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Emily Galloway

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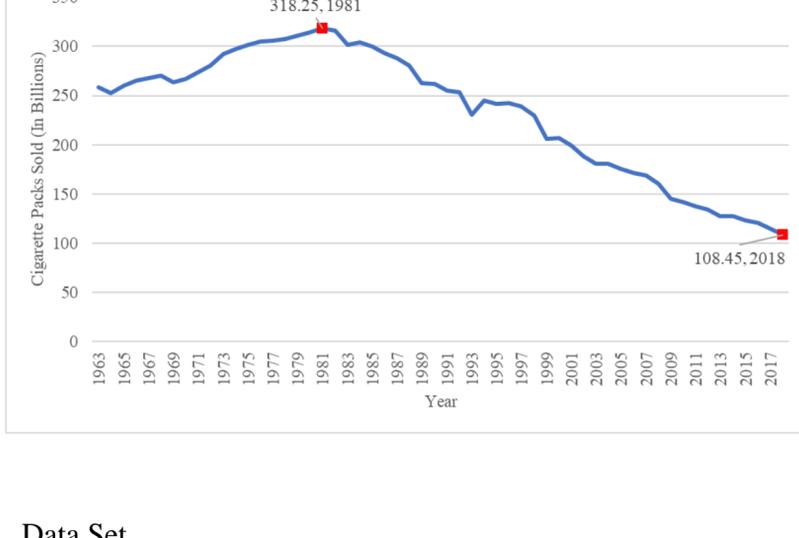
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# Cigarette Demand in the United States

Emily Galloway  
ECON 460-01

In 2017, the number of daily cigarette smokers in the United States had declined 67% since 1965 (Centers for Disease Control and Prevention). Despite studies suggesting a link between lung cancer and cigarettes dating as far back as 1898, tobacco companies continued to push back against any negative publicity with “industry friendly” research and ad campaigns (Proctor). When the Surgeon General’s Report released in 1964, public opinion finally seemed to shift and the dangers of smoking were realized; despite this, cigarette consumption continually rose throughout the seventies. As shown in Figure 1, cigarette consumption did not hit its final peak until 1981, which saw 318.25 billion cigarette packs sold. This paper will study cigarette demand in the United States from 1964 to 2018, and attempt to numericize the complex societal factors that go into its purchase, including price, income, and population.

Figure 1. Number of Cigarette Packs Sold in United States from 1963 to 2018, Time Series



## Data Set

The empirical model is illustrated below.

$$CIG_i = \beta_0 - \beta_1PRICE_i - \beta_2INCOME_i + \beta_3POP_i + \beta_3LDV_{i-1}$$

Where:

$CIG_i$  = total number of cigarette packs sold in the United States in the  $i$ th year; data sourced from the Federal Trade Commission Cigarette Report for 2018

$PRICE_i$  = average cost of a pack of cigarettes with federal and state tax included in the United States in the  $i$ th year; data sourced from 24/7 Wall Street and the Centers for Disease Control and Prevention

$INCOME_i$  = median household income in the United States in the  $i$ th year; data sourced from the United States Census Bureau

$POP_i$  = United States population in the  $i$ th year; data sourced from The World Bank

$LDV_{i-1}$  = the value of  $\beta_0$  in the year previous of the  $i$ th; data sourced from the Federal Trade Commission Cigarette Report for 2018

The descriptive statistics of the independent variables are illustrated below in Table 1.

Table 1. Descriptive Statistics

Variable	Mean	Standard Dev.	Min	Max
Cigarettes Sold	23,345,892,857	6,481,795,494	10,845,000,000	31,825,000,000
Price per Pack	\$2.334	2.097	\$0.28	\$6.90
Income	\$30,399.929	17,251.154	\$6,200.00	\$63,179.00
Population	256,201,549.464	42,293,004.223	189,242,000	326,687,501
Sales Lagged	23,573,181,818	6,312,301,875	11,455,000,000	31,825,000,000

N = 55

## Results

The regression equation is illustrated below, a table of the results is illustrated in Table 2.

$$CIG_i = -5897749306 - 170200124.5PRICE_i - 150549.677INCOME_i + 49.872POP_i + 0.908LDV_{i-1}$$

Table 2. Regression Results

Variable	Coefficient (Standard Error)	T-statistic	P-value
Constant	-5897749306 (4151963114)	-1.420	0.162
Price per pack	-170200124.5 (226590920.1)	-0.751	0.456
Income	-150549.677 (50680.366)	-2.971*	0.005
Population	49.872 (22.319)	2.234*	0.03
Sales Lagged	0.908 (0.046)	19.638*	3.72844E-25

N = 55

F-stat = 1,514.115; Significance = 1.74E-51

R<sup>2</sup> = 0.992

Adjusted R<sup>2</sup> = 0.991

Durbin-Watson Statistic = 2.25039; d<sub>L</sub> = 1.41362 and d<sub>U</sub> = 1.72399

\*Significant at the 5% level

- High F-statistic of 1,514.115 with a small significance of 1.74E-51 indicates overall equation fit is statistically significant, and there exists only a very small chance the null hypothesis cannot be rejected
- High R<sup>2</sup> of 0.992 and adjusted R<sup>2</sup> of 0.991 indicate the equation explains 99% of the variation in the data
- Durbin-Watson Statistic of 2.25039 is above d<sub>U</sub> of 1.72399, indicating no positive serial correlation
- Price p-value of 0.456 indicates insignificance; this is expected in addictive products
- Income’s coefficient of -150549.677 indicates for each one dollar increase in income, all other things held constant, the number of cigarette packs purchased decreases by 150549.677
- Population’s coefficient of 49.872 indicates that for each one person increase in the population, all other things held constant, the number of cigarette packs purchased increases by 49.872
- The lagged dependent variable’s p-value of 3.72844E-25 indicates it is the most significant independent variable; smoking is addictive, making the number of cigarettes purchased in one year largely dependent upon the number purchased in the year previous, making this expected

## Conclusion

This paper set out to find out which of the independent variables of price, income, and population affected the purchase of cigarettes the most. To eliminate serial correlation the lagged dependent variable was included, and this turned out to be the most significant of the independent variables. This significance is in line with addictive products, as the number of cigarette packs purchased in a year depends largely on the number purchased in the year previous. The second most significant variable was income, which holds a p-value of 0.005. The decrease in purchases as income rises may be attributed to tobacco companies targeting lower-income areas (Tavernise and Gebeloff). The least, yet still significant, variable was population, which follows basic economic theory. The more potential consumers in a market, the more a product is purchased. Further research should be done as more information on the health effects of smoking become public, and as purchasing restrictions continue to be put into law. The complexity of societal factors on the demand of cigarettes cannot be overstated and should also be researched as necessary.

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