

GOVERNMENTAL REGULATION OF  
CIGARETTE HEALTH INFORMATION\*

by

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## I. Introduction

Scientific evidence on the detrimental health effects connected with smoking goes back to the turn of the century.<sup>1</sup> Many systematic medical studies have been done since that time linking cigarette smoking to heart, lung and other diseases, and public awareness of this health information is generally believed to have increased dramatically over the past twenty five years. This awareness is generally associated with two widely publicized reports: a 1953 report by the American Cancer Society and the British Medical Research Council, which claimed that death rates were significantly higher for cigarette smokers than nonsmokers, and the 1964 U.S. Surgeon General's Report, which reviewed more than 11,000 scientific studies and concluded that cigarette smoking was causally related to lung cancer.

Governmental policy since 1964 supposedly has been designed to inform consumers about the health hazards associated with cigarette smoking and to discourage the consumption of cigarettes. Health warnings were required on cigarette packages in 1965. These warnings were strengthened in 1970 and extended to print advertising in 1972. In 1967 systematic testing of the "tar"

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<sup>1</sup>In the early 1900s some physicians claimed that cigarette consumption was a cause of pneumonia, tuberculosis, stillbirths, sterility and other maladies. Also in the early 1900s a study of 180,000 policyholders conducted by the New England Life Insurance Company found that during the same period 57 out of 100 nonusers of tobacco died, while 95 out of 100 users died. For a history of the antismoking movement in the United States see Susan Wagner, Cigarette Country, Praeger Publishers, 1971.

and nicotine deliveries of each cigarette brand was undertaken by the Federal Trade Commission and since 1971 cigarette companies have disclosed these figures in their advertising. In 1968 a ruling by the FCC required TV and radio stations under the Fairness Doctrine to air anticigarette commercials in a ratio of approximately one antismoking commercial for every four cigarette commercials broadcast. Finally, on January 1, 1971 Federal law banned all broadcast cigarette advertising.

The purpose of this study is to estimate the effects the 1953 and 1964 health information "shocks" had on the consumption of cigarettes over time and the effect the governmental regulation of advertising, namely the Fairness Doctrine and the ban, had on this informational process. Previous studies have generally concluded that the 1964 Surgeon General's Report produced a significant decrease in consumption while the 1953 health information generally did not produce any major permanent decrease.<sup>2</sup> These studies have on the other hand, not generally reached a conclusion regarding the effects on consumption of

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<sup>2</sup>The most systematic published empirical study is by Hamilton. He estimated a demand function over the 1926-70 time period and concluded (from his linear specification which he emphasizes) that the 1964 Surgeon General's Report reduced per capita consumption by 229 cigarettes per year, while the 1953 health information only decreased consumption by 37 cigarettes per year. (Actual consumption increased by 233 cigarettes per year during the 1930-70 period.) Warner (1977) in a 1947-70 study finds that the Surgeon General's Report decreased per capita consumption by almost 5 percent and that per capita consumption was reduced by 3 percent in 1953 and 8 percent in 1954 but that this effect trailed off to zero through the 1950s. Ippolito, Murphy and Sant (1979), over the 1925-75 period find a significant 3.5 percent per year secular decrease in per capita consumption in the post 1964 period and a once and for all 17.6 percent decrease in per capita consumption in the post 1953 period.

the Fairness Doctrine or the advertising ban.<sup>3</sup>

The results of these previous empirical studies are seriously flawed. We will demonstrate that the previous estimates of the health information and regulatory effects are based upon a cigarette demand function that is misspecified. When the major specification problems of the previous studies are corrected and an economically meaningful model of the cigarette demand function is estimated, significant negative effects on consumption are shown to be present in the post 1953 and post 1964 time periods. Of particular importance is the further result that the effect of the anticigarette advertising required by the Fairness Doctrine and the effect of the government imposed advertising ban are small when compared to this large "voluntary" consumer response to the information that cigarette smoking is unhealthful. In fact some suggestive evidence is presented that the advertising ban's effect on consumption is likely to have been positive. Governmental regulations of cigarette advertising is shown to have likely been counterproductive both in terms of promoting

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<sup>3</sup>For example, Hamilton finds the effect of the Fairness Doctrine to be significantly negative and predicts from this that the advertising ban, by simultaneously eliminating pro cigarette advertising (which has a very small positive aggregate effect, increasing per capita consumption only 76 cigarettes per year over the 1950-70 period) and anticigarette advertising (which had a strong negative effect, decreasing per capita consumption 507 cigarettes per year during 1968-70), would have a strong positive effect on cigarette consumption. Warner finds a strong negative effect of both the antismoking commercials and the ban, while Ippolito, et. al., finds both effects to be insignificant.

public health and more generally in terms of maximizing social welfare.

## II. Benchmark Results

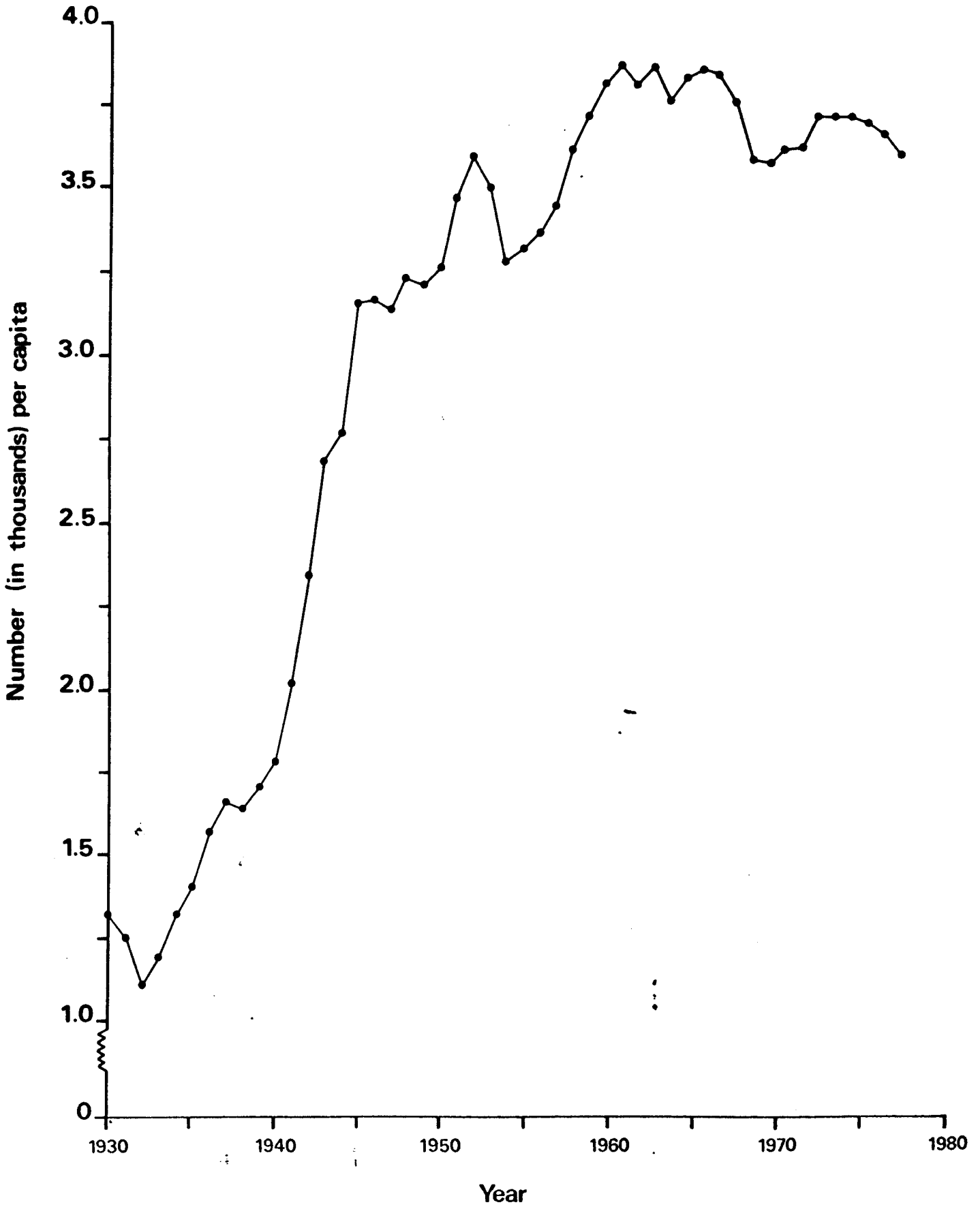
Figure 1 below plots U.S. per capita cigarette consumption for the period of our investigation, 1930-1978.<sup>4</sup> As we can readily observe, the period consists of a very sharp initial upward trend to a 1963 peak and then a gradual decline. Annual per capita consumption in 1963 is at a rate of more than 2 1/2 times its 1930 level. Per capita consumption then begins to fall and by 1978 is seven percent below the peak, or at approximately the same rate as in 1958. In somewhat more detail, during the recent period a peak in per capita consumption in 1952 was followed by a sharp drop in consumption for 1953-54, a resumption in the upward trend to the ultimate peak in 1963,

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<sup>4</sup>Although data is available for the 1925-1978 period, we begin our regression in 1930 in order to construct a reasonably accurate advertising stock variable for our initial year. The potential cigarette smoking population is assumed to be all individuals greater than or equal to 14 years of age. Other researchers have used this or slightly higher or lower cutoff age points. We obtained very similar results with alternative ages and with a "weighted" smoking population variable, constructed by weighting different age groups by the probability that an individual in the particular age group would be a smoker. The probabilities were obtained from two 1970 cross-sectional studies of smoking behavior, Adult Use of Tobacco, 1970, U.S. Department of HEW, and Teenage Smoking: National Patterns of Cigarette Smoking, Ages 12 through 18 in 1968 and 1970, U.S. Department of HEW. Since the age at which individuals start to smoke appears to have declined secularly, this constant weighting procedure is misleading. Taking account of the secular decline would raise the effective population in the later period compared with the earlier period and increase the recent decline in per capita consumption exhibited by our series.

Figure 1

U.S. Per Capita Cigarette Consumption, 1930-1978



Source: Tobacco Situation

a sharp drop in 1964, a very gradual rise to 1967, a sharp drop again in 1968-69, a leveling off during 1970-72, a rise in 1973, and a gradual decline since 1974.

Perhaps the most useful point at which to begin is by considering the simple demand function reported in equation (1) that was estimated over the 1930-70 time period before the advertising ban was instituted.<sup>5</sup>

$$\begin{aligned} (1) \quad \log C = & 2.116 + 1.289 \log y - .724 \log P + .032 \log A \\ & (1.41) \quad (17.7) \quad (2.38) \quad (0.33) \\ & - .114 D_F + .038 D_{53} - .115 D_{64} \quad R^2 = .960 \\ & (1.84) \quad (0.50) \quad (1.71) \quad D.W. = 0.67 \end{aligned}$$

where C is the per capita consumption of cigarettes series plotted in Figure 1, y is real per capita income, P is the real retail price of cigarettes, A is the advertising stock, where real advertising flows are assumed to have an annual retention rate of .67,<sup>6</sup> D<sub>F</sub> is a dummy variable for the Fairness

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<sup>5</sup>In order to estimate just a cigarette demand function rather than a supply-demand system we implicitly are assuming a horizontal (perfectly elastic supply curve) at the current price and independent stochastic components in the supply and demand equations.

<sup>6</sup>We experimented with alternative depreciation rates and found very similar results within a wide range of depreciation rates. Clarke (1976) reports the depreciation rates on cigarette advertising obtained in five previous studies of cigarette consumption. The depreciation rates on industry advertising range from .86 to .11. Based on a review of many studies, not only of cigarette advertising, Weiss (1969) considered a depreciation rate for advertising capital of .33, a reasonable estimate.



Doctrine period, 7/1/67-12/31/70, standardized annually for the estimated quantity of anticigarette advertising during the period,<sup>7</sup> and  $D_{53}$  and  $D_{64}$  are two dummy variables representing health information events that occurred in 1953 and 1964 which are generally assumed to have permanently lowered consumption. The number in parentheses under each estimated coefficient is the absolute value of the t-statistic.

The results reported in equation (1) appear superficially plausible. The price elasticity of demand is similar to that found in previous studies.<sup>8</sup> The insignificance of the advertising stock should not be too disturbing since previous theoretical and empirical results indicate that most of a firm's advertising expenditure affects the distribution of sales between firms

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<sup>7</sup>The annual values of this variable were determined by the fraction each year anticigarette commercials were of the average annual rate that such commercials were aired during the Fairness Doctrine period. Therefore, it represents a dummy variable for the effect of the average amount of antismoking commercials during the Fairness Doctrine period. Since it assumes that antismoking commercials are zero before and after the Fairness Doctrine period, it overstates the effects of these commercials.

<sup>8</sup>Ippolito, et. al., estimated a price elasticity of  $-.811$ . James Hamilton used an extraneous estimate of  $-.511$  obtained from a cross-sectional study of cigarette demand by Lyon and Simon, and Warner used the same extraneous estimate.

and not total demand.<sup>9</sup> In addition, the insignificance of the 1953 health event and the negative impact of the 1964 Surgeon General's Report and the anticigarette advertising campaign are not surprising. What is particularly surprising is the extremely large value for the estimated income elasticity of demand for cigarettes. The idea that cigarettes are a luxury good conflicts dramatically with current perceptions and previous estimates.<sup>10</sup>

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<sup>9</sup> In several empirical studies of the aggregate demand for cigarettes, cigarette advertising has not been included as an explanatory variable in the demand function. (See, for example, the studies by Sacknin (1962), Houthakker and Taylor (1970), Atkinson and Skegg (1973), and Ippolito (1979)). Schmalensee (1972) after estimating over 70 industry demand functions for the period 1956-67, concluded that his results were not strong enough to allow him to state that aggregate advertising has any effect on aggregate demand. Hamilton also found the effect of advertising on aggregate demand to be insignificant.

Many studies have found that cigarette advertising has a significant and positive effect on interfirm or interbrand demand. For example, Grawbowski investigated the effects of advertising on market share for five industries: cigarettes, soft drinks, cereals, beer and gasoline. He found that advertising significantly affected the market shares of cigarette brands and concluded that his findings in conjunction with his earlier work on the effect of advertising on interindustry demand, "indicate that the main impact of advertising is on the consumer's choice of brands or products with a particular industry class rather than across product groups".

<sup>10</sup> Hamilton estimated a cross state income elasticity of .734 and used this estimate as an extraneous coefficient in a time series cigarette demand function. Ippolito obtained an estimate of .735 in a 1925-75 time series regression on cigarette demand. Warner did not include an income variable in his cigarette demand function. He states, "...recent studies have found income elasticities to be small and nonsignificant, with time trends performing equally well or better". In a cross-sectional study of cigarette demand using data from a 1976 Health Interview Survey, Lewit and Coate, estimated the income elasticity among smokers to be approximately .2.

The high serial correlation of the residuals indicated by the low Durbin-Watson statistic suggests a possible misspecification in the equation. Any confidence we may have in the equation is completely shattered when we use it to predict consumption after 1970. These results are plotted in Figure 2. Predicted consumption, using actual values for the variables and our estimated coefficients from equation (1), is significantly above actual consumption. The deviation between actual and predicted consumption widens over the period and reaches approximately 55 percent in 1978.

Another way of emphasizing the magnitude of the misspecification of the demand relationships given in Equation (1) is by noting the large change in the estimated coefficients when the equation is extended and reestimated for the entire 1930-78 period with another dummy variable,  $D_{71}$ , added for the post advertising ban period.

$$(2) \quad \log C = \begin{matrix} .045 & + & 1.252 \log Y & - & .190 \log P & - & .155 \log A \\ (0.03) & & (16.3) & & (.72) & & (1.84) \end{matrix}$$

$$- \begin{matrix} .129 D_F & + & .165 D_{53} & - & .074 D_{64} & - & .312 D_{71} \\ (1.95) & & (2.33) & & (1.05) & & (5.04) \end{matrix}$$

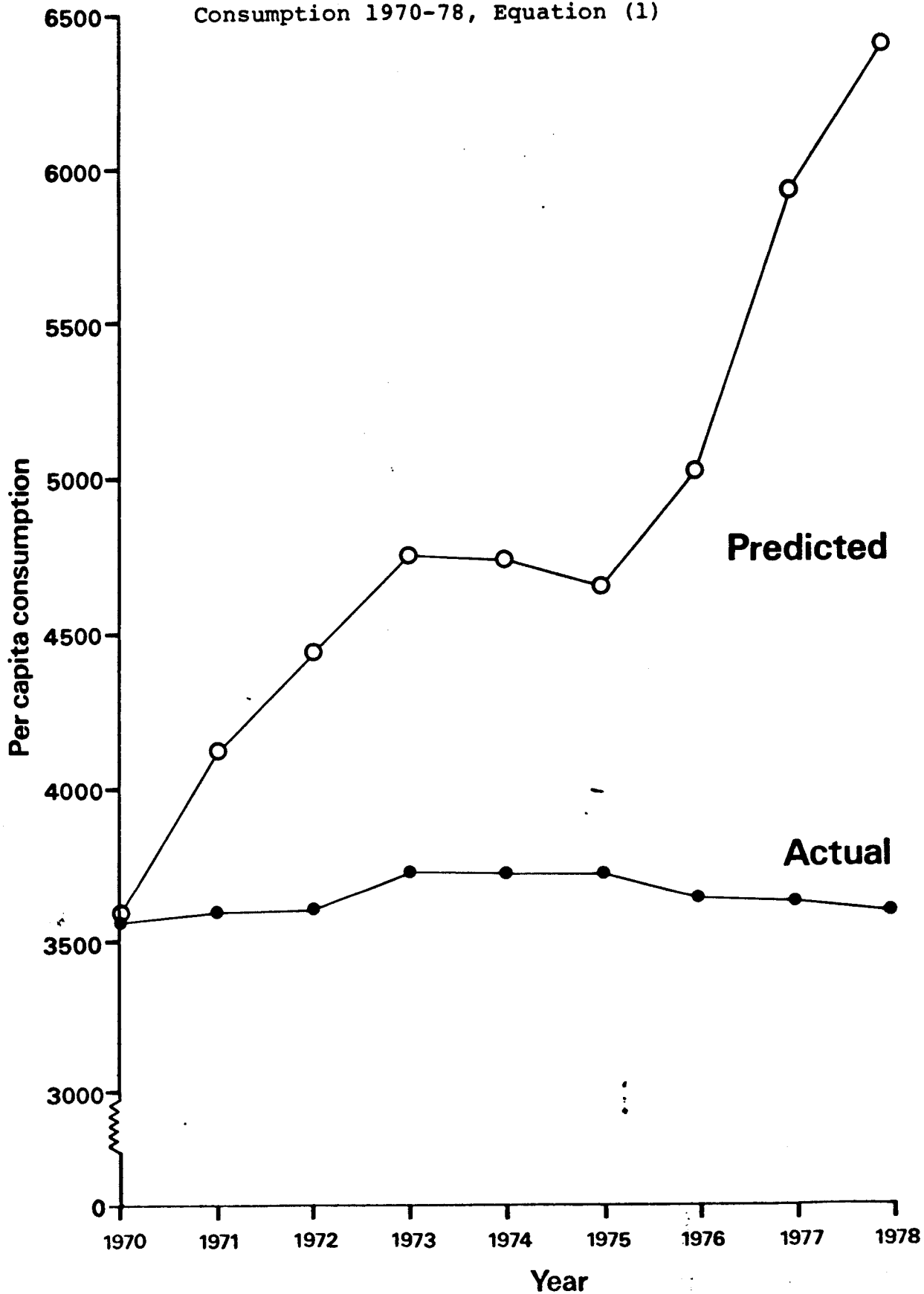
$$R^2 = .950$$

$$D.W. = 0.62$$

The previously estimated relationship breaks down. The new estimated coefficients are not only different, but also in some cases economically meaningless. Price is no longer a significant determinant of demand and the advertising stock is now negatively related to cigarette consumption. In

Figure 2

Actual and Predicted Per Capita Cigarette Consumption 1970-78, Equation (1)



Source: Tobacco Situation

addition, the dummy variable for the 1964 Surgeon General's Report becomes insignificant and the 1953 health information dummy becomes significantly positive. Finally, the dummy variable for the advertising ban period enters negatively and significantly, indicating that per capita consumption is 27 percent<sup>11</sup> lower over the period that the advertising ban has been in effect. If the rest of the estimated relationship were not so unstable and difficult to interpret this would indicate an enormous effect of the advertising ban on cigarette smoking.

Even if we had confidence in the other estimated coefficients, the mechanism by which the ban is likely to have produced such a decline in consumption remains a mystery. The only apparent effects of an advertising ban would seem to be on reducing advertising expenditures, reducing the effectiveness of such expenditures, and reducing antismoking commercials on radio and TV. The first and third effects have already been completely controlled for in our equation and, in any event, our estimates indicate that both of these effects are likely to be small. The second effect can therefore not be very large. A net negative effect of about thirty percent makes little sense. Obviously something else is being picked up by the regression. Before we can laud the beneficial social health effects of the ban we must have more confidence in our theoretical analysis and our empirical results. Otherwise, we are merely renaming

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<sup>11</sup> $1 - e^{-.31} = .27.$

the large residuals of a poorly specified equation.<sup>12</sup>

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<sup>12</sup> Warner, for example, discusses the significant negative effects on consumption of the advertising ban while not even entering an advertising variable in his equation. He unconvincingly attributes the lower demand (i.e., discrepancy in his regression) during the advertising ban period to "effect of the anti-smoking campaign." He states, "while actual consumption rose through 1973, it leveled off in 1974 and dropped slightly in 1975, years of growing anti-smoking militancy reflected in the passage of legislation recognizing the rights of nonsmokers."

### III. Specification Problems

There are three major specification problems with the simple equations we have reported and discussed in Section II. The first and probably the most important problem concerns the obviously disparate trends in the consumption series in the early compared with the later time period. It is the extremely high rate of growth of consumption in the first half of our period that produces the higher income elasticity estimates; it is the abrupt slowdown that then produces the large overprediction at the end of our period and the observed significant effect for the dummy variable for the ban period. It seems likely, merely by looking at Figure 1, that there is something different occurring in the early period compared to the later period. The second problem concerns the correct modeling of the effect of the advertising ban, which we have already indicated should not enter as a dummy variable for the advertising ban period. The third problem concerns the correct way to model the health information effects. These effects may not be correctly operationalized by (0,1) dummy variables.

#### a) Estimating "the trend" rate of growth in demand

All previous time series studies of cigarette demand have "recognized" the problem of the very high trend rate of growth in demand over the first twenty or thirty years of our sample. This high trend rate of growth leads to unreasonably high income elasticity estimates. These high income elasticity

estimates in turn imply overpredictions for consumption in the later period and therefore potentially significant overestimation of the 1964 Surgeon General's Report, Fairness Doctrine and advertising ban dummy effects. The previous studies, however, have merely attempted to fit (and in most cases "overfit") the data rather than understand the basic economic forces behind the time series.

Most researchers have explicitly entered a time trend variable into the regression equation (for example, Ippolito, et. al., Warner and Telser). This implies an explicit recognition of ignorance (that is, some left out variable correlated with time) since there is nothing in demand theory that suggests that time per se should influence consumption.<sup>13</sup> Such a procedure produces the seemingly advantageous result of reducing the estimated income elasticity of demand. But without some additional highly arbitrary decision to cut off the arbitrary trend variable in, for example, 1964, we still are left with

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<sup>13</sup> Warner claims that his trend variable reflects, in part, increases over time in the smoking population. Since his regression is run in per capita terms, we assume that he must be referring to an increase in the smoking population represented by the increased likelihood over time that younger individuals and women will smoke. Although these movements would not be captured in a simple per capita variable, they are relatively recent trends that would not explain the early rapid growth in consumption. In fact, these movements would further decrease measured per capita consumption in our later period. Ippolito et. al., claim that their trend variable takes account of the fact that "Per capita smoking has exhibited a secular upward trend, independent of strictly economic influences, which presumably reflects a host of social factors that have increased the popularity of cigarettes." (p. 6) Telser includes a trend variable to "serve as a proxy measure of the increased effectiveness of advertising" over time.



the same result of large overpredictions in the post-1964 period.<sup>14</sup>

Rather than cutting off the trend in 1964, Ippolito accomplishes the same result by beginning a new negative and therefore cancelling trend in that year, supposedly as a measure of delayed health information effects. This procedure is an extreme form of ad hoc curve fitting rather than economic analysis. Therefore we should have little confidence in the validity of the results extended to a period outside their sample. For example, can we expect the knowledge of the detrimental health effects of smoking to continue decreasing consumption by the same percentage amount every year into the future.

Many researchers attack the problem of unreasonably high income elasticity of demand estimates by using extraneous estimates of the income elasticity obtained from cross-section (for example, cross-state) regressions. Hamilton, for example, uses an estimate of .734 obtained as an average of two cross-state studies done in 1954 and 1965.<sup>15</sup> These lower, more reasonable

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<sup>14</sup>Ippolito, et. al., find using a trend variable together with income and price variables to estimate a cigarette demand function over the 1925-63 period, that the post-1963 consumption path implies a predicted consumption level by 1975 that is 50 percent above actual consumption. A great deal is obviously left to be "explained" by increasing health concerns or other possible factors.

<sup>15</sup>While the rationale for the use of extraneous estimates by these researchers is the existence of extreme multicollinearity, we did not find high multicollinearity in our data set. What they have is an unreasonably high unreported income elasticity estimate and high multicollinearity between income and their arbitrary trend variables introduced to "solve" this problem.

extraneous estimates must then be combined with trend variables in order to "explain" the early period.<sup>16</sup> This procedure then implies the same final result of very large overprediction in the later years of our sample.<sup>17,18</sup>

Rather than the ad hoc curve fitting done by previous researchers we have decided to examine the industry and cigarette data with a more sophisticated economic theory. First of all, there is no a priori reason to expect that the income elasticity of demand will necessarily be the same at every point in time over the entire time period of our sample. In fact, over such a long period we would expect the measured income

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<sup>16</sup> Warner explicitly introduces a trend variable. Hamilton uses a somewhat more subtle procedure of including a lagged dependent variable with a coefficient close to but less than one, (.8), together with a significant constant term. If no other variables are trended with time (or adjusted appropriately) this implies that cigarette consumption will grow over time (given his starting conditions) similar to a trend variable. But rather than continuing to grow at a constant rate it will level off where the level of the log of consumption is about five times (i.e.,  $\frac{1}{1-.8}$ ) the value of the intercept evaluated at the mean of the other variables.

<sup>17</sup> For example, reestimation of our equation (1) with the addition of a trend variable, lowers the estimated income elasticity to .54 but produces an even larger overprediction of consumption. In 1978, predicted consumption is 85 percent greater than actual consumption.

<sup>18</sup> Hamilton's study ends in 1970 and he incorrectly attributes the large negative residuals from his incorrectly specified trend, that occur at the end of his period to the presence of the anticigarette advertising during the period of the Fairness Doctrine. He therefore predicts that the ban, by eliminating these commercials, would increase consumption in 1971 about twelve percent.

elasticity of demand to decline rather drastically. Empirically, most goods when they are introduced into the market are initially "luxury" goods and over time become "necessities". As a mathematical necessity, given the consumers budget constraint, income elasticities of luxury goods must decline towards one over time.

Pre-rolled cigarettes were a luxury good back at the turn of the century and only accounted for about two percent of all tobacco sales in 1900-04.<sup>19</sup> Most "cigarettes" were consumed by individuals rolling their own and therefore are not included in our cigarette series. By 1910 the percentage of all tobacco used in cigarettes was only about six percent (about the same as snuff). This percentage rose secularly to about 32 percent in 1925, 49 percent in 1935, 73 percent in 1945 and about 79 percent in 1955, reaching a peak percentage of 85 in the 1960s and 1970s (see Table 1).<sup>20</sup> Between 1900 and 1920 cigarette consumption increased by more than a factor of ten. If this earlier implied extremely high income elasticity estimate were

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<sup>19</sup> See Nicholls, Price Policies in the Cigarette Industry, p. 7.

<sup>20</sup> This process of substitution towards cigarettes and away from other forms of tobacco consumption over time was not monotonic. The percentage of tobacco consumed as cigarettes declined from 1930 to 1933 as individuals in large numbers once again rolled their own cigarettes due to budgetary considerations. In 1930, 15 billion roll-your-own cigarettes were consumed, in 1935 total consumption of roll-your-own reached a peak of 50 billion cigarettes, and by 1946 roll-your-own cigarettes consumed had dropped back to 11 billion. These statistics are from Tobacco Situation.

Table 1

Percent of Tobacco Used In Cigarettes, 1925-1978

<u>Year</u>	<u>Percent</u>	<u>Year</u>	<u>Percent</u>	<u>Year</u>	<u>Percent</u>
1925	32.1	1943	68.3	1961	82.0
1926	33.6	1944	70.4	1962	82.1
1927	37.7	1945	72.8	1963	82.3
1928	39.1	1946	75.0	1964	79.8
1929	41.4	1947	75.3	1965	81.4
1930	43.4	1948	76.2	1966	81.7
1931	43.2	1949	77.3	1967	82.0
1932	41.6	1950	77.6	1968	82.1
1933	43.0	1951	78.9	1969	81.4
1934	45.3	1952	79.6	1970	80.7
1935	48.7	1953	80.1	1971	81.4
1936	51.1	1954	79.2	1972	82.4
1937	52.7	1955	79.2	1973	83.1
1938	53.2	1956	80.3	1974	84.0
1939	55.1	1957	80.5	1975	84.6
1940	55.6	1958	80.7	1976	84.6
1941	59.5	1959	80.8	1977	84.9
1942	64.7	1960	81.6	1978	85.1

Source: Tobacco Situation

merely extended over the next 60 years individuals would now be spending more than 100 percent of their income on cigarette consumption.

If we consider the movements over time in tobacco consumption, plotted in Figure 3, we see that the per capita tobacco consumption series is quite different from the per capita cigarette consumption series plotted in Figure 1. Instead of peaking in 1963 per capita tobacco consumption peaks ten years earlier and declines much more dramatically from its peak value. Instead of a measured decline of about seven percent from its peak rate of consumption, as occurred for cigarettes, per capita tobacco consumption in 1978 is more than 42 percent below its 1953 peak and nearly 15 percent below its 1930 value. Clearly the average income elasticity of demand for total tobacco consumption is significantly lower than the demand for the cigarette element of that consumption.

Modeling the income elasticity of demand for cigarettes as a function of time or of income would imply a model very close to the previous ad hoc studies we have criticized. An alternative naive solution to this problem would be to directly add the ratio of tobacco in cigarettes to total tobacco as another independent variable in the cigarette demand regression. But this would place the same variable on both sides of the regression and have the obvious drawback of creating spurious correlation. The ratio would likely be correlated with the error term either because some omitted variable that alters

Figure 3

Per Capita Tobacco Consumption, 1930-78



cigarette consumption is also likely to influence the ratio in the same direction or because there is measurement error in our cigarette data.

To avoid the problems associated with simultaneity and measurement bias we attempt to develop a suitable instrument for the switching by individuals from other forms of tobacco consumption to cigarettes which is both statistically satisfactory in terms of consistency of the derived estimates and economically appealing in its formulation. We model this switching by assuming that below a critical cutoff level of income,  $y_c$ , all tobacco is consumed in forms other than pre-rolled cigarettes whereas above this level potential cigarette consumers consume all their tobacco in the form of cigarettes. Hence, as income rises the percentage of the population above this critical level rises and therefore a larger and larger percentage of tobacco consumers consume their tobacco in the form of cigarettes.<sup>21</sup>

To estimate this cutoff level of income we assume that the distribution of income at any point in time is described by the following function:

$$(3) \quad f(y) = \alpha^2 y e^{-\alpha y}$$

where  $y$  is real disposable personal income and  $\bar{y}$ , the mean of the distribution, is equal to  $2/\alpha$ . This distribution shifts

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<sup>21</sup>This specification, however, implies that there will be people who continue to use other forms of tobacco at all income levels.

over time as is depicted in Figure 4. As this distribution shifts to the right, the percentage of the population with incomes less than the cutoff level of income,  $y_c$ , declines. Taking the integral of this function and substituting  $\bar{y}$ , annual per capita income, for  $2/\alpha$ , the percentage of tobacco consumers who smoke cigarettes at any point in time, is:

$$(4) \quad 1 - F_t(y_c) = \left[ 1 + \frac{2y_c}{\bar{y}_t} \right] e^{-2y_c/\bar{y}_t}$$

where  $\bar{y}_t$  is the mean disposable personal income at time  $t$ ,  $F_t$  is the cumulative distribution function of  $f(y_t)$ , and  $F_t(y_c)$  is the percent of the population whose income level is below  $y_c$  at time  $t$ .<sup>22</sup>

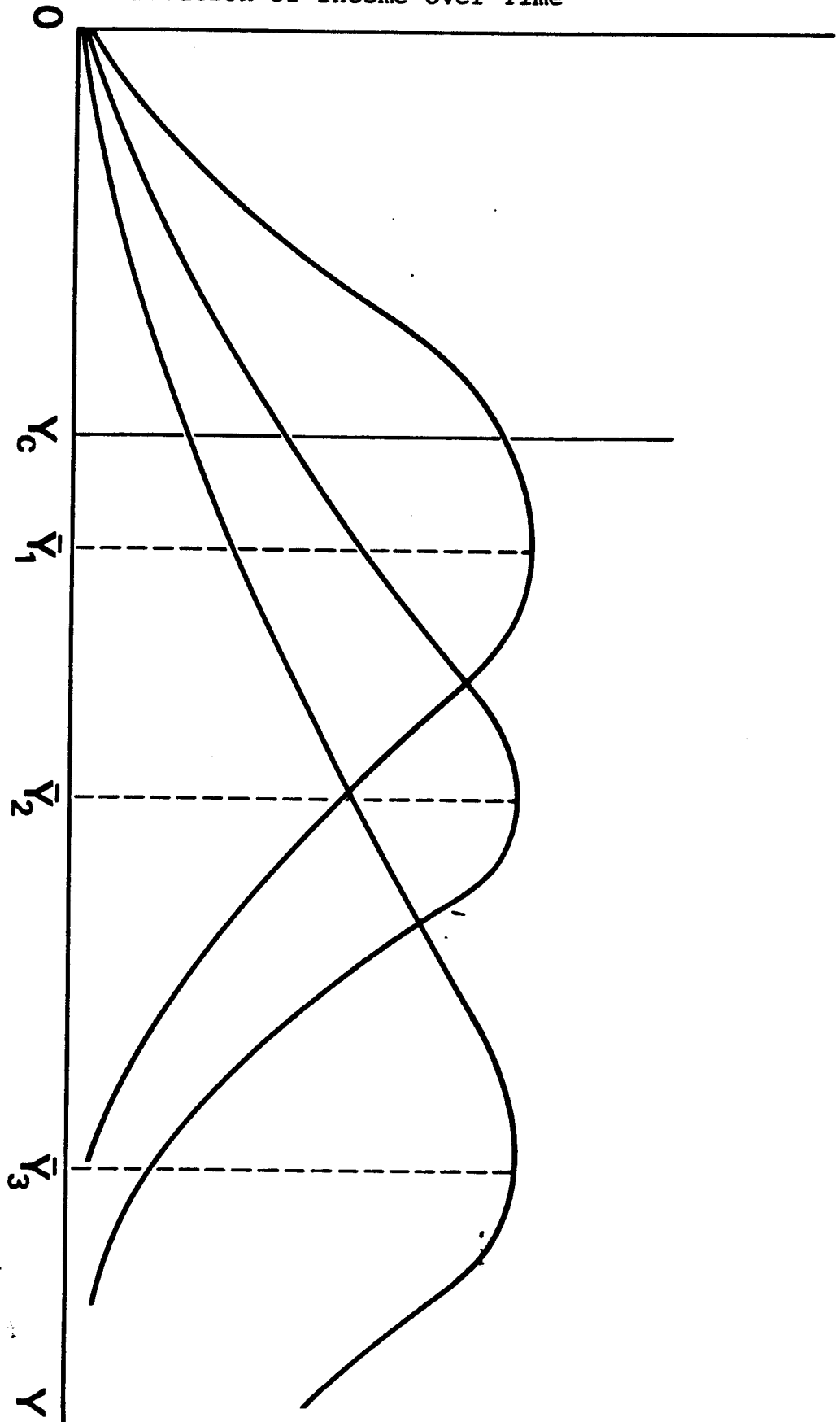
This formulation crudely corresponds to our data series in that it implies large marginal effects of increases in income in the beginning of our sample period and small marginal effects at the end. In fact, using a nonlinear minimum sum of squares procedure to estimate the percentage of tobacco consumed as cigarettes,  $T_c/T$ , we find (equation (5)) that our income instrument variable,  $\log(1+2y_c/\bar{y}) - 2y_c/\bar{y}$ , explains more than 90 percent of the variation in the percentage over the period 1925-78.

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<sup>22</sup>Although this critical value of switching may not be appealing to economists more familiar with continuous specifications, it should be noted that most individuals consumer the great majority of their tobacco in only one form. Further, the choice between roll-your-own and pre-rolled cigarettes in the early period seems largely a function of income as seen by the substantial decline during the Great Depression in the share of cigarettes as a fraction of total tobacco consumption. Therefore this initial cutoff value can be thought of as a means of operationalizing this dichotomous choice. A similar function has been used by Welch and Cunningham (1978) to describe cross-sectional income distributions.



Figure 4  
The Distribution of Income Over Time



$$(5) \quad \log T_c/T = \underset{(1.64)}{-.0299} + \log \underset{(32.6)}{1+2(551)/\bar{y}} - \underset{(32.6)}{2(551)/\bar{y}} \quad R^2 = .92$$

The cutoff level of income parameter  $y_c$ , below which we assumed tobacco was consumed in other forms than cigarettes, is estimated to be 551 (1929) dollars and the percentage of consumers above this cutoff value who will continue to consume other forms of tobacco rather than cigarettes is estimated to be three percent.

We then used the predicted values from the above regression as an instrument for the percent of tobacco consumed in the form of cigarettes. This proxy variable for "switching" is included in our cigarette regression to partially explain in economically meaningful terms the sharp rise in cigarette consumption without resorting to ad hoc trend variables.

b) Modeling the Effect of the Ad Ban

Analyzing the effect of the ban on the demand for cigarettes is theoretically more complex than previous studies have recognized. These studies have generally modeled the ban by including in the cigarette regression a dummy variable for the post-ban period. This formulation does not measure changes in the average productivity of advertising expenditures which is the primary mechanism by which the ban is likely to directly effect consumption.

The theoretically correct way of modeling the advertising ban would take into account the effect of the ban on the entire production function for "advertising services". A shift down

in this production function may lower the average and marginal productivity of advertising expenditures, the desired quantity of advertising stock and finally the price of cigarettes. The development of a more complete theoretical model is left for section V of the paper. For estimation purposes we will now merely assume that the advertising stock has the same effect on per capita consumption before and after the ban, but that the ban changes the average productivity of advertising expenditures in creating advertising stock. Since we have constant returns to advertising flows in creating advertising capital, the ban is equivalent to a higher price for advertising capital.

The value of the advertising stock in year  $t$ ,  $A_t$ , is therefore given by the following function of current and past annual real advertising expenditures,  $a_i$ ,

$$(6) \quad A_t = \sum_{i \leq t} (1-\lambda)^{t-i} a_i r^I$$

where

$$I = \begin{cases} 0 & \text{if } i < 1971 \\ 1 & \text{if } i \geq 1971 \end{cases}$$

$\lambda$  equals the depreciation rate of advertising expenditures and  $r$  is the average productivity of advertising expenditures in the post-ban period compared to the pre-ban period.<sup>23</sup>

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<sup>23</sup>To illustrate,  $A_{1970} = (1-\lambda) A_{1969} + a_{1970}$ ;  
 $A_{1971} = (1-\lambda) A_{1970} + r a_{1971}$ ;  $A_{1972} = (1-\lambda)^2 A_{1970} + r(1-\lambda) a_{1971} + r a_{1972}$ .

When estimating our cigarette demand function we use an advertising stock variable of the form  $(A_1 + rA_2)$ , where  $A_1$  is the advertising stock created before the ban and  $rA_2$  is the effective stock created after the ban. We use nonlinear techniques to estimate  $r$  and would expect  $r$  to be less than one, thereby indicating a decrease in the average productivity of advertising expenditures in creating advertising stock.<sup>24</sup>

c) Operationalizing the Health Information "Shocks"

There is no obvious way to model the health information effects on consumption. There are two obvious problems with using zero-one dummy variables for the 1953-1978 and the 1964-1978 periods. First, while these two dates are very important

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<sup>24</sup>This formulation is based upon simplifying assumptions. In particular, as we shall later discuss, the ban decreases advertising flows and pushes us back along the production function for advertising stock. Therefore unless we assume constant returns to scale of flows in creating stock, the decrease in the observed average productivity will not be indicative of the decrease in the overall production function produced by the ban. If there are decreasing returns to scale throughout the range of our interest,  $r$  will underestimate the downward shift of the production function since a decrease in advertising inputs will put us at a point at which the average product is higher. It is in fact possible (but not likely) that the average product at the new equilibrium point on the lower production function is actually higher than the pre-ban average product. Further, although our empirical specification allows for decreasing returns to advertising stock, it assumes constant returns to scale of advertising expenditures in producing advertising stock. This assumption is unrealistic since there are diminishing returns to advertising expenditures in creating advertising stock. In addition, the stock of advertising at a point in time is likely to affect the productivity of advertising expenditures. The implications of this simplifying assumption are discussed in Section V of the paper. However, any more complicated specification is beyond estimation given the limited data available.

markers for key health scares information on the adverse effects of smoking must have been revealed to consumers in a sequence of findings and reports. Secondly, adjustment by consumers to the new information takes time. Hence, even if the 1953 and 1964 reports were the only relevant sources of new information, the zero-one specification would still be inappropriate. Given substantial lags in consumer adjustment, it is unlikely that all of the long run percentage effect on consumption will be felt in the first year of the release of new information. However, once we start playing with other types of more arbitrary (in terms of accepted econometric practice) dummy variables, we can obtain any result we desire.<sup>25</sup> The basic problem is that we do not have an observable measure of the magnitude and spread over time of the health information produced by the 1953 and 1964 "shocks".

Our crude attempt to operationalize these health information variables consists of looking at some indirect consumer behavior. The first health scare in 1953 led to the rapid introduction and success of filter tip brands. Table 2 indicates that filter tip cigarettes grew from a market share of 3 percent in 1953 to a 45 percent market share five years later and a 90 percent market share in 1978. We use this as a market indication of the

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<sup>25</sup>Ippolito, et. al., for example, by using counter (trend) dummy variables, one beginning in 1953 and another beginning in 1964, in addition to the standard (0,1) dummy variables for those years, eliminates the significance of the dummy variable for the advertising ban period.

Table 2  
Operationalization of the Health  
Information "Shocks"

	<u>Market Share of Filter Cigarettes (percent)</u>	<u>Market Share of Cigarettes Yielding 15 mg "Tar" or Less (percent)</u>
1953	3	
1954	9	
1955	19	
1956	28	
1957	38	
1958	45	
1959	49	
1960	51	
1961	53	
1962	55	
1963	58	
1964	61	.3
1965	64	.2
1966	68	.7
1967	72	2.0
1968	74	2.5
1969	77	3.0
1970	80	3.6
1971	82	3.8
1972	84	6.6
1973	85	8.9
1974	86	8.9
1975	87	13.5
1976	88	15.9
1977	90	22.7
1978	90	27.5

Source: (1) 1953-1962 from Tobacco Situation

(2) 1963-1978 from Federal Trade Commission, Report To Congress, Pursuant to the Public Health Cigarette Smoking Act, for the Year 1978.

magnitude and spread over time of the 1953 health information shock. In particular, if this dramatic shift toward filter tip cigarettes measures a response over time to the same health information that affects overall cigarette consumption and if the adjustment pattern of the shift in the composition of consumption to the information is assumed to be similar to the pattern we would expect in the adjustment of cigarette consumption, then we have a suitable measure of the timing of the 1953 health information "shock". When this variable is entered in our cigarette demand function in semi-logarithmic form, the estimated coefficient can be interpreted as the percentage reduction in the number of cigarettes consumed per capita with the introduction of new health information sufficient to produce a one percentage point change in the percentage of filter tip cigarettes as a share of total cigarette sales.

Similarly, we use the market share of low "tar" brands (15 mg or less) over time as a market measure of the spread of the Surgeon General's 1964 Report. Table 2 indicates that in 1964 less than 1 percent of the market consisted of these brands, while in 1978 these brands were 27.5 percent of the market.<sup>26</sup>

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<sup>26</sup>Table 1 also indicates that individuals in 1964 substituted away from cigarettes to other forms of tobacco consumption which the Surgeon General's Report claimed were less harmful than cigarettes.

IV. Empirical Results

Before we can reestimate our cigarette demand regression, some further specification modifications must be made.

In particular, in the cigarette demand function our income instrument variable and income are highly colinear. Therefore, we decided to use our income instrument variable to proxy for the switching over time between cigarettes and other forms of tobacco consumed and an extraneous estimate of the income elasticity of demand for tobacco obtained directly from a tobacco regression. This regression was estimated over the same time period with many of the same variables as in our cigarette regression. The income elasticity of demand for tobacco was found to be .462 which we then substituted into our cigarette regression.

The complete tobacco demand results are presented in equation (7).

$$\begin{aligned}
 (7) \quad \log T = & \quad -.949 + \quad .462 \log y - \quad .949 \log P_T \\
 & \quad (3.70) \quad (12.17) \quad (7.45) \\
 & \quad + \quad .039 \log (A_{1T} + .176 A_{2T}) - \quad .049 D_F \\
 & \quad (1.25) \quad (0.15) \quad (1.92) \\
 & \quad - \quad .0027 F - \quad .0177 L \quad R^2 = .944 \\
 & \quad (4.36) \quad (7.02) \quad D.W. = 1.26
 \end{aligned}$$

where T is tobacco consumption per capita (population 14 and older), y is real per capita income (total population),  $P_T$  is a real retail price index for tobacco,  $A_{1T}$  is the tobacco advertising stock before the ban and  $A_{2T}$  is the tobacco advertising stock after the ban,  $D_F$  is a dummy variable for the Fairness



Doctrine period, July 1, 1967 to January 1, 1971, standardized annually for the number of antismoking commercials broadcast during that period,  $F$  is the percentage of filter tip cigarettes consumed as a fraction of total cigarette consumption and  $L$  is the percentage of low tar cigarettes consumed as a fraction of total cigarette consumption.

Using this extraneous income elasticity estimate makes a good deal of theoretical sense. It is a direct and independent estimate of exactly what we are looking for, the income elasticity of demand for cigarettes after taking account of the switching from other types of tobacco to cigarettes, and is estimated over the same time period as our cigarette regression. It is not subject to the problems encountered by the previous studies which employ an extraneous income elasticity of demand for cigarettes obtained from cross-section cigarette demand regressions. Such an extraneous estimate is likely to be a negative function of the particular year chosen for the cross-section experiment and is not at all measuring what we would want theoretically in the demand for cigarettes regression. For example, Hamilton's estimate of .734 obtained from cross-section equations run in 1954 and 1965 seriously underestimates "the average" income elasticity of demand for cigarettes over the entire time period, but more importantly misspecifies the nature of the relationship of cigarette demand and income. While it may make sense to talk about "the" income elasticity of demand for cigarettes over time holding constant the separate effect

of rising income on increasing cigarette demand by switching tobacco consumption towards cigarettes, it obviously makes no sense to plug in the total estimated income effect on cigarette demand in a particular year as an estimate of this elasticity. Such an estimate is truly extraneous in the sense of being totally irrelevant.

Our cigarette demand regression is reported below in equation (8):

$$\begin{aligned}
 (8) \quad \log C = & \quad 2.243 + .462 \log y - 1.218 \log P \\
 & \quad (0.57) \qquad \qquad \qquad (5.47) \\
 & + \quad .971 \log I + \quad .046 \log (A_1 + .264 A_2) - \quad .075 D_F \\
 & \quad (10.45) \qquad \quad (0.70) \qquad \quad (0.11) \qquad \quad (1.41) \\
 & - \quad .0021 F - \quad .0235 L - 1.386 \log (Tpercig) \quad R^2 = .957 \\
 & \quad (0.76) \qquad \quad (4.11) \qquad \quad (1.98) \\
 & \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad D.W. = 0.98
 \end{aligned}$$

where C is per capita cigarette consumption (population 14 and older), y is real per capita income (total population), P is a real retail price of cigarettes index, I is the predicted values from our income instrument regression, equation (5), A<sub>1</sub> is the cigarette advertising stock before the ban, A<sub>2</sub> is the stock after the ban, D<sub>F</sub> is a dummy variable for the Fairness Doctrine period standardized annually for the number of antismoking commercials broadcast, F is the percentage of filter tip cigarettes, L is the percentage of low tar cigarettes and (Tpercig) is the average annual amount of tobacco in each cigarette consumed.

The income elasticity of demand for tobacco, which is used as an extraneous estimate of the income elasticity of demand for cigarettes holding constant switching to cigarettes from

other forms of tobacco consumption, works well. The t-statistic on this restriction which measures whether the extraneous estimate is significantly different from that the data would estimate, is not significant. Further, the estimated coefficient on the instrument is .98 which is extremely close to its theoretical value of one, thus indicating that the income coefficient is "about right".

The price elasticity of demand is significantly negative and indicates an elastic response of consumption to price.<sup>27</sup> Advertising coefficients, on the other hand, indicate very small, statistically insignificant consumption responses. In particular, the coefficients on the advertising stock created before and after the ban indicate that: a) advertising has a positive and insignificant effect on per capita consumption before and after the ban and b) the change in the average productivity of advertising expenditures in creating advertising stock is not significant. Our best, although extremely weak, estimate is that the effective stock of advertising is only 26.4 percent of the actual advertising stock after the ban or that there is a 73.6 percent reduction in the effectiveness

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<sup>27</sup>This estimate is somewhat higher than estimates from previous cross-section and time series studies. One possible reason for the high price estimate is that we do not take account of the price subsidies given to members of the armed forces which were quite large during World War II. However, when we included a separate variable in the regression for the percent of the population aged 14 and older who are on active duty each year it was insignificant and did not influence the price elasticity estimate.

of expenditures in creating stock.<sup>28,29</sup> The Fairness Doctrine dummy variable for the presence of antismoking commercials was also statistically insignificantly different from zero. But, once again, our best estimate is that consumption was reduced on average by 7.5 percent during 1968-70.

To take account of the health information shocks of 1953 and 1964 on cigarette consumption, operationalized by the share of filters and the share of low tars, we had to include an additional variable, the average amount of tobacco in each cigarette consumed, Tpercig. This was necessary because the new health

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<sup>28</sup>Theoretically, the value of  $r$ , the relative average product of advertising expenditures after the ban in creating advertising stock, is related to the depreciation rate of the stock of cigarette advertising. The higher the depreciation rate, the less stock there would be after the ban, and therefore the higher would be the average productivity of advertising expenditures after the ban. Therefore, we might expect the value of  $r$  in our regression to be sensitive to the choice of the depreciation rate on advertising stock. In regressions which differed only in the depreciation rate used in calculating the stock of advertising, we found that although  $r$  varied with the depreciation rate chosen the changes in  $r$  were not significant nor of very large magnitude over a wide range of depreciation rates. However, depreciation rates very close to one did alter  $r$  substantially. This was probably due more to the econometric specification (log) than any theoretical effect.

<sup>29</sup>Since the ban initially only covered cigarette advertising, noncigarette advertising remained on TV and radio. In fact, before the ban was extended to small cigars in 1973, TV advertising on such cigars increased dramatically. The large increase and then decrease in consumption (after the ban was extended to these items) clearly indicates the potent relative consumption effects of TV advertising. In any event, the less than full coverage of the ban with regard to tobacco would suggest that the estimated  $r$  for cigarette advertising would be less than for tobacco advertising, which is not the case.

information represented by these two shocks, in addition to leading consumers to consume more filter tip and more low tar (and presumably less total) cigarettes, also lead consumers to switch to cigarettes with lower tobacco content.<sup>30</sup>

With the spread of health information consumers can be expected to substitute other characteristics of cigarette consumption for tobacco and its associated unhealthy tar and nicotine. The coefficient on the amount of tobacco per cigarette can be thought of as measuring this substitution. As Table 3 and Figure 5 indicates, this effect appears to be quite large. A sharp break appears to have occurred in 1953 with the average amount of tobacco per cigarette declining nearly 40 percent since then. This reduction is, in fact, a major method by which cigarette firms have reduced the tar and nicotine per cigarette. If this additional health information variable is not taken into account, the health effects will be significantly understated.

Although individuals reacting to the new health information will certainly decrease tobacco consumption, this substitution away from tobacco towards other characteristics of cigarettes can actually lead to an increase in the number of cigarettes consumed.

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<sup>30</sup> Inclusion of this variable may be thought to create an endogeneity problem. But the amount of tobacco per cigarette can be largely "explained" by our variables that operationalize the spread of health information, namely the market share of filters and of low tars. Therefore inclusion of another instrument based upon these health variables would merely entail the renaming of our "health information" coefficients in our cigarette regression.

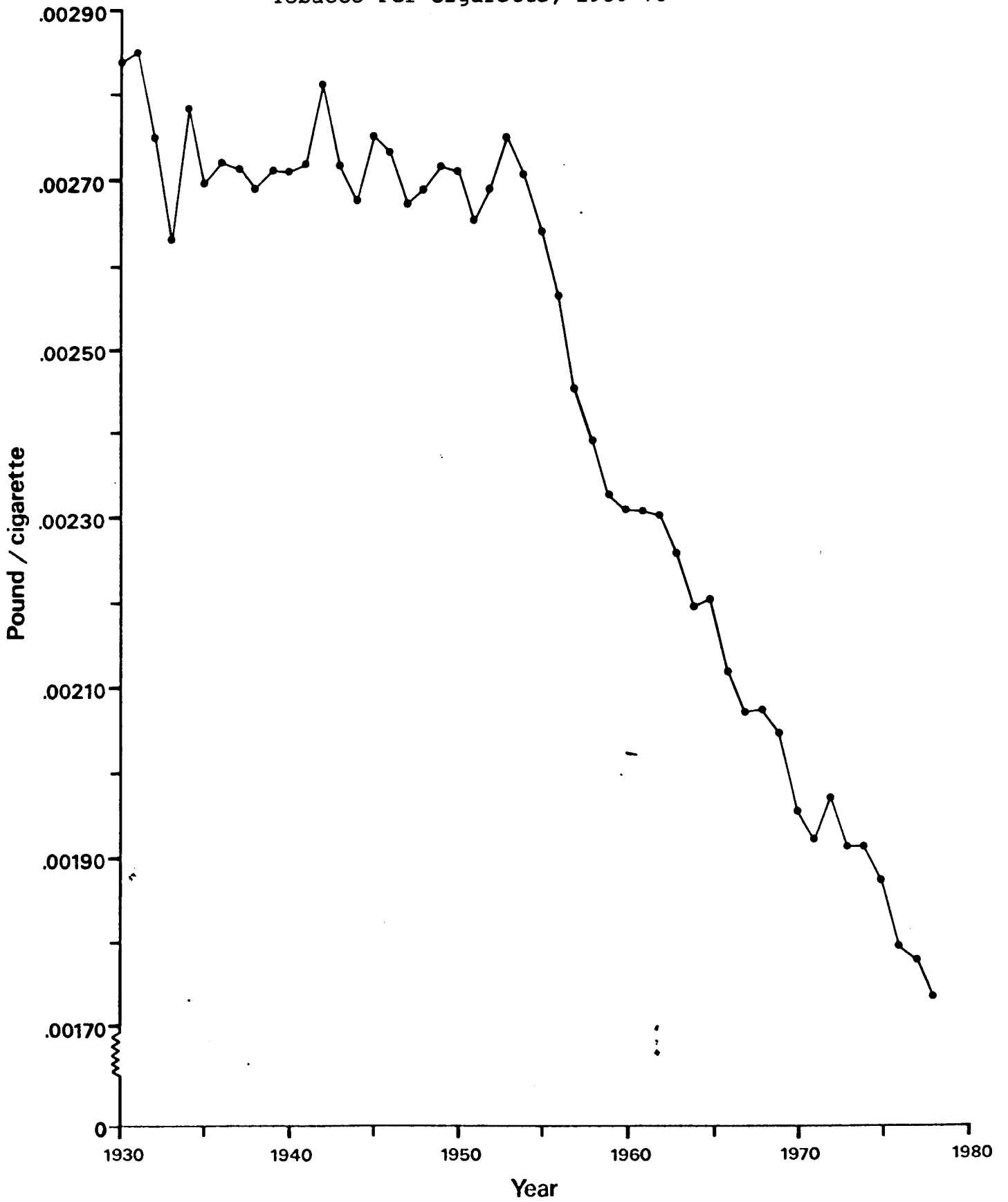
Table 3  
Tobacco Per Cigarette

<u>Year</u>	<u>Pounds/Cigarette</u>	<u>Year</u>	<u>Pounds/Cigarette</u>
1930	.00283	1955	.00263
1931	.00285	1956	.00256
1932	.00275	1957	.00245
1933	.00263	1958	.00239
1934	.00278	1959	.00233
1935	.00270	1960	.00231
1936	.00272	1961	.00231
1937	.00271	1962	.00230
1938	.00269	1963	.00226
1939	.00271	1964	.00220
1940	.00271	1965	.00220
1941	.00272	1966	.00212
1942	.00281	1967	.00207
1943	.00272	1968	.00208
1944	.00267	1969	.00204
1945	.00275	1970	.00195
1946	.00274	1971	.00192
1947	.00267	1972	.00197
1948	.00269	1973	.00191
1949	.00272	1974	.00191
1950	.00271	1975	.00187
1951	.00266	1976	.00179
1952	.00269	1977	.00178
1953	.00275	1978	.00173
1954	.00270		

Source: Tobacco Situation, Historical Statistics and Current Population Reports, Series P-25.

Figure 5

Tobacco Per Cigarette, 1930-78



For example, when this variable is not included in our cigarette demand regression and the amount of tobacco per cigarette is allowed to vary, the estimated effect of the 1953 health information shock on cigarette consumption measured solely by the market share of filters is significantly positive. While the tobacco regression, equation (7), indicates that the 1953 health information had a significant negative effect on tobacco consumption and hence a negative effect on tar and nicotine consumption, the information operated solely through the increased consumption of filter cigarettes with their lower tobacco per cigarette levels and not at all through any reduction in the number of cigarettes consumed. In fact, as consumers switched to these lower tobacco per cigarette filter cigarettes they compensated by increasing the number of cigarettes smoked. Although there was an overall decline in tobacco consumption there was a net increase in cigarette consumption.

The cigarette regression, equation (8), is specified so that the 1953 health information shock has two effects: a switch from nonfilter to filter cigarettes and a decrease in the amount of tobacco per cigarette. Holding the amount of tobacco per cigarette constant, the 1953 shock, represented by the percentage of filters, had a large negative effect on consumption. This coefficient though very large absolutely is statistically insignificant due to the fact that its coefficient is highly correlated with that of the tobacco per cigarette



variable.<sup>31</sup> However, we have much more confidence in this coefficient than the t-statistic would indicate since we find a highly significant coefficient in the tobacco regression of quite similar magnitude on the same filter variable. Therefore it is highly likely that the 1953 health scare produced a very large consumer response. Previous studies have missed this decrease in demand due to the 1953 health information because of their failure to look at tobacco rather than cigarette consumption or to standardize their cigarette regression for tobacco per cigarette. Only in this way can the relevant health effects of the information shock, namely changes in consumption of tar and nicotine, be considered.

The second effect of the 1953 health information on cigarette demand is represented by the amount of tobacco per cigarette. The coefficient on this variable is significant and negative. This indicates that the decline in the amount of tobacco per cigarette since 1953 has resulted in a significant increase in the number of cigarettes consumed per capita.<sup>32</sup>

Considering the cigarette demand equation, the total 1953 health information shock measured by the change in the market share

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<sup>31</sup>It is, of course, not surprising that these two variables are highly colinear given that we view both as effects of the same health information and the fact that lower tobacco per cigarette was largely achieved through the switch to filter cigarettes.

<sup>32</sup>While we would expect this later coefficient to be less than one, i.e., total tobacco consumption decreases due to the 1953 shock as indicated by the tobacco regression, it is actually greater than (but not significantly different from) one. This is not surprising given the multicollinearity problem discussed above.

of filter cigarettes and in the amount of tobacco per cigarette, resulted in an increase in the number of cigarettes consumed per capita over the 1953-64 period of 15.6 percent. However, the relevant health effect is not the change in the number of cigarettes consumed but the change in number of cigarettes consumed holding tobacco per cigarette constant. Over the 1953-64 period this partial effect on demand is large and negative and similar to the implied effect estimated in the tobacco regression.

Considering our tobacco demand results, the 1953 health information shock, measured solely by the filter cigarette share, indicates a 14.9 percent decrease in per capita tobacco consumption over the same 1953-64 period. Since the tobacco regression predicts a decline in tobacco consumption of 14.9 percent and the cigarette consumption was estimated to have risen by 15.6 percent due to the 1953 health scare, we can infer that tobacco per cigarette must have fallen approximately 30 percent.<sup>33</sup>

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<sup>33</sup> We are assuming that the reduction in tobacco was approximately neutral across cigarettes and other forms of tobacco. While the cigarette tobacco consumption share of total tobacco consumption was growing slightly over this time period the cigarette share was so large over this period (about 80 percent) that the assumption must be approximately correct. The actual decrease in tobacco per cigarette over the period was only about 17 percent.

As in all of the previous studies we reviewed, we found that the 1964 Surgeon General's report had a significant negative effect on per capita cigarette consumption. Similar to the 1953 health information, this new shock can be expected to affect the amount of tobacco per cigarette and to have an indirect effect on cigarette consumption in addition to the measured direct effect by the movement towards low tars.<sup>34</sup>

We cannot isolate in our regression the separate effects of the 1953 and 1964 shocks on tobacco per cigarette. In the post-1964 period our three health information variables taken together can be assumed to measure the effects of the health information shocks on cigarette consumption. The total effect of the health information shocks over the 1964-78 period is a decrease of approximately 37 percent in per capita consumption (or 32 percent ignoring the effect of filters). Over the entire

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<sup>34</sup>In some recent studies, it has been found that smokers who switch to lower tar and nicotine cigarettes tend to hold in each puff for a longer period of time and to smoke more cigarettes. In "Consumer Beliefs and Behavior With Respect to Cigarette Smoking: A Critical Analysis," A Report Prepared for the Staff of the Federal Trade Commission, several of these studies are cited. Martin Fishbein, the author of the report states:

...there appears to be a substantial proportion of current smokers who smoke in order to maintain a given level of nicotine in their systems. Moreover, there is evidence that when these smokers are provided with low nicotine cigarettes, they adjust their smoking behavior in order to maintain this nicotine level. That is, they are likely to take more deeper puffs on each cigarette, to hold the smoke in their lungs for greater periods of time, to smoke more of each cigarette, and, to increase the number of cigarettes they smoke.

1953-78 period these three variables produced a 8.3 percent reduction in per capita cigarette consumption (measured in terms of number of cigarettes).

Similarly, our tobacco demand estimates indicate that the impact of the 1964 Surgeon General's Report, which can be measured entirely by the growth in the percentage of low tar cigarettes, decreased per capita consumption of tobacco by 39 percent over the 1964-78 period. The total effect of the 1953 and 1964 health information shocks is a 47 percent reduction in per capita consumption by 1978.

Although our cigarette and tobacco results are fundamentally quite similar, the tobacco regression estimates are probably more reliable than the cigarette regression estimates. There is no problem of modeling the switching between different types of tobacco consumption and, in particular, the movement to cigarettes from other forms of tobacco consumption over time. In addition, there is no problem of misestimating the health information effects as individuals consuming cigarettes move to cigarettes with less tobacco. The tobacco consumption regression also more closely corresponds with our health concerns since it is more closely related to tar and nicotine consumption than

the number of cigarettes.<sup>35</sup>

Finally, the autocorrelation pattern of the residuals appear to be approximately an MA-1 time series process in both the tobacco and cigarette regressions.<sup>36</sup> However, the significance levels for the first order serial correlation of the residuals are rather low and without a definite theoretical reason for the presence of such a process we decided not to re-estimate our equations based upon the observed autocorrelation pattern.

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<sup>35</sup> Our attempts to directly estimate tar and nicotine regressions have been limited by severe data shortcomings. A consistent series has only been available since the FTC began testing and reporting by brand in 1967. Data on tar and nicotine deliveries of cigarettes is available for scattered years back to 1938, but most of the testing methods are unreliable or not comparable to the Federal Trade Commission figures. Ippolito uses the tar and nicotine content of existing brands in 1975 to calculate a time series for sales weighted average nicotine delivery per cigarette back to 1934. However, it is evident from the Federal Trade Commission data that sales weighted average tar and nicotine deliveries have declined for two reasons: 1) the growth in the market shares of "low" tar and nicotine brands and 2) a secular decline in the average tar and nicotine deliveries of some "high" tar and nicotine brands. For example, Marlboro, filter, 85 mm, cigarettes had 20.7 milligrams of tar and 1.41 milligrams of nicotine in 1967 and 17.7 and 1.08 milligrams of tar and nicotine in 1976. Ippolito does not recognize this second cause of the decline in sales weighted average tar and nicotine deliveries. Therefore, his regression on nicotine deliveries severely underestimates the health effects of the 1953 and 1964 health information "shocks".

<sup>36</sup> It is clearly not an AR-1 process and therefore use of a Cochrane-Orcutt transformation, as has been done in many previous studies, is not called for here.

V. The Effect of the Advertising Ban

If the advertising ban operates solely through a reduction in the average productivity of advertising expenditures in creating advertising stock, we would expect the effect of the ban on cigarette or tobacco consumption to be small. Since the advertising stock has a very small estimated effect on consumption, the presence of the ban merely pushes the aggregate advertising effect closer to zero. In addition, since the ban simultaneously eliminated the anticigarette advertising required by the Fairness Doctrine, this produced an estimated increase of 4.9 percent in tobacco consumption.

But this estimated increase in demand produced by the ban is incomplete. It is also likely that the ban had effects on the desired level and cost of the advertising stock and on the price of cigarettes. To consider these effects, however, a more complete theoretical framework is necessary.

It is useful to consider advertising services (which influence demand) as a flow from an accumulated body of advertising information which we shall call advertising stock. This stock is then assumed to be created by flows of advertising expenditures. The notation we will adopt is the following:

$S_t$  = units of real advertising stock at time  $t$

$(P_S)_t$  = price of a unit of advertising stock at time  $t$

$s_t$  = units of real advertising input flow at time  $t$

$(p_s)_t$  = price of a unit rate of flow of real advertising input  
at time t

$A_t = S_t (p_s)_t$  = value of the advertising stock at time t.

$a_t = s_t (p_s)_t$  = real advertising expenditures at time t

and

$$(9) \quad S_t = (1-\lambda)S_{t-1} + f(s|S)$$

where  $\lambda$  is the depreciation rate of advertising stock and  $f(\cdot)$  is the production function of real advertising flows in creating advertising stock.

We will assume that advertising capital stock is purchased in a competitive market at a price  $P_s$ , where

$$(10) \quad P_s = \frac{p_s}{f_s(s|S)}$$

This price is assumed to be independent of the amount of advertising currently produced and of the existing advertising stock.<sup>37</sup>

The immediate effect of the ban is to shift down the production function of advertising flows in creating advertising stock. As long as television and radio advertising are not inferior factors in this production process, the net result of this downward shift is an increase in the marginal cost of creating advertising capital. This increase in the cost

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<sup>37</sup> A major consequence of dropping this assumption would be a desire by firms to smooth out advertising expenditure flows over time in response to changes in desired levels of the stock since the cost of  $S$  would then be convex in  $s$ .

of maintaining or increasing the current stock of advertising capital then leads to a reduction in the desired level of advertising stock.<sup>38</sup>

Given our simplifying assumption of constant returns to advertising flows in creating advertising stock, firms will stop investing in new flows. The value of an extra unit of advertising capital (determined by consumers) has not changed while costs have risen. Firms will not invest in advertising (i.e., purchase advertising flows) until the advertising stock depreciates to the level where the new higher cost of a unit of advertising capital,  $P_S$  times the increase of average product of advertising flows in producing advertising capital, is equal to the value of an additional unit of advertising capital.

More generally, however, since there is likely to be declining marginal product of advertising flows in creating stock, advertising flows will not drop to zero after the ban. They will only drop until the value of the marginal product

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<sup>38</sup>We are assuming that the imposition of the ban is unanticipated. If the ban is anticipated, firms may invest in additional advertising capital prior to the ban to avoid the anticipated increase in cost. However the magnitude of this preinvestment may not necessarily be large since an overinvestment in advertising stock has early losses followed by later gains. If there are decreasing returns to flows in creating stocks, then capital will have to be accumulated over time prior to the ban (rather than immediately before it goes into effect). Given the interest cost and the fact that much of the capital will depreciate prior to the point in time at which it would have been required, preinvestment is likely to be small. Since real advertising expenditures were actually lower in 1970 than in 1969 it suggests that preinvestment was not of major importance.



of advertising flows equals the new higher cost of advertising flows. This more general condition will slow the depreciation of the capital stock and hence increase the time required to reach the new equilibrium level of advertising capital.

After the actual stock of advertising capital depreciates to its desired equilibrium level, the effect of the ban on advertising expenditures will depend upon the elasticity of demand for advertising stock. If the demand for advertising services and hence the derived demand for advertising stock is elastic, then the increase in  $P_S$  will imply a more than proportional decrease in desired  $S$  and lead to a decrease in equilibrium advertising expenditures. (In steady state equilibrium expenditures on advertising flows are proportional to the desired advertising stock with the constant of proportionality the given depreciation rate,  $\lambda$ .) If, on the other hand, the demand for advertising stock is inelastic, expenditures on advertising services will rise with the ban. Therefore without additional information regarding the elasticity of demand for advertising capital, the effect of the ban on the equilibrium rate of advertising expenditure is indeterminate.

We do have some information prior to the ban regarding the empirical magnitude of the elasticity of demand for advertising stock. During the 1950s an analogous shock in the cost of creating advertising stock took place. The introduction and rapid spread of television technology can be thought of as

an upward technological shift in producing advertising stock quite similar to the downward technological shift of the ban which essentially eliminated television as a mechanism of producing such capital.<sup>39</sup>

The reaction to the  $P_S$  decrease during the 1950s was a dramatic increase in advertising expenditures, indicating an elastic demand for advertising stock. Table 4 which lists real advertising expenditures and the percentage of households with television sets indicates a rapid and permanent rise in advertising expenditures. Real advertising expenditures increased by more than 87 percent from 1951 to 1957 (as the percent of households with TV increased from 23.5 to 78.6) and then essentially remained at this level until 1961-62.

It is therefore not surprising that the ban produced a decrease in real advertising expenditures of more than 20 percent in 1971. In 1974, a point at which the actual stock must have depreciated to its desired level given our high advertising depreciation rate, real advertising expenditures were still at the low 1971 level and 23 percent below the 1970 pre-ban rate.<sup>40</sup> It

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<sup>39</sup>We say essentially because television continues to be used to advertise cigarettes via TV cigarette firm sponsorship of sporting events and in other much less efficient ways than direct advertising of the product.

<sup>40</sup>See Figure 6, panel 3. An extremely dramatic increase in real advertising expenditures of more than 100 percent occurs in the post-1974 period which we will discuss later.

Figure 6  
Consumption, Price and Advertising, 1970-78

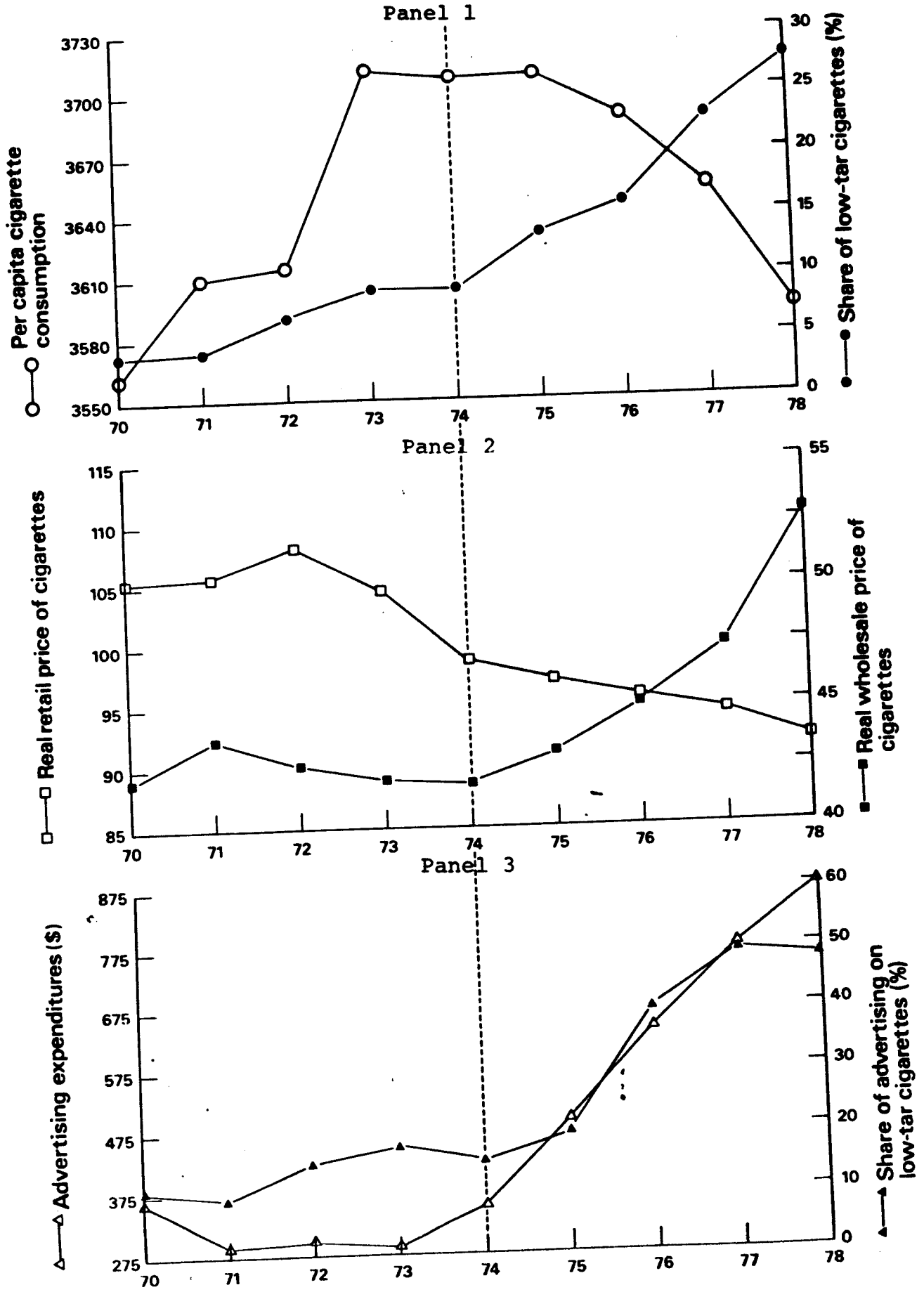


Table 4  
Real Cigarette Advertising Expenditures  
And TV Penetration, 1950-78

<u>Year</u>	<u>Real Cigarette Advertising Expenditures (millions of 1929 dollars)</u>	<u>Households With Television (percent)</u>
1950	42.8	9.0
1951	47.4	23.5
1952	53.2	34.2
1953	62.1	44.7
1954	70.2	55.7
1955	72.5	64.5
1956	83.7	71.8
1957	112.7	78.6
1958	109.9	83.2
1959	118.3	85.9
1960	114.4	87.1
1961	111.6	88.8
1962	120.6	90.0
1963	141.1	91.3
1964	145.3	92.3
1965	143.6	92.6
1966	158.0	93.0
1967	160.5	93.6
1968	153.8	94.6
1969	144.5	95.0
1970	140.9	95.3
1971	107.6	95.5
1972	106.7	95.8
1973	96.9	96.4
1974	109.1	96.9
1975	139.5	97.1
1976	172.6	97.4
1977	199.2	97.4
1978	226.1	97.6

Source: Television Bureau of Advertising, Inc.

therefore appears reasonable to assume that the demand for advertising stock is elastic.

Given an elastic demand for advertising stock, an indirect effect of the ban is a decrease in the equilibrium price of cigarettes. The mechanism by which this occurs can be thought of as a shift outward over time of the supply schedule as fixed costs (advertising capital) declines and new brands enter. Initially, entry of new brands will not occur because the reproduction cost of the existing high level of advertising capital is higher than its value. (The capital is assumed to be firm and brand specific and therefore not saleable to a firm producing another brand). New entry occurs when the advertising capital stock of existing brands declines to a level sufficient to allow the entrant to provide consumers with an alternative level of price and advertising services to which they will be indifferent to the existing combinations. This new entry will then increase supply and cause price to fall to the now lower total equilibrium cost level of supplying cigarettes.<sup>41</sup>

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<sup>41</sup>Another factor which could have a significant effect on the price path is an equilibrium in which the competitive price is maintained via potential entrant competition rather than internal competition. In this case the ban represents a large decrease in the effectiveness of this potential competition and hence an increase in market power of the existing brands. This increase in market power would allow the price of existing brands to rise to the new higher cost of entering the market faced by new brands. Existing brands are thus able to capture the increased value of the preexisting advertising stock. As this capital depreciates entry will occur and price will gradually fall to the same equilibrium level as outlined in the text. Since an initial sharp price increase is not present in the post-ban data we can assume that internal (inter-existing brand) competition determines the market price.

This is illustrated in Figure 7.  $D_1$  and  $MC_1$  refer to the demand for cigarettes and the marginal cost of producing and selling cigarettes pre-ban. The ban has two effects:

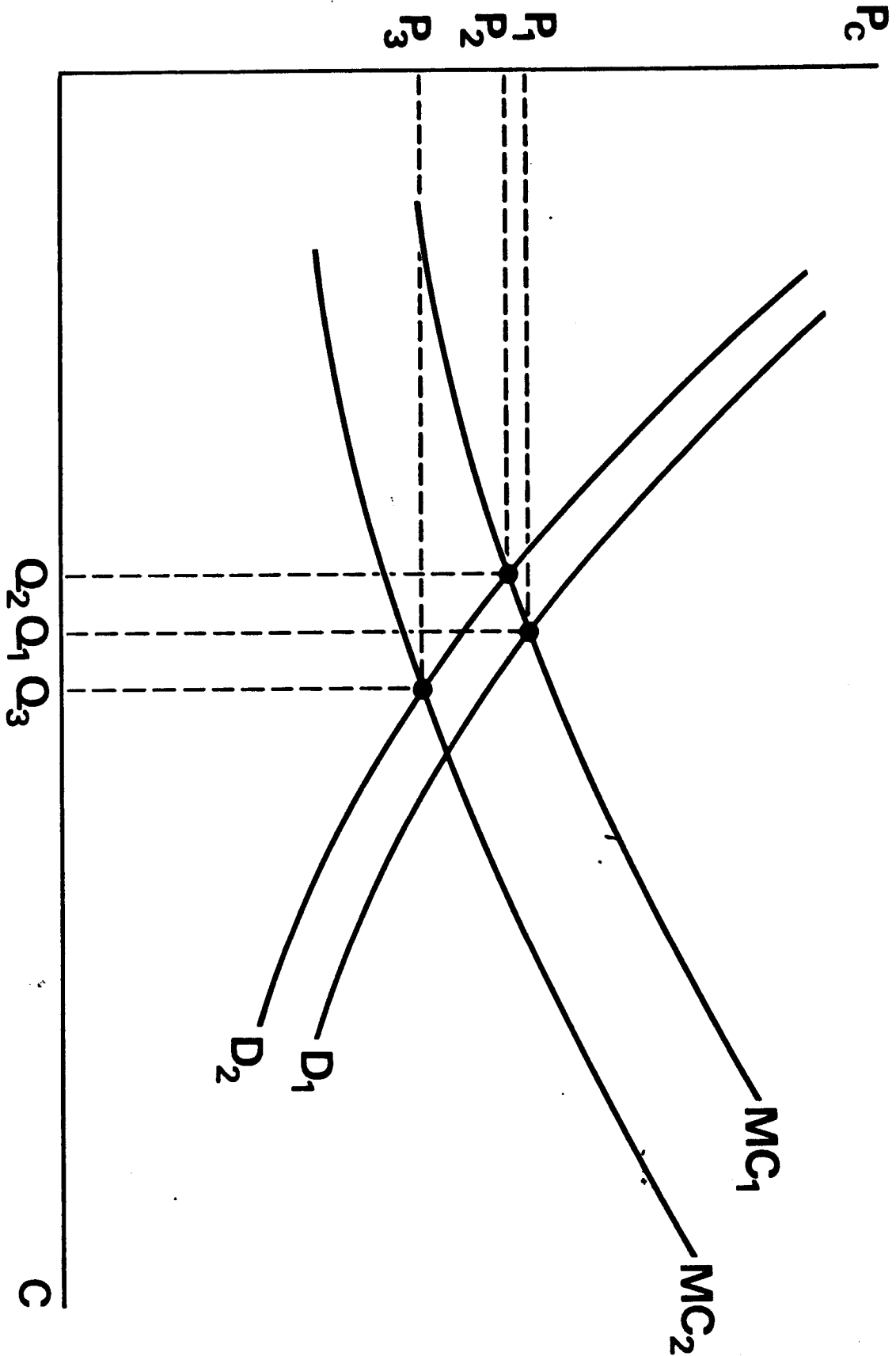
- (1) a decrease in the demand function from  $D_1$  to  $D_2$  as the desired and therefore actual advertising stock declines and
- (2) a shift down in the cost of selling cigarettes as equilibrium advertising expenditures decline. Effect (1) decreases price and quantity, effect (2) decreases price and increases quantity. Given the small, statistically insignificant estimated advertising effects in our demand equations, it seems likely that effect (1) will be very small or nonexistent. Therefore, although advertising expenditures are only about five percent of total retail sales, it is likely that effect (2) will dominate.<sup>42</sup>

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<sup>42</sup>As Figure 6, panel 2 indicates the real wholesale price of cigarettes declines by about 5 percent during 1971-74. Real retail price declines by about 7 percent, partially because the federal excise tax remained constant in nominal terms at eight cents per pack.

We attempted to estimate a cigarette price regression and examine the residuals for this time period. But we were not able to estimate an accurate simple relationship and gave up on the project. Part of the statistical problem is that theoretically what affects the wholesale price is not current advertising expenditures but the current cost of the equilibrium advertising stock. If our depreciation rate,  $\lambda$ , is not a fixed constant but a random variable (for example, due to changing tastes of various products) we will have significant estimation problems. In particular, if  $\lambda \cdot A_{t-1}$  fluctuates a great deal relative to the desired stock, then observed movements in advertising expenditures will be primarily a response to fluctuating depreciation rates. Further, if firms only partially adjust their advertising capital stock to its desired level, then our estimate of the advertising stock will be negatively correlated with the true stock for these changes in flows due to shifts in the depreciation rate. This is a possibly serious empirical problem with our demand regressions and for all other previous empirical studies of the effects of advertising on the demand for consumer goods where there are likely to be large fluctuations in advertising stock depreciation rates (for example, where brand market shares fluctuate substantially).

Figure 7  
The Effect of the Ban on Cigarette Market



The fact that the decrease in price produced by the advertising ban is likely to increase consumption by more than the decrease in consumption due to the lower advertising stock produced by the ban does not mean the level of advertising expenditures in the initial equilibrium was inefficient. We must assume that the consumer demand for advertising capital is based upon the services yielded by the advertising. Therefore since advertising stock is at a significantly lower level post-ban, we can say that the average "quality" of the cigarettes in some sense has fallen and the quality adjusted price has risen. The quantity scale on Figure 7 and the units used in estimating our demand function have misleadingly not been standardized for quality.<sup>43</sup>

This role of advertising in directly providing quality services, e.g., as "image" consumed with the cigarettes, is an important yet unemphasized notion relevant for many consumer

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<sup>43</sup>In fact if advertising "quality" per cigarette is a close substitute for quantity of cigarettes advertising may not necessarily affect the demand for cigarettes positively.



goods.<sup>44</sup> While some economists have extolled the benefits of advertising in providing price and other quality characteristics information and therefore lowering market prices by reducing consumer search costs (e.g., Benham), this alternative "quality of advertising" framework has not been discussed in the recent literature. The effect on price is not the sole criterion by which to judge the efficiency of advertising. If the reduction in price were actually worth more to consumers than the increased advertising, consumers would have voluntarily demanded lower advertised, lower priced brands.

The implicit alternative model to advertising as quality is to think of advertising as "fishing" (or "overfishing")

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<sup>44</sup> Therefore Peltzman in "The Effects of FTC Advertising Regulation," JLE, this volume has incompletely modeled the role of much of the consumer good advertising attacked by the FTC as "untruthful". Since the period of repurchase is so small for many of these goods (e.g., Campbells Soup) it is unlikely that the advertising serves as a signal that a price premium exists such that the level of brand name capital (or collateral) is greater than the firm's potential short run cheating return. (See B. Klein and K. Leffler, "The Role of Market Forces in Assuring Contractual Performance," JPE, August 1981 for a restatement of the framework originally presented in Nelson, "Advertising as Information," JPE 81, no. 4, August 1974, pp. 729-54. Rather the advertising may be presenting "an image" that is directly consumed by the consumer (e.g., "soup like mother made"). When Peltzman finds that FTC attacks on such advertising often have significant negative effects on the firm's net worth, it is incorrect for him to conclude that these costs to the owners of firms may be "offset by gains to consumers of the affected products...." Rather than providing consumers with valuable product information, the FTC policy which makes it known, for example, that Campbells shot their TV commercials with marbles in their soup may merely partially destroy Campbell's "homemade" image. Such senseless capital asset destruction would be a deadweight social cost.

for customers.<sup>45</sup> However, even if most of the observed effect of advertising is relative, i.e., shifting demand among firms rather than increasing the total number of units demanded, it does not mean that the "common pool" problem is present and that too much resources are invested by firms in supplying advertising capital.

A common solution to this problem is to distinguish between a "technological externality" such as congestion or the effect of another boat on a common lake lowering the productivity of all others in catching fish and a "pecuniary externality" or a change in the value of one firm's assets due to the normal (efficient) competitive process without any change in the firm's production function. However, this distinction is meaningless since it depends crucially upon how one defines the production function. If we consider the cost of obtaining another customer for your product, one firm's advertising expenditures lowers the marginal productivity of all other firms' advertising expenditures.

But customers are not analogous to fish. While each individual firm's advertising produces "externalities" of a sort on every other firm in the market, namely it takes customers away from the other firms, customers voluntarily move to the firm doing the advertising and are not "caught".

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<sup>45</sup>See, for example, Gordon, "The Economic Theory of a Common Property Resource: The Fishery," JPE August 1954.

The essence of the "common pool" problem is competition for an unspecified property right. Prespecified ownership of all resources is both necessary and sufficient to prevent "overfishing".<sup>46</sup> If the customers sought by firms are not owned, we will have overinvestment, but this does not mean that the customers must be owned by someone other than themselves, namely the competing firms. The market need not be allocated in some manner among firms to avoid excess advertising. The market is not like a lake since customers, by definition, own themselves. This is one of the basic underlying assumptions of the classical economic model.

Unless we think of customers as fish, there cannot be overadvertising. Therefore the advertising ban not only had negative health effects (increased the consumption of cigarettes) it also necessarily decreased consumer welfare.

#### The Post-1974 Period

As Figure 6, panel 3, indicates, the period after 1974 is one in which real advertising flows increase dramatically. In terms of our model this must be due to either a large increase in the depreciation rate of advertising capital or to an increase in

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<sup>46</sup>Note that we must not confuse two distinct questions: (a) defining the property right and (b) the minimum transaction cost definition of property rights. Analytically, to solve the "common pool" problem we need only specify (and enforce) property rights to each particular fish in the lake; the minimum transaction cost solution is likely to be one owner of all the fish in the lake.

the desired advertising capital stock. If there was a once and for all decrease in the actual advertising stock, advertising flows would increase temporarily and there would be no effect on final product price. The firms would have to digest a windfall capital loss and would be unable to pass it on to consumers. If the increase in the depreciation rate were permanent,<sup>47</sup> this would increase the cost of advertising capital and therefore decrease the desired advertising stock. Since the demand for advertising services is highly elastic, this would decrease the equilibrium advertising expenditure flow. If, on the other hand, the shock is due to an increase in the desired advertising stock, this would increase the product price (as the 1971 decrease in desired advertising stock is likely to have decreased product price).

As Figure 6, panel 2 indicates, the post-1974 period is one where the real wholesale price of cigarettes rises by about 20 percent. (Real retail price continues to decline because of the nominally fixed federal excise tax.) It is therefore likely that an increase in the desired advertising stock occurred in the post-1974 period.

As Table 2 and Figure 6, panel 1 indicates, during this period consumers began to move in significant numbers to low tar brands, and as Figure 6, panel 3, indicates an increasing share of advertising was concen-

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<sup>47</sup>Nonbroadcast media advertising might have a higher depreciation rate than broadcast media advertising.

trated on these brands. It is not unreasonable to suppose that this shift also produced an increase in the desired level of advertising stock as consumers demanded increased information about comparative tar and nicotine figures and a new "light" or "healthful" image from their cigarettes. In any event, the price shift clearly indicates that the equilibrium cost of the desired advertising capital per cigarette has shifted up.

Although the price has shifted up due to this shift out in the demand for advertising services, it is likely that price remains lower (and therefore demand higher) than it would be in the absence of the ban. As long as the elasticity of demand for advertising remains unchanged, or at least remains in the elastic range, the ban implies a lower price and therefore higher level of consumption.

In addition, the ban and the lower level of effective advertising stock which the ban has produced appears to have made it more difficult for consumers to switch to low tar cigarettes. Because the ban makes it more costly to obtain information, fewer people will switch to low tars at every point in time than would have in the absence of the ban. Suggestive evidence in this regard can be obtained by observing the relatively slower initial movement to the equilibrium market share of low tar cigarettes compared to other innovations in the past

such as the introduction of filter tip cigarettes.<sup>48</sup>

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<sup>48</sup>One response to the increased cost of advertising capital in the face of this shift in demand has been an increase in "line extensions" (for example, Camel Lights) rather than the creation of entirely new brands. By taking advantage of existing brands the firm need only produce the lower tar and nicotine information capital, but at the added cost of destroying part of the old brand image and creating an imperfect new brand image.

## VI. Summary and Conclusion

Our results indicate that consumers have reacted quite vigorously to the information that has been supplied to them regarding the health dangers of smoking. Most previous studies have greatly underestimated the consumer response to publication of the 1953 American Cancer Society Report. The evidence appeared to show that this health information did not lead consumers to permanently decrease their consumption of cigarettes. However, these previous studies have seriously misestimated the demand relationship. We have seen that the primary response to the 1953 information was a movement by cigarette smokers to filter cigarettes with their lower tobacco per cigarette content. If we consider changes in the per capita consumption of tobacco rather than in the number of cigarettes, the negative effect of the 1953 Report is large. By 1964 there is a more than fifteen percent reduction in consumption. If, on the other hand, we analyze the per capita consumption of cigarettes over the post-1953 period, it is crucial that we standardize for this effect. Not taking account of changes in the quantity of tobacco per cigarette actually implies the result that the 1953 health information shock produced an increase in the number of cigarettes consumed.

Our results indicate that the 1964 Surgeon General's Report intensified the consumer movement away from tobacco consumption. While per capita cigarette consumption was actually about two percent higher by the start of 1971 than in 1953,

our empirical results indicate that the cumulative effect of the two health reports had produced a reduction in per capita tobacco consumption of about twenty five percent. In addition, by 1971 the antismoking commercials required by the FCC Fairness Doctrine had further reduced per capita tobacco consumption by another five percent, for a total reduction of thirty percent.

Within the context of this large and continuing, but largely unmeasured, movement by consumers away from tobacco consumption, Congress imposed a ban in 1971 on all cigarette broadcast advertising. While many previous studies have reported a negative impact on cigarette consumption due to the ban, our results indicate that the ban increased consumption.

The negative effect on consumption due to the advertising ban that is found in previous studies can be generally attributed to a misspecification of the long run trend or income elasticity of demand for cigarettes in these studies. There is a very rapid growth in cigarette consumption in the early part of our time period and when this trend growth is extended to the later years it results in significant negative residuals for the post-1971 period to be partially explained by the advertising ban. When the trend growth rate in cigarette demand is modeled correctly by considering the switching over time by consumers to cigarettes from other forms of tobacco consumption, the large unexplained shift down in actual cigarette consumption in the last decade is eliminated and with it the large residuals to be explained by the ban.



Given the trivial effect of advertising on aggregate cigarette consumption, governmental prohibition of broadcast cigarette advertising could not have had any significant effect in terms of reducing demand. Instead, we find that the policy actually increased demand, producing detrimental effects on both social health and consumer welfare. The decrease in the quantity and effectiveness of advertising expenditures produced by the ban is likely to have lowered the quality (utility) of cigarettes consumed by making it more costly for consumers to buy the "advertising services" they demand. In addition, the decrease in advertising expenditures appears to have led to a lower (non-quality adjusted) cigarette price and hence to increased consumption. Further, the ban increased consumption via the elimination of the antismoking commercials. Finally, the ban substantially increased the cost to firms of introducing new low tar brands and the cost to consumers of obtaining information about these newer brands thus slowing down the movement of these lower tar cigarettes.

Our results indicate that in the post-1971 period consumers continued to respond to the health dangers associated with smoking. By 1978 per capita tobacco consumption is nearly fifty percent lower than it would have been in the absence of the 1953 and 1964 health reports. The government imposed ban on cigarette advertising only slowed down this significant movement by consumers away from smoking.

Data Sources

- C Per capita consumption of cigarettes, domestic and overseas forces, population aged 14 and older (number)
- (1) Tobacco Situation, TS-113, September 1965, TS-147, March 1974, TS-163, March 1978, TS-173, September 1980, U.S. Department of Agriculture, Economics, Statistics and Cooperatives Service.
  - (2) Historical Statistics, Series A29-42, "Annual Estimates of the Population by Age: 1900-1970," U.S. Department of Commerce, Bureau of the Census.
  - (3) Current Population Reports, Series P-25, No. 614, No. 645, No. 875, U.S. Department of Commerce, Bureau of the Census.
- P Retail price index for cigarettes deflated by the consumer price index for all commodities.
- (1) Neil H. Borden, The Economic Effects of Advertising, Richard D. Irwin, Inc., Chicago, 1944.
  - (2) Consumer Price Index, Price Indexes for Selected Items and Groups, 1935-1961, U.S. Department of Labor, Bureau of Labor Statistics.
  - (3) Consumer Price Index, Quarterly Price Indexes for Selected Items and Groups, December 1962 to March 1964, U.S. Department of Labor, Bureau of Labor Statistics.
  - (4) Consumer Price Index, Consumer Price Indexes for Selected Items and Groups, December 1963 to December 1965, December 1965 to December 1967.
  - (5) Federal Trade Commission, Report to Congress Pursuant to the Federal Cigarette Labeling and Advertising Act, 1978.
  - (6) Long Term Economic Growth, 1860-1970, U.S. Department of Commerce, Bureau of Economic Analysis.
  - (7) Printer's Ink, various issues.
  - (8) Barron's, various issues, 1970-1975.

- P<sub>T</sub> Tobacco price index deflated by the consumer price index for all commodities
- (1) Ada Beney, Cost of Living in the United States, National Industrial Conference Board, 1936
  - (2) Bulletin #996, U.S. Department of Labor, Bureau of Labor Statistics
  - (3) Handbook of Labor Statistics, 1974, U.S. Department of Labor, Bureau of Labor Statistics
  - (4) Tobacco Situation, TS-163, March 1978, U.S. Department of Agriculture, Economics, Statistics and Cooperatives Service
  - (5) Federal Trade Commission, Report to Congress Pursuant to the Federal Cigarette Labeling and Advertising Act, 1978
  - (6) Long Term Economic Growth, 1860-1970, U.S. Department of Commerce, Bureau of Economic Analysis.

- T Tobacco consumption per capita, population aged 14 and older (pounds)
- (1) Tobacco Situation, TS-173, September 1980, TS-137, September 1971, U.S. Department of Agriculture, Economics, Statistics and Cooperatives Service
  - (2) Historical Statistics, Series A29-42, "Annual Estimates of the Population by Age: 1900-1970," U.S. Department of Commerce, Bureau of the Census.
  - (3) Current Population Reports, Series P-25, No. 614, No. 645, No. 875, U.S. Department of Commerce, Bureau of the Census

T<sub>C</sub> Consumption per capita of tobacco in cigarettes, population aged 14 and older (1929 dollars)  
Source: same as for T.

- Y Real per capita income (dollars)
- (1) Net national product, Long Term Economic Growth, 1860-1970, U.S. Department of Commerce, Bureau of Economic Analysis
  - (2) Statistical Abstract, 1974, 1979, U.S. Department of Commerce, Bureau of the Census.

- A Advertising stock, created using a depreciation rate of 1/3 (1929 dollars)
- (1) William H. Nicholls, Price Policies in the Cigarette Industry, The Vanderbilt Press, Nashville, 1971
  - (2) Richard Schmalensee, The Economics of Advertising, North-Holland Publishing Company, Amsterdam, 1972
  - (3) Advertising Age, various issues
  - (4) Printer's Ink, various issues
  - (5) Federal Trade Commission, Report to Congress Pursuant to the Federal Cigarette Labeling and Advertising Act, 1968, 1970, 1975, 1977, 1978, Washington, D.C.
  - (6) Leading National Advertisers, Inc., National Advertising Investments, 1948-1967
  - (7) Magazine Advertising Bureau, National Advertising Investments, 1945-1948.
- F Market share of filter cigarettes (percent)
- (1) Tobacco Situation, U.S. Department of Agriculture, Economics, Statistics and Cooperatives Service, various issues
  - (2) Federal Trade Commission, Report to Congress Pursuant to the Federal Cigarette Labeling and Advertising Act, 1978.
- L Market share of low tar cigarettes (percent)
- (1) Federal Trade Commission, Report to Congress Pursuant to the Federal Cigarette Labeling and Advertising Act, 1978
  - (2) Maxwell Associates, Historical Trends in the Tobacco Industry, Virginia, 1977.
- D<sub>F</sub> Antismoking commercials (number)
- I. Rimer, Comment in The Second World Conference on Smoking and Health, edited by Robert G. Richardson, Health Education Council, 1971.

Selected References

- Atkinson, A.B., and Skegg, J.L., "Antismoking Publicity and the Demand for Tobacco in the U.K.," Manchester School of Economics and Social Studies, 41: 3, Sept. 1973, pp. 265-82.
- Clarke, Darral G., "Econometric Measurement of the Duration of Advertising Effect on Sales," Journal of Marketing Research, XIII, November 1976, pp. 345-57.
- Fishbein, Martin, "Consumer Beliefs and Behavior With Respect to Cigarette Smoking: A Critical Analysis of the Public Literature," A Report Prepared for the Staff of the Federal Trade Commission, May 1977.
- Gordon, Donald, "The Economic Theory of a Common Property Resource: The Fishery," Journal of Political Economy, August 1954.
- Grawbowski, Henry G., "The Effects of Advertising on Intraindustry Shifts in Demands," Explorations in Economic Research, Spring 1976.
- \_\_\_\_\_, "The Effects of Advertising on the Interindustry Distribution of Demand," Explorations in Economic Research, Spring 1976.
- Hamilton, James L., "The Demand for Cigarettes: Advertising, the Health Scare and the Cigarette Advertising Ban," Review of Economics and Statistics, 54, November 1974, pp. 401-11.
- Ippolito, Richard A., Murphy, R. Dennis, and Sant, Donald, Staff Report on Consumer Responses to Cigarette Health Information, Federal Trade Commission, August 1979.
- Klein, Benjamin and Leffler, K., "The Role of Market Forces in Assuring Contractual Performance," Journal of Political Economy, August 1981.
- Lewit, Eugene and Coate, Douglas, "The Potential of Reducing Cigarette Smoking Through Excise Tax Increases: A Preliminary Analysis," unpublished.
- Lyon, H.L., and Simon, J.L., "Price Elasticity of the Demand for Cigarettes in the United States," American Journal of Agricultural Economics, 50, November 1968, pp. 881-93.
- Nelson, Philip, "Advertising as Information," Journal of Political Economy, August 1974, pp. 729-54.

Nicholls, William H., Price Policies in the Cigarette Industry,  
The Vanderbilt University Press, Nashville, 1951.

Peltzman, Sam, "The Effects of FTC Advertising Regulation,"  
Journal of Law and Economics, October 1981.

Sacknin, S.M., "Factors Affecting the Demand for Cigarettes,"  
Agricultural Economics Research, 14, July 1962, pp. 81-88.

Schmalensee, Richard, The Economics of Advertising, North-  
Holland Publishing Co., Amsterdam, 1972.

Telser, Lester G., "Advertising and Cigarettes," Journal of  
Political Economy, October 1962, pp. 471-99.

Wagner, Susan, Cigarette Country, Praeger Publishers, 1971.

Warner, Kenneth E., "The Effects of the Antismoking Campaign on  
Cigarette Consumption," American Journal of Public Health,  
67, #7, July 1977.

Weiss, Leonard W., "Advertising, Profits and Corporate Taxes,"  
Review of Economics and Statistics, 51 (4) November 1969,  
pp. 421-30.

Welch, Finis and James Cunningham, "Effects of Minimum Wages  
on the Level and Age Composition of Youth Employment,"  
Review of Economics and Statistics, 60, #4, February 1978,  
pp. 140-45.