Local alcohol availability and public health: Evidence from Texas

Somdeepa Das

August 26, 2024

1 Introduction

This paper delves into the relationship between local alcohol regulations and public health and safety outcomes such as traffic fatalities, crimes, alcohol-related morbidity, and neonatal health. The United States offers a distinct opportunity to study these effects due to the decentralization of alcohol sales regulations in the post-Prohibition era. We specifically targets the impact of changes in alcohol availability on public health and safety outcomes in Texas, drawing on data from local option elections that allow communities to shift from being 'dry' (restricted alcohol sales) to 'wet' (no restrictions), creating a natural experiment to study the effects of exogenous changes in local alcohol availability.

In the past nine decades, decentralized alcohol policy changes in numerous Texas counties from dry to wet settings provide a unique policy experiment to examine how these changes in alcohol availability influence public safety and health outcomes. I use a novel dataset that includes detailed historical records from local-level referendum-style elections on alcohol availability in Texas, which spans over more than nine decades (1937-2020). These elections have allowed numerous counties to transition from being dry communities to liberalizing alcohol sales. This geographical variation is crucial as it offers a unique opportunity to examine the impact of alcohol policy changes on public safety, health, and crime outcomes in a way that is both comprehensive and representative of the population. Unlike alcohol regulations that affect only certain groups or time periods, such as minimum legal drinking age laws or Sunday sales bans, the geographic variation in alcohol policy affects entire communities, providing a more comprehensive view of the consequences of alcohol access.

Using administrative data from the Texas Alcoholic Beverages Commission (TABC), we frist estimate the first-stage relationship between changes in local alcohol policy and the number of active of liquor licenses. The analysis focuses on jurisdictions that permitted

liquor sales for the first time during the study period 1997-2019, i.e. they changed status from being dry to wet for the first time. The results of this analysis reveal a significant and somewhat counterintuitive trend: despite the widespread liberalization of alcohol policies in Texas during the study period, there was a notable decline in the number of liquor licenses issued per capita from 2002 to 2014. This decline occurred even as many jurisdictions transitioned from dry to wet or further relaxed their alcohol regulations. Such a trend is unexpected, as one would anticipate an increase in liquor licenses corresponding with the greater permissibility of alcohol sales. The decline in licenses also began well before the Great Recession, suggesting that broader economic trends do not fully explain the observed pattern. Ho

We find the despite the overall decline in liquor licenses in Texas, a jurisdiction which transitioned from dry to wet experienced a 50% increase in the total number of liquor licenses in their area. Our first stage results sets the stage for a broader investigation into the public health and safety outcomes impacted by these policies.

2 Background

2.1 Access to alcohol, traffic fatalities, health outcomes and crime

The literature on the effects of alcohol policy on various outcomes is extensive and has employed a range of quasi-experimental methods to infer causal relationships. One significant area of research has focused on the minimum legal drinking age (MLDA). Studies like those by Chalfin et al. (2023), Carpenter and Dobkin (2015), and Conover and Scrimgeour (2013) have either utilized the sharp age discontinuity at the legal drinking age, or the increase in MLDA from 18 to 21, to explore its impact on health, traffic safety, and crime [1]. These studies often find significant impacts on alcohol consumption and related outcomes, such as an increase in traffic fatalities and injuries among young adults once they reach the legal drinking age. However, the scope of these findings is limited as they only pertain to a narrow age group, making it difficult to generalize to the broader population.

Another body of research has examined the effects of specific policy changes such as bans on Sunday alcohol sales. For example, Yörük and Lee (2018) and Bernheim et al. (2016) analyzed the impact of these bans on alcohol consumption and related health outcomes[2]. These studies generally found that banning alcohol sales on Sundays led to temporary reductions in alcohol consumption and traffic accidents. However, the effects were often short-lived and

[1] Also see Crost and Rees (2013), Yörük and Yörük (2011), Fertig and Watson (2009), DiNardo and Lemieux (2001).

[2] Also see Carpenter and Eisenberg (2009), Heaton (2012), Stehr (2010).

did not provide a comprehensive view of the impact of alcohol availability, as the bans only affected a single day of the week.

Geographic variation in alcohol policy, such as the transition from dry to wet counties, offers several advantages over the aforementioned policy changes. Firstly, it affects the entire population of a region, providing a more inclusive assessment of the impact of alcohol availability. Unlike the MLDA or Sunday sales bans, which only apply to specific groups or times, the geographic variation affects all residents within a jurisdiction, thereby offering a more extensive perspective on the public saftey and health impacts of alcohol availability and consumption.

Another literature has utilized local-level policy changes to understand the impact of alcohol availability on various outcomes. For instance, Brown et al. (1996) examined the effects of local alcohol policy changes on traffic crashes and found varied results depending on the nature and extent of the changes. Similarly, Baughman et al. (2001) found that local policy changes in dry counties had mixed impacts on traffic safety, with some regions experiencing increases in alcohol-related accidents while others saw no significant change. Anderson et al. (2018) investigated the impact of transitioning from dry to wet status in Kansas counties and found significant increases in both the number of alcohol outlets and instances of violent crime. Similarly, Conlin et al. (2005) examined the effects of alcohol policy changes in Texas and found that increased alcohol availability was associated with a reduction in drug-related crimes, suggesting a substitution effect between alcohol and illicit drugs. Fernandez et al. (2018) found that counties in Kentucky that transitioned from dry to wet experienced a substantial decrease in meth lab seizures, indicating a potential public health benefit of more liberal alcohol policies. This contrasts with mixed evidence from earlier studies on alcohol-related traffic crashes, which varied in their findings based on the context and specifics of the policy changes examined (Baughman et al., 2001; Brown et al., 1996).

2.2 Dry communities and local options in the United States

The impact of alcohol consumption on public health outcomes had always been a major bone of contention in U.S. history, reaching critical policy relevance with the enactment of the Prohibition period from 1920-1933, which resulted in a nationwide ban on the sale and manufacturing of alcohol. After the 21st Amendment ended the national prohibition, alcohol control and regulation reverted to individual states. Additionally, around that time, about half of the states introduced local option laws, which allowed cities, counties, and other local governments to set their own alcohol policies. This resulted in hundreds of dry communities

across the United States, where the sales of alcohol were completely or partially banned. Most dry communities are located in the southern United States, the historical heartland of the temperance movement that instigated Prohibition. Examples of states that allowed local options on alcohol include Kansas, Kentucky, Texas, and Tennessee.

In the 21st century, there has been a shift away from dry communities towards less restrictive alcohol policy regimes. Numerous localities, even those with deep historical connections to alcohol prohibition, have changed their stance and permitted liquor sales through local options elections. Especially over the past two decades, regions across the United States with varied geography and populations have become more receptive to alcohol sales.

2.3 Local options elections in Texas

Texas has been a focal point for the movement away from dry jurisdictions. Over the past ten years, 22 counties and more than 200 cities and towns in the state, which were previously dry, have permitted some level of alcohol sales. There are various reasons why the modern trends have been towards liberalization of alcohol sales. Moral/religious objections to alcohol are on the wane, and restrictions on alcohol sales appear extremely out of place in the modern United States. The other motives are economic - dry jurisdictions do not want to forgo the tax revenues generated by the alcohol industry. As of 2023, only 5 counties are remaining which are completely dry.

In this study, I will focus on elections that occurred in the relatively recent period of 1997-2020. Election records on local options elections was obtained from the Texas Alcoholic Beverages Commission, and digitized for analysis. There were 1000+ local options elections throughout 1997-2020, as shown in Figure 2a, with an overall win rate of 80%. Status changes resulting from successful elections are shown in Figure 2b. There is a sharp rise in the number of elections post-2003, attributable to state legislation which substantially simplified the process of getting wet/dry election issues on the ballot [3]. The movement from dry to wet status is clearly illustrated in Figure 1, which shows the evolution of wet/dry status in Texas counties from 1997 to 2020.

However, it is important to note that elections can also occur in municipalities (cites/towns), and Justice of the peace Precincts[4]. Election issues can be specific to the type of alcoholic beverage (beer, wine, distilled spirits), and off-premise vs on-premise consumption. This results in a complex patchwork of alcohol regulation that varies both geographically and in terms of intensity. Table 1 summarizes the types of issues that come up in these elections.

[3]House Bill 1199, 78th session of the Texas Legislature, 2003

[4]Justice of the Peace Precincts are similar to county subdivisions in Texas.

Figure 1: Wet/Dry map of Texas Counties, 1997 and 2020

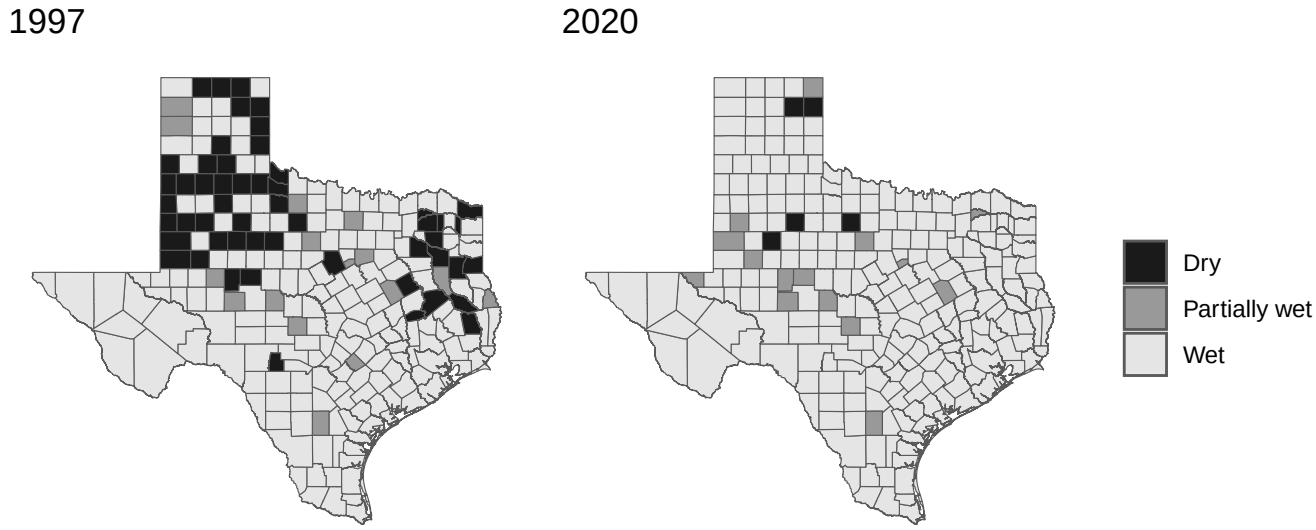


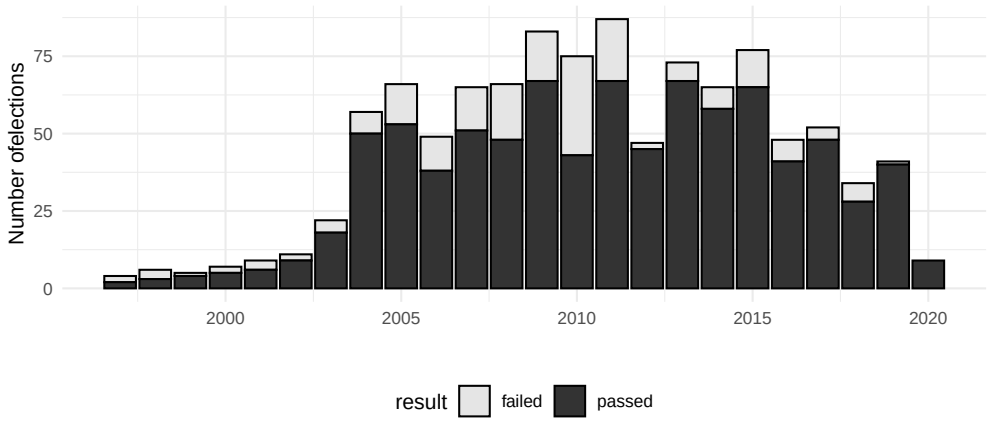
Table 2 summarizes the number of elections and status changes that happen from 1997-2020. In this period, elections take place either at the city/precinct/county level in 184 out of 254 counties in Texas.

3 Effect of Status Changes on Liquor Licenses

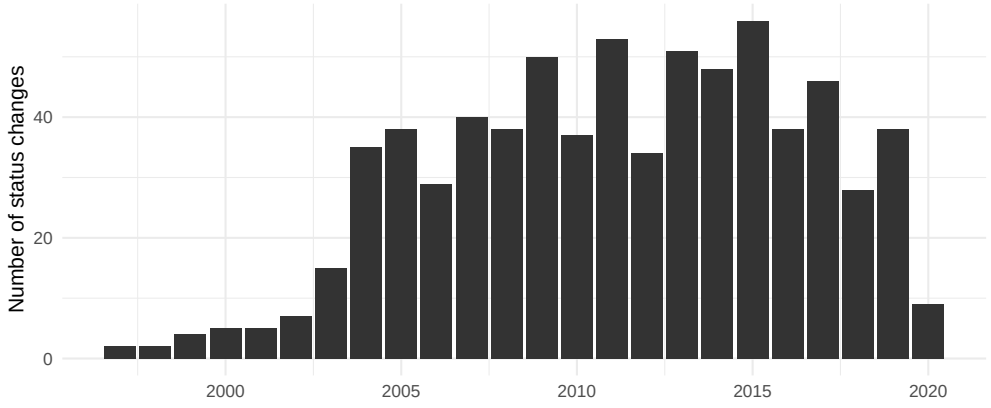
A successful local option election in a jurisdictions means that local business now have the option of obtaining liquor licenses in order to start selling alcohol. Although the type of liquor license permitted after a status change is restricted to the specific types of alcohol legalized by the election, a successful status change will likely lead to an increase in the total number of liquor licenses in the area. Subsequently, any effects on health or road safety outcomes must be through the greater local availability alcohol as proxied by the increased number of liquor businesses. The relationship between the number of liquor licenses and status changes from dry to wet in a jurisdiction can be the first-stage of an IV approach, similar to the strategy followed by Anderson et al. (2018). To test this relationship we use administrative data on liquor licenses from the Texas Alcoholic Beverages Commission (TABC). Figures 3a and 3b shows the trend of alcohol licenses per capita in the study period. For a description of the types of liquor licenses, see Table 4 in the Appendix.

We see a sharp decline in the number of licenses per capita from the years 2002-2014, during a time when a large of Texas jurisdictions changed status from dry to wet, or allowed

Figure 2



(a) Local option elections, 1997-2020



(b) Status changes In Texas jurisdictions, 1997-2020

Multiple successful elections for a jurisdiction in a year is counted as one unique status change.

Table 1: Election issues in Local Options Elections, 1997-2019

Election issue	All	failed	passed
All Alcohol Off-Premise	6	1	5
All Alcohol Off-Premise	172	61	111
All Alcohol On-Premise	204	24	180
Beer/Wine Off-Premise	353	66	287
Beer/Wine On-Premise	62	10	52
Mixed Beverages On-Premise	256	27	229

There are 10 prohibitory elections in this period, which are excluded from the above table. All alcohol includes sales of beer, wine and distilled spirits. Mixed beverages refer to mixed-drink sales in restaurants and bars.

Table 2: Summary of Unique Status Changes in Texas jurisdictions, 1997-2019

				N
			Successful elections	869
			Unique Status changes	707
Geography	City-level	Type of Change	Dry to wet	315
			Wet to dry	1
			Wet to more wet	237
	County-level		Dry to wet	21
			Wet to dry	1
			Wet to more wet	22
	Precinct-level		Dry to wet	37
			Wet to dry	1
			Wet to more wet	71

Many jurisdictions vote on multiple issues at the same time – for example "for the sale of beer and wine for off-premises consumption" and "for the sale of mixed beverages in restaurants with food and beverage certificates. We treat multiple elections in a jurisdiction on the same date as a single status change. This is referred to as a unique status change.

more alcohol liberalization. This is quite counter-intuitive as Texas became unambiguously less restrictive with regards to alcohol sales in this period. Moreover, this decline starts much before the Great Recession, so statewide economic trends do not explain the decline either. We can also see that trends for on-premise and off-premise licenses are identical, which is relevant for the analysis below.

To test the relationship between status changes in jurisdictions and the number of liquor licenses following the status change, we estimate a linear model with panel data on active liquor licenses (1). $StatusChange_{it}$ is a treatment indicator that equals 1 if city i changes status from time period t onwards.

$$Licenses_{it} = \alpha_i + \alpha_t + \beta \times StatusChange_{it} + \epsilon_{it} \tag{1}$$

Our analysis focuses on cities that permitted liquor sales for the first time during the study period. By limiting the sample to city-level elections, we avoid the complexities of county-level status changes, which affect all cities within a county's boundaries. Additionally, we only consider the first instance of a jurisdiction's status change, thereby simplifying the analysis by excluding variations in treatment intensity from subsequent liberalizations over this period.

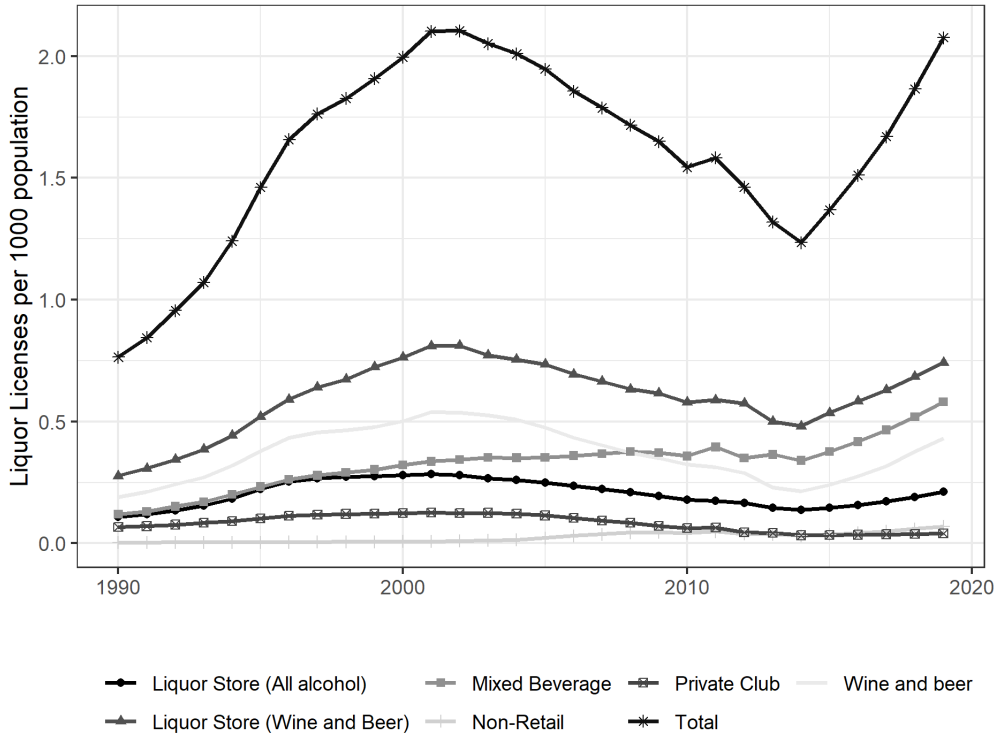
Table 3 shows the estimates from 1 for all licenses, on-premise and off-premise licenses. We can see that the change of status from dry to wet leads to a 50% increase in liquor licenses per capita, which is mostly driven by an increase in the number of off-premise licenses. On-premise licenses are not affected by status changes. This is exactly the opposite of the result from Anderson et al. (2018) - in Kansas, status changes lead to an increase in on-premise licenses, but no changes in the number of off-premise licenses.

For estimating the dynamic effects of wet laws in Texas jurisdictions on the number active liquor licenses in that area, we also estimate an event-study difference-in-difference regression of the form. Following Callaway and Sant'Anna (2021) (CS21), cities are divided into groups according to the time they get treated, with G_i signifying the time period when the $i-th$ city passes a wet law for the first time.

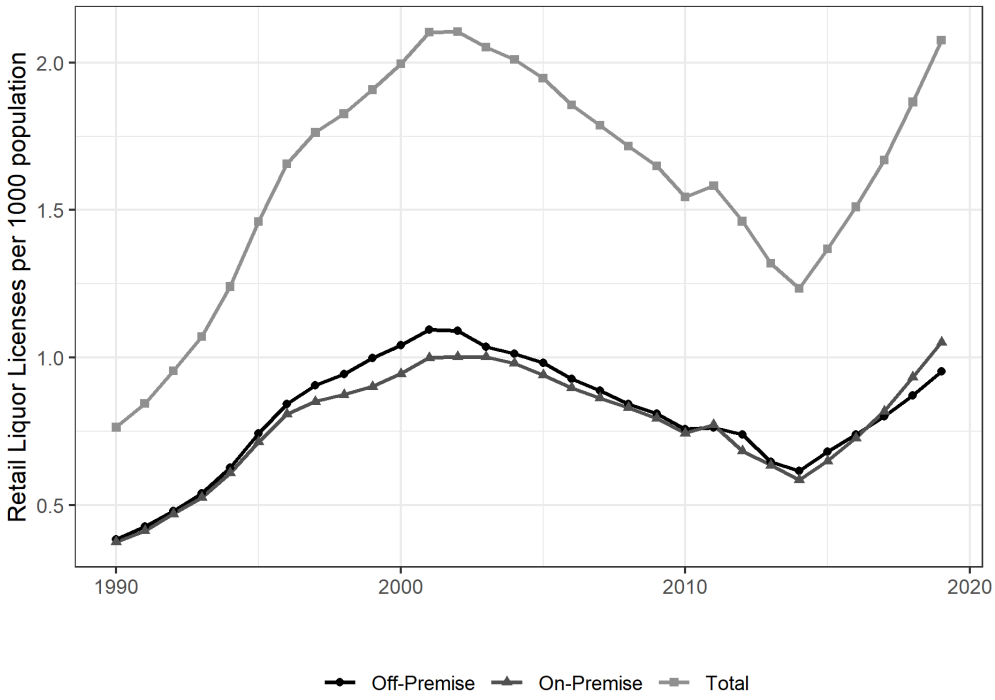
$$Licenses_{it} = \alpha_i + \gamma_t + \sum_{k=-K, k\neq -1}^{L} \beta_k \times D_{it}^k \alpha_i + \epsilon_{it} \tag{2}$$

Here $D_{it}^k = \mathbf{1}\{t - G_i = k\}$ is an "event-study" dummy variable, taking the value 1 if at time t, city i is k periods away from the period they first got treated (i.e. changed their status from dry to wet). K and L indicates the number of leads and lags taken, respectively. We use the CS21 estimator to estimate and aggregate dynamic treatment effects, by choosing

Figure 3



(a) Alcohol licenses per 1000 population in Texas, 1990-2019



(b) Retail Alcohol licenses per 1000 population in Texas, 1990-2019

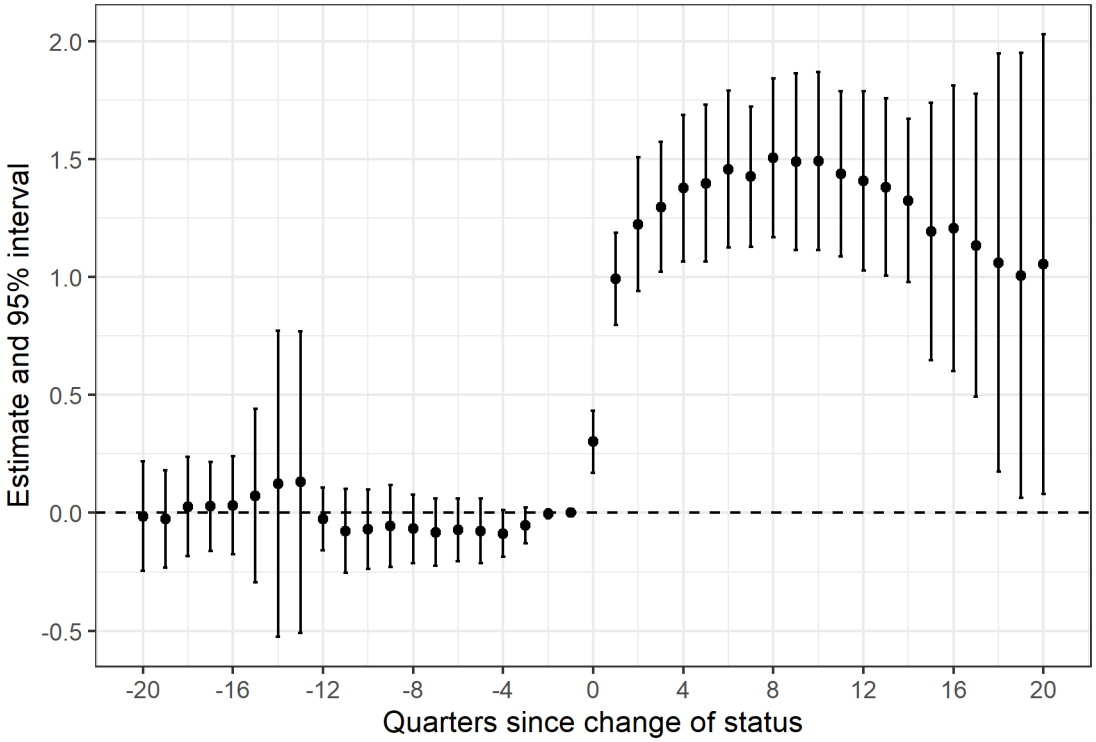
Table 3: Status changes and Alochol Licenses in Texas, 1990-2019

	All	On-Premise	Off-Premise
Status Change==1	1.301	0.063	1.146
	(0.186)	(0.051)	(0.165)
Mean of Dep. Var.	0.872	0.856	0.856
N	34 564	35 376	35 376
R^2	0.69	0.69	0.68
City fixed effects	X	X	X
Time fixed effects	X	X	X

Each column represents results from a separate OLS regression with city and quarter fixed effects. The dependent variable is equal to the number of active licenses per 1000 population in city i at quarter t. Standard errros are clustered at the city level.

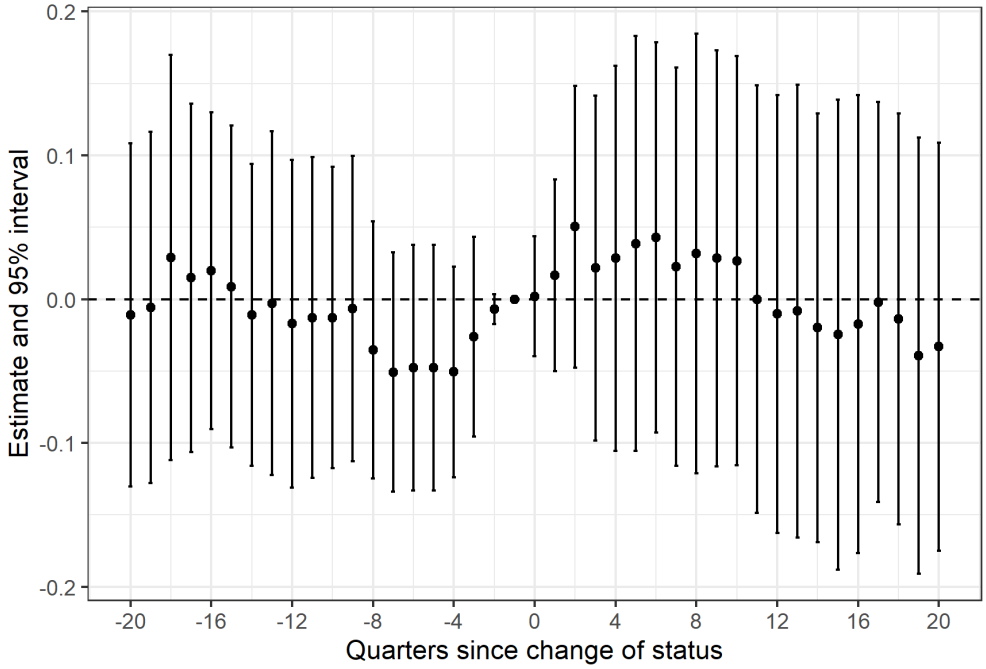
the not-yet-treated cities as the comparison group. It should be noted that at the end of the study period, all but 5 jurisdictions in Texas are wet, so using the not-yet-treated jurisdictions as a control group is a practical choice.

Figure 4: Trends in liquor licenses

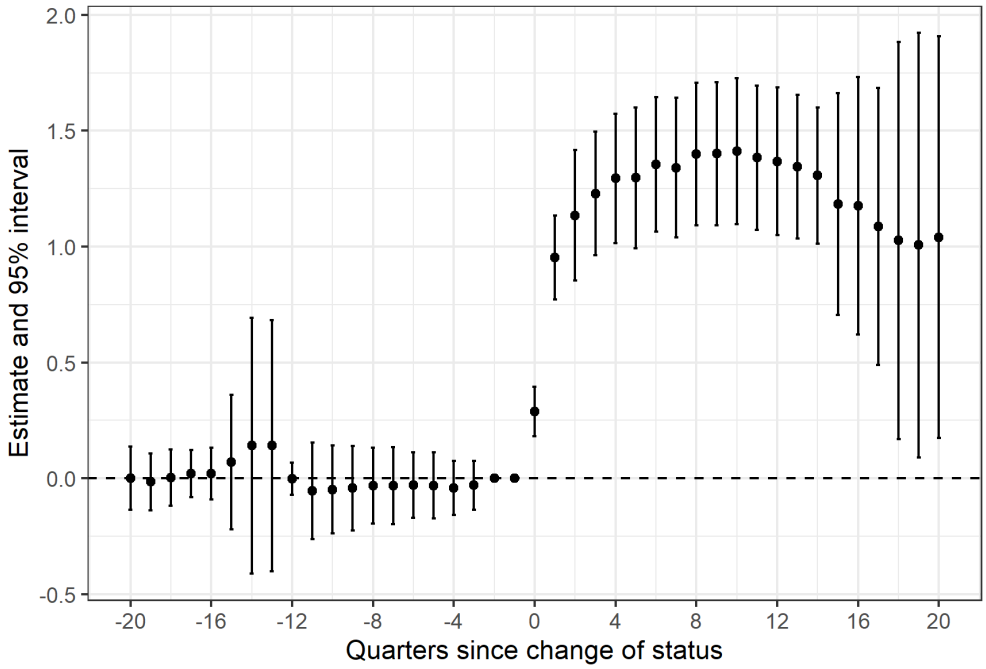


Dynamic time effects and confidence intervals from CS21 estimator are reported. The dependent variable is licenses per 1000 population. The control group is not-yet-treated jurisdictions.

Figure 5



(a) Trends in On-premise liquor licenses



(b) Trends in Off-premise liquor licenses

Dynamic time effects and confidence intervals from CS21 estimator are reported. The dependent variable is licenses per 1000 population. The control group is not-yet-treated jurisdictions.

The dynamic effects shown in Figures 4 and 5 corroborate the overall treatment effects from Table 3 - the change in status from dry to wet cause a sharp increase in per-capita liquor licenses which is sustained over time. This increase occurs is mostly attributable to the rise the in off-premise licenses, while there is no significant increase in the number of on-premise licenses. Similar graphs using the raw data can be found in the Appendix (Figures 6 and 7).

References

D. Mark Anderson, Benjamin Crost, and Daniel I. Rees. Wet Laws, Drinking Establishments and Violent Crime. The Economic Journal, 128(611):1333–1366, June 2018. ISSN 0013-0133. doi: 10.1111/ecoj.12451. URL https://doi.org/10.1111/ecoj.12451.

Reagan Baughman, Michael Conlin, Stacy Dickert-Conlin, and John Pepper. Slippery when wet: the effects of local alcohol access laws on highway safety. Journal of Health Economics, 20(6):1089–1096, November 2001. ISSN 0167-6296. doi: 10.1016/S0167-6296(01)00103-5. URL https://www.sciencedirect.com/science/article/pii/S0167629601001035.

B. Douglas Bernheim, Jonathan Meer, and Neva K. Novarro. Do Consumers Exploit Commitment Opportunities? Evidence from Natural Experiments Involving Liquor Consumption. American Economic Journal: Economic Policy, 8(4):41–69, November 2016. ISSN 1945-7731. doi: 10.1257/pol.20130351. URL https://www.aeaweb.org/articles?id=10.1257/pol.20130351.

Ciro Biderman, João MP De Mello, and Alexandre Schneider. Dry laws and homicides: evidence from the São Paulo metropolitan area. The economic journal, 120(543):157–182, 2010. URL https://academic.oup.com/ej/article-abstract/120/543/157/5089594. Publisher: Oxford University Press Oxford, UK.

Stephen B. Billings. Local Option, Alcohol and Crime. The B.E. Journal of Economic Analysis & Policy, 14(3):791–816, July 2014. ISSN 1935-1682. doi: 10.1515/bejeap-2013-0040. URL https://www.degruyter.com/document/doi/10.1515/bejeap-2013-0040/html?casa_token=WigVt9TtzGsAAAAA%3AfHLcpNbO_yrUQsFo9SIF1xYRC27hA9dCiD-8rXqMT5fBj82bDqF4GZvZbq5AeTVN3nYoCfEyXsA. Publisher: De Gruyter.

Robert W. Brown, R. Todd Jewell, and Jerrell Richer. Endogenous Alcohol Prohibition and Drunk Driving. Southern Economic Journal, 62(4):1043–1053, 1996. ISSN 0038-4038. doi: 10.2307/1060947. URL https://www.jstor.org/stable/1060947. Publisher: Southern Economic Association.

Brantly Callaway and Pedro HC Sant'Anna. Difference-in-differences with multiple time periods. Journal of econometrics, 225(2):200–230, 2021. URL https://www.sciencedirect.com/science/article/pii/S0304407620303948?casa_token=cn1aD0sBogoAAAAA:qV1cZBlWKkZ5wB9_i32oeW5zfDCteAUzHuBB2tDlMTgtKZf_mylX_kIO8_5wVts2SM-Q-kD2. Publisher: Elsevier.

Christopher Carpenter and Carlos Dobkin. The minimum legal drinking age and crime. Review of economics and statistics, 97(2):521–524, 2015. URL https://direct.mit.edu/rest/article-abstract/97/2/521/58237. Publisher: The MIT Press.

Christopher S. Carpenter and Daniel Eisenberg. Effects of Sunday Sales Restrictions on Overall and Day-Specific Alcohol Consumption: Evidence From Canada. Journal of Studies on Alcohol and Drugs, 70(1):126–133, January 2009. ISSN 1937-1888. doi: 10.15288/jsad.2009.70.126. URL https://www.jsad.com/doi/abs/10.15288/jsad.2009.70.126. Publisher: Alcohol Research Documentation, Inc.

Aaron Chalfin, Benjamin Hansen, and Rachel Ryley. The Minimum Legal Drinking Age and Crime Victimization. Journal of Human Resources, 58(4):1141–1177, July 2023. ISSN 0022-166X, 1548-8004. doi: 10.3368/jhr.59.2.0720-11070R2. URL https://jhr.uwpress.org/content/58/4/1141. Publisher: University of Wisconsin Press Section: Articles.

Michael Conlin, Stacy Dickert-Conlin, and John Pepper. The Effect of Alcohol Prohibition on Illicit-Drug-Related Crimes. The Journal of Law and Economics, 48(1):215–234, April 2005. ISSN 0022-2186, 1537-5285. doi: 10.1086/428017. URL https://www.journals.uchicago.edu/doi/10.1086/428017.

Emily Conover and Dean Scrimgeour. Health consequences of easier access to alcohol: New Zealand evidence. Journal of Health Economics, 32(3):570–585, May 2013. ISSN 0167-6296. doi: 10.1016/j.jhealeco.2013.02.006. URL https://www.sciencedirect.com/science/article/pii/S0167629613000301.

Benjamin Crost and Daniel I. Rees. The minimum legal drinking age and marijuana use: New estimates from the NLSY97. Journal of Health Economics, 32(2):474–476, March 2013. ISSN 0167-6296. doi: 10.1016/j.jhealeco.2012.09.008. URL https://www.sciencedirect.com/science/article/pii/S0167629612001245.

John DiNardo and Thomas Lemieux. Alcohol, marijuana, and American youth: the unintended consequences of government regulation. Journal of health economics, 20 (6):991–1010, 2001. URL https://www.sciencedirect.com/science/article/pii/S0167629601001023. Publisher: Elsevier.

Jose Fernandez, Stephan Gohmann, and Joshua C. Pinkston. Breaking Bad in Bourbon Country: Does Alcohol Prohibition Encourage Methamphetamine Production? Southern Economic Journal, 84(4):1001–1023, 2018. ISSN 2325-8012. doi: 10.1002/soej.12262. URL https://onlinelibrary.wiley.com/doi/abs/10.1002/soej.12262. _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1002/soej.12262.

Angela R. Fertig and Tara Watson. Minimum drinking age laws and infant health outcomes. Journal of Health Economics, 28(3):737–747, May 2009. ISSN 0167-6296. doi: 10.1016/j.jhealeco.2009.02.006. URL https://www.sciencedirect.com/science/article/pii/S0167629609000319.

Paul Heaton. Sunday liquor laws and crime. Journal of Public Economics, 96(1):42–52, February 2012. ISSN 0047-2727. doi: 10.1016/j.jpubeco.2011.08.002. URL https://www.sciencedirect.com/science/article/pii/S0047272711001435.

Mark F. Stehr. The Effect of Sunday Sales of Alcohol on Highway Crash Fatalities. The B.E. Journal of Economic Analysis & Policy, 10(1), August 2010. ISSN 1935-1682. doi: 10.2202/1935-1682.1844. URL https://www.degruyter.com/document/doi/10.2202/1935-1682.1844/html. Publisher: De Gruyter.

Baris K. Yörük and Jungtaek Lee. Did Legalization of Sunday Alcohol Sales Increase Crime in the United States? Evidence From Seven States. Journal of Studies on Alcohol and Drugs, 79(6):816–825, November 2018. ISSN 1937-1888. doi: 10.15288/jsad.2018.79.816. URL https://www.jsad.com/doi/full/10.15288/jsad.2018.79.816. Publisher: Alcohol Research Documentation, Inc.

Barış K. Yörük and Ceren Ertan Yörük. The impact of minimum legal drinking age laws on alcohol consumption, smoking, and marijuana use: Evidence from a regression discontinuity design using exact date of birth. Journal of health economics, 30(4):740–752, 2011. URL https://www.sciencedirect.com/science/article/pii/S0167629611000634. Publisher: Elsevier.

A Figures and tables

Table 4: License Types and Their Descriptions

Type	Description	Category	Off/On
MB	Authorizes the sale of distilled spirits, wine, and malt beverages for on-premise consumption.	Mixed Beverage	On-Premise
FB	In certain circumstances, Mixed Beverage Permit holder must have a Food and Beverage Certificate.	Mixed Beverage	On-Premise
P	Authorizes the sale of distilled spirits, wine, and malt beverages to consumers for off-premise consumption.	Liquor Store (All alcohol)	Off-Premise
Q	Authorizes the sale of malt beverages and wine to consumers for off-premise consumption.	Liquor Store (All alcohol)	Off-Premise
BE	Authorizes the sale of malt beverages for on-premise consumption. Grandfathered BFs in beer-only local option areas can sell malt beverages of up to 5% alcohol by volume.	Wine and beer	On-Premise
BF	Authorizes the sale of malt beverages for off-premise consumption. Grandfathered BFs in beer-only local option areas can sell malt beverages of up to 5% alcohol by volume.	Liquor Store (Wine and Beer)	Off-Premise
BG	Authorizes the sale of wine and malt beverages for on- and off-premise consumption.	Wine and beer	On-Premise
BQ	Authorizes the sale of malt beverages and wine for off-premise consumption.	Liquor Store (Wine and Beer)	Off-Premise
N	Authorizes the storage and service of distilled spirits, wine, and malt beverages for club members' on-premise consumption, even in dry areas.	Private Club	On-Premise
NB	Authorizes the storage and service of malt beverages and wine for club members' on-premise consumption, even in dry areas.	Private Club	On-Premise

Figure 6: Trends in liquor licenses, Raw data

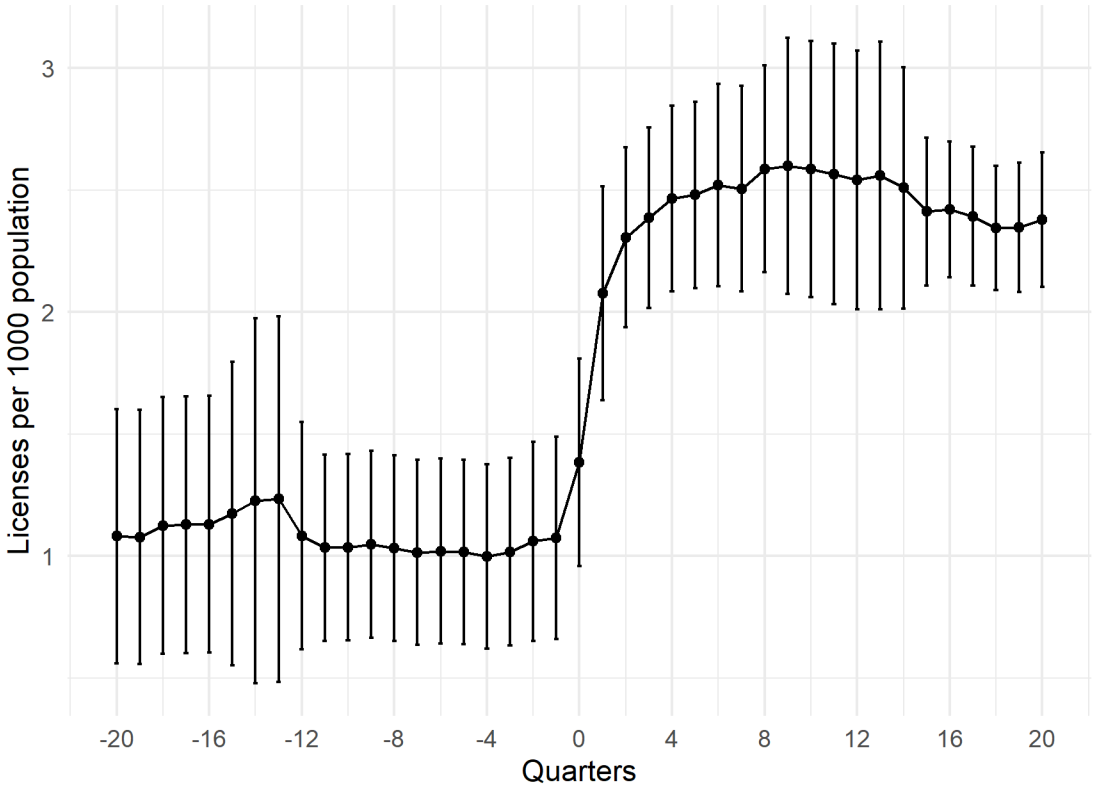
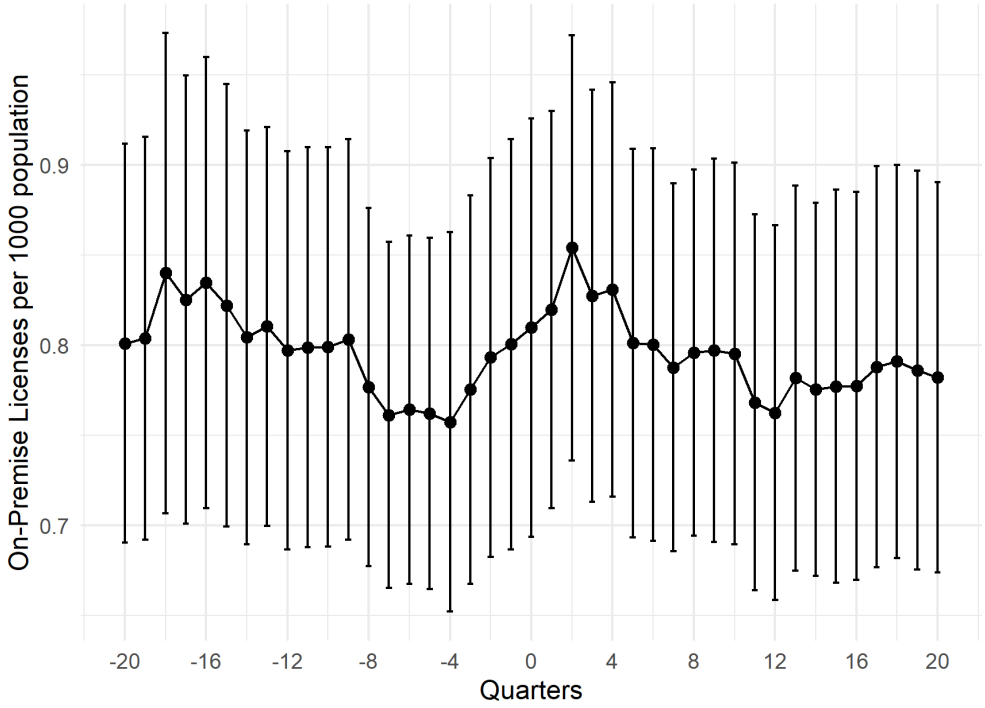
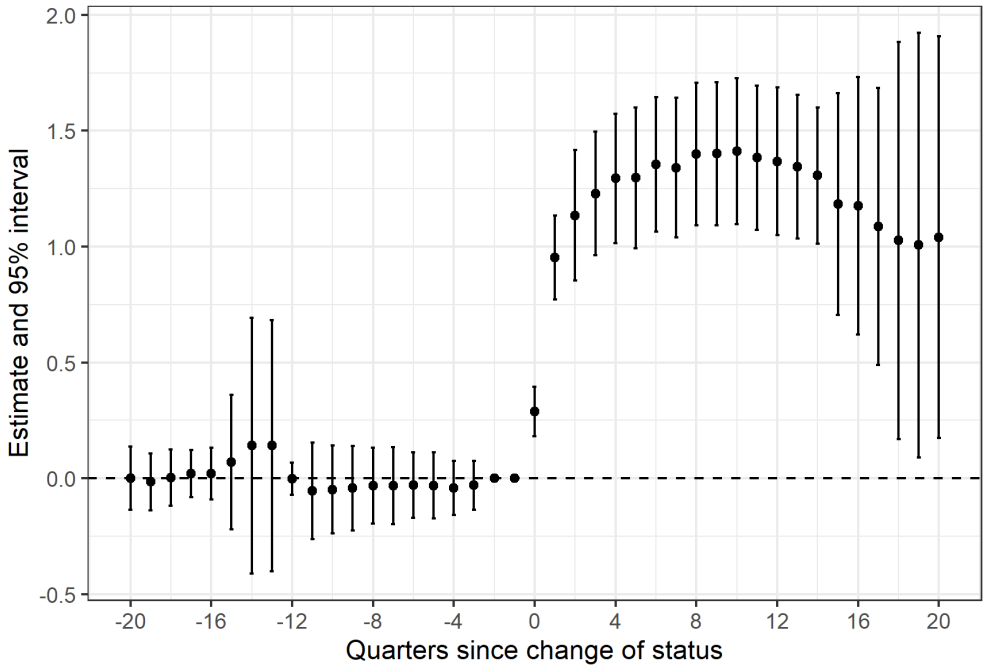


Figure 7



(a) Trends in On-premise liquor licenses, Raw data



(b) Trends in Off-premise liquor licenses, Raw data

B Literature Review

B.1 Anderson et al. (2018)

Policy change: local options on alcohol (staggered adoption)

Geography: Kansas

Period of Study: 1977-2011

Identification strategy: IV (# of On-premise licenses)

Outcomes: Violent crime

Figure 8

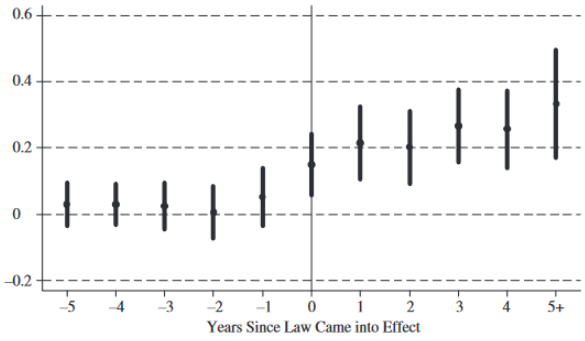


Fig. 1. *Trends in On-premises Alcohol Licences*

(a) On-premise

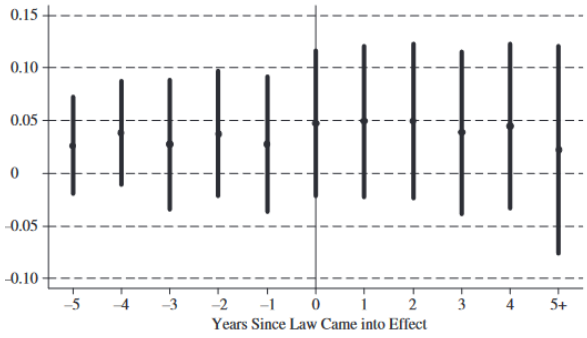


Fig. 2. *Trends in Off-premises Alcohol Licences*

(b) Off-Premise

The paper examines the relationship between the density of establishments licensed to sell alcohol and violent crime rates, using county-level data from Kansas. The study exploits changes in local laws regarding alcohol sales (wet laws), which affects alcohol sales at the county level. The core model is based on a two-stage least squares (2SLS) analysis, where the first stage uses the legal status of by-the-drink sales as an instrument for the number of drinking establishments.

The empirical analysis utilizes panel data from Kansas counties from 1977 to 2011 (crime data is from UCR). An instrumental variables approach is employed to address potential endogeneity between the number of drinking establishments and crime rates. An assumption of this identification strategy is that changes in wet laws only after crimes rates through an

On-premises Licences and Violent Crime, 1977–2011

	OLS	OLS	OLS	2SLS	2SLS	2SLS
	Violent Crime	*Violent Crime*	*Violent Crime*	*Violent Crime*	*Violent Crime*	*Violent Crime*
On-Premises Licences	0.199	0.853*	1.24*	3.64**	4.31**	5.00***
	(0.466)	(0.500)	(0.667)	(1.55)	(1.77)	(1.87)
Pre-treatment mean of *Violent Crime*	3.05	3.05	3.05	3.05	3.05	3.05
N	3,352	3,352	3,352	3,352	3,352	3,352
R^2	0.730	0.758	0.847	0.709	0.740	0.836
F-test of instrument	–	–	–	47.9	51.9	41.9
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	Yes	No	Yes	Yes
County linear trends	No	No	Yes	No	No	Yes

Notes. * Statistically significant at 10% level; ** at 5% level; *** at 1% level. Each column represents the results from a separate OLS regression. The dependent variable is equal to the violent crime rate in county c and year t. The years 1995, 1996, and 1999 are excluded because of missing crime data. A list of covariates is provided in Table 2. Regressions are weighted by county population and standard errors are corrected for clustering at the county level.

Figure 9

increase in on-premise licenses - while an increase in off-premise licenses does not potentially affect violent crime rates. Therefore, changes in wet laws instruments for an increase in on-premise licenses (bars and restaurants) and should have no effect on off-premise licenses to satisfy the exclusion restriction.

$$On\text{-}Premises\ Licences_{ct} = \alpha_0 + \alpha_1 Wet\ Law_{ct} + \mathbf{X}_{ct}\boldsymbol{\alpha_2} + v_c + z_t + \varepsilon_{ct}, \quad (1)$$

$$Violent\ Crime_{ct} = \beta_0 + \beta_1 On\text{-}Premises\ Licences_{ct} + \mathbf{X}_{ct}\boldsymbol{\beta_2} + v_c + z_t + \varepsilon_{ct}, \quad (2)$$

Main Findings: A 10% increase in drinking establishments is associated with a 3-5% increase in violent crime. The results for property crime is positive but not significant.

Table 2. Effect of Alcohol Access on DEA Meth Lab Seizures per 100,000. OLS and the Preferred IV Estimates

	OLS		IV
Wet	−1.907**	−1.534**[a]	−2.387*[a]
	(0.863)	(0.765)	(1.290)
Moist	−0.949	...	...
	(0.655)		
First-stage F stat	...	...	16.007
Pct. Population Wet	−1.757**		−2.567*
	(0.857)		(1.393)
First-stage F stat	...	...	14.844
Liquor Stores per cap	−0.0535	...	−0.0915*
	(0.0396)		(0.0525)
First-stage F stat	...	...	22.580
Observations	780	780	780

Standard errors (in parentheses) are clustered by county. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
The sample is limited to observations with Pr (dry) between 0.0001 and 0.9999.
Regressions control for a wide variety of county demographic and geographic characteristics, current religious membership, interstate highway access, Census commuting patterns, agricultural land use, and year fixed effects. See section 2 for details.
The instrumental variables in the last column are the percent of the population in 1936 who belonged to a religious congregation, and the square root of that percent.
[a]Moist counties are included with dry counties in this regression.

Figure 10

B.2 Fernandez et al. (2018)

Policy change: local options on alcohol (staggered adoption)

Geography: Kentucky

Period of Study: 2004-2010

Identification strategy: IV (Religious composition in the 1930s)

Outcomes: Meth-lab seizures per capita (proxy for production and consumption of meth)

The paper looks into the relationship between alcohol prohibition and meth lab seizures in Kentucky, which is a proxy for the production and use of methamphetamine. Alcohol and other drugs can be either substitutes or complements; this paper takes the view that they are mostly substitutes - forbidding alcohol sales can cause an increase in the production/consumption of illegal drugs.

The paper uses county-level data on local option ordinances in Kentucky from 2004-2010 and uses a instrumental variables approach to control for the possible endogeneity of local level policy changes. The use the variation in religious composition of a county in the pre-Prohibition era to instrument for local-options ordinances (They find that religious composition in the 1930s strongly predicts wet/dry status of Kentucky counties). They also control for counties' current religious composition in all their regressions (as initial religious composition is correlated with current . Two continuous treatment variables are used - the proportion of a county's population that lives in a wet jurisdiction, as well as the number of liquor stores per-capita. The outcome variable is the number of per-capita meth lab seizures.

Main Findings: Wet counties have fewer meth lab seizures per capita, or concurrently fewer meth labs. If all counties in Kentucky becomes wet, the number of meth labs would be reduced by 35%.

B.3 Billings (2014)

Policy change: local options on alcohol (staggered adoption)

Geography: Alabama, Kentucky, North Carolina, Tennessee and Texas

Period of Study: 1994-2006

Identification strategy: Propensity score matching to find control group of counties

Outcomes: Crime

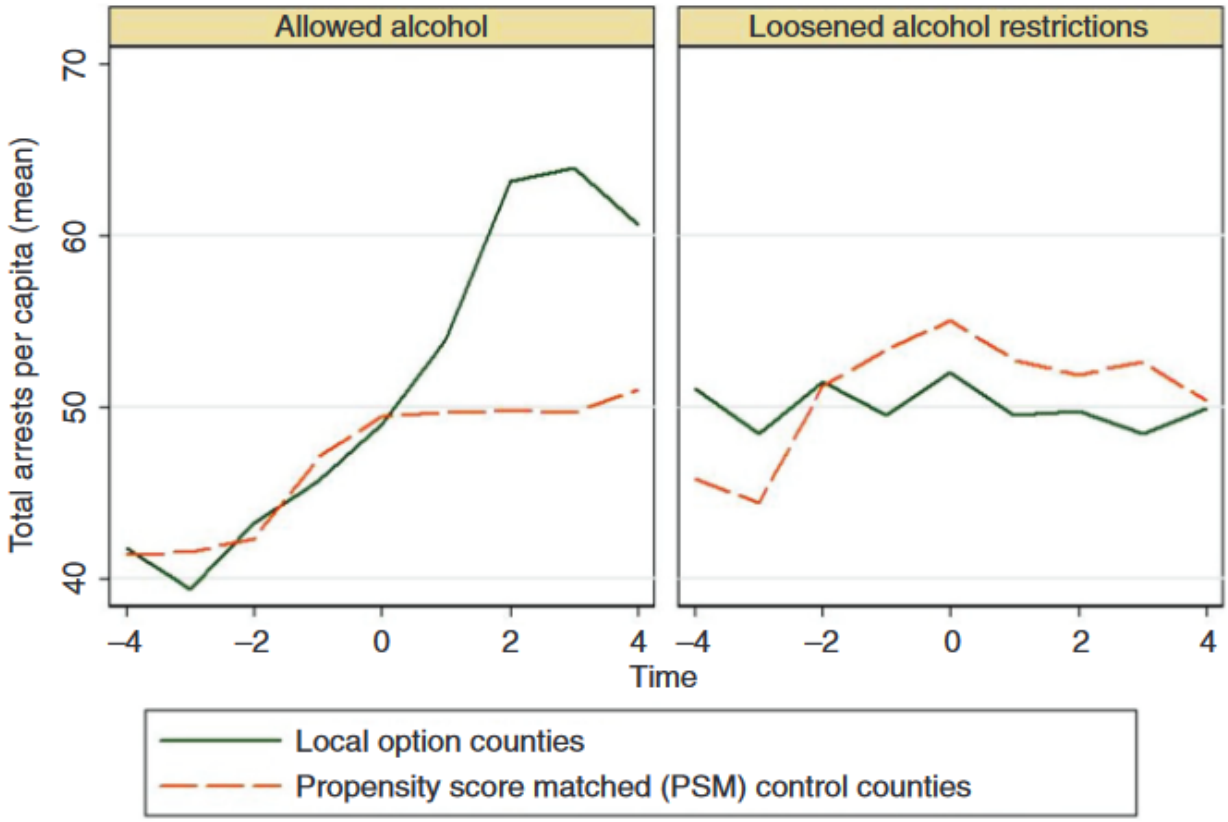


Figure 11

This study examines the impact of local options alcohol policies on crime. The study includes 5 Southern states (Alabama, Kentucky, North Carolina, Tennessee and Texas) which allows local options for alcohol sales. County-level crime data is taken from UCR. To account for the unobservables affecting both local options elections and crime, the author

Dep Var => total arrests per 1,000 People	Panel	Panel with Neighbors	Panel (PSM NN) with Neighbors	Panel (PSM Caliper = 0.01) with Neighbors
	(1)	(2)	(3)	(4)
Allowed Alcohol	11.022**	7.407**	5.250*	5.815*
	(2.548)	(2.995)	(2.966)	(2.935)
Loosened alcohol	−0.888	1.231	0.740	0.464
	(2.845)	(4.152)	(4.462)	(4.203)
NonDryNeigh (% of Neighs)		11.820*	24.078*	42.871
		(6.890)	(14.056)	(27.110)
County characteristics (from Table 1)	Yes	Yes	Yes	Yes
County-specific time trends	No	Yes	Yes	Yes
Fixed effects	Year, county	Year, county	Year, county	Year, county
Observations	8,268	8,268	1,638	1,053
R-squared	0.765	0.766	0.694	0.651

Notes: Clustered standard errors by county in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. PS (M) = Propensity Score (Matching). PSM NN = PSM using nearest neighbor PS without replacement. PSM Caliper = 0.01 involves using up to five control counties with replacement for each local option county as long as the counties are within 0.01 PS. We weight non-local option observations by the frequency they are matched in the PSM caliper models. The fewer number of counties in PSM Caliper is due to the use of some counties multiple times.

uses a propensity-score estimator to match a treated county to a control county with similar characteristics. They also looked at heterogeneity within different crime types - interestingly they find no impact of alochol liberalization on DUIs and public drunkenness. They do find that alcohol liberalizations lead to an increase in arrest rates.

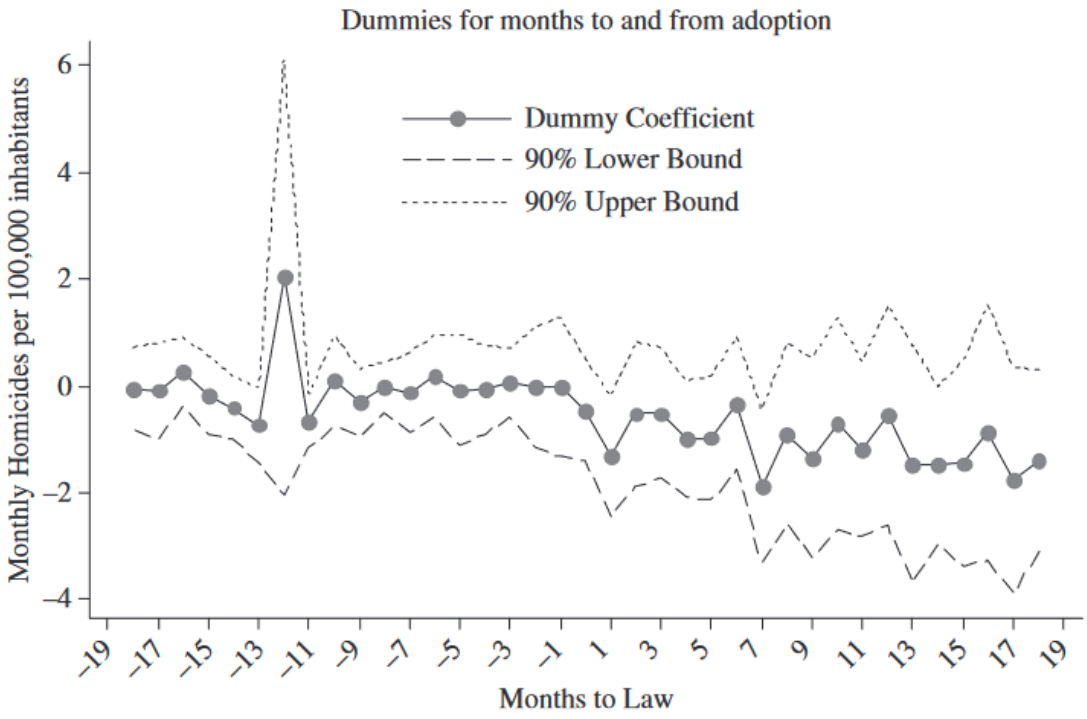


Fig. 4. *Impact of Dry Laws: Dummies for Months To and From Adoption*
Source. Secretaria de Segurança do Estado de São Paulo, Fundação SEADE and Municipal Laws. Homicides are regressed on covariates (listed in Table 5), four lags of homicides, city-specific trends and a treatment variable. Treatment is coded as a set of 37 dummies for 18 months before the law, the month of adoption and 18 months subsequent to the adoption of the law. The figure shows the dummy coefficient estimates. Only 18 months before and after adoption included in sample for this regression. Only adopting cities included in this regression.

B.4 Biderman et al. (2010)

Policy change: Mandatory closing hours for bars and restaurants (staggered adoption between 2001 and 2004)

Geography: Sao Paulo Metropolitan Area

Period of Study: 1994-2004

Identification strategy: TWFE

Outcomes: Murders, battery and traffic fatalities

This is another study that uses dry laws to look at the relationship between alcohol and violent crime. they focus on the Sao Paulo Metropolitan area (composed of 39 municipalities)

Main Estimates

Dependent Variable: Homicides per 100,000 inhabitants				
	Full Sample		January 01 to December 04	
	(*a*) adopting and non-adopting cities			
	(1)	(2)	(3)	(4)
AdoptLaw	−0.616	−0.490	−0.605	−0.613
	(0.342)*	(0.210)**	(0.252)**	(0.245)**
Covariates?†	No	Yes	Yes	Yes
4 Lags of Homicide?	No	Yes	Yes	Yes
Enforcement Variables?‡	No	No	No	Yes
no of Observations	2,535	2,535	1,872	1,872
	(*b*) Only adopting cities			
AdoptLaw	−0.877	−0.668	−0.649	−0.654
	(0.309)***	(0.291)**	(0.362)*	(0.381)*
Covariates?†	No	Yes	Yes	Yes
4 Lags of Homicide?	No	Yes	Yes	Yes
Enforcement Variables?‡	No	No	No	Yes
no of Observations	1,040	1,040	768	768

Source. Secretaria Estadual de Segurança Pública de São Paulo, Fundação SEADE and Municipal Laws.
*** = significant at the 1% level, ** = significant at the 5%, * = significant at the 10%. In all specifications, observations are weighted according to population. Standard errors in parentheses are clustered at the city level. Period of Analysis is May 1999 to December 2004, unless otherwise noted. All specifications contain a full set of period (month) and city dummies.
†Covariates include: logs of population, of income per capita, of the number of 15–30 year-old males, the number of neighbouring cities that adopted the law, a dummy for the presence of a municipal secretary of justice, a dummy for the presence of a municipal police force and log of its size, the log of the municipal per capita spending on education, and the log of the municipal per capita spending on welfare programmes.
‡Yearly data on the number of guns apprehended per capita, the number of prisons per capita and the number of police officers per capita.

in the period 1999-2004 to estimate the effect of alcohol prohibition on violent crime. They also use a standard TWFE model with city and month fixed effects.

Main Findings: Dry laws cause a 10% decrease in homicides, similar effects found for battery and traffic fatalities.

B.5 Conlin et al. (2005)

Policy change: Local options on alcohol sales

Geography: Texas counties

Period of Study: 1978-1996

Identification strategy: TWFE + county-specific linear time trend

Outcomes: Illegal drug-related arrests

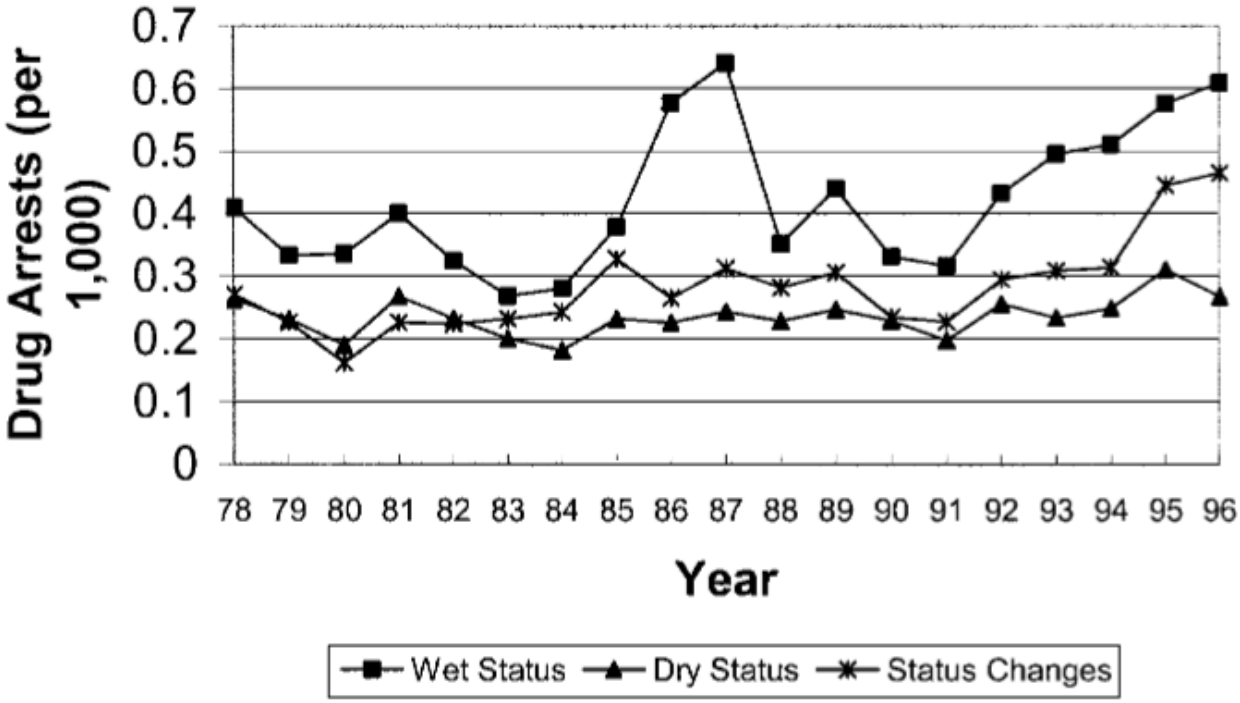


FIGURE 1.—Trends in total drug arrests by county alcohol access policy

Figure 12: Conlin et al. (2005)

Main finding: Local alcohol access reduces drug-related arrests by 9-30%. Prohibiting underage liquor sales increases the fraction of drug-related arrests more in wet counties compared to dry counties. Alcohol access and drug-related crimes are substitutes.

TABLE 3

ESTIMATED EFFECT OF ALCOHOL ACCESS ON CRIMES PER 1,000 INDIVIDUALS ASSOCIATED WITH ALL DRUGS

	Model 1	Model 2	Model 3
County status wet	.07 (.04)	−.05 (.06)	−.16 (.09)
R^2	.02	.22	.26
County fixed effects	No	Yes	Yes
County time trend	No	No	Yes

NOTE.—Standard errors are in parentheses. The standard errors are robust to arbitrary heteroskedasticity and correlation within counties over time. The covariates included in the regression are police expenditures, percentage of Catholic residents, percentage of Baptist residents, population, and per capita income. All models include year fixed effects. $N = 4{,}826$.

Figure 13: Conlin et al. (2005)

B.6 Baughman et al. (2001)

Policy change: Local options on alcohol sales (same as previous paper)

Geography: Texas counties

Period of Study: 1978-1996

Identification strategy: TWFE + county-specific linear time trend

Outcomes: Traffic crashes

Main findings: The effect of local access to alcohol is either zero or negative (effect of increased consumption out-weighed by the shorter driving distances due to local availability).

Table 2
Results: dependent variable is alcohol-related motor vehicle accidents ($N = 5888$)[a]

	(1)	(2)	(3)	(4)	(5)	(6)
Wet	6.71 (5.28)	2.12 (3.27)	−5.34 (2.79)			
Beer and/or wine				3.46 (2.97)	−0.53 (5.79)	−10.19 (4.54)
All liquors off-premise				2.10 (3.57)	3.19 (3.33)	−3.42 (3.13)
All liquors off- and on-premise				19.27 (13.18)	0.37 (5.66)	−4.01 (5.86)
Registered vehicles	−0.001 (0.002)	0.00 (0.00)	−0.002 (0.001)	−0.002 (0.002)	0.00 (0.00)	−0.002 (0.001)
Highway expenditures	−0.286 (1.75)	4.16 (1.43)	4.81 (0.82)	−0.24 (1.78)	4.16 (1.43)	4.81 (0.82)
Police expenditures	−6.03 (1.59)	−3.30 (1.16)	−23.51 (6.56)	−5.98 (1.58)	−3.30 (1.16)	−23.50 (6.56)
Percent population catholic	26.14 (16.75)	24.06 (17.93)	22.63 (19.18)	22.31 (17.77)	24.02 (18.06)	22.94 (19.15)
Percent population Baptist	21.48 (14.54)	4.86 (12.20)	6.01 (17.22)	5.53 (9.73)	5.11 (12.28)	5.60 (17.23)
Population	175.49 (31.78)	21.89 (59.61)	10.81 (84.09)	175.00 (31.95)	21.82 (59.63)	10.76 (84.12)
Per-capita income	97.89 (105.85)	90.66 (77.31)	−25.83 (75.95)	86.27 (101.91)	91.40 (77.81)	−25.31 (75.98)
Vehicle miles — highway	1.34 (2.25)	1.52 (1.84)	3.92 (2.73)	1.23 (2.31)	1.52 (1.84)	3.91 (2.73)
Vehicle miles — total	2.57 (1.56)	1.04 (0.72)	0.83 (1.36)	2.59 (1.57)	1.04 (0.72)	0.83 (1.36)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
County specific fixed effects	No	Yes	Yes	No	Yes	Yes
County specific fixed effects and time trends	No	No	Yes	No	No	Yes
R^2	0.95	0.98	0.99	0.95	0.98	0.99

[a] Standard errors in parentheses, corrected for heteroskedasticity and clustering around county. Registered vehicles, population, per-capita income and vehicle miles are measured in units of 100,000. Highway and police expenditures are in millions of dollars. Source: authors' calculations on data from the Department of Congress (2001), Quinn (1982), Bradley (1992) and unpublished data from the Texas Alcoholic Beverage Commission, the Texas Department of Public Safety, the Texas Transportation and Planning Division, the Texas Vehicle Titles and Registration Division, and the Texas Department of Public Safety.

Figure 14: Baughman et al. (2001)

B.7 Carpenter and Dobkin (2015)

The paper investigates the causal effect of legal access to alcohol on crime rates by exploiting the discontinuity in legal drinking age at 21 in California. The authors employ a regression discontinuity design (RDD) to compare arrest rates for individuals just below and above the legal drinking age, providing evidence on whether alcohol access contributes to criminal behavior. The core of the model is the RDD, which assumes that individuals just below and above the age threshold are similar in all respects except for legal access to alcohol. The paper explores the channels through which alcohol access might affect crime, including alcohol-related offenses and violent and property crimes. The implications of the findings are significant for public policy debates on legal drinking age.

The empirical analysis utilizes data from California's Monthly Arrest and Citation Register (MACR) spanning from 1979 to 2006. The authors employ a sharp RDD approach, comparing arrest rates for individuals around the age of 21. The analysis is disaggregated by types of crime to assess the specific impact of alcohol access on different criminal behaviors. The empirical strategy hinges on the validity of the RDD assumptions and the robustness of the results to different bandwidth choices and specification checks.

In my own research, I could use the insights from this paper to explore the impact of other age-related policies on social outcomes, such as the effects of tobacco or cannabis legalization on public health and crime. The methodological approach of using sharp RDD

could be applied to assess causal relationships in settings where a clear cutoff point exists for policy implementation.