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Public Safety for Women: Is Regulation of Social Drinking Spaces Effective?

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Abstract

This paper examines the impact of reduced availability of hard liquor in bars on sexual crimes against women outside their homes. We construct a district level panel dataset on reported crimes and use an identification strategy that exploits a natural experiment that led to a complete crackdown on bars selling hard liquor in a state of India. Using a difference-in-differences strategy, we show that placing restrictions on alcohol sale through closure of on-premise drinking outlets that serve hard liquor reduces reported incidence of sexual assault and harassment against women but has no effect on reported rapes. We conduct placebo tests and show that the result is not driven by existing pre-trends. The result is also robust to an alternative estimation strategy using a synthetic control construction and the most conservative estimate shows a reduction in sexual assaults by 10%. These results have policy implications for regulating social drinking spaces due to their impact on women's public safety.

JEL Classification: D78, J16, K42, O20

Keywords: alcohol regulation, hard liquor, bars, violence against women, sexual assaults

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1 Introduction

Violence against women and girls is a pervasive issue across countries. This can take the shape of intimate partner violence, violence experienced at the hands of other relatives, rape, sexual assaults and harassment, molestation, stalking etc. Globally, 35% of women report having experienced either physical or sexual violence ever in their life and 7% have been assaulted by someone other than a partner (World Health Organization (WHO)). Alcohol consumption may act as a mediator in perpetration of such crimes. The seminal model by Becker (1968) on theory of crime was extended to include alcohol consumption by Zimmerman (2004). Theoretically, the effect of alcohol operates through a decrease in risk aversion and change in the rate of discount about perceived benefits and costs. The link between alcohol consumption and increased probability of violence against women stems from impaired cognitive functioning under alcohol influence which increases the likelihood of committing a crime.

This paper draws attention to the link between drinking in social spaces like bars and crimes committed against women in public spaces, since bars serve as on-premise drinking spaces in public areas. To discern the causal impact we exploit a regulation change which led to closure of local bars serving hard liquor in a state of India, namely Kerala, and the effects of this regulation change on reported incidence of sexual assaults, harassment and rapes. Such a regulation change is expected to increase the distance to alcohol outlets serving hard liquor and increase the cost of its purchase and drinking outside home. By limiting the number of bars serving hard liquor, it can potentially reduce social drinking or reduce the degree of inebriation when drinking outside home.

The impact of such a regulation change on crimes committed against women in public spaces is likely to operate through an effect on the location of hard liquor consumption - moving it away from bars which serve as drinking spaces in public areas - and in turn, reducing interpersonal interactions while inebriated. We construct a district level panel data on reported crimes and use a difference-in-differences strategy (using border districts in neighboring states as a control group) along with synthetic control methods to study the effect of this policy change on crimes against women like sexual assaults, harassment and rapes which usually involve interactions outside home between the perpetrator and the victim.

Our research contributes to the literature in several ways. First, rather generally, it contributes to the literature on alcohol consumption and violence. Second, it contributes to the nascent literature that evaluates the effect of social consumption of alcohol in bars on crimes, using quasi experimental settings. There are currently two published studies in this

strand of literature. *Anderson et al.* (2018) find that an increase in bar densities in Kansas state in the U.S., led to an increase in reported incidents of rape and robbery and a marginally significant increase in general assaults. *Biderman et al.* (2009) show that early closing of bars reduced homicides in Sao Paulo Metropolitan area of Brazil. Third, we contribute to the growing literature on violence against women in developing countries and pathways to decrease it. Existing literature looks at the role of income shocks and employment (*Aizer (2010)*, *Bobonis et al. (2013)*, *Anderberg et al. (2015)*, *Sekhri & Storeygard (2014)*), women's role in policing services (*Kavanaugh et al. (2017)*, *Perova & Reynolds (2017)*, *Amaral et al. (2018)*, *Siwach (2018)*), segregation in public transportation (*Aguilar et al. (2020)*) and female political representation (*Iyer et al. (2012)*) on both incidence and reporting of such crimes.

While there is a large literature on effect of various alcohol regulations on mortality, violent crimes and public health outcomes like driving under influence and consequent accident related mortality, there is little evidence on crimes against women. Nevertheless, we also evaluate the effect of this policy change on other violent crimes.¹ Lastly, this paper looks at a regulation change, which has not yet been studied in the literature - reduction in consumption of hard liquor in bars. Therefore, it furthers our understanding about public policies which can effectuate a reduction in crimes against women in developing countries.

In the existing literature, regulations reducing alcohol availability, that in turn reduce alcohol consumption, are shown to have a negative effect on public health outcomes like deaths under influence, accidental deaths, violent and property crimes. The evidence is largely developed country based. These regulations can be effectuated either by price or non-price interventions. Price interventions involve direct changes in price of alcohol or through taxation policies. Non-price based policy interventions include minimum drinking age laws, drunk driving laws, laws placing restrictions on quantity of alcohol purchased, regulations that limit density of liquor stores in a region and lastly, by regulation of closing days and hours of bars. *Carpenter & Dobkin (2010)* undertake a detailed review of studies that look at the effect of alcohol regulations on different crimes. *Markowitz et al. (2012)* discuss various alcohol control policies in the United States and after conducting a meta analyses of the published studies conclude that increasing the price of alcohol is the most effective strategy in reducing crimes.²

¹Crimes like driving under influence are unfortunately not disclosed by the crime records bureau in India.

²Recent papers studying the effect of these alcohol regulation policies on general crimes include *Markowitz (2005)*, *Carpenter (2005)*, *Carpenter (2007)*, *Heaton (2012)*, *Cook & Durrance (2013)*, *Carpenter & Dobkin (2015)*, *Hansen & Waddell (2018)* and *Lindo et al. (2018)*. In the Indian context, two recent studies *Chaudhuri et al. (2018)* and *Dar & Sahay (2018)* evaluate the effect of alcohol ban imposed in the state of Bihar in India on general violent and non-violent crimes.

A few quasi-experimental studies specifically evaluate the effect of such regulations on violence against women. Cook & Moore (1993) find that an increase in beer tax reduces rapes while Cook & Durrance (2013) and Markowitz (2005) discern no significant effect of alcohol taxes on rapes. Norström & Skog (2005) also find no effect of opening liquor stores on Saturdays in Sweden on domestic violence or sexual assaults. Carpenter & Dobkin (2015) look at a discontinuity in arrest rates for rape at the minimum legal drinking age and observe no significant effect. On the other hand, Luca *et al.* (2015) and Luca *et al.* (2019) show that imposition of alcohol bans and higher MLDA in India significantly reduces reported incidence of domestic violence and sexual harassment.³ The literature thus finds mixed results of general alcohol regulatory policies like MLDA, taxes, prohibitions and closing down off-premise drinking outlets on sexual assaults, rapes and domestic violence faced by women.

Regulation of on-premise drinking outlets like bars has not received much attention in the literature. Drinking in bars can increase the probability of social contact between a likely perpetrator and a potential victim resulting in an increase in sexual assaults experienced by women outside home. In the Indian context it is likely to arise from inebriated men coming in contact with women on their way back from these bars and engaging in inappropriate behavior. This can lead to an increased incidence of sexual assaults experienced by women.⁴ Safe city initiative by Jagori and UN Women conducted a survey in India on factors which contribute to women feeling unsafe in public spaces. It showed that 50% of women report consumption of alcohol by men as a threat to their safety outside home.

From a policy perspective too it is useful to know which type of regulations are effective and on what crimes, since public safety of women is a pertinent issue. Public safety of women has other associated social costs as well. Recent papers in the Indian context show that incidence of sexual assaults in public spaces give rise to safety concerns which can lead to reduced participation in the labor force and sub-optimal choice of college by women (Chakraborty *et al.* (2018), Siddique (2018) and Borker (2018)). A better understanding of policies that can increase public safety of women is thus of paramount importance. It is possible that certain policies impose social costs but do not reduce crime or generate other

³A few recent studies look at alcohol consumption and violence faced by women. Card & Dahl (2011) find that unexpected home team losses increase alcohol consumption, thus leading to an increase in domestic violence rates. Lindo *et al.* (2018) find that partying and drinking in college increases incidence of sexual assaults.

⁴In India, percentage men who drink alcohol stands at 30% while for women this figure is a meagre 1.2% according to the latest National Family Health Survey 2015-16. Indian men are, thus, more likely to drink alcohol and engage in socially undesirable behaviour than the effect coming from victims (women) being under the influence.

social benefits.⁵

The policy shift in Kerala that shut down bars selling hard liquor can also have other potential effects. First, this can result in a substitution away from hard liquor towards beer and wine (which have a comparatively lower alcoholic content and are more highly priced for the same alcohol content) in the local bars. We may not find any negative effect on sexual assaults against women if men who drink in bars increase their consumption (of beer and wine) to the point they have the same level of inebriation as without regulation. Second, it can lead to an increase in purchase of hard liquor in state-run stores or greater brewing at home, both spurring an increased alcohol consumption at home. This can cause undesirable consequences like increased domestic violence against women if men who substitute drinking hard liquor in bars with drinking at home, engage in violent acts against their partner, but were not earlier doing so when they were consuming liquor in bars. It can also result in a reduction in domestic violence if men come home less inebriated than before as a consequence of this regulation. Therefore, in addition to crimes against women outside home, we also look at the spillover effects of the policy change on domestic violence faced by women.

The difference-in-differences estimation results show that the regulation change led to a fall in reported incidence of sexual assaults against women by approximately 20% but had no robust effect on reported incidence of rape. The negative effect on sexual assaults was larger in districts where more bars were closed down and where initial consumption of hard liquor was higher. The synthetic control construction method also shows a reduction in sexual assaults against women by 10% after the policy came into effect. We find no consistent effect on reported incidence of rapes. One concern is that the placement of the policy change was not exogenous. The context of the policy change, discussed in detail in the next section, clearly shows that women's movements were not responsible for the regulation change in Kerala. Second, sexual crimes are usually under-reported across the world and more so in developing countries. Hence, we discuss the issue of under-reporting and its consequences for our estimates.

As long as the levels in under-reporting stay the same over the time period of our analyses or change the same for control and treatment areas, the estimates will not be affected. Also, in the wake of women progressive policies, if anything, there is likely to be an increase in reporting by women (*Iyer et al. (2012)*). Negative effects obtained in our analyses in that case should exist when actual incidence reduction trumps increased

⁵One such policy is complete prohibition of alcohol. Deaths due to drinking of spurious liquor as a result of such prohibitions has been reported to rise in India (*Luca et al. (2019)*). See *Jofre-Bonet & Petry (2008)* for relation between alcohol and usage of drugs.

reporting. We also check for pre-trends and conduct placebo tests. With regard to domestic violence we find no robust effect of the regulation change on such incidence - at worst there is no effect and at best there is a negative effect in some specifications.⁶

Rest of the paper is organized as follows. In Section 2 we discuss the background of the policy experiment and in Section 3 lay out the details of the empirical strategy. Section 4 contains data description and Section 5 discusses the estimation results. Section 6 shows the robustness of the findings to alternate specifications and discusses possible mechanisms for the results obtained. Conclusions are gathered in Section 7.

2 Background

In August 2014, the government of Kerala clamped down on local bars selling hard liquor and only bars in five star hotels were allowed to sell it. There was no effect of the ban on toddy (it is a mildly alcoholic locally brewed beverage in Kerala), wine and beer shops. After the announcement of the ban, 418 bars whose licenses were not renewed in April 2014 were shut down. The implementation of the policy led to a shutdown of all 730 foreign liquor bars run by private hoteliers by August 2014. This was in addition to 10% of total outlets of government run retail shops which were shut when the regulation was implemented in 2014.⁷ Many bars serving hard liquor then converted to beer and wine parlours.⁸

The political economy consideration behind the regulation change was insistence from the opposition party, which cornered the Chief Minister of the ruling United Democratic Front (UDF) government for being in cahoots with the liquor lobby. To prove otherwise, the UDF government passed a legislation which aimed at complete alcohol prohibition in the state by 2023. As a starting point, all local bars selling hard liquor were shut down. Importantly, this regulation change was not a result of women's movements in the State and was linked to accusations of corruption made by the opposition parties against the existing government. The immediate consequence of this policy change was an increase in the cost of access to hard liquor and consequently a reduction in consumption of hard

⁶The policy change was implemented in only one state, but against the recent spate of electoral promises in India which are centred around alcohol control measures (ban in Bihar and gradual closure of liquor shops in Tamil Nadu from 2016 onwards and a clamour among political parties to limit alcohol consumption in Madhya Pradesh and Andhra Pradesh in the run-up to state elections), this question assumes significant importance in public policy debates in India.

⁷The government of Kerala set up Kerala State Beverages Corporation Ltd (KSBC), also known as BEVCO in 1984. BEVCO is the state run organization in Kerala which is responsible for distribution of liquor across the state. It runs all liquor retail shops in Kerala and controls wholesale liquor sales to bars.

⁸ For details see,
<http://www.thehindu.com/news/national/kerala/kerala-to-shut-down-730-bars/article6341353.ece>

liquor in the state.

Table 1 shows the figures for sale of different types of alcohol in Kerala from 2010 onwards. It can be seen that the sale of Indian Made Foreign Liquor (IMFL), a category which covers most hard liquor consumption in India, increased till 2012-13 in Kerala and thereafter saw a drastic reduction from 2014-15 onwards by approximately 18% till 2015-16. Simultaneously, there was a rise in sale of beer which is much larger than the pre-existing trend seen in the previous years for Kerala. Prima facie it seems that there has been a substitution away from hard liquor towards beer. There may have been substitution towards country made liquor as well which is not captured in government data.⁹

State level estimates from the National Sample Survey(NSS) consumption round in 2011 show that per capita annual consumption of all types of alcohol by adults in Kerala, stood at 3.84 litres and 2.4 litres in rural and urban areas respectively. This was higher than the national average in 2011 (*Vidhukumar et al. (2016)*). According to *Global Survey on Alcohol and Health* conducted by WHO, per capita annual consumption of alcohol in India by adults doubled from 2.4 litres to 5.7 litres during 2005-2016.¹⁰ Crimes reported by women, especially sexual assaults and rapes, have also been rising in India over the past decade, especially in the northern states. Among all the crimes against women, the reported incidence of sexual assaults was 0.064 per 1000 population in India in 2015. State level analyses of data on all crimes against women shows that Kerala was among the top five states in reported incidence of such crimes in 2011. Figure 1 shows incidence of total crimes against women across the major states of India. Kerala stood at 0.17 in 2001 and at 0.34 in 2011 but in 2015 the incidence of such crimes had fallen in Kerala relative to the other states. Whether this can be attributed to the new regulation is an open question which this paper seeks to answer.

The closure of bars was partially revoked in July 2017 when Left Democratic Government (LDF) came to power. The new alcohol policy allowed bars attached to three and four star hotels to serve hard liquor. This resulted in re-opening of about 77 bars in the state in 2017 (about 730 bars were shut down in 2014 following the liquor policy). This reversal in policy was largely due to loss in state revenues earned from taxes imposed on hard liquor. Overall, liquor taxes comprised approximately 25% of state revenue from various taxes and services before the policy change.¹¹

⁹NSS report for 68th consumer expenditure round (2011) shows that out of the total liquor (toddy, country liquor, beer, wine and other foreign liquor) consumed in rural areas 86% is toddy and country liquor while for urban areas this figure is 53% (authors' own calculations). Unfortunately, there is no survey which captures actual consumption of alcohol at the individual level in Kerala, post the imposition of the regulation.

¹⁰The results of this survey are made available only at the national level.

¹¹See: <https://www.hindustantimes.com/india-news/kerala-announces-new-liquor-policy-bars-in-3-4-star-hotels-to-reopen/story-9oOl0zFnqpuTBuIcpEyWMP.html>

The southern state of Kerala in India has a population of 35 million. The neighboring states of Karnataka and Tamil Nadu are taken as a control group in our analyses. These three states together comprise of 160 million people (Census 2011). Kerala is one of the most developed states in India with the highest literacy rate (94%), the highest life expectancy (75%), and the most favorable sex ratio (1084 females for every 1000 males). In terms of institutional capacity to implement such a policy change, Kerala may be one of the best equipped states. For example [Dar & Sahay \(2018\)](#) find that complete alcohol prohibition in the Indian state of Bihar was not effective in curbing major crimes because limited state police capacity was diverted to implementation of the ban. Kerala, on the other hand has better institutional capacity due to better governance structures along with police strength per resident of the state, which is double that of Bihar (Bureau of Police Research and Development report, 2015).

3 Empirical Strategy

Our identification strategy is to compare changes in the reported incidence of crimes perpetrated against women in districts of Kerala (treatment) to those lying in the neighboring states of Kerala, namely, Karnataka and Tamil Nadu (control) that did not experience a change in alcohol regulation. Figure 2 shows the maps of Kerala and its neighboring states of Karnataka and Tamil Nadu. We utilize border states to construct the counterfactual of change in crime rates in Kerala in the absence of such a regulation. Border states are more likely to experience similar trends in crime changes as in Kerala and are the most similar culturally to Kerala than those from the rest of India. Districts are smaller administrative units within a state in India and the smallest geographic level at which crime data is reported. There can be concern that the immediate border districts in the neighboring states could lead to transfer of crime from Kerala to its bordering districts. This could lead to an overestimation if people migrate to bordering areas to access alcohol and commit crimes in these bordering districts. It can also lead to an underestimation to the extent that bars in the districts lying along the border provide access to hard liquor and the crime rates in Kerala do not change as a consequence. ¹²

It must be noted that as an administrative unit, a district is large and given that alcohol was still available through liquor shops for consumption at home, it is highly unlikely that a substantial population would spend long travel times to visit local bars in the neighboring districts for hard liquor. Nonetheless, to check for our findings, we also

¹²The border districts included are: Karnataka (Chamarajnagar, Dakshina Kannada, Kodagu and Mysore District) and Tamil Nadu (Coimbatore, Dindigul, Kanyakumari, Nilgiri, Theni, Tirunelveli, Tiruppur and Virudhunagar).

define the control group as all the districts in the neighboring states, excluding the border districts. The district level crime data for Kerala is only available at yearly level and there may be a concern that our specification captures a general change in crime trends and not a causal effect. To allay this concern all our econometric specifications control for district specific trends in reported crime for that category.¹³ The district level panel dataset is collated for years 2010-2015.¹⁴

The below specification is estimated to infer the causal effect of the regulation using the above identification strategy

$$\log(Crime_{dst}) = \beta_0 + \beta_1 Regulation_{dst} + \beta_2 X_{st} + D_d + T_t + D_d * t + \epsilon_{dst} \quad (1)$$

where, 'd' denotes district, 's' denotes state and 't' denotes time (year). $Crime_{dst}$ refers to the number of crimes in a particular category per 1000 population, $Regulation_{dst}$ is the interaction dummy of treatment years (2014, 2015) and the treated districts, X_{st} are time varying state controls for police force and per capita income levels, D_d are district fixed effects (these capture time invariant variables like demographic composition, culture, attitudes towards women etc) and T_t are year fixed effects. District specific time trends ($D_d * t$) are included in all specifications to control for reported crime trends which may vary across districts.¹⁵

The dependent variables used in the analyses are defined as the log of number of crimes perpetrated against women in a district, normalized by the population in a district, in various crime categories. If a crime category had zero reported incidence in a given district year then we add one to it and divide it by the population before taking a logarithm. The years before regulation was imposed are referred to as the pre-treatment years (2010-2013) and the years after it was imposed are referred to as the treatment years (2014-2015). The coefficient of interest is β_1 , which indicates whether there was any impact of the regulation change on crime incidence. If it resulted in a reduction in a particular category of crime then we would expect $\beta_1 < 0$ for that category considered. The baseline specification estimates robust standard errors clustered at the district level. To account for the

¹³Apart from NCRB reported yearly crime data, some states in India release their own monthly level crime statistics. Kerala, however, does not release monthly level crime data. Our analysis is based on annual crime data at district level.

¹⁴The latest year for which crime data is available is 2016. Our main analyses is till year 2015 since one of the control states also started closure of liquor vends in 2016. All the results are robust to inclusion of year 2016, but there is a fall in magnitude, as shown in the Appendix. We go back to the year 2010 for consistency since reporting of district level crimes against women by NCRB under various categories underwent a change post 2009.

¹⁵The results presented in the paper are also robust to state time trends. Since inclusion of district time trends is a stricter specification, we present those results here.

treatment being given at the state level in this specification, p-values based on standard errors clustered at the state level are also included in braces. Given the small number of states in our analyses, the wild cluster bootstrap percentile-t method described by Cameron *et al.* (2008) is used to estimate the p-values clustered at the state level.¹⁶

There are three remaining concerns with the above identification strategy. If there was a crackdown on crimes against women due to better policing in treatment areas along with the imposition of the regulation then the effect can be an overestimate of the true effect. To alleviate this concern we control for state level police force in our specification. We also look at other crimes like burglary and kidnapping which are unlikely to be affected by alcohol policies but will be affected by better policing. Second, crimes against women are often subject to the criticism that they are under-reported, which is an issue that afflicts most illicit behavior studies. If the levels of under-reporting do not change differently across districts over time then this has no consequences for our analyses. Since we use a six year period to consider the effects of the regulation, along with district specific time trends, this is unlikely to affect our results. If anything, there should be a positive effect of empowerment (such a regulation change is likely to empower women by creating an impression of a woman friendly government) on reporting by women (Iyer *et al.* (2012) and Amaral *et al.* (2018)). If we find any negative effect on crimes then that is likely to be a lower bound if reporting increases in treated areas post the regulation change.

The third possible pitfall, which afflicts all studies using difference-in-differences estimation is differential pre-trends in crimes perpetrated against women between the treatment and the control districts. There could have been an effective crackdown on crimes against women or there could be a change in reporting of crimes in treatment districts due to an active state government even before the alcohol regulation came into effect.¹⁷ To check for this we visually inspect trends in the major crime categories against women and show the pre-trends for sexual assaults. We also use a placebo test for year of regulation implementation. In the placebo test, same specification as in equation (1) is estimated (for the years 2010-2013) but now *Regulation* is defined as an interaction dummy for the year 2013 and the treated districts. Any differential negative effect on the incidence of crimes before the regulation came into effect will be reflected in a negative coefficient of the placebo treatment defined in this manner. If the coefficient is significantly

¹⁶Clustering standard errors at the state-level using the usual robust inference method does not give any different conclusions to clustering the standard errors at the district level and in many cases decreases the standard errors. Hence, the usual state clustered standard errors have been omitted for brevity.

¹⁷Tamil Nadu started a phase-wise crackdown on liquor vends in the state in 2016. Given that Tamil Nadu is one of the control states, this implies that Kerala and Tamil Nadu may well have been on the same path in terms of curtailing crimes against women. Kerala just happened to do it first.

negative then it implies that the fall in crime in treatment areas had started before the regulation came into effect and hence we cannot attribute a negative effect obtained in the main specification to the imposition of regulation.

In our next specification, we exploit the fact that intensity of treatment was different across districts. The information on number of bars selling hard liquor, which were closed down in each district, was obtained from the excise department of Kerala to construct a measure of treatment intensity which varies across districts. The number of bars shut down in each district is interacted with the imposition of regulation to arrive at the treatment intensity. The below specification is estimated to account for the differential exposure of districts to the treatment.¹⁸

$$\log(Crime_{dst}) = \delta_0 + \delta_1 Regulation_{dst} + \delta_2 X_{st} + D_d + T_t + D_d * t + \epsilon_{dst} \quad (2)$$

where $Regulation_{dst}$ is the number of bars closed down in the treated district per one lakh population in district d interacted with a post treatment time period indicator variable. This variable takes a value zero for control districts and for treated districts in pre-treatment years, since no major bar closures happened in control areas during this period and in years before the regulation change in the treated areas. It takes the value of the actual number of bars closed down for districts in Kerala, normalized by population, for years 2014 and 2015 when the regulation was imposed. Again, the coefficient of interest is δ_1 which indicates whether there was a differential impact of the regulation on crimes in districts where a larger number of bars were shut down. If the negative change obtained in a simple difference-in-differences estimation is indeed because of bar closure, then a negative sign must be obtained on δ_1 in this specification as well.

The latest year for which district level crime data has recently been made available is 2016, but we limit the analyses presented in the main paper to 2015. This is because one of the neighboring state of Kerala, namely Tamil Nadu, started a phase wise closure of liquor vends in 2016, with 500 shops shut in 2016 and a further 500 in 2017. Including data for year 2016 in our analyses can contaminate the results due to a control unit becoming a potentially treated unit, albeit with a different alcohol regulation change. These liquor vends shut down in Tamil Nadu are places from which alcohol can be bought and then consumed in private places. These are not social drinking bars so it is not clear in which direction estimates should move in 2016. If people shift to local bars in Tamil Nadu because vends were shut down then this can increase the magnitude of the estimated impact of Kerala's policy change. It could also reduce the impact if sexual assaults reduce

¹⁸This specification is similar to the one used by Clemens *et al.* (2018) to estimate the effect of bracero exclusion on domestic employment and wages in the US.

in Tamil Nadu due to lower drinking at home and movement in public. The results including crime data for year 2016 are shown in the Appendix. The conclusions, however, do not change when data for year 2016 is incorporated but they become weaker in 2016.

4 Data

The only source for various reported crimes in India is the data repository with National Crime Record Bureau (NCRB) which provides the official data for crimes at district level after aggregating them from all police stations. Crimes against women are reported separately under the following categories - sexual assaults, insults (involves verbal attacks), rape, domestic violence as cruelty by husband or other relatives, dowry-deaths, kidnapping of girls and importation of girls from foreign countries. A few other categories were added in 2014.¹⁹ Of all these crimes, sexual assaults constituted 25%, insults 3%, rape 11%, domestic violence 35% and dowry-deaths 2% in 2015.²⁰

The crime categories which reflect public safety of women are sexual assaults (Assaults) and verbal harassment (Insults). These would be of primary interest in our study.²¹ Among these two crime categories, *Insults* constitute a very small proportion. Hence, *Assaults* will be the most important category to consider. When it comes to rapes, there are a few caveats involved. Firstly, rapes in India may not particularly reflect public safety in aggregate since in the Indian context, the rape offenders are usually known to the victim in approximately 90% of the cases.²² Also, rape is an extreme physical-sexual crime whose reporting is subject to social stigma. It is possible that a regulation change that is seen favorable to women results in more women coming forward and reporting rapes. We may then either see a reduction, no change or an increase in rapes if reporting of rapes simultaneously increases. Previous work on total alcohol consumption prohibition in India by Luca *et al.* (2015) does not find reduction in incidence of reported rape as a result of

¹⁹Dowry is the groom price paid by the bride's family at the time of marriage. This custom is illegal but is still prevalent in India and married women who are harassed and eventually killed for their inability to bring more dowry from their parents are recorded as dowry-deaths. We do not analyze kidnapping or illegal importation of women since such crimes are unlikely to be specifically linked to consumption of alcohol by the perpetrator in public spaces. Also, importation of girls has zero reported incidences for majority of district and years. The estimations, as expected, turn out to be insignificant for these crime categories and have been omitted for brevity. Crimes for which reporting starts from 2014 are also not included in the analyses

²⁰The remaining categories are importation, trafficking and kidnapping of women.

²¹Crimes like kidnapping reflect a bad law and order situation. Women form 75% of the kidnapping victims. While most of the cases do not have a registered purpose, NCRB state reports show the most prominent reason for kidnapping is marriage, ransom etc. We later also show the results for kidnapping and do not find any evidence of hard liquor regulation having any effect on it.

²²A 2014 report by NCRB states that offenders were known to the victims in 86% of rape cases that year. <http://www.ncrb.gov.in/StatPublications/CII/CII2014/Compendium%202014.pdf>

such bans.

Apart from the above crimes against women, we also examine the effect of the regulation change on domestic violence - captured in cruelty by husband and relatives (Dom.V.) and deaths due to dowry demand by husband or relatives (Dowry-D.). The effect on these crimes could go in either direction as discussed previously. It could increase if in home drinking increases as a result of crackdown on bars or could reduce if men come home in a less inebriated condition. Table 2 shows the summary statistics of the crimes for the sample. It also shows the descriptive statistics for other control variables included in the regression specifications like police intensity, net state domestic product per capita and nightlight luminosity.

5 Results

5.1 Main Specification

Table 3, panel A, shows the estimation results for the main specification. The results show that there is a significant reduction in sexual assault cases reported by women post the closure of hard liquor bars by 22%. There is a negative effect on cases of verbal insults and a positive effect on rapes but these are not significant. The absolute number of crimes reported under verbal insults and rapes are also few in comparison to assaults. The table also shows the results for domestic violence by husbands and relatives and dowry-deaths. There is no significant effect of the regulation on reported incidences of these crimes against women within homes. The wild-clustered standard errors at state level are larger and the level of significance for sexual assaults drops to 13%.

Panel B of Table 3 shows the estimation results with treatment intensity varying across districts. The results show a significantly negative effect of bar closures on reported sexual assaults. This implies that the reduction in assaults due to the regulation is greater in districts where a larger number of bars were closed down. The estimates show that for each bar (per lakh population) selling hard liquor shut down in a district, the sexual assaults reported reduce by approximately 1%. The effect on verbal insults is insignificant and the effect on rapes now becomes positive and significant. It is possible that increased reporting of rapes was more than the reduction in rape incidence, resulting in an overall positive effect. But we do not infer much from these results on rapes since pre-trends will be later shown to be of concern for this category of crimes against women. Again, no consistent or significant effects are seen of bar closures on domestic violence.

5.2 Pre-trends and Placebo Specification

To visually inspect the pre-trends in the crime categories that capture women's public safety, Figure A.1 plots the average crime rates for the treated and control districts. The figure for sexual assaults shows that trends were similar upto 2013 but post the regulation while the assaults continued along their increasing path in the control areas, they started falling in the treated areas. The trends for verbal insults do not look exactly similar but are close. The pre-trends in rapes are completely off the mark with each year showing a different trend for treated and control areas. From these graphs we can conclude that sexual assaults are likely to satisfy the similar pre-trends assumption and the result on reduction in sexual assaults is unlikely to be driven by differential pre-trends.

As argued earlier, the causal interpretation of the above results hinge on the regulation being a trigger and no pre-existing falling trend in sexual assaults in the treatment group otherwise. To check for this, a placebo specification is also estimated where the treatment is given in year 2013. Table 4 shows the results for the specification with both the difference-in-differences and the treatment intensity estimates. The estimates show that there is no significantly negative effect of the placebo treatment on sexual assault and insult cases that began prior to 2014, before the regulation was imposed. Large negative signs are for rape and dowry deaths (albeit insignificant) in the placebo specification.²³

The above analyses shows that the most consistent and convincing effect of the bar closure policy on crimes against women is on sexual assaults not amounting to rape. The placebo test confirms that there was no negative change in assaults in the year prior to the policy was implemented. The pre-trends plot for sexual assaults for each year before the policy change is shown in Figure 3. The x-axis shows the year for which the coefficient is plotted, with the base year as 2010, for each year before the policy change. The policy was implemented in April 2014 and hence year 2013 is the last year before the policy was implemented. The plot shows a statistically insignificant change in sexual assaults prior to the implementation of the bar closure policy between the treatment and the control group for years 2012 and 2013. There is a positive change in 2011 when compared 2010 but it is not statistically different from 2012 or 2013. These placebo and pre-trends analyses give credibility to the difference-in-differences estimates that show a reduction in sexual assaults against women after the local bars were shut down.

The above analyses show that curbing hard liquor sales through closure of bars was effective in reducing crimes against women in public spaces like sexual assaults. Rapes do not show consistent effects, and are also plagued with differential pre-trends. For other

²³In another placebo specification we take the placebo treatment years as 2012 and 2013, but here too we do not find a significant effect on sexual assaults. The results are available on request.

crimes faced by women within their home premises, like domestic violence, there are no significant effects of the regulation change using the difference-in-differences strategy.

5.3 Heterogeneity

The alcohol regulation considered was aimed at affecting consumption of hard liquor in bars. Any effect of such a regulation change in reducing crimes, then must be higher in districts where initial consumption of hard liquor was greater. We construct a measure of alcohol consumption from the National Sample Surveys (NSS) of India. The last such survey is available for year 2011. The consumption schedule of these surveys captures household expenditure on different items including different types of alcohol. It is possible to construct a district level measure of per capita consumption of hard liquor (this includes Indian Made Foreign Liquor (IMFL), which constitutes hard liquor in India and wine) from these consumption surveys.²⁴ The category of IMFL was primarily affected by the imposed alcohol regulation since its sale was mostly through these bars that were shut down (already seen in Table 1). This district level measure of hard liquor consumption is interacted with the treatment dummy to see if there was a greater reduction in sexual assaults in districts with higher level of initial hard liquor consumption.

The results are shown in column 1 of Table 5. It can be seen that there is a larger negative effect in districts where hard liquor was consumed in greater quantity before the regulation was effectuated. The marginal effect calculated at mean hard liquor consumption in Kerala is negative and significant.²⁵ These estimates show that the reduction in sexual assaults seen due to the regulation change was largest in districts where initial hard liquor consumption was higher. A similar specification estimated with the treatment indicator interacted with initial consumption of country liquor/toddy/beer shows no effect on reported crime rates (results omitted due to brevity but are available on request).

Secondly, we look at the heterogeneity in the effects of regulation by the years since treatment on the reported incidence of sexual assaults. The first year of regulation was 2014. The treatment started with a few bars shutting the shop in April and all bars closed down by the month of August.²⁶ If closure of bars and consequent increased cost of access to hard liquor is the main mechanism through which the treatment works then we should see a greater effect in the year 2015 when the treatment was imposed throughout the year.

²⁴Category for only IMFL is not available in the surveys. But given that IMFL represents approximately 99 percent among the sale of wine and IMFL in India, it is most likely to reflect hard liquor consumption. So, this can serve as a good proxy. (for details see <https://www.indiatoday.in/india/story/kerala-sets-an-example-by-reducing-alcohol-consumption-276631-2015-12-10>)

²⁵The mean hard liquor consumption in Kerala is 0.061 litres per month per capita according to NSS 2011.

²⁶Monthly level data on crime against women at district level is not available from NCRB to specifically look at the two months as specific cut off points for treatment.

However, to the extent that there is a greater chance of covert operations increasing over the years as people and bar owners figure out alternative means to access and distribute hard liquor this effect can be diminished over time as well. Table 5, columns (2) and (3) shows the year wise estimates for difference-in-differences results and for treatment intensity, respectively. We find that the negative effects are present in both 2014 and 2015 but are larger in the year 2015.

6 Robustness Checks

6.1 Other specifications

Differential economic growth across districts can potentially have an effect on crimes against women. We include per capita state domestic product in our basic set of controls but check the robustness of the results to including average luminosity in a district as a proxy for economic prosperity following [Henderson *et al.* \(2012\)](#). The nighttime average luminosity data is produced by National Oceanic and Atmospheric Administration (NOAA). This data is processed for each year in the analyses to construct district level year wise nightlight luminosity. Columns (1) and (2) of Table 6 show the results with the additional control. The results on sexual assaults remain robust to this alternative specification, in both the simple difference-in-differences (DiD) and the treatment intensity (TI) specification. The DiD estimate shows a reduction in sexual assaults by 15% and treatment intensity estimates show a reduction of 1% per bar shut down per one lakh persons.

There may be a concern of increased crime rates against women in the border districts (of the control group) as men may travel to neighboring districts in other states to consume hard liquor in the bars there. As already mentioned, we do not expect this to be playing any major role since districts are large enough administrative units in India. Nevertheless, to allay any concerns, we exclude the border districts in the neighboring states of the treated area from the control group. This specification includes all districts in the neighboring states of Tamil Nadu and Karnataka, except those lying on the border of Kerala, in the control group. The results in Table 6, columns (3) and (4) show that the negative effect on sexual assaults is robust to this specification as well. The magnitude of the impact on sexual assaults is around 20% in the DiD specification.

Lastly, we include crime data for year 2016, the latest time period for which it is available in India. However, as mentioned earlier, one of the neighboring states of Kerala, namely Tamil Nadu started a phase wise closure of liquor vends in 2016. This can potentially contaminate our results when the same specification is extended to the year

2016. Table A.1 in the Appendix show the results for sexual assaults against women estimated using both the simple DID and the treatment intensity specification. The negative effects on sexual assaults are robust to the alternative specifications. The magnitude of the effect has fallen and now stands at 18% when all districts of the neighboring states are taken in the control group. Excluding Tamil Nadu, when data for 2016 is included, makes the negative effect stronger at 35%. The specifications with treatment intensity in columns (3) and (4) also show a negative and significant effect on sexual assaults when data for 2016 is included and the magnitude is similar when compared to the main specification in Table 3, treatment intensity estimates.

6.2 Synthetic Control Method

We use the synthetic control method proposed by Abadie & Gardeazabal (2003) and Abadie *et al.* (2010) to check the robustness of the results obtained on sexual assaults and also to check for any differential results on rape and domestic violence.²⁷ This method allows one to choose comparison control units which are similar to the treatment units. It is a data driven approach for estimating treatment effects and is considered suitable for impact evaluation when a small number of observational units are affected by treatment Cameron & Miller (2015). Similar to a difference-in-differences design it exploits the difference in treated and untreated units before and after the treatment but does not give the same weight to each control unit. The weights are given to each control unit such that a weighted average of all the potential comparison units best resembles the characteristics of the treated unit in terms of pre-intervention trend in outcome variables.

We discuss the method briefly. Suppose there is one treated unit and J potential control units. The treated unit is indexed by $i = 1$ and the potential control units are indexed by $i = 2, \dots, J + 1$. The time period is indexed by $t = 1, \dots, T$. The pre-intervention periods are denoted by T_0 and the post-intervention periods are denoted by T_1 and $T = T_0 + T_1$. In other words, pre-intervention years are $1, 2, \dots, T_0$ and the post-intervention years are $T_0 + 1, \dots, T$. The weight attached to the control units is given by $W = (w_2, \dots, w_{J+1})'$ which is a $J \times 1$ vector such that $0 \leq w_j \leq 1$ and $\sum_{j=2}^{J+1} w_j = 1$. The value of W is chosen such that pre-trends in outcome variables of interest in the treated unit are best imitated by the synthetic control.²⁸

The treatment effect is then quantified by comparing the post-treatment period outcome

²⁷Rape and domestic violence have the largest incidence among the crime categories reported specifically for women. The reported incidence of verbal insults and dowry-deaths are too few and in some cases zero for certain district years which makes matching on trends using the synthetic control method undesirable.

²⁸Abadie & Gardeazabal (2003) and Abadie *et al.* (2010) discuss the minimization problem involved in matching the pre-treatment characteristics to arrive at these weights.

in the treated unit with the weighted average of the post-treatment period outcome in the control units. The weighted average of the outcome in the post-treatment period thus serves as the counterfactual. The outcome of unit j at time t is denoted by Y_{jt} . Then for period t (for $t > T_0$), the synthetic control estimator of the treatment effect is given by the difference between the outcome for the treated unit and the outcome for the synthetic control in that period i.e. $Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$. To evaluate the synthetic control estimates a potential *donor pool* for the control units needs to be selected. We consider two *donor pools* - the districts of neighboring two states and the districts of all southern states of India (five states namely Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Orissa).²⁹

Table 7 shows the estimates obtained from the synthetic control method for sexual assaults, rape and domestic violence. The synthetic control method which matches the treatment districts and the control districts on trends, re-scales the dependent variable by giving the value of one to the crime incidence in 2013 (the time period just before the treatment) for each district. These estimates are interpreted as percentage changes to the mean crime incidence (normalized by population) in 2013, the year just before treatment. The bootstrapped p-values for each coefficient are given in braces. A test for whether the treatment group and the synthetic control created match well on the pre-trends is also shown for each specification. A rejection of this test would imply that the best synthetic control generated using the data driven method cannot match the treatment group outcome trends in the pre-treatment period. The results in Table 7 show that this test is rejected only for rapes. Both sexual assaults and domestic violence meet the criteria that the synthetic control is well matched in pre-trends to the treatment group in the years before regulation change occurred.

The synthetic control estimates show a negative effect of the regulation change on sexual assaults in both the years after the treatment came into effect. The magnitude of this negative effect is 10% when neighboring states are taken in the donor pool (Panel A of Table 7). The effect increases to almost 20% in the first year and to 48% in the second year of regulation, when all southern states are taken as a donor pool for constructing the synthetic control group (Panel B of Table 7).³⁰ These results corroborate the findings of the difference-in-differences analyses that shows a significantly negative impact of the regulation on sexual assaults. However, for domestic violence, the results now change. We now find a significantly negative effect of regulation on domestic violence, which is larger in

²⁹The northern states are not selected in the donor pool since there is a trend break in reports of sexual assaults and rapes against women in these states post 2012. Also, the southern and the northern states of India are considered quite disparate in reporting crimes.

³⁰The results with all southern states in the donor pool give larger estimates and we continue to infer main effects from only the neighboring states of Kerala in the donor pool.

the second year of regulation. These estimates suggest that reported domestic violence falls by almost 16% when the donor pool is the neighboring states in the second year and by 35% (albeit insignificant) when all southern states are taken to be the donor pool. Given that we did not find any significant results on domestic violence in the difference-in-differences or the treatment intensity estimates, we conclude that the effect on domestic violence of such a regulation change can potentially be negative but the result is not robust to alternate specifications. On the other hand, the reduction in reported sexual assaults due to the regulation is robust to both methods.

Additional results for the Synthetic Control Method of estimation for sexual assaults when year 2016 is included in the analyses are shown in Appendix Table A.2. Here we find that there is a significant reduction in sexual assaults in years 2014 and 2015 but not in 2016 when the state of Tamil Nadu is included in the control group along with the other neighboring state of Karnataka (column 1). When Tamil Nadu is excluded in column (2), there is a consistent negative effect on sexual assaults even in 2016. When all southern states are included in the donor pool, the negative effect on sexual assaults continues to hold.

6.3 Mechanism

We have already seen that there was a reallocation in the type of liquor being consumed in Kerala post the closure of hard liquor bars (Table 1) from IMFL, which is hard liquor and an increase in beer consumption. This shows a clear reduction in hard liquor in the state of Kerala post the regulation change and some shift towards beer. The alcohol by volume percentage is much higher in IMFL than in beer or wine which were allowed to be served in local bars.³¹ We cannot verify if there was a reduction alcohol consumption post the regulation change in Kerala because of lack of household level consumption data but these statistics clearly show a reduction in hard liquor. There could have been a reduction in overall alcohol consumption in Kerala post the regulation but not necessarily since people could have shifted towards beer or started drinking at home. Hence, whether or not there was any reduction in total alcohol consumption does not matter. Even if there was no reduction in alcohol consumption or expenditure in Kerala post this regulation change, it would have lowered the alcohol content in the same quantity of liquor consumed, thus reducing inebriation.

Our hypothesis is that the main mechanism for the regulation change (that led to reduced hard liquor availability in local bars) to effectuate any reduction in sexual assaults reported by women should be through decreased interpersonal interactions between women

³¹<https://www.alcohol.org/statistics-information/abv/>

and inebriated men in public spaces. Women are unlikely to be found in the bars (since few visit them in India) but are likely to come in contact with men when they travel in an inebriated condition. Drinking in groups in public spaces like bars can also make men under inebriation to act more brazenly because they are likely to be egged on by fellow mates. This policy change resulted in decreased consumption of hard liquor in bars and our finding that effects on sexual assaults were larger in districts where more number of bars were closed shows evidence of this mechanism.³² A competing hypothesis can be that quality of policing improved in these areas simultaneously with the closure of bars leading to a reduction in reported crimes like sexual assaults. If our hypothesis is correct then the negative effect of bar closures, if any, should be larger on crimes which involve greater interpersonal interactions and not on other crime categories.

We look at five other crimes categories reported by NCRB which are not women specific - *Hurt*, *Theft*, *Burglary*, *Kidnapping* and *Murder*. The category of *Hurt* includes incidents of physical assaults which may occur during fights, acid attacks, and any other act that endangers the life of others. *Theft* includes theft of personal belongings outside the house, auto theft, and theft inside a house by members or servants.³³ *Burglary* is committed when a perpetrator specifically breaks into a house or property. Among these crimes, *Murder* is a fatal crime and *Kidnapping* is a crime unlikely to be affected by drinking in public spaces.³⁴ Increased probability of committing a crime due to greater interpersonal interactions under an inebriated condition is the highest for the category of *Hurt* among all these crime categories since people are most likely to break into fights when drunk. Reduction in heavy drinking in public spaces can decrease reported incidence of such crimes. For petty theft crimes outside homes, it is again possible that less number of inebriated people in public areas can lead to some reduction in such crimes too but these may constitute a small proportion of overall theft cases. On the other hand crimes like burglary, kidnapping and murder should have little relation with drinking in public spaces. If one finds a reduction in these crimes as well due to the regulation change then the mechanism could possibly be better overall law and order improvement in treatment areas along with the closure of bars.

Table 8 shows the results from the difference-in-differences and treatment intensity estimations. The crime category for which the results are large and significantly negative is *Hurt* where the regulation resulted in almost 39% reduction in such reported cases. The effect is also negative for hurts in the specification with treatment intensity but is not significant. On the other hand, there is no such significantly negative effect observed for

³²The bars in Kerala operate between 9 a.m. to 11 p.m..

³³It is not possible to separate these categories within theft at the district level.

³⁴Kidnapping of only women is also reported but we do not find any effect on that either.

theft, burglary, kidnapping or murder. The placebo estimates, omitted for brevity, also show no pre-existing negative trend for the reported incidence of committing grievous hurts. This confirms that it was indeed the regulation change that resulted in the negative effect observed on sexual assaults against women post-treatment and not driven by improved policing in the state.

Another potential mechanism at play may be changes in tourism levels in Kerala due to a change in domestic policy. If tourism changes have an effect on crimes, then a doubt will be cast on the above mechanism. It must be noted that while local bars could not serve hard liquor, bars in five star hotels could still do so and there was no restriction on drinking inside hotel rooms, where tourists are likely to stay. Nonetheless, we look at any drastic changes in tourist inflow in Kerala after the policy change. Figure 4 shows the total inflow of domestic and foreign tourists in Kerala during 2010-2017 for which the data is available. Clearly, there is no visible change in trends in tourism inflow and there is a steady increase in tourism over the years. This rules out changes in tourism levels affecting crimes in Kerala post the regulation change.

7 Conclusion

In this paper, we use a natural experiment to estimate the effect of a regulation change which curtails sale of hard liquor through bars on crimes against women. We find that such a policy change resulted in a decline in incidence of sexual assaults against women, which was not offset by an increase in domestic violence. The results are robust across different specifications that use difference-in-differences, treatment intensity, exclusion of border areas and construction of synthetic control groups to infer the causal impact of the policy change. The pre-trends analysis and the placebo treatment show that these results are not driven by pre-existing differential trends in sexual assaults across the treated and the control group before the regulation was implemented. Hence, our results are unlikely to be confounded by presence of negative pre-trends. We also argue that reporting changes are unlikely to explain the results obtained. The regulation change considered in this study is likely to lower social drinking outside the home resulting in a decreased likelihood of interpersonal interactions between a potential victim and perpetrator. In terms of magnitude, the most conservative results show a reduction in sexual assault cases by approximately 10% after the regulation was implemented. These effects are economically significant and show that regulating inebriation in bars can increase public safety of women.

References

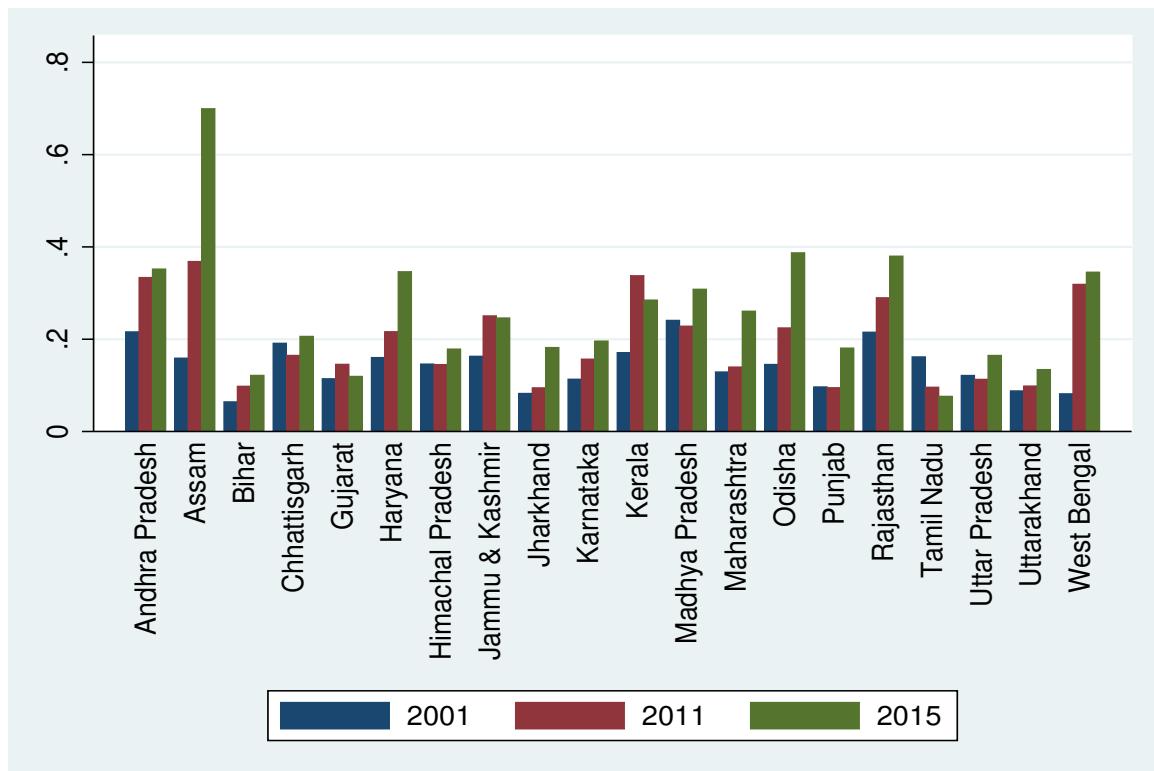
- Abadie, Alberto, & Gardeazabal, Javier. 2003. The economic costs of conflict: A case study of the Basque Country. *American Economic Review*, **93**(1), 113–132.
- Abadie, Alberto, Diamond, Alexis, & Hainmueller, Jens. 2010. Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program. *Journal of the American statistical Association*, **105**(490), 493–505.
- Aguilar, Arturo Alberto, Gutierrez, Emilio, & Villagran, Paula Soto. 2020. Benefits and Unintended Consequences of Gender Segregation in Public Transportation: Evidence from Mexico City's Subway System. *Forthcoming: Economic Development and Cultural Change*.
- Aizer, Anna. 2010. The gender wage gap and domestic violence. *American Economic Review*, **100**(4), 1847–59.
- Amaral, Sofia, Nishith, Prakash, & Bhalotra, Sonia. 2018. Gender, Crime and Punishment: Evidence from Women Police Stations in India. *Cornell University: NEUDC Retrieved from http://barrett.dyson.cornell.edu/NEUDC/paper_32.pdf*.
- Anderberg, Dan, Rainer, Helmut, Wadsworth, Jonathan, & Wilson, Tanya. 2015. Unemployment and domestic violence: Theory and evidence. *The Economic Journal*, **126**(597), 1947–1979.
- Anderson, D Mark, Crost, Benjamin, Rees, Daniel I, et al. 2018. Wet Laws, Drinking Establishments and Violent Crime. *The Economic Journal*, **128**(611), 1333–1366.
- Becker, Gary S. 1968. Crime and punishment: An economic approach. *Pages 13–68 of: The economic dimensions of crime*. Springer.
- Biderman, Ciro, De Mello, João MP, & Schneider, Alexandre. 2009. Dry laws and homicides: evidence from the São Paulo metropolitan area. *The Economic Journal*, **120**(543), 157–182.
- Bobonis, Gustavo J, González-Brenes, Melissa, & Castro, Roberto. 2013. Public transfers and domestic violence: The roles of private information and spousal control. *American Economic Journal: Economic Policy*, **5**(1), 179–205.
- Borker, Girija. 2018. Safety First: Perceived Risk of Street Harassment and Educational Choices of Women. *Cornell University: NEUDC Retrieved from http://barrett.dyson.cornell.edu/NEUDC/paper_432.pdf*.

- Cameron, A Colin, & Miller, Douglas L. 2015. A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, **50**(2), 317–372.
- Cameron, A Colin, Gelbach, Jonah B, & Miller, Douglas L. 2008. Bootstrap-based improvements for inference with clustered errors. *The Review of Economics and Statistics*, **90**(3), 414–427.
- Card, David, & Dahl, Gordon B. 2011. Family violence and football: The effect of unexpected emotional cues on violent behavior. *The Quarterly Journal of Economics*, **126**(1), 103–143.
- Carpenter, Christopher. 2007. Heavy alcohol use and crime: Evidence from underage drunk-driving laws. *The Journal of Law and Economics*, **50**(3), 539–557.
- Carpenter, Christopher, & Dobkin, Carlos. 2010. Alcohol regulation and crime. *Pages 291–329 of: Controlling crime: Strategies and tradeoffs*. University of Chicago Press.
- Carpenter, Christopher, & Dobkin, Carlos. 2015. The minimum legal drinking age and crime. *The Review of Economics and Statistics*, **97**(2), 521–524.
- Carpenter, Christopher S. 2005. Heavy alcohol use and the commission of nuisance crime: Evidence from underage drunk driving laws. *American Economic Review*, **95**(2), 267–272.
- Chakraborty, Tanika, Mukherjee, Anirban, Rachapalli, Swapnika Reddy, & Saha, Sarani. 2018. Stigma of sexual violence and women's decision to work. *World Development*, **103**, 226–238.
- Chaudhuri, Kalyani, Jha, Natasha, Nilayamgode, Mrithyunjayan, & Suryanarayana, Revathy. 2018. Alcohol Ban and Crime: The ABC's of the Bihar Prohibition. *Cornell University: NEUDC Retrieved from http://barrett.dyson.cornell.edu/NEUDC/paper_248.pdf.*
- Clemens, Michael A, Lewis, Ethan G, & Postel, Hannah M. 2018. Immigration restrictions as active labor market policy: Evidence from the mexican bracero exclusion. *American Economic Review*, **108**(6), 1468–87.
- Cook, Philip J, & Durrance, Christine Piette. 2013. The virtuous tax: lifesaving and crime-prevention effects of the 1991 federal alcohol-tax increase. *Journal of Health Economics*, **32**(1), 261–267.

- Cook, Philip J, & Moore, Michael J. 1993. Violence reduction through restrictions on alcohol availability. *Alcohol Research*, **17**(2), 151.
- Dar, Aaditya, & Sahay, Abhilasha. 2018. Designing Policy in Weak States: Unintended Consequences of Alcohol Prohibition in Bihar. *Available at SSRN 3165159*.
- Hansen, Benjamin, & Waddell, Glen R. 2018. Legal access to alcohol and criminality. *Journal of Health Economics*, **57**, 277–289.
- Heaton, Paul. 2012. Sunday liquor laws and crime. *Journal of Public Economics*, **96**(1-2), 42–52.
- Henderson, J Vernon, Storeygard, Adam, & Weil, David N. 2012. Measuring economic growth from outer space. *American Economic Review*, **102**(2), 994–1028.
- Iyer, Lakshmi, Mani, Anandi, Mishra, Prachi, & Topalova, Petia. 2012. The power of political voice: women's political representation and crime in India. *American Economic Journal: Applied Economics*, **4**(4), 165–93.
- Jofre-Bonet, Mireia, & Petry, Nancy M. 2008. Trading apples for oranges?: Results of an experiment on the effects of Heroin and Cocaine price changes on addicts' polydrug use. *Journal of Economic Behavior & Organization*, **66**(2), 281–311.
- Kavanaugh, Guadalupe E, Sviatschi, Maria Micaela, & Trako, Iva. 2017. Inter-Generational Benefits of Improving Access to Justice for Women: Evidence from Peru. *IZA Conference, Working Paper*.
- Lindo, Jason M, Siminski, Peter, & Swensen, Isaac D. 2018. College party culture and sexual assault. *American Economic Journal: Applied Economics*, **10**(1), 236–65.
- Luca, Dara Lee, Owens, Emily, & Sharma, Gunjan. 2015. Can alcohol prohibition reduce violence against women? *American Economic Review: Papers and Proceedings*, **105**(5), 625–29.
- Luca, Dara Lee, Owens, Emily, & Sharma, Gunjan. 2019. The effectiveness and effects of alcohol regulation: evidence from India. *IZA Journal of Development and Migration*, **9**(1), 4.
- Markowitz, Sara. 2005. Alcohol, drugs and violent crime. *International Review of Law and Economics*, **25**(1), 20–44.

- Markowitz, Sara, Nesson, Erik, Poe-Yamagata, Eileen, Florence, Curtis, Deb, Partha, Andrews, Tracy, & Barnett, Sarah Beth L. 2012. Estimating the relationship between alcohol policies and criminal violence and victimization. *German Economic Review*, **13**(4), 416–435.
- Norström, Thor, & Skog, Ole-Jørgen. 2005. Saturday opening of alcohol retail shops in Sweden: an experiment in two phases. *Addiction*, **100**(6), 767–776.
- Perova, Elizaveta, & Reynolds, Sarah Anne. 2017. Women's police stations and intimate partner violence: Evidence from Brazil. *Social Science & Medicine*, **174**, 188–196.
- Sekhri, Sheetal, & Storeygard, Adam. 2014. Dowry deaths: Response to weather variability in India. *Journal of Development Economics*, **111**, 212–223.
- Siddique, Zahra. 2018. Violence and the labor supply of married women in India. *Cornell University: NEUDC Retrieved from*
http://barrett.dyson.cornell.edu/NEUDC/paper_345.pdf.
- Siwach, Garima. 2018. Crimes Against Women in India: Evaluating the Role of a Gender Representative Police Force. *Available at SSRN 3165531*.
- Vidhukumar, K, Nazeer, E, & Anil, P. 2016. Prevalence and pattern of alcohol use in Kerala—A district based survey. *Int J Recent Trends Sci Technol*, **18**, 363–7.
- Zimmerman, Paul R. 2004. A theoretical analysis of alcohol regulation and drinking-related economic crime. *European Journal of Law and Economics*, **18**(2), 169–190.

Figure 1: State-Wise Total Crimes against Women (per 1000 population) for the Years 2001, 2011, 2015



Source: NCRB (Authors' own calculations)

Figure 2: Kerala and Bordering States

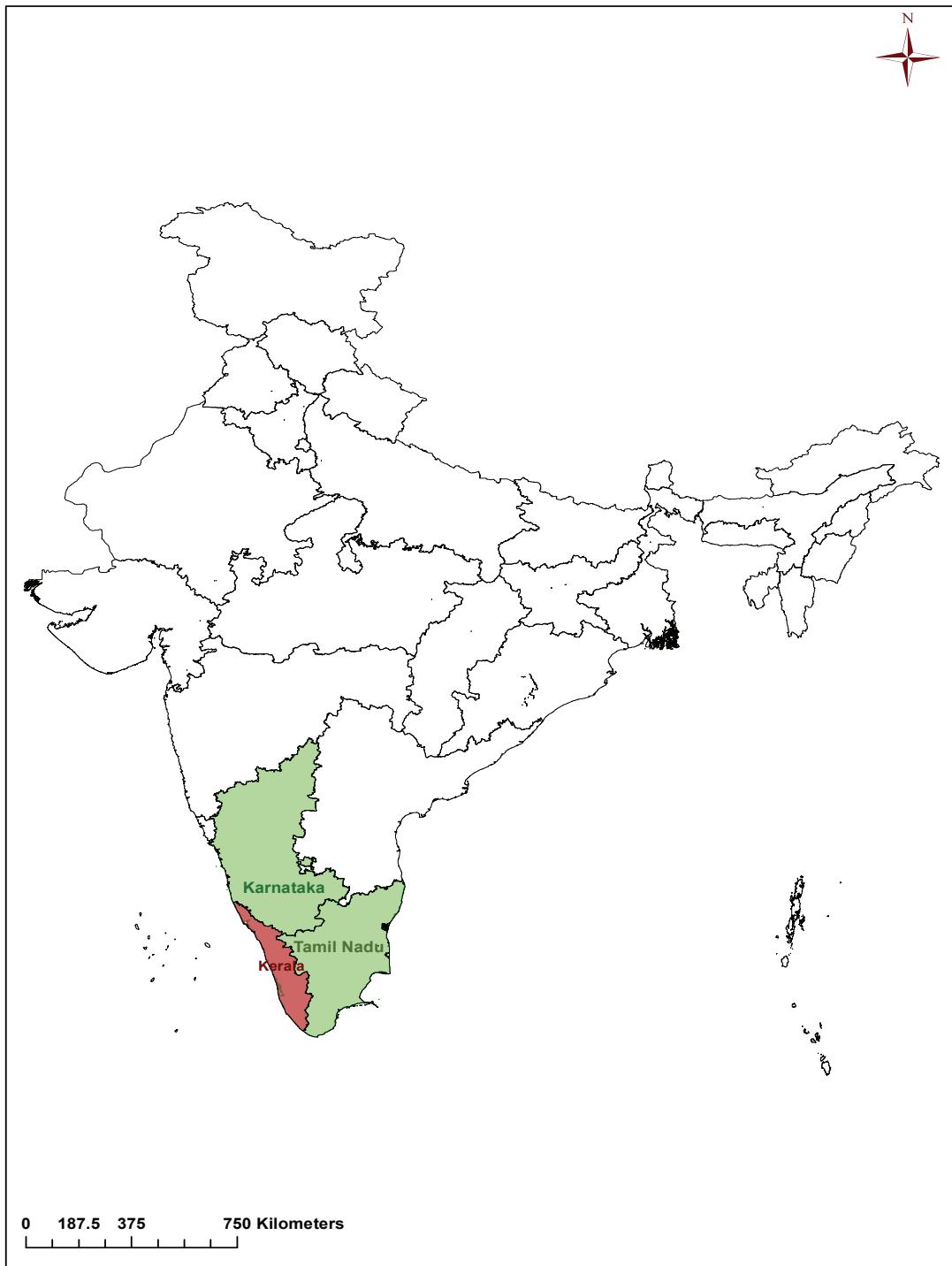
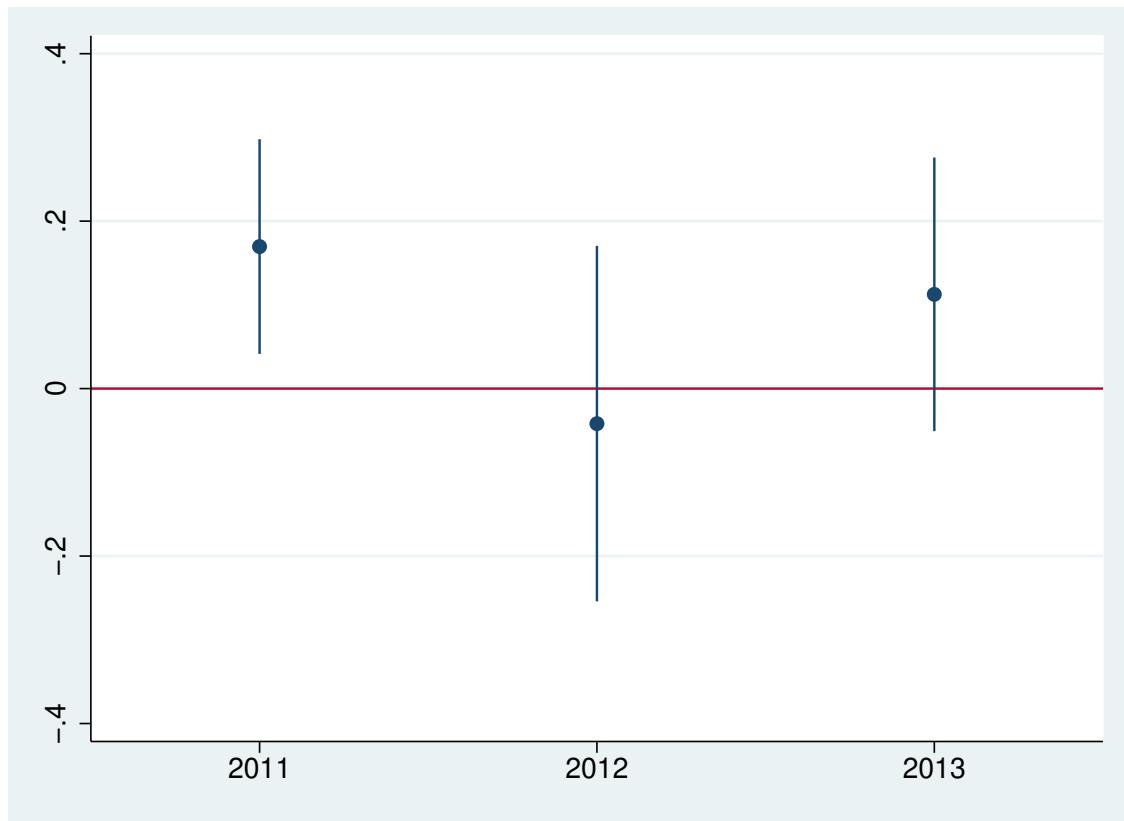


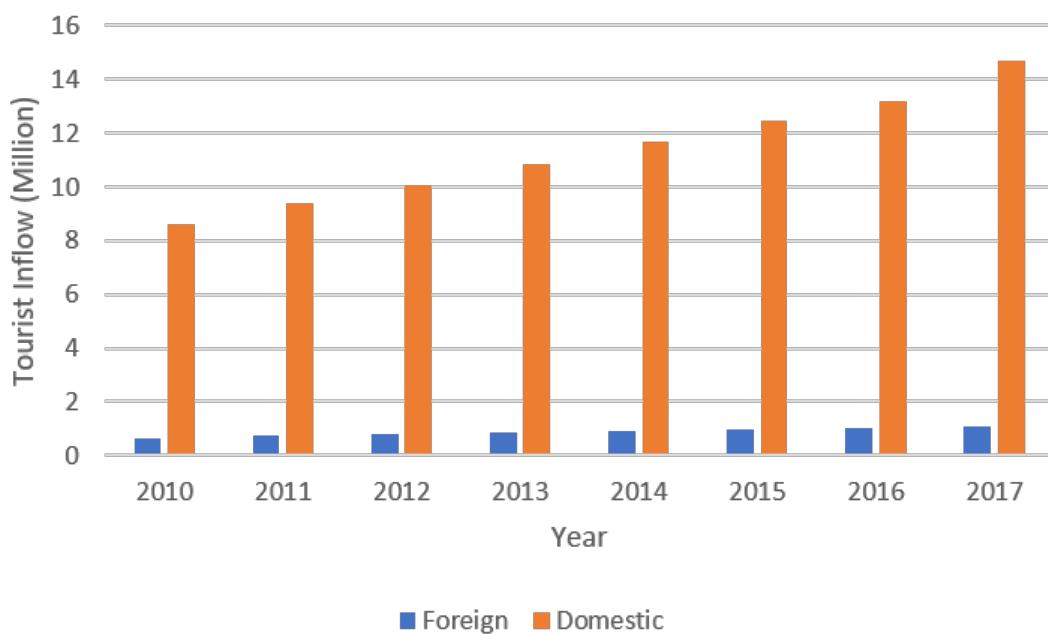
Figure 3: Pre-trends plot: Sexual Assaults against Women



Source: NCRB (Authors' own calculations)

Notes: The dependent variable is log of number of sexual assaults against women per 1000 population. The reference year is 2010.

Figure 4: Tourist Inflow in Kerala



Source: Kerala Tourism website (<https://www.keralatourism.org/touriststatistics/>)

Table 1: Change in Sale by Types of Alcohol in Kerala

Year	IMFL (cases in lakhs)	Beer (cases in lakhs)
2010 – 2011	217.41	85.61
2011 – 2012	241.78	97.82
2012 – 2013	244.33	101.64
2013 – 2014	240.67	107.96
2014 – 2015	220.58	95.59
2015 – 2016	201.75	154.20

Source: BEVCO (<https://www.ksbc.kerala.gov.in/sales.htm>)

Notes: The sale figures refer to a financial year (April-March).

Table 2: Summary Statistics

	Observations	Mean	Std. Dev.	Min	Max
<i>Crimes per 1000 population</i>					
Assault	450	.056	.05	.001	.284
Insult	450	.005	.009	0	.074
Rape	450	.016	.015	0	.127
Domestic Violence (Dom.V.)	450	.059	.051	.001	.252
Dowry Deaths (Dowry-D.)	450	.002	.003	0	.021
Hurt	450	.28	.271	0	1.386
Theft	450	.188	.145	.04	1.261
Kidnapping	450	.022	.016	.001	.104
Murder	450	.024	.011	.003	.082
<i>Other Variables</i>					
Police per capita	450	12.8	1.12	11	15
NSDP per capita (Rs.)	450	101097.94	10148.93	87144	124773
Annual Nightlights	450	13.3	20.07	2	254

Source: NCRB (crime data), Police (Bureau of Police Research and Development), NSDP (Reserve Bank of India) and NOAA/NCEI (nightlights)

Table 3: Estimated Effects of Closure of Hard Liquor Bars on Crimes against Women

	(1)	(2)	(3)	(4)	(5)
	Assault	Insult	Rape	Dom.V.	Dowry-D.
Panel A: Difference-in-differences					
Regulation	-0.22*** (0.08) {0.13}	-0.36 (0.31) {0.55}	0.10 (0.10) {0.23}	0.12 (0.08) {0.74}	-0.26 (0.24) {0.65}
R-squared	0.51	0.45	0.62	0.51	0.34
Observations	450	450	450	450	450
Panel B: DiD with Treatment Intensity					
Regulation	-0.01*** (0.00) {0.13}	-0.00 (0.02) {0.88}	0.01*** (0.00) {0.27}	0.01 (0.00) {0.68}	-0.01 (0.01) {0.71}
R-squared	0.51	0.45	0.63	0.50	0.34
Observations	444	444	444	444	444

Source: NCRB for Crimes and Excise Department of Kerala for number of bars closed down.

Notes: The dependent variable is log of crimes in a category per 1000 population. The data contains observations on 75 districts in difference-in-differences and 74 districts in treatment intensity (since data on bar closures could not be obtained for one district in Kerala) for 6 years. All districts in neighboring states are in the control group. District and year fixed effects along with district specific time trends are controlled for in all specifications. Other controls include police and income per capita. Regressions are weighted by district population and standard errors clustered at district level are in parentheses. The Wild-State-Clustered Bootstrap p-value is in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

Table 4: Estimated Effects of Placebo Treatment on Crimes against Women

	(1)	(2)	(3)	(4)	(5)
	Assault	Insult	Rape	Dom.V.	Dowry-D.
Panel A: Difference-in-differences					
Placebo Regulation	-0.06 (0.48) {0.85}	0.40 (0.99) {0.44}	-0.67 (0.57) {0.64}	0.27 (0.44) {0.09}	-1.08 (1.17) {0.45}
R-squared	0.40	0.63	0.63	0.56	0.31
Observations	300	300	300	300	300
Panel B: Treatment Intensity					
Placebo Regulation	0.00 (0.01) {0.85}	0.02 (0.02) {0.52}	0.00 (0.01) {0.89}	-0.00 (0.01) {0.85}	0.02 (0.03) {0.62}
R-squared	0.39	0.63	0.63	0.56	0.30
Observations	296	296	296	296	296

Source: NCRB for Crimes and Excise Department of Kerala for number of bars closed down.

Notes: The dependent variable is log of crimes in a category per 1000 population. The data contains observations on 75 districts in difference-in-differences and 74 districts in treatment intensity (since data on bar closures could not be obtained for one district in Kerala) for 4 years. All districts in neighboring states are in the control group. District and year fixed effects along with district specific time trends are controlled for in all specifications. Other controls include police and income per capita. Regressions are weighted by district population and standard errors clustered at district level are in parentheses. Wild-State-Clustered Bootstrap p-value is given in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

Table 5: Estimated Effects of Closure of Hard Liquor Bars on Sexual Assaults against Women: Heterogeneity

	(1)		(2)	(3)
<i>Initial Consumption</i>	<i>Yearwise</i>			
Regulation	-0.15 (0.10) {0.17}	Regulation 2014	-0.16** (0.08) {0.09}	-0.01** (0.00) {0.37}
Regulation*Initial consumption	-1.18 (0.95) {0.03}	Regulation 2015	-0.40*** (0.12) {0.11}	-0.02*** (0.01) {0.14}
R-squared	0.51	R-squared	0.51	0.51
Marginal Effect (at mean)	-0.23*** {0.00}	Specification	DiD	TI
Observations	450	Observations	450	444

Source: NCRB for Crimes and Excise Department of Kerala for number of bars closed down. Alcohol consumption (NSS 2011, Consumption Schedule). *Notes:* The dependent variable is log of crimes in a category per 1000 population. TI refers to treatment intensity. All districts in neighboring states are in the control group. District and year fixed effects along with district specific time trends are controlled for in all specifications. Other controls include police and income per capita. Regressions are weighted by district population and standard errors clustered at district level are in parentheses. Wild-State-Clustered Bootstrap p-value is given in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

Table 6: Estimated Effects of Closure of Hard Liquor Bars on Sexual Assaults against Women: Robustness

	(1)	(2)	(3)	(4)
	Nightlights control		Excluding border districts	
Regulation	-0.15* (0.08) {0.11}	-0.01** (0.00) {0.18}	-0.20** (0.08) {0.120}	-0.01*** (0.00) {0.16}
R-squared	0.49	0.49	0.50	0.49
Observations	450	444	378	372
Specification	DiD	TI	DiD	TI

Source: NCRB for Crimes and Excise Department of Kerala for number of bars closed down.

Notes: The dependent variable is log of crimes in a category per 1000 population. TI refers to the specification with Treatment Intensity. All districts in neighboring states are in the control group in columns (1) and (2). The data contains observations on 75 districts in difference-in-differences and 74 districts in treatment intensity (since data on bar closures could not be obtained for one district in Kerala) for 6 years. District and year fixed effects along with district specific time trends are controlled for in all specifications. Other controls include police and income per capita. Regressions are weighted by district population and standard errors clustered at district level are in parentheses. Wild-State-Clustered Bootstrap p-value is given in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

Table 7: Estimated Effects of Closure of Hard Liquor Bars on Crimes against Women:
Synthetic Control Method

	(1)	(2)	(3)
	Assault	Rape	Dom.V.
Panel A: Donor Pool is Neighboring States			
Regulation 2014	-0.09** {0.03}	0.18 {0.57}	-0.052 {0.94}
Regulation 2015	-0.108** {0.02}	0.41*** {0.01}	-0.164** {0.02}
Test for same pre-trends	0.99	0.004	0.99
Panel B: Donor Pool is Southern States			
Regulation 2014	-0.201 {0.16}	0.079 {0.48}	-0.106 {0.26}
Regulation 2015	-0.487** {0.03}	.008 {0.75}	-.347 {0.08}
Test for pre-trends	0.95	0.007	0.99

Source: NCRB for Crimes.

Notes: The dependent variable is number of reported crimes in a category per 1000 population. The data contains observations on 75 districts in donor pool of neighboring states and 163 districts in donor pool of southern states for 6 years. The p-value for the coefficients is given in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

Table 8: Estimated Effects of Closure of Hard Liquor Bars on Other Crimes

	(1)	(2)	(3)	(4)	(5)
	Hurt	Theft	Burglary	Kidnapping	Murder
Panel A: Difference-in-Difference					
Regulation	-0.39*** (0.14) {0.64}	0.08 (0.08) {0.85}	0.10 (0.09) {0.66}	-0.07 (0.15) {0.66}	-0.08 (0.09) {0.35}
R-squared	0.96	0.52	0.55	0.50	0.36
Observations	450	450	450	450	450
Panel B: Treatment Intensity					
Bar Closure	-0.01 (0.01) {0.38}	0.00 (0.00) {0.87}	0.00 (0.00) {0.45}	0.00 (0.01) {0.85}	-0.00 (0.01) {0.36}
R-squared	0.95	0.52	0.56	0.50	0.36
Observations	444	444	444	444	444

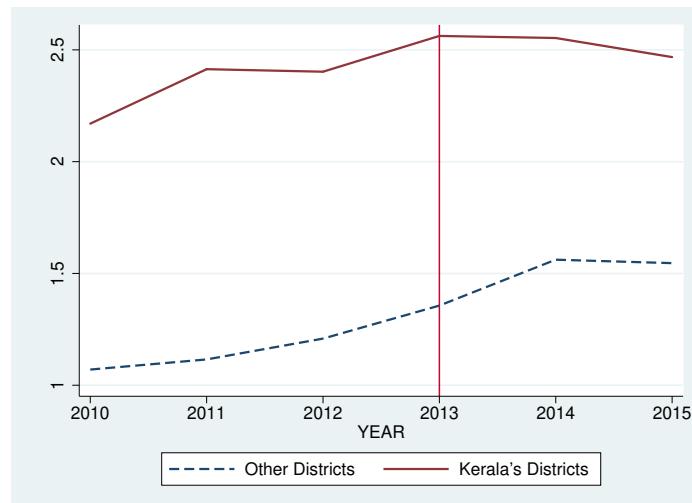
Source: NCRB for Crimes and Excise Department of Kerala for number of bars closed down.

Notes: The dependent variable is log of crimes in a category per 1000 population. The data contains observations on 75 districts in difference-in-differences and 74 districts in treatment intensity (since data on bar closures could not be obtained for one district in Kerala) for 6 years. District and year fixed effects along with district specific time trends are controlled for in all specifications. Other controls include police and income per capita. Regressions are weighted by district population and standard errors clustered at district level are in parentheses. Wild-State-Clustered Bootstrap p-value in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

ONLINE APPENDIX

Figure A.1: Log of Crimes per 1000 population: Kerala and its bordering states

(a) Assaults



(b) Insults

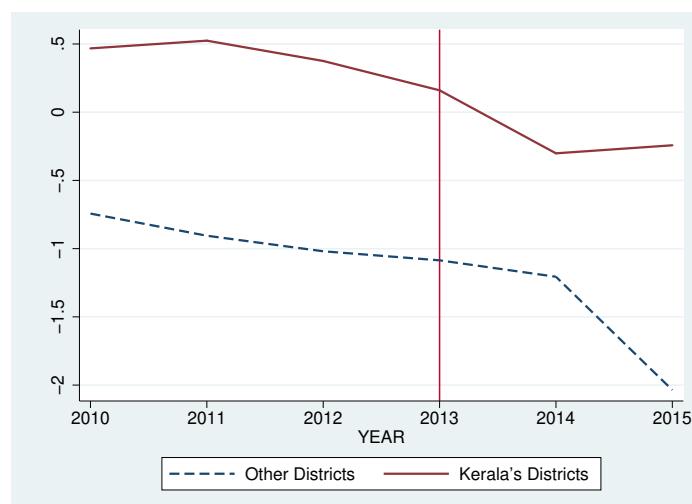
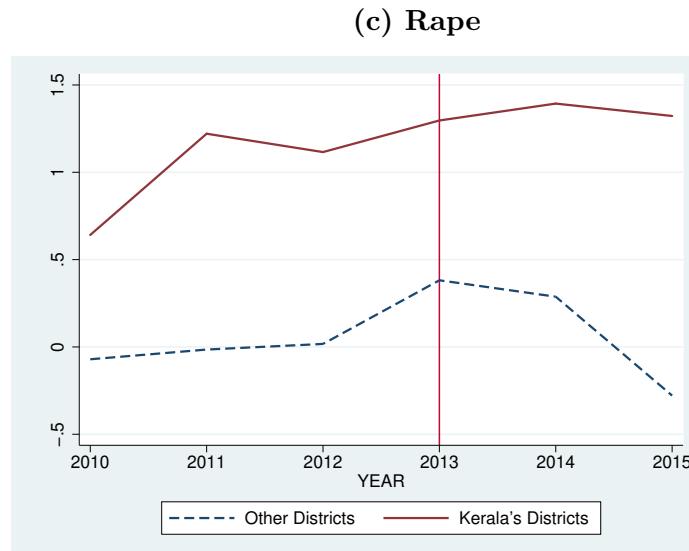


Figure A.1 (contd): Log of Crimes per 1000 population: Kerala and its bordering states



Source: NCRB for crime data and Census 2011 for population data.

Table A.1: Estimated Effects of Closure of Hard Liquor Bars on Sexual Assaults:
Including Year 2016

	(1)	(2)	(3)	(4)
	All Districts	Exc Tamil Nadu	All Districts	Exc Tamil Nadu
Regulation	-0.18** (0.09) {0.56}	-0.35*** (0.09) {0.11}	-0.01*** (0.00) {0.55}	-0.02*** (0.00) {0.665}
R-squared	0.52	0.75	0.52	0.75
Observations	525	301	518	294
Districts	75	43	74	42
Specification	DiD	DiD	TI	TI

Source: NCRB for Crimes and Excise Department of Kerala for number of bars closed down.

Notes: The dependent variable is log of crimes in a category per 1000 population. TI refers to the specification with Treatment Intensity. District and year fixed effects along with district specific time trends are controlled for in all specifications. Other controls include police and income per capita. Regressions are weighted by district population and standard errors clustered at district level are in parentheses. Wild-State-Clustered Bootstrap p-value in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.

Table A.2: Estimated Effects of Closure of Hard Liquor Bars on Sexual Assaults:
Synthetic Control Method, Including Year 2016

	(1)	(2)	(3)
Donor pool	Neighboring States	Neighboring States exc TN	Southern States
Regulation 2014	-0.092** {0.03}	-0.430*** {0.00}	-.201 {0.16}
Regulation 2015	-0.108** {0.02}	-0.407*** {0.00}	-0.487** {0.03}
Regulation 2016	.021 {0.86}	-0.487*** {0.00}	-0.511* {0.06}
Test for pre-trends	.999	.995	.946

Source: NCRB for Crimes.

Notes: The dependent variable is number of reported crimes in a category. The data contains observations on 75 districts in donor pool of neighboring states, 43 districts in donor pool of neighboring states excluding Tamil Nadu, 163 districts in donor pool of southern states and 131 districts in donor pool of southern states excluding Tamil Nadu for 6 years. The p-value for the coefficients is given in braces. ***, **, * show significance at 1%, 5% and 10%, respectively.