fairness Doctrine went into effect.

[39] Rimer, *supra* note 3.

[40] Doran, *supra* note 3, gives total outlays on TV and radio advertising by cigarette companies. We multiplied his series by the ratio of TV expenditures by all advertisers to the sum of TV and radio expenditures (Bureau of Census 1980). As indicated by the data, the same ratio for each year between 1965 and 1970 is appropriate.

TABLE 4
REGRESSION COEFFICIENTS OF THE PRICE OF CIGARETTES AND THE PRICE DIFFERENCE, ALTERNATIVE SPECIFICATIONS AND SAMPLES

VARIABLE	TOTAL SAMPLE (N = 5,308)		SAMPLE IN WHICH PDIF = 0 (N = 2,974)
	Regression 1	Regression 2	(Regression 3)
A. Smoking-participation regressions:			
PRICE	−.006	−.005	−.004
	(−4.60)	(−4.48)	(−2.87)
Elasticity at mean	−1.43	−1.19	−.97
PDIF	.004	...	...
	(1.14)	...	...
Adjusted R^2	.10357	.10352	.10639
B. Quantity-smoked regressions:			
PRICE	−.003	−.003	−.003
	(−3.74)	(−3.86)	(−2.83)
Elasticity at mean	−1.44	−1.44	−1.42
PDIF	.001	...	...
	(.28)	...	...
Adjusted R^2	.10623	.10639	.10187

NOTE.—t-ratios in parentheses. The critical t-ratios at the 5 percent level are 1.64 for a one-tailed test and 1.96 for a two-tailed test. The F-ratio associated with each regression (not shown) is statistically significant at the 1 percent level of significance.

ticipation regressions are presented in panel A of table 4. The corresponding price effects from quantity-smoked regressions are presented in panel B. Each regression includes all family and youth characteristics mentioned in Section II but excludes variables related to the Fairness Doctrine. Regression (1) includes the price difference (PDIF), while regression (2) omits it. Regression (3) is estimated using a subsample of youths in which the price difference is zero (the border price is either equal to or larger than the own price).

In all three specifications price elasticities at the mean are substantial; in most cases they exceed one in absolute value. Moreover, the elasticities in the table are the appropriate ones to use in evaluating the impacts of an increase in the federal excise tax on cigarettes or an increase in price due to an increase in input prices. In these situations the own price and the low price rise by the same amount, and the difference between them remains the same.[41]

[41] These are not the appropriate elasticities to use in evaluating the effect on teenage smoking of an increase in state or local excise taxes. In these cases, even a small increase in the local tax rate can result in a substantial increase in the price difference if border-area taxes are not also increased. As a result, some of the deterrent effects of a state or local tax

One explanation of the large price elasticities in table 4 is that they may incorporate income effects as well as substitution effects. We do hold constant real family income and proxies for the amount of discretionary income that a youth can spend on his own consumption, such as whether or not he works for pay. But in the absence of a perfect measure of a youth's real income, the estimated price effect is something other than a pure (utility-constant) price effect.

It should be noted that the price elasticity of the number of cigarettes smoked by youths who smoke is relatively small. Let Q be the quantity smoked by youths who smoke, and interpret smoking participation as the probability that a given youth smokes. Hence

$$\text{QSMOKE} = (\text{SMOKEP})\ (Q), \tag{5}$$

and

$$\frac{\partial \ln Q}{\partial \ln \text{PRICE}} = \frac{\partial \ln \text{QSMOKE}}{\partial \ln \text{PRICE}} - \frac{\partial \ln \text{SMOKEP}}{\partial \ln \text{PRICE}}. \tag{6}$$

The estimates of the elasticity on the left-hand side of the last equation are $-.01$ in regression (1), $-.25$ in regression (2), and $-.45$ in regression (3).

In all regressions the own relative price of cigarettes (PRICE) has a negative and statistically significant regression coefficient. The regression coefficient of the price difference has the anticipated positive sign, but it is not significant. The own price effects are stable across alternative specifications. They are identical in panel B and range from $-.004$ to $-.006$ in panel A. A principal message of table 4 is clear: the border phenomenon is not an important issue in the estimation of youth cigarette demand functions. This finding is consistent with the notions that youths are less mobile than adults and have less incentive to search for lower-priced cigarettes because youths typically smoke much less than adults.

Seven alternative regressions for assessing the impacts of the Fairness Doctrine on smoking participation are shown in table 5. The corresponding regressions for assessing the impacts of the doctrine on the quantity smoked are shown in table 6. The regression coefficients associated with the price of cigarettes and the price difference also are given. As in table 4, the regressions in tables 5 and 6 include all family and youth characteristics. An inspection of the price effects in the two new tables reveals that the conclusions reached with respect to these effects are not altered when the Fairness Doctrine variables are added to the regressions. In particu-

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increase may be mitigated. Of course, to predict the percentage reduction in cigarette consumption caused by a 1 percent increase in any excise tax, one has to know the share of the tax in total price as well as the price elasticity of demand.

TABLE 5
SELECTED COEFFICIENTS, SMOKING-PARTICIPATION REGRESSIONS, TOTAL SAMPLE

A. REGRESSIONS 1–4

	REGRESSION NUMBER			
VARIABLE	1	2	3	4
PRICE	−.005	−.005	−.005	−.005
	(−3.83)	(−3.86)	(−4.03)	(−3.92)
Elasticity at mean	−1.19	−1.19	−1.19	−1.19
PDIF	.002	.004	.003	.004
	(.72)	(1.12)	(.94)	(1.10)
FAIR	−.030	...	...	...
	(−2.76)			
T1	...	−.052	...	...
		(−3.59)		
T2	...	−.021	...	...
		(−1.52)		
T3	...	−.026	...	...
		(−1.61)		
TV	...	...	.011	.011
			(2.83)	(2.83)
TV × FAIR	...	...	−.008	...
			(−2.55)	
TV × T1	...	...	...	−.012
				(−2.75)
TV × T2	...	...	...	−.009
				(−2.17)
TV × T3	...	...	...	−.005
				(−1.01)
Adjusted R^2	.10470	.10525	.10479	.10487

B. REGRESSIONS 5–7

	REGRESSION NUMBER		
VARIABLE	5	6	7
PRICE	−.006	−.005	−.005
	(−4.55)	(−4.30)	(−3.96)
Elasticity at mean	−1.43	−1.19	−1.19
PDIF	.004	.003	.004
	(1.07)	(.88)	(1.06)
PROTV	.678D-07	.581D-07	.131D-06
	(1.56)	(1.32)	(2.48)
ANTITV	−.801D-06	−.816D-05	−.116D-06
	(−.45)	(−1.70)	(−.00)
ANTITVS	...	.931D-09	.411D-09
		(1.66)	(.69)
PRTVFAIR	...	...	−.153D-06
			(−2.48)
Adjusted R^2	.10364	.10394	.10481

NOTE.—See note to table 4.

TABLE 6
SELECTED COEFFICIENTS, QUANTITY-SMOKED REGRESSIONS, TOTAL SAMPLE

A. REGRESSIONS 1–4

	REGRESSION NUMBER			
VARIABLE	1	2	3	4
PRICE	−.003	−.003	−.003	−.003
	(−3.51)	(−3.63)	(−3.59)	(−3.60)
Elasticity at mean	−1.44	−1.44	−1.44	−1.44
PDIF	.005D-01	.002	.006D-01	.001
	(.19)	(.80)	(.24)	(.58)
FAIR	−.004	...	...	...
	(−.54)			
T1	...	−.026	...	...
		(−2.59)		
T2	...	.007	...	...
		(.74)		
T3	...	−.001	...	...
		(−.10)		
TV	...	...	.005D-01	.006D-01
			(.18)	(.22)
TV × FAIR	...	...	−.008D-01	...
			(−.34)	
TV × T1	...	...	...	−.005
				(−1.72)
TV × T2	...	...	...	.007D-01
				(.08)
TV × T3	...	...	...	.001
				(.39)
Adjusted R^2	.10611	.10771	.10591	.10651

B. REGRESSIONS 5–7

	REGRESSION NUMBER		
VARIABLE	5	6	7
PRICE	−.003	−.003	−.003
	(−3.87)	(−3.82)	(−3.59)
Elasticity at mean	−1.44	−1.44	−1.44
PDIF	.001	.001	.002
	(.51)	(.49)	(.61)
PROTV	−.002D-05	−.002D-05	.001D-05
	(−.72)	(−.74)	(.30)
ANTITV	.002D-03	.001D-03	.005D-03
	(1.34)	(.36)	(1.21)
ANTITVS	...	.006D-08	−.002D-07
		(.16)	(−.42)
PRTVFAIR	...	...	−.007D-05
			(−1.63)
Adjusted R^2	.10621	.10604	.10632

NOTE.—See note to table 4.

lar, the own price coefficients are negative and significant, while the price-difference coefficients are positive and not significant. In addition, elasticities at the mean always exceed one. The smoking participation elasticity of approximately -1.20 is nearly five times larger than the implied elasticity of quantity smoked by those who smoke of $-.25$.

An overview of the impacts of the Fairness Doctrine in the seven alternative specifications indicates that, whatever the impacts of the doctrine on smoking participation, it has little or no impact on the quantity smoked. For this reason and because of the importance of smoking participation as a behavioral variable, we focus on the results of table 5 in the remainder of this section.

In regression (1), the coefficient of the dichotomous variable that identifies youths who were interviewed during the period of the Fairness Doctrine (FAIR) is negative and significant. It indicates that during the period of the doctrine the teenage smoking rate was 3.0 percentage points smaller than in the sixteen-month period prior to the doctrine (March 1966–June 1967). Time trends in smoking participation during the Fairness Doctrine period itself are explored in regression (2). As shown by the coefficient of T1, the smoking rate fell by 5.2 percentage points during the first year of the doctrine. The rate rose by 3.1 percentage points in the second year (given by the difference between the coefficient of T2 and that of T1) and declined by .5 percentage points in the third year relative to the second (the coefficient of T3 minus that of T2).

Clearly, the above findings suggest that the Fairness Doctrine had its largest impact in the first year of its existence. Put differently, the introduction of the doctrine represented a "shock" to the underlying upward trend in teenage smoking in the mid-1960s and early 1970s. But by the second year of the doctrine, the trend factor began to dominate the shock. This scenario mirrors the shocks to aggregate time trends in smoking due to antismoking developments that are modeled and estimated by Ippolito, Murphy, and Sant[42] and by Lewit, Coate, and Grossman (in progress). The decline in smoking participation in the first year of the Fairness Doctrine is dramatic evidence that smoking behavior can change drastically when the rate of change in antismoking information is extremely large. The coefficients of T2 and T3 indicate that the impact of antismoking messages is subject to diminishing returns. For teenagers, the effects of the doctrine in its second and third years are dominated by the trend.[43]

[42] Ippolito, Murphy, & Sant, *supra* note 7.

[43] The above findings are inconsistent with the hypothesis of a continuous downward trend in teenage smoking during the Fairness Doctrine period due to an upward trend in underreporting.

Our findings also are consistent with trends in teenage smoking in the surveys conducted by the National Clearinghouse for Smoking and Health (NCSH) that are shown in table 1. According to the NCSH surveys, the teenage smoking rate rose by 3.7 percentage points between 1968 and 1970. According to regression (2), the teenage smoking rate rose by 2.6 percentage points between the first and third years of the Fairness Doctrine (the coefficient of T3 minus that of T1). The two estimates differ because the NCSH survey includes eighteen-year-olds, because our estimate controls for variables that may have changed between 1968 and 1970, and because the two time periods (1968 and 1970 versus the first and third years of the Fairness Doctrine) are not exactly the same. It is important to note that the increase in teenage smoking between 1968 and 1970 or between the first and third years of the Fairness Doctrine does not indicate that the antismoking messages failed to discourage smoking by teenagers, as claimed by the proponents of the advertising ban.[44] Based on our first regression, teenage smoking was 3.0 percentage points smaller during the Fairness Doctrine than it was in the sixteen months prior to the doctrine. Based on the second regression, the doctrine was associated with a 3.4 percentage point reduction in smoking.[45]

The five additional regressions in table 5 try to identify mechanisms via which the Fairness Doctrine reduced teenage smoking. In regression (3) the number of hours per week spent watching television (TV) has a positive and significant impact on the probability of smoking. On the other hand, the interaction between TV watching and the Fairness Doctrine dummy variable has a negative and significant impact on this probability. Although TV watching has a positive impact on the probability of smoking during the Fairness Doctrine period (given by the sum of the coefficients of TV and TV $\times$ FAIR), the effect is much weaker than in the predoctrine period. To be specific, a one hour per week increase in TV watching raises the smoking probability by 1.1 percentage points in the predoctrine period. The comparable increase in the during period is .3 percentage points. The weaker effect in the latter period reflects the presence of antismoking messages on TV. The effect is positive rather than negative, in part, because the number of prosmoking messages exceeded the number of antismoking messages throughout the period of the Fairness Doctrine.

In regression (4), we model the initial shock and diminishing effect process by interacting TV with each of the three years of the Fairness

[44] Evans, *supra* note 11; and Gritz, *supra* note 11.

[45] This is a weighted average of the coefficients of T1, T2, and T3. The weights are the number of youths interviewed in each year of the Fairness Doctrine relative to all youths interviewed during the period of the doctrine.

Doctrine (TV × T1, TV × T2, TV × T3). The coefficients of all these interactions are negative and, for the first two periods, significant. Moreover, an increase in TV watching has a slight negative effect on the probability of smoking in the first year of the Fairness Doctrine.

In regressions (5), (6), and (7), the proxies for the number of pro- and antismoking messages seen are entered (PROTV and ANTITV).[46] In regression (5) the coefficient of PROTV has the anticipated positive sign, and the coefficient of ANTITV has the anticipated negative sign. Neither coefficient, however, is statistically significant. In the sixth regression we include the square of ANTITV (ANTITVS) as an additional independent variable. This is an attempt to capture elements of a model with an initial shock followed by a diminishing effect. It is particularly important to allow the number of antismoking messages aired to have a nonlinear effect because both TV watching and the number of messages aired rose throughout the period of the Fairness Doctrine. The finding that the coefficient of ANTITV is negative and significant, while the coefficient of ANTITVS is positive and significant, is consistent with the hypothesized diminishing effect of antismoking messages. The model is refined further in regression (7) by allowing procigarette advertising to have a different effect in the Fairness Doctrine period than in the predoctrine period.[47] Consistent with a priori notions, the coefficient of PROTV is positive and significant, while that of the interaction between PROTV and the Fairness Doctrine dummy (PRTVFAIR) is negative and significant. The coefficients of ANTITV and ANTITVS have the appropriate signs but are not significant.

Clearly, the four measures of pro- and antismoking messages seen in regression (7) are highly correlated. One cannot expect all four variables to achieve statistical significance. The finding that all three have the appropriate signs in regression (6) and all four have the appropriate signs in regression (7) is consistent with our expectations.

Panel A of table 7 summarizes the implied impacts of the Fairness Doctrine on teenage smoking participation rates from each of the seven regressions in table 5. The procedure simply is to predict smoking participation in the periods before and during the doctrine based on the

[46] Regressions (5), (6), and (7) do not allow for cumulative or lagged antismoking effects, except to the extent that current TV watching probably is positively related to prior TV watching. We do not try to "tease out" lagged effects, in part because we have a very short time series and because we do not believe them to be important in the case of teenage smokers. In Lewit, Coate, & Grossman (in progress) we do allow for lagged responses to antismoking messages in the aggregate population of smokers.

[47] In regressions not shown, we allowed for a diminishing proadvertising effect by including the square of PROTV as an independent variable. There was no evidence of a nonlinear effect.

TABLE 7
PERCENTAGE-POINT IMPACTS OF THE FAIRNESS DOCTRINE AND THE ADVERTISING BAN ON TEENAGE SMOKING PARTICIPATION RATES

REGRESSION NUMBER						
1	2	3	4	5	6	7
A. Fairness Doctrine impacts:						
−3.0	−3.4	−2.1	−2.7	−.1	−.8	−2.4
B. Advertising ban impacts:						
...	...	−.9	−.2	−1.2	−.4	−.3
				(−2.0)	(−.6)	(.0)

regression coefficients and on the mean values in each period of the Fairness Doctrine variables.[48] The computations reveal that we have specified a plausible mechanism by which the Fairness Doctrine reduced teenage smoking. In particular, regressions (3), (4), and (7) account for between 2.1 percentage points and 2.7 percentage points of the 3.0–3.4-percentage-point reduction predicted by the simple trend equations [regressions (1) and (2)]. Note that equation (4) does a better job of explaining the trend than those that enter the proxy for antismoking messages seen and allow it to have a diminishing effect. We believe that this is because even the nonlinear specification does not fully capture the initial shock caused by the messages.

Panel B of table 7 contains the predicted impact of the advertising ban on further changes in teenage smoking from regressions (3)–(7). In the first two predictions, it is assumed that the effects of TV watching disappear after the end of the Fairness Doctrine. In the last three predictions, it is assumed that the number of antismoking messages aired falls to zero after the end of the doctrine. Although the antismoking messages did not disappear entirely after 1970, the number aired declined by almost 80 percent relative to the number aired in 1969. Moreover, in the postdoctrine period many of the messages were aired at times when youths are extremely unlikely to be viewing television.[49] The figures in parentheses show how the last three estimates are altered when the number of antismoking messages aired during the ban equals 20 percent of the 1969 value.[50] The predicted declines in teenage smoking after the end of the

[48] Consider regression (3): $\text{SMOKEP} = a_0 + a_1\text{TV} + a_2(\text{TV} \times \text{FAIR})$. Then $\text{SMOKEP}_D - \text{SMOKEP}_B = (a_1 + a_2)\,\overline{\text{TV}}_D - a_1\overline{\text{TV}}_B$, where the subscripts D and B denote the periods during and before the doctrine and bars over variables denote means.

[49] For reasons of confidentiality, we do not reveal the source of this information.

[50] These figures also incorporate an upward trend in TV watching due to an increase in the percentage of families with television sets.

Fairness Doctrine are modest. They suggest that the ban was not a particularly effective policy instrument to curtail teenage smoking in a post–Fairness Doctrine environment. Of course, since small declines in smoking rather than increases are shown in panel B, one can argue that the advertising ban was no worse a policy than the Fairness Doctrine. In particular, our extrapolations suggest that the ban should have discouraged teenage smoking. This is in contrast to the findings by Hamilton and Doran that the ban should have increased per capita cigarette consumption in the aggregate.[51] Our results differ from those of Hamilton and Doran in part because we include an explicit measure of exposure to antismoking messages in our regressions. Moreover, we focus on teenagers, whose responses to pro- and antismoking messages are likely to differ from adults' responses.

A full cost-benefit analysis of the Fairness Doctrine, the advertising ban, or an increase in the federal excise tax on cigarettes vis-à-vis teenage smoking is beyond the scope of this paper. Similarly, we cannot provide a definitive statement with regard to the relative merits of an active antismoking policy versus a policy of laissez-faire. But based on our results, we can highlight a number of policy-relevant facts and insights:

1. Teenage price elasticities of demand for cigarettes are large. The smoking participation elasticity equals -1.2, and the quantity smoked elasticity equals -1.4. This result is consistent with Lewit and Coate's finding that smoking by young adults ages twenty through twenty-four is much more responsive to price than smoking by older adults.[52] It follows that, if future reductions in youth smoking are desired, an increase in the federal excise tax is a potent policy to accomplish this goal. Such a policy may also be an effective way to curb the deterimental health effects of smoking in the long run without substantially harming the cigarette industry in the short run. Since youth and young adult price elasticities are much larger than adult price elasticities, while adult smokers account for the bulk of cigarette sales, a substantial excise tax increase would substantially reduce smoking participation by young new smokers but leave industry sales largely unchanged. Given the evidence that individuals are considerably less likely to initiate smoking after age twenty-five, it is quite possible that the cohort of young smokers who never began to smoke as a result of the tax increase would never become regular smokers. As a consequence, over a period of several decades, aggregate smoking and its associated detrimental health effects would decline substantially.

2. The contention of the proponents of the advertising ban that the

[51] Hamilton, *supra* note 4; Doran, *supra* note 3.

[52] Lewit & Coate, *supra* note 17.

Fairness Doctrine failed in the case of teenagers is incorrect. According to our results, the doctrine had a substantial negative impact on teenage smoking participation rates. We also have evidence that the mechanism at work was the responsiveness of teenagers to antismoking messages that stress the health hazards posed by smoking. This calls into question Evans's argument that teenagers are not sensitive to such messages.[53]

3. Between 1970 and 1974, smoking participation by teenagers rose by 0.4 percentage points (see table 1). Based on the computations in panel B of table 7 we predict a reduction of approximately 0.6 percentage points over this period due to the advertising ban.[54] Why did the percentage of teenagers who smoke rise rather than fall? The obvious answer is that our forecast assumes no changes in the determinants of teenage smoking except for variables related to the Fairness Doctrine. Smoking rates may have risen because an underlying upward trend in this behavior dominated developments related to the advertising ban. But there is a more obvious explanation. Between 1970 and 1974, the relative price of cigarettes declined by roughly 6 percent due to a rapid increase in the Consumer Price Index accompanied by no change in the federal excise tax rate. Our regression results suggest that this should have caused the smoking rate to rise by 1.0 percentage points. The net extrapolation, based on these two competing factors, is an increase of .4 percentage points, which coincides with the observed increase.[55]

4. As shown in table 1, the teenage smoking rate peaked in 1974; it declined from 15.6 percent in that year to 11.7 percent in 1979. It is still too early to explain the apparent reversal in trend or the differential trends for boys and girls.[56] It is plausible to hypothesize, however, that the trend reversal represents in part a lagged response to the downward trend in adult smoking participation rates reported in table 2.

[53] Evans, *supra* note 11.

[54] This figure is an average of six of the eight estimates in panel B of table 7. The smallest and largest figures are omitted from the average.

[55] Smoking rates also may have risen because of changes in family-background characteristics. For instance, the percentage of mothers who work full time and the percentage of youths who live with their mothers only rose. Rough computations suggest, however, that, given the sizes of the observed changes, their impacts on smoking were minimal. Moreover, there are factors that go in the other direction: family size fell and parents' schooling rose. Note also that the reduction in teenage smoking from 1970 to 1972 (see table 1) occurred in a period in which the relative price of cigarettes rose.

[56] In preliminary research, we find that the Fairness Doctrine variables have larger effects on smoking participation rates of boys than on smoking participation rates of girls.