DO CONSUMERS EXPLOIT PRECOMMITMENT OPPORTUNITIES? EVIDENCE
FROM NATURAL EXPERIMENTS INVOLVING LIQUOR CONSUMPTION

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ABSTRACT

This paper provides evidence concerning the extent to which consumers of liquor exhibit a demand
for precommitment devices. One of the most frequently mentioned strategies for exercising self-control
is to limit the availability of a problematic good by not maintaining an easily accessed supply. In a
policy regime with shorter sales hours (either for on-premise or off-premise consumption), this strategy
should be more effective; hence, if the strategy is widely used, alcohol consumption should be lower.
In contrast, without time inconsistency, one would expect liquor consumption to decline with shorter
on-premise sales hours (because of complementarities between liquor and other on-premise activities
such as dining and socializing), but not necessarily with shorter off-premise sales hours (because liquor
is storable at low cost). We examine a collection of natural experiments in which states expanded allowable
Sunday sales hours for liquor. Our results indicate that consumers increase their liquor consumption
in response to extended Sunday on-premise sales hours, but not in response to extended off-premise
sales hours. Thus we find no indication that precommitment strategies affecting availability play meaningful
roles in aggregate liquor consumption. Instead, the observed pattern coincides with predictions for
time-consistent consumers who have rational expectations and low costs of carrying inventories.

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1. Introduction

Over the last twenty years, the concept of time inconsistency has emerged as a central theme in behavioral economics. As is well-known, any consumer sufficiently self-aware to notice her time-inconsistent tendencies will manifest a demand for precommitment technologies. At a minimum, consumers should acquire such self-awareness with respect to frequently repeated activities for which they consistently fail to follow through on prior intentions. Yet oddly, there is surprisingly little evidence that people actually value and exploit precommitment opportunities.[1] A collection of relatively recent papers has begun to fill that gap.[2] Still, nagging doubts persist, partly because much of the evidence is equivocal, and partly because its scope is limited.[3] Skeptics continue to wonder why, if time inconsistency is so prevalent, the free market provides so few precommitment devices, and unambiguous examples in the field are so difficult to find.[4] Indeed, some suggest that the fewness of the obvious exceptions proves the rule.

The consumption of addictive substances is often offered as a leading example of time inconsistency. Becker and Murphy (1988) have shown that a consumer with time-consistent preferences could exhibit many of the choice patterns associated with such substances. However, unlike certain behavioral theories of addiction that envision various forms of time inconsistency, such as quasi-hyperbolic discounting (Gruber and Koszegi, 2001), cue-triggered visceral modes (Bernheim and Rangel, 2004), and temptation preferences (Gul and Pesendorfer, 2007), the Becker-Murphy model does not imply a demand for precommitment. Despite the centrality of this implication, evidence that users of addictive substances actually value precommitment opportunities is almost entirely limited to anecdotes. An important recent exception is Gine, Karlan, and Zinman (2010), who study the use of a commitment device for smoking cessation, but the

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[1] Most of the pertinent literature echoes this evaluation. For example, Gine, Karlan, and Zinman (2010) write that "there is little field evidence on the demand for or effectiveness of such commitment devices." For recent surveys, see Bryan et al. (2010) and DellaVigna (2009).

[2] See in particular Ariely and Wertenbroch (2002) on homework assignments, Ashraf, Karlan, and Yin (2006) on commitment savings devices in the Phillipines, Beshears, Choi, Laibson, and Madrian (2011) on commitment savings devices in the U.S., Houser et al. (2010) for a laboratory experiment in which subjects gain relevant experience, and Kauer, Kramer, and Mullainathan (2011) on incentive schemes.

[3] For example, in Ariely and Wertenbroch's experiment, students may have been motivated by a misguided desire to signal diligence. Likewise, much of the evidence on the demand for commitment savings products in developing countries is potentially attributable to other-control (i.e., family and friends) than to self-control; see, e.g., Dupas and Robinson (2011).

[4] Many common financial products, such as mortgages and retirement accounts, entail precommitments. However, those products offer other advantages, and it is not clear whether their inflexibility increases or reduces demand.

general lessons to be drawn from their experiment are unclear.[5] Without more systematic and extensive evidence, it is impossible to know whether the anecdotes pertain to commonplace or exceptional modes of behavior.

Some evidence from clinical practice actually casts a degree of doubt on the hypothesis that addicts value precommitment opportunities. For example, alcoholics can commit to sobriety by taking disulfiram, a drug that produces an unpleasant reaction to alcohol. However, only *supervised* disulfiram administration is generally recognized as effective; compliance is poor among patients who are given the drug to take on their own (see, e.g., Hughes and Cook, 1997, and Anton, 2001). Whether this pattern reflects the absence of a demand for precommitment or a deficiency of this particular precommitment device remains unclear.[6]

A simple method for exercising self-control is to limit the availability of a problematic good by not maintaining an easily accessed supply. For example, dieters are counseled against keeping fattening foods at home, while smokers and alcoholics who wish to quit or at least control their habits are often given similar advice.[7] We will refer to this self-control technique as the *availability strategy*. Notice that it involves a partial precommitment: while it does not prevent an individual from obtaining the good in question, it restricts future opportunities in a way that makes the targeted behavior less convenient. When enumerating popular precommitment devices, economists regularly cite the use of the availability strategy to control alcohol consumption. According to Schelling (1988), the strategy is to "[r]emove the mischievous resources: don't keep liquor, or sleeping pills, in the house." Likewise, Bryan, Karlan, and Nelson (2010) describe a handful of techniques to illustrate "ad hoc commitment devices," which includes "not keeping alcohol in the house."

In this paper, we look for evidence that consumers actually employ the availability strategy to control their liquor consumption. We exploit a collection of state-level policy changes that

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[5] Subjects were offered the opportunity to post a bond, the principle of which was forfeited to a charity if they failed a urine test after six months. It is not clear whether the relatively low take-up rate (11 percent) indicates a rather small demand for precommitment devices in general or for this device in particular. Also, either generosity or a desire to signal generosity toward the charity may have artificially inflated the take-up rate (particularly inasmuch as two-thirds who participated failed to quit smoking).

[6] Disulfiram does not directly suppress alcohol cravings. Thus, when an alcoholic takes disulfiram, he runs the risk that he will give in to cravings and experience an extremely unpleasant reaction.

[7] Notably, the National Institute on Alcohol Abuse and Alcoholism (a division of the NIH) maintains a website called "Rethinking Drinking," on which it offers "Tips to Try" for those who have not decided to give up alcohol entirely but want to cut down. The NIAAA recommends that "[i]f drinking at home is a problem, keep little or no alcohol there." See http://rethinkingdrinking.niaaa.nih.gov/Strategies/TipsToTry.asp (accessed January 9, 2012). This recommendation is echoed in many other self-help resources.

altered the hours during which consumers can purchase liquor on Sundays (so-called "blue laws"). Someone who attempts to control liquor consumption by keeping no liquor at home will have greater success (at least on Sundays) in a regime with strict blue laws. Thus, under the hypothesis that the availability strategy is prevalent, a relaxation of blue laws should lead to a noticeable increase in liquor consumption. Of course, the same is true for a time-consistent consumer: assuming (plausibly) that liquor is complementary to restaurant meals and socializing at bars, then those who like to dine out and/or socialize on Sundays will consume less liquor in a regime with stringent blue laws. Thus, the mere fact that blue laws reduce liquor consumption – a proposition that already has some support in the literature (see Section 2) – cannot discriminate between the hypotheses of interest. A more discerning test is needed.

A critical feature of our analysis is that it distinguishes between restrictions on *off-premise* liquor sales (through liquor and package stores) and *on-premise* sales (in restaurants and bars).[8] For a practitioner of the availability strategy, *both* types of restrictions make the acquisition of alcohol significantly more difficult when none is kept at home; hence both should reduce liquor consumption. In contrast, time-consistent consumers should respond to off-premise restrictions by carrying "inventories."[9] Liquor consumption among such consumers will be affected by Sunday off-premise sales restrictions only if the costs of carrying inventories are implausibly large. Thus, a model of time-consistent consumption can easily account for the absence of a relationship between liquor consumption and *off-premise* sales restrictions (indeed, we take this to be the most natural implication of such models).

We investigate these issues by examining the effects on annual state-wide liquor purchases of changes in state laws defining allowable Sunday hours for liquor sales. We focus on liquor rather than wine or beer for two reasons: first, sales restrictions are generally simpler and easier to code for liquor than for beer and wine;[10] second, there is evidence that the self-control problems commonly associated with alcohol consumption are most prevalent for liquor (see, for example, Kerr *et al.*, 2002, or Roizen *et al.* 1999). We examine 32 changes in allowable off-

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[8] The precise definitions of off-premise and on-premise sales are set by state licensing laws.

[9] Rational time consistency has a different implication for on-premise sales restrictions because alcohol in bars and restaurants is not storable (consumers cannot hold inventories), and consumes are not completely indifferent with respect to going out on different days of the week.

[10] Laws pertaining to beer and wine sales tended to be more complicated, with many states carving out exemptions that are difficult to code. For example, particularly during the earlier part of our sample, some of these laws distinguished between different types of beer and wine based on alcohol content. In comparison, laws governing the sale of distilled spirits were generally more straightforward.

premise hours and 46 changes in allowable on-premise hours occurring between 1970 and 2007; in 22 of these cases, states changed both limits during the same year. We estimate panel regressions with state fixed effects (to control for unobserved differences in attitudes toward alcohol that may affect both regulations and consumption) and year effects (to control for general trends in liquor consumption over time). Thus, we identify the effects of restrictions on allowable Sunday sales hours by, in effect, comparing the changes over time in liquor purchases for states that modified their regulations to the changes for states that did not. We address some threats to our identification strategy below.

Our central finding is that liquor consumption increases along with allowable on-premise Sunday sales hours, but there is no evidence that it is affected by off-premise Sunday sales hours. These findings are robust with respect to a wide variety of specifications, including ones that control for pre-existing trends and concurrent changes in related restrictions. Thus, to our considerable surprise, we find no indication that the availability strategy plays a meaningful role in aggregate liquor consumption. Instead, the observed pattern coincides with our prediction for time-consistent consumers who have rational expectations and low costs of carrying inventories. Naturally, the possibility remains that liquor purchasers are time-inconsistent, but that they favor some other technique for exercising self-control; for instance, Bernheim, Ray, and Yeltekin (2013) demonstrate that a time-inconsistent decision maker may avoid external commitments because they undermine internal self-control strategies.

In addition to shedding light on the demand for precommitment devices, our analysis also has direct implications for tax policy. Over the last few decades, many states have repealed or relaxed blue laws in an attempt to increase tax revenues. The efficacy of these measures is controversial. For example, a recent article in the *New York Times* cited projections that permitting Sunday sales would increase tax revenues in Georgia, but also referenced unnamed analysts who "are less certain that [this step] will bring in much new money because drinkers are likely simply to shift the days they buy alcohol" (Severson, 2011). Our analysis informs that debate by showing that relaxing restrictions for on-premise sales is likely to increase revenue, but doing so for off-premise sales is not.

2. Relation to the Existing Literature on the Effects of Blue Laws

There is a small but growing literature concerning the effects of blue laws on the consumption of alcohol and alcohol-related behaviors. However, that literature has not explored the implications of those effects regarding time-inconsistency and the demand for precommitment technologies, or estimated the effects in a way that permits one to draw those implications.

Several studies have estimated the impact of blue laws on alcohol consumption. Ornstein and Hanssens (1985) evaluate the effects of several alcohol control measures using a state-level cross-section. They include a dummy variable indicating whether a state allows off-premise Sunday sales and find a positive and statistically significant relationship for beer but an implausible negative (and statistically significant) relationship for liquor. Stehr (2007) uses panel data to estimate the effects of alcohol taxes and Sunday restrictions on off-premise alcohol sales;[11] he finds that liquor consumption increases by 3 to 7 percent when a Sunday off-premise ban is repealed. Carpenter and Eisenberg (2010) provide cross-sectional evidence for Canadian provinces, and study changes in the drinking habits of Ontario residents after that province repealed its Sunday ban on off-premise sales in 1997. Based on survey data, they find an increase in drinking on Sundays coupled with a decline on Saturdays, and "no evidence that these policies affected overall population drinking rates."

Two considerations prevent one from drawing implications concerning the demand for precommitment devices from the aforementioned studies. First, cross-sectional evidence on the effects of blue laws (e.g., Ornstein and Hanssen, 1985, and much of Carpenter and Eisenberg, 2010) is suspect due to the likelihood that unobserved differences in attitudes toward alcohol affect both regulations and consumption. Second, none of these studies explicitly controls for restrictions pertaining to on-premise alcohol sales. In our sample, the correlation between allowable on-premise and off-premise Sunday sales hours is 0.57, and states changed both limits in the same year 22 times, which represents 69% of the changes in allowable off-premise hours, and 48% of the changes in allowable on-premise hours. Thus, the effects measured by the aforementioned studies (whether in cross-sections or panel data) likely reflect the blended impact of off-premise and on-premise restrictions. While this consideration is not especially problematic for their purposes, it is fatal for ours (because we are concerned with the differential impact of off-

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[11] Stehr's paper does not explicitly mention whether the changes he examines pertain to off-premise or on-premise sales. He clarified this issue for us through a personal communication.

premise and on-premise restrictions). The one exception is Carpenter and Eisenberg's analysis of Ontario's 1997 liberalization; as far as we can determine, Ontario did not alter on-premise restrictions on alcohol sales at the same time. However, that evidence is limited to a single policy change; consequently, all statements concerning statistical significance presuppose the absence of any common unobserved shocks to alcohol consumption across Ontario residents.

We also depart from the aforementioned literature by studying the effects of allowable hours rather than outright bans. Information on bans is far more readily available than data on allowable hours. We undertook the time-consuming process of collecting the latter information because it permits us to employ richer characterizations of each state's policies, and because it enables us to study the effects of a much larger set of legislative events.

In principle, one can also draw inferences concerning the effects of blue laws on alcohol consumption indirectly from studies that examine alcohol-related activity – specifically, traffic accidents and crime. McMillan and Lapham (2006) found that repealing the ban on off-premise Sunday alcohol sales in New Mexico led to a 29% increase in alcohol-related traffic accidents and a 42% increase in alcohol-related traffic fatalities. Similarly, Ligon and Thyer (1993) found that a Sunday sales ban on alcohol reduced the incidence of DUIs. Smith (1990) reports on a handful of studies concerning alcohol policy changes in Australia; generally, he finds a positive relationship between increased Sunday alcohol sales and traffic accidents. Olsson and Wikstrom (1982) note that alcohol sales fell by 8% during an experimental period in 1981 when Swedish liquor stores were closed on Saturdays, with accompanying declines in domestic disturbances and arrests for drunkenness; however, they are careful to point out that causality is unclear because the experiment was nationwide. Other recent studies have found much more limited effects. Stehr (2010) examines changes in Sunday off-premise sales bans in a number of states and finds an increase in traffic fatalities only for New Mexico. Using similar data, Lovenheim and Steefel (2010), conclude that "blue laws have little effect on fatal accidents." Finally, a recent paper by Heaton (2012) showed that crime increased somewhat along with the phased introduction of Sunday package liquor sales in Virginia. Like the studies of alcohol consumption mentioned above, these analyses shed limited light on the questions motivating our investigation because they make no explicit attempt to differentiate between the effects of on-premise and off-premise sales, and/or concern single policy changes. One must also exercise caution in drawing conclusions about alcohol consumption from alcohol-related activity; for example, the absence

of a statistically significant effect on traffic accidents or crime would not necessarily imply the absence of a statistically significant effect on consumption.

The current paper is also related to recent work by Hinnosaar (2012), who estimates the effect of a ban on Sunday beer sales indirectly, rather than from studying actual policy changes. Using scanner data on beer purchases, she derives an estimate of the fraction of consumers who have time-inconsistent preferences, and then uses that model to simulate the effects of a Sunday ban under the assumption that those consumers would employ the availability strategy. Her work is complementary to ours, in that we examine actual policy changes and determine whether be-havioral responses are consistent with precommitment behavior.

3. Theoretical Considerations

A simple theoretical model helps to illuminate the circumstances in which people may at-tempt to exercise self-control over off-premises alcohol consumption by limiting readily availa-ble supplies. For simplicity, the model has only three time periods, $t = 0,1,2$. Decisions unfold as follows:

At time 0, the consumer has a convenient opportunity to purchase one unit of alcohol. By "convenient," we mean that he shops at time 0 for other reasons, so that the incremental cost of buying alcohol is limited to its price. For simplicity, no consumption occurs at time 0, but any alcohol purchases are storable.

At time 1, the consumer decides whether or not to drink a unit of alcohol. The immediate benefit of doing so is B. If he has purchased and stored alcohol at time 0, consumption involves no other immediate costs. If he has no supply at home, he can make a separate trip to buy some, but incurs an immediate cost, T, as a result of the inconvenience.

Time 2 represents the future, during which various other costs are incurred. Future costs result from drinking alcohol (which harms health) and spending money (which reduces future consumption). We use H and C to denote the costs associated with the former and the latter, re-spectively. In addition, if the consumer purchased alcohol at time 0 and did not drink it at time 1, he will receive some additional benefit from owning alcohol at time 2. Instead of deriving that value in the context of a full dynamic programming model, we simplify by assuming that the consumer must hold a unit of alcohol at the end of this period.[12] Consequently, if he does not car-

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[12] Once could instead assume that the consumer can sell any stock he owns as of time 2; the results are the same.

ry stock into the period, he must purchase it at the cost C. He does so when shopping for other reasons, so that the inconvenience cost T is avoided.

In terms of objectives, we assume the consumer always maximizes the difference between immediate benefits and costs, plus a factor $\beta \in [0,1]$ times the difference between future benefits and costs. As a result, he is time-inconsistent.[13] However, β matters only at time 1: at time 0, he makes a decision but faces no immediate consequences, while at time 2, he makes no decision. We assume that the value of β applicable at time 1 is realized at the outset of that period, and that its distribution is governed by F, a CDF with support $\left[\underline{\beta}, \overline{\beta}\right]$. We treat β as random on the grounds that severity of self-control problems depends on environmental cues that the consumer may or may not encounter, as in Bernheim and Rangel [2004]. We will assume for the moment that the individual is potentially time-inconsistent with respect to alcohol,[14] which requires $B - C - H < 0$, so that as of time 0 he wishes to avoid drinking at time 1, and $B - \underline{\beta}(C + H) > 0$, so that as of time 1 he may wish to drink at time 1.

Period 1 is the point in time at which sales restrictions on alcohol may apply – in other words, it represents "Sunday." At the outset, we will assume that no such restrictions are in place, and examine the consumer's decisions.

If the consumer holds a unit of alcohol at time 1, he will drink it as long as $B \geq \beta(C + H)$. Consequently, assuming he is sophisticated, his expected utility conditional upon purchasing a unit at time 0, from the perspective of time 0, is:

$$U_P = F\left(\frac{B}{C+H}\right)(B - C - H) - C.$$

In contrast, if he does not hold a unit at time 1, he will purchase one and drink it as long as $B - T \geq \beta(C + H)$. Because he ends up purchasing alcohol at time 2 regardless of whether he consumes at time 1, his expected utility conditional upon not purchasing a unit at time 0, from the perspective of time 0, is:

$$U_{NP} = F\left(\frac{B-T}{C+H}\right)(B - C - H - T) - C.$$

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[13] In particular, he is a quasihyperbolic discounter.

[14] We classify the consumer as potentially time-inconsistent with respect to alcohol if his use of alcohol at time 1 could depend on the timing of his decision (i.e., whether he makes the choice at time 0 or time 1). Conversely, we classify him as time-consistent with respect to alcohol if his use of alcohol at time 1 definitely does not depend on the timing of his decision. Note that $\beta = 1$ is a sufficient condition for time-consistency with respect to alcohol, but it is not a necessary condition.

A sophisticated consumer controls alcohol consumption by keeping no easily accessible supplies iff $U_P \leq U_{NP}$,[15] or equivalently

$$TF\left(\tfrac{B-T}{C+H}\right) \leq \left[F\left(\tfrac{B}{C+H}\right) - F\left(\tfrac{B-T}{C+H}\right)\right](C + H - B).$$

Notice that refraining from purchasing alcohol at time 0 reduces total expected purchases from $1 + F\left(\tfrac{B}{C+H}\right)$ to $1 + F\left(\tfrac{B-T}{C+H}\right)$.

Depending on the values of the model's parameters, a sophisticated consumer may or may not choose to maintain a readily available supply. For instance, if $F\left(\tfrac{B-T}{C+H}\right) = 0$ (but $F\left(\tfrac{B}{C+H}\right) > 0$), so that the absence of readily available supply definitely deters drinking, we necessarily have $U_P < U_{NP}$, which means the consumer buys nothing at time 0. On the other hand, if $F\left(\tfrac{B-T}{C+H}\right) = 1$ (which implies $F\left(\tfrac{B}{C+H}\right) = 1$), the consumer drinks regardless of whether he maintains a supply at home, so $U_P > U_{NP}$; in other words, it is optimal to avoid the costs of inconvenience by stocking up in advance.

Now imagine that a law prevents sales of alcohol at time 1 ("Sunday"). Assuming the consumer stocks up at time 0, his outcome is unchanged: we have $U_P^B = U_P$ (where the superscript B denotes an outcome with a ban). However, if he fails to stock up, he can consume nothing at time 1, and hence his payoff is simply $U_{NP}^B = -C$. Because $B - C - H < 0$, we have $U_P^B < U_{NP}^B$, so he is unambiguously better off purchasing nothing at time 0. Consequently, his expected purchases fall to unity, irrespective of the parameters. Off-premises purchases are lower with the ban because it both expands the use and improves the effectiveness of strategies to impose self-discipline by avoiding ready accessibility.

Similar conclusions follow if the consumer is naïve. Because $B - C - H < 0$, he does not anticipate his desire to consume alcohol at time 1; consequently he is indifferent between stocking up at time 0 and not stocking up (given that he must have a stock of one unit as of time 2). As long as some naïve consumers resolve their indifference in favor of not stocking up at time 0, they will inadvertently employ the availability strategy, which will be more effective with a Sunday ban (i.e., their total purchases will fall from $1 + F\left(\tfrac{B-T}{C+H}\right)$ to 1).[16] Thus, once again, the ban will reduce alcohol purchases.

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[15] For the "iff" statement, we have resolved indifference in favor of no purchase.

[16] In a more elaborate model, naïve consumers might have reason to strictly prefer stocking up either at time 0 or at time 2. As long as some would choose not to stock up at time 0, the same conclusion would follow.

Critically, our conclusion hinges on the assumption that the individual is potentially time-inconsistent with respect to alcohol, so that he uses availability as a self-disciplining device. For if $B - \underline{\beta}(C + H) < 0$, the consumer would purchase no alcohol under any circumstances, and if $B - C - H > 0$, he would always stock up on alcohol at time 0 to avoid the costs of inconvenience. Thus, the degree to which a ban on Sunday off-premise sales reduces overall alcohol consumption provides a gauge of the extent to which consumers are time-inconsistent with respect to alcohol, and are using availability (either intentionally or unintentionally) to exercise self-control.

We have assumed above that a ban on "Sunday" off-premise sales makes alcohol unavailable, or equivalently that it increases the value of T by a large (prohibitive) amount. In fact, consumers may be able to obtain alcohol on Sundays at a higher but non-prohibitive cost by going to a bar or restaurant, in which case a ban effectively increases T by some smaller amount.[17] Strictly speaking, the effect of a small increase in T on total alcohol consumption is theoretically ambiguous: conditional on refraining from purchasing alcohol at time 0, consumption declines (because the effective price rises), but more people could end up purchasing alcohol at time 0 (e.g., if they know they would otherwise likely incur the higher costs of going to a bar). The latter possibility strikes us as rather perverse: it requires that, on the margin, an increase in inconvenience costs starting from T reduces the attractiveness of the availability strategy, even though that strategy is more attractive when those costs are T rather than zero,[18] and more attractive when they are B (i.e., prohibitive) rather than T. Still, in light of this theoretical possibility, we investigate whether the effect of a change in off-premise sales hours differs according to the length of on-premise sales hours as part of our empirical analysis.

Now consider the effects of a change in *on-premise* sales hours. As a first step, suppose the timing of the individual's trips to bars and restaurants is fixed. An important difference between off-premise and on-premise purchases is that alcohol is storable in the former context but not in the latter. Assuming that alcohol is complementary to restaurant meals and/or social inter-

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[17] As is clear from Table 2, off-premises Sunday sales hours are generally shorter than on-premises hours. In principle, a consumer might also obtain alcohol on Sunday from friends. But anyone attempting to control alcohol consumption through the availability strategy would also have an incentive to encourage their friends not to share alcohol with them on Sundays. For those unable to control access through friends, the availability strategy is likely ineffective to begin with.

[18] When inconvenience costs are zero, the consumer's payoff is the same regardless of whether or not he purchases alcohol at time 0. Therefore, he will refrain from purchasing at time 0 when the inconvenience costs are T only if the availability strategy delivers a higher payoff with inconvenience costs of T than with inconvenience costs of zero.

action (so that consumption at home is an imperfect substitute), a partial or complete ban on Sunday sales will unambiguously reduce purchases. Next consider how changes in the timing of trips affect this conclusion. A consumer who is time-consistent with respect to alcohol may shift his trips away from Sundays to avoid the ban. This response will mute the reduction in consumption to some degree, but not entirely, unless he is entirely indifferent as to timing. A sophisticated time-inconsistent consumer with self-control problems may shift his trips to Sundays to take advantage of the ban (i.e., exposing himself to cues that could trigger alcohol consumption only when it is not available). That will magnify the reduction in consumption. Finally, a naïve time-inconsistent consumer with self-control problems will not adjust the timing of his trips, because he expects to refrain from consuming. Thus, regardless of the composition of the population, an abbreviation of on-premise Sunday hours should reduce alcohol purchases.

One limitation of our simple model is that it abstracts from considerations that might cause consumers to respond asymmetrically depending upon whether Sunday sales hours rise or fall. In states where Sunday sales bans have been in place for a long period of time, consumers may tailor their self-control strategies to exploit it, e.g., by making sure not to stock up on liquor before a weekend, or by eating out on Sundays. In contrast, in states where Sunday sales have always been permitted, consumers presumably develop other self-control techniques. Asymmetric responses to changes in Sunday hours are likely because the prevalent self-control strategies probably depend on the historical regime and evolve slowly in response to a change in that regime. Thus, for example, when on-premise Sunday sales are liberalized, alcohol consumption may rise by a larger amount in the short term than in the long term because consumers with self-control problems are in the habit of eating out on Sundays. When evaluating our findings, it is therefore important to bear in mind that states have, in general, progressive liberalized their regulations of Sunday liquor sales.

4. Data

Characterizing the evolution of each state's alcohol sales policies from 1970 through 2007 involved laborious archival research. We began by identifying the most recent statutes for each state. Using the amendment dates listed in the notes of the current statutes, we then searched for the pre-amended statutes, from which we determined the nature of the changes to the alcohol control laws. We collected information on the number of allowable hours for both

on- and off-premises sales as well as the legal drinking age, in all cases noting whether localities were given discretion to set either more or less restrictive rules. We supplemented this information with data compiled by the Distilled Spirits Council of the United States and published in its annual handbooks, which were available for a portion of the pertinent time period.

Stehr (2007) describes the patchwork of state alcohol regulations as Byzantine, but even that term understates their variety and complexity. For instance, some states prohibit the sale of alcohol unless food is also served; others have complicated rules that depend on a county's population. In many instances we found it challenging to characterize these laws along simple measurable dimensions. As a general rule, we measured allowable hours based on the least stringent statewide default rule, even if local jurisdictions were granted and frequently exercised discretion to deviate from the default. In cases where laws provide for contiguous hours of operation after midnight, we associate those hours with the previous day; for example, if a state allows sales from 10am on Saturday to 2am on Sunday but not otherwise on Sunday, we record 16 hours for Saturday and zero hours for Sunday. Several states provide no default and leave the regulation of hours (either on-premises, off-premises, or both) entirely up to local governments; three states did so for part of the period we study. We drop those state-year observations from the sample.[19]

Between 1970 and 2007, fifteen states repealed blue laws banning off-premises liquor sales on Sunday and fourteen states did so for on-premises sales. Including these repeals, twenty-one states increased allowable off-premise Sunday sales hours a total of thirty-four times, while thirty states increased allowable on-premise Sunday sales hours a total of forty-six times. All such changes are listed in Table 1.

Annual state-level data on liquor sales in gallons of pure ethanol equivalent come from the National Institute on Alcohol Abuse and Alcoholism. Using Census Bureau population data; we convert these figures into gallons of pure ethanol per person over the age of 18. Since these data describe sales rather than consumption, our results necessarily encompass effects on cross-border traffic (see, for example, Lovenheim and Slemrod, 2010, on evasion of the legal drinking age).[20] Another limitation of these data is that they are highly aggregated, not only across individuals, but also across off-premise and on-premise sales. While aggregate data suffice for the

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[19] Including these observations with the default set to 24 hours (since, technically, a local govermnent could choose to set those hours) does not affect our results in a meaningful way. Full results provided on request.

[20] Note, however, that we use the terms "sales" and "consumption" interchangeably throughout the paper.

purpose of testing the hypotheses outlined in Section 3, they do not permit us to explore popula-tion heterogeneity with respect to the demand for and use of commitment devices.

To separate cross-border effects from the impact on consumption among a state's resi-dents, we control for differences between the regulations of neighboring states using two sets of variables. The first set is designed to control for the possibility that residents of the border coun-ties of neighboring states travel into a state that has laxer laws than their own. For each state, we compute the number of allowable Sunday sales hours in excess of each of its neighbors (zero if it has shorter hours). We then multiply these excess hours by the number of people living in the border counties of the neighboring state, and sum over all neighbors to obtain the total number of potential person-hours driving inflows of customers (outflows of liquor). Finally, we divide by the original state's population to scale the variable in the same way as our dependent variable. We call the resulting variables OnInflows and OffInflows for on-premise and off-premise hours, respectively. The second set of variables is designed to control for the possibility that the state's residents cross borders to purchase alcohol in other states. For each state, we compute excess Sunday sales hours for each of its neighbors (i.e., the difference between the neighbor's hours and the state's hours, truncated below at zero). We then multiply these excess hours by the num-ber of people living in the border counties of the subject state, and sum over all neighboring states to obtain the total number of potential person-hours driving outflows of customers (inflows of liquor). Again we divide by the subject state's population so that variables reflect comparable scaling. We call these variables OnOutflows and OffOutflows for on-premise and off-premise hours, respectively.[21]

Table 2 shows summary statistics. The mean consumption in our sample is nearly one gallon of ethanol equivalent per adult per year, though there is substantial heterogeneity both within and across states. The unconditional means for on- and off-premises Sunday sales hours are 10.0 and 4.9, respectively; conditional on positive hours, the means are 15.8 hours and 14.0 hours. Per-capita consumption is 5.5 percent higher for observations pertaining to states and years for which Sunday on-premise sales were allowed, compared with those for which such sales were not allowed, and 16 percent higher for observations pertaining to states and years for which Sunday off-premise sales were allowed, compared with those for which such sales were

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[21] These measures are similar to variables used by Stehr (2007), who uses an indicator for a Sunday sales ban instead of the difference in hours of sale.

not allowed. However, these simple comparisons do not account for unobserved cross-state variation in attitudes toward alcohol that likely affect both Sunday sales restrictions and consumption; nor do they account for other alcohol regulations or broader trends.

5. Results

The unit of observation in our analysis is a state-year. For all the specifications reported here, we regress the log of annual per capita ethanol-equivalent liquor sales on our measures of allowable Sunday on-premise and off-premise sales hours, state fixed effects (to capture differences in attitudes toward alcohol across states), year fixed effects (to capture general trends in alcohol consumption, macroeconomic activity, and other time-varying factors), and other controls. Thus, our central identifying assumption is that there are no systematic differences in unobserved factors affecting trends in alcohol consumption between states that do and do not change their policies regarding Sunday liquor sales. We employ standard diagnostics to evaluate the validity of that assumption below. In all cases, the additional controls include variables capturing the legal drinking age, as well as dichotomous variables indicating whether local governments had the authority to expand or restrict the statewide default for Sunday sales hours.[22] Standard errors are clustered at the state level. For brevity, we report coefficients only for key variables that capture aspects of policies targeting alcohol consumption; full results are available on request.

5.1 Main Results

Column (1) of Table 3 reports estimates for a parsimonious specification that includes only the variables listed above. Widening the allowable on-premise Sunday sales window by one hour is associated with a statistically significant 0.78 percent (s.e. = 0.24 percent) increase in sales, while expanding the allowable off-premise Sunday sales window by one hour is associated with a small and statistically insignificant 0.32 percent (s.e. = 0.19 percent) increase in sales. Though the magnitudes are fairly different, these effects are not statistically distinguishable from each other at conventional confidence levels ($p = 0.19$). A local option to expand allowable hours relative to the state default increases sales by 8.1 percent (s.e. = 2.1 percent), and a local option to restrict hours reduces sales by 10.0 percent (s.e. = 3.2 percent). When the legal drinking age is

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[22] Of the fifty-six legislative events that relaxed restrictions on Sunday sales hours (either on- or off-premises), thirteen were accompanied by changes in local governments' discretion to set either more or less restrictive rules.

18 rather than 21, alcohol sales are 6.9 percent (s.e. = 4.3 percent) higher; when the legal age is 19 or 20, the effects are smaller and statistically insignificant.

We experimented with specifications controlling for other time-and-state-varying factors potentially affecting alcohol consumption. For example, in Column (2) we add controls for the state unemployment rate and population over 18. The results are generally similar. The estimated effect of allowable on-premise sales hours drops slightly, from 0.78 percent to 0.77 percent, and remains highly statistically significant, while that of allowable off-premise sales hours falls from 0.32 percent to 0.26 percent, and remains statistically insignificant. The estimated effect of the state unemployment rate is negative and significant (-1.2 percent, s.e. = 0.5 percent). Other specifications, reported in Appendix A, include consumption of beer and wine, as well as allowable sales hours for liquor on other days of the week. The results are not substantially different from those in Table 3.

Column (3) adds our controls for conditions affecting cross-border traffic (in particular, it includes the variables OnInflows, OffInflows, OnOutflows, and OffOutflows). With these controls included, the coefficients of allowable Sunday sales hours measure the effects of that variable assuming neighboring states implement parallel changes, so that there is no change in the person-hour opportunities that drive interstate traffic. The coefficient for allowable on-premise hours rises to 1.16 percent (s.e. = 0.35 percent), and the one for allowable off-premises hours falls to 0.12 percent (s.e. = 0.25 percent). These coefficients are significantly different from each other at $p = 0.06$. The neighboring state controls are jointly significant ($p = 0.01$), with only On-Outflows individually statistically significant, but some of the signs are counterintuitive.

The specification in Column (4) is identical to the one in Column (3), except that we use dichotomous variables indicating whether Sunday on-premise and off-premise sales are allowed, rather than the number of hours. We include this specification primarily because it is more comparable to those in existing papers (see Section 2). According to this specification, eliminating a ban on on-premises sales causes a large and robust increase in sales, while eliminating a ban on off-premises sales causes a smaller and statistically insignificant increase. Taken together, the coefficients are similar in magnitude to those in Stehr (2007).

In Section 3, we observed that the effects of a change in off-premise sales hours on the efficacy of the availability strategy, and hence on alcohol purchases, may differ according to the length of on-premise sales hours. In particular, the implication that those using the availability

strategy should increase off-premise purchases in response to longer off-premise sales hours follows most cleanly when on-premise hours do not exceed off-premise hours. Thus, at least as a matter of principle, our failure to detect a significant effect of off-premise hours could be attributable to the fact that on-premise hours tend to be longer than off-premise hours.[23] To test this possibility, we added an interaction term between on-premise and off-premise hours to the specification. If longer on-premise hours weaken the effect of off-premise hours, the coefficient of the interaction term should be negative.[24] In fact, as shown in Column (5) of Table 3, that coefficient is small, *positive*, and statistically insignificant; moreover, the coefficient of off-premise hours becomes slightly negative. Consequently, we can rule out the possibility that the effect of off-premise hours has been muted by substitution to on-premise consumption.

     5.2 Tests of the Identifying Assumptions

     As mentioned above, our central identifying assumption is that there are no systematic differences in unobserved factors affecting trends in alcohol consumption between states that do and do not change their policies regarding Sunday liquor sales. Thus, a threat to identification arises from the possibility that changes in laws affecting allowable Sunday sales hours were caused by state-specific changes in attitudes toward alcohol that also influenced consumption. For instance, legislators may have responded to increasing consumer demand for alcohol by relaxing restrictions. In that case, the key coefficients in our specifications may be spurious. Based on our reading of the historical record, it appears more likely that liberalizations of sales hours have been driven primarily by orthogonal concerns about tax revenues. Still, the issue merits further investigation.

     We address this issue in several ways. First, we add the one-year leads of allowable on-premise and off-premise Sunday sales hours to specification (3) from Table 3; see Column (1) of Table 4. If the concerns described above are indeed serious, the coefficients of the leads should be relatively large, indicating elevated consumption prior to the change in the law. Yet those coefficients are quite small and statistically insignificant. The addition of the leads leaves the coefficient for allowable on-premises sales hour effectively unchanged, while the coefficient for allowable off-premise sales hours falls to -0.04 percent (s.e. = 0.29 percent). Thus, the small, positive, and statistically insignificant effect of off-premise hours found in other specifications ap-

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[23] Off-premise hours exceeded on-premise hours only in South Dakota.
[24] In making this statement, we invoke the reasonable assumption that the degree of substitution from off-premise to on-premise consumption is limited by the number of on-premise hours.

pears to be entirely an artifact of coincidental trends. Including two leads does not change these results appreciably, as seen in Column (2) of Table 4.

Second, we also estimated specifications including lags of the key policy variables, which could enter with significant coefficients either because of confounding trends, or because liquor sales respond gradually to changes in sales hours. As shown in Column (3) of Table 4, the coefficients of the lags are statistically insignificant, and the effects of interest are largely unchanged. While measurement of a lagged effect does not permit us to distinguish between confounding trends and gradualism, there is no indication that either is important.

Finally, we estimated specifications that included interactions between a linear time trend and two dummy variables, one indicating whether a state ever changed off-premise sales restrictions during the sample period, and the other indicating whether it every changed on-premise restrictions. Results appear in Column (4) of Table 4. The coefficients of the trend variables are small and statistically insignificant, and the main effects of interest remain largely unchanged.

Based on these tests, we find strong support for the central identifying assumption underlying our analysis.

5.3 Potentially Confounding Policy Changes

Another concern is that states may have changed other policies affecting alcohol consumption at the same time they adjusted Sunday sales hours. For example, if legislatures relax Sunday sales restrictions with the aim of increasing tax revenues, they may well raise tax rates simultaneously. Such occurrences would tend to offset any increase in alcohol sales resulting from longer sales hours. To address this concern, we use information on taxes compiled and generously provided by Mark Stehr (see Stehr, 2007). These data are available starting in 1981, so the inclusion of tax variables somewhat reduces our sample size. The impact on our results is minimal, as seen in Column (1) of Table 5. As in Stehr (2007), the coefficients on the tax variable is negative. We also examined specifications including the taxes on wine and beer; our results are similarly unchanged and can be found in Appendix A.

Another possibility is that changes in regulation affecting the sale of liquor may have coincided with similar changes affecting wine and beer.[25] To the extent liquor, wine, and been are

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[25] Separately, we also examined whether Sunday sales hours for wine and beer affected wine and beer consumption. For wine, we obtain the same qualitative pattern as for liquor; however, the on-premise coefficient is not statistically significant (even though it is large economically). For beer, our results are puzzling: the estimated effect of *off-premise* hours is positive, though not significant in the richer specifications, while the *on-premise* effect is roughly

substitutes, such occurrences could potentially confound our results. We examine this possibility by investigating whether the inclusion of hours of sale for wine and beer affect our conclusions; they do not. As seen in Column (2) of Table 5, allowable hours for wine and beer sales have no statistically significant effect on the consumption of liquor, and the coefficients for the hours of sale of liquor are largely unchanged.

To the extent that the consumption of cigarettes and alcohol are related, it is possible that roughly coincident changes in restrictions on smoking affect our results. We added the log of the tax on a pack of cigarettes in Column (3) of Table 5, limiting the sample to 1980-2007 (these data were generously provided by Michael Lovenheim; see Harding, Leibtag, and Lovenheim, 2012). While the measured effect of the cigarette tax on liquor consumption is statistically significant at -0.029 (s.e. = 0.013), our main results are unchanged. We also examine the effect of bar smoking bans in Column (4). The effects of bans are statistically insignificant (-0.005, s.e. = 0.032), and the inclusion of this variable does not affect our main results.

6. Conclusions

Taken as a whole, our results indicate that consumers increase their liquor consumption in response to extended Sunday on-premise sales hours, but not in response to extended off-premise sales hours. While our analysis uncovers no indication that off-premise sales hours affect alcohol purchases, it does not prove that such an effect is absent. As always, it is impossible to reject the hypothesis that an effect is non-zero. Still, in all specifications we fail to reject the hypothesis that the effect is zero (and thus that a demand for precommitment via the availability strategy is absent). Though we obtain small positive point estimates in some specifications, those appear to reflect spurious contaminants; the coefficient of interest is almost literally zero in Column (1) of Table 4, where we have included a proxy variable to capture unobserved factors that might lead to coincidental timing. Most strikingly, we fail to detect an effect of off-premise sales hours even though we easily detect a strong effect for on-premise sales hours. That disparity is at odds with the hypothesis that the demand for precommitment via the availability strategy is prevalent.

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zero. As we noted in the introduction, the results for liquor speak most directly and reliably to the hypotheses of interest because self-control problems are more prevalent for liquor (Kerr *et al*., 2002, and Roizen *et al*. 1999), and because sales restrictions are generally simpler and easier to code for liquor than for beer and wine.

Thus, to our considerable surprise, we find no indication that precommitment strategies affecting availability play meaningful roles in aggregate liquor consumption. Instead, the observed pattern coincides with predictions for time-consistent consumers who have rational expectations and low costs of carrying inventories. Though the aggregated nature of the available data on liquor consumption precludes us from exploring population heterogeneity with respect to the demand for and use of commitment devices, we can nevertheless infer that use of the availability strategy is apparently not widespread. Our findings also have important implications concerning tax policy and public health. Measures that relax restrictions pertaining to on-premise liquor sales are likely to increase state tax revenue, but may also entail greater alcohol-related social costs. However, measures that relax restrictions pertaining to off-premise liquor sales are unlikely to have either effect.

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Table 1: Changes in Hours of Sale

State	Year	On- or Off-Premises	Original Hours	New Hours
Arizona	1986	Both	13	15
Arizona	2004	Both	15	16
Arkansas	1999	Both	0	10
Colorado	1997	On	12	19
Connecticut	1993	On	0	15
District of Columbia	2004	On	17	16
Florida	1972	Both	0	17
Indiana	2004	On	0	10
Iowa	1974	Both	0	10
Iowa	1984	Both	10	14
Iowa	1991	Both	14	18
Kansas	1986	On	0	17
Maine	1976	On	0	13
Maine	1991	Off	0	5
Maine	1993	Off	5	13
Maine	1995	Both	13	16
Massachusetts	2004	Off	0	12
Massachusetts	2004	On	0	13
Michigan	1976	Both	10	12
Michigan	2004	Both	12	14
Missouri	1986	On	0	12
Missouri	1993	Off	0	11
Missouri	1993	On	12	13
Missouri	1994	Off	11	13
Missouri	2001	Both	13	15
Missouri	2004	Both	15	19.5
Montana	1975	Both	13	18
Nebraska	1991	Both	0	13
New Hampshire	1994	Off	14.75	17.75
New Hampshire	1994	On	16	19
New Mexico	1995	Off	0	12
New York	1976	On	14	16
North Carolina	1971	On	10.75	13
North Carolina	1993	On	13	14
North Dakota	1993	Both	0	13
North Dakota	2004	Both	13	14
Ohio	2001	On	11	14
Oregon	2002	Off	0	15
Pennsylvania	1975	On	9	13
Pennsylvania	1984	On	13	15
Pennsylvania	2002	Off	0	5
Rhode Island	2004	Off	0	6
South Dakota	1989	Off	0	17
South Dakota	1991	On	11	13
South Dakota	2004	On	13	15
Texas	1993	On	12	14
Utah	1985	On	12	11
Utah	1993	On	11	12
Utah	2004	On	12	15
Vermont	1973	Off	9	14
Vermont	2001	Off	14	18
Vermont	2001	On	16	18
Virginia	2004	Off	0	11
Washington	1976	On	12	20
West Virginia	1983	On	0	11
West Virginia	1986	On	11	13
West Virginia	2004	On	13	14
Wisconsin	1988	On	17.5	20
Wyoming	1973	Both	7	10
Wyoming	1996	Both	10	20

Table 2: Variable Definitions and Summary Statistics

Variable	Description	Mean	Standard Deviation
Sales	Per-capita distilled spirits sale (gallons of ethanol equivalent)	0.972	0.472
LogSales	Log of ethanol-equivalent sales	-0.111	0.384
AllowSundayOnPremises	1 if the state allows on-premises Sunday sales	0.657	0.475
AllowSundayOffPremises	1 if the state allows off-premises Sunday sales	0.334	0.468
SundayOnHours	Number of on-premises Sunday sales hours	10.0	7.70
SundayOffHours	Number of off-premises Sunday sales hours	4.89	7.25
UnemploymentRate	State-level unemployment rate	5.88	2.01
PopOver18	State population over 18 years of age in millions	3.69	4.16
LegalAge18	1 if the state drinking age is 18 in that year.	0.083	0.272
LegalAge19	1 if the state drinking age is 19 in that year.	0.076	0.258
LegalAge20	1 if the state drinking age is 20 in that year.	0.031	0.162
LegalAge21	1 if the state drinking age is 21 in that year.	0.811	0.389
Expand	Local option to expand on- or off-premises Sunday hours from the default.	0.501	0.500
Restrict	Local option to restrict on- or off-premises Sunday hours from the default.	0.426	0.496
OnInflows	Number of on-premises sale hours in excess of neighbor states, weighted by neighbor state border county population over own state population	2.66	7.74
OffInflows	Number of off-premises sale hours in excess of neighbor states, weighted by neighbor state border county population over own state population	2.08	7.05
OnOutflows	Number of on-premises sale hours less than neighbor states, weighted by own state border county population over own state population	3.21	7.59
OffOutflows	Number of off-premises sale hours less than neighbor states, weighted by own state border county population over own state population	2.71	6.06

This table reports means and standard deviations for 1722 observations across 47 states that had a state default for both on- and off-premises hours of sale for at least one year.

Table 3: Main Results

Variable	(1)	(2)	(3)	(4)	(5)
SundayOnHours	0.0078** (0.0024)	0.0077** (0.0026)	0.0116** (0.0035)	-	0.0114** (0.0036)
SundayOffHours	0.0032 (0.0019)	0.0026 (0.0020)	0.0012 (0.0025)	-	-0.0010 (0.0036)
AllowsSundayOn	-	-	-	0.105** (0.0450)	-
AllowsSundayOff	-	-	-	0.0423 (0.0457)	-
SundayOnHours x SundayOffHours	-	-	-	-	0.0001 (0.0002)
LegalAge18	0.0689 (0.0434)	0.0743** (0.0428)	0.0482 (0.0397)	0.0438 (0.0401)	0.0438 (0.0401)
LegalAge19	-0.0002 (0.0251)	0.0067 (0.0244)	-0.0057 (0.0235)	-0.0120 (0.0251)	-0.0120 (0.0251)
LegalAge20	-0.0331 (0.0293)	-0.0295 (0.0241)	-0.0381 (0.0226)	-0.0382 (0.0219)	-0.0382 (0.0219)
Expand	0.0814** (0.0210)	0.0800** (0.0224)	0.0483** (0.0218)	0.0540** (0.0251)	0.0540** (0.0251)
Restrict	-0.101** (0.0418)	-0.101** (0.0272)	-0.0640** (0.0232)	-0.0603** (0.0216)	-0.0603** (0.0216)
Unemployment Rate and Population		X	X	X	X
Neighboring State Controls			X	X	X
N	1722	1722	1722	1722	1722

Coefficients are reported from an OLS model with the log of per-capita alcohol sales as the dependent variable. Each regression also includes state and year fixed effects. Standard errors clustered at the state level are in parentheses; those significant at the 10% level are marked with * and those significant at the 5% level are marked with **.

Table 4: Tests of the Identifying Assumptions

Variable	(1)	(2)	(3)	(4)
SundayOnHours	0.0106** (0.0034)	0.0100** (0.0033)	0.0092** (0.0030)	0.0115** (0.0041)
SundayOffHours	-0.0002 (0.0029)	0.0004 (0.0027)	0.0021 (0.0026)	0.0009 (0.0030)
SundayOnHours – Lead	0.0006 (0.0021)	-0.0009 (0.0018)	-	-
SundayOffHours – Lead	0.0019 (0.0022)	-0.0002 (0.0016)	-	-
SundayOnHours – Two Leads	-	0.0017 (0.0024)	-	-
SundayOffHours – Two Leads	-	0.0022 (0.0026)	-	-
SundayOnHours – Lag	-	-	9.65×10^{-5} (0.0007)	-
SundayOffHours – Lag	-	-	-0.0008 (0.0008)	-
SundayOnHours – Two Lags	-	-	0.0033 (0.0023)	-
SundayOffHours – Two Lags	-	-	-0.0003 (0.0020)	-
EverOnChange x Trend	-	-	-	1.40×10^{-6} (0.0021)
EverOffChange x Trend	-	-	-	0.0004 (0.0020)
N	1675	1628	1628	1722

Coefficients are reported from an OLS model with the log of per-capita alcohol sales as the dependent variable. Each regression also includes a set of indicators for the state's legal drinking age, indicators for whether local jurisdictions can expand or restrict hours of sale, unemployment rate, population, neighboring state controls, and state and year fixed effects. Standard errors clustered at the state level are in parentheses; those significant at the 10% level are marked with * and those significant at the 5% level are marked with **.

Table 5: Potentially Confounding Policy Changes

Variable	(1)	(2)	(3)	(4)
SundayOnHours	0.0103** (0.0029)	0.0134** (0.0046)	0.0092** (0.0028)	0.0115** (0.0035)
SundayOffHours	0.0011 (0.0025)	0.0040 (0.0041)	0.0014 (0.0024)	0.0012 (0.0025)
Liquor Tax (log of real dollars per gallon)	-0.0380** (0.0179)	-	-	-
SundayBeerOnHours	-	0.0061 (0.0086)	-	-
SundayBeerOffHours	-	0.0041 (0.0059)	-	-
SundayWineOnHours	-	-0.0078 (0.0087)	-	-
SundayWineOffHours	-	-0.0061 (0.0065)	-	-
Cigarette Tax	-	-	-0.0286** (0.0126)	-
Ban on Smoking in Bars	-	-	-	-0.0049 (0.0323)
N	1219	1722	1241	1722

Coefficients are reported from an OLS model with the log of per-capita alcohol sales as the dependent variable. Each regression also includes a set of indicators for the state's legal drinking age, indicators for whether local jurisdictions can expand or restrict hours of sale, unemployment rate, population, neighboring state controls, and state and year fixed effects. Standard errors clustered at the state level are in parentheses; those significant at the 10% level are marked with * and those significant at the 5% level are marked with **.

Appendix A: Additional Specifications

Variable	(1)	(2)	(3)
SundayOnHours	0.0110** (0.0031)	0.0144** (0.0041)	0.0103** (0.0029)
SundayOffHours	0.0004 (0.0025)	-0.0011 (0.0024)	0.0011 (0.0025)
Log of Beer Consumption	0.281** (0.0844)	-	-
Log of Wine Consumption	0.113** (0.0393)	-	-
NonSundayAverageOnHours	-	0.0073 (0.0072)	-
NonSundayAverageOffHours	-	-0.0099 (0.0076)	-
Liquor Tax (log of real dollars per gallon)	-	-	-0.0370** (0.0174)
Wine Tax (log of real dollars per gallon)	-	-	-0.0030 (0.0208)
Beer Tax (log of real dollars per gallon)	-	-	-0.0058 (0.0768)
N	1722	1488	1219

Coefficients are reported from an OLS model with the log of per-capita alcohol sales as the dependent variable. Each regression also includes a set of indicators for the state's legal drinking age, indicators for whether local juris-dictions can expand or restrict hours of sale, unemployment rate, population, neighboring state controls, and state and year fixed effects. Standard errors clustered at the state level are in parentheses; those significant at the 10% level are marked with * and those significant at the 5% level are marked with **.