Alcohol Ban and Crime: The ABC's of the Bihar Prohibition

Kalyani Chaudhuri * Natasha Jha † Mrithyunjayan Nilayamgode ‡
Revathy Suryanarayana §
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Abstract

While alcohol regulation policies may help control crime, the effects of such policies are highly dynamic and may be difficult to understand using the annual crime data normally available in developing countries. Using district-level monthly crime data and a difference-in-differences research design, we study a total alcohol prohibition in the Indian state of Bihar. We find that the prohibition led to a 0.21 standard deviation reduction in the incidence of violent crimes but had no significant impact on non-violent crimes. These results illustrate the idea that intoxication reduces risk aversion, thereby increasing the probability of committing a violent crime. Our results are concentrated in areas where the ban may have had a larger impact, due to either higher alcoholism at the baseline or where the ban may be easier to implement. They are also robust to a number of alternate specifications, including the use of a synthetic control group.

*kalchau@ucdavis.edu
†nj279@cornell.edu
‡mn4yk@virginia.edu
§rs2452@cornell.edu

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1 Introduction

Criminal violence imposes large costs on society, a large part of which may even go unnoticed. For example, the United States spent $179 billion in 2007 on policing, judicial activities, and corrections in addition to $15 billion in direct losses to the victims of crime (McCollister et al., 2010). Violent crimes such as murder, rape, and robbery alone resulted in a social cost of more than $42 billion in the US in 2010 (Shapiro and Hassett, 2012). Apart from inflicting personal harm, violent crimes are found to discourage education, increase capital flight, and lower social cohesion (Higginson et al., 2015). These costs are expected to be magnified in developing countries, given their weaker legal and judicial institutions. Characteristics such as widespread poverty, unemployment, and income inequality have significantly contributed to an increase in the incidence of violent crime, especially homicide and domestic violence, in developing societies (Fajnzylber et al., 2002). In this context, we need to study the channels that directly or indirectly affect crime and evaluate the efficiency of policies that have the potential to reduce crime.

The literature has documented a strong positive correlation between alcohol consumption and crime (Weatherburn et al., 2001). Economists have found that excess alcohol consumption can lead to an increase in nuisance crimes such as public drunkenness, and disorderly conduct (Carpenter, 2007). Alcohol regulation policies such as increasing the Minimum Legal Drinking Age (MLDA) were found to decrease the incidence of crimes like Driving Under the Influence, assaults, and robberies (Carpenter and Dobkin, 2010). The psychology literature posits that alcohol could spur criminal activity by impairing perception and inducing a present bias (Steele and Josephs, 1990), and increasing aggression and hostility in individuals (Zhang et al., 1997).

Correspondingly, alcohol regulation policies have historically been associated with a reduction in crime. The most notable such experiment was the 13-year-long US prohibition (1920-33), which resulted in lower levels of alcohol-related crimes such as public drunkenness

and disorderly conduct (Dills et al., 2005) (Miron, 1999). In developing countries, alcohol prohibition was found to reduce domestic violence and crimes against women (Luca et al., 2015; Khurana and Mahajan, 2018). This evidence further motivates us to study the effect of alcohol regulation on crime.

Alcohol regulation policy may interact with crime through multiple channels. If these policies reduce alcohol consumption, then lower tendencies of impulsivity, aggression, and hostility could directly reduce crime[1]. On the other hand, alcohol regulation is often accompanied by major changes in police activity. This channel could push reported crime in either direction, since stricter policing might discourage criminal behaviour, but a greater police presence might also lead to higher reporting of crime. If a large fraction of the police capacity is deployed to enforce the prohibition, criminals may switch to relatively unpoliced activites. Further, the ban may lead to an increase in organized crime through the creation of an underground economy (Thornton, 1991).

The effect of the policy may also be limited by the existence or creation of alternate intoxicants such as narcotics and other addictive substances. Alcohol consumption may also differentially affect different kinds of crime. On the one hand, alcohol myopia and the loss of judgment might increase the likelihood of committing a violent crime or a crime of passion. On the other hand, the impairment of cognitive abilities as a result of intoxication may make it harder to execute a crime that requires planning or skill. However, insofar as these categories are not entirely disjoint, a priori the differential effect of prohibition on violent and non-violent crimes is unclear.

This paper tests the relationship between alcohol prohibition and crime in the context of a state-wide total prohibition in Bihar, India. The state government prohibited the manufacture, transport, sale, and consumption of alcohol throughout the state in April 2016. The policy was enacted roughly six months after the state elections, which insulates its effects from the institutional changes brought about by the presence of a new government.

[1]At the same time, alcohol regulation policies such as the MLDA were found to induce evasion of local alcohol policies leading to more traffic fatalities in border areas (Lovenheim and Slemrod, 2010).

Furthermore, the government did not enact any contemporaneous state-wide policies that may have affected crime, offering an appropriate setting to study the impact of alcohol regulation on crime.

We use crime data obtained from Bihar Police to study the impact of the ban on violent and non-violent crimes. We employ a differences-in-differences strategy to estimate the effect of prohibition on crime in Bihar using the neigbouring state of Jharkhand as a control group[2] (Muralidharan and Prakash, 2017). We have data on eight different crime categories, which we classify into violent and non-violent crimes, using the definition provided by the National Crime Records Bureau. As per this definition, murder, rape, kidnapping, dacoity, robbery, and riots constitute violent crimes, whereas burglary and theft constitute non-violent crimes. To illustrate that the effects are largely driven through the channel of alcohol availability, we test for a differential impact of the ban in the border districts vis-a-vis the non-border districts of Bihar, as well as a heterogeneity analysis using baseline alcohol consumption in Bihar. To account for any spillover effects that may exist in the border districts, we also estimate the difference in the impact of the ban in the non-border districts of Bihar compared to districts of Jharkhand that do not share a border with Bihar. We also employ the synthetic control method (Abadie and Gardeazabal, 2003) as an additional check to test the robustness of our results.

Our results indicate that the incidence of violent crimes in Bihar declined ($-0.21, p < 0.1$) during the post-ban period, while the incidence of non-violent crimes remained largely unchanged ($-0.068, p > 0.1$). The reduction in crime was larger in the interior districts of Bihar and in districts with higher baseline alcohol consumption. These findings do not change qualitatively when we employ the synthetic control method. Lastly, we find that the decline persists six quarters into the ban, suggesting that the effect of the prohibition may not be short-lived.

The empirical strategies we use in the paper allow us to overcome a number of identifica-

[2]Jharkhand was split from Bihar to form a new state in 2000, and due to its shared history and geographical proximity, the state is a good control group.

tion issues associated with estimating the effect of alcohol regulation on crime. First, the ban is as an exogenous shock to the supply of alcohol in Bihar. Since there was no such supply shock in the control state of Jharkhand, we are able to provide conclusive evidence on the effect of the ban on crime and mitigate concerns of endogeneity. Another concern lies in the identification of the channel through which the policy might affect crime. While an alcohol regulation policy reduces the overall supply of alcohol in the state, there could be a number of other factors such as policing that could also affect crime rates in the state. We employ several heterogeneity tests to arrive at the conclusion that it is the regulation of alcohol and subsequent lower consumption that impacted crimes in the state. First, we find that the ban had a stronger impact in those districts of Bihar with higher baseline alcohol consumption before the ban. Second, we isolate the direct effect of the ban on crime from any spillover effects by comparing the effects of the ban in border and interior districts of Bihar and by comparing the effects of the ban in the interior districts of Bihar and Jharkhand.

Our findings have policy relevance in light of a number of Indian states (Andhra Pradesh, Kerala, Madhya Pradesh) also exploring alcohol bans [3]. Further, Bihar has also experimented with prohibition in the past, only to repeal it within a year because of rising corruption and bootlegging [4]. The effectiveness of the ban in fighting violence and crime in the state and the social savings or benefits accruing from such a reduction lend support to the worth of continuing to implement it despite the heavy financial costs it imposes on the government.

Prohibition is relatively understudied as an alcohol regulation policy in the context of developing countries. Moreover, the impact of this policy may be different today from what it was a hundred years ago during the US Prohibition. To our knowledge, this paper offers the first empirical analysis to study the possible impact of a large-scale alcohol ban on a wide portfolio of crimes. We are also able to distinguish between the impact of the ban on violent and non-violent crimes, which adds to the literature on the impact of alcohol on violence.

[3] https://www.thehindu.com/todays-paper/tp-opinion/of-populism-and-prohibition/article8495922.ece

[4] https://www.telegraphindia.com/1160331/jsp/bihar/story_77310.jsp

Finally, we also evaluate the persistence of these effects six quarters into its implementation.

2 Context: Alcohol Consumption and Political Background in Bihar

In India, alcohol regulation laws are made and implemented at the state level[5]. The alcohol ban in Bihar was implemented through the Bihar Prohibition and Excise Act that came into effect on April 1, 2016. The Act states that "no person shall manufacture, bottle, distribute, transport, collect, store, possess, purchase, sell or consume any intoxicant or liquor".

The alcohol prohibition was an electoral promise by Nitish Kumar, the current chief minister of Bihar, who had pledged to purge alcoholism from the state while campaigning for the 2015 assembly elections. This was in response to repeated complaints of domestic violence and a demand for prohibition by women voters[6]. Bihar is also notorious for its high incidence of crime, reporting 10.4% of all violent crimes in India (NCRB, 2016) against only 8.5% of the national population. At the same time, the state ranks sixth among all Indian states in alcohol consumption, with a per-capita annual consumption of 14.7 litres (NSSO 2011-12). Reports also suggest that there was a higher turnout among women voters during this election[7].

There are strict penal provisions in place for any violation of the Act. For example, the manufacturers and suppliers of illicit liquor will be awarded the death penalty for any death reported as a result of consuming spurious liquor ('death for death'). Even drinking in public spaces is punishable by a jail term of 5-10 years and a fine of up to Rs 10 lakhs; drinking at home and creating a nuisance may attract a sentence ranging from 10 years to life in

[5]Excise duties and taxes on liquor for human consumption are classified as items under the 'State List' as per the Indian constitution.

[6]The Indian Express quotes Kumar after he won the assembly elections in November 2015, "My government is committed to fulfilling promises made to women during the election campaign. There was a surge of complaints from women about male members of the family resorting to drinking and creating nuisance, which also affected the education of their children. Though the excise department can earn Rs. 4,000 cr per year (from liquor sale), we have to think in terms of public interest and take this decision" (Singh, 2015)

[7]https://www.ndtv.com/bihar/women-outvote-men-in-bihar-what-it-means-1240553

jail. People are encouraged to report cases of drinking and nuisance to the police through a toll-free number painted on walls across the city (Singh, 2016a).

Further, anectodal evidence suggests that the government did not leave any stone unturned in enforcing the Act – liquor manufacturers recently alleged in the Supreme Court that stocks of alcoholic beverages worth Rs. 5 crore were destroyed by the Bihar government in a 'vindictive and arbitrary manner' (PTI, 2017). Reports also suggest that the ban was strictly enforced in terms of preventive measures against cross-border smuggling of liquor[8].

3 Empirical Analysis

3.1 Data

The primary source of data for our analysis is district-level monthly crime data collected by the Bihar state police department. We use data for 14 different crime categories for the time period 2003-2017. For our differences-in-differences analysis, we use the neighbouring state of Jharkhand as a control group[9]. The Jharkhand Police also publishes data in a manner similar to that of the Bihar Police. Consistent with the crime data organization in Bihar, we match eight different crime categories (burglary, dacoity, kidnapping, murder, rape, riot, robbery and theft) for the period starting January 2013. We standardize all crime numbers with respect to Jharkhand for each crime category. We then classify each crime type as either violent or non-violent crime drawing on the definitions provided in the National Crime Records Bureau. As per this definition, murder, rape, kidnapping, dacoity, robbery, and riots constitute violent crimes, whereas burglary and theft constitute non-violent crimes.

As stated previously, we use the state of Jharkhand as a control group for the differences-in-differences analysis. Traditionally, the districts of what is now Jharkhand were part of the relatively under-developed southern region of Bihar. However, after a fifty-year struggle

[8]The chief minister said, "We have put in place a system of digital locks for liquor containers travelling through Bihar. Such locks can be opened only after (these) vehicles cross Bihar. We have already spoken to neighbouring states' police chiefs" (Singh, 2016a)

[9]Jharkhand has been used as a suitable control for Bihar by previous studies in India (Muralidharan and Prakash, 2017)

by the tribal population of Bihar, the Parliament of India passed the Bihar Reorganisation Bill on August 2, 2000 to carve out 18 districts of Bihar to create the state of Jharkhand. Apart from the shared history, Bihar and Jharkhand also have similar patterns of alcohol consumption. As per the 2011-2012 round of the NSSO, per capita weekly consumption of toddy and country liquor is 266ml in Bihar and 320 ml in Jharkhand. Similarly, Bihar consumes 17 ml of imported alcohol, beer, and wine weekly per capita, while Jharkhand consumes 14 ml.

Crime rates in both states have also followed similar trends. The incidence of cognizable crime (per 1000 population) in 2015 was 171.6 in Bihar and 135.1 in Jharkhand. At the same time, the proportion of violent crimes to total cognizable crime in Bihar and Jharkhand was 20.2 and 18.9 percent respectively (NCRB, 2015). This suggests that the proportion of violent crime in both states was similar before the alcohol ban in Bihar. Furthermore, when the ban was introduced in Bihar in April 2016, there was no such parallel ban by the ruling party in Jharkhand. Due to these reasons, we choose Jharkhand as our control group to identify the effects of the alcohol ban on crime. We obtain data for all crime categories from January 2013 to September 2017 for all 24 districts in Jharkhand and merge this with the Bihar crime data to obtain the panel for the differences-in-differences model.

We use the fourth round of the National Family Health Survey (2015-16) to construct a measure of pre-ban alcohol consumption for the districts in Bihar. NFHS is conducted roughly every ten years in a representative sample of households across the states of India. The survey collects information on various demographic and health characteristics including fertility, mortality, maternal and child health outcomes. It also asks the respondents about their alcohol consumption habits and frequency of consumption. Using these questions, we construct a binary measure of alcohol consumption, thereby dividing the districts of Bihar into high-consumption and low-consumption districts.

Finally, we use data from the 2011 Census of India for district-level demographic information to control for time-invariant district-level characteristics that could have impacted

crime in both states. We construct five variables from the Census data for each district: the percentage of SC-ST population, sex ratio, male literacy rate, male employment rate, and the proportion of the working population engaged in agriculture. We use male literacy and employment rates rather than the overall rates because of the imbalance in alcohol consumption by gender. We also obtain the area and total population of each district from the Census.

We merge the census data with the crime data using district names as identifiers to obtain our final dataset. Our final dataset yields 3,534 observations for each crime category (62 districts – 38 in Bihar and 24 in Jharkhand – over a period of 57 months).

3.2 Specification

The objective of the exercise is to empirically determine the effects of prohibition on crime. We first employ a differences-in-differences analysis looking at standardized crime numbers, comparing the change in crime in Bihar to the change in a control group (where there was no ban, i.e. Jharkhand) after the ban. The key identifying assumption is that there were no other simultaneous policy changes in Bihar that could have impacted crime rates. Examining the political scenario in Bihar at the time of the ban, we do not find any other major policy development that could have affected crime. In each regression, we include district-level characteristics obtained from the census data to account for time-invariant district characteristics, calendar month fixed effects to control for seasonality, and district-specific time trends. Standard errors are clustered at the district level.

$$y_{dt} = \alpha + \beta_1 Post_t + \beta_2 Treat_d + \beta_3 Treat * Post_{dt} + \delta d_t + \gamma X_d + \eta_t + e_{dt} \qquad (1)$$

y_{dt} is our variable of interest and is a measure of the incidence of violent or non-violent crime in district d in month t. $Treat_d$ refers to a district of Bihar and $Post_t$ is an indicator for months after April 2016. d_t is for district-specific time trends, X_d for district-level demographics to account for time-invariant district characteristics, and η_t for calendar month

fixed effects. β_3 is the main coefficient of interest which represents the DiD estimate of the impact of the ban on crime in the state (Table 3). Treating this DiD estimate as causal would require that there were parallel trends in crime between Bihar and Jharkhand in the pre ban period. We present evidence to support the parallel trend assumption (Table 2).

In the second part of our analysis, we examine the channels through which the alcohol ban affects crime rates in the state. If reduced alcohol availability was responsible for reduction in violent crimes in the state, then we expect to see a differentially larger effect of the ban in those districts of Bihar which had higher levels of alcohol consumption before the ban. Using NFHS 2015-16 data, we construct measures of baseline alcohol consumption for each district in Bihar. The survey asks respondents about their alcohol consumption habits, specifically whether the individual consumes alcohol and the frequency of alcohol consumption. Using the first measure, we obtain the mean number of individuals in Bihar who consume alcohol in a district, and divide the districts in Bihar as high-alcohol-consuming or low-alcohol-consuming, according to whether fall above or below the mean measure (Figure 2). We then perform a heterogeneity analysis looking at the differential effect of the alcohol ban in districts with high and low baseline alcohol consumption.

$$y_{dt} = \alpha + \beta_1 Post_t + \beta_2 HiAlcohol_d + \beta_3 HiAlcohol * Post_{dt} + \delta d_t + \gamma X_d + \eta_t + e_{dt} \qquad (2)$$

In this specification, $HiAlcohol_d$ is an indicator variable for those districts in Bihar where the baseline alcohol consumption was high. β_3 is the coefficient of interest which gives the differential effect of the ban on high-alcohol-consuming districts (Table 4).

Next, we perform a second heterogeneity analysis to understand the differential effects of the ban on border and interior districts of Bihar ('border' districts refer to those that share a border with some other state or country such as Jharkhand, West Bengal, Uttar Pradesh, and Nepal). Given that state borders are largely open and that there is relatively free movement of people and goods across states, a state-wide ban may not be equally effective

across districts. Anecdotal evidence suggests that there was cross-border movement by locals residing in border districts in search of alcohol [10] [11]. Reports also suggest that there was a significant increase in business for small traders in Nepal who sell low quality alcohol [12]. This suggests that the enforcement of the ban may not have been airtight in the border districts of Bihar. We hypothesize that the ban would be more effective in interior districts than in border districts as it would be easier to enforce the ban in the absence of cross-border movement of alcohol or alcohol-seekers. As a result, if the ban leads to a reduction in crime by reducing the supply and therefore the consumption of alcohol, we would expect the reduction in crime to be much more pronounced in these interior districts. In the following equation, $Interior_d$ denotes a district of Bihar that does not share a border with a district of another state or country.

$$y_{dt} = \alpha + \beta_1 Post_t + \beta_2 Interior_d + \beta_3 Interior * Post_{dt} + \delta d_t + \gamma X_d + \eta_t + e_{dt} \qquad (3)$$

For example, Kishanganj is a district in Bihar which shares a border with both Nepal and West Bengal, while Patna is another district in the state which is only bordered by other districts of Bihar (Figure 3). In this manner we divide Bihar into 22 border districts (such as Kishanganj) and 16 interior districts (such as Patna). This specification uses the same covariates, fixed effects, and time trends as equation (1) and (2).

Our analysis leads us to conclude that the full effect of the ban was displayed only in the interior districts of Bihar (Table 5). Moreover, it is likely that the ban had spillover effects on crime in the districts (say, in Jharkhand) just across the border from Bihar, since these districts are visited by a large number of alcohol-seekers. Further, to get at the uncontaminated impact of the ban, we restrict the sample to the interior districts of Bihar

[10] https://www.hindustantimes.com/ranchi/bihar-residents-adopt-new-methods-to-drink-liquor/story-iisVRDsCWzisvKCqQR7lrL.html

[11] https://www.ndtv.com/india-news/70-from-bihar-arrested-in-nepal-over-consuming-alcohol-police-1409716

[12] https://www.ndtv.com/india-news/after-bihar-liquor-ban-alcohol-sellers-flourish-on-india-nepal-border-1380321

and the interior districts of Jharkhand and also perform a DiD on this sample (Table 6).

To reaffirm our results, we employ the synthetic control method as an alternative to DiD estimation (Abadie and Gardeazabal, 2003). This method takes care of differential trends by constructing artificial counterfactual comparison units from the data. We use the standardized crime numbers and the district covariates listed previously to construct a weighted convex combination of the control units (Jharkhand districts) to create a comparison group that is similar in characteristics to the treatment units in the pre-treatment period. This exercise affirms that the reduction in violent crimes in Bihar was caused by the ban (Figures 6 and 7).

Last, we also evaluate the persistence of these effects. Economists have found that the efficiency of various alcohol regulation policies with regards to impacts on crime reduce over time due to a number of factors such as substitution into other narcotics and ineffective implementation. To test this hypothesis in the case of the Bihar ban we perform differences-in-differences analyses by starting with data only until one quarter into the ban and then successively adding observations one additional quarter at a time. We then plot the main coefficient of interest for violent and non-violent crime indices to observe the effect of the ban over time (Figures 8 and 9).

4 Results

We find evidence to support a significant effect of the ban on reducing violent crimes in Bihar (our violent crime index includes murder, rape, kidnapping, dacoity, robbery, and riots). By plotting the residual numbers of crimes over time, we see a relatively sharper decline in the number of violent crimes as compared to non violent crimes, immediately after the ban (Firgures 3 and 4). Our results for violent crimes also hold through different specifications, as described below.

Table 3 reports that the alcohol ban had a negative impact on the incidence of violent crime, leading to a 0.21 standard deviation reduction ($p < 0.1$). In particular, violent

crimes such as murder and robbery decrease by $0.17(p < 0.1)$ and $0.30(p < 0.05)$ standard deviations respectively (Table 8). There is no significant effect on non-violent crime. The results suggest that the ban is more effective in reducing violent crimes as opposed to crimes that are non-violent or may require more cognitive abilities for execution. The relatively high R-squared on the regressions for violent and non-violent crime indices (0.84 and 0.89 respectively) suggests that the factors included in our model explain most of the observed variation in crime.

The validity of the DiD estimate rests on the assumption of parallel trends in crime between Bihar and Jharkhand in the pre-ban period. We test this assumption using district-level crime data for the period January 2013 - March 2016 and present the results in Table 2. We see that the parallel trends hypothesis holds for the violent and non-violent crime indices.

We also report results using the synthetic control method, which depicts a divergence between the treatment and control groups in the post-ban trends for violent crime (Figure 6). For instance, while the violent crime index declines by 0.41 standard deviations (Table 7), we also observe an increase in non-violent crime $(0.13, p < 0.01)$. Since the synthetic control method matches pre-treatment characteristics and crime trends between the treatment and synthetic control groups, the observed divergence is likely to be a result of the ban and not due to any other time-varying unobservables.

We divide our study period into quarters and find coefficients of similar magnitude as we continue to include observations further into the ban period, one quarter at a time. Figures (8) and (9) show that the coefficients are significant and largely unchanging six quarters into the ban. Our results indicate that the ban had the favorable effect of reducing the incidence of violent crime within the state and remains effective atleast six quarters into its implementation.

4.1 Plausible Channels

There could be multiple channels through which the alcohol ban led to a reduction in violent crime. One potential mechanism is the increased policing that was put in place for the effective implementation of the ban – one could argue that increased police deployment generated a greater sense of security and was an effective deterrent for criminal activities. The other plausible mechanism for a drop in violent crime could be the reduced availability and consumption of alcohol, which led to a drop in alcohol-induced violent crimes, by reducing tendencies of aggression, hostility, and present-bias (Zhang et al., 1997; Steele and Josephs, 1990)[13]. We perform heterogeneity tests to isolate the channel through which the ban reduced violent crime and provide suggestive evidence to support the alcohol availability story.

First, we perform heterogeneity tests by dividing districts in Bihar according to their baseline alcohol consumption level (Table 4). We find that violent crime decreased by an additional 0.54 ($p < 0.05$) standard deviations in districts with high baseline alcohol consumption as compared to those with low baseline consumption. In contrast, there is no significant differential impact between high-consumption and low-consumption districts for non-violent crimes. This suggests that reduced alcohol consumption as a result of reduced availability might be an important channel through which the policy affected crime in the state.

Second, we inspect heterogeneity of the impact on border and interior districts of Bihar (Table 5). As discussed previously, we expect to see a stronger decline in violent crimes in the interior districts compared to the border districts due to reduced availability of alcohol. We find that the ban had a stronger impact in the interior districts with violent crimes declining by an additional 0.47 standard deviations ($p < 0.05$) compared to border districts. We find no differential effect on non-violent crimes (-0.066, $p > 0.1$).

These results indicate that the full effect of the ban was displayed only in the *interior*

[13]For instance, prohibition in the United States was associated with an immediate decrease in alcohol consumption by 30 percent(Miron and Zwiebel, 1991).

districts of Bihar, and only the *interior* districts of Jharkhand were completely unaffected by it. Restricting our sample to only the interior districts of Bihar and Jharkhand, we find that the ban reduced violent crime in Bihar by 0.50 ($p < 0.05$) standard deviations as compared to Jharkhand (Table 6)[14]. Comparing this coefficient to our DiD and synthetic control results (Tables 3 and 7), we find that the restricted sample displays a significantly larger effect ($p = 0.0235$). This suggests that the border districts were indeed suffering from spillover effects which diluted the effect of the ban. This lends further credence to our argument that the ban affected crime through the channel of alcohol availability.

There is no reason to expect differentially stronger policing in the interior districts in the post-ban period, but plenty to expect that porous borders may pose larger challenges to implementing the ban in border districts. Furthermore, we find a significant decrease only in the violent crime categories such as murder and robbery, and a larger decline in interior districts and districts with high baseline alcohol consumption. One could posit that if the drop in crime numbers was on account of improved policing, this effect should have been consistent across crime categories and geographical locations. These results suggests that the ban affected crime through the channel of reduced alcohol availability rather than through increased policing.

5 Discussion

The social costs of alcohol consumption include violence and alcohol-related crime. We know from the literature that excess alcohol consumption can lead to an increase in nuisance crimes such as public drunkenness, and disorderly conduct (Carpenter, 2007). Alcohol regulation policies such as increasing the Minimum Legal Drinking Age were found to decrease the incidence of crimes like Driving Under the Influence, assaults, and robberies (Carpenter and Dobkin, 2010). Sloan et al. (1994) find that higher prices and reduced availability of alcohol lower homicide rates.

[14]This result does not qualitatively change when we perform a triple difference specification using the unrestricted sample.

These observations are confirmed by our findings, where we study the incidence of crime in the presence of reduced alcohol availability on account of a state-wide prohibition. We find that the ban led to a significant reduction in violent crimes such as murder and robbery, an observation that is robust to several different specifications and heterogeneity tests. Further, the decline is larger in interior districts and districts with high baseline alcohol consumption. Insofar as state borders in India are porous to the movement of alcohol-seekers and potentially even alcohol itself, this result lends credence to the availability story over the channel of police deployment. In fact, news reports have provided anecdotal evidence of the sudden growth in business for shops selling alcohol along the Bihar-UP border [15].

This is interesting in the historical context of past experiments with alcohol bans that failed and were eventually revoked, partly as a result of increased hooch production and smuggling of alcohol (for example, Haryana and Andhra Pradesh in the 1990's). More recently, Kerala is struggling with the partial alcohol ban imposed in the state since 2014. Police evidence from Kerala suggests that alcoholics are substituting alcohol consumption with drug use to compensate for the lack of alcohol availability.

Our results should be interpreted keeping in mind certain caveats. First, alcohol belongs to a broad class of intoxicants that have varying but similar impact on the outcomes of health, productivity, and social harm. In the presence of alternatives such as cannabis, sedatives, and opioids, the effect of an alcohol ban on crime will be limited towards the scarcity of one alternative. Anecdotal evidence from hospitals across Bihar highlight increased cases of substance abuse as compared to the pre-ban period [16][17]. While changes in the consumption of alternate intoxicants may also affect crime, this paper is unable to comment on these effects. Second, the impact of alcohol prohibition on crime that we uncover in this paper is not necessarily generalizable. Factors such as implementation of the ban, initial crime patterns,

[15] https://timesofindia.indiatimes.com/city/patna/Jump-in-liquor-sale-in-UP-border-areas/articleshow/51748326.cms

[16] https://www.financialexpress.com/india-news/alcohol-banned-in-nitish-kumars-bihar-now-cases-of-drug-abuse-spike/620525/

[17] https://www.indiatoday.in/india/story/india-today-exclusive-investigation-udta-bihar-black-marketing-alcohol-drugs-ban-980475-2017-06-01

and prevalence of baseline alcohol consumption could influence crime rates differently in another context. Last, we are unable to conclusively comment on the welfare effects of a prohibition (Kumar and Prakash, 2016). Prohibition is associated with a loss in revenue for private individuals as well as for the government. At the same time, alcohol regulation policies have also been found to positively affect health outcomes (Barreca and Page, 2015). We cannot qualitatively assess such welfare aspects of prohibition in our paper.

Nonetheless, this paper has significant implications for policy and research on substance abuse and controlling crime. It would be interesting to compare the costs and benefits inherent in such a policy and to outline its other social, economic, and health implications.

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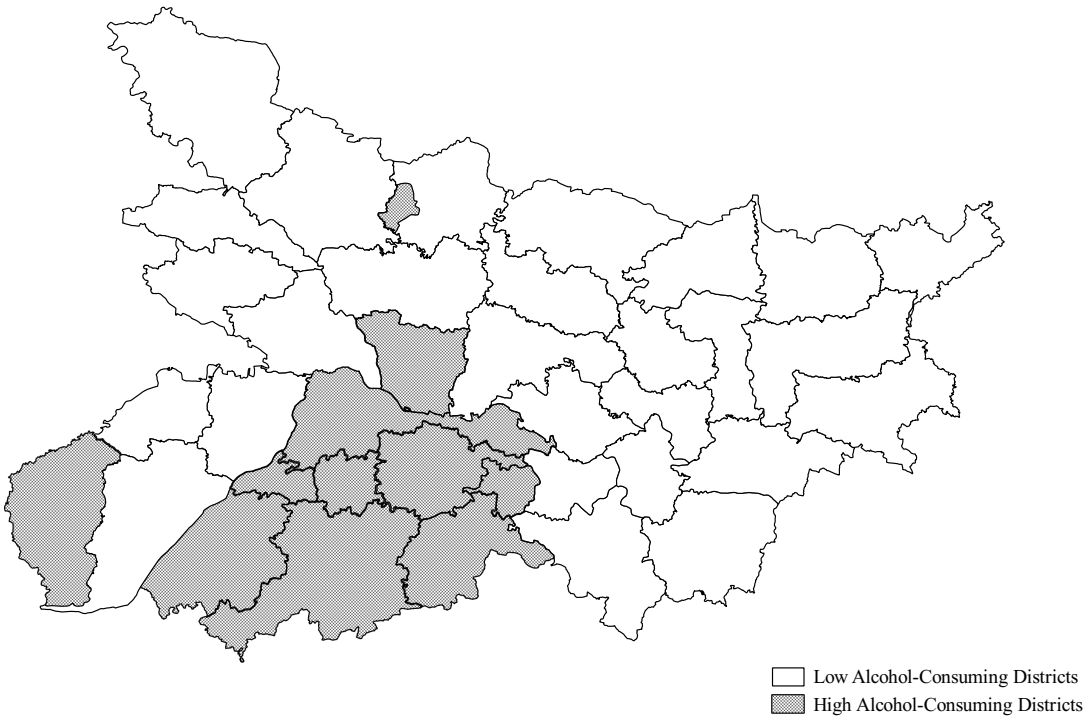
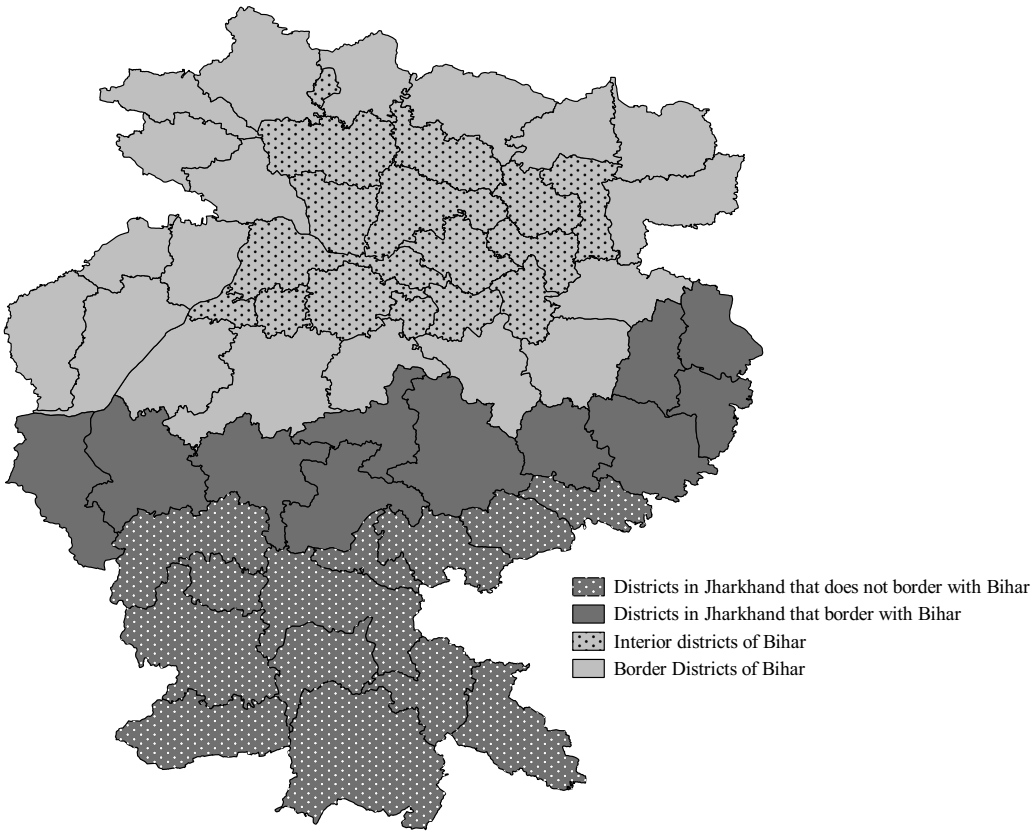
Figure 1: Location of Bihar and Jharkhand in India

Figure 2: Districts in Bihar According to Baseline Alcohol Consumption



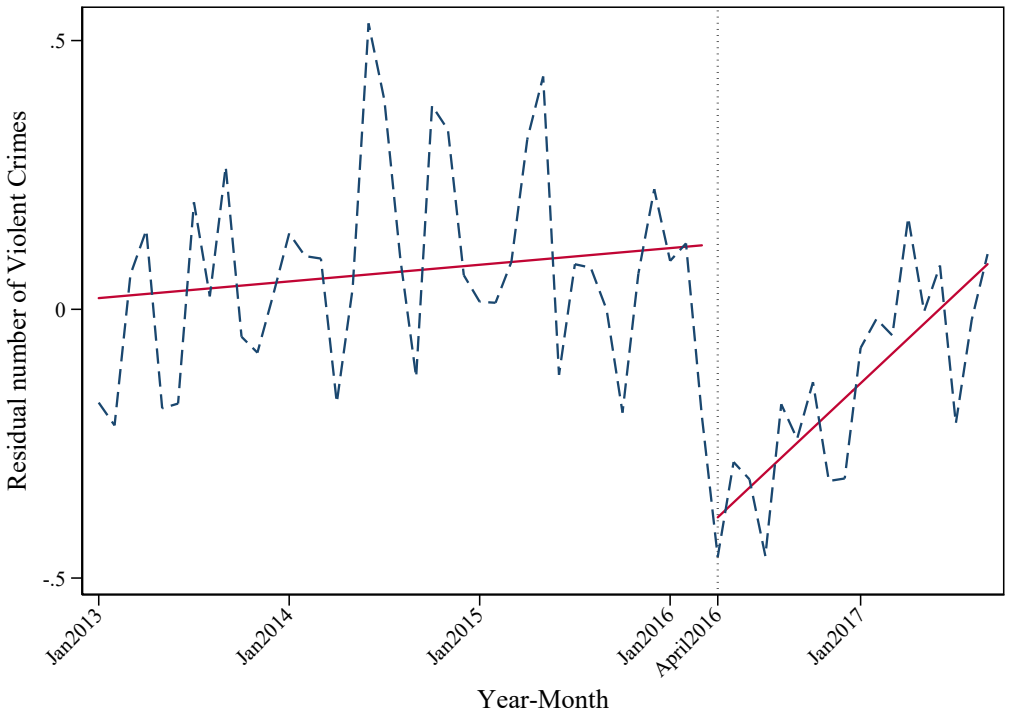
Note: Graph constructed using data from NFHS 2015-16 round.

Figure 3: Interior and Border Districts of Bihar and Jharkhand



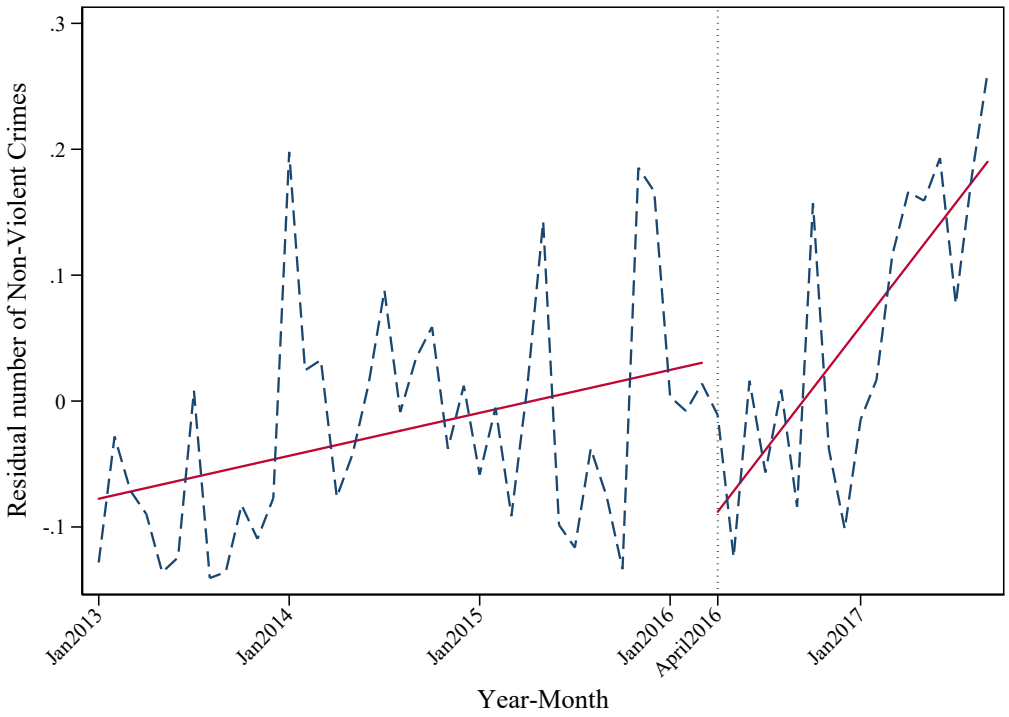
Note: Graph constructed using data from NFHS 2015-16 round.

Figure 4: Residual Number of Violent Crimes over Time



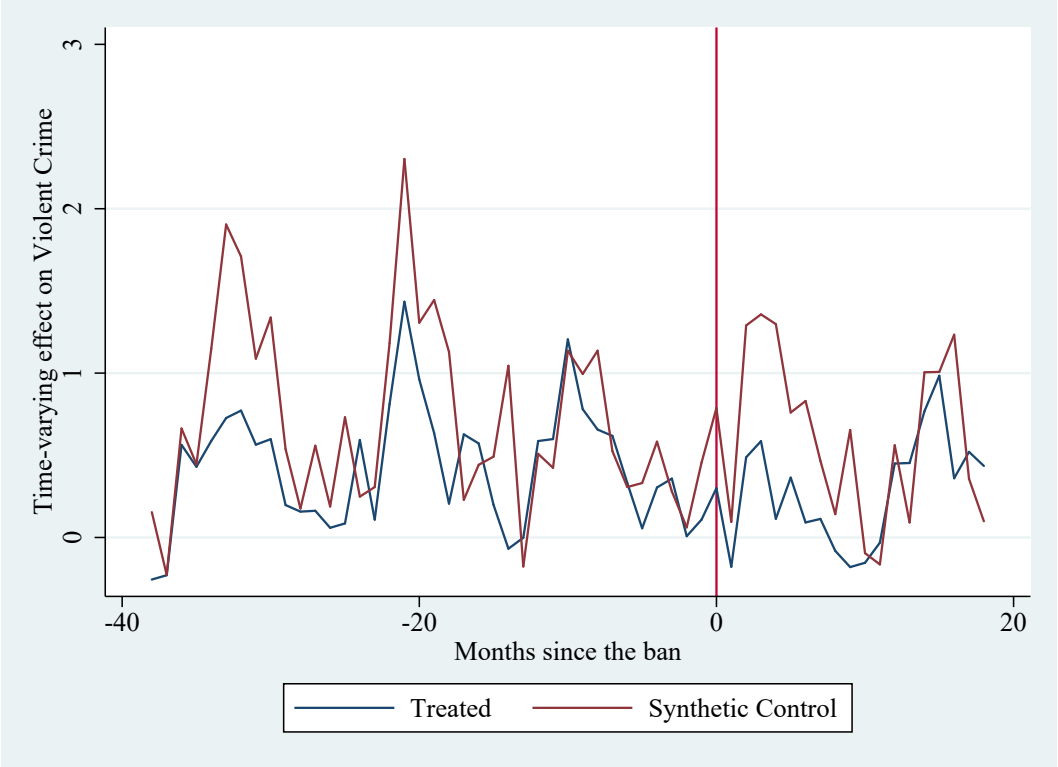
Note: Data consists of district level monthly crime data from January 2013 to September 2017 obtained from Bihar Police. The residuals are plotted after extracting calendar-month fixed effects and district covariates. The alcohol ban was implemented in April 2016.

Figure 5: Residual Number of Non-violent Crimes over Time



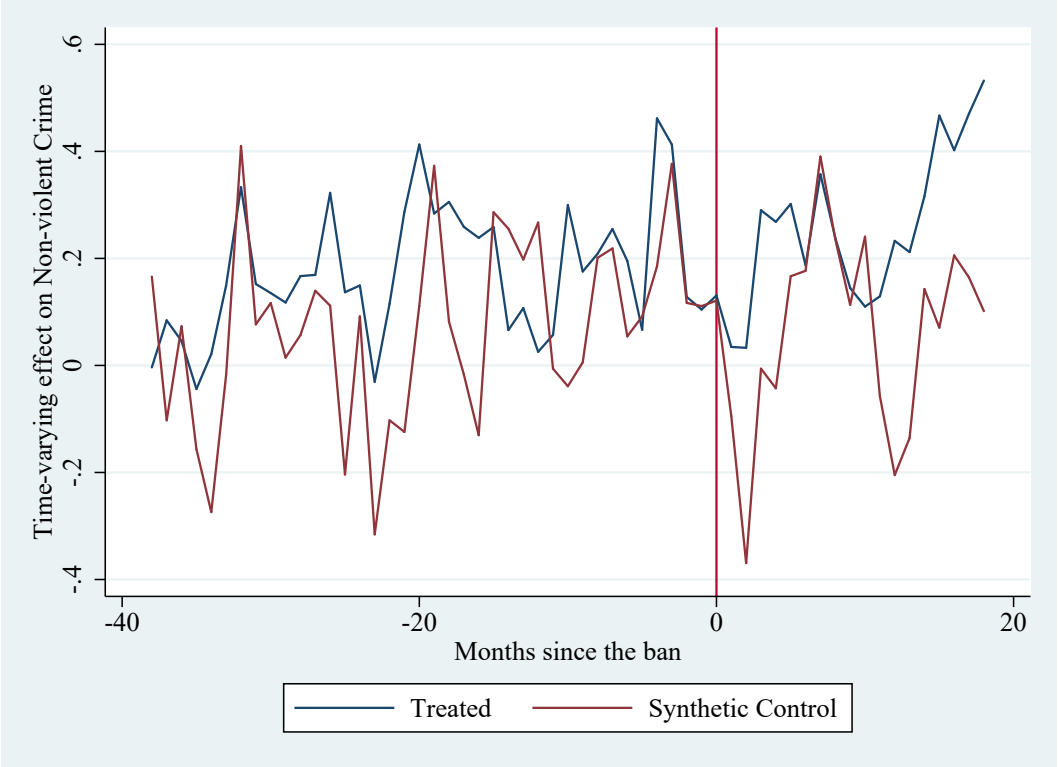
Note: Data consists of district level monthly crime data from January 2013 to September 2017 obtained from Bihar Police. The residuals are plotted after extracting calendar-month fixed effects and district covariates. The alcohol ban was implemented in April 2016.

Figure 6: Effect of the Ban on Violent Crimes - Using Synthetic Controls



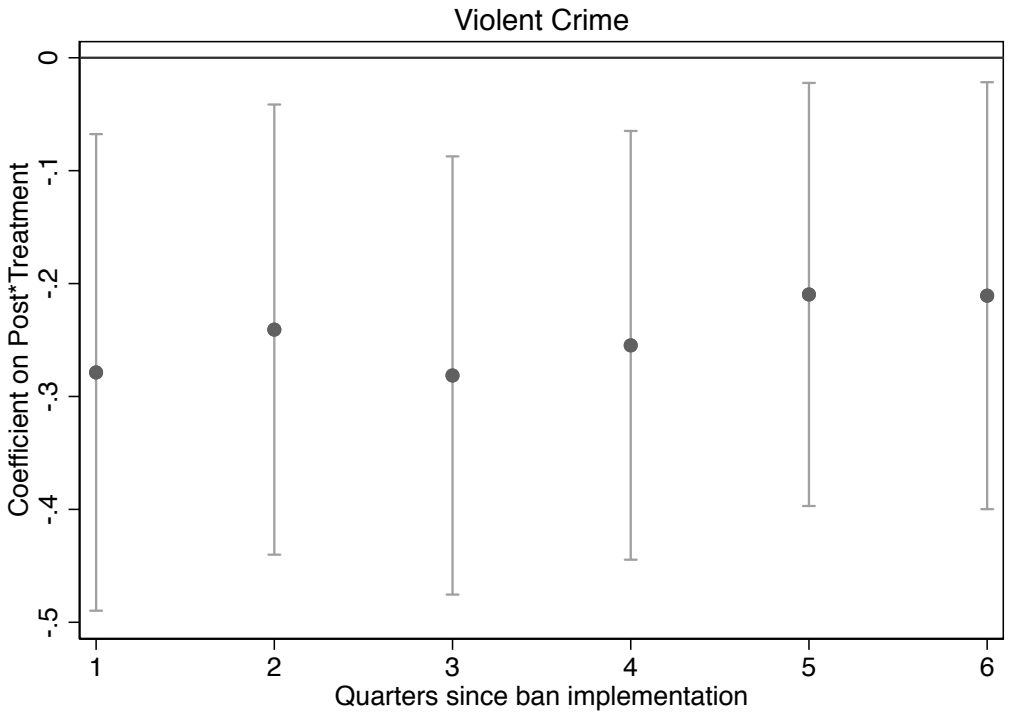
Note: Data consists of district level monthly crime data from January 2013 to September 2017 obtained from Bihar Police and Jharkhand Police. District characteristics were obtained from Census 2011 to construct the synthetic control group. The alcohol ban was implemented in April 2016.

Figure 7: Effect of the Ban on Non-violent Crimes - Using Synthetic Controls



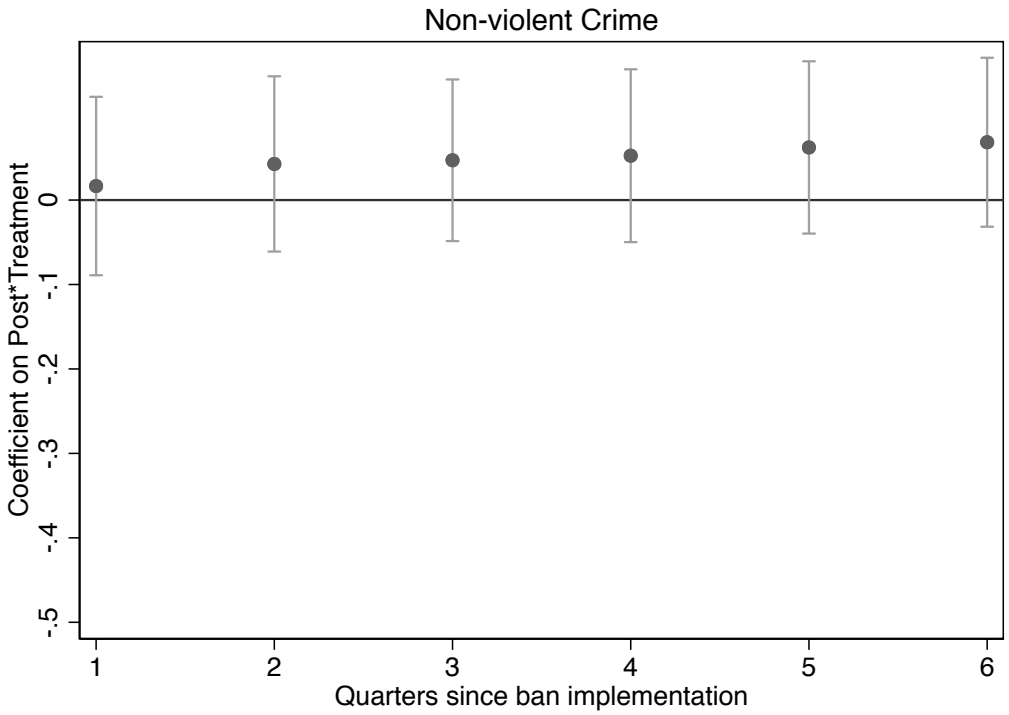
Note: Data consists of district level monthly crime data from January 2013 to September 2017 obtained from Bihar Police and Jharkhand Police. District characteristics were obtained from Census 2011 to construct the synthetic control group. The alcohol ban was implemented in April 2016.

Figure 8: Time Varying Effects of Ban on Violent Crimes



Note: Data consists of district level monthly crime data from 2013 January to 2017 September obtained from Bihar Police and Jharkhand Police. All estimates include district specific time trends and calendar month fixed effects.

Figure 9: Time Varying Effects of Ban on Non-Violent Crimes



Note: Data consists of district level monthly crime data from January 2013 to September 2017 obtained from Bihar Police and Jharkhand Police. All estimates include district specific time trends and calendar month fixed effects.

Table 1: Summary Statistics

	Bihar	Jharkhand
SC/ST population	.17	.43
	[.04]	[.18]
Sex ratio	.94	.95
	[.02]	[.02]
Literacy rate - male	3.21	3.83
	[.52]	[.84]
Employment rate - male	.46	.5
	[.02]	[.02]
Agriculture workers	.27	.1
	[.07]	[.04]
Area	2477.97	3321.5
	[1069.74]	[1403.83]
Total population person	2739459	1374506
	[1278810]	[681973]
Drinks Alcohol (yes/no)	0.302	0.405
	[.459]	[.491]
Drinks alcohol almost ever day (yes/no)	.148	.150
	[.356]	[.357]

Notes: District level characteristics are obtained from Census 2011 data. Data on baseline alcohol consumption of Bihar and Jharkhand is obtained from National Family Health Survey 2015-16

Table 2: Test for Parallel Pre-Trends

	Violent Crime	Non-violent Crime
Treat	-0.200	-0.250
	(0.314)	(0.308)
Month-year	-0.00187	0.00336**
	(0.00256)	(0.00151)
Treat*month-year	0.00685	-0.000241
	(0.00555)	(0.00245)
Observations	2,356	2,356
R2	0.710	0.642

Notes: All specifications control for district covariates and include calendar month fixed effects. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 3: Effect of the Ban on Violent and Non-Violent Crimes

	Violent crime Index (1)	Non-violent crime Index (2)
Treat × Post	-0.21*	0.068
	(0.11)	(0.06)
N	3534	3534
R2	0.84	0.89

Notes: All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 4: Effect of the Ban by Baseline Alcohol Consumption

	Violent crime Index (1)	Non-violent crime Index (2)
Post × Alcohol	-0.54**	-0.11
	(0.26)	(0.08)
N	2166	2166
R2	0.86	0.90

Notes: All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 5: Effect of the Ban in Border and Interior Districts of Bihar

	Violent crime Index (1)	Non-violent crime Index (2)
Interior × Post	-0.47**	-0.066
	(0.19)	(0.08)
N	2166	2166
R2	0.86	0.90

Notes: All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 6: Effect of the Ban with a restricted sample of Interior districts of Bihar and Jharkhand

	Violent crime Index (1)	Non-violent crime Index (2)
Post × Interior	-0.50**	0.072
	(0.20)	(0.09)
N	1710	1710
R2	0.89	0.92

Notes: All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively. The sample of districts is restricted to interior districts of Bihar and districts in Jharkhand that do not share a border with Bihar.

Table 7: Effect of the ban using Synthetic Controls

	Violent crime Index (1)	Non-violent crime Index (2)
Treat × Post	-0.41***	0.13***
	(0.10)	(0.04)
Average	.42	.17
No. of Observations	4294	4294
R Squared	0.82	0.89

Notes: All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Appendix

Table 8: Effect of the Ban on Violent and Non-Violent Crimes

	Violent crimes						Non-violent crimes	
	Dacoity (1)	Kidnapping (2)	Murder (3)	Rape (4)	Riot (5)	Robbery (6)	Burglary (7)	Theft (8)
Treat × Post	0.0088	0.10	-0.17*	-0.047	-0.29	-0.30**	0.039	0.091
	(0.11)	(0.21)	(0.09)	(0.09)	(0.18)	(0.13)	(0.10)	(0.06)
N	3534	3534	3534	3534	3534	3534	3534	3534
R2	0.32	0.84	0.63	0.45	0.77	0.58	0.83	0.86

Notes: Data consists of number of crimes in each sub-group between January, 2013 and September, 2017 in the state of Bihar. All specifications controls for district covariates and includes calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 9: Effect of the Ban by Baseline Alcohol Consumption

	Violent crimes						Non-violent crimes	
	Dacoity (1)	Kidnapping (2)	Murder (3)	Rape (4)	Riot (5)	Robbery (6)	Burglary (7)	Theft (8)
Post × Alcohol	-0.067	-0.80**	-0.37**	-0.093	-0.33	-0.40*	-0.17	-0.053
	(0.16)	(0.37)	(0.15)	(0.09)	(0.46)	(0.22)	(0.15)	(0.05)
N	2166	2166	2166	2166	2166	2166	2166	2166
R2	0.34	0.83	0.69	0.42	0.71	0.59	0.85	0.87

Notes: Data consists of number of crimes in each sub-group between January, 2013 and September, 2017 in the state of Bihar. All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 10: Effect of the Ban in Border and Interior Districts of Bihar

	Violent crimes						Non-violent crimes	
	Dacoity (1)	Kidnapping (2)	Murder (3)	Rape (4)	Riot (5)	Robbery (6)	Burglary (7)	Theft (8)
Treat × Post	-0.13	-0.14	-0.22	-0.20**	-0.76**	-0.40**	-0.15	0.015
	(0.15)	(0.41)	(0.13)	(0.08)	(0.34)	(0.19)	(0.14)	(0.06)
N	2166	2166	2166	2166	2166	2166	2166	2166
R2	0.34	0.83	0.68	0.42	0.71	0.59	0.84	0.87

Notes: Data consists of number of crimes in each sub-group between January, 2013 and September, 2017 in the state of Bihar. All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 11: Effect of the Ban with a restricted sample of Interior districts of Bihar and Jharkhand

	Violent crimes						Non-violent crimes	
	Dacoity (1)	Kidnapping (2)	Murder (3)	Rape (4)	Riot (5)	Robbery (6)	Burglary (7)	Theft (8)
Post × Interior	-0.11	0.14	-0.23	-0.14	-0.75**	-0.68***	0.050	0.088
	(0.11)	(0.40)	(0.14)	(0.12)	(0.30)	(0.18)	(0.15)	(0.06)
N	1710	1710	1710	1710	1710	1710	1710	1710
R2	0.41	0.88	0.73	0.60	0.84	0.70	0.89	0.90

Notes: Data consists of number of crimes in each sub-group between January, 2013 and September, 2017 in the state of Bihar. All specifications control for district covariates and include calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.

Table 12: Effect of the ban using Synthetic Controls

	Violent crimes						Non-violent crimes	
	Dacoity (1)	Kidnapping (2)	Murder (3)	Rape (4)	Riot (5)	Robbery (6)	Burglary (7)	Theft (8)
Treat × Post	-0.31***	-0.077	-0.13**	-0.35***	-0.28*	-0.35***	0.094	0.20***
	(0.09)	(0.21)	(0.07)	(0.06)	(0.16)	(0.10)	(0.08)	(0.04)
Average	.32	1.9	.07	-.51	2.8	.64	.63	.34
No. of Observations	4294	4294	4294	4294	4294	4294	4294	4294
R Squared	0.33	0.80	0.64	0.54	0.72	0.60	0.82	0.88

Notes: Data consists of number of crimes in each sub-group between January, 2013 and September, 2017 in the state of Bihar. All specifications controls for district covariates and includes calendar month fixed effects and district-specific time trends. Errors are clustered at the district level. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels respectively.