Did Legalization of Sunday Alcohol Sales Increase Crime in the United States? Evidence From Seven States

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ABSTRACT. Objective: This study investigates the impact of the legalization of Sunday alcohol sales on several different types of criminal activity in the United States. **Method:** The 2000–2010 data from the Federal Bureau of Investigation's National Incident-Based Reporting System (NIBRS) for seven states ($n = 1,746,249$) and difference-in-differences type models are used to estimate the effect of the legalization of Sunday alcohol sales on different types of criminal activity. **Results:** States that legalized Sunday sales of alcohol experienced up to a 16% to 23% increase in the total number of violent and property crimes committed on Sundays ($p < .01$). However, the aggregate impact of this policy

change on crimes committed on all days of the week is not significant because of either positive or statistically insignificant spillover effects of the repeal of Sunday alcohol sales bans on crimes committed on Mondays through Saturdays. These results are robust under alternative model specifications. **Conclusions:** We find evidence that the negative effects of legalizing Sunday alcohol sales on criminal activity are day specific, and the overall crime trends are not affected by this policy change. These findings are particularly important given the ongoing public policy debates about the relevancy of the restrictions on Sunday sales of alcohol at off-premise locations. (*J. Stud. Alcohol Drugs*, 79, 816–825, 2018)

ONE OF THE WIDELY IMPLEMENTED forms of regulation on alcohol availability in the United States is restricting the Sunday sale of alcoholic beverages at off-premise locations, that is, liquor stores and other locations where alcohol may be purchased but not consumed. Understanding the effect of the Sunday alcohol sales laws is important because recently several states have repealed these laws, and removing the restriction on Sunday alcohol sales is a current policy debate in remaining states with such laws. Proponents of Sunday sales argue that by allowing people to buy beer, wine, or distilled spirits on Sundays at grocery or liquor stores, states can increase their tax revenue. On the other hand, opponents argue that removing bans on Sunday sales would increase alcohol consumption and cause adverse public health consequences.

Although the literature investigating the effect of Sunday alcohol sales bans in the United States is relatively limited, the existing studies find evidence that states that legalized sales of alcohol on Sundays experienced significant increases in alcohol consumption (Stehr, 2007; Yörük, 2014b). Furthermore, several studies find that repealing restrictions on Sunday alcohol sales led to significant increases in traffic accidents and fatalities on Sundays (McMillan & Lapham, 2006; McMillan et al., 2007). There is also an extensive literature that links alcohol consumption to increased criminal activity (Carpenter, 2007; Grönqvist & Niknam, 2014; Markowitz, 2005). These results suggest that the repeal of the

restrictions on Sunday alcohol sales may have a significant impact on criminal activity.

In this article, we investigate whether the repeal of the restrictions on Sunday alcohol sales have significant spillover effects on criminal activity using detailed, day-specific crime data from the National Incident-Based Reporting System (NIBRS) from 2000 to 2010 for seven states. We use difference-in-differences (DD) type models to identify the impact of the legalization of Sunday alcohol sales on criminal activity by exploiting the variation in the implementation of this policy change across different states at different times. In contrast to few existing studies that investigated the effect of the Sunday alcohol laws on crime for a single state, we compare the changes in the number of crimes that are committed in the treatment states (Colorado, Delaware, and Massachusetts) after they repealed their Sunday alcohol sales ban with the number of crimes that are committed in the control states (Connecticut, South Carolina, Tennessee, Utah), which retained their Sunday alcohol sales ban during the period considered. To our best knowledge, this article is the first to use data from multiple states to investigate the effect of the repeal of Sunday alcohol sales bans in the United States on criminal activity.

Literature review

The literature investigating the effect of the Sunday alcohol sales ban in the United States is relatively limited. Stehr (2007) finds that repeal of the Sunday alcohol sales ban is associated with a 2.4% increase in total beer sales and a 3.5% increase in total spirits sales. Yörük (2014b) shows that among the states that legalized Sunday sales of alcoholic beverages, Delaware, Pennsylvania, and New Mexico experienced significant increases in overall alcohol consumption. However, the effect of the legalization of Sunday alcohol

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sales in Massachusetts and Rhode Island on per capita alcohol consumption was insignificant. Several countries including Canada, Sweden, and Australia also repealed their laws restricting the sale of alcohol on certain days of the week. Carpenter and Eisenberg (2009) examine the effect of repealing the Sunday alcohol sales ban on day-specific alcohol consumption in Ontario, Canada. They find that repealing the Sunday alcohol sales ban is associated with a 7% to 15% increase in Sunday alcohol consumption. Smith (1978, 1987, 1988, 1990) investigates the effect of repealing restriction on Sunday sales of alcohol at different cities in Australia. He finds that the repeal of these laws is significantly associated with increased alcohol consumption and traffic accidents on Sundays. Norström and Skog (2003, 2005) and Olsson and Wikström (1982) show that alcohol consumption in Sweden was significantly increased after alcohol retail shops were allowed to operate on Saturdays. In a recent article, Grönqvist and Niknami (2014) show that this policy change also led to an increase in crime rates in Sweden.

Several studies investigate the effect of repealing the Sunday alcohol sales ban on traffic accidents in the United States. McMillan and Lapham (2006) and McMillan, Hanson, and Lapham (2007) find very large increases in Sunday fatalities in New Mexico. However, Stehr (2010) documents several limitations of McMillan and Lapham (2006) and finds a far more modest effect of repealing the ban on the traffic fatalities. Similarly, Lovenheim and Steefel (2011) find that restricting alcohol sales on Sunday has at most a small effect on fatal accident rates.

To our best knowledge, only three studies have investigated the relationship between Sunday alcohol sales bans in the United States and crime before. All of these studies focus on a single state. Ligon et al. (1996) find that partially removing a Sunday liquor sales ban in Athens, GA, restaurants did not have a significant impact on driving under the influence (DUI) arrests. Han and colleagues (2016) find that the repeal of the Sunday alcohol sales ban in Philadelphia was associated with a significant increase in total and property-crime incidents occurring around Sunday-open state liquor stores in low-socioeconomic-status neighborhoods. Heaton (2012) finds that the repeal of the Sunday alcohol sales ban in some counties of Virginia had no significant impact on violent, property, and public order (drug law violation and weapon law violation) crimes. However, his results indicate a significant impact of the policy on disorderly conduct and alcohol-related serious crimes. Instead of focusing on a single state, in this article, we estimate the effect of removing restrictions on Sunday sales of alcohol in multiple states. Heaton (2012) uses day-specific data to estimate the impact of Sunday alcohol sales on crime. His measure of a day is a 24-hour period starting from 6 A.M. on any given day. This measure may be problematic since Sunday sales of alcohol generally start at noon and continue until 5 P.M. to midnight in different states. Therefore, one would expect to observe

the main impact of the Sunday sales after 6 P.M. on Sundays. In this article, instead of using the number of crimes committed during 24-hour periods, we use number of crimes committed during 12-hour periods as our outcome variable. Our main interest is to estimate the effect of repealing the Sunday alcohol sales ban on the number of crimes committed during the 12-hour period from 6 P.M. on Sundays to 6 A.M. on Mondays (hereafter, Sunday P.M.).

Method

Data

We use data from the NIBRS from 2000 to 2010 to examine the effect of repealing the Sunday alcohol sales ban on different types of crimes. The NIBRS provides separate data on arrestees and offenders. We use data on arrestees since offender data suffer heavily from missing information. Participation in the NIBRS is voluntary, and police departments may not report crime data at all or for certain periods. In this article, we include a police department in our sample if it reported crime data for each month during 2000–2010. The exception is data for Delaware. For this state, we consider the 2001–2010 period because of the lack of data for 2000. Our sample covers cities or counties with a population of 25,000 or more.

The NIBRS data include location and date of the incident, and characteristics of the arrestee(s), offender(s), victim(s), and type and value of property stolen in connection with the crime. We exclude crimes that occurred at bars or restaurants since Sunday alcohol laws regulate off-premise alcohol consumption. Because the minimum legal drinking age in the United States is 21, we also exclude crimes that are committed by those who are younger than 21. The NIBRS reports the exact time (hour and date) of each crime incident. Using this information, we calculate the number of crimes committed for every 12-hour period as reported by each police station. Our main variable of interest is the number of different types of crimes committed on Sunday P.M.S. A limitation of the NIBRS is that the reported times in the data may not necessarily be the exact times of incident occurrence. Rather, it is likely to be the times when the incidents were reported to the police. However, as long as this measurement error is uncorrelated with the policy variable, it should not affect our main findings.

The laws on Sunday alcohol sales in the United States are complex. During 2000–2010, Sunday alcohol sales were allowed in 27 states, 5 states repealed their laws restricting the sales of all types of alcohol on Sundays, and 11 states retained their restrictions on Sunday alcohol sales. The remaining 8 states had different policies toward Sunday sales. Most of them allowed beer and wine sales and allowed Sunday sales of distilled spirits at the local level after a certain date. Our empirical analysis uses data from the states that repealed their

TABLE 1. Summary statistics for violent and property crimes

Variable	Full sample		Treatment states		Control states	
	All days	Sunday P.M.	All days	Sunday P.M.	All days	Sunday P.M.
Violent crimes						
Assault	0.782 (1.390)	0.564 (1.099)	0.719 (1.245)	0.536 (1.045)	0.811 (1.452)	0.578 (1.124)
Robbery	0.048 (0.276)	0.040 (0.248)	0.050 (0.265)	0.039 (0.228)	0.047 (0.279)	0.040 (0.257)
Vandalism	0.401 (0.917)	0.284 (0.787)	0.529 (1.093)	0.363 (0.900)	0.341 (0.814)	0.246 (0.723)
Forcible sex	0.035 (0.207)	0.023 (0.165)	0.042 (0.221)	0.028 (0.178)	0.032 (0.200)	0.021 (0.158)
Total violent crimes	1.266 (1.976)	0.911 (1.597)	1.340 (1.991)	0.966 (1.648)	1.232 (1.967)	0.885 (1.574)
Property crimes						
Larceny	0.851 (1.642)	0.670 (1.262)	0.899 (1.794)	0.403 (1.002)	0.828 (1.564)	0.419 (0.932)
Motor vehicle theft	0.103 (0.396)	0.075 (0.334)	0.134 (0.481)	0.094 (0.399)	0.089 (0.347)	0.066 (0.297)
Burglary	0.238 (0.641)	0.140 (0.451)	0.255 (0.679)	0.151 (0.474)	0.230 (0.622)	0.135 (0.439)
Total property crimes	1.192 (2.129)	0.630 (1.276)	1.288 (2.394)	0.648 (1.404)	1.146 (1.990)	0.621 (1.210)
No. of observations	1,746,249	166,293	561,720	53,501	1,184,529	112,792

Notes: The average number of crimes reported by each police agency for each 12-hour period is presented in Data Columns 1, 3, and 5. The average number of crimes reported by each police agency for each 12-hour period between Sunday 6 P.M. and Monday 6 A.M. is presented in Data Columns 2, 4, and 6. Standard deviations are presented in parenthesis. No. = number.

laws restricting the sales of all types of alcohol on Sundays (treatment group) during 2000–2010, and from the states that retained their Sunday alcohol law (control group) during the same period. Treatment and control states are identified through Alcohol Policy Information System (APIS), Stehr (2010), and Yörük (2014b). Five states that removed their restrictions on Sunday sales of beer, wine, and spirits during 2000–2010 are Colorado, Delaware, Massachusetts, Rhode Island, and Pennsylvania. However, our treatment group includes only Colorado, Delaware, and Massachusetts because of the limitations of the data. The participation to the NIBRS is voluntary and the number of police departments participating in the system varies by state, year, and month. The NIBRS does not provide daily crime data for Pennsylvania and provides data for Rhode Island only for 2005–2010. Because Rhode Island repealed its Sunday alcohol sales ban in 2004, we exclude this state from our treatment group. Similarly, we cannot include Georgia, Illinois, Indiana, Minnesota, and Nebraska in our control group since the NIBRS does not report detailed crime data for these states. The NIBRS provides crime data from only one police agency in Alabama and two police agencies in Oklahoma. We also exclude these states from the control group because of this limited information. Therefore, our control group includes four states, namely Connecticut, South Carolina, Tennessee, and Utah. We report the number of police departments for each state, date of the repeal of Sunday alcohol sales ban for the treatment states, and the number of observations for each state in Appendix Table A1.

In this article, we focus on serious violent and property crimes, which are labeled as Group A offenses in the NIBRS. Violent crimes include assault, vandalism, robbery, and forcible sex crimes, whereas property crimes include larceny, motor vehicle theft, and burglary. For a falsification test, we also use data for forgery and fraud crimes to show that repealing the Sunday alcohol sales ban does not have a significant impact on crimes that are not related to alcohol consumption. Table 1 provides the summary statistics for violent and property crimes committed on all days and on Sunday P.M.s for the full sample and separately for treatment and control states. The average number of crimes committed on Sunday P.M.s is less than the average number of crimes committed on other days of the week. Except for assault and robbery, compared with the control states, the average number of crimes committed on Sunday P.M.s in treatment states is relatively higher.

Empirical model

Several states repealed their Sunday alcohol sales bans at different times. We estimate the effect of repealing Sunday alcohol sales ban on criminal activity by exploiting this variation across different states. First, we use data only on crimes committed on Sunday P.M.s and employ a DD-type model. Next, we use a similar model to estimate the spillover effects of the policy change on crimes committed on other days of the week and to assess the overall impact of the

policy change on crime trends. Since the outcome variables are count variables, we report results from Poisson and negative binomial models.

Our DD model can be expressed as follows:

$$Y_{ismt} = \beta' X_{st} + \lambda \text{Ban}_{smt} + \theta_i + \gamma_m + \eta_t + (\text{trend} \times \sigma_s) + e_{ismt} \quad (1)$$

where Y_{ismt} is the number of certain type of crime committed in state s on a particular Sunday P.M. in month m of year t as reported by police agency i . In Equation 1, Ban_{smt} is an indicator variable that is equal to 1 if Sunday alcohol sales were allowed in a state at a given date, and X_{st} is a set of state-level control variables including log of total population; percentage of Black, White, and Hispanic population; percentage of population who are between 15 and 19 years old; percentage of female population; unemployment rate; log of per capita income; poverty rate; percentage of high school and college graduates; percentage of high school dropouts; beer consumption per capita; beer tax; number of police officers per 1,000 people; and an indicator variable that controls for whether the state governor is a Democrat. The data for beer tax and beer consumption per capita come from Brewer's Almanac. The data for number of police officers are collected from Uniform Crime Reporting Data. We use data from the Council of State Governments, the National Governors' Association, and Elections Research Center to determine whether the state governor is a Democrat or Republican. The data for remaining control variables are collected from U.S. Census Bureau, Bureau of Labor Statistics, and Bureau of Economic Analysis.

Equation 1 also includes agency, month, and year fixed effects as denoted by θ_i , γ_m , and η_t , respectively. In Equation 1, the coefficient of interest is λ , which shows the impact of repealing restrictions on Sunday sales of alcohol on crimes committed on Sunday P.M.S.

The key identifying assumption in a DD-type model is the common trends condition, which requires that in the absence of the repeal of the Sunday alcohol sales ban in the treatment states, crime trends in treatment and control states would be similar. This assumption may fail if states that experienced relatively lower crime rates might be more likely to repeal the Sunday alcohol sales ban compared with those states with relatively higher crime rates. However, Figure 1 clearly shows that these laws could not have been repealed as a reaction to decreased crime rates in the states that have repealed these laws. In addition to aggregated state-month level crime rates, we also plot the nonparametric kernel density of total number of violent and property crimes for treatment and control states over time. With an exception of Massachusetts, trends in crime rates are fairly similar across states that removed restrictions on Sunday alcohol sales and those that did not before repeal of these laws. We also present calendar time trends in Appendix Figure A1. In line with Figure 1, there is an

increasing trend in crime rates in Massachusetts before the policy change and there is a smooth trend for the control states. Because in Massachusetts, crime rate appears to have an increasing trend before the liberalization of Sunday alcohol sales instead of exhibiting a decreasing trend, it is unlikely that Massachusetts repealed restrictions on Sunday alcohol sales due to a decreasing trend in criminal activity. Furthermore, to address the potential concerns for the failure of parallel trends assumption, we extend the basic DD analysis in two ways. First, we incorporate state-specific linear time trends ($\text{trend} \times \sigma_s$) to Equation 1 by interacting a dummy variable for each state with a time trend. These state-specific linear time trends control for a variety of other variables that are associated with crime trends that vary smoothly within states over time. Inclusion of the state trends also reduces concerns for potential omitted variables bias. Second, following Gruber and Hungerman (2008) and Yörük (2014b), we estimate models that contain a dummy variable for one year before the effective date of the repeal of the Sunday alcohol sales ban in treatment states (placebo treatment). If the treatment dummy is just picking up a pre-existing decreasing or increasing trend in alcohol consumption and crime in the treatment states, then the placebo treatment dummy should be negative and significant (Gruber & Hungerman, 2008).

Following Carpenter (2004) and Yörük (2014a), we also extend the basic DD analysis and investigate the dynamic impact of repealing restrictions on Sunday alcohol sales on crime trends. In this model, we replace the treatment dummy with a series of time dummies for the years leading up to and after a state repeals its Sunday alcohol law. In all models, we adjust for potential serial correlation, within-state spatial correlation, and heterogeneity in errors by clustering the standard errors by police agency (Bertrand et al., 2004).

Results

Violent crimes

The first two columns of Table 2 present DD estimates of the model for the effect of repealing the Sunday alcohol sales ban on the number of violent crimes committed on Sunday P.M.S. The first specification reports the results from a Poisson model. The results show that states that repealed their Sunday alcohol law experienced a significant increase in the total number of violent crimes. Before the policy change, on average, 0.643 violent crimes were reported by a police agency located at a treatment state on a random Sunday P.M. Our model predicts that the marginal impact of repealing the restrictions on Sunday alcohol sales is a 0.104 point increase in the number of violent crimes reported by each police agency ($p < .01$) or alternatively, 16% increase in the total number of violent crimes compared with the period before the repeal. The second specification replicates the

FIGURE 1. Trends in total crimes in treatment and control states. *Notes:* Using the actual data, the Epanechnikov kernel-weighted local polynomials for the total number of violent crimes per 100,000 people are plotted for treatment and control states before and after the repeal of the Sunday alcohol sales ban. The dots represent the aggregated state-month level data for control and each of the treatment states. The figure is centered in the month and year the policy became effective in each of treatment states (Time 0). For control states, average crime trends during the same period are plotted.

TABLE 2. The effect of the repeal of Sunday alcohol bans on violent and property crimes committed on Sunday P.M.S

	Violent crimes		Property crimes	
	Total violent		Total property	
Treatment	0.104*** (0.032)	0.103*** (0.031)	0.084** (0.033)	0.094*** (0.034)
Incidence rate ratio	1.163	1.160	1.201	1.226
	Assault		Larceny	
Treatment	0.052*** (0.019)	0.053*** (0.018)	0.071*** (0.024)	0.077*** (0.025)
Incidence rate ratio	1.135	1.137	1.269	1.288
	Forcible sex		Burglary	
Treatment	-0.001 (0.002)	-0.001 (0.001)	0.012 (0.0081)	0.014 (0.0083)
Incidence rate ratio	0.922	0.919	1.122	1.147
	Robbery		Motor vehicle theft	
Treatment	-0.002 (0.002)	-0.002 (0.002)	0.006 (0.0050)	0.005 (0.0046)
Incidence rate ratio	0.854	0.830	1.170	1.165
	Vandalism			
Treatment	0.050*** (0.015)	0.046*** (0.014)		
Incidence rate ratio	1.290	1.265		
Model	Poisson	Negative binominal	Poisson	Negative binominal

Notes: The number of observations in all specifications is 166,293. Marginal effect for the treatment is reported. All regressions include full set of control variables, state-specific linear time trends, and month, year, and police agency fixed effects as discussed in the text. Standard errors are clustered at the police agency level and reported in parenthesis. The signs ** and *** denote statistical significance at 5, and 1 percent significance levels, respectively.

same analysis using a negative binomial model. The results from this specification are very similar compared to the results from the Poisson model.

In the remaining specifications, we investigate the effect of repealing the Sunday alcohol sales ban on different types of violent crimes committed on Sunday P.M.S. The results indicate that the repeal of the Sunday alcohol law leads to an approximately 13.5% increase in assault in the treatment states ($p < .01$). Although the repeal of the Sunday alcohol law did not have a significant impact on forcible sex and robbery, it significantly affected vandalism in the treatment states. In particular, states that repealed their Sunday alcohol law experienced a 27% to 29% ($p < .01$) increase in vandalism on Sunday P.M.S.

Property crimes

The last two columns of Table 2 report the estimates of the effect of the repeal of Sunday alcohol laws on property crimes committed on Sunday P.M.S. The results imply that compared with the control states, repealing restrictions on sale of alcohol on Sundays increased total property crimes committed on Sunday P.M.S in the treatment states by 20% to 23% ($p < .05$).

The results also show that after the repeal of the alcohol

sales ban, compared with the control states, the number of larceny cases in the treatment states on Sunday P.M.S increased by 27% to 29% ($p < .01$). Similarly, repeal of the Sunday alcohol law led to a 12% to 15% increase in burglary and up to a 17% increase in motor vehicle theft cases in the treatment states. However, these effects are not statistically significant at conventional significance levels.

Impact of the repeal of bans on crimes committed on other days of the week

Because the policy was mainly aimed at increasing alcohol sales and, hence, tax revenue on Sundays, the impact of the repeal of the Sunday alcohol law on alcohol consumption and crimes committed on other days of the week should be relatively limited. We investigate this hypothesis and report the results in Appendix Table A2. As expected, when the outcome variables are different types of crimes committed on other days of the week, the coefficient on the treatment variable is mostly negative and statistically insignificant. The exceptions are total violent crimes committed on Mondays and Saturdays and assaults committed on Saturdays. The results show that repeal of the Sunday alcohol law leads to significant decreases in total violent crimes and assaults committed on these days.

TABLE 3. The effect of the repeal of Sunday alcohol bans on violent and property crimes committed on all days of the week

	Total violent		Total property	
Treatment	-0.039 (0.029)	-0.045 (0.030)	0.009 (0.036)	-0.007 (0.033)
Incidence rate ratio	0.958	0.952	1.011	0.992
	Assault		Larceny	
Treatment	-0.026 (0.017)	-0.024 (0.017)	0.004 (0.025)	-0.006 (0.024)
Incidence rate ratio	0.952	0.955	1.007	0.990
	Robbery		Burglary	
Treatment	-0.001 (0.002)	-0.001 (0.001)	-0.000 (0.008)	-0.002 (0.008)
Incidence rate ratio	0.969	0.961	0.997	0.990
	Forcible sex		Motor vehicle theft	
Treatment	0.001 (0.002)	0.001 (0.001)	0.004 (0.006)	0.003 (0.005)
Incidence rate ratio	1.050	1.046	1.071	1.057
	Vandalism			
Treatment	-0.006 (0.011)	-0.010 (0.012)		
Incidence rate ratio	0.978	0.962		
Model	Poisson	Negative binominal	Poisson	Negative binominal

Notes: The number of observations in all specifications is 1,663,108. Marginal effect for the treatment is reported. All regressions include full set of control variables, state-specific linear time trends, month, year, day of the week, and police agency fixed effects as discussed in the text. Standard errors are clustered at the police agency level and reported in parenthesis.

We documented the negative impact of removing restrictions on Sunday sales of alcohol on crimes committed on Sunday P.M.S. However, we also showed that the spillover effects of the repeal of the Sunday alcohol sales ban on crimes committed on other days of the week are either positive or statistically insignificant. These results imply that the aggregate effect of the policy change on crimes committed on all days of the week might be positive or insignificant as well. We test this hypothesis by estimating a model similar to Equation 1 using data on crimes committed on all days of the week. Our empirical model for this exercise is slightly different than Equation 1, because using data for all days of the week instead of focusing on a single day also enables us to include fixed effects for each 12-hour period to our model (day of the week fixed effects). Results reported in Table 3 show that the effect of the repeal of the ban on all types of violent and property crimes committed on all days of the week is statistically insignificant. This result is robust to the model selection.

Falsification and robustness tests

We run a series of falsification tests to check the robustness of our results. First, we estimate models that contain a dummy variable for one year before the effective date of the repeal of the Sunday alcohol sales ban in treatment states.

If the treatment dummy is just picking up a pre-existing increasing or decreasing trend in alcohol consumption and crime, then the coefficient of the early treatment dummy should be statistically significant. The results reported in Table 4 clearly show that this is not the case. The coefficient on the placebo treatment is insignificant for all outcomes.

Next, we investigate the effect of the repeal of Sunday alcohol laws on two crime types that are supposedly not related to alcohol consumption: fraud and forgery. Table 4 shows that the marginal impact of the treatment on these outcomes is small and insignificant, which suggests that the policy change did not have a significant impact on fraud and forgery in the treatment states.

We mentioned that in Massachusetts, crime rates appear to exhibit an increasing trend before the liberalization of Sunday alcohol sales. Although our models that contain a placebo treatment and the dynamic DD analysis that we present in the next section show that the effects of the pre-existing trends are statistically insignificant and the increase in crime rates in Massachusetts should not confound our analysis, we further address this issue by excluding the data from Massachusetts from our sample. The results presented in Appendix Table A3 show that even after Massachusetts is excluded from the sample, the results are very similar to those we present in Tables 2 and A2. This result shows that our results are not driven from the crime trends in Massachusetts.

TABLE 4. Falsification tests

	Violent and property crimes	Fraud and forgery
	Total violent	Forgery
Treatment		
Placebo treatment	-0.037 (0.059)	-0.000 (0.001)
	Assault	Fraud
Treatment		
Placebo treatment	-0.085 (0.066)	0.001 (0.002)
	Robbery	
Treatment		
Placebo treatment	-0.088 (0.152)	
	Forcible sex	
Treatment		
Placebo treatment	-0.017 (0.171)	
	Vandalism	
Treatment		
Placebo treatment	0.065 (0.086)	
	Total property	
Treatment		
Placebo treatment	0.058 (0.094)	
	Larceny	
Treatment		
Placebo treatment	0.084 (0.102)	
	Burglary	
Treatment		
Placebo treatment	-0.095 (0.095)	
	Motor vehicle theft	
Treatment		
Placebo treatment	0.067 (0.142)	

Notes: The number of observations in all specifications is 166,293. Marginal effect for the treatment or the placebo treatment is reported. All regressions include full set of control variables, state-specific linear time trends, and month, year, and police agency fixed effects as discussed in the text. Standard errors are clustered at the police agency level and reported in parenthesis. State-specific linear time trends are included.

Dynamic effects

In Table 5, we investigate dynamic responses of different crime types to the repeal of the Sunday alcohol sales ban. The estimates in this table are from a DD-type model that, instead of the treatment dummy, contains binary indicators for the years leading up to and after a state repeals its Sunday alcohol sales ban. For all crime types, the coefficient estimates on years before the policy change are small and insignificant, which imply that states that repealed their ban did not remove the restrictions on Sunday alcohol sales as a response to significant changes in crime trends. On the other hand, Table 5 shows a significant increase in all crime types committed on Sunday P.M.s in the first year immediately following the repeal of the Sunday alcohol sales ban. Similarly, estimates for 2–7 years since the repeal of the ban are uniformly positive and mostly significant. Therefore, the negative impact of removing restrictions on Sunday sales of alcohol on crimes committed on Sunday P.M.s remains in the long run.

Discussion

In this article, we investigate the effect of the legalization of Sunday alcohol sales on several different types of violent and property crimes using day-specific crime data from the NIBRS for seven states. Although Ligon et al. (1996), Han et al. (2016), and Heaton (2012) investigated the relationship between Sunday alcohol laws and criminal activity in the United States, all of these studies focus on a single state. Using DD-type models that control for state, time, and police agency fixed effects, we find that the legalization of Sunday alcohol sales is associated with significant increases in total violent and property crimes committed on Sundays. Our findings imply that states that removed restrictions on Sunday sales of alcohol experienced a 16% to 20% increase in the total number of violent and property crimes committed on Sundays ($p < .01$). However, we also show that the aggregate impact of this policy change on crimes committed on all days of the week is not significant due to either positive or statistically

TABLE 5. Dynamic effects of the repeal of Sunday alcohol bans

Variable	Total violent	Assault	Vandalism	Total property	Larceny
3–4 years before	-0.028 (0.117)	-0.117 (0.117)	-0.126 (0.187)	-0.019 (0.164)	-0.045 (0.193)
2–3 years before	0.062 (0.086)	0.035 (0.084)	0.005 (0.140)	0.036 (0.128)	0.014 (0.149)
1–2 years before	0.015 (0.063)	0.010 (0.065)	-0.014 (0.099)	-0.041 (0.088)	-0.058 (0.095)
0–1 years before (omitted)					
0–1 years after	0.243*** (0.046)	0.258*** (0.046)	0.305*** (0.074)	0.257*** (0.073)	0.243*** (0.077)
1–2 years after	0.261*** (0.069)	0.311*** (0.060)	0.323*** (0.117)	0.309*** (0.108)	0.353*** (0.116)
2–3 years after	0.238*** (0.070)	0.274*** (0.049)	0.390*** (0.126)	0.270*** (0.100)	0.329*** (0.110)
3–4 years after	0.286*** (0.088)	0.399*** (0.062)	0.229 (0.148)	0.309*** (0.108)	0.177 (0.132)
4–5 years after	0.435*** (0.125)	0.601*** (0.098)	0.332 (0.211)	0.270*** (0.100)	0.462** (0.199)
5–6 years after	0.553*** (0.169)	0.756*** (0.136)	0.480 (0.273)	0.171 (0.121)	0.248 (0.277)
6–7 years after	0.778*** (0.206)	0.938*** (0.173)	0.833*** (0.322)	0.375** (0.183)	0.499 (0.321)

Notes: Results from negative binomial models are reported. The number of observations in all models is 166,293. All regressions include full set of control variables, and month, year, and police agency fixed effects as discussed in the text. Standard errors are clustered at the police agency level and reported in parenthesis. The signs ** and *** denote statistical significance at 5 and 1 percent significance levels, respectively.

insignificant spillover effects of the repeal of Sunday alcohol sales bans on crimes committed on Mondays through Saturdays.

These findings are important given the ongoing debates about the relevancy of the restrictions on Sunday sales of alcohol at off-premise locations. We find evidence that the negative effects of legalizing Sunday alcohol sales on criminal activity is day specific and the overall crime trends are not affected by this policy change. This result is in line with that of Carpenter and Eisenberg (2009). They find that in Canada, Sunday sales are associated with a significant increase in drinking on Sundays. However, there is no evidence for increase in overall drinking. Our findings are also in line with Lovenheim and Steefel (2011), who find that the aggregate impact of restricting alcohol sales on Sunday has at most a small effect on fatal accident rates in the United States. One likely reason for these results is the possibility that individuals adjust their daily alcohol consumption patterns after the legalization of Sunday alcohol sales by drinking or purchasing more on Sundays but less on the other days of the week. However, we acknowledge that this hypothesis is not testable because of the lack of day-specific alcohol consumption data in the United States.

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