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Legalization of Sunday alcohol sales and alcohol consumption in the United States

Barış K. Yörük

University at Albany, State University of New York, Department of Economics, 1400 Washington Ave., Albany, NY 12222, byoruk@albany.edu

Abstract

Aims—To investigate the relationship between legalization of Sunday alcohol sales and alcohol consumption in the United States.

Design—State-level per capita consumption of beer, wine, and spirits was analyzed using difference-in-differences econometric methods.

Setting—United States.

Participants—5 treatment states that repealed their laws restricting Sunday alcohol sales during 1990–2007 and 12 control states that retained their Sunday alcohol laws during the same period.

Measurements—Outcome measures are state-level per capita consumption of overall alcohol, beer, wine, and spirits.

Findings—Among the states that legalized Sunday sales of alcoholic beverages, Delaware, Pennsylvania, and New Mexico experienced significant increases in overall alcohol consumption ($P < 0.05$). However, the effect of the legalization of Sunday alcohol sales in Massachusetts and Rhode Island on per capita alcohol consumption was insignificant ($P = 0.964$ and $P = 0.367$).

Conclusions—Three out of five states in the USA that repealed their laws restricting Sunday sale of alcoholic beverages during 1990–2007, experienced significant increases in per capita alcohol consumption. This finding implies that increased alcohol availability leads to an increase in alcohol consumption.

Introduction

One of the most direct forms of regulation on alcohol availability in the United States is restricting the Sunday sale of alcoholic beverages at off-premise locations, i.e., liquor stores and other locations where alcohol may be purchased but not consumed. Understanding the effect of the Sunday alcohol sales laws (hereafter, SAS laws) is particularly important since recently several states have repealed these laws, while removing the restriction on Sunday alcohol sales is a current policy debate in remaining states with such laws. On the one hand, proponents of Sunday sales argue that by allowing people to buy beer, wine, or liquor on Sundays at grocery or liquor stores, states can increase their tax revenue. On the other hand, opponents of such sales argue that lifting bans on Sunday sales would increase alcohol consumption and hence, cause adverse public health consequences such as risky behavior, crime, and traffic accidents.

Several countries including Canada and Australia repealed their SAS laws. The existing research has shown that these repeals did not change the overall alcohol consumption in Canada [2] but significantly increased alcohol consumption in Australia [14, 15, 16, 17]. Furthermore, in Australia, removing restrictions on Sunday alcohol sales resulted in significant increase in the proportion of persons killed and number of crashes on Sundays [16, 17]. Recently, Sweden removed bans on Saturday sales of alcohol at off-premise locations. Removing restrictions on Saturday alcohol sales resulted in increased alcohol consumption in Sweden [11, 12, 13]. A recent review of the existing literature also concludes that increasing days of sale by allowing previously banned alcohol sales on either Saturdays or Sundays is associated with excessive alcohol consumption and related harms, including motor vehicle crashes, incidents of DUI, police interventions against intoxicated people, and, in some cases, assaults and domestic disturbances [10].

The literature investigating the effect of removing bans on Sunday sales in the United States is relatively limited. The existing studies show that on average, sales of beer and spirits were increased by 2.4 and 3.5 percent respectively in those states that repealed their SAS laws [18]. Although 2004, 2006, and 2008 editions of Georgia Behavioral Risk Factor Surveillance System (BRFSS) report that driving under the influence (DUI) arrests on Sundays in Athens, Georgia increased after Sunday sales of alcoholic beverages were allowed in restaurants, recent research finds that Sunday alcohol sales in Athens, Georgia restaurants did not have a significant impact on DUI arrests [5]. Similarly, a recent study finds that there was no statistically significant increase in total alcohol-related accidents or alcohol-related fatal crashes on Sundays in New Mexico after the repeal of the SAS law [7]. However, this study uses monthly and annual indicator variables rather than a continuous time trend to control for the trend in traffic crash rates in New Mexico. In contrast to findings of this study, several studies conclude that alcohol related Sunday crash fatalities significantly increased in New Mexico counties in which the SAS laws were repealed [8, 9, 19]. Using data from all states, another study finds that removing the SAS laws has at most a small effect on fatal accident rates [6]. The existing literature also focuses on the relationship between the SAS laws and crime. Few counties in Virginia that repealed their laws restricting Sunday sales of spirits experienced an increase in minor crime by 5 percent and alcohol-involved serious crime by 10 percent [4].

In this paper, I analyze the impact of the SAS laws on beer, wine, and spirits consumption for 1990–2007. The SAS laws in the United States are quite complex. During this period, 26 states did not have a SAS law (i.e., allowed Sunday sales of alcohol), 5 states repealed their SAS laws restricting the sales of all types of alcohol, and 12 states retained their SAS law. The remaining 8 states had different policies towards Sunday sales. Most of them allowed beer and wine sales and allowed Sunday sales of spirits at the local level after a certain date. For instance, in Virginia, beer and wine sales on Sundays were legal but spirits sales were not. In 2004, few counties in Virginia started selling spirits on Sundays but in several counties of Virginia, spirits sales on Sundays are still not allowed. My empirical analysis focuses on 5 states repealed their SAS laws restricting the sales of all types of alcohol (treatment group), and 12 states retained their SAS law (control group).

In contrast to the majority of previous studies that focus on a single state and rely on a pre-post comparison of outcome variables, I use data from both treatment and control states and employ a difference-in-differences (DD) estimation technique, which also allows for a comparison between treatment and control states. I also separately examine the change in alcohol consumption patterns for all five states that repealed their SAS laws during 1990–2007. Furthermore, I estimate the effect of the repeals of the SAS laws on beer, wine, and spirits consumption separately. To my best knowledge, none of the existing studies in the literature document the effect of the SAS laws on wine consumption. Finally, few recent

studies that use DD methodology to estimate the effect of the SAS laws use data from all states. There are two main problems with this approach. First, it is not clear whether states that repealed their SAS laws at the local level or that allowed Sunday sales of spirits only (beer and wine were already sold in grocery stores on Sundays in these states) are in the treatment group. Second, in these studies, the estimated impact of the SAS laws can be interpreted as the effect of these laws on treatment states compared with those states that did not change their Sunday alcohol sales policy (control states). However, there is no variation in the SAS law in those states that allowed Sunday sales of alcohol during the analysis period or that retained their SAS law during the same period. Therefore, these studies treat both groups of states as the control group. In this paper, in contrast to these studies, I restrict my sample to 17 states, i.e., 5 treatment states that repealed their SAS laws restricting the sales of all types of alcohol during 1990–2007 and 12 control states that retained their SAS law during the same period. In my analysis, the estimated impact of the SAS laws can be interpreted as the effect of these laws on states that repealed these laws compared with those states that retained their SAS laws.

Methods

Data for state level per capita alcohol consumption in gallons come from the National Institute on Alcohol Abuse and Alcoholism (NIAAA), which compiles annual data on alcohol sales of beer, wine, and spirits for each state in the United States. The NIAAA uses state population estimates for persons ages 14 and older obtained from the U.S. Census Bureau (2010) to calculate the per capita alcohol consumption figures. The treatment group consists of five states which removed their restrictions on Sunday sales of beer, wine, and spirits during 1990–2007. These states are New Mexico, Delaware, Massachusetts, Pennsylvania, and Rhode Island, and are identified through the Alcohol Policy Information System (APIS) of the NIAAA and Stehr [18]. After the repeal of the SAS laws, these states implemented slightly different policies on how alcohol can be purchased on Sundays at off-premise locations. Delaware allows Sunday sales of alcohol from noon to 8 pm at liquor stores only. In New Mexico, Sunday sales of alcohol are allowed from noon to midnight at grocery stores. Massachusetts recently allowed beer and wine to be sold in grocery stores. Sunday sales of alcohol are allowed in this state from noon to 11 pm. Rhode Island allows Sunday sales of alcohol from noon to 6 pm at liquor stores only. Compared with the other treatment states, Pennsylvania has relatively stricter alcohol laws. Alcohol can be purchased from noon to 5 pm on Sundays at state-operated liquor stores. Recently, beer sales in grocery stores were approved in selected Western Pennsylvania locations.

The list of states that retained their SAS laws during 1990–2007 is slightly different in the APIS and Stehr [18]. As a control group, I use 12 states that are common in both sources. These states are Colorado, Connecticut, South Carolina, Georgia, Alabama, Tennessee, Indiana, Illinois, Minnesota, Oklahoma, Nebraska, and Utah. The list of treatment states, date of policy changes, and the list of control states are reported in Table 1.

In order to estimate the impact of repeals of the SAS laws on alcohol consumption, I use panel data and estimate the following model that controls for unobserved state level fixed effects, which are time invariant but can be correlated with alcohol sales:

$$\log(A_{st}) = \beta' X_{st} + \lambda T_{st} + \mu_s + \eta_t + (\text{trend} \times \mu_s) + e_{st}. \quad (1)$$

This panel data model which contains state and time fixed effects is a generalization of simple DD type model with only two time periods, i.e. before and after the policy change [20]. In equation (1), A_{st} represents gallons per capita ethanol (all alcoholic beverages), beer, wine, or spirits consumption in state s at year t . For each A_{st} , I take the natural logarithm and

use it as the dependent variable in my regressions. T_{st} is a binary variable which takes the value of unity for those states that do not impose any restrictions on the sales of alcohol on Sundays at year t , including the year of the repeal and zero otherwise, μ_s is a set of fixed state effects that are time-invariant, η_t is a set of year fixed effects, $trend \times \mu_s$ is state-specific linear time trend, and e_{st} is the normally distributed error term with zero mean and constant variance. Following earlier literature on the effectiveness of alcohol control policies, state-specific linear time trend is constructed by interacting a binary indicator for each state with a time trend that equals one in 1990, two in 1991, and so forth [1]. The coefficient of the treatment variable (λ) is the DD estimate which shows the magnitude of the change in alcohol consumption in the treatment states with respect to the control states that retained their SAS laws once the treatment states remove the restriction on Sunday alcohol sales. Since treatment and control states may have different macroeconomic conditions, the empirical models also control for several state level time-variant variables (X_{st}) including log of income per capita in 2007 dollars, beer tax per gallon in 2007 dollars, percent of individuals with high school, college, and graduate degrees, median age, unemployment rate, percent of individuals who are Hispanic, black, and female, and a dummy variable which controls for the presence of a Blood Alcohol Concentration (BAC) 0.08 law. The data for these variables come from the U.S. Census, National Center for Educational Statistics, Bureau of Labor Statistics, and the APIS. Descriptive statistics for the full sample, control states, and each of the treatment states are reported in Table 2.

A natural limitation of the DD analysis is potential missing variables that may affect alcohol consumption per capita across different states. Although equation (1) controls for several state level characteristics, fixed state and year effects, and state level time trends, if there exists other state level regulations, drinking traditions, and economic factors that are both associated with the introduction of a SAS law and alcohol consumption, then the estimated impact of the SAS law on alcohol consumption may be biased. This is a potential problem especially if SAS laws are introduced due to increased alcohol consumption. Therefore, a common threat to the validity of the empirical analysis is underlying trends in the data. If there was an upward trend in alcohol consumption at the same time as the repeal of Sunday alcohol ban, this would appear as a causal effect of the policy change even if the policy change has no impact on alcohol demand. Figure 1 shows that with the exception of Delaware, alcohol consumption patterns in treatment and control states exhibit similar trends before the policy change. Alcohol consumption patterns in the control states exhibit a smooth trend after the policy change as well. However, in the treatment states, overall alcohol consumption per capita exhibits an increasing trend after the repeal of the SAS law. Furthermore, in Delaware, Rhode Island, and Pennsylvania, the increasing trend in alcohol consumption per capita continues for at least three years after the policy change. I also explicitly address this potential policy endogeneity problem in two ways. First, all empirical models contain dummy variables that control for state and year fixed effects and state-specific linear time trends. If there is an underlying trend in alcohol consumption over time within the states that repeal the SAS laws, these dummy variables should help to capture that trend. Second, following earlier literature [3], under certain model specifications, the set of control variables in Equation (1) contains a lead dummy which is equal to unity for the two years before the repeal of SAS laws. If the coefficient on the treatment variable is just picking up a pre-existing trend in alcohol consumption, then this should be captured by this lead dummy variable.

I also estimate the effect of removing restrictions on Sunday sales on alcohol consumption for each of the treatment states separately. In order to this, I create dummy variables for each treatment state except the particular state that I focus on, and interact these dummy variables with the treatment variable. For instance, in order to estimate the effect of removing restrictions on Sunday sales on alcohol consumption trends in Massachusetts, I generate

dummy variables for the remaining treatment states, i.e., Delaware, Pennsylvania, Rhode Island, and New Mexico, and interact these dummies with the treatment variable. In this model, which contains dummy variables for treatment states and their interactions with the main treatment variable (T_{st}), the coefficient on the treatment variable (λ) is the effect of the legalization of Sunday sales on alcohol consumption in the excluded treatment state, i.e., Massachusetts.

Results

I first estimate the average impact of the legalization of Sunday alcohol sales on alcohol consumption by considering all treatment states as a single treatment group. I estimate Equation (1) with and without the lead dummy and report the results in Table 3. The standard errors are clustered at the state level and are robust to heteroskedasticity. The results show that keeping other variables constant, states that repealed their SAS laws experienced a 2.8 percent increase in per capita demand for alcohol ($p=0.050$). This effect is significant at conventional significance levels but is not robust to the inclusion of the lead term. Although the repeal of SAS laws does not have a significant impact on wine and spirits demand, the law change leads to a 3.9 percent increase in beer sales ($p=0.016$). The increase in beer demand is not robust to the inclusion of the lead term.

The remaining specifications of Table 3 report the effect of the legalization of Sunday sales on alcohol consumption for each treatment state separately. Removing the Sunday alcohol sales ban in Delaware is associated with a 4 ($p=0.004$) to 4.7 ($p=0.021$) percent increase in per capita alcohol demand in this state. The increase in alcohol sales is statistically significant at conventional significance levels and primarily due the increase in demand for beer, which increased by 4.2 ($p=0.009$) to 5.2 ($p=0.024$) percent after the repeal of the SAS law.

Repeal of the SAS law appears to have a limited impact on alcohol consumption in Massachusetts. In particular, this state did not experience a significant change in beer, wine, and spirits demand due to increased alcohol availability on Sundays.

Table 2 shows that alcohol consumption per capita in Pennsylvania increased by 4 to 4.6 percent after the SAS law was repealed ($p<0.001$). After this policy change, beer consumption per capita increased by 6.4 ($p=0.005$) to 7.3 percent ($p=0.000$) and spirits consumption per capita increased by 4 ($p=0.030$) to 4.8 ($p=0.049$) percent. However, the effect of the repeal of the SAS law on wine consumption in Pennsylvania was small and insignificant.

The effect of removing restrictions on Sunday sales of alcohol on overall alcohol demand in Rhode Island was minor and statistically insignificant. Interestingly, the repeal of the SAS law in Rhode Island led to a considerable decrease in wine consumption.

Finally, Table 3 shows that repeal of the SAS law in New Mexico was significantly associated with an increase in overall alcohol consumption. In particular, New Mexico experienced a 6.5 ($p=0.001$) to 7.1 ($p=0.009$) percent increase in per capita demand for alcohol after the SAS law was repealed. This effect is primarily due to the increased beer consumption in this state, which increased by 7.4 ($p=0.002$) to 8.4 ($p=0.029$) percent after the repeal of the SAS law. This result is consistent with those from earlier studies which argue that the repeal in New Mexico led to an increase in traffic fatalities due to the increased alcohol consumption [19].

Discussion

Recently, several states have repealed their laws restricting Sunday sales of alcohol. Although one may expect to observe an increase in alcohol demand in these states due to the increased alcohol availability, legalization of Sunday alcohol sales may not have a significant impact on alcohol demand since individuals may want to adjust their daily alcohol consumption or purchase patterns by drinking or purchasing less on the other days of the week. Therefore, understanding more about the effects of this policy change is important and may help policy makers in shaping future alcohol policies. This paper investigates the effect of the recent repeals of SAS laws in five states, i.e., New Mexico, Delaware, Massachusetts, Pennsylvania, and Rhode Island. Rhode Island and Massachusetts did not experience a significant change in overall alcohol demand after they removed the restrictions on Sunday alcohol sales. The effect of removing restrictions on Sunday sales of alcohol on alcohol demand in Delaware, Pennsylvania, and New Mexico was considerable. Alcohol consumption per capita increased by 4 ($p=0.004$) to 4.7 ($p=0.021$) percent in Delaware after the SAS law was repealed. Pennsylvania experienced a 4 to 4.6 percent increase in per capita alcohol demand after the policy change ($p\leq 0.001$). Similarly, alcohol demand per capita in New Mexico increased by 6.5 ($p=0.001$) to 7.1 ($p=0.009$) percent after the repeal of the SAS law. After the repeal of the SAS laws, treatment states implemented different policies on how alcohol can be purchased on Sundays at off-premise locations. Although the empirical models control for several state level time-variant characteristics including alcohol taxes and certain alcohol control policies, these differences among the treatment states may explain why the repeal of the SAS law increased alcohol demand only in certain states. On the other hand, statistical significance and magnitude of these estimates have important policy implications and show that the main public health concern that increased alcohol availability leads to an increase in alcohol consumption appears to be valid.

The existing literature shows that SAS laws have considerable spillover effects on alcohol consumption related outcomes such as alcohol-related traffic accidents and crime. These spillover effects might be more responsive to changes in Sunday sales of alcohol than even per capita consumption of beer, wine, and spirits. The inherent limitation of this paper is that it focuses only on the direct impact of the SAS laws on per capita alcohol consumption and does not investigate the spillover effects of these laws. Therefore, future research is needed to examine the effects of the SAS laws on alcohol consumption related outcomes.

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Figure 1. Alcohol consumption trends in treatment and control states

Notes: Per capita annual consumption of gallons of all alcoholic beverages including beer, wine, and spirits for treatment and control states 3 years before and after the policy change is plotted. New Mexico repealed its law restricting the sale of alcohol on Sundays in 1995. Delaware, Massachusetts, and Pennsylvania repealed their laws restricting the sale of alcohol on Sundays in 2003. Rhode Island repealed its law restricting the sale of alcohol on Sundays in 2004. The year of the policy change for each treatment state is normalized to 0. For control states, average alcohol consumption trends during the same period are plotted. For instance, per capita annual consumption of gallons of all alcoholic beverages for control states at time 0 is calculated as an average of three years, i.e., 1995, 2003, and 2004.

Table 1

List of treatment and control states

Treatment States	Date of the Policy Change	Control States		
Delaware (DE)	5/15/2003	Alabama (AL)	Indiana (IN)	South Carolina (SC)
Massachusetts (MA)	11/26/2003	Colorado (CO)	Utah (UT)	Tennessee(TN)
Pennsylvania (PA)	2/7/2003	Connecticut (CT)	Minnesota (MN)	
Rhode Island (RI)	7/1/2004	Georgia (GA)	Nebraska (NE)	
New Mexico (NM)	7/1/1995	Illinois (IL)	Oklahoma (OK)	

Notes: State codes are reported in parenthesis. Treatment states include five states that repealed their laws banning Sunday sales of alcoholic beverages for off-premises consumption during 1990–2007. Control states retained their Sunday alcohol sales laws during the same period.

Table 2

Descriptive Statistics

	Full sample	Control states	DE	MA	PA	RI	NM
Per capita beer consumption in gallons	1.215 (0.185)	1.178 (0.185)	1.395 (0.037)	1.122 (0.045)	1.286 (0.063)	1.184 (0.063)	1.519 (0.072)
Per capita wine consumption in gallons	0.283 (0.132)	0.244 (0.109)	0.471 (0.088)	0.508 (0.062)	0.203 (0.026)	0.449 (0.056)	0.256 (0.029)
Per capita spirits consumption in gallons	0.684 (0.175)	0.657 (0.152)	1.070 (0.128)	0.821 (0.053)	0.499 (0.046)	0.724 (0.082)	0.629 (0.041)
Income per capita	33328 (6907)	32696 (6101)	36258 (2849)	42115 (4584)	34357 (2766)	34751 (2861)	26747 (2514)
Unemployment rate	4.870 (1.325)	4.671 (1.234)	4.183 (0.925)	5.300 (1.787)	5.467 (1.032)	5.706 (1.417)	6.083 (1.113)
Median age	34.28 (2.39)	33.88 (2.48)	34.88 (1.44)	35.55 (1.44)	36.93 (1.34)	35.76 (1.32)	33.18 (1.30)
Beer tax per gallon	0.327 (0.246)	0.378 (0.266)	0.202 (0.028)	0.139 (0.019)	0.101 (0.014)	0.127 (0.017)	0.455 (0.094)
Percent female	0.512 (0.007)	0.510 (0.007)	0.512 (0.004)	0.520 (0.000)	0.518 (0.004)	0.520 (0.000)	0.510 (0.000)
Percent black	0.118 (0.091)	0.130 (0.099)	0.194 (0.014)	0.066 (0.007)	0.101 (0.007)	0.055 (0.011)	0.026 (0.003)
Percent Hispanic	0.076 (0.093)	0.056 (0.046)	0.041 (0.015)	0.065 (0.012)	0.030 (0.009)	0.076 (0.024)	0.409 (0.020)
Percent of population with high school degree or more	80.89 (5.31)	81.05 (5.81)	81.87 (2.82)	84.12 (2.64)	80.80 (3.84)	77.29 (3.45)	78.404 (2.18)
Percent of population with college degree or more	24.06 (4.80)	23.52 (4.85)	24.37 (1.78)	32.37 (3.28)	21.79 (2.48)	25.29 (2.75)	22.96 (1.56)
Percent of population with advanced degree or more	8.69 (2.22)	8.16 (2.07)	9.16 (0.91)	13.23 (1.68)	8.17 (1.01)	9.56 (1.20)	9.60 (0.81)
BAC	0.422 (0.495)	0.431 (0.496)	0.222 (0.428)	0.278 (0.461)	0.278 (0.461)	0.444 (0.511)	0.778 (0.428)

Notes: Variable means are reported. Standard deviations are reported in parenthesis. The number of observations for the full sample is 306. The number of observations for the control states is 216. The number of observations for each of the treatment states (DE, MA, PA, RI, and NM) is 18. Income per capita and beer tax per gallon are reported in 2007 prices.

Table 3

The effect of removing the restriction on Sunday alcohol sales on alcohol consumption

	log (Per Capita Consumption in Gallons)							
	All Beverages		Beer		Wine		Spirits	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Aggregate effect	0.028 (0.050) *	0.033 (0.125)	0.039 (0.016) *	0.048 (0.086)	-0.008 (0.860)	-0.051 (0.251)	0.008 (0.552)	0.016 (0.489)
	[4.48]	[2.62]	[7.22]	[3.34]	[0.03]	[1.42]	[0.37]	[0.50]
Decomposition								
DE	0.040 (0.004) **	0.047 (0.021) *	0.042 (0.009) **	0.052 (0.024) *	-0.003 (0.947)	-0.049 (0.342)	0.030 (0.136)	0.039 (0.148)
	[11.32]	[6.50]	[8.95]	[6.19]	[0.00]	[0.96]	[2.47]	[2.31]
MA	-0.006 (0.651)	-0.001 (0.964)	-0.002 (0.903)	0.007 (0.795)	-0.008 (0.821)	-0.050 (0.262)	-0.041 (0.174)	-0.033 (0.318)
	[0.21]	[0.00]	[0.02]	[0.07]	[0.05]	[1.35]	[2.03]	[1.06]
PA	0.040 (0.001) **	0.046 (0.000) **	0.064 (0.005) **	0.073 (0.000) **	-0.004 (0.932)	-0.046 (0.301)	0.040 (0.030) *	0.048 (0.049) *
	[17.34]	[19.64]	[10.49]	[19.61]	[0.01]	[1.14]	[5.68]	[4.54]
RI	-0.014 (0.291)	-0.008 (0.367)	0.005 (0.778)	0.015 (0.285)	-0.157 (0.004) **	-0.200 (0.001) **	-0.017 (0.535)	-0.009 (0.642)
	[1.19]	[0.86]	[0.08]	[1.23]	[11.55]	[14.70]	[0.40]	[0.22]
NM	0.065 (0.001) **	0.071 (0.009) **	0.074 (0.002) **	0.084 (0.029) *	0.107 (0.052) *	0.064 (0.191)	0.017 (0.374)	0.025 (0.264)
	[16.79]	[8.87]	[14.16]	[5.79]	[4.40]	[1.86]	[0.84]	[1.34]
Lead term	No	Yes	No	Yes	No	Yes	No	Yes

Notes: All regressions include state level controls, state and year fixed effects, and state-specific linear time trend. Standard errors are clustered at the state level. F-tests use F distribution with (1, 16) degrees of freedom and are reported in brackets. The resulting P-values are reported in parenthesis. Number of observations in all regressions is 306.

The sign * indicates $p \leq 0.05$.

The sign ** indicates $p \leq 0.01$.