

# Is the Cigarette Price Effect Nonlinear?

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## Abstract

Many econometric studies have examined the effect of cigarette price on cigarette consumption. Consensus estimates from these studies imply that a 10 percent increase in cigarette price will reduce overall cigarette consumption by approximately 4 percent. These studies typically evaluate the price elasticity of demand for each observation and report the average price elasticity across all observations or report the price elasticity of demand at the mean of the price variable. While these average price effects are important, they provide no information on the likely non-linear effect of price on cigarette demand.

This research is the first econometric study to examine the non-linear effects of price on cigarette demand and estimate price elasticities at different price levels. We use both aggregate state-level data and individual-level data from the Tobacco Use Supplements to the Current Population Surveys. We employ generalized linear models to estimate cigarette demand equations.

We find that the absolute value of the price elasticity of demand monotonically increases with price. The findings from this study will be extremely important to policymakers contemplating increasing cigarette excise taxes.

## Research Question

Is there a differential effect of price on cigarette demand at different price levels?

## Data

### Aggregate State Level Data 1991-2012

#### Dependent variable:

Per-Capita State Cigarette Sales

#### Independent Variables:

Real Cigarette Price Gender Indicator  
Smoke-free air Index Race/Ethnicity Indicators  
Tax Avoidance Import Education Indicators  
Tax Avoidance Export Age Indicators  
Unemployment rate Year Fixed Effects  
Real Personal Income State Fixed Effects

### Individual-level Survey Data

2010-11 Tobacco Use Supplement to the Current Population Survey

#### Dependent variable:

Average Daily Cigarettes Smoked by Every day Smokers Past Month

#### Independent variables:

Gender Indicator  
Race/Ethnicity Indicators  
Age Indicators  
Education Indicators  
Employment Indicators  
Income Indicators  
Industry Indicators

### 3 Alternative Measures of Cigarette Prices

Nielsen Market Scanner Prices  
TBOT Prices  
Adjusted Self Reported Prices

## Methods

### Aggregate State Level Data

- Generalized Linear Models With Log-link and Gamma Distribution
- Model 1: No control for tax avoidance and SFA
- Model 2: Controls for tax avoidance and SFA

### Individual-level Survey Data

- Generalized Linear Models With Log-link and Gaussian Distribution
- 4 models estimated, each using a different price

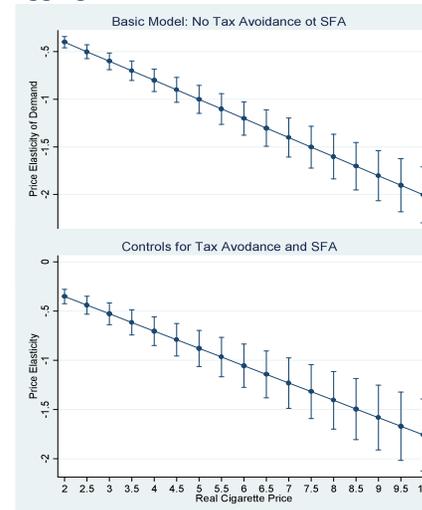
### Modified Park Test used for Distribution

### Box-Cox test used for link function

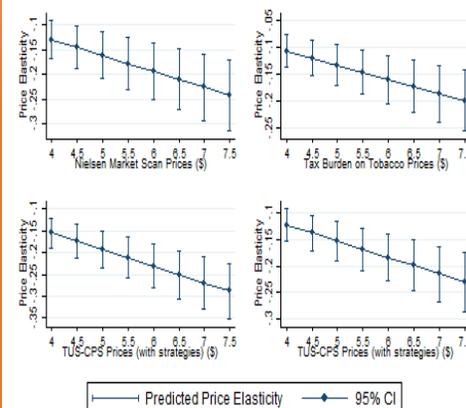
## Results

Price is found to have a significant non-linear effect on cigarette consumption

### Aggregate State Level Data



### Individual-level Survey Data



Elasticities are calculated using a GLM model with log link and Gaussian distribution, controlling for gender, age, race/ethnicity, education, employment status, industry, and income. Survey weights are used in all regressions.

## Implications for State and Community Tobacco Control

States contemplating cigarette excise tax increases rely on average price elasticity estimates from the literature when predicting changes in revenue or cigarette consumption. There is tremendous variation in cigarette prices across states and the use of an average price elasticity may yield misleading predictions. The estimates from this research will be invaluable to policy makers as they will be able to more accurately predict the effects of cigarette tax increases.

## Conclusions

This research shows that the absolute value of the price elasticity of cigarette demand monotonically increases with price.

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