Introduction

In this project, we consider possible relationships between liquor purchase patterns and the 2016 Presidential Election in the state of Iowa. An abundance of data and a plethora of political campaign activity provide many opportunities for analysis. For example, examining the relationship between liquor purchases and political affiliations or liquor purchase patterns' response to major political events such as debates, the Iowa Caucus, or election day. To conduct this data examination, we will utilize liquor sale data and county-level population and vote data from the periods surrounding the election season in 2016 to visualize data trends and look for correlative patterns between datasets. The largest challenge will be understanding confounding factors (such as underlying population trends or non-political events) that may also affect liquor consumption.

Literature Review

There is a substantial amount of academic literature concerning the economics of alcohol consumption in the United States. Having a good understanding of the intricacies of alcohol markets is necessary for studying impacts that alcohol has on public health. Many economists and researchers have explored this topic specifically within the United States, conducting research on the many factors that can influence alcohol consumption. There are several papers that are particularly relevant to our research project concerning alcohol consumption in Iowa during United States' presidential election cycle.

There are several published academic papers concerning general alcohol consumption patterns in the United States. Hart's 2019 paper *Evolving Consumption Patterns in the U.S. Alcohol Market: Disaggregated Spatial Analysis* used alcohol consumption data across a forty-year timespan which included the 2016 presidential election. The paper found evidence that individuals who voted for Donald Trump tended to demand more beer but less of all other liquor products (wine, spirits), and also found that ancestral demographics had an influence on the type and quantity of alcohol consumed. However,

the paper found that alcohol consumption patterns across time are not consistent and greatly vary across geographic areas, time, and demographics. Hart concludes that there is strong evidence that ancestral alcohol consumption, urbanization, and political affiliation influence alcohol type preference but does not make any causality claims.

Moore's 2005 paper *Longitudinal Patterns and Predictors of Alcohol Consumption in the United States* used a mixed effects model to analyze alcohol consumption data across the United States in relation to age (birth year) and other demographic factors. Using data collected in several periods between 1971 and 1992, the paper found that after early adulthood, older ages are associated with less alcohol use. It also found that several demographic variables were associated with high levels of alcohol use, including being male, white, unmarried, smoking, higher education, and higher income.

Yakolev's 2013 paper *Alcohol Consumption and Political Ideology: What's Party Got to Do with It?* estimates the impact of political ideology on demand levels for beer, wine, and spirits using alcohol consumption panel data from 1952-2010 and a citizen ideology index. The paper found that as state populations become more politically liberal, they increase their use of beer and spirits at a per capita level while decreasing their use of wine. The paper posits that this is an expected outcome given other economic literature's findings that people with socialist ideology are involved with more unhealthy behaviors.

Musse's 2020 paper *The Effect of Presidential Election Outcomes on Alcohol Drinking* found that support for a losing presidential candidate is associated with an alcohol consumption increase. Using alcohol consumption data from 2004 to 2017 and election data from the 2004, 2008, 2012, and 2016 United States presidential elections, the paper establishes a link between alcohol use and support for losing presidential candidates, but only for the 2016 election. It posits that this is due to the emotional charge, inaccurate predictions and involvement of social media in that particular election. It also associates risky

health behaviors (alcohol use) with stress-inducing events. It found that high stress levels within four weeks of the election were associated with increased alcohol use.

These four papers establish some trends to look for in our own data concerning Iowa alcohol consumption during the 2016 presidential election. We can also expect areas of Iowa with concentrations of certain ethnicities to influence the type of alcohol consumed in that area. From Moore's 2005 paper, we should look at the age distribution of Iowa counties and examine the effect that might have on alcohol consumption during the election cycle. Yakolev's 2013 paper indicates that we might see increased alcohol consumption in Iowa counties that voted Democrat in the election. And finally, Musse's 2020 paper indicates that we might expect higher levels of alcohol consumption in the weeks close to the election as stress levels are higher, but that the relationship between alcohol consumption and the 2016 presidential election might be very different than historical precedent.

Description of Dataset

The primary liquor purchase dataset was made available through the Iowa Alcoholic Beverages Division (ABD). Iowa established a monopolistic 'control' system in 1934 after the repeal of 18th Amendment. Today, the ABD is the sole wholesaler of alcoholic liquor in the state and is responsible for regulating and licensing private establishments that sell alcohol. Iowa code requires the ABD to markup liquor by 50 percent and return those funds to public spending. To track funds and taxes required to be collected for the various state funds supported by alcohol sales in Iowa, the ABD is required to keep stringent records on the volume, value, and type of liquors sold within each county.

The specific data used was published by the Alcoholic Beverages Division and provided by the Iowa Department of Commerce and is part of an ongoing series of public alcohol consumption datasets provided by the Iowa state government. The dataset contains over 3 million data descriptors of individual alcohol purchases occurring in Iowa between January 1st, 2014 and October 1st, 2017. Each

data point lists the date of the purchase, the name of the store selling the purchase, store address, city, county, product brand, item description, bottle volume in milliliters, cost of the alcohol, cost of alcohol including tax, number of bottles sold, total purchase cost, and volume sold in liters and gallons.

Iowa Alcohol Consumption Data Expectations

Based on prior studies of alcohol consumption patterns in the United States, we have some general expectations for what the results from the Iowa alcohol data will show. Intuitively, counties with the highest population will also most likely have the highest amount of alcohol consumption and a greater amount of liquor stores. The five biggest cities in Iowa are Des Moines, Cedar Rapids, Davenport, Sioux City, and Iowa City, so we can expect those associated counties to have more alcohol consumption than more rural areas of Iowa. There are also several large universities in Iowa located in Ames, Iowa City, Cedar Rapids, Cedar Falls, and Davenport. The higher concentration of young people in university areas might result in more alcohol consumption in those areas. We anticipate that university sessions will have a large impact on alcohol consumption, with alcohol consumption decreasing by a significant amount during the summer when students are not on campus.

Based on the literature review, there is an expectation that areas with a higher population of registered Democrats tend towards more alcohol consumption compared to Republicans. Historically, Iowa has had a higher concentration of registered Democrats in the more urban areas of central and eastern Iowa. However, the majority of Iowa is rural with a higher proportion of Republican support.

There are several major events that we expect to have an impact on alcohol consumption in Iowa. Alcohol is often used during celebratory events, so we expect increased levels of alcohol sales around major holidays celebrated in Iowa, specifically New Years, Independence Day, Thanksgiving, and Christmas. There are also celebratory events that could increase alcohol consumption levels, such as the Iowa State Fair, Old Thresher's Festival, and university football games. The Iowa State Fair is held in Des

Moines and takes place over a span of 11 days in August. It also doubles as a political event, as many presidential candidates use the fair to gather support for their campaigns. Old Thresher's Festival is held in Mt. Pleasant over several days in September and brings in people from around the state to celebrate the start of harvest. Tailgates for Iowa State and University of Iowa football games also represent major cultural events that are often associated with increased alcohol consumption.

We expect that alcohol sales will spike around major holidays and cultural events and will drop when universities are out of session (May-August). Around major political events, we expect alcohol consumption for certain demographics to increase or decrease based on outcome. Specific political events that we suspect may impact alcohol consumption are the Iowa caucus (February 1), the general election debates (September 26, October 9, October 19), and election day (November 8).

Presidential Politics: The Iowa Caucus

We specifically considered the relationship between politics and liquor sales because of the role Iowa played in the 2016 presidential election. Iowa is home to the first contest in the presidential cycle and usually serves to 'kickoff' the election season, with candidates devoting substantial presence and resources to the state to build momentum for their national campaigns. The caucus is not structured like a traditional primary vote: citizens 'vote' at local gatherings by organizing themselves into groups based on what candidate they support. Because the voters organize themselves in this manner, their vote is not secret. This traditionally invites discussion and debate between groups as voters make the case for their candidate and attempt to convince their neighbors to switch their loyalties, so candidates are particularly motivated to provide debate fodder and inspire their supporters in Iowa. Any candidate under 15% support in the initial tallying of 'votes' is considered 'unviable' and participants must either choose another candidate or rally others to join them to reach the threshold. The supported candidates are then assigned pledged delegates at the state level. More than half of Iowa caucus winners since

1972 have gone on to win their party's nomination to the presidency. The stigma of being branded 'unviable' is not attractive to any presidential hopeful, so it is typically viewed as politically advantageous to generate as much discussion and support in Iowa as possible. Candidates inundate the state in the months before the caucus with a series of townhalls, forums, debates, rallies, and the infamous pork tent at the Iowa State Fair (also complete with a corn-kernel voting system, The Presidential Soapbox, and plenty of turkey-leg photo ops) in hopes of generating sound bites and airtime.

The 2016 Iowa Presidential Caucus was held on February 1, 2020. 186, 932 votes were cast in the Republican caucus. Ted Cruz won the Republican caucus with 27.6% of support and leading runner-up Donald Trump by only one delegate. 12 candidates were viable for contest. The Republican Party sponsored several large events in Iowa leading up to the vote: the Presidential Family Forum was held in Des Moines on November 20, 2015 and hosted a debate on January 28, 2016 (also in Des Moines). In the Democratic caucus, Hillary Clinton defeated Bernie Sanders by the closest margin in caucus history (less than one-quarter of a percentage point). 171, 517 votes were cast in the Democratic caucus. The Democratic party hosted a debate in Des Moines on November 14, 2015, and a second on January 11, 2016 (also in Des Moines).

Because of the substantial presence of political campaign activity in Iowa, we think a strong possibility exists in Iowa for describing potential patterns between liquor consumption and political activity.

Data Manipulation

The liquor dataset from the state of Iowa's Alcoholic Beverages Division contains over 12.5 million observations. Using the raw data provided by the ABD, we cleaned the data to prepare it for analysis using the following methods.

To look at county variations in consumption we need to ensure that all the data entries had correctly specified counties. Upon further inspection, the raw dataset stated that there were more counties in Iowa than actually existed, in addition to having differences in spelling of county names. For example, O'Brien county registered as a different county than Obrien county. We adjusted the data to account for errors in the raw data and merge counties with misspelled county names. After these adjustments were made, there were still several observations with null county entries. Fortunately, all unique store identifiers had one county name associated with it, which meant that the null county entries could be entered using the same unique store identifier for an entry with county already entered.

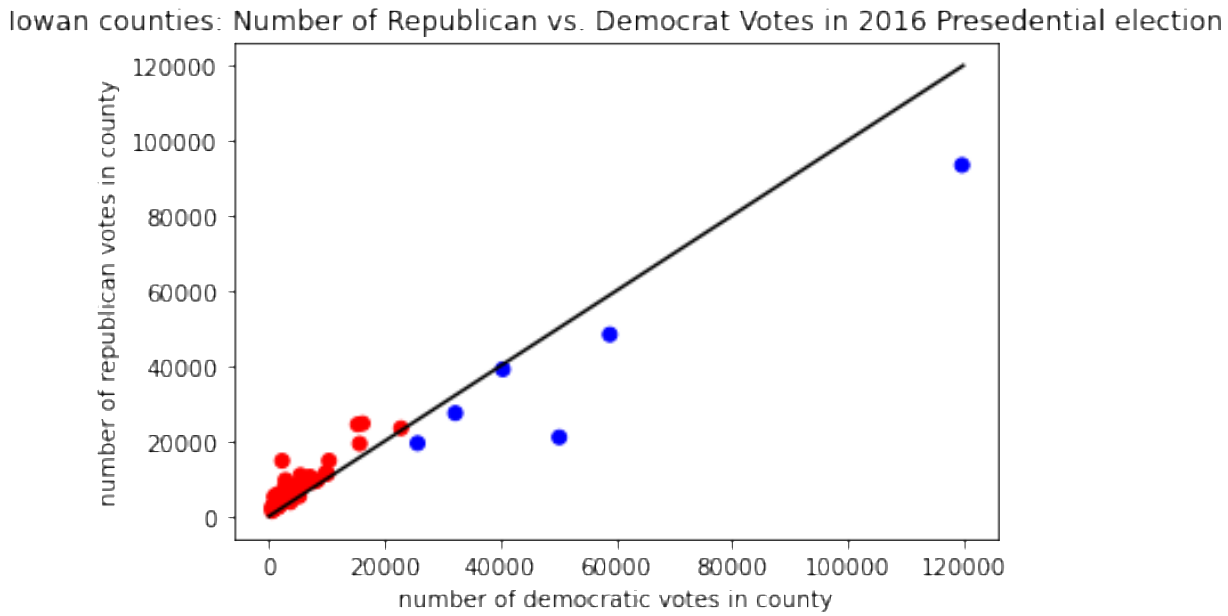
One of the first operations we performed on the data was to convert the 'Date' column to datetime data type. This is important for allow for the groupby functions that will need to be used to organize the data. We then aggregated the data by date and county, with summation of sales in dollars and volume in liters for each day. We exported two csv files, one that contained daily sales and the other with volume data for each county in Iowa. A similar process was used to create a dataset with monthly sales and volume, with the only difference being that aggregation was done at the monthly level. Two csv files were exported with the analogous monthly sales and volume for each Iowan county.

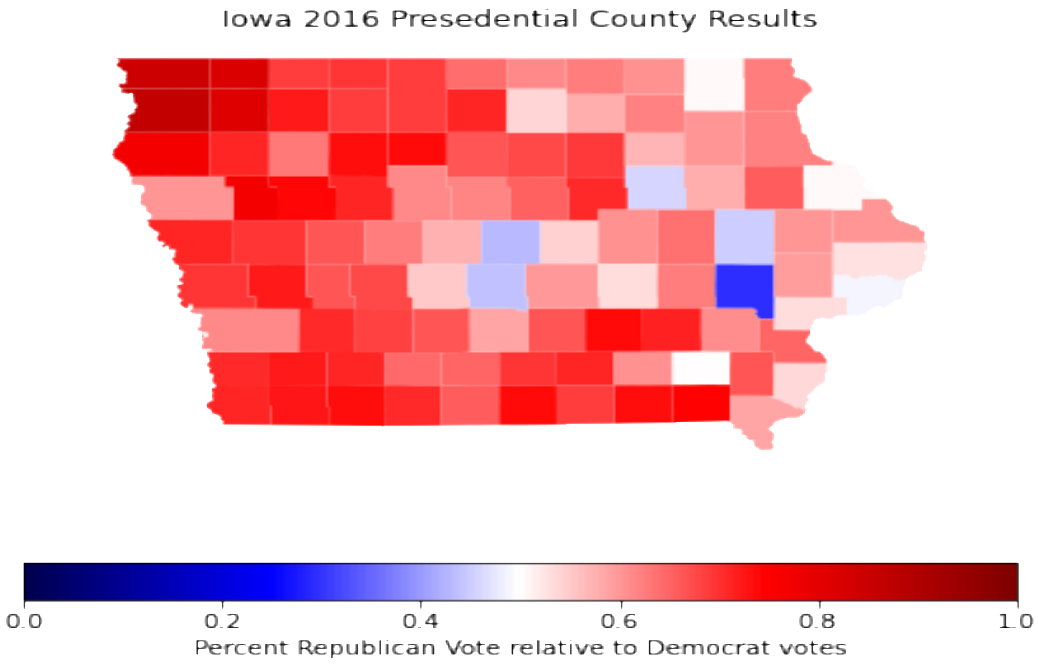
We merged the clean liquor sales by county dataset on voting data for each party in the 2016 Presidential election. To determine the partisan majority in each county, a column of Booleans was created in the voting data indicating whether votes for Democrats was greater than votes for Republicans. We then grouped the data by majority party in each county to inform a data plot making comparisons between liquor consumption of these counties.

One problem with the liquor sales dataset is that there were no recorded liquor sales for Sundays and many missing values for Saturdays. We hypothesized that this is likely due to the Iowa Alcoholic Beverages Division failing to collect data on these days. Iowa does not have legislation blocking purchase

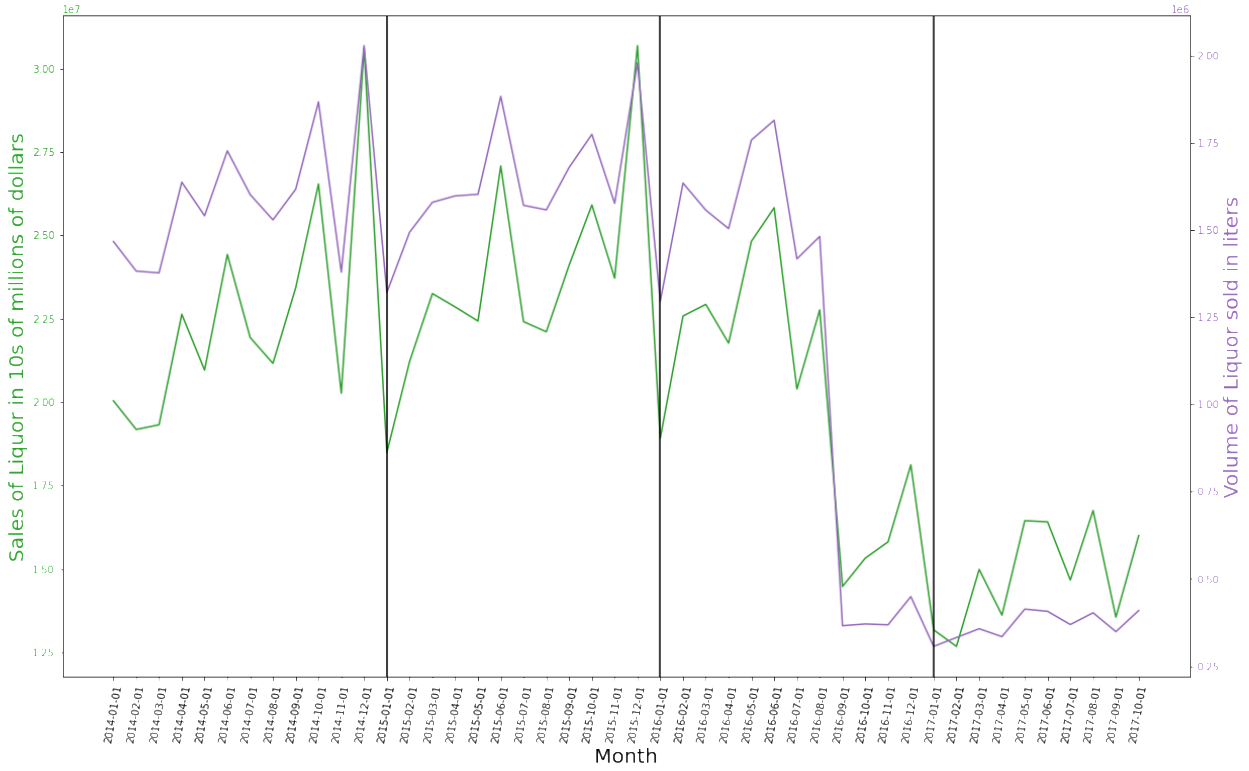
of liquor on weekends, so there is reason to believe that there is data missing from the dataset. Given this complication and that some smaller counties often reported sales for only a few days a week, we aggregated the liquor purchase data by week to adjust for the missing data observations.

Results



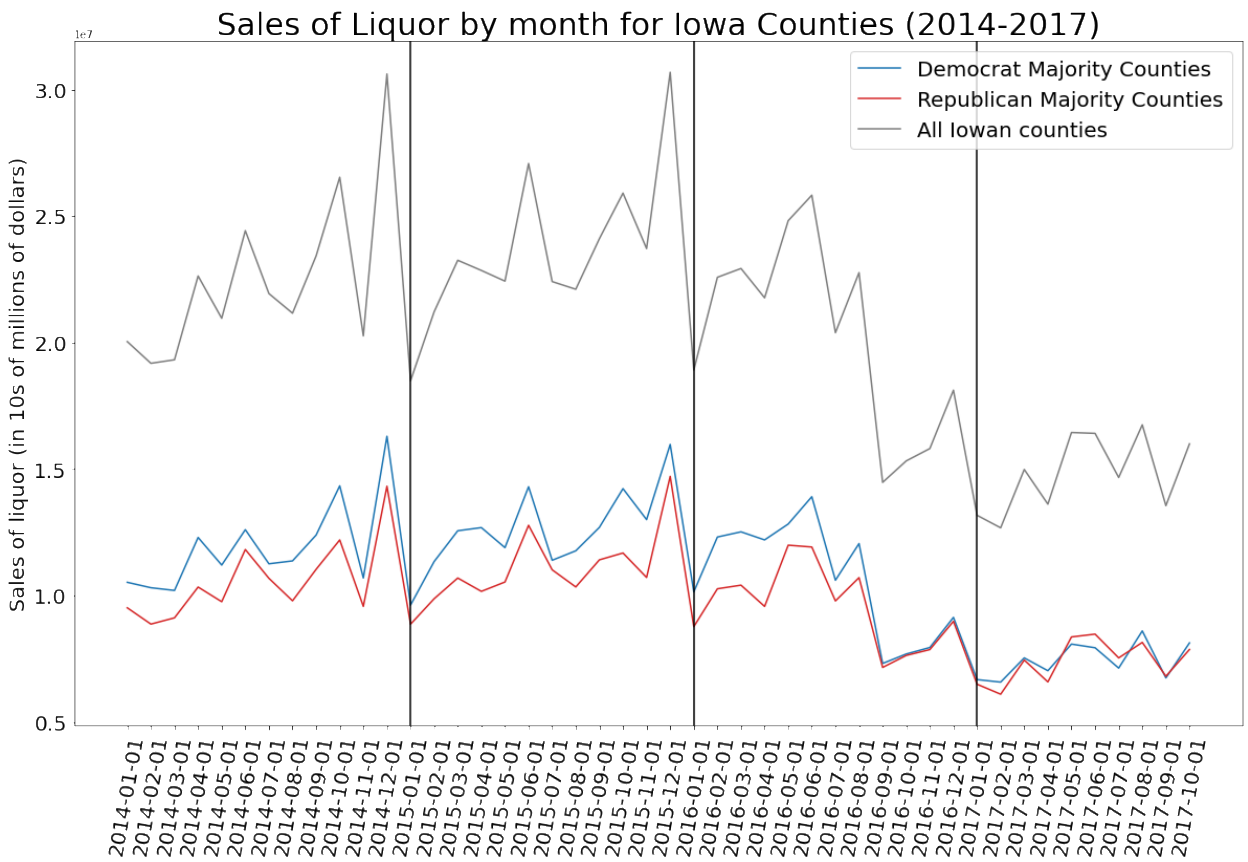


The first comparison made was between number of votes per county and the candidate that carried that county in the 2016 election. As expected based on national trends, larger populated (more urban) counties were carried by the Democratic candidate and counties with lower populations (more rural) were carried by the Republican candidate in 2016. Of note, it was determined that 38% of Iowa's population lived in the six majority-Democratic counties indicated above. This realization of the distribution of political affiliation and population led us to understand that a per capita analysis approach would paint a clearer picture of alcohol consumption by party than gross numbers.

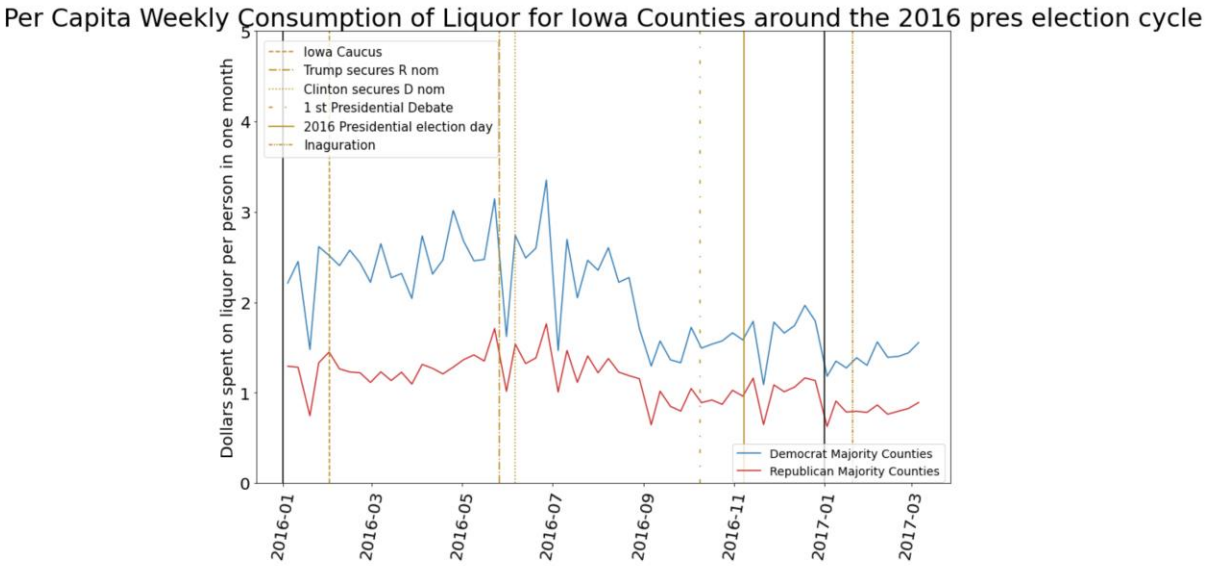


Further analysis considered differences in sales values and volumes of the liquor sold. Our main purpose in making this comparison was to look for any discrepancies that might indicate a pattern we would like to explain with our evaluation. There were no major deviations between the two measures, but there are some areas where prices may have increased or people may have been purchasing more expensive

liquor.



After splitting liquor sales by political party using the methods described in the previous section, the pattern expected from the literature review began to emerge. Correlation between Republican and Democrat counties is very high at .92. Of note here is that, as found in the first comparison made above, the Democratic counties contain less than 40% of the population but consume more liquor by value than the more than 60% of the population contained in the Republican-carried counties.



Our last analysis included both consumption by party and over time, plotting significant political events in the election cycle held in Iowa with trends in liquor sales. Based on the idea in the Musse paper, we were looking for deviations between the parties immediately prior to or after an event. We ultimately did not find any patterns of particular interest except potentially the week following the caucus. The ability to draw an assumption about this, however, was limited by our weekly aggregation of the data and lack of other events (and corresponding responses) that followed this pattern.

Conclusion

Our work uses three years of data to study the relationship between liquor sales and either Republican or Democratic political party affiliation. We first utilized data visualization techniques to compare the magnitude of liquor sales between parties for our study period, including a closer look at the 2016 presidential election cycle. We find that Republican and Democratic majority counties hold similar magnitudes of consumption. However, since Democratic majority counties comprise only 38% of the total population in Iowa, this means they hold a larger per-capita liquor consumption than Republican-majority counties. This can be attributed to myriad of different factors (e.g., large colleges are in

Democratic countries), but there are a few areas of improvement that must be addressed to accurately answer this question.

First, we must analyze results at finer temporal resolution. This study was analyzed using weekly and monthly observations but using daily data may present new findings otherwise lost through aggregation to more coarse temporal resolution. Second, we must obtain data that was missing from the original dataset. These missing items may paint a misleading picture of the found results. Finally, the original dataset only contains liquor sales from one type of alcohol consumption – commercial sales. There are many other avenues for which consumers purchase alcohol, including sporting events, bars and restaurants, and concerts. Ideally, data from as many of these sources as possible should be obtained so we can draw a more general conclusion about the true relationship between liquor sales and political party affiliation.

Proper analysis of liquor purchase patterns is necessary for understanding how and why populations consume alcohol. Liquor purchases can potentially impact community health through a variety of channels, as well as providing economic support to local communities through jobs and small businesses. Negative health impacts of increased liquor consumption can be substantial and can include increased rates of alcoholism, intoxicated driving, and intoxication related arrests. Understanding what drives liquor purchases can help inform community action to manage negative health effects. Liquor sales also provide substantial tax revenue to the Iowa state government. Having a robust understanding of what factors affect liquor sales allows for legislators to make informed decisions around tax legislation and related public policies. We believe there is a considerable amount of untapped research potential regarding the economic drivers of liquor purchases and that continued analysis in this field is important for understanding the intricacies of liquor demand in the United States.

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