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Impacts of Cigarette Smoking on Consumer Health

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According to the Centers for Disease Control and Prevention, there was a reported 42.1 million people, 20.5% male and 15.3% female, in 2012 aged 18 years or older who were current smokers. Additionally, more than 3,200 individuals younger than 18 years old try their first cigarette each day ("Fast Facts"). Also, an estimated 2,100 individuals who were occasional smokers become daily smokers ("Fast Facts"). Cigarette and tobacco use is responsible for more than 5 million deaths per year with more than 480,000 of those deaths in the United States alone ("Fast Facts"). Many people do not realize that even non-smokers are being affected as much by the consumption of tobacco as smokers are. About 41,000 of those deaths in the United States are from secondhand exposure to smoking ("Fast Facts"). This means that about one in every five deaths is caused by smoking annually or about 1,300 deaths a day ("Fast Facts"). More than 16 million individuals are suffering from diseases due to tobacco consumption, including multiple kinds of cancer, heart disease, stroke, different kinds of lung diseases, and diabetes ("Fast Facts"). Although there is a decreasing rate of cigarette consumption in the United States, it is still estimated that about 5.6 million Americans younger than 18 years old will die prematurely from a smoking induced illness ("Fast Facts").

About 25.7 billion dollars are currently being collected in the United States from tobacco taxes and legal settlements related to tobacco use but only 1.9% of that money is used for prevention programs ("Fast Facts"). No state in the U.S. uses their funds to finance tobacco control programs at the level recommended by the CDC and only two states (North Dakota and Alaska) fund these programs at the minimum level ("Fast Facts"). That being said, the tobacco

industry spent 8.4 billion dollars on cigarette advertising and promotions and a combined total of 8.8 billion dollars on marketing for cigarette and smokeless tobacco in the U.S. in 2011("Economic Facts About U.S. Tobacco Production and Use"). Seven billion dollars or 83.6% of the money used was spent on price discounts on tobacco ("Economic Facts About U.S. Tobacco Production and Use"). More than 293 billion cigarettes were purchased in the U.S in 2011 ("Economic Facts About U.S. Tobacco Production and Use").

Cigarette smoking has not only a public health concern but also an economic one as the increasing amount of costs related to health care and lost productivity rise each year. It is estimated that 133 billion dollars are used for direct medical care and 156 billion in lost productivity for smokes and 5.6 billion dollars in lost productivity due to secondhand exposure ("Economic Facts About U.S. Tobacco Production and Use"). One of the most widely and increasingly used methods of combating smoker behavior is the use of taxation at both the federal and state levels. Increases in cigarette prices due to taxes are one of the leading causes of reductions in smoking behavior. According to the Centers of Disease Control and Prevention, a 10% increase in cigarette prices can reduce consumption by 3-5% ("Economic Facts About U.S. Tobacco Production and Use"). Youth and young adults are two to three times more responsive to the price increase than adults ("Economic Facts About U.S. Tobacco Production and Use"). In this paper, I will analyze the effects taxes impose on smoking behavior given the relative inelastic demand cigarettes have had over time.

Methodology

This paper analyzes the effectiveness of state level excise taxes on cigarettes in an effort to combat smoking behavior on a state-by-state basis. This paper attempts to do so through the review of relevant literature, analysis of the elasticity of demand for cigarettes, and a multivariate

regression analysis. The paper is organized as follows: the first section describes a brief history of the consumption of cigarettes in the U.S. and taxation, followed by a discussion of the elasticity of demand for cigarettes, next by a discussion on the rationale of cigarette excise taxes, then by a review of relevant literate, followed by an analysis of the multivariable regression, and finally ending with a recommendation for policy action following the analysis of the effectiveness of taxes.

History of Tobacco and its Taxation

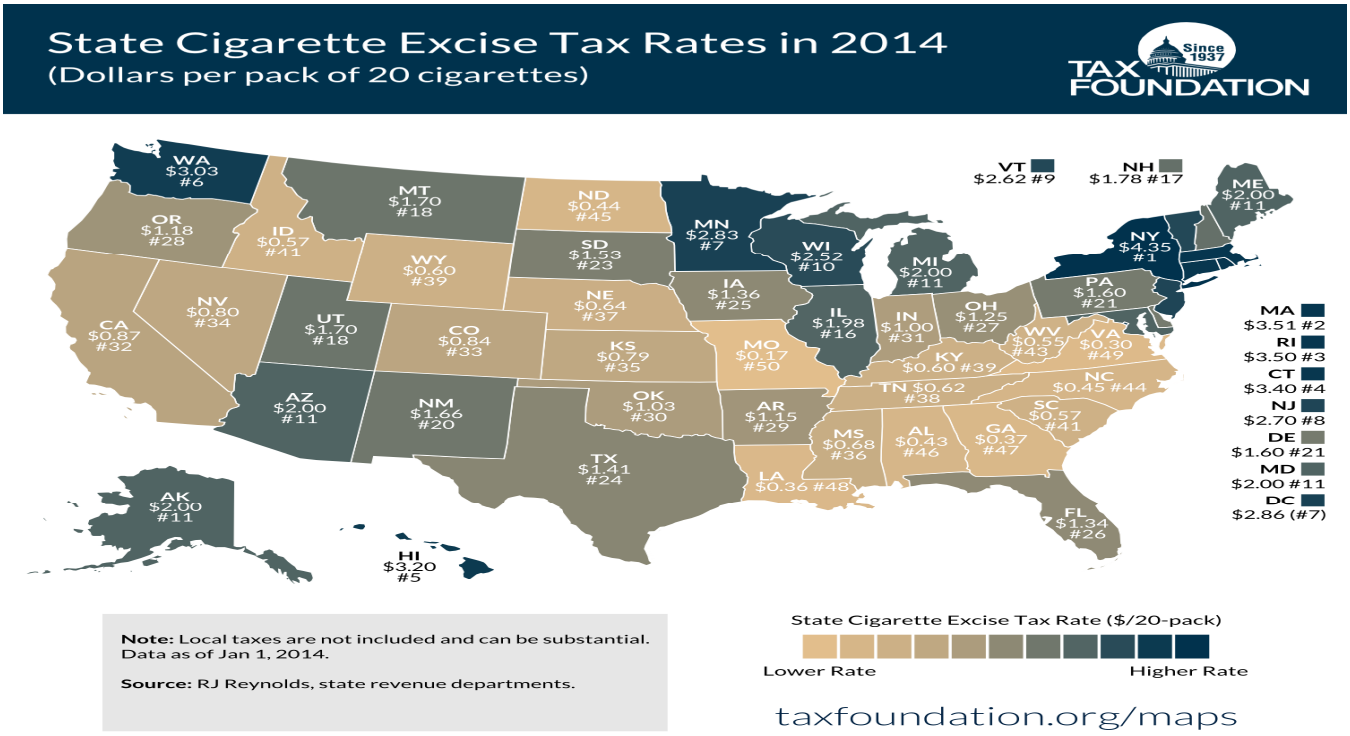
Native Americans first primarily used tobacco for medicinal and religious purposes as early as 1 B.C. Christopher Columbus brought back with him some tobacco leaves and seeds to Europe as a gift from the Native Americans he encountered, but most people did not get their first taste until 1550's with Jean Nicot's popularization of tobacco ("A Brief History of Tobacco"). The first successful crop growing was in Virginia in 1612 and tobacco became their largest export and cash crop ("A Brief History of Tobacco"). Tobacco was mainly used for pipes, chewing and snuff, but became popular in cigarette form after the Civil War and with James Buchanan's cigarette making machine in the 1880's ("A Brief History of Tobacco"). Many people did not know the ill effects of tobacco use and actually believe it had medicinal benefits, as did the Native Americans. It was not until the 20th century that the negative effects of tobacco started being published in medical journals. In 1952 Reader's Digest published an article that detailed the dangers of smoking and sales of cigarettes began to decline following the publication ("A Brief History of Tobacco"). The tobacco industry responded by marketing filtered cigarettes and low tar cigarette formulas and with that cigarette sales were back up and prospering.

In the 1960's the tobacco industry suffered another attack with the creation of the Surgeon General's Advisory Committee and their 387-page report in 1964 that stated a

relationship between lung cancer and smoking ("A Brief History of Tobacco"). It stated that smokers had a 9-10 times higher chance of getting lung cancer than did a non-smoker ("A Brief History of Tobacco"). With that report came Congress's passing of the Federal Cigarette Labeling and Advertising Act in 1965 ("A Brief History of Tobacco"). This act required all cigarette producers to put a visible surgeon general's warning on each carton produced.

In 1864 the first federal tax was put into effect as revenue for the Civil War. The first state level excise tax was levied on cigarettes in 1921 in Iowa and it wasn't until 1969 that all 50 states in the U.S. enacted an excise tax. The federal rate currently stands at $1.0066 per pack of cigarettes and with the combination of state and local taxes can add as much as $6.16 (see figure 1.1) more per pack of cigarettes (Drenkard 7). With the growing taxation rates, Chicago has seen the highest combined federal and state taxes totaling $7.17 and with New York following suit totaling $5.85 (Drenkard 6).

Figure 1.1



Price Elasticity of Demand for Cigarettes

It is a generally accepted economic theory that increasing or decreasing the price of a commodity reduces or increases demand for that commodity respectively. Price elasticity of demand measures how responsive the demand for that product is to a change in price. If a product's demand were inelastic then demand would fall or rise only slightly in response to a price change while an elastic product would fall or rise significantly due to a price change. Elasticity of demand is measured by taking the percentage change in quantity demanded divided by the percent change in price. If the resulting number is greater than one then it is considered to be elastic and significantly responsive to a price change while if the resulting number is less than one then the product is inelastic and only slightly responsive to a price change.

Elasticity also can be used to evaluate which party will be affected more by the burden of the tax. If the demand for a product is more elastic then the burden of the tax falls more on the suppliers than consumers. This is because as price increases individuals will start using other products or substitutes in order to evade the tax burden. Products with inelastic demand place the burden of the tax on the consumer, as they are not easily able to substitute for that product with others and will continue to use it.

A study done by the Department of Economics in Waterloo, Canada has shown that daily participation elasticity for cigarettes are between -.10 to -.14, which suggests that little and even significant changes in price have limited impacts on the smoking behavior of individuals (Sen 1272). It also implies that the burden of the tax is borne mostly by the consumer, as there are not many viable or satisfactory options for cigarettes. An article in Forbes magazine states that "the long-term price elasticity of the cigarette industry has ranged from -0.3 to -0.4 in 10-year

averages, however, Citigroup found that price elasticity in the U.S. was -0.8 in 2012" (Gara). According to the World Health Organization, the price elasticity of demand for cigarettes in high-income countries is -.4 and between -.2 and -.8 for low and middle-income countries (Perucic 16). The World Health Organization also states that youths are more responsive to price changes than adults. Youths in high-income countries have an elasticity between -.5 and -1.2, which are two or three times more responsive than adults (Perucic 19). The poor seems to respond more to price changes than do the rich in high-income countries. The inelastic demand for cigarettes can be attributed to the fact that cigarettes are highly addictive due to the nicotine that they contain and that cigarettes do not have many close substitutes. What individuals can conclude from this information on elasticity of cigarettes is that although taxes can encourage users to quit, reduce consumption, and prevent individuals from starting or taking up the habit again, these taxes only have a slight effect on reduction and/or prevention. Addiction seems to overpower the effect of higher prices on consumer behavior.

Rationale Behind Cigarette Taxation

Excise taxes are imposed on cigarettes due to their harmful nature. Governments often use the tax as a way to discourage the use of tobacco or punish those who continue to use it (Giertz). Although cigarettes have a relatively inelastic demand, governments still benefit from the tax by using it to provide for a stable source of revenue. Individuals are often in support of the excise tax as well because they are not forced to participate in the tax (Giertz). The government does not force individuals to buy packs of cigarettes nor are they an essential for survival. This means that those who are affected by the tax are being affected voluntarily as they are choosing to continue to buy cigarettes given the increased tax (Giertz).

Additionally excise taxes are used to combat negative spillover effects. Due to the fact that smoking is a negative consumption externality, economic theory justifies the taxing of cigarettes in an effort to reduce consumption. Cigarette smoke not only causes health problems for those consuming cigarettes but those who are in contact with them indirectly. It has been estimated that 133 billion dollars are used for direct medical care and 156 billion in lost productivity for smokes and 5.6 billion dollars in lost productivity due to secondhand exposure ("Economic Facts About U.S. Tobacco Production and Use"). Given this, economic theory suggests that if lost productivity of workers is causing economic inefficiency then taxation should be used to raise the productivity of workers in labor markets.

Literature Review

Before interpreting and explaining the results I obtained from the empirical analysis below, it is necessary to examine the earlier research on the topic. It seems that all of the relevant literature I reviewed came to the consensus that cigarette taxes have little effect on smoking behavior. Each article I reviewed concluded that there are small negative relationships between cigarette taxes and cigarette consumption and/or intensity (i.e. the amount of cigarettes an individual smokes a day).

In Kevin Callison and Robert Kaestner's 2014 paper "Do Higher Tobacco Taxes Reduce Adult Smoking? New Evidence of the Effect of Recent Cigarette Tax Increases on Adult Smoking," Callison and Kaestner found that the relationship between cigarette taxes and participation (i.e. the number of individuals who smoke cigarettes daily) and intensity (i.e. the amount of cigarettes smoked daily) was not only negative but also very small and not statistically significant (155). They found from their research that from 1998 to 2008 state taxes on tobacco had over 100 increases and federal taxes doubled but there was not a significant decline in

tobacco consumption despite the increase in taxes (Callison and Kaestner 155). Callison and Kaestner used data from the Current Population Tobacco Use Supplements to examine how taxes affected propensity and how many cigarettes individuals continued to smoke. The results that they obtained across all states from their study were that adult smokers between the ages of 18 and 74 responded to a 10% increase in taxes by decreasing their participation by .3-.6% and the number of cigarettes by .3-.4% (Callison and Kaestner 156). Callison and Kaestner also found that the previously accepted theory that youth respond more intensively to a price increase in cigarettes than adults was invalid. Conducting experiments using number from three sets of age groups, they found little difference in the sensitivity to price among youth and adults. They concluded that a 10% increase in state tax resulted in a .3-.7% decrease in participation for 18 to 34 year olds, while there was a .2-.4% decrease for those aged 35 to 54, and .3-.6% decrease for those aged 55 to 74 (Callison and Kaestner 156). Following that same increase, 18 to 34 year olds decreased their intensity by .3-.5%, while 35 to 54 year olds decreased by .3%, and those aged 35 to 74 decreased by .3-.4% (Callison and Kaestner 156).

The study found that the reasons for the relatively small response to the increase in cigarette taxes was due to brand loyalty having market power to firms causing little effect on retail prices (Callison and Kaestner 156). Consumers also are shifting to cheaper brands and consumers making interstate smuggling purchases. Taxation also has little effect on smoking behavior as the pool of individuals who smoke are becoming more concentrated with individuals who have strong attractions/addictions to smoking so little does anything to deter them from smoking. Callison and Kaestner ultimately concluded that even a 100% increase in taxes would only decrease consumption by 5% (169).

In Richard Cebula, Maggie Foley, and Robert Houmes' 2014 article "Empirical Analysis of the Impact of Cigarette Excise Taxes on Cigarette Consumptions: Estimates from Recent State-level Data," Cebula et al explain that although there is reduction in the total amount of cigarettes consumed due to higher taxes, there is evidence that smokers will migrate towards consuming cigarettes with higher nicotine and tar content to offset the fact that prices are higher (167). If consumers smoke cigarettes with more nicotine and tar in them per cigarette then a pack of cigarettes will in theory last longer and therefore not deter them from buying cigarettes due to a price increase. Cebula et al found in their regression model that their variable that consisted of federal and state taxes added together was negative and was "significant at the 1% level" (172). That meant that the "higher the excise tax, the lower the aggregate consumption of cigarettes per capita" (Cebula et al 172). Their study calculated coefficients between "-.0049 and .0058 which meant on average a one-cent increase in taxes would reduce total consumption over the 50 states by .49% to .58%" which was based on recent state-level data (Cebula et al 174). Cebula et al suggests that a "simultaneous and uniform tax increase across all 50 states by $1.00 could reduce consumption by approximately 53%-58%" (174).

In Lesley Chiou and Erich Muehlegger's 2014 paper "Consumer Response to Cigarette Excise Tax Changes," Chiou and Muehlegger found evidence that individuals try to alleviate the burden of a tax increase by preparing for it before the increase happens. They observed individuals stocking up on low priced cigarettes rather than high priced cigarettes prior to a tax increase. Weekly sales of lower priced cigarettes were "2.2 times more" than prior months in anticipation of a tax increase (Chiou and Muehlegger 636). Also following the tax increase, Chiou and Muehlegger found that consumers started substituting high price/quality cigarettes for cigarettes of a lesser price and quality instead. They observed a significant drop in purchases of

high-tier cigarettes after a tax increase and a minimal drop in low-tier cigarette purchases which was caused by the substitution of high-tier with low-tier after the tax increase. This means that in the short run the demand for lower priced cigarettes are more inelastically demanded than high priced ones (Chiou and Muehlegger 623). Eventually in the long run though, Chiou and Muehlegger predict that a "flight-to-quality" will result in individuals consuming less but resorting back to high-tier cigarettes (648). Chiou and Muehlegger find that tax policies have a "negative long term health effect as average levels of nicotine, tar and carbon monoxide per pack of cigarettes rises as individuals substitutes across tiers and brands following a tax increase" (648).

In Johanna Catherine Maclean, Douglas A. Webber, and Joachim Marti's 2014 article "An Application of Unconditional Quantile Regression to Cigarette Taxes," the authors looked at the relationship between taxes and cigarettes smoked in the past 30 days. Maclean et al used "unconditional quantile regression (UQR) to examine heterogeneity in cigarette tax elasticity among adult smokers" (188-189). UQR results showed a U-shaped relationship between cigarette taxes and the number of cigarettes smoked in the past 30 days (Maclean et al 207). The study results suggested a -.03 tax elasticity and that consumers in the 20^{th} and 50^{th} quantiles were most responsive to an increase in tax (Maclean et al 199). The study found that a $1.00 increase in tax lead to a 3.5% reduction in consumption or 15.75 fewer cigarettes (Maclean et al 199). The 75^{th} quantile was reduced to 2.58 fewer cigarettes following the tax increase while below 20^{th} and above 80^{th} quantiles didn't respond to a tax increase (Maclean et al 199). The regression also found that a $1.00 increase in taxes led to a 1.47% decrease in the probability of smoking (Maclean et al 198). The coefficient on tax was -1.74, which suggested that adult smokers don't substantially adjust their smoking patterns due to a tax increase (Maclean at al 198). Maclean et

al suggests that if policymakers wish to make a significant impact on smoking consumption that they should look into "regulating labeling and packing sizes, provision of reduced cost smoking cessation services, and outcome based financial incentives" (207). This would include offering low cost group and more importantly individual counseling as well as access to low cost medications to quit smoking. Not only is it important to provide these low cost options during the process of quitting but after as well to continue to stay smoke free.

Overall each scholarly article I reviewed saw very little evidence to support the theory that increases in taxes are a significantly effective way to reduce smoking consumption. Whether the taxes only have a small negative effect on consumption or taxes motivate individuals to look for low-tier alternatives, taxes alone do not have enough strength to overcome the addictive nature of nicotine. According to these articles, taxes must be combined with bans or higher regulations to cause any sort of substantial reduction in consumption and intensity of cigarettes. Although when deciding which variables to use in my regression, I found rationale for the variables I decided to use in Cebula et al's 2014 paper.

Cebula et al in "Empirical Analysis of the Impact of Cigarette Excise Taxes on Cigarette Consumptions: Estimates from Recent State-level Data" states that overall:

> Smoking is negatively impacted by the absence of health insurance, by higher cigarette excise tax levels, by higher income levels, and by a higher level of formal education. It is also expected from the studies summarized above that smoking (along with alcohol consumption) is a "coping mechanism" for the unemployed and therefore that smoking is more likely to be directly/positively associated with both unemployment and alcohol consumption. (167)

Model and Data

The model used in this regression will analyze how independent variables (X) such as excise tax rates, absence of health care coverage, the unemployment rate, and the level of education, alcohol consumption, and median age effect the percentage of current adult smokers in 2013 (Y). This model will evaluate how dependent or how much of the percentage of current adult smokers is determined by each of the six independent variables stated above. It will be used to analyze the direction of the effect on the dependent variable. Independent variables that are positively and/or directly related to the number of current adult smokers will cause the percentage to rise and cause the coefficients to respond in the same direction respectively. Independent variables that are negatively and/or inversely related to the number of current adult smokers will cause the percentage to drop and cause the coefficients to respond in opposite directions respectively. The model will be used to estimate not only the direction of the effect of the independent variables but also the magnitude or by how much the dependent variable is moved in that direction. The data consists of information obtained for all 50 states in 2013 including the District of Colombia.

In the regression below, the dependent variable (Y) is the percent of adults who are current smokers based on the data collected in 2013 by the Behavioral Risk Factor Surveillance System. Although I realize that there can be some problems with using self-reported data because of inaccuracies due to measurement issues and lack of honesty, I felt that this was a reliable source. I could have used the number of packs purchased annually or the total expenditure on cigarettes but I did not find that data readily available. Using the percentage of adults who are current smokers is important as it shows how large or how small the amount of smokers are compared to nonsmokers in a given sample size in each state. It allows individuals

to more accurately portray each state's smoking population when compared to other states with fewer or more people. The percentage used is useful because it accounts for current smokers and not previous smokers, which allows for a more accurate portrayal of the amount of current smokers per state.

The first independent variable used in the model and the focus of this paper is the excise tax rates. The excise tax rates are based on data collected by the Tax Foundation in 2013. It is measured in dollars per 20-pack of cigarettes. This variable is very important, as it is one of the main focal points of this paper. The model examines how influential each state's amount of taxes measured in dollars per 20-pack effects the number of current smokers in that state. I chose to use only the state level tax rate since federal tax rate on cigarettes is $1.0066 for each state (Drenkard 7). I wanted to see how the differences in state levels affected the number of current smokers (i.e. if higher state taxes lead to more reduction in the number of smokers). Policy makers "primary political justification for higher tobacco taxes is the public argument that assumes that high taxes will reduce smoking" (Callison and Kaestner 155). This model is used to analyze the effectiveness of rising taxes alone on cigarettes as a substantial way to reduce smoking behavior. If it is concluded that taxes alone are not effective enough policy makers can use other combative measures to reduce smoking in addition. The expectation of the sign of the tax rate variable is negative. We would expect that as taxes rise and the total price per pack of 20 cigarettes rise, the number of current smokers will drop. The inverse relationship would result from the theory of law of demand that states that since cigarettes are more expense now, people will buy fewer cigarettes or quit smoking to mitigate the tax burden. We can expect that the magnitude of the negative relationship will be very small due to the relative inelastic nature of

demand for cigarettes. Cigarettes have no close substitutes and the nicotine content has a very addictive quality that causes people to continue to buy cigarettes regardless of a price change.

The second independent variable in the regression is healthcare coverage. The data was collected in 2013 by the Behavioral Risk Factor Surveillance System and measures the percentage of people who had no healthcare whatsoever. This variable is important as those with healthcare insurance may have an incentive to continue to smoke. Cebula et al states that, "health insurance coverage might potentially increase the likelihood of a risk-averse individual's smoking" (167). If individuals know they have access to high quality healthcare, they see no reason to change their smoking behavior. Any illness or disease that arises due to smoking can be treated using their provided healthcare. We see evidence for this theory when Cebula et al reasons that, "health insurance partly insulates individuals from the health problems smoking can create by reducing the financial risk associated with smoking through allowing access to healthcare and mitigating the individual smoker's financial burden from smoking-related illness or illnesses" (167).

Cebula et al also notes that, "ceteris paribus; alternatively, in theory, the absence of health insurance may act to discourage smoking among risk-averse individuals" (167). Those who do not have access to healthcare are at a higher risk of prolonged illness or fatality due to smoking which should in theory deter them from smoking. The model will examine how the absence of healthcare coverage affects the number of adult smokers. We would expect the sign on the percent of absence of healthcare per state coefficient to be negative, suggesting that the lower the percentage of adults with healthcare in each states, the greater the percent of smokers. The inverse relationship is due to the theory that when individuals do not have access to

healthcare, they will reduce the amount or quit smoking to avoid illness and death since they do not have access to affordable help or treatment.

The third independent variable pertains to the financial well being of households per state. Measuring consumers' income is important because it is often an indicator of the amount of money after all essentials are paid that is in access to use on nonessentials such as cigarettes. If people are unemployed, they do not have a source of income and thus do not have the money for nonessentials. Given this information, the third independent variable is the average annual unemployment rates measured in percentage terms for each states based on 2013 data collected by the Bureau of Labor Statistics. The unemployment rate is a measurement of labor force that is currently unemployed and earning no income but is actively seeking employment. The theory behind unemployment is that those who are unemployed do not have extra money to spend on cigarettes. They cannot affordable the essentials for survival and the added cost of buying a pack of cigarettes every week at current and rising prices. With that being said, we would expect the sign on unemployment to be negative and have an inverse relationship with the number of smokers. As unemployment rises, less money is available to spend on the higher prices of cigarettes leading to fewer smokers.

Although we may expect those who experience a drop in income might respond by buying fewer cigarettes, that is not usually the case. Due to the highly addictive quality and few substitutes, cigarettes are usually estimated to have a relatively inelastic demand. More commonly we see that unemployment rate has a direct and positive relationship with smoking behavior. Cebula et al found that "smoking is a 'coping mechanism' for the unemployed and therefore that smoking is more likely to be direct/positively associated with unemployment" (167). So as unemployment rises, individuals may smoke more to cope with the stress of

unemployment. This suggests that cigarettes are an inferior good, which means as income rises the demand for cigarettes fall.

The fourth independent variable used in the model is the level of education attained. The level of education is the percentage of individuals who at least earned their high school diploma or earned an equivalent G.E.D. in 2013. It is important to see how the level of education affects the type of job individuals acquire and in turn the level of income per capita they earn. It is observed that when individuals make more income per capita the fewer individuals consume cigarettes. Cebula et al confirmed this when they stated, "the greater the average educational attainment level among the adult population and the higher the per capita income level, the lower the aggregate consumption rate of cigarettes" (167). Following the previous argument above that individuals use cigarettes to cope with unemployment, if individuals who attained high levels of education are attaining high paying jobs and are not faced with the threats or consequences of unemployment, they find no need to use any coping mechanisms and no smoking behavior is induced. Also those the more that individuals are educated, the better they understand the dire consequences that accompany smoking. Given this, education level and the number of smokers have an inverse relationship with education level having a negative sign. More education attained reduces the amount of adult smokers.

The fifth independent variable in this model is the percent of individuals who consumed any amount of alcohol within the last 30 days (BRFSS 2013). The Behavioral Risk Factor Surveillance System collected the data in 2013. Alcohol consumption and smoking are commonly taken together. Evidence shows that smoking combined with alcohol use is used to cope with the consequences of unemployment. Cebula et al states "that smoking (along with alcohol consumption) is a 'coping mechanism' for the unemployed and therefore that smoking is

more likely to be directly/positively associated with both unemployment and alcohol consumption (167). The higher the percentage of drinkers in a state's population, the more smokers there currently are. Due to this theory, we see that the alcohol consumption variable has a positive sign and is directly related to the number of current smokers in each state.

The sixth independent variable in the regression is a measurement of the median age of individuals in each state in 2013. The data is presented in years and was gathered by statista.com. It is important to see what age groups primarily make up each state and how that age group composition affects the propensity to smoke. It has been observed by Cebula et al that older individuals have a higher propensity to smoke as they have grown up in times when smoking was more popular such as the 60's and 70's. Also older generations have been smoking longer and therefore are more highly addicted to the nicotine that cigarettes contain. Cebula et al states that, "smokers who are older on average tend to have a longer history of smoking and thus are likely to be more strongly 'addicted' to cigarette smoking (nicotine) than younger smokers, so that the higher the age of a given population cohort member, the greater the likelihood that said person is a smoker" (167). We would expect that the higher the ages of a state's population, the higher the number of smokers. Thus median age may have a positive sign and be directly related to the number of current smokers.

Given this information, we can derive a predicted regression equation as described below: Y (%of current smokers)= -TaxRate ($) –NoHealthCare (%) +Unemployment (%) – Education (%) +AlcoholConsump (%) +MedianAge (Yrs).

Regression Model Results

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.792943626

R Square	0.628759594
Adjusted R Square	0.578135903
Standard Error	2.265793031
Observations	51

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	382.5802407	63.76337346	12.42026358	3.91344E-08
Residual	44	225.8879946	5.133818058		
Total	50	608.4682353			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	8.789151485	6.140273103	1.431394229	0.159382341	-3.585755826
Excise Tax ($)	-1.44690502	0.422573405	-3.424032374	0.001345801	-2.298545759
No Health Care Coverage (%)	-0.082637858	0.097011396	-0.851836607	0.398917501	-0.27815148
Alcohol Consumption (%)	0.017478904	0.056867358	0.307362688	0.760017456	-0.097129726
Unemployment (%)	0.655223811	0.245579037	2.668077122	0.010639219	0.160291782
Education (%)	0.622072996	0.126198352	4.929327402	1.21726E-05	0.367736929
Median Age (Yrs)	-0.25674226	0.197616014	-1.299197645	0.200642863	-0.655011168

Analysis

The regression was run using an Ordinary Least Squares model, which seeks to minimize the differences between the observed variables in a linear regression model. The regression was tested at an alpha level of .05 or at a 95% confidence level. As we can see from the regression, the model was significant at the 95% confidence level. The F significance statistic was measured at .00000003913, which means it was highly significant at the .05 level. As we can observe from the R squared statistic, the independent variables explain .629 or 62.9% of the variation in the dependent variable. This means that 62.9% of the variation in the percentage of current smokers

is explained by the explanatory variables as a group (i.e. excise tax, the absence of health coverage, alcohol consumption, unemployment, education, and median age).

Most interesting, given the focus of this paper, is that the excise tax variable was significant at the level of .05. The p-value was less than .05 measuring at .0013. As predicted, the sign on the excise tax coefficient is negative. This means that as state taxes rise, the percentage of current smokers fall. Although out of all the coefficients the excise tax had the greatest effect on the percentage of current smokers, the magnitude of the effect was relatively small. The regression measured the excise tax coefficient at -1.45 meaning that as the dollar amount of taxes rise, the percentage of smokers fall by -1.45 each time. The fact that the percentage of smokers only falls about 1.5% due to each dollar increase in taxes, we see the relative inelastic demand cigarettes have.

The next variable that was observed was the absence of health care coverage. As we can see at the level of .05, this variable is statistically insignificant at a p-value of .399. One possible explanation for the insignificance here can be due to multicollinearity. The absence of healthcare coverage may be highly correlated with unemployment or be too closely related to it that it does not have a significant effect on the percentage of current smokers. People who are unemployed are typically the ones who cannot afford healthcare coverage and thus is highly correlated.

The next variable in the regression was alcohol consumption. It was insignificant at the level of .05 measuring at a p-value of .760. The insignificance might be explained by the fact that many public areas, such as bars and restaurants, today have smoking bans. Instead of designated smoking areas, now there is no smoking allowed at all. Because many public areas now do not allow smoking, the percentage of current smokers data taken from the survey may not have any correlation with alcohol. The lack of correlation is a result because many individuals used to

smoke and drink in public areas but now are not allowed to smoke publicly anymore. Alcohol could also be to highly correlated with unemployment because people have been observed to use alcohol in addition to smoking to cope with unemployment. Also I could have considered using amount of alcohol consumed annually as opposed to in the past 30 days and that may have given me a statistically significant outcome.

The next variable tested in the regression was unemployment. The unemployment rate is significant at the level of .05 with a p-value of .011. The sign on the coefficient was positive as predicted. This means that as the percentage of those unemployed rises so does the percentage of current smokers. As the percentage of individual's unemployed rises, the percentage of current smokers rises by .66. This means that the percentage of current smokers rise by a little more than a half of a percent.

The next variable in the regression was education. The education statistic is significant at the level of .05 with a p-value measurement of .000012. The sign of the variable is positive, which is not consistent with what was earlier predicted. This means that as the percentage of individuals who at least obtained a high school diploma rises so does the percentage of current smokers. As the percentage of individuals rise, the percentage of current smokers rise by .622, which is fairly small. The sign may have been positive because perhaps the percent of individuals who have college or graduate education would be a better variable to use. College or graduate level education may be a variable that is correlated with less smoking because most people have at least a high school education and it is more rare to find those with a college education as well. Those who have a college or graduate education may understand the consequences of smoking better than those with only a high school education.

Lastly the median age was tested in the regression at the level of .05. At this level the coefficient is insignificant with a p-value of .20. The insignificance can be explained by the fact that given the inelastic demand of cigarettes and their highly addictive quality, age may play a very small role in the percentage of current smokers. I thought it was still important to include it in my regression given that addiction does not seem to evade young or old smokers because of the differing culture of eras associated with age. I felt as though those who were older would be more highly addicted to cigarettes due to the higher prevalence of smoking in the 50s, 60s, and 70s.

Conclusion

As we can see due to the relatively inelastic demand for cigarettes, taxes have little effect on the reduction and prevention of smoking behavior. Through review of relevant literature and the regression conducted above we can see that excise taxes have a weak inverse relationship with the percentage of current smokers in each state. We were able to see from the scholarly literature that even a 100% increase in taxes would only lead to a 5% decrease in cigarette consumption. Additionally we were also able to see from the regression that excise taxes only accounted for a small percentage of the variation in the percentage of current smokers and the magnitude of the variation although was negative, would only reduce the percentage of smokers by 1.5. With that being said, it seems to me what would make the most sense in reducing the percentage of smokers would be to increase the federal tax rate at the same rate of the states. Taken together, the state rate and federal tax rate increased together simultaneously may have a substantial effect on the percentage of current smokers. Additionally more smoking bans or increased regulation on the amount of cigarettes sold to each individual a day or per week may cause a significant decrease in the percentage of current smokers as well.

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