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PRECOMMITMENT OPPORTUNITIES?**

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EXPERIMENTS INVOLVING
LIQUOR CONSUMPTION**

B. Douglas Bernheim,
Jonathan Meer and Neva K. Novarro

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**Do Consumers Exploit Precommitment Opportunities?
Evidence from Natural Experiments Involving Liquor Consumption**

B. Douglas Bernheim
Stanford University and
National Bureau of Economic Research

Jonathan Meer
Texas A&M University

Neva K. Novarro
Pomona College

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Abstract

The object of this paper is to provide 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 and the experience is repeated with high frequency). 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.

B. Douglas Bernheim
Department of Economics
Stanford University
Stanford, CA 94305
bernheim@stanford.edu

Jonathan Meer
Department of Economics
Texas A&M University
College Station, TX 77843
jmeer@econmail.tamu.edu

Neva K. Navarro
Department of Economics
Pomona College
Claremont, CA 91711
nnavarro@gmail.com

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

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) rather 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

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 they fail to learn the distribution of their Sunday liquor demand despite weekly experience, or if the costs of carrying inventories are 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, we were able to obtain more accurate and complete information on laws affecting liquor sales; second, we suspect that the self-control problems commonly associated with alcohol consumption are most prevalent for liquor. We examine 32 changes in allowable off-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 differ-

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 and consumers cannot hold inventories.

ences 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. 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. If liquor purchasers are time-inconsistent, then either they are naïve (which strikes us as implausible in light of the fact that the scenario is repeated weekly), or they favor some other technique for exercising self-control. The latter possibility is consistent with the hypothesis (formulated theoretically by Bernheim, Ray, and Yeltekin, 2011) 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 effect 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;¹⁰ 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-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.

¹⁰ 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.

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.

3. 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.¹¹

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,

¹¹ Including these observations with the default set to 24 hours (since, technically, a local government could choose to set those hours) does not affect our results in a meaningful way. Full results provided on request.

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).¹²

To separate cross-border effects from the impact on consumption among a state's residents, 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 counties 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 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 number 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 are variables reflect comparable scaling. We call these variables *OnOutflows* and *OffOutflows* for on-premise and off-premise hours, respectively.¹³

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

¹² Note, however, that we use the terms "sales" and "consumption" interchangeably throughout the paper.

¹³ 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.

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 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.

4. Results

The unit of observation in our analysis is a state-year pair. 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.¹⁴ 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.¹⁵ Standard errors are clustered at the state level. Our main results appear in Table 3. For brevity, we report coefficients only for key variables that capture aspects of policies targeting alcohol consumption; full results are available on request.

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.¹⁶ 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

¹⁴ We also estimated specifications using dichotomous indicators for bans on Sunday sales (one for on-premise sales and one for off-premise sales) rather than sales hours. According to those estimates, 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 in sales. Taken together, the coefficients are similar in magnitude to those in Stehr (2007). Those results are available on request.

¹⁵ 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.

¹⁶ When we add an interaction between the two hours-of-sales variables, the associated coefficient is extremely small and statistically insignificant (0.0001, s.e. = 0.0002).

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 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 effects.

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 (not reported here but available on request) included variables measuring a state's religious composition, political affiliation of the state executive and legislature, measures of state income, sales of beer and wine, and allowable sales hours for liquor on Saturdays, Fridays, and other weekdays.¹⁷ The results are not substantially different from those reported 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 1.17 percent (s.e. = 0.27 percent), and the one for allowable off-premises hours falls to 0.11 percent (s.e. = 0.26 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 OnOutflows individually statistically significant, but some of the signs are counterintuitive.

An important threat to identification is 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

¹⁷ Allowable hours on other days of the week tend to be highly collinear, so we included the total number of allowable sales hours for days other than Sundays. Far fewer legislative events impacted these variables; for example, there were only sixteen changes to allowable on-premise weekday sales hours. In a specification otherwise resembling the one estimated in Column (3) of Table 3, the coefficient of allowable off-premise non-Sunday sales hours was -0.0022, while the coefficient of allowable on-premise non-Sunday sales hours was 0.0021. Both coefficients were close to statistically significant at the 10 percent confidence level. Neither the magnitude nor the significance of the coefficients for the Sunday sales hour variables were greatly affected by the inclusion of these additional controls.

consumer demand for alcohol by relaxing restrictions. In that case, the key coefficients in our specifications may be spurious. We address this issue by including the one-year leads of allowable on-premise and off-premise Sunday sales hours. 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, as shown in Column (4), 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 appears to be entirely an artifact of coincidental trends. Including either two or three leads (as opposed to just one) does not change these results appreciably.¹⁸ We therefore conclude that our findings are likely not attributable to other causal mechanisms (such as reverse causation or common causal factors).

A notable omission from our basic specification is a control for alcohol tax rates. If legislatures relax Sunday sales restrictions with the aim of increasing tax revenues, they may well raise tax rates at the same time. Such measures would tend to offset any increase in alcohol sales resulting from longer sales hours. To address this concern, we use information on tax rates 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. For instance, adding the total federal and state tax rate to the specification in Column (3) changes the coefficient for off-premise Sunday hours from 0.0019 (s.e. = 0.0025) to 0.0018 (s.e. = 0.0025), and the coefficient for on-premises Sunday hours from 0.0093 (s.e. = 0.0030) to 0.0082 (s.e. = 0.0030).¹⁹ Similar results hold for other specifications. As in Stehr (2007), the coefficients of the tax variables are all negative. Full results are available on request.

A final possibility worth considering is that the efficacy of the availability strategy is determined only by the *maximum* of off-premise and on-premise sales hours (the idea being that a consumer who finds herself without alcohol can go either to a liquor store or to a bar). We do not find that view especially plausible: purchasing liquor at bars and restaurants involves considera-

¹⁸ We also added lags of the key policy variables to evaluate how quickly liquor sales adapt to changes in the laws. The associated coefficients are negligible and statistically insignificant, indicating that consumers respond quickly to changes in state alcohol regulations.

¹⁹ For the comparison reported here, we re-estimate the specification in Column (3) of Table (2) excluding all data prior to 1981, so that the sample period does not change when we add the tax variables. That is why the coefficients reported in the text for the specification without tax variables differ slightly from those reported in Table 3.

bly greater expense than doing so at liquor and package stores, and narrowly restricts the context for consumption. Still, we investigate this possibility by adding a control for the excess of off-premise hours over on-premise hours. Unfortunately, restrictions on sales hours tend to be more permissive for on-premise sales than for off-premise sales, and as a result off-premise hours exceed on-premise hours for only 19 state-year observations. Nevertheless, the coefficient of the pertinent variable in a specification that otherwise resembles the one in Column 3 of Table 3 is negative and statistically significant. While we take this result with a grain of salt given the small number of relevant observations, there is certainly no indication that longer off-premise sales hours stimulate liquor consumption when they exceed on-premise hours.

While our analysis uncovers no indication that off-premise sales hours affect purchases of alcohol, 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 (4) of Table 3, where we have included a proxy variable to capture unobserved factors that might lead to coincidental timing. Most strikingly, we fail to detect a significant effect for off-premise sales hours even though we easily detect a strong effect for on-premise hours. That disparity is at odds with the hypothesis that the demand for precommitment via the availability strategy is prevalent.

5. Conclusions

Taken as a whole, our results indicate that consumers increase their liquor consumption in response to extended Sunday on-premise sales hours, but fail to establish that a similar pattern holds for off-premise hours. Thus, to our considerable surprise, we find no evidence 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. 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)
SundayOnHours	0.0078** (0.0024)	0.0077** (0.0026)	0.0117** (0.0027)	0.0106** (0.0034)
SundayOffHours	0.0032 (0.0019)	0.0026 (0.0020)	0.0011 (0.0026)	-0.0004 (0.0029)
SundayOnHours – Lead	-	-	-	0.0007 (0.0021)
SundayOffHours – Lead	-	-	-	0.0019 (0.0022)
LegalAge18	0.0690 (0.0434)	0.0744** (0.0428)	0.0484 (0.0397)	0.0462 (0.0388)
LegalAge19	-0.0001 (0.0251)	0.0067 (0.0244)	-0.0055 (0.0235)	-0.0050 (0.0233)
LegalAge20	-0.0331 (0.0293)	-0.0295 (0.0241)	-0.0382 (0.0226)	-0.0370 (0.0220)
Expand	0.0815** (0.0210)	0.0801** (0.0224)	0.0490** (0.0218)	0.0508** (0.0207)
Restrict	-0.101** (0.0418)	-0.102** (0.0272)	-0.0651** (0.0233)	-0.0628** (0.0232)
Unemployment Rate and Population		X	X	X
Neighboring State Controls			X	X
N	1722	1722	1722	1675

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 **.