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Authors

Hu, Teh-wei
Sung, Hai-yen
Keeler, Theodore E.

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UNIVERSITY OF CALIFORNIA AT BERKELEY

Department of Economics

Berkeley, California 94720

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**Tobacco Taxes and the Anti-Smoking Media
Campaign: The California Experience**

Teh-wei Hu
Hai-yen Sung
Theodore E. Keeler

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Abstract

In 1988, California voters enacted Proposition 99, increasing the tax on cigarettes by 25 cents per pack effective January 1989. Proposition 99 also earmarked 20% of the revenue raised by this new tax for an anti-smoking media campaign and other educational programs to reduce tobacco use. The purpose of this paper is to examine the relative effects of taxation versus the anti-smoking media campaign on cigarette sales. Quarterly sales data reported by the California State Board of Equalization between 1980 and 1992, adjusted for seasonal variations and time trends, show that sales of cigarettes were reduced by 1333 million packs as a result of the additional 25-cent tax, while the anti-smoking media campaign reduced cigarette sales by 232 million packs during the same period, July 1990-December 1992. The combined effects of taxes and the anti-smoking media campaign during the 4-year post Proposition 99 period resulted in 1.565 billion fewer packs of cigarettes sold in California. The magnitude of those effects is influenced by the magnitude of taxes compared with the amount of the anti-smoking media campaign budget.

Teh-wei Hu
Professor of Health
Economics
School of Public Health
University of California
at Berkeley

Hai-yen Sung
Research Associate
Institute of Business and
Economic Research
University of California
at Berkeley

Theodore E. Keeler
Professor of Economics
University of California
at Berkeley

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The California Experience

Introduction

In 1988, the state of California passed Proposition 99, the California Tobacco Tax and Health Promotion Act, increasing the tax on each package of cigarettes from 10 cents to 35 cents beginning January 1989. In addition, the Act earmarked 20% of the revenue raised by this new tax for educational programs to reduce tobacco use. These educational programs included statewide multimedia campaigns, tobacco prevention education in the public schools, community intervention programs administered through local health departments, and a network of competitive grants projects targeting high-risk populations. The most visible component of these four programs is the statewide anti-smoking multimedia campaign, which was unprecedented. During fiscal years 1989-1993, the state spent about \$26 million for a media campaign. Never before had a state government used paid advertising to promote changes in health-related behavior on this large a scale.

The focus of the statewide media campaign was to change tobacco-related attitudes and behaviors of the program's target groups: (1) adult smokers, (2) pregnant women, (3) ethnic minorities, and (4) children. To implement the program, paid advertising was used to deliver the message to the target audience through television. Community relations agencies and

public relations firms were hired to promote the media campaign and to foster opportunities for unpaid media coverage for anti-smoking messages (Bal et al., 1990). It took some time for the state office to establish the tobacco control infrastructure and to set up the media campaign program. The \$28.6 million appropriated for media campaigns for fiscal years 1989-91 was spent beginning in April 1990, with a concentration during the period June 1990-June 1991. It was temporarily halted in early 1992 where California's Governor decided to divert these media campaign funds to medical care for the poor. This action caused considerable debate among policymakers and health promotion professionals about the effectiveness of the anti-smoking media campaign versus taxation on cigarettes sales in California (Skolnick, 1992; Glantz, 1993).

Although the superior court ruled the funding must be reinstated, the concern about the relative effectiveness of these two approaches continues to be of interest to policymakers and health promotion experts. The purpose of this paper is to use the California tobacco sales data from 1980 through 1992 to empirically examine the relative effects of the media campaign and increased taxation on cigarette sales since the passage of Proposition 99.

Methods

Data

Cigarette sales data were obtained from the California State Board of Equalization, reported on the basis of monthly sales of

cigarette tax stamps. In this paper we converted monthly sales for 1980 through 1992 into quarterly data. Cigarette sales are expressed as number of packs per capita (civilian population). Population figures are used as the denominator to adjust for the effect of population growth on cigarette sales. Military personnel are excluded because cigarettes sold at federal military installations are exempt from state excise taxes. Annual civilian population were based on January estimates obtained from the California Department of Finance (1993). **Figure 1** illustrates quarterly per capita sales of cigarettes in California between January 1980 and December 1992.

The cigarette price variable was measured in cents per pack at the retail sales level, deflated by the U.S. consumer price index for all items (1982-1984=100). The retail cigarette price is the average price of four types of cigarettes and four types of transactions weighted by their national market share, obtained from the Tobacco Institute (1993). California and federal tax on cigarettes also were obtained from the Tobacco Institute (1993). Before 1989, the state cigarette tax rate was 10 cents per pack; beginning in 1989, the tax rate increased to 35 cents per pack. The federal tax rate was 8 cents per pack from January 1980 to December 1982; it became 16 cents per pack from January 1982 to December 1990; it increased to 20 cents beginning in 1991.

Information on California's anti-smoking media campaign is measured in terms of the media placement expenditures by the Tobacco Control Section, California Department of Health

Services. These expenditures are reported on a monthly basis and reflect the net costs of buying television and radio time and outdoor (billboard, transit, and mall posters) and print space. The monthly totals are invoiced from the media campaign and, therefore, approximately reflect the month in which the media placements occurred. Although they are reflected in a particular month's expenditures, these media placements usually occur in the following one to six months (Duerr, Personal Communication, June 1993). Through the end of 1992, the state had spent \$11.8 million on television, \$4 million on radio, \$1.1 million on print, \$2.7 million on an outdoor campaign, for a total of \$19.6 million dollars.

Statistical Analysis

To examine the effect of the cigarette tax and anti-smoking media campaign on cigarette sales, a time-series method (Box and Tiao, 1975) was used. Explanatory variables in the model include: a time trend, quarterly dummy variable, California state tax, federal tax, retail price other than taxes (i.e. retail price minus state and federal taxes), and the media campaign variable.

The time trend variable accounts for the general decline in cigarette sales over time in the absence of tax increases. Quarterly dummy variables (4th quarter is the comparison quarter) account for the seasonal fluctuations in sales. Retail prices are decomposed into three components: state tax, federal tax, and the retail price net of taxes, which includes the wholesale

price, retail mark-up, and so forth. This decomposition enables the model to sort out the possible separate effects and differences in the increase in state tax versus federal tax during the studied year.

The media campaign variable is approximated by the dollar amount spent for the anti-smoking media campaign. Media expenditures are estimated by accumulating the monthly figures over time. Studies of the effect of advertising on cigarette consumption (Hamilton, 1974; McGuinness and Cowling, 1975; Baltagi and Levin, 1986) have often considered media as having a cumulative effect, i.e., as a stock variable concept, rather than a flow variable concept. In other words, it takes time to achieve the intended effects of a media campaign. The studies cited above considered the effect of cigarette industry advertising on the increased demand for cigarette consumption. In this study, reverse consideration is to be examined, that is, the effect of an anti-smoking media campaign on reducing sales of cigarettes. Although expenditures were paid by the government during the month and media effects were implemented in that month, the actual impact may take its cumulative activities and longer time horizon. On the other hand, the effect of the media campaign, expressed in expenditures, may depreciate over time. Therefore, the media campaign variable in this study is constructed by the accumulated total media expenditures adjusted by a depreciation rate, 5%, as suggested by McGuinness and Cowling (1975). To reflect the fact that media placement usually

occurs after the expenditures payment is reported, one period lag (one quarter) is assumed to examine the effect of media campaign on cigarette sales:

$$\text{Media}_t = \sum_{n=1}^{t-1} (1 - B)^{n-1} (\text{media expenditures}_{t-n})$$

Where B is the depreciation rate, t is the present time period, and n is the beginning time period. In other words, "Media" is the weighted sum of aggregate total media campaign expenditure.

The model was estimated with the Box-Tiao Time-Series Intervention Analysis (1975) conditional least-squares estimation sub-routines in the Statistical Analysis System (SAS). Various dotted lines in **Figure 1** demonstrate the extent to which the model fits the observed data and the relative impact of the state tax and the media campaign, respectively.

Results

The estimated results presented in **Table 1** indicate that the state tax, the federal tax, and the anti-smoking media campaign all are statistically significant in reducing cigarette sales in California. As expected, the magnitude of the two tax coefficients, -0.146 for the state tax and -0.127 for the federal tax, are quite comparable. Based on these estimated coefficients, it can be seen that a 25-cent increase in state tax rate could reduce cigarette sales by 3.65(=25 x 0.146) packs per capita per quarter, while a 25-cent increase in federal tax rate could reduce cigarette sales by 3.18(=25 x 0.127) packs per capita per quarter. An additional \$10 million spent for the

anti-smoking media campaign could reduce cigarette sales by 0.85 packs per capita per quarter. Judging from the respective t-ratios of these coefficients, it also can be inferred that the degree of significance is much stronger for the state tax than for the media campaign variable. The calculated elasticity of cigarette sales with respect to the state tax is $-0.30 (= -0.146 \times 35/17.1)$ during the post-Proposition 99 period (1989-1992), where 35-cent is the tax rate and 17.1 is the first quarter of 1989 per capita cigarette sales. In other words, a 10 percent increase in the state tax could lead to a 3 percent reduction in cigarette sales. The calculated elasticity of cigarette sales with respect to media campaign expenditures is $-0.05 (= -0.085 \times 10/17.1)$, where a figure 10 refers to \$10 million expenditures on the media campaign. That is, a 10 percent increase in media campaign expenditures would lead to 0.5 percent reduction in cigarette sales.

It should be noted that the coefficient of the residual price variable is not statistically significant in the estimated equation. The non-significance of the coefficient could be due to multicollinearity of other variables, such as trend, or due to gradual income in residual price which would not lead a consumer to respond drastically, after taking away the shock effect of tax increase.

To examine the relative impact of the 25-cent taxation versus the anti-smoking media campaign, the estimated coefficients in **Table 1** are used to simulate the predicted

cigarette sales under two conditions: (1) if there had been no 25-cent state tax increase since 1989, or (2) if there had been no anti-smoking media campaign since April 1990. The calculated results can be compared to the actual sales during the simulation period to obtain the predicted effect of taxation versus a media campaign on cigarette sales.

Table 2 provides summaries of the separate effects of the 25-cent tax increase and the anti-smoking media campaign. Between the first quarter of 1989 and the first quarter of 1990, there was no anti-smoking media campaign. During that time, the estimated effect of the 25-cent tax increase was a reduction of 514 million packs sold, or 17.1 packs per capita. The comparison of the effect of the tax versus the media campaign should be based on the results estimated between 1990, 3rd Quarter and 1992, 4th Quarter (10 quarters). The estimated results suggest that the 25-cent tax reduced cigarette sales by 819 million packs (or 27.3 packs per capita), while the media campaign reduced sales by 232 million packs (or 7.7 packs per capita) during the same time period. The total effect of the cigarette tax during the entire 4-year post tax period was a reduction in sales of 1.33 billion packs. The combined effects of taxes and the media campaign during the 4-year post-Proposition 99 period was 1.56 billion fewer packs of cigarettes sold in California.

Discussion

The time-series analysis, based on monthly cigarette sales data in California between 1989 and 1992, indicates that both the

25-cents per pack excise tax increase and the anti-smoking media campaign were statistically significant in reducing cigarette sales. The magnitude of these effects is conditioned by the magnitude of the tax increase and the magnitude of the anti-smoking campaign. In other words, the relative effect of taxation versus the media campaign should hinge on the magnitude of the tax increase versus the size of the anti-smoking media budget spent to control tobacco usage. This study suggests that individually both increased taxation and the anti-smoking campaign are statistically significant in reducing cigarette sales. Perhaps the debate about their relative effectiveness is less significant, since they represent two different ways to reduce cigarette consumption. One provides an economic disincentive while the other is a form of behavior modification in the demand for cigarette consumption. The implementation of Proposition 99 in California indicates that raising taxes and at the same time using part of the tax revenue for the anti-smoking media campaign is an effective approach to reduce cigarette consumption.

The findings from this study are based on aggregate sales data. The results obtained from the estimated model are the end result of both individual behavior and the changes in the industry and market. For instance, the effects of taxation in this model are the end result of changes in pricing, such as the resulting response from the cigarette industry to promote the sales of discount-brand cigarettes. The effects of the anti-

smoking media campaign in this model are the end result in spite of the tobacco industry's media campaign launched in response to the government's anti-smoking campaign. In other words, had there been no industry media advertising, the state's anti-smoking media campaign could have been more effective, assuming that the industry media campaign was indeed effective.

Aggregate data can provide general trends and a rough approximation of the impact of implementing a policy. The questions of how the taxation or the anti-smoking campaign affected individual behavior patterns--how many people quit smoking, were deterred from smoking, or reduced the amount they smoked--would require additional analysis of individual behavior data. To study the effectiveness of the media campaign on individuals, for example, one would first examine the amount of exposure to the media message, the subsequent impact in terms of understanding or the perception of the message, and then the changes in behavior. These analyses would require an intensive survey study, which is beyond the scope of this paper.

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Table 1
 Quarterly Time-Series Analysis for California Cigarette Sales
 (Per Capita Sales in Packs, 1980-1992)

Variables	Coefficients (t-value)
Intercept	33.136 (27.49)**
Time Trend	-0.244 (14.46)**
State Tax	-0.146 (11.06)**
Federal Tax	-0.127 (4.18)**
Residual Price	0.022 (1.08)
Media	-0.085 (2.42)*
First Quarter	-2.294 (6.44)**
Second Quarter	-0.065 (0.21)
Third Quarter	-0.365 (1.01)
MA (1)	0.508 (3.62)**

Note: ** indicates a 1% level of significance (two-tailed test)
 * indicates a 2% level of significance (two-tailed test)

Table 2
 Predicted Effects of 25 Cents State Tax
 Versus Anti-Smoking Media Campaign, 1989-1992

Time Period	Tobacco Control Programs	Reductions in Sales (packs)	
		State	Per Capita
1989.1-1990.2	Tax Increase (25 cents)	514 million	17.1
1990.3-1992.4	Tax Increase (25 cents)	819 million	27.3
1989.1-1992.4	Tax Increase (25 cents)	1,333 million	44.4
1990.3-1992.4	Anti-smoking Media	232 million	7.7
1989.1-1992.4	Tax Increase & Media	1,565 million	52.1

Note: Calculations based on results in Table 1. Total population in California is estimated to be 30 million, according to 1990 census.

Figure I - Quarterly Per Capita Cigarette Sales in California

