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Alcohol Excise Taxes and their Effects on the Community

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Doctor of Public Health Capstone Project

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by

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Abstract

Objectives: This study examines the association of an additional excise tax on alcoholic beverages in Georgetown, Kentucky with alcohol-related motor vehicle accidents. Evaluate the additional benefits of the excise tax on the community of Georgetown, Kentucky.

Methods: Using an interrupted time series design, this study compares alcohol-related crash statistics from two similar cities based on 126 months of data from the Kentucky State Police. Analyses included linear regression and Poisson models to evaluate the data in each city to determine population-wide results.

Results: Alcohol-related motor vehicle crashes immediately declined (-12.5%) in Georgetown following the implementation of the excise tax and remained below the previous rates for the remainder of the study. Excise taxes on alcohol produced revenue that can be used in a variety of ways to improve the community.

Conclusions: An increase in alcohol taxes was associated with reduced mortality and could provide greater financial opportunities for cities across the Commonwealth of Kentucky.

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Chapter One: Introduction

In August of 2012, the city of Georgetown, Kentucky voted in favor of a bill allowing alcohol package sales for the first time. (Office of the Mayor) That law was unusual because the sales tax for alcohol was set at 13% instead of the standard 6%. This study has two major aims: to examine the correlation between the supplemental alcohol sales tax in Georgetown, KY and alcohol-related motor vehicle crashes compared to a Kentucky town with a similar population that does not have the higher sales tax, and to document additional potential benefits from the extra revenue generated by the excise tax.

"Excise taxes are taxes that are imposed on various goods, services and activities. Such taxes may be imposed on the manufacturer, retailer or consumer, depending on the specific tax." (Internal Revenue Service, 2020) These taxes can be categorized as *ad valorem* or *specific* and can be enacted by local, state or federal governments. Ad valorem taxes are assessed based on the value of the item, with the most common being property taxes. Real estate, motor vehicles, and boats are all examples of property that can be taxed in this fashion. (Kagan, 2021) Specific taxes, or *per unit taxes* base the tax on the item that is being taxed, rather than the value of the item in question. Levies on products and services such as coal, sports wagering, indoor tanning services, motor vehicle fuel, airline tickets, sugary beverages, alcohol, and tobacco are all examples of specific excise taxes. (Oxford Reference, 2020) Taxes on items that may be considered harmful to society or individuals are often called *sin taxes*. Alcohol, tobacco, and sugary beverages are common consumer goods that may be assessed an additional sin tax. These taxes are often implemented by the government as a public health initiative to reduce consumption or deter the public from purchasing the products.

In most cases, excise taxes on alcohol are applied before the consumer purchases alcoholic beverages in a local liquor, convenience, or big-box store. For example, in Kentucky beer, wine and distilled spirits are taxed 'at-the-barrel' ($.08, $.50, $1.92 per gallon respectively) and again when sold wholesale to distributors (10.75%). (SalesTaxHandbook, 2021) These taxes are often reflected in a higher sale price and most consumers are unaware of its origin, but the tax employed in Georgetown, Kentucky is in addition to the regular 6% state sales tax (total of 13%). This results in a considerably higher final sale price than what consumers are expecting based on the price listed at the retail establishment. To date, this form of excise tax is more common with sugary beverages or sodas than with alcoholic beverages. Cities and countries such as Philadelphia, Pennsylvania, Seattle, Washington, Berkeley, California, Mexico, Chile, and England have successfully implemented these taxes with the aim of combating obesity and diabetes in their local populations resulting in massive success. According to Dr. Sara Bleich, Professor of Public Health Policy at the Harvard Chan School of Public Health, "[Soda taxes are] an enormous health win…with no apparent negative economic impact." (Flatt, 2020)

This study will investigate the potential benefits of the municipal alcohol tax, in particular the rates of alcohol-related motor vehicle crashes and the financial implications for the local community, an as they have not been fully explored in the same fashion as those of their non-alcoholic counterparts.

In this study, over 9 years (126 months from July 2010 to December 2020) of Kentucky traffic collision data has been evaluated with an interrupted time series model to observe the changes in alcohol-related crash data in Georgetown, KY, Elizabethtown, KY, and the entire Commonwealth of Kentucky over the same period. In addition to the collision data, seven years of financial documents were obtained and evaluated to ascertain the economic impact that the

excise tax has on the Georgetown community, how the funds have been distributed, and how a similar tax may benefit other cities and counties across the state.

Chapter Two: Literature Review

While there is little literature that specifically relates to this study, there is a similar study by Alexander C. Wagenaar that "examined the effects of a 2009 increase in alcohol taxes in Illinois on alcohol-related fatal motor vehicle crashes" using an interrupted time series design. Wagenaar collected data from driver alcohol test results from several months before and after the intervention of an increase in alcohol tax. The study found that alcohol-related crashes decreased by nearly 10% and that the severity of intoxication also decreased by over 20%. (Wagenaar, 2015) In related analyses and meta-reviews performed by Wagenaar, data showed that a "10% increase in the price of alcoholic beverages is associated with a 5% to 8% decrease in drinking" (Wagenaar, 2009) and "alcohol tax increases result in significant declines in chronic disease (e.g., cirrhosis, esophageal cancer), sexually transmitted infections, injuries, violence, and motor vehicle crashes." (Wagenaar, 2010) In addition to these studies, it has also been shown that increased taxes were linked to significant declines in consumption and fewer alcohol-related harms in underage populations. (Elder, 2010) Finally, an earlier study by Chaloupka found that not only does an increase in alcohol taxes result in the reduction of harm related to alcohol use and abuse, but that alcohol tax rates have not grown proportionally with inflation since the 1960s, so there is room for tax increases. (Chaloupka, 1998) In every case, the studies observe changes in a location where alcohol sales were already present. This is an important distinction, as Georgetown did not allow alcohol package sales prior to the tax.

In addition to the studies by Wagenaar and Chaloupka, there are additional studies that further investigate the status of alcohol sales on the local communities. A series of studies by

H.A. Khaleel et al. examined the relationship between alcohol sales and both homicide and suicide rates. These studies provided data suggesting an increased risk for suicide and homicide in wet counties when compared to dry and moist counties. (Khaleel et al., 2019, Khaleel et al., 2016)

Previous studies provide data that correlate with the intent of this study while simultaneously demonstrating the limited number of policy changes that have been enacted despite the evidence that reflects the efficacy of this intervention. This study and subsequent financial review intend to build upon previous data and serve as a policy recommendation for lawmakers in the state of Kentucky to consider, as not only can there be a health benefit to the population, but also a significant financial aspect that can result in dividends for local governments across the state.

Chapter Three: Methodology

The main portion of this study is an interrupted time series design that evaluates monthly alcohol-related crash data from 2010 to 2020. An interrupted time series (ITS) design involves data that is measured at several points in time, both before and after the intervention/exposure. While randomized control trials (RCTs) are considered the gold-standard design for evaluating interventions, there are many instances when it is not feasible to incorporate that design in a study, because of ethical concerns or financial limitations. The ITS design is considered quasi-experimental, as it possesses some, but not all of the defining characteristics of traditional experimental designs. ITS designs are particularly effective in avoiding threats to internal validity. The availability of observational data and the inability to perform a randomized trial supports the use of the ITS design. (Turner, 2019) Time-series designs are particularly beneficial

in interventions in the fields of clinical psychology, education, and health promotion, and have been instrumental in the continued understanding of behavioral reinforcement. (Biglan, 2000)

This study incorporates a controlled interrupted time series design that includes an exposed group and a control group. The addition of a control group allows for comparable data beyond the baseline trend in the intervention group as shown in Figure 1. This structure is a stronger design than the single ITS, as it enhances the capacity to control for potential threats to internal validity such as history, maturation, instrumentation, regression to the mean and attrition. (Hategeka, 2020)

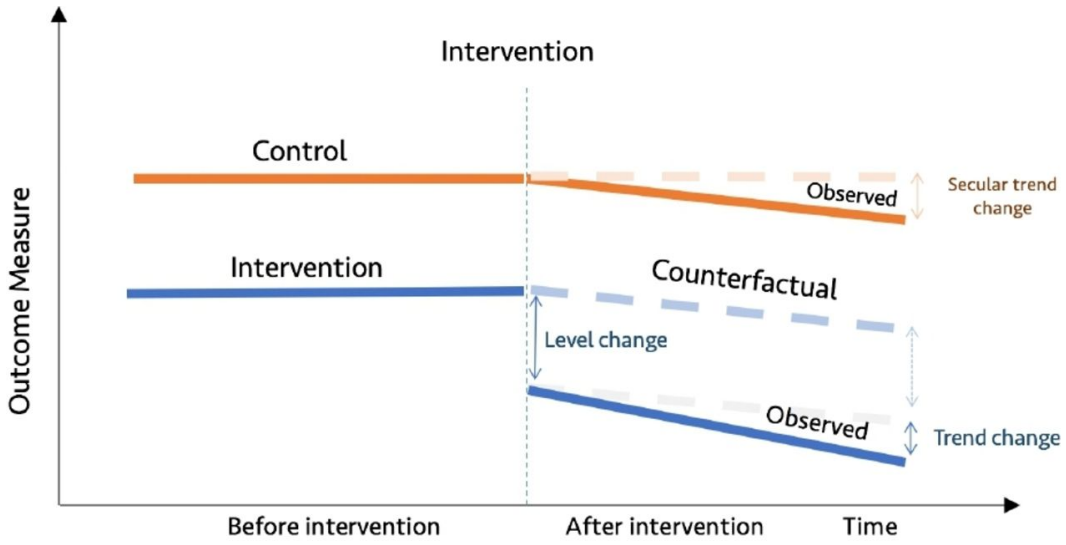


Figure 1 – Controlled interrupted time series. (Hategeka 2020)

The data for this study was documented by the Kentucky State Police and published on their Collision Data site at http://crashinformationky.org/AdvancedSearch. Data from July 2010 through December 2020 was collected and analyzed, with 26 months before and 100 months after the intervention (approved alcohol sales with extra tax) in Georgetown, Kentucky. Elizabethtown, Kentucky was chosen as a control group as this city is comparable in population

and Elizabethtown voted to sell alcohol less than one year before Georgetown with the standard sales tax of 6%. Elizabethtown data 16 months before and 110 months after intervention (approved alcohol sales with standard sales tax) is also analyzed as a comparison group to the data in Georgetown. Data from the state of Kentucky during the same 126 months is also observed to compare the individual cities' statistics against that of the entire state. Table 1, below, shows the basic demographic data from Georgetown, Elizabethtown, and the state of Kentucky. Elizabethtown was chosen due to its similar population, as well as the similar timing regarding the cities' choice to sell alcohol with the standard sales tax.

Demographic Data

	Georgetown	Elizabethtown	Kentucky
2010 Census Population	29098	28531	4339367
2020 Census Population	37086	31394	4505836
% increase	20.10%	8%	3%
White alone	85.20%	76.50%	87.50%
Black or African American alone	6.10%	11.30%	8.50%
American Indian/Alaskan Native alone	0.30%	0.20%	0.30%
Asian alone	1.60%	4.00%	1.60%
Native Hawaiian/Pacific Islander alone	0.00%	0.20%	0.10%
Two or more races	4.60%	6.60%	2.00%
Hispanic or Latino alone	3.90%	5.50%	3.90%
High School Graduate or higher	91.50%	90.60%	86.30%
Bachelor's Degree or higher	27.50%	28.60%	24.20%
Median Household Income	$65,812	$46,754	$50,589

Table 1 (United States Census Bureau, 2020)

The Poisson distribution model used in this study is estimated using $y = \alpha + \beta_1 T + \beta_2 X + \beta_3 XT + \varepsilon$, where T is time, X is the study phase and XT is the time after interruption. Population growth in each city was also accounted for in this model, which was imperative due to the higher rate of growth in Georgetown. This model was implemented with

the Georgetown and Elizabethtown data using GENMOD in SAS 9.4. Prior to running the Poisson model, SPSS 28 was used to run a curve estimation, as well as an ARIMA model to chart the data.

The other data that is being evaluated are the financial documents that detail the revenue created by the additional tax. This data can be used to show lawmakers and citizens the extra potential when considering alcohol sales and taxes in their communities. The data was provided by the Scott County Clerk's office and showcases the possibilities provided by the additional revenue stream and offers a framework for other communities to consider when evaluating future policy changes.

Chapter Four: Results

Analyses revealed a lower rate of alcohol-related motor vehicle crashes in Georgetown after the implementation of the law to allow the sales of alcohol that included the additional tax when taking population into consideration. The monthly average of alcohol-related accidents in Georgetown prior to the intervention was 3.88, and the average after the intervention was 4.71, however, the rate per 10,000 population before the intervention was 1.333, while the rate in the first year following the intervention was 1.166. The cumulative rate of accidents post intervention was 1.270. Elizabethtown produced a pre-intervention average of 5.5 accidents per month and an average of 5.01 after the intervention. The accident rates in Elizabethtown were 1.928 before and 1.596 after the sales of alcohol were allowed. Figures 2-5 below show the raw data of alcohol-related accidents in both Georgetown and Elizabethtown, as well as the trend lines for each graph, while figures 6 and 7 demonstrate the entirety of the study in each location with the averages before and after intervention. A curve estimation for both cities was also

evaluated to determine possible significant analysis methods. The results can be observed in Figures 8 and 9 below.

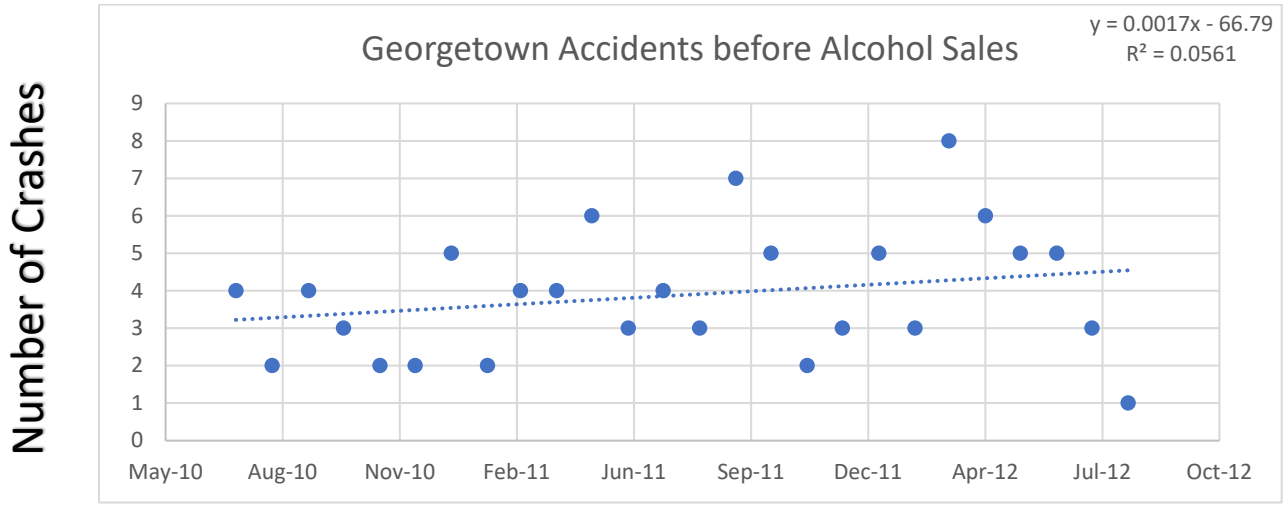


Figure 2

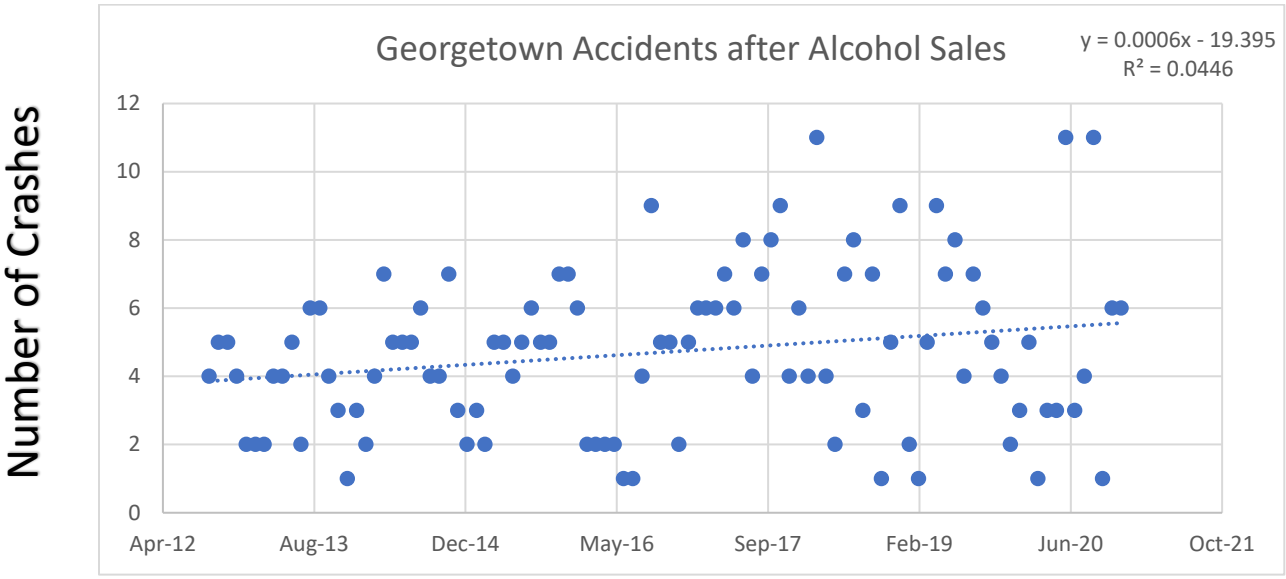
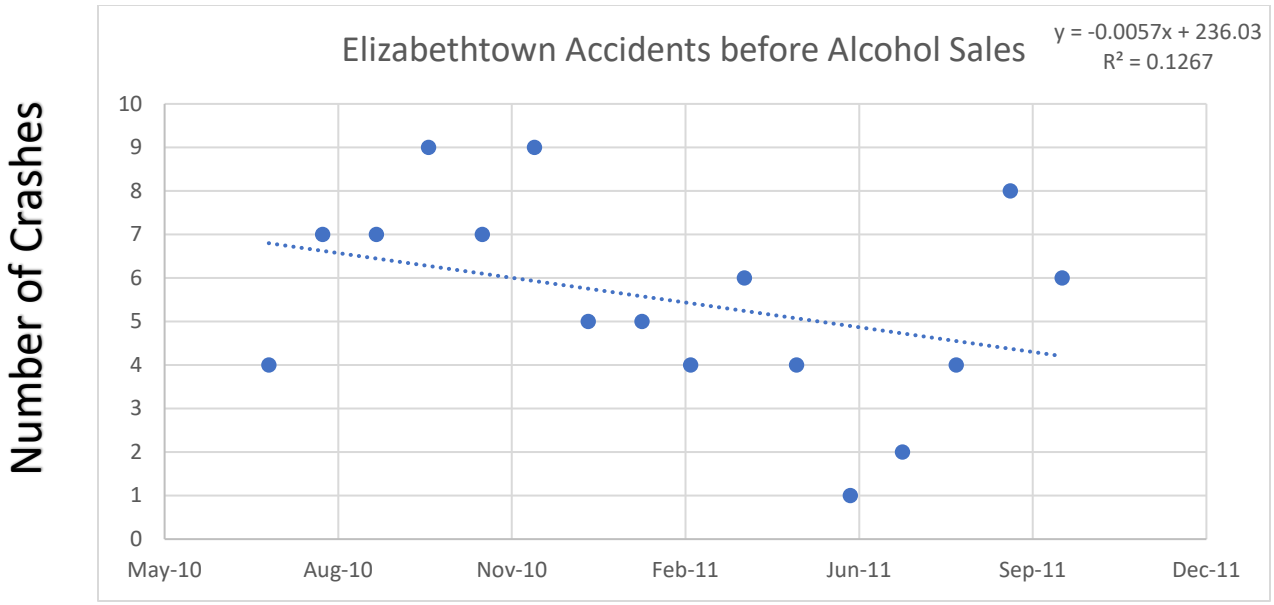


Figure 3



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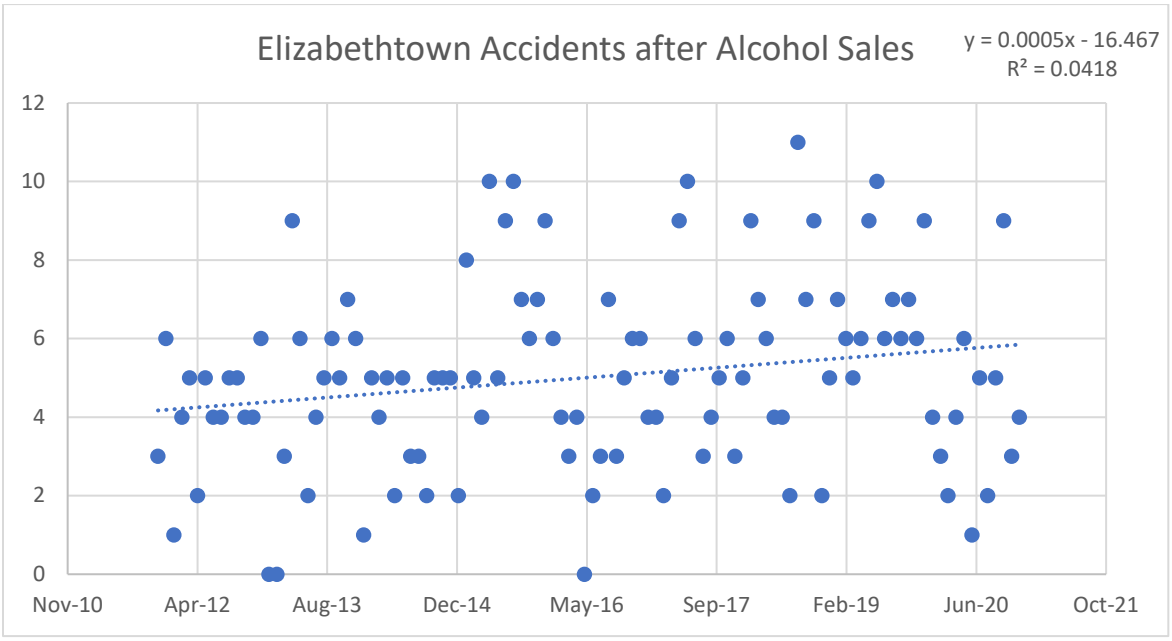

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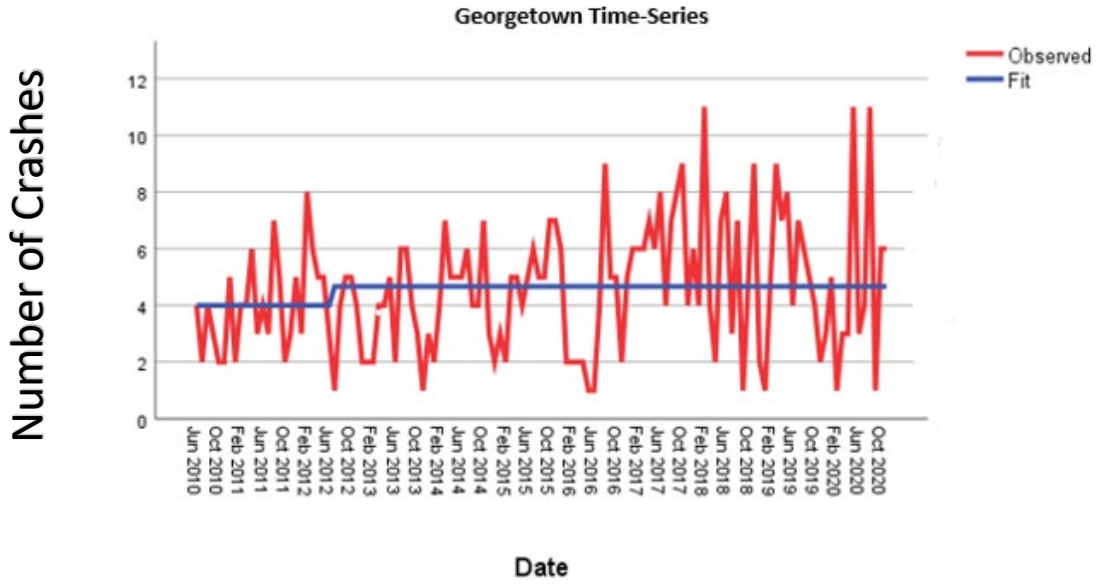

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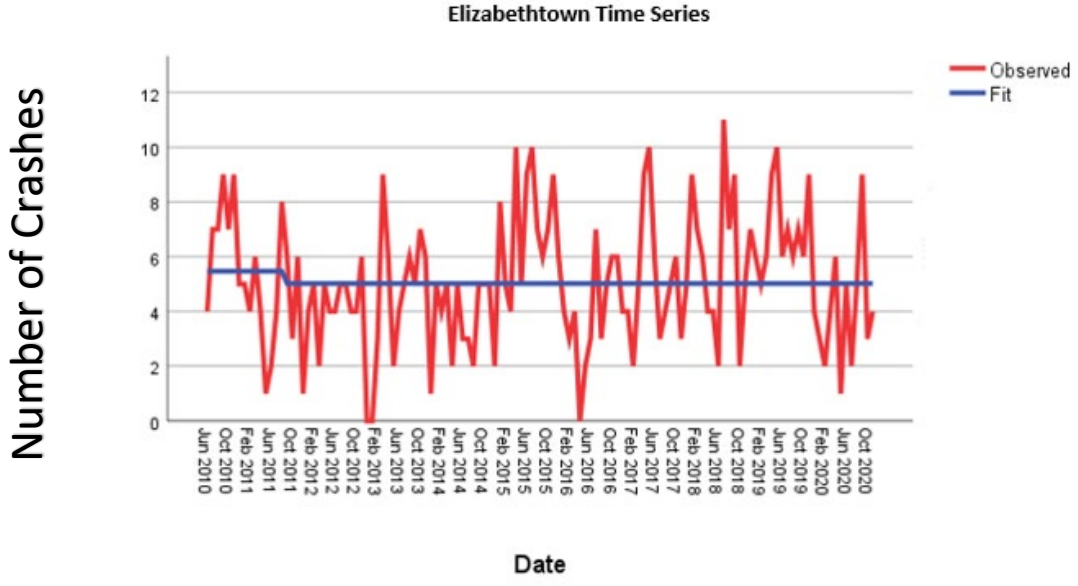

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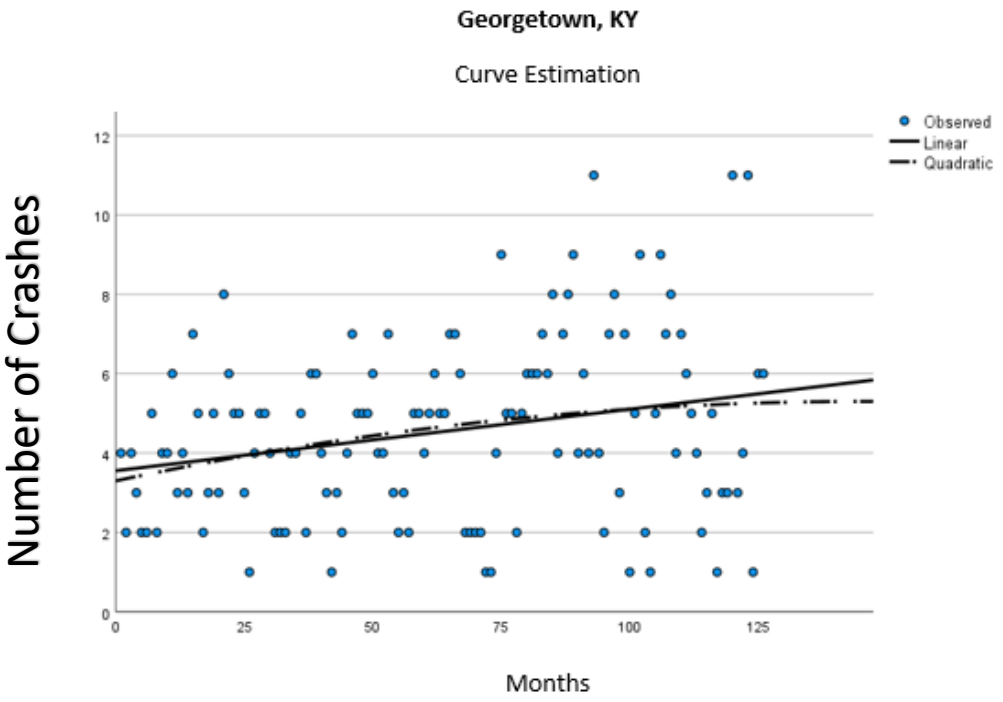

Figure 8

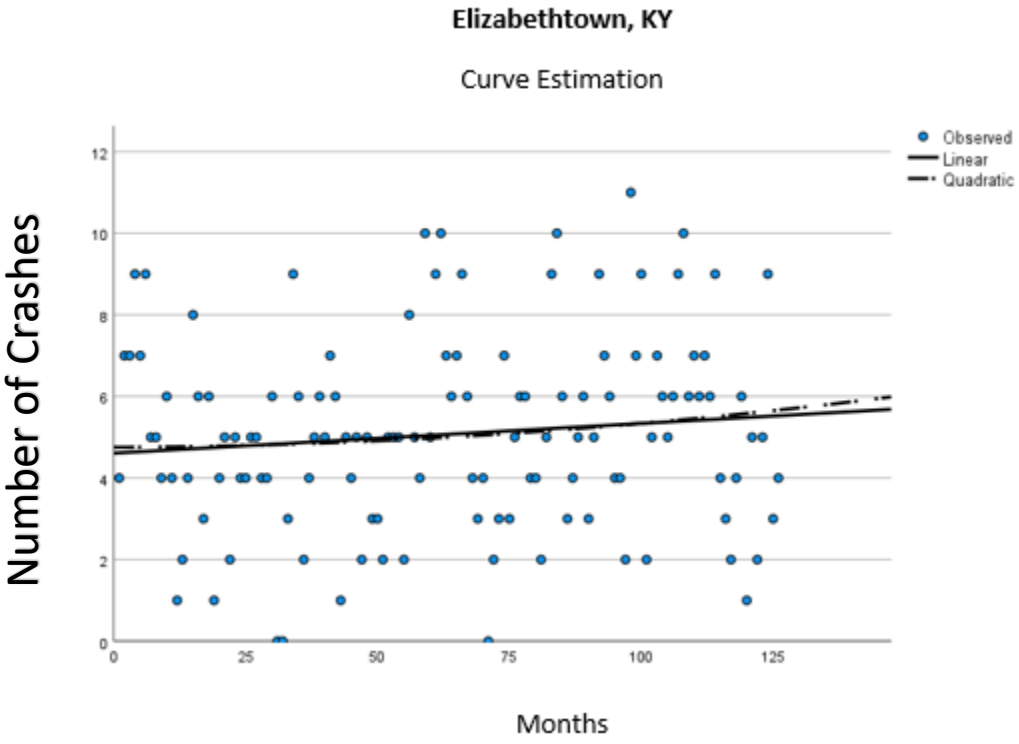

Figure 9

Once the initial analyses were complete, the Poisson regression model was applied, resulting in statistically significant results in Georgetown (Table 2, Figure 10) and non-significant results in Elizabethtown (Table 3, Figure 11). When controlling for the population change in this model, the rate of alcohol-related accidents per 10,000 people in Georgetown after the intervention is dramatic. As shown in Table 2, there is an increase in accidents in Georgetown over time of T=2.03% (95% CI .21%, 3.85%), however there is a decrease in accidents when considering the start of the intervention [GX=-30% (95% CI -61.68%, 1.35%)] and over the course of the study post intervention [GXT=-1.8% (95% CI -3.67%, .02%)]. In Elizabethtown, there is an overall decrease of time, T=-4.22% (95% -9.99%, 1.54%), and an increase in EX (study phase) =5.79% (95% CI -51.41%, 62.99%) and EXT (time after interruption) =4.44% (95% CI -1.33%, 10.21%). The complete set of data for the state of Kentucky was also analyzed, however it proved to be a nearly static line that mimicked that of the population increase and provided no value to the study.

Analysis Of GEE Parameter Estimates						
Empirical Standard Error Estimates						
Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept	-9.1907	0.1377	-9.4606	-8.9208	-66.74	<.0001
T	0.0203	0.0093	0.0021	0.0385	2.19	0.0285
GX	-0.3017	0.1608	-0.6168	0.0135	-1.88	0.0606
GXT	-0.0182	0.0094	-0.0367	0.0002	-1.93	0.0531

Table 2

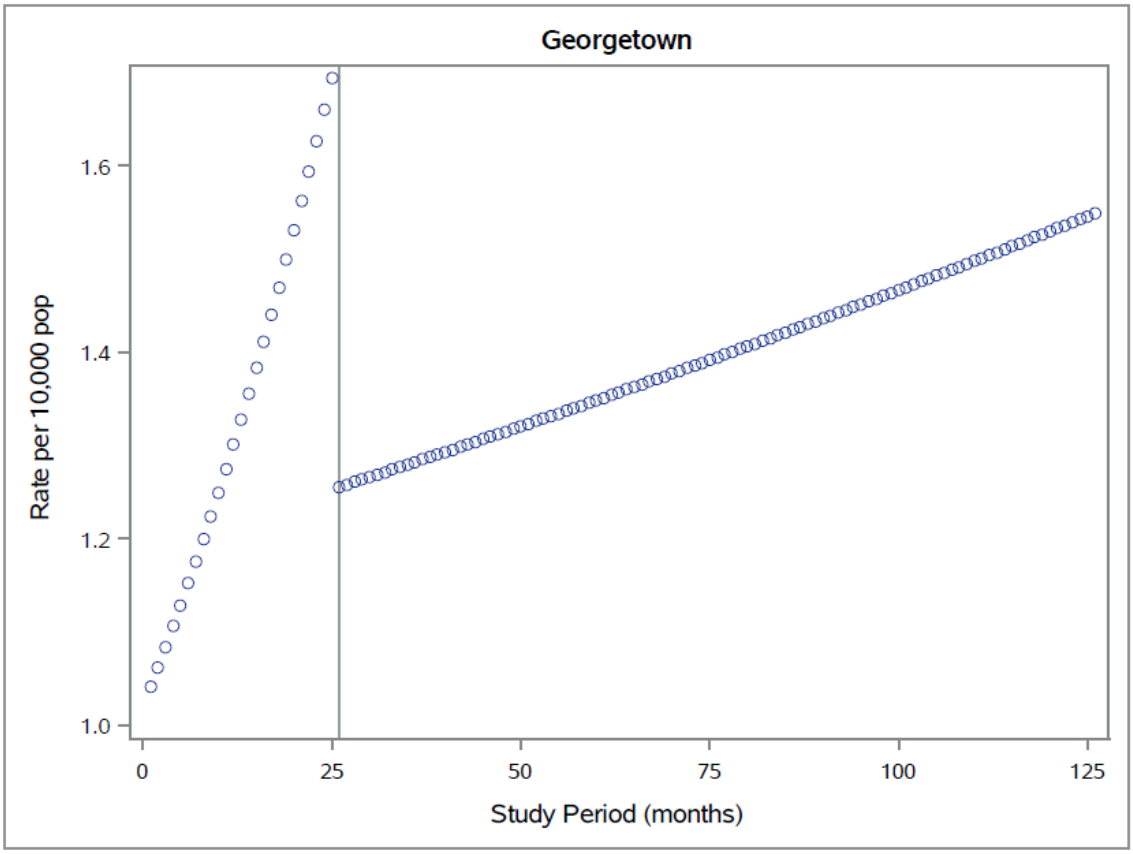

Figure 10

Analysis Of GEE Parameter Estimates						
Empirical Standard Error Estimates						
Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept	-8.2431	0.2017	-8.6384	-7.8477	-40.86	<.0001
T	-0.0422	0.0294	-0.0999	0.0154	-1.44	0.1512
EX	0.0579	0.2919	-0.5141	0.6299	0.20	0.8427
EXT	0.0444	0.0294	-0.0133	0.1021	1.51	0.1319

Table 3

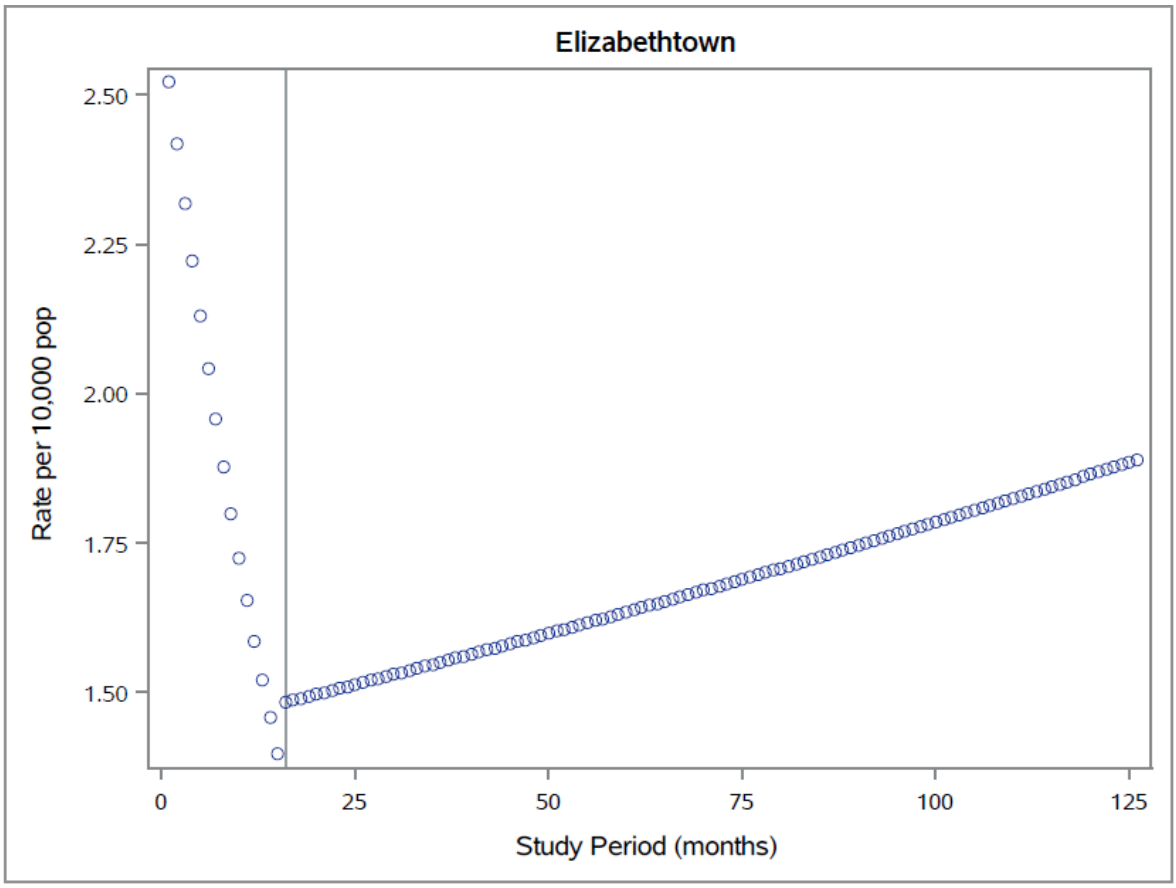

Figure 11

There are additional benefits of taxing alcoholic beverages beyond the standard rates. In the first year, the city of Georgetown collected over $750,000 in taxes and fees, with the highest revenue of over $1.15 million in 2019. Some of these funds were used to create new administrative and police department jobs, as Georgetown anticipated the need for more officers after the sale of alcohol was approved. (Clerk's Office, Office of the Mayor) Georgetown also invested in new equipment, as well as an updated fleet of police vehicles to better serve the community. Finally, the city invested in a new alcohol education program that is implemented in the schools across the community in an effort to limit alcohol abuse by educating the student population. These actions show foresight and understanding from the local government, with different aspects of public health being addressed with the additional funding. Over time,

Georgetown could expand their education program or use the funds from the tax to implement further public health initiatives, such as a diabetes prevention or smoking cessation programs.

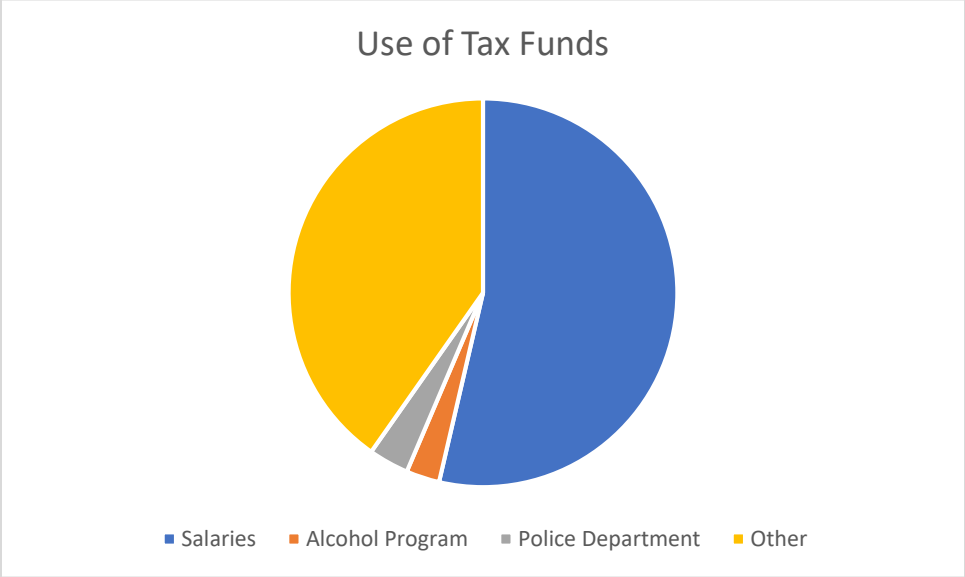

Figure 12 (Clerk's Office)

Chapter Five: Discussion

This study expands upon previous studies, demonstrating that when implemented in tandem with authorization of package liquor sales, a higher alcohol tax is associated with significant reduction in alcohol-related automobile accidents. The impact of the tax on motor vehicle crash rates was immediate and long-lasting, associated with a much slower rate of accidents than prior to the tax, as well as a lower rate when compared to a city (Elizabethtown, Kentucky) that did not implement and additional tax on alcoholic beverages.

While the data in Georgetown is statistically significant and shows a change post-intervention, even with a 20.1% increase in population, the analyzed data in Elizabethtown is not as strong. This is likely due to the low number of observations pre-intervention, which has caused the data to show a decline in accidents in the 15-month period prior to the start of alcohol

sales in the city. Considering the limitations of the data, the rate of alcohol-related accidents in Elizabethtown still appear to increase at a high rate in both the linear and Poisson models.

While a higher alcohol tax is expected to reduce the affordability of alcohol and the amount of alcohol that a consumer can purchase (which may result in lower consumption and lower crash rates), it is also important to consider that the legalization of alcohol sales in a community may have an effect on these rates as well. Allowing alcohol sales in a city, such as Georgetown or Elizabethtown – will likely decrease the number of individuals travelling to nearby counties that already sell alcohol. Fewer people driving long distances to buy alcohol may result in fewer crashes as well. Kentucky State Police data shows an association between dry counties and higher DUI rates, while counties that authorize the sale of alcohol often see a decrease in motor vehicle crashes over time, according to records from 1995-2010. (Sulfridge, 2012)

Additional considerations for factors that may have influenced the crash rates during the study period were evaluated, including seasonality and other policy changes in Georgetown, but were not found significant. There does not appear to be any seasonal trend and there were no other policy changes or traffic laws during this time that would have influenced alcohol-related accident rates. Georgetown is also very close to a much larger city (Lexington, KY), which may influence the total alcohol sales as many Georgetown residents work in Lexington or travel there often and are able to avoid the tax by purchasing alcohol outside of Georgetown.

This study provides information regarding the additional benefits of a tax on alcoholic beverages that can be used to implement new programs as well as supplement existing programs and departments. This added benefit may be used by lawmakers to inform citizens in communities that are unsure of voting in favor of alcohol sales or added taxes. If the public is

shown how their tax dollars are used to better their cities, towns, and counties they may be more likely to vote in favor of the extra tax.

The extra tax dollars provide opportunities for community programs, upgraded infrastructure, and an increase in funding for schools, emergency services, and local government jobs. Georgetown has proven that an increase in alcohol sales tax can be beneficial beyond the potential decrease in car accidents; it can also result in advantages for the city and residents.

Limitations of this study include the small number of observations prior to intervention in both Georgetown and Elizabethtown, the dramatic population increase in Georgetown over the course of the 10-year study period, and the fact that there is no period in Georgetown when alcohol sales were legal without the presence of the excise tax. The limited observations, particularly in Elizabethtown, can skew the trend line to show a decrease in accidents prior to the intervention when that is highly unlikely. The populations of Elizabethtown and Georgetown were nearly identical at the start of the study, but very different at the conclusion. This can limit the validity of the comparison group, forcing population rates to be considered rather than basic population data. The increase in population is likely due to the emergence of the Toyota plant as one of the largest job creators in the region. Toyota continues to invest in Georgetown and the city will likely continue its rapid growth rate for years to come. Finally, the lack of alcohol sales data in Georgetown absent the extra tax prevents the analysis of pre and post-tax figures, as Georgetown began package sales with the 13% tax. In addition to these limitations, there is also a concern with the confidence interval size and the fact that the range includes 0. However, this may be due to the limited sample size in each month, resulting in larger confidence intervals.

Chapter Six: Conclusion

In conclusion, this study demonstrates the potential of an excise tax on alcoholic beverages to decrease alcohol-related vehicle crashes. Like excise taxes on other goods (sodas, tobacco, etc.), an additional sales tax on alcohol can be an effective public health initiative to reduce the overuse of alcohol, limiting potential crashes and fatalities. With this information, as well as the accompanying financial benefits, city council members across the Commonwealth of Kentucky should consider implementing a tax similar to that in Georgetown.

Future studies may examine the benefits of the excise tax for the community when compared to surrounding areas. For example, does the presence of the tax provide programs that are used by individuals that travel from nearby counties? Does the community produce more high school graduates, create more jobs, or have less food insecurity than the local averages? Are business owners more attracted to Georgetown as opposed to a comparable town due to the opportunities that are made possible by the funds and subsequent programs that are generated by the alcohol tax?

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