Title
Effect of increased social unacceptability of cigarette smoking on reduction in cigarette consumption.

Journal
American journal of public health, 96(8)

ISSN
1541-0048

Authors
Alamar, Benjamin
Glantz, Stanton A

Publication Date
2006-08-01

Peer reviewed

Effect of Increased Social Unacceptability of Cigarette Smoking on Reduction in Cigarette Consumption

Benjamin Alamar, PhD, and Stanton A. Glantz, PhD

Taxes on cigarettes have long been used to help reduce cigarette consumption. Social factors also affect cigarette consumption, but this impact has not been quantified. We computed a social unacceptability index based on individuals' responses to questions regarding locations where smoking should be allowed.

A regression analysis showed that the social unacceptability index and price had similar elasticities and that their effects were independent of each other. If, through an active tobacco control campaign, the average individual's views on the social unacceptability of smoking changed to more closely resemble the views of California residents, there would be a 15% drop in cigarette consumption, equivalent to a $1.17 increase in the excise tax on cigarettes. (*Am J Public Health.* 2006;96:1359–1363. doi:10.2105/AJPH.2005.069617)

STUDIES FOCUSING ON HOW changes in price affect cigarette consumption often estimate the price elasticity of cigarette demand (the percentage change in consumption associated with a 1% change in price).[1–3] Such studies have shown that increases in cigarette taxes are an effective tool in reducing consumption. Social circumstances, such as policies establishing smoke-free workplaces and restaurants and aggressive media campaigns stressing the dangers of environmental tobacco smoke, also affect cigarette consumption.[4–6] For example, restrictions on locations where individuals can smoke increase the opportunity costs of smoking and alter its level of social unacceptability.

The tobacco industry understands the effects that changing social norms can have on cigarette consumption.[7,8] Individual attitudes and perceived social pressure, along with price, determine levels of consumption. Social unacceptability has been repeatedly shown to be an important influence on both initiation and quitting.[9,10] Social learning theory[11] also supports the role of social constructs in shaping an individual's smoking behavior. We used 1996 through 1999 price and consumption data and data from a national survey on attitudes toward smoking to construct an index reflecting the social unacceptability of smoking. Changes in consumption are as sensitive to changes in social unacceptability as changes in price, and these effects are independent of each other.

METHODS

Data

Data on cigarette prices and consumption were obtained from *The Tax Burden on Tobacco,*[12] a standard source for these data. Also, during the period spanning the mid-to-late 1990s, the Tobacco Use Supplement (TUS) of the US Census Bureau's Current Population Survey collected data on individuals' attitudes toward smoking policies (and thus the extent to which smoking is socially unacceptable). The TUS, sponsored by the National Cancer Institute, was administered in September 1995, January 1996, May 1996, September 1998, and January 1999. The major advantage of the TUS is its large sample size (approximately 133 000 in each year of its administration).

The TUS gathered data on attitudes toward cigarette advertising and restrictions on locations where individuals can smoke by asking respondents whether they supported smoke-free restaurants and bars and whether they allowed smoking in their homes. Respondents were also asked whether they currently smoked and their state of residence. Specifically, they were asked the following questions:

1. In restaurants, do you think that smoking should be allowed in all areas, allowed in some areas, or not allowed at all?
2. In bars, do you think that smoking should be allowed in all areas, allowed in some areas, or not allowed at all?
3. Which statement best describes the rules about smoking in your home?
   a. No one is allowed to smoke anywhere.
   b. Smoking is allowed in some places or at some times.
   c. Smoking is permitted anywhere.

Data from the TUS can be used to calculate the percentages of smokers and nonsmokers in each state and the District of Columbia who support 100% smoke-free laws and have 100% smoke-free homes (Table 1). In January 1999, according to overall state averages, 17.4% of smokers and 57.4% of nonsmokers supported smoke-free restaurants, 6.4% of smokers and 32.5% of nonsmokers supported smoke-free bars, and 15.9% of smokers and 69% of nonsmokers had smoke-free homes. The states most supportive of smoke-free laws were California and Utah, and the states least supportive were Kentucky and Wyoming.

Smoke-free restaurants, which were supported by the majority of nonsmokers in 45 states, received more support than smoke-free bars, which were not supported by a majority of nonsmokers in any state. In all 50

TABLE 1—Support in 1999 for Smoke-Free Areas: 50 States and the District of Columbia

State	Smoke-Free Restaurants, %		Smoke-Free Bars, %		Smoke-Free Homes, %	
	Smokers	Nonsmokers	Smokers	Nonsmokers	Smokers	Nonsmokers
Alabama	16.7	57.5	7.6	37.9	16.0	65.0
Alaska	16.0	57.2	3.2	29.6	13.6	72.6
Arizona	23.4	59.7	13.6	31.0	28.6	77.7
Arkansas	12.6	55.6	5.1	34.1	14.1	61.9
California	47.2	76.0	15.9	48.2	30.9	80.0
Colorado	14.2	58.8	4.3	27.9	20.6	74.5
Connecticut	19.8	59.5	10.4	38.5	21.7	67.5
Delaware	12.2	53.7	3.5	37.8	14.8	69.8
District of Columbia	22.1	52.7	9.5	32.9	7.4	65.3
Florida	20.2	62.3	8.4	41.2	20.6	75.8
Georgia	17.2	56.9	11.8	38.8	20.7	70.3
Hawaii	22.2	61.6	9.9	31.6	9.9	74.2
Idaho	17.9	65.1	5.8	32.3	25.6	79.9
Illinois	13.1	54.9	5.0	28.2	8.8	66.2
Indiana	9.0	49.8	3.7	27.2	9.6	61.7
Iowa	15.2	54.0	3.4	28.8	12.4	60.4
Kansas	9.2	56.4	4.9	29.6	17.2	69.0
Kentucky	8.2	39.5	5.1	23.6	5.6	49.4
Louisiana	14.9	58.2	7.5	34.7	14.9	67.8
Maine	19.7	63.1	9.5	37.6	15.3	63.4
Maryland	19.4	58.3	8.3	31.7	16.7	74.3
Massachusetts	17.6	63.7	8.1	39.7	11.9	69.9
Michigan	12.0	57.5	4.5	32.7	11.8	62.6
Minnesota	16.1	56.7	2.9	26.8	15.3	72.7
Mississippi	20.6	57.1	7.1	39.1	9.2	62.2
Missouri	13.7	52.1	5.0	31.0	11.5	62.7
Montana	12.9	56.6	2.3	27.9	14.6	72.9
Nebraska	12.1	56.2	2.1	27.3	11.4	68.4
Nevada	21.1	54.1	8.1	26.7	15.5	73.0
New Hampshire	24.8	59.5	9.4	30.0	17.1	70.4
New Jersey	14.8	56.2	8.2	36.9	23.5	71.0
New Mexico	20.6	61.4	7.4	33.7	16.2	73.0
New York	18.8	58.5	9.7	36.0	11.5	64.3
North Carolina	14.4	43.4	7.2	28.0	15.5	61.9
North Dakota	9.5	52.6	2.9	27.1	13.9	64.9
Ohio	9.0	49.8	4.9	26.3	10.1	61.4
Oklahoma	14.3	59.9	2.9	36.8	12.9	67.2
Oregon	21.1	66.2	4.1	34.2	29.3	82.4
Pennsylvania	14.1	52.3	7.2	27.8	14.7	66.8
Rhode Island	29.8	61.9	8.5	38.5	18.1	70.2
South Carolina	9.7	56.5	5.3	34.3	10.6	70.4
South Dakota	21.1	57.9	6.6	29.5	13.9	65.7
Tennessee	9.4	49.3	4.1	32.2	11.1	64.5
Texas	17.4	60.0	8.3	34.5	24.2	74.4
Utah	44.9	79.4	3.8	21.7	30.8	90.9
Vermont	30.3	65.7	9.0	38.3	16.4	71.6
Virginia	11.0	50.4	4.7	31.3	17.4	69.1
Washington	19.4	63.1	7.2	29.6	24.5	78.7
West Virginia	10.5	47.3	5.0	32.1	6.8	54.8
Wisconsin	12.7	53.5	2.8	29.8	14.4	63.7
Wyoming	13.2	55.7	1.3	32.6	13.2	68.8
Maximum	47.2	79.4	15.9	48.2	30.9	90.9
Average	17.4	57.4	6.4	32.5	15.9	69.0
Minimum	8.2	39.5	1.3	21.7	5.6	49.4

Continued

TABLE 1—*Continued*

states and the District of Columbia, a majority of nonsmokers had smoke-free homes. In an earlier study, Gilpin et al. used TUS data to analyze changes in attitudes toward smoke-free policies in California, and our results are consistent with theirs.[13]

Estimating the Social Unacceptability Index

We combined the data from the 5 administrations of the TUS in a single factor analysis to establish the social unacceptability index. We used EViews (Quantitative Micro Software, Irvine, Calif) to conduct the factor analysis. We used data for each state and each year on the percentages of individuals who supported 100% smoke-free restaurants and bars and who had smoke-free homes in calculating the index. We separated the attitudes of smokers and those of nonsmokers in the factor analysis because we hypothesized that changes in the attitudes of these 2 groups would have different effects on the social acceptability of smoking.

Six variables were assessed in the factor analysis with data from each state and each year (3 questions each for smokers and nonsmokers), yielding a total of 255 possible data points for each variable (50 states and the District of Columbia multiplied by 5 surveys). Table 2 shows the first 3 factors resulting from this analysis. The weights for the first factor were all positive, and this factor accounted for 56% of the variance in the 6 variables assessed. We used the weights associated with this first factor to create the social unacceptability index by summing the level of support for each smoke-free law (among smokers and nonsmokers) weighted by the factor weights for each state. The index then represented the overall level of support for smoke-free environments in a given state relative to other states.

We combined the survey data with the factor weights to

TABLE 2—Factor Weights From Analysis of Tobacco Use Supplement Data Set (n = 255)

	Factor 1	Factor 2	Factor 3
Smokers			
Restaurants	0.465	0.132	0.388
Bars	0.296	0.605	0.495
Homes	0.430	–0.357	0.153
Nonsmokers			
Restaurants	0.479	–0.151	–0.297
Bars	0.309	0.538	–0.697
Homes	0.430	–0.419	–0.080
Eigenvalue	3.371	1.359	0.519
Variance proportion	0.562	0.227	0.087
Cumulative proportion	0.562	0.789	0.876

Note. Only the first 3 factors are shown.

calculate social unacceptability index values for each survey year and each state. Because price and consumption data were reported by fiscal year, we used linear interpolation to match the social unacceptability index to the appropriate time period (fiscal year) for the price and consumption data. Table 3 shows index values for each state from 1996 to 1998, along with percentage changes from 1996 to 1999. California had the highest value in all 4 years, and Kentucky had the lowest. Nevada showed the largest increase over the 4 years, 26.1%, whereas the District of Columbia showed a decline of 2.2%. Overall, states averaged a 10.3% increase in social unacceptability index values between 1996 and 1999.

Elasticity Estimates

To test for the effects of the social unacceptability index on cigarette consumption, we used the following consumption equation to conduct a least squares regression analysis that also included cigarette price:

$$(1)\ ln(\text{Consumption}_t) = \alpha_{\text{Consumption}_{t-1}} ln(\text{Consumption}_{t-1}) + \beta_{\text{Price}} ln(\text{Price}_t) + \delta_{\text{Social Unacceptability}} ln(\text{Social Unacceptability}).$$

The coefficients of the *ln* terms in the equation were the relevant elasticities; these coefficients can be easily compared because they represent the effect on consumption of a 1% change in the variable. We included lagged consumption in the regression analysis because smoking is addictive, and a significant degree of current consumption is due to consumption in the previous period.

RESULTS

Table 4 shows the results of the regression analysis. The fit

TABLE 3—Social Unacceptability Index Values: 50 States and the District of Columbia, 1996–1999

State	1996	1997	1998	1999	Change, %, 1996–1999
Alabama	0.85	0.80	0.82	0.84	–1.3
Alaska	0.84	0.91	0.87	0.82	–2.0
Arizona	0.91	0.94	0.91	0.99	7.9
Arkansas	0.67	0.77	0.76	0.77	14.5
California	1.09	1.15	1.19	1.26	14.1
Colorado	0.77	0.82	0.85	0.86	11.0
Connecticut	0.85	0.84	0.89	0.91	7.4
Delaware	0.76	0.70	0.74	0.81	6.2
District of Columbia	0.82	0.79	0.79	0.80	–2.2
Florida	0.86	0.87	0.88	0.96	10.7
Georgia	0.84	0.80	0.84	0.90	7.4
Hawaii	0.88	0.91	0.93	0.89	1.3
Idaho	0.88	0.90	0.91	0.97	9.9
Illinois	0.70	0.71	0.73	0.75	6.2
Indiana	0.68	0.65	0.70	0.68	–0.3
Iowa	0.74	0.73	0.75	0.74	0.5
Kansas	0.69	0.73	0.79	0.79	14.2
Kentucky	0.50	0.57	0.61	0.55	9.4
Louisiana	0.81	0.82	0.83	0.83	3.1
Maine	0.79	0.88	0.87	0.88	10.6
Maryland	0.80	0.85	0.87	0.88	10.2
Massachusetts	0.76	0.86	0.86	0.89	15.6
Michigan	0.66	0.73	0.75	0.77	15.1
Minnesota	0.76	0.77	0.79	0.82	7.0
Mississippi	0.81	0.83	0.88	0.82	0.5
Missouri	0.62	0.65	0.69	0.74	18.3
Montana	0.70	0.73	0.79	0.80	13.3
Nebraska	0.73	0.77	0.79	0.76	3.7
New Hampshire	0.73	0.86	0.87	0.90	20.3
New Jersey	0.77	0.83	0.86	0.88	14.1
New Mexico	0.81	0.83	0.87	0.90	10.8
Nevada	0.65	0.74	0.79	0.85	26.1
New York	0.77	0.85	0.85	0.83	7.6
North Carolina	0.59	0.68	0.70	0.72	18.6
North Dakota	0.67	0.70	0.74	0.73	8.3
Ohio	0.62	0.66	0.68	0.68	10.5
Oklahoma	0.73	0.70	0.76	0.82	12.1
Oregon	0.91	0.97	0.98	1.01	10.7
Pennsylvania	0.68	0.76	0.78	0.77	13.0
Rhode Island	0.76	0.89	0.93	0.96	23.6

Continued

TABLE 3—*Continued*

South Carolina	0.62	0.75	0.80	0.79	24.0
South Dakota	0.70	0.71	0.74	0.83	16.6
Tennessee	0.67	0.73	0.71	0.72	7.3
Texas	0.84	0.86	0.88	0.92	9.8
Utah	0.96	1.05	1.10	1.19	21.4
Vermont	0.87	0.92	0.95	0.98	12.5
Virginia	0.70	0.75	0.77	0.78	10.4
Washington	0.88	0.91	0.91	0.95	7.9
West Virginia	0.60	0.62	0.62	0.65	9.0
Wisconsin	0.68	0.73	0.76	0.75	10.8
Wyoming	0.72	0.75	0.81	0.79	8.8
Maximum	1.09	1.15	1.19	1.26	26.1
Average	0.76	0.80	0.82	0.84	10.3
Minimum	0.50	0.57	0.61	0.55	–2.2

Note. The social unacceptability index represents the level of support for smoke-free laws in a given state relative to the level of support for smoke-free laws in all other states.

TABLE 4—Regression Analysis Results: Estimated Effects on Consumption (n = 153)

	Coefficient (SE)	*t*	*P*	Variance Inflation Factor
$ln(\text{Consumption}_{t-1})$	0.98 (0.05)	9.18	<.001	1.64
ln(Price)	–0.38 (0.21)	–1.85	.067	1.56
ln(Social Unacceptability)	–0.37 (0.18)	–2.03	.045	1.62
R^2	0.98			

of the data to the model was good, as shown by the high R^2 value of 0.98. The variance inflation factors for the explanatory variables were all well below 2, indicating that there was little collinearity between the independent variables and that the effects were independent of each other. The statistically significant and positive effect of lagged consumption on current consumption was expected because, as mentioned, past consumption is positively related to current consumption (when the model was estimated without the lagged consumption term, there were no significant changes in the other estimates, and the R^2 value was 0.42).

The magnitude of the price elasticity estimate of –0.38 was similar to previous estimates (–0.20 to –0.72[1–3]). It means that a 3.8% drop in consumption would occur for every 10% increase in the price of cigarettes. The elasticity of the social unacceptability index was –0.37; that is, for every 10% increase in the social unacceptability index, there would be an associated 3.7% drop in consumption. In terms of average 1999 values, a 1.81 percentage-point increase in the number of smokers supporting smoke-free restaurant policies and a 1.75 percentage-point increase in the number of nonsmokers supporting such policies would translate into a 1% increase in the social unacceptability index and a 0.37% drop in consumption.

DISCUSSION

The price and social unacceptability elasticities estimated here indicate that social policies that increase the social unacceptability of smoking and taxes that increase cigarette prices have similar effects in terms of reducing cigarette consumption. Our results also indicate that social unacceptability index and price effects are independent. The magnitude of the effect observed for the social unacceptability index is supported by social learning theory, which identifies the importance of social constructs such as parental and peer attitudes in shaping behavior.[11] The average increase in the social unacceptability index during 1996 to 1999 was 10.3%, meaning that there was a drop of 3.7% in consumption over the 4 years related to the increase in social unacceptability. The average price of a pack of cigarettes in 1999 was $2.93; a tax increase of $0.29 would have been required to achieve the same effect.

The average level of the social unacceptability index in 1999 for all states was 0.84, as compared with California's level of 1.26. If, through the use of an active tobacco control campaign, the social unacceptability index for the entire country were raised to the level of California in 1999 (a 40% increase), there would be a 15% decrease in consumption. A tax increase of $1.17 per pack would be needed to achieve this same decrease. Our results indicate that increasing the social unacceptability of smoking is a highly effective policy tool in reducing consumption. Tobacco control programs should stress the dangers of environmental tobacco smoke and reinforce the nonsmoking norm. ■

About the Authors

The authors are with the Center for Tobacco Control Research and Education, University of California, San Francisco.

Requests for reprints should be sent to Stanton A. Glantz, PhD, Center for Tobacco Control Research and Education, University of California, San Francisco, 530 Parnassus Ave, Suite 366, San Francisco, CA 94143 (email: glantz@medicine.ucsf.edu).

This article was accepted October 12, 2005.

Contributors

B. Alamar originated the study, drafted the article, and analyzed and interpreted the data. S.A. Glantz assisted in the data analysis and interpretation and in the editing of the article.

References

1. Baltagi BH, Levin D. Estimating dynamic demand for cigarettes using panel data: the effects of bootlegging, taxation and advertising reconsidered. *Rev Economics Stat.* 1986;68:148–155.

2. Chaloupka F. Rational addictive behavior and cigarette smoking. *J Political Economy.* 1991;99:722–742.

3. Yen ST, Jones AM. Individual cigarette consumption and addiction: a flexible limited dependent variable approach. *Health Economics.* 1996;5: 105–117.

4. Fichtenberg CM, Glantz SA. Effect of smoke-free workplaces on smoking behavior: systematic review. *BMJ.* 2002;325:188–191.

5. Evans WN, Farrelly MC, Montgomery E. Do workplace smoking bans reduce smoking? *Am Econ Rev.* 1999; 89:728–747.

6. Bitton A, Fichtenberg C, Glantz S. Reducing smoking prevalence to 10% in five years. *JAMA.* 2001;286: 2733–2734.

7. Ling P, Glantz S. Using tobacco-industry marketing research to design more effective tobacco-control campaigns. *JAMA.* 2002;287: 2983–2989.

8. Ling P, Glantz S. Tobacco industry research on smoking cessation: recapturing young adults and other recent quitters. *J Gen Intern Med.* 2004;19: 419–426.

9. *Preventing Tobacco Use Among Young People: A Report of the Surgeon General.* Washington, DC: US Dept of Health and Human Services; 1994.

10. *Reducing Tobacco Use: A Report of the Surgeon General.* Washington, DC: US Dept of Health and Human Services; 2000.

11. Akers R, Lee G. A longitudinal test of social learning theory: adolescent smoking. *J Drug Issues.* 1996;26: 317–343.

12. Orzechowski W, Walker RC. *The Tax Burden on Tobacco.* Arlington, Va: Orzechowski & Walker; 2002.

13. Gilpin E, Lee L, Pierce J. Changes in population attitudes about where smoking should not be allowed: California versus the rest of the USA. *Tob Control.* 2004;13:38–44.