

Do Taxes Really Affect the Consumption of Cigarettes?

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The issue of smoking has recently been under close scrutiny by the government. Tobacco companies have been blamed for marketing their products to young teenagers who are not even legally old enough to smoke. In recent years, cigarette advertising has been severely limited by the government. Large billboards that once sported such figures as Joe Camel and the Marlboro Man now have to display messages about smoking cessation or why smoking "isn't cool." In fact, a person will not see Joe Camel at all due to the prohibition of the use of the R.J. Reynolds cartoon. In addition, tobacco company sponsorship of sporting events is beginning to be limited.

Since the government is launching a full-scale attack on the tobacco industry, taxes have become the medium by which prices are controlled. There have been several studies concerning the consumption of cigarettes and the explanatory variables associated with that consumption. All of the studies have shown that taxes can be significant in reducing smoking. Yoram Barzel (1976) says that the effect of a per unit tax raises the price by more than the amount of the tax, while an ad valorem tax actually decreases the price by less than the amount of the tax. John A. Bishop and Jang H. Yoo (1985) determined that the consumption of cigarettes is significantly affected by the taxes levied on the cigarettes. The tax, they found, had more of an effect on consumption than did the health scare created by the government in the 1960's in Surgeon General's reports. Additionally, W. Kip Viscusi (1990) found that excise taxes

discourage smoking by serving as a monetary cost for the risks associated with smoking.

In this study, the effects of state cigarette taxes on the consumption of cigarettes among age groups 18-24, 25-44, 45-64, and 65 and over will be tested. This study is differentiated from others because it tests how state taxes affect the percentage of smokers in each age group instead of testing the effects on quantity demanded. Although using a demand function for cigarettes as a measure of consumption is more common, this paper argues that regressing the percentage of smokers on the state cigarette tax should more appropriately depict how taxes affect cigarette consumption behavior in a state at large. This method is more appropriate because a study with the demand for cigarettes as the dependent variable does not actually measure how many people have stopped smoking, while a study using the percentage of smokers as the dependent variable does. For instance, a decrease in demand could occur because smokers have reduced the amount of cigarettes they smoke, not necessarily because they have stopped smoking altogether.

The hypothesis of this study assumes that the youngest age group, 18-24, is affected the most by cigarette taxes. Since this age group (and even younger age groups) is supposed to be the target audience of the advertisements of the tobacco industry, proving this hypothesis could show that state governments actually could reduce the number of smokers in this age group by imposing higher taxes on cigarettes. This should decrease the overall number of smokers because most people who are life-long smokers start smoking at an early age. Therefore, if taxes impose a barrier to this age group's smoking then the overall percentage of smokers can be decreased.

II. Literature Review

Bishop and Yoo (1985) investigated the determinants of cigarette consumption, including taxes, the 1950's health scare, and the advertising ban. They found that the taxes were more effective in reducing the consumption than the health scare or the advertising ban. In fact, the latter two had little effect on reducing smoking¹. Therefore, it has been shown that levying taxes on cigarettes would be an effective means of reducing the consumption of cigarettes.

To fully understand this issue, one must look at the price elasticity of cigarettes. Since cigarettes are the objects of an addiction, one would suspect that cigarettes would be an inelastic good. If people are addicted to the good, a small change in price, theoretically, should not see a large change in the quantity demanded². However, among the age group 18-24, it is likely that individuals would not have the money to afford such a habit. Furthermore, the opportunity cost of a pack of cigarettes would be greater for individuals in the age group 18-24 because they are sacrificing longer life expectancy and hence, potential earnings in the future. Therefore, due to the fact that younger people do not have as much money as older people, the regressions should show that the effects of the state cigarette taxes are negative and more substantial among this age group than in the older age groups.

There are other issues that apply to opportunity costs, which include the costs of health care in the future. In this case, there is the direct cost per individual who smokes, plus the cost to pay for all of those affected by second-hand smoke. If it could somehow be calculated, a tax should be able to assess the risks associated with smoking and distribute the costs to smokers. Viscusi (1990) implies this, but his model

primarily deals with the perceived susceptibility to lung cancer from smoking. However, Viscusi (1990) found that the amount of money generated by taxes more than accounts for the cost of health care in the future. This implies that the government is making a profit on the taxes, rather than just covering future health care costs, which, as aforementioned, is what taxes are supposed to do.

From a health care standpoint, this study's distinguishing point of using the percentage of smokers as the dependent variable has benefit. Where a study using the demand for cigarettes as the dependent variable measures how much the demand has or has not dropped for cigarettes, this study focuses on how many have quit. If a person only reduces their smoking from two packs a day to one pack a day, there will still be health costs down the road, perhaps only delayed a bit by the decrease. However, if a person quits smoking, then some of the health costs can be reduced.

Opportunity costs also include the price of cigarettes relative to the cost of living. If the price of cigarettes is relatively small to the cost of living, then people are more likely to smoke, but if prices are high enough (greater taxes), then smoking would not be worthwhile. Consequently, this effect on consumption is being controlled in the regressions by the CPI variable.

Finally, Jeffrey E. Harris (1985) finds that people in poverty are more likely to smoke. He looks at incomes among age groups, and in all age groups but one (65 and over), those individuals with lower incomes are smokers, while those with higher incomes are not.

III. Theory

The hypothesis and focus of this study is that most people feel that an effective way to prevent smoking among young people is to levy cigarette taxes, which will raise the price of cigarettes. However, other variables in the relationship need to be taken into consideration for the purpose of control. The data for EDUCATION (percentage of the state's population with a bachelor's degree or higher), INCOME (per capita income by state), and POVERTY (percentage of people 18 and older in poverty by state) came from the 1990 US Census. The data for the TOBACCO DUMMY variable (which indicates a "1" for the top seven tobacco producing states and a "0" for everything else) came from research done by Gregory Lilly (1999). The data for the CPI variable comes from the Bureau of Labor Statistics (BLS)³. The TAX variable came from *State Tobacco Control Highlights 1996*, a publication of the Centers for Disease Control (CDC), and used state per pack tax rates as of December 1, 1995⁴. The TAX DIFFERENTIAL DUMMY is a comparison of the 1995 state taxes to the 1996 state taxes⁵. If the difference was more than ten cents⁶, the state was assigned a "1", while all other states were assigned a "0". This variable captures any differences in smoking instances caused by differences in tax rates between 1995 and 1996. The data for the % OF SMOKERS (percentage of smokers in each state, by age group, in 1997) came from the State Tobacco Activities Tracking and Evaluation System (STATE), which was developed by the CDC.

From this, a regression model was developed:

$$(1) \text{ PERCENT OF SMOKERS} = \mathbf{b}_1 + \mathbf{b}_2 (\text{EDUCATION}) + \mathbf{b}_3 (\text{INCOME}) + \mathbf{b}_4 (\text{POVERTY}) \\ + \mathbf{b}_5 (\text{TOBACCO DUMMY}) + \mathbf{b}_6 (\text{CPI}) + \mathbf{b}_7 (\text{TAX}) + \mathbf{b}_8 (\text{TAX DIFFERENTIAL DUMMY})$$

It is hypothesized that TAX and TAX DIFFERENTIAL DUMMY variables will have a negative effect on consumption following the literature of Bishop and Yoo (1985). EDUCATION should have a negative effect on consumption because it is theorized that as people become more educated, they are more aware of the true opportunity costs of smoking (i.e., the trade-off of a longer life expectancy for present utility). The CPI variable hopes to account for the cost of living in different regions of the country; it should have a negative effect on consumption because as the cost of living increases, real buying power decreases. Changes in INCOME should increase consumption because cigarettes are normal goods implying that as income and the standard of living increase, so should consumption. POVERTY is used to capture the effects of Harris's (1985) study, also leading to an increase in consumption. Finally, the TOBACCO DUMMY is used to differentiate states that are major tobacco producing states from those that are not. Since these states most likely rely heavily on tobacco for their economic stability, it is hypothesized that the percentage of smokers in these states is higher than in states that are not major tobacco producers.

IV. Empirical Results

Referring to Table 1, Regression 1 tested the effects of the tax on the 18-24 age group. The parameter estimate for the state cigarette tax is negative as predicted, but it is supported only by weak evidence, not enough to say that the tax has the effect predicted in the hypothesis. However, since the data for the state cigarette tax was in cents per pack, the data was transformed by taking the natural log of the state cigarette tax to explain the relationship linearly. This yielded the following regression model:

$$(2) \text{ PERCENT OF SMOKERS} = b_1 + b_2 (\text{EDUCATION}) + b_3 (\text{INCOME}) + b_4 (\text{POVERTY}) \\ + b_5 (\text{TOBACCO DUMMY}) + b_6 (\text{CPI}) + b_7 (\text{LnTAX}) + b_8 (\text{TAX DIFFERENTIAL DUMMY})$$

Table 1

ADJUSTED R-SQUARE	CONSTANT	EDUCATION	INCOME	POVERTY	TOBACCO DUMMY	CPI	TAX	LnTAX	TAX DIFFERENTIAL DUMMY
Model 1: Percentage of Smokers in Age Group 18-24 with the 1995 Standard Tax									
0.1289	5.304	-0.554*	0.000	-0.503	-0.392	0.232	-0.063		-2.574
n=51	(0.175)	(-1.948)	(0.722)	(-1.640)	(-0.150)	(1.223)	(-1.204)		(-1.066)
Model 2.1: Percentage of Smokers in Age Group 18-24 with the Natural Log of the 1995 Tax									
0.1756	12.952	-0.560**	0.001	-0.522*	-3.902	0.236		-3.158*	-2.505
n=51	(0.445)	(-2.031)	(0.838)	(-1.755)	(-1.155)	(1.289)		(-1.993)	(-1.068)
Model 2.2: Percentage of Smokers in Age Group 25-44 with the Natural Log of the 1995 Tax									
0.4532	41.594**	-1.013**	0.001**	0.199	-0.875	-0.065		-0.911	1.529
n=51	(2.342)	(-6.016)	(3.350)	(1.095)	(-0.424)	(-0.581)		(-0.942)	(1.067)
Model 2.3: Percentage of Smokers in Age Group 45-64 with the Natural Log of the 1995 Tax									
0.4974	43.101**	-0.781**	0.001**	0.273*	-0.419	-0.104		-1.385	1.726
n=51	(2.743)	(-5.239)	(3.048)	(1.697)	(-0.230)	(-1.054)		(-1.617)	(1.361)
Model 2.4: Percentage of Smokers in Age Group 65 and Over with the Natural Log of the 1995 Tax									
0.2651	-4.200	-0.527**	0.001**	0.212	-1.304	0.074		-1.103	-1.624
n=51	(-0.303)	(-4.015)	(3.888)	(1.497)	(-0.811)	(0.842)		(-1.462)	(-1.453)

t-statistics in parentheses

*-Significant at the 10 Percent Rejection Level

**Significant at the 5 Percent Rejection Level

As can be seen in Table 1, the results for the second regression (2.1) again tested the effects on the 18-24 age group, and the parameter estimate for the state cigarette tax proves to be negative and significant at the ten percent significance level. This indicates that as taxes on cigarettes increase by one percent the percentage of people smoking will decrease by 3.158 percentage points⁷. Also significant at the ten percent level was the negative effect of poverty, which contradicted Harris's claims. At the five percent significance level, EDUCATION had a negative effect⁸.

In the 25-44 year old group (Model 2.2), the tax was negative, but insignificant, however, the INCOME variable was positive and significant at the five percent level along with the EDUCATION variable. The 45-64 year old group (Model 2.3) was similar to Model 2.2 with the exception of the POVERTY variable, which was positive and significant at the ten percent level, supporting Harris's claims that as poverty increases, so do the instances of smoking⁹. Finally, in the 65 and over age group (Model 2.4), the tax is again negative and insignificant, while the EDUCATION and INCOME variables are significant at the five percent level.

V. Conclusion

The hypothesis of this paper was that the youngest age group (18-24) would see a decrease in the percentage of people smoking if taxes were increased. The parameter estimate for the TAX variable in the 18-24 year old group (Model 2.1) did indicate that increases in taxes would decrease the percentage of people smoking and thus upheld that hypothesis. However, the TAX variable, though negative, did not prove to be significant for any of the other age groups.

Like previous studies, the data in this study indicates that increases in taxes can deter smoking, particularly among young people. However, this study used the percentage of smokers among different age groups across states as the dependent variable where the other studies have used a demand function for cigarettes as the dependent variable. The importance of this difference is that although demand may decrease by thirty percent, it is not as crucial as a five percent decrease in the percentage of smokers, especially from a health care cost standpoint. Decreasing the amount of cigarettes smoked will still incur health care costs down the road because

any smoking is unhealthy; however, medical research has proven that by quitting smoking, a former smoker now can reduce the health risks imposed on his or her self, thus reducing health care costs.

A possible problem with the regression is the problem of simultaneous equations. For example, there may be a two-way relationship between the dependent variable, or the percentage of smokers, and one of the independent variables, in this case, the tax¹⁰. Although the tax rate may affect the percentage of smokers, the percentage of smokers may affect the tax rate. If a state has a large population of smokers, then the state would probably not have that high of a tax rate, or vice versa. Nonetheless, in accordance with the other studies (and differing by testing the effects of the tax on the percentage of smokers), it appears that taxes can be used to decrease instances of smoking.

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End Notes

¹ The advertising ban appears to slightly increase the demand for cigarettes.

² Bishop and Yoo (1985) found the elasticity to be -0.387 , well below unity.

³ The CPI variable was calculated from information obtained from the BLS web site. The BLS has broken the country down into ten regions, with each region reporting its CPI (the CPI for "all goods" was used). The variable was used as a proxy for the cost of living in each region to maintain that the cost of living varies in different areas of the country (although it does differ slightly from year to year). The variable is based on 1997 information with the base period being 1982-84=100. In some regions, only metropolitan areas reported a CPI, and in that case, an average of the reported metropolitan areas was taken and used as the proxy CPI for the geographic region.

⁴ The 1995 tax rates were used to capture the lagged effects that taxes have.

⁵ Data for the 1996 state cigarette taxes came from the Action on Smoking and Health (ASH), a nonprofit group that fights for nonsmokers' rights, web site.

⁶ The assignment of ten cents as the dividing point was arbitrary.

⁷ The interpretation of this lin-log model will be demonstrated through this hypothetical example. Suppose a state has 1,000 smokers in the 18-24 year old age group (which comprises 10% of its population). Given the coefficient of LnTAX of -3.158, the increase in taxes by 1% causes the number of smokers to decrease by 3.158 percentage points. In other words, the percentage of smokers in the 18-24 year old age group is now 6.842%.

⁸ At this point, the F test was performed proving the regression to be significant at the five percent level. A partial F test was performed on the LnTAX variable, and it proved to be significant at the ten percent significance level. Additionally, consideration was given to the fact that multicollinearity may exist between the education and tax variables. This is probable because if there are many people with higher education (who are more informed of smoking's harms) in a state, they may favor higher taxes on cigarettes, which would then be a possible cause for multicollinearity. Finally, a Goldfeld-Quandt test was performed on the LnTAX and EDUCATION variables to determine if there was heteroscedasticity. LnTAX showed no signs of heteroscedasticity and there was only weak evidence suggesting that it was present in the EDUCATION variable. A possible problem is that the distribution of the residuals is not normal. In Models 2.1 and 2.2, the distribution is left skewed and platykurtic. In Model 2.3, the distribution is right skewed and platykurtic, and in Model 2.4, the distribution is right skewed and leptokurtic.

⁹ The reason for the insignificance of this variable (in all but the case of Model 2.3) is that there may be some multicollinearity between the POVERTY variable and the INCOME variable.

¹⁰ The tax variable is assumed to be exogenous.