Sparking the #MeToo Revolution in India: The "Nirbhaya" Case in Delhi

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Abstract

In 2012, anger erupted on the streets of Delhi following the violent rape and murder of a young woman. The scale of the protests, the extent of the media coverage, and the intensity of the public's opprobrium of the police and the administration of Delhi, was unprecedented. This paper argues that these events had a measurable impact on the reporting of crimes against women – rape and other sexual assaults – in Delhi. The sweeping public debates may have lessened the stigma typically associated with reporting such crimes. Further, an intense media focus on how the authorities in Delhi were handing these complaints, may have provided women of Delhi greater confidence to report these crimes. Using the synthetic control method, we estimate the impact of the 2012 incident on the reporting of crimes against women in Delhi. Our estimates show a significant increase in crime reporting relative to a combination of other states and federally administered areas in India that are used to construct a counterfactual Delhi. We suggest that nearly all of this is a consequence of a greater willingness to report such crimes, rather than the result of improved law and order condition. While reported crimes increased, the convictions rate did not change significantly.

I. Introduction

In December 2012, a 23-year-old female was beaten and gang raped by six men in a moving bus in a middle-class South Delhi neighborhood in India. After the attack, she was thrown out on to the roadside. Thirteen days later, she succumbed to her injuries. Crimes against women are common in India. As per a 2018 poll by Thomson Reuters, India is the most dangerous country for women.[1] Yet this gruesome incident shocked the country.[2] The rape was covered widely not just in the national media but in international newspapers and was condemned all across the world. People in Delhi took to the streets to protest the state and the federal government and demanded urgent steps to guarantee safety for women in Delhi and speedy justice for the brutalized and deceased victim. The rape victim is now remembered as "Nirbhaya", meaning fearless, for her resistance against the perpetrators of the crime as well as her thirteen days of fight for life after the injuries inflicted on her.

Given the enormity of this incident and the public outcry that followed in Delhi, did this incident lead to a significant change in reporting of crimes against women in Delhi vis-à-vis other jurisdictions? Did it create a more favorable environment for the women of Delhi to speak out against such incidents, similar to the #MeToo movement we are witnessing in the developed world?

Lack of reporting is the most fundamental and common obstruction in addressing crimes against women owing to factors like stigmatization, apathy and foot-dragging of the law enforcement, and fear of retribution for the victims. Despite the increases in reporting over time there still is substantial under-reporting of crimes against women. A recent paper by Gupta (2014) comparing data from the National Crime Records Bureau (NCRB) and the National Family Health

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[1] http://poll2018.trust.org/country/?id=india [last accessed: 15 December 2018].
[2] https://www.ndtv.com/india-news/the-nirbhaya-rape-case-that-rocked-india-1880338 [last accessed: 15 December 2018].

Survey (NFHS) in India finds that, as recently as 2005, only about 2 percent of the incidents of physical violence by the husbands towards their wives were officially reported. Even for a developed economy like the United States, rate of rape reporting has remained low. Studies using random sample surveys of large numbers of women find reporting rates ranging from 16 percent to 36 percent (Anderson 2003).

In India, traditionally, rape has not been considered an issue that can be discussed publicly (Nigam 2014). However, with the 2012 "Nirbhaya" Delhi rape case, it was manifestly different. According to Drache et al. (2013), rape reporting in media increased by 30 percent after the Delhi rape, with the Delhi rape taking between 10-20 percent of the share of rape stories across varying storylines. The authors argue that the Delhi rape case can be understood as a trigger event that provoked people to engage more pointedly with the issue of gender justice.

Some of this was a consequence of the fact that people learnt about the personal story of the victim. The media highlighted the educational background of the victim and her achievements, promise as a student and her aspirational story of a small-town girl striving to make it in a big city like Delhi. People came to know about the sacrifices made by her family towards getting her educated (selling land and moonlighting in work) and having a career. When The New York Times interviewed the victim's father he talked about her childhood dream of becoming a doctor that later had to be dropped for a career in physiotherapy instead, due to the exorbitant cost of a medical education.[3] These discussions in the media worked to create a feeling of connectedness as readers and viewers could relate with such stories of sacrifice in their own families (Drache et al. 2013).

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[3] https://www.nytimes.com/2013/01/12/world/asia/for-india-rape-victims-family-layers-of-loss.html [last accessed: 15 December 2018].

This was not the first case of gang rape in India; yet, this time, the government was compelled to take measures which it had not taken before. A committee, under the leadership of Justice Verma was created to suggest changes in Criminal Law, which were soon implemented. The judicial committee recommended improvements in police and government procedures in incidents of rape. As part of the Criminal Law Ordinance of 2013, several new laws were passed and six new fast-track courts were created to hear rape cases. The government identified the registration of a First Information Report (FIR) at all police stations, police reforms such as a three-digit emergency response number and publicizing the identity of those convicted of crimes against women as potential strategies to increase rape reporting.

The Nirbhaya case and the events that followed constitute an exogenous shock. The unprecedented media coverage, the widespread sympathy the victim evoked, and the scale and intensity of public outcry witnessed in the aftermath of this gruesome crime, may have emboldened victims to come forward and demand justice. Our hypothesis is that, following the Nirbhaya case, at least in the short to medium term, victims of such abuse were more likely to come forward and report these crimes. We employ a synthetic control approach to estimate the causal impact of the 2012 Nirbhaya case on reporting of crime against women in Delhi.

In India, the social and institutional elements that collude to suppress reporting of crimes again women are notably strong and resilient. Why are women less likely to report rape? According to Cahill (2001) "rape must be understood fundamentally … as an affront to the embodied subject … a sexually specific act that destroys the intersubjective, embodied agency and therefore personhood of a woman." Anderson (2005), cites "dehumanization, objectification, and domination" as prominent in the accounts of both rapists and rape victims. Rape, she concludes, is best understood not only as the denial of sexual autonomy, but as "sexually invasive dehumanization", factors that militate against reporting.

In a culture of apathy and victim blaming, a woman is deterred from filing an FIR. The victims, more so in traditional societies like India's, are faced with feelings of contamination, of having been defiled or desecrated—exacerbated by cultural judgments that treat raped women as dirty and impure, or as "damaged goods" (Banerjee 2003, Baxi et al. 2006, Ruggi 1998). There have been instances of prominent politicians blaming rape victims for inviting trouble by going to pubs, drinking and smoking, or generally claiming that "boys will be boys."[4] In other cases, there have been attempts to marry off rape victims to their rapists, since the ultimate goal is for the victim to not remain unmarried.[5] In a highly publicized investigation carried out by Tehelka, an Indian News Magazine known for its investigative journalism, members of the Delhi Police force were filmed discussing their apathy toward rape victims. In the videos, the policemen are shown supporting rape myths such as "women are asking for it," crying "rape as a source of income", and other forms of victim blaming. Note that this reporting, titled "Investigation: The Rapes will Go On," first came out on April 14, 2012, predating the Nirbhaya case in December 2012.

In recent decades, specifically in developed countries, awareness of the extent of such crimes has increased.[6] Black et al. (2011) report that of over 16,000 Americans, 18.3 percent of women report having been victims of rape or attempted rape at some time in their lives. Of these women, 42.2 percent were under age eighteen when they were first raped. An earlier study showed that these women were twice as likely to report having been raped as adults (Tjaden and Thoennes, 2000).

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[4] https://www.news18.com/news/politics/10-bizarre-statements-made-by-indian-politicians-that-will-make-you-facepalm-hard-1481489.html [last accessed: 15 December 2018].

[5] https://www.washingtonpost.com/news/worldviews/wp/2012/12/29/india-rape-victim-dies-sexual-violence-proble/?utm_term=.b0342edf3edb [last accessed: 15 December 2018].

[6] The "rape shield" laws often attempt to counter some of the victim blaming that take place. These laws often include restrictions on the admissibility of evidence about a victim's sexual history, elimination of prompt reporting requirement, the corroboration requirement, and the reciting of the traditional cautionary rule.

Destigmatization, women's empowerment and greater ease of reporting are critical factors in reporting of crimes against women particularly in case of rape. Wyatt (1992) shows that African-American women in her study were less likely than white women to have disclosed their rapes mainly because they did not believe that they would be protected by traditional authorities and institutions. Factors that reduce stigma and indicate reduction in apathy, can increase reporting. In South Africa for example, while sexual violence is widely prevalent, the rise in reported rape may in part be attributed to the post-apartheid regime, under which black women feel safer reporting sexual crimes. Evidence suggests that assault was endemic during the apartheid era, with Johannesburg's most popular daily, The Star, reporting twenty or thirty rapes every weekend in Soweto.

A small number of earlier papers, using India data, have documented increased reporting of women centric crimes in response to policies that lead to women empowerment. Iyer et al. (2012) show that increases in political reservations increase documented crimes against women. They argue that this is due to an increase in reporting rather than an increase in the actual incidence of these crimes. Amaral (2014) finds that the inheritance law changes significantly reduce both documented crimes against women and reports of violence in India.[7]

In a related paper, using nationally representative survey data, Mathur and Slavov (2017) suggest that improved representation increased the reported probability of domestic violence. There are two competing explanations for these results. First, women may have experienced

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[7] There are numerous studies on the determinants of domestic violence in India. Some find a lower risk of domestic violence among women who work (Bhattacharya, Bedi and Chhachhi, 2009), earn more income (Rao 1997), or have greater wealth (Panda and Agarwal 2005). Panda and Agarwal (2005) further find that women who own assets are also more likely to leave their homes if they experience violence. Rao (1997) finds that the woman's income plays a larger role in explaining reductions in violence than the incomes of other family members. On the other hand, Jejeebhoy (1998) finds no statistically significant relationship between domestic violence and a woman's paid employment, and Kishor and Johnson (2004), Eswaran and Malhotra (2011), Kimuna et al. (2013) and Krishnan et al. (2010) find an increase in the risk of domestic violence among women who work for pay. Of these studies, Kishor and Johnson (2004), Kimuna et al. (2013), and Eswaran and Malhotra (2011) use the NFHS data.

retaliation by men who feared the erosion of their power and opposed the policy change. Second, the policy change may have made women more willing to report the violence to interviewers. Amaral et al. (2015) studied the impact of the National Rural Employment Guarantee Scheme in India on domestic violence. With the employment opportunities that expanded to women and the empowerment, the authors find an increase in reported domestic violence.

Based on the National Crime Records Bureau (NCRB) data, our synthetic control method estimates show that the 2012 Nirbhaya case had a positive impact on the reporting of crimes against women – rape, and molestation and sexual harassment – in Delhi. Over the period 2013-2015, the annual average reporting of rape cases in Delhi was 23 percent higher compared with its pre-intervention annual average (2001-2011); average annual reporting of molestation and sexual harassment over the period 2013-2015 was 40 percent higher compared with its pre-intervention annual average. In a recent paper, McDougal et al. (2018) report that relative to the period 2005-2012, there was a 33 percent increase in rape reporting nationwide, over the period 2013-2016. The increases after 2012 were higher in regions closer to Delhi. In particular, the paper finds that for every additional 100 km farther from Delhi that a district was located, there was a significant decrease in rapes reported to the police relative to what may have been expected based on previous trends.

To understand whether our results are driven by changes in reporting behavior or incidence of actual crime against women we carry out a series of falsification tests. First we estimate the impact of the Nirbhaya case on murder and culpable homicide, a crime that is not subject to significant reporting bias; we find no impact. We then estimate the impact of the Nirbhaya case on road accidents and, an outcome that would not be affected by the Nirbhaya case; again we find no effect. Therefore, in general, the actual incidence of crime appears to have been unaffected despite the policing and enforcement changes we discussed earlier. Hence, our findings

appear to be a result of greater reporting of crimes against women after this extremely violent crime and the outrage thereafter, rather than part of any other trend related to criminal activities in general. And finally, while we find reported crimes increased the convictions rate did not change significantly. We, therefore, suggest that nearly all of the increased reporting is a consequence of a greater willingness to report such crimes, rather than the result of improved law and order condition.

This paper contributes to the literature on the economics of violence against women. Several papers such as Aizer, (2010), Andberg et al. (2016) and Bobonis et al. (2013) look at economic drivers such as income and employment as a factor in crime against women. Other papers like Amaral et al. (2016) look at policing changes and its effects on greater reporting of crimes against women. Miller and Segal (2014) investigate the effects of incorporating women in the police in the U.S. on reporting rates of domestic violence. The authors find that the increase led to a rise in reporting rates of domestic violence incidents and a decrease in female homicides committed by the intimate-partner. Iyer et al. (2012) who find that improvements in female representation at the local level, increased reporting of crimes committed against women. In our paper, we find that while reporting increased after 2012, there has been little change in the conviction rates for crimes against women, suggesting that policing and other changes did not materially affect outcomes beyond reporting. In fact, the conviction rate for rape crimes has continued to decline since 2007, and has reached a historic low of 18.9 percent in 2016.

II. Data Description

The procedure for filing a crime in India is as follows. When a person reports a crime to the police, the crime has to be recorded in a written report, an FIR (First Information Report), which is then read and signed by the person reporting. When this procedure is complete, the crime is

treated as reported and becomes a part of crime records maintained by the police (Iyer et al. 2012). We use data on the reported number of crimes at the state level from various issues of the "Crime in India" publications of the National Crime Records Bureau (NCRB), Government of India, for the period 2001-2015. These data emerge from the FIRs for the specific crimes.

The data analyzed in this paper are from all the states and federally administered areas (known as union territories in the Indian context). Delhi was the location of the 2012 "Nirbhaya" rape and murder, and subsequently the venue for widespread protests.

Our focus outcome variables are the reported crimes against women. These are: rape reported per 100,000, molestation and sexual harassment reported per 100,000. We specifically do not look at domestic violence or other crimes such as harassment for dowry. The motivations and the reporting systems for such crimes are different and have been studied before (Mathur and Slavov 2017). Road accidents per 100,000 and murder and culpable homicide per 100,000 are used in the falsification tests.

Table 1 presents a comparative profile of reported crimes in Delhi alongside the donor pool for the period 2005-2016. Figure 1 shows that, post-2012, reported rape in Delhi saw a larger spike compared to the donor pool average. Figure 1 also shows a similar, a starker uptick post-2012 in reported molestation and sexual harassment in Delhi, relative to the donor pool average.

To see if these trends are distinct from those in other reported crimes, Figure 1 further presents the reporting of cases of different infractions that do not necessarily belong to the category of crimes against women. In case of these infringements, the reporting rates over time have been quite similar between Delhi and other states even after the incident in 2012. These comprise of murder and culpable homicide per 100,000, assault per 100,000, and road accidents per 100,000 population. In general, these data suggest that in the specific cases of rape, and

molestation and sexual harassment, Delhi did show a distinct break in trend relative to the pre-2012 period.

III. Estimation: Synthetic Control Method (SCM)

The fact that Delhi is the sole location for the 2012 incident (a single treated unit), underscores the choice of SCM as our preferred method for assessing the impacts of the 2012 Nirbhaya case on reporting in Delhi. With a solitary affected unit, accurate inference is difficult, perhaps impossible, in a clustering framework (Donald and Lang, 2007, Buchmueller et al., 2011). SCM, on the other hand, is devised to address precisely these kinds of situations, and the method naturally renders itself to permutations or randomization tests for inference (Bertrand et al., 2004, Abadie et al., 2010, Buchmueller et al., 2011, Bohn et al., 2014). Appendix A discusses some of the advantages of using SCM.

As in a program evaluation, one of the more serious issues is finding appropriate comparison or control states that can provide a reliable counterfactual for the treatment/affected unit, Delhi. Not every other state or Union territory in India would be a suitable candidate for a comparison unit for Delhi given its size, its location, identity as a capital city, cultural distinctiveness, composition of the population composition with high share of migrants and most importantly the aspirations of its citizens. It is unlikely that we can find a single state/union territory in India that would have characteristics of the population, administrative structure, penetration of the media, women's participation in labor force and numerous other state-specific factors similar to those of Delhi.

Under these circumstances, SCM provides a systematic way to choose comparison units. In SCM, the counterfactual is the weighted average of the states and union territories other than Delhi where the pre-intervention matching across a wide variety of characteristics and over an extended

period of time, generates the weights. Our set of control units, or donor pool, consists of the 31 states and union territories of India (see Table 1 for the full set of donor pool states and union territories of India). As shown in Table 1, we use an extensive set of predictor variables to obtain pre-intervention matching.

III.1. Main Results

We start our SCM estimation with the assessment of the impact on reporting of two main crimes against women in Delhi. The top two pictures and the bottom two pictures of Figure 2 show the impact of the December 2012 Nirbhaya case on reporting of rapes, and reporting of molestation and sexual harassment, respectively. The picture on the left shows a close pre-intervention fit between the actual and synthetic Delhi and a wide gap afterwards. The post-intervention gap is the measure of the causal impact on reporting.

Next, we determine the statistical significance of the estimated impact. The permutations/randomization test, which is a placebo test, answers the question, "How often would we obtain a gap as large as this if we had chosen a state or union territory at random instead of Delhi?" We therefore apply a placebo intervention in 2012 to each state and union territory in the donor pool. The pictures on the right panel of Figure 2 present results of the permutation/randomization/placebo tests (Abadie et al. 2010; Bertrand et al. 2004; Bohn et al. 2014; Munasib and Maguire 2016; Munasib and Rickman 2015). The gap between the actual and the synthetic for Delhi is represented by the darker line and for every donor pool state and union territory. It is clear that Delhi stands out from the placebo estimates (where the induced changes due to the incident did not take place). We thus infer that the impact of the changes brought about by the December 2012 incident on reporting of crime against women in Delhi was significant.

Columns 1 and 3 of Table 2 presents the formal statistical test that follows Figure 2. It presents the pre-intervention absolute prediction error to mean ratio (APEMR) and pre-

intervention Root Mean Square Prediction Error (RMSPE) that describe the goodness of the pre-estimation fits. The estimated impact is the difference between the actual and the synthetic Delhi (Bohn et al. 2014, Munasib and Rickman 2015). We estimate that, over the period 2013-2015, the annual average reporting of rape cases in Delhi increase by 2.17 per 100,000, or by 23 percent, compared with its pre-intervention annual average (2001-2011); average annual reporting of molestation and sexual harassment over the period 2013-2015 increased by 6.33 per 100,000, or by 40 percent, compared with its pre-intervention annual average.

The finding of the permutations or randomization tests is described in terms of the following statistics. First, we calculate the difference-in-difference (DID) statistic, which is the difference between the actual and the synthetic minus the pre-intervention difference between the actual and the synthetic (Bohn et al. 2014, Munasib and Rickman 2015). We then calculate the DID rank, which is the ranking of the absolute value of the magnitude of the DID of the treatment state against all the placebo DID magnitudes (Bohn et al. 2014, Munasib and Rickman 2015). The interpretation of a large DID is that the difference in the post-intervention outcome between the actual and the synthetic is much larger compared to the same during pre-intervention. Therefore, if DID rank is 1 then the estimated impact of the intervention in the treatment state is greater than any of the estimated placebo impacts. We also calculate the p-value of the DID statistics and the donor probability – the probability of obtaining a DID as large as Delhi's if one were to assign the intervention at random in the data. We find that in case of both crimes against women, DID rank is 1 that is significant at 1 percent level with very low donor probability (3 percent). We, therefore, conclude that the impact of the Nirbhaya case on reporting of crime against women was statistically significant. Table 2 also reports the 'optimal' weights generated by the SCM procedure. Chhattisgarh, Chandigarh and Tripura contribute with the largest weights towards making a synthetic Delhi for rape per 100,000, while Puducherry, Chandigargh, Sikkim and Andhra Pradesh

contribute with the largest weight making a synthetic Delhi for molestation and sexual harassment per 100,000.

III.2. Falsification Tests

Columns 2, 4 and 5 of Table 2 summarize the findings when the above exercise is repeated for the rest of the outcome variables. The three main falsification tests that we conduct are: murder and culpable homicide, assaults and road accidents. These crimes are not likely to be directly affected by the altered incentives for reporting due to the 2012 Nirbhaya case. In the reporting of these crimes, the estimated impacts are not significant, the DID ranks are 16, 29 and 19, respectively, out of 31 comparison units.

Murder and culpable homicides, by the very nature of the crime, is not susceptible to large and systematic reporting issues. That we do not find an impact of the Nirbhaya case on this outcome indicates that the intervention may not be conflated with a general rise in crime in 2012 for some unobserved reason. Assault, on the other hand, can have significant reporting issues. That we find no impact on assault indicates that the impact of the Nirbhaya case is specific to reporting of crimes against women and not reporting of all crimes. And finally, the test with road accidents is a pure falsification test where the outcome, reasonably, would not be affect by the Nirbhaya case.

III.3. Robustness Tests

In Table 3, we present a robustness test where we re-estimate the impact of the incident on all outcomes using a different set of predictors. We retain some of the key predictors – education enrollment, density of police overall and female police, per capita GDP, population 65 and older and gender composition of the population. We augment the set of predictors with a marker of female political participation and voice, i.e., ratio of votes for female to male candidates in the parliamentary elections.

In Table 4, we report yet another robustness test: we go back to our main estimates in Tables 2, and this time, artificially assume the date of the incident to be in 2006, i.e., the time placebo tests. The results are presented in Panel A of Table 4. With the time placebo, the estimated impacts are not significant for any of the outcomes the crimes against women. Passing the time placebo test points to reliability of the tests in Tables 2 and 3.

In Panel B of Table 4, we estimate the impact when we exclude the states adjacent to Delhi. As noted earlier, McDougal et al. (2018) finds that rape reporting increased more in districts closer to Delhi. It is possible that, due to proximity, some of the areas surrounding Delhi – belonging to two states, Haryana and Uttar Pradesh, that are adjacent to Delhi – may have witnessed some of the same effects as Delhi. We, therefore, exclude Haryana and Uttar Pradesh from the donor pool and run the SCM estimates. Our results do not change and it is reassuring that the estimated impacts remain virtually the same.

Finally, in Panel C of Table 4, we estimate the impact of the Nirbhaya case on convictions in cases of crimes against women. We find no effect. Note that the convictions data is available for the period 2006-2015.

IV. Discussion

We estimate that the 2012 "Nirbhaya" crime case had a causal impact on the reporting of crimes against women in Delhi, particularly rape and molestation and sexual harassment. We ran a series of robustness and falsification tests that strengthened our findings.

We argue that while policing may have played a role, the reporting effect dominates as an explanation for the outcome. As we show, Delhi always had a level of police density that surpassed other jurisdictions, including higher fractions of women in the police force. Yet prior to the incident, reporting levels were similar in Delhi as in other regions. Hence the push towards greater

reporting of crimes against women in Delhi seems consistent with the larger public outcry in Delhi, after this incident. The placebo tests also signify that these changes had only limited spillover effects.

Our results suggest that in order to create incentives for higher reporting, there needs to be a big push. First, the Nirbhaya case may have led to a sizeable shakeup in the attitudes towards rape and promptness for police in registering such cases given the public pressure. The size of public protests was nothing that the country had seen before. Secondly destigmatization can go a long way in changing the recording and reporting of such crimes. Third, changes in policing cannot explain all of the result. While the crime may have led police to be more prompt in recording crimes against women, there is hardly any significant increase in conviction rates for the crimes against women. Further, if policing were the solution, we should have seen a similar increase in reporting or reduction in other crimes as well, which did not occur. Generally, the effect of policing on crime has been widely debated in the literature (Di Tella and Schardorstsky 2004).

Is it possible that Delhi exhibited a different reporting dynamic for crimes against women than the rest of India in the period before the December 2012 attack? If reporting were increasing in Delhi more than rest of the states and union territories in India, then we might perhaps be rounding up an association as a causal relationship. Time placebo helps us by considering a different sample that protects against spurious correlation. The non-significant result in time placebo tests reveal no special dynamics in reporting before this attack that differentiated Delhi in relation to other states and union territories. The question whether the incident coincided with other unrelated changes leading to greater reporting can also be addressed through time placebo tests. Further, the use of the synthetic control method with good pre-intervention fits over a long-time period, accounts for both time varying observed and unobserved factors that could be related to reporting.

V. Conclusions

A crucial challenge in the literature on crime is to obtain an estimate of the effect of changes in the external environment on reporting of crimes, particularly those against women. In this paper, we have addressed this question exploiting a natural experiment. In December 2012, an incident of rape and murder that was the most publicized that India had seen, occurred in Delhi, the nation's capital. What followed were mass protests and media outrage, the order of magnitude of which was totally unprecedented. To estimate the impact of this change, we collected data on different crimes across Indian states. We find a large, positive, and local effect of the incident on reporting. Delhi, where the incident took place, witnessed a significant increase in reporting, relative to other regions around the country.

The robustness of our empirical strategy is illustrated by the fact that we reach similar conclusions using a difference-in-difference approach. The results are also robust to alternative specifications with different set of predictors, different subsamples for the donor pool, and different placebo tests. The empirical strategy employed in our paper suggests that the estimated effects correspond to changed incentives for reporting and recording. While the public pressure and outrage may have lead more women to report crimes against them, it may also have lead to increased recording of crimes by the police. However, the policing effect does not extend much beyond greater recording. Our data show that the rate of convictions or arrests did not change significantly following the incident. Hence we ascribe much of the reported increase in crimes to a willingness by women to come forward and report incidents, rather than a greater willingness of the police to convict criminals associated with these crimes.

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Figures

Figure 1: Descriptive Pictures of the Outcome Variables
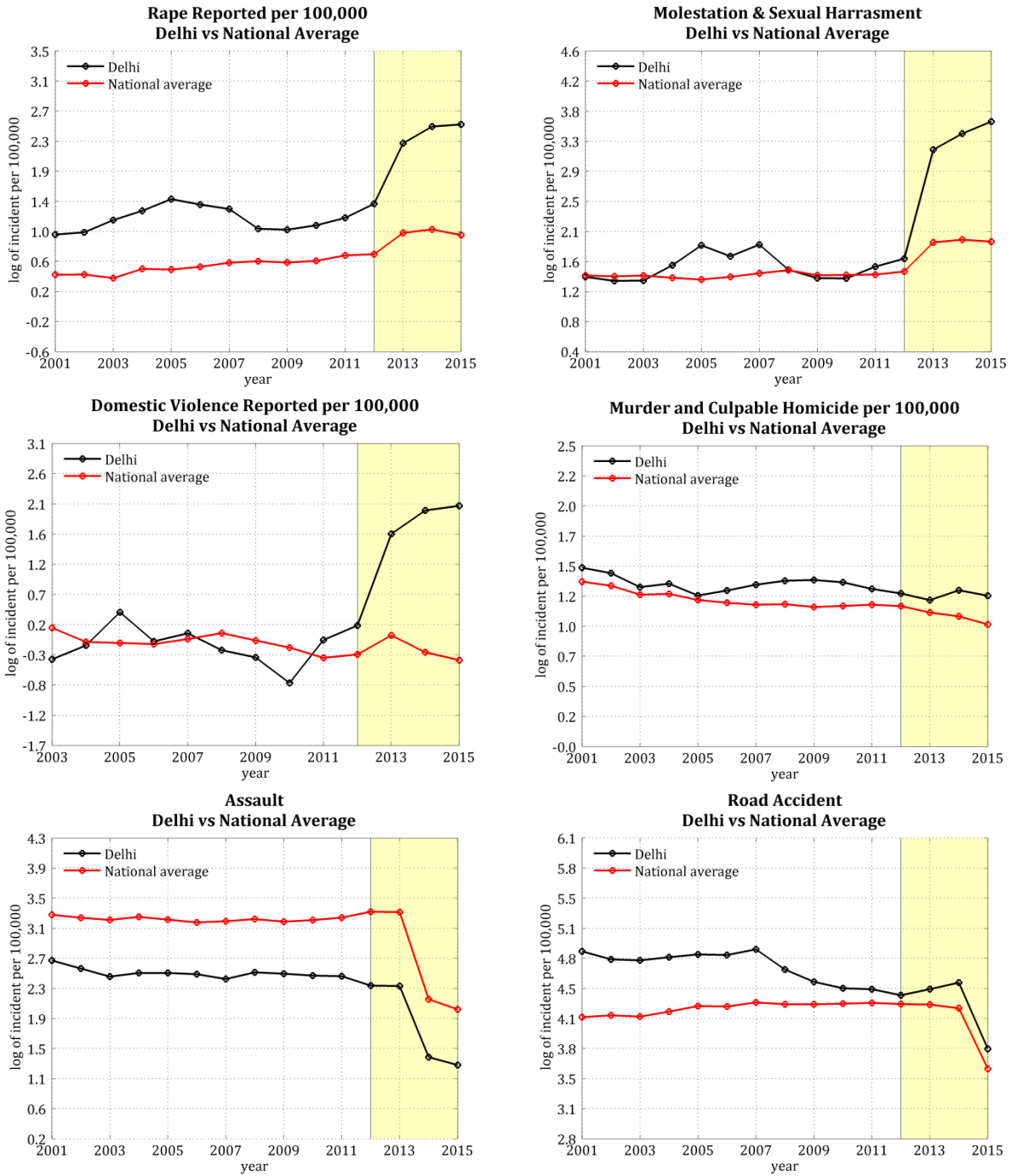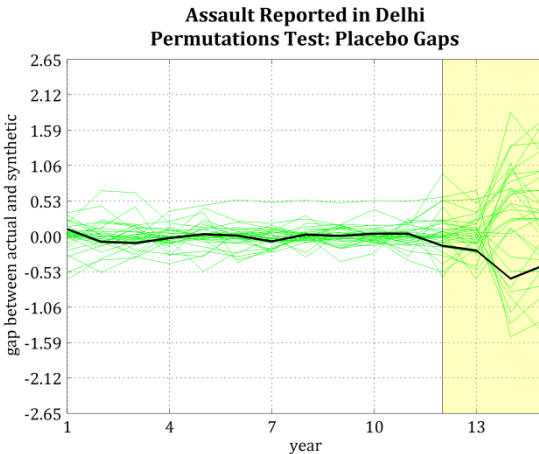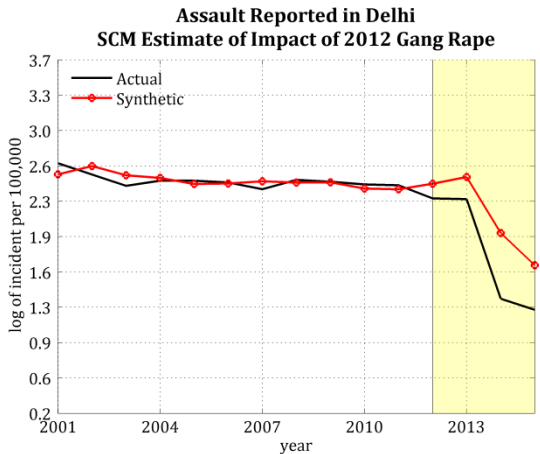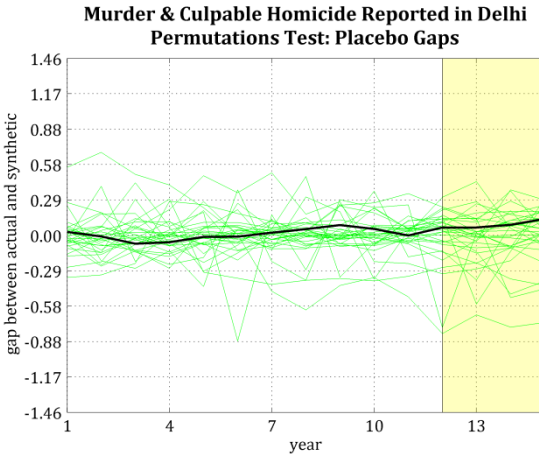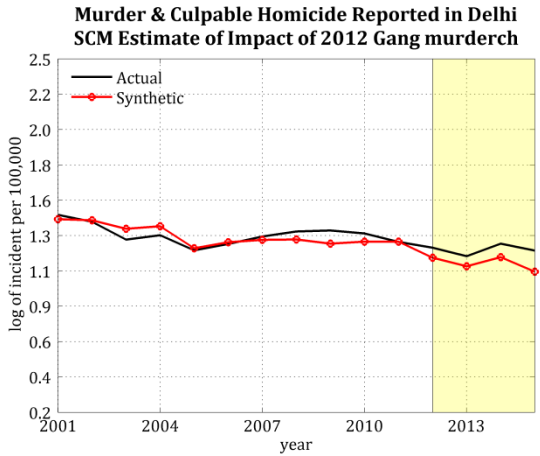
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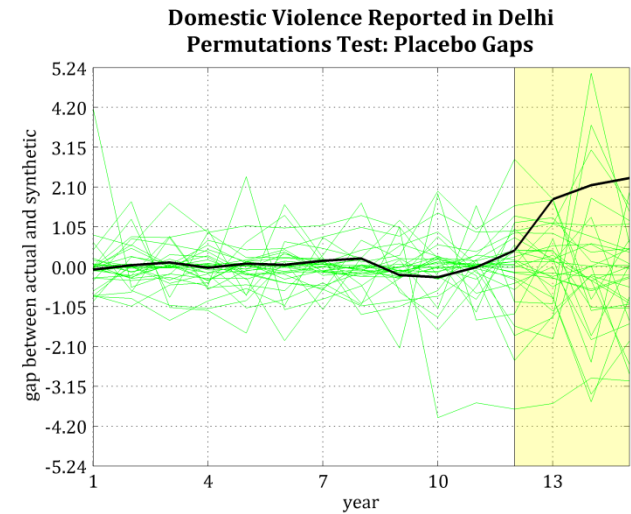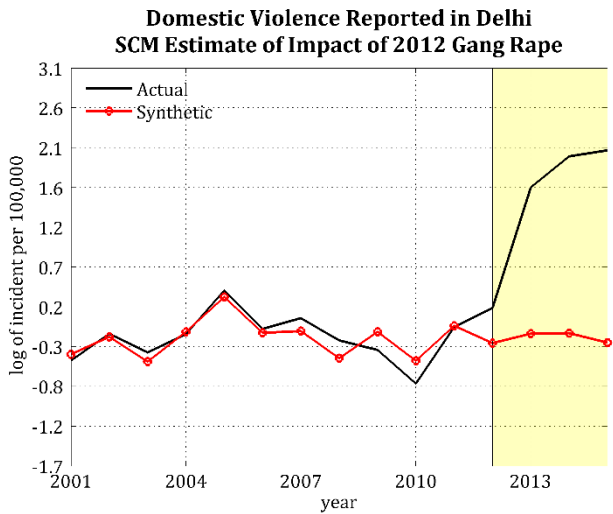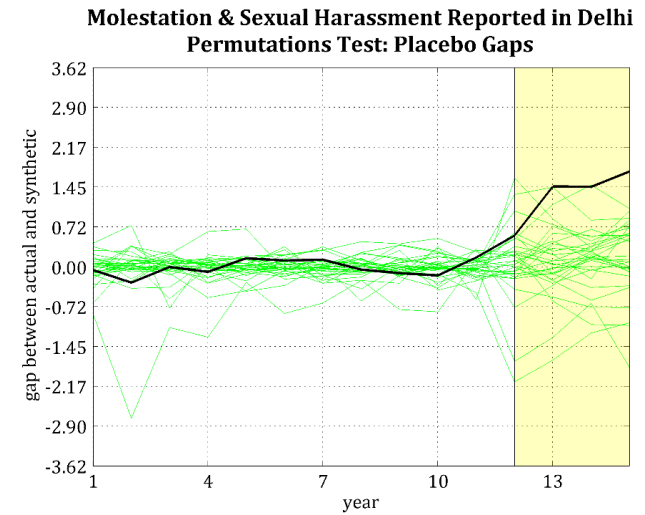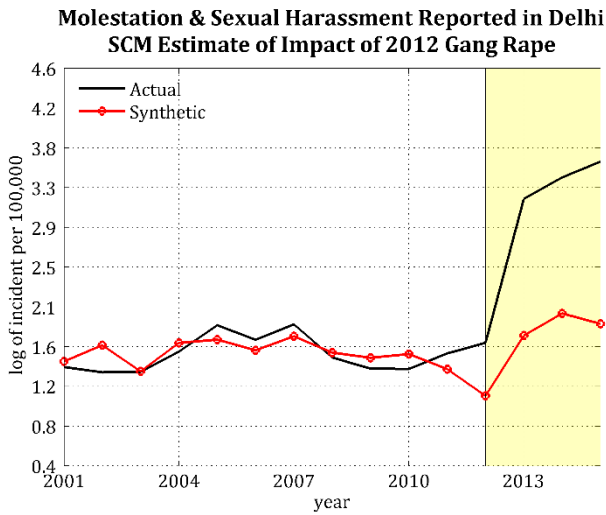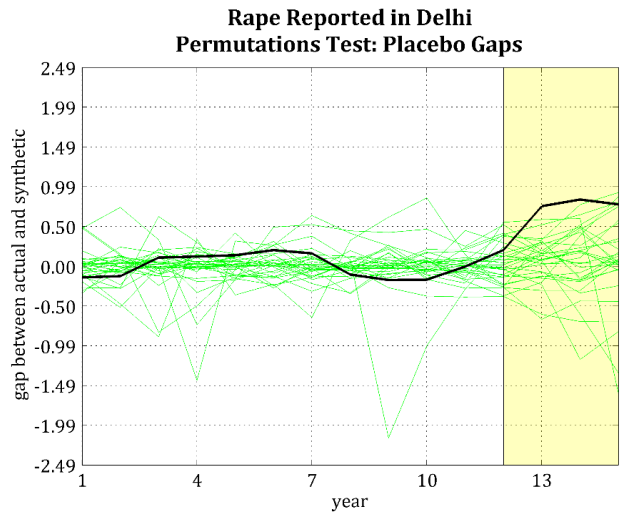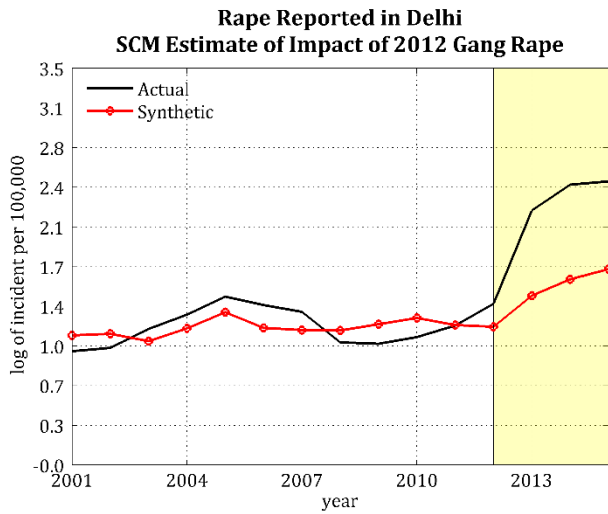
Figures 3: SCM Estimates of the Impact of 2012 Nirbhaya Gang Rape on Reporting of Murder, Assault and Road Accidents
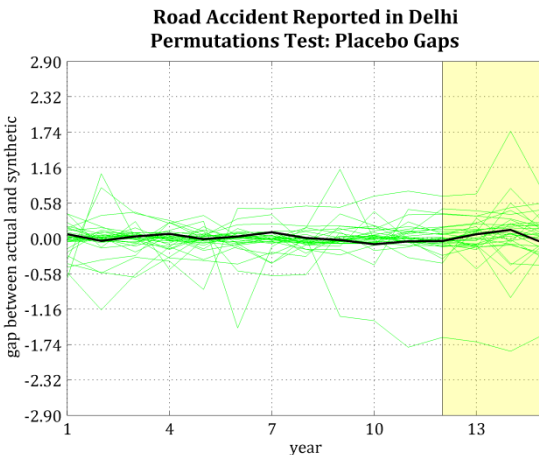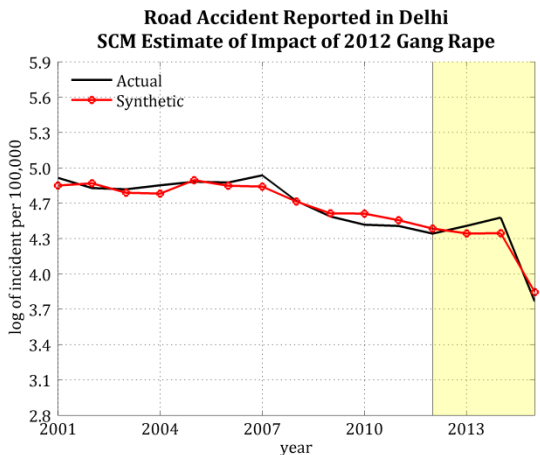
Tables

Table 1: Summary Statistics

Label	Donor Pool (31 states/territories)				Delhi
	Mean	Std dev	Min	Max	Mean
Outcomes					
Reporting per 100,000 (*2001-2015*)					
Rape reported	2.54	1.74	0.09	10.14	4.93
Molestation & sexual harassment reported	5.18	3.9	0.05	23.01	10.21
Domestic violence reported	0.84	1.34	0.00	9.30	2.11
Murder & culpable homicide reported	3.59	1.54	1.12	10.77	3.71
Assault reported	22.11	21.06	0.95	119.68	10.65
Road accidents	81.43	87.86	1.78	565.89	103.72
Convictions per 100,000 (*2006-2015*)					
Persons convicted in rape cases	0.50	1.08	0.00	10.86	1.02
Persons convicted in MSH cases	0.78	1.28	0.00	10.94	1.59
Persons convicted in Domestic violence cases	0.68	1.18	0.00	7.46	0.81
Predictors: Characteristics (*2001-2011*)					
Main set of predictors					
Female police per 100,000	10.49	11.72	0	77.69	20.59
Police per 100,000 people	281.9	223.68	37.83	991.67	388.6
Women's share of higher education enrollment	0.43	0.08	0.18	0.69	0.46
Higher education enrollment (% of population)	1.53	0.98	0.47	7.49	2.87
Per capita GDP (current Rs lakh)	0.46	0.32	0.07	2.4	0.96
Per capita GDP secondary sector (current Rs lakh)	0.13	0.13	0.01	0.96	0.16
All crimes against women: arrests per 100,000	22.39	13.32	1.33	78.18	27.32
Male age 15-35 (% of population)	17.94	3.65	1.77	30.92	20.99
Annual population growth rate	1.08	0.11	0.61	1.61	1.1
Growth in urban population 2001-2011	1.2	0.28	1	2.57	1.13
Annual per capita GDP growth rate	1.99	0.93	0.95	7.01	2.09
Additional predictors					
All crimes reported per 100,000	184.17	89.72	43.2	513.81	340.52
All crimes: arrests per 100,000	237.91	125.52	36.02	670.82	287.51
All crimes against women: arrests per 100,000	22.39	13.32	1.33	78.18	27.32
Election: ratio votes for female to male candidate	8.4	10.74	0	58.01	12.04

Note: (a) The donor pool consists of the following 31 states/territories: Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu And Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Puducherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal. (b) The following variables have only two data points over the period 2001-2011: male age 15-35 (% of population), growth in urban population 2001-2011, Loksabha election: ratio of votes for female to male candidate. (c) Domestic violence is defined as "cruelty to women by husband and/or his relative". (d) The election refers to the Loksabha (parliamentary) election.

Table 2: SCM Estimate of the Impact of 2012 Nirbhaya Gang Rape on Reporting (Main Set of Predictors)

	Rape	MSH	Domestic	MCH	Assault	Accident	
APEMR	0.11	0.08	-0.64	0.03	0.02	0.01	
Pre-intervention RMSPE	0.14	0.14	0.14	0.04	0.06	0.06	
Estimated impact	0.79	1.55	2.08	0.10	-0.43	0.04	
DID rank	1	1	2	17	14	30	
P-value: DID	0.00	0.00	0.03	0.50	0.41	0.91	
Donor probability	0.03	0.03	0.06	0.53	0.44	0.94	
Donor pool weight							
Andaman & Nicobar Islands	0.00	0.00	0.00	0.00	0.13	0.00	
Andhra Pradesh	0.07	0.10	0.25	0.05	0.00	0.07	
Arunachal Pradesh	0.00	0.00	0.00	0.05	0.05	0.00	
Chandigarh	0.27	0.20	0.20	0.10	0.00	0.61	
Chhattisgarh	0.50	0.00	0.00	0.00	0.00	0.00	
Goa	0.00	0.19	0.00	0.06	0.22	0.00	
Haryana	0.00	0.00	0.07	0.30	0.00	0.00	
Himachal Pradesh	0.00	0.00	0.00	0.00	0.21	0.00	
Jammu And Kashmir	0.00	0.00	0.14	0.01	0.21	0.12	
Kerala	0.00	0.00	0.11	0.00	0.00	0.08	
Mizoram	0.00	0.00	0.15	0.00	0.00	0.00	
Nagaland	0.00	0.00	0.03	0.00	0.00	0.00	
Orissa	0.00	0.13	0.00	0.00	0.13	0.00	
Puducherry	0.00	0.34	0.00	0.10	0.00	0.12	
Sikkim	0.01	0.03	0.00	0.00	0.00	0.00	
Tamil Nadu	0.00	0.00	0.00	0.00	0.01	0.00	
Tripura	0.16	0.00	0.00	0.20	0.05	0.00	
Uttar Pradesh	0.00	0.00	0.06	0.00	0.00	0.00	
Uttarakhand	0.00	0.00	0.00	0.12	0.00	0.00	
Pre-intervention characteristic							Actual Delhi
Female police per 100,000	2.06	2.38	1.27	2.14	2.64	2.84	2.98
Police per 100,000 people	5.33	5.38	5.63	5.54	5.74	5.76	5.96
Women higher edu enrollment	0.44	0.47	0.46	0.45	0.46	0.52	0.46
Higher education enrollment	1.97	2.65	2.26	2.04	1.40	3.36	2.87
Per cap GDP	-0.89	-0.39	-0.81	-0.64	-0.74	-0.30	-0.14
Per cap GDP secondary sector	-2.31	-1.56	-2.39	-1.93	-1.94	-1.86	-1.91
Arrests: crimes against women	3.25	2.99	3.29	3.24	2.97	3.12	3.26
Male age 15-35	18.38	17.69	20.59	18.67	17.27	19.66	20.99
Population growth rate	1.12	1.09	1.03	1.09	1.10	1.17	1.10
Growth in urban population	1.22	1.17	1.20	1.23	1.15	1.17	1.13
Per capita GDP growth rate	1.99	2.03	1.89	2.01	2.08	1.82	2.09

Notes: (a) Outcome variables are per 100,000. For example, Rape = rape reported per 100,000. (b) MSH = Molestation & sexual harassment reported, Domestic = Domestic violence reported, MCH = Murder & culpable homicide reported, Assault = Assault reported, Accident = Road accidents. (c) APEMR = Absolute prediction error to mean ratio, RMSPE = Root mean squared prediction error. (d) The donor pool consists of 31 states/territories. The table reports only those with positive weight>=0.01 for at least of the outcomes.

Table 3: SCM Estimate of the Impact of 2012 Nirbhaya Gang Rape on Reporting (Alternative Set of Predictors)

	Rape	MSH	Domestic	MCH	Assault	Accident	
APEMR	0.11	0.06	-0.72	0.04	0.02	0.01	
Pre-intervention RMSPE	0.14	0.11	0.16	0.06	0.07	0.05	
Estimated impact	0.86	1.54	1.91	0.16	0.14	0.17	
DID rank	1	1	2	10	25	15	
P-value: DID	0.00	0.00	0.03	0.28	0.75	0.44	
Donor probability	0.03	0.03	0.06	0.31	0.78	0.47	
Donor pool weight							
Andhra Pradesh	0.00	0.31	0.33	0.04	0.24	0.00	
Arunachal Pradesh	0.00	0.00	0.00	0.31	0.00	0.00	
Chandigarh	0.11	0.16	0.23	0.16	0.40	0.50	
Chhattisgarh	0.57	0.00	0.00	0.00	0.00	0.00	
Goa	0.00	0.00	0.00	0.00	0.11	0.00	
Jammu And Kashmir	0.11	0.00	0.00	0.01	0.00	0.00	
Maharashtra	0.00	0.00	0.00	0.00	0.01	0.00	
Manipur	0.00	0.00	0.00	0.03	0.00	0.00	
Meghalaya	0.06	0.07	0.07	0.02	0.23	0.00	
Mizoram	0.00	0.00	0.14	0.00	0.00	0.00	
Nagaland	0.00	0.00	0.00	0.00	0.00	0.08	
Puducherry	0.03	0.15	0.22	0.39	0.01	0.41	
Punjab	0.00	0.11	0.00	0.00	0.00	0.01	
Sikkim	0.00	0.19	0.00	0.04	0.00	0.00	
Tripura	0.12	0.00	0.00	0.00	0.00	0.00	
Pre-intervention characteristic							Actual Delhi
Female police per 100,000	1.92	2.15	1.44	2.67	2.34	2.76	2.98
Police per 100,000 people	5.31	5.60	5.59	5.77	5.65	5.69	5.96
Women higher edu enrollment	0.44	0.45	0.46	0.46	0.49	0.51	0.46
Higher education enrollment	1.46	2.54	2.83	2.45	2.89	3.41	2.87
Per cap GDP	-1.07	-0.66	-0.62	-0.59	-0.50	-0.20	-0.14
Per cap GDP secondary sector	-2.38	-2.01	-2.07	-1.74	-2.09	-1.55	-1.91
All crimes reported	5.24	5.33	5.62	5.57	5.31	5.69	5.83
Arrests: all crimes	5.44	5.47	5.73	5.69	5.28	5.71	5.64
Arrests: crimes against women	3.16	3.00	3.16	2.82	2.83	2.79	3.26
Male age 15-35	17.57	20.48	20.12	18.09	19.70	18.37	20.99
Election: female to male candidate	12.01	12.00	12.02	12.03	9.97	11.72	12.04

Notes: (a) Outcome variables are per 100,000. For example, Rape = rape reported per 100,000. (b) MSH = Molestation & sexual harassment reported, Domestic = Domestic violence reported, MCH = Murder & culpable homicide reported, Assault = Assault reported, Accident = Road accidents. (c) APEMR = Absolute prediction error to mean ratio, RMSPE = Root mean squared prediction error. (d) The donor pool consists of 31 states/territories. The table reports only those with positive weight>=0.01 for at least of the outcomes.

Table 4: SCM Estimate of the Impact of 2012 Nirbhaya Gang Rape on Reporting – Robustness Checks

Panel A: Time Placebo Test

	Rape	MSH	Domestic	MCH	Assault	Accident
APEMR	0.04	0.07	-0.49	0.04	0.03	0.02
Pre-intervention RMSPE	0.05	0.13	0.05	0.06	0.07	0.12
Estimated impact	-0.42	-0.05	-0.78	0.17	0.17	-0.35
DID rank	5	29	12	15	16	10
P-value: DID	0.13	0.88	0.34	0.44	0.47	0.28
Donor probability	0.16	0.91	0.38	0.47	0.50	0.31

Panel B: Excluding States Adjacent to Delhi

	Rape	MSH	Domestic	MCH	Assault	Accident
APEMR	0.11	0.06	-0.59	0.03	0.03	0.01
Pre-intervention RMSPE	0.14	0.10	0.13	0.05	0.10	0.06
Estimated impact	0.76	1.71	2.13	0.09	0.03	-0.01
DID rank	1	1	1	14	30	29
P-value: DID	0.00	0.00	0.00	0.43	0.97	0.93
Donor probability	0.03	0.03	0.03	0.47	1.00	0.97

Panel C: The Law and Order Side - Convictions

	Persons convicted per 100,000 in cases of ...		
	Rape	MSH	Domestic
APEMR	0.40	0.18	-3.28
Pre-intervention RMSPE	0.13	0.12	0.22
Estimated impact	0.21	0.68	0.40
DID rank	25	16	13
P-value: DID	0.75	0.47	0.38
Donor probability	0.78	0.50	0.41

Notes: (a) Panel A: Time placebo test for 2001-2011, with a placebo intervention in 2008. (b) (c) Panel: The donor pool consists of 29 states/territories; the two states that surround Delhi, Haryana and Uttar Pradesh, are dropped from the donor pool. Donor pool for panels A and C are the same as the main estimates in Table 2 (32 states/territories). Panel C: Convictions data are available for 2006-2015. (d) Outcome variables are per 100,000. For example, Rape = rape reported per 100,000. (e) MSH = Molestation & sexual harassment reported, Domestic = Domestic violence reported, MCH = Murder & culpable homicide reported, Assault = Assault reported, Accident = Road accidents. (d) APEMR = Absolute prediction error to mean ratio, RMSPE = Root mean squared prediction error. (c) The donor pool consists of 31 states/territories. The table reports only those with positive weight>=0.01 for at least of the outcomes.

Appendix: Advantages of Using Synthetic Control Method (SCM)

This Appendix is based on Ehric, Munasib and Roy (2017). There are a number of advantages to using SCM for this study. Neither every state/union territory nor a single state/union territory in the control group would likely approximate the most relevant characteristics of Delhi, the treatment unit. SCM provides a comparison unit (or synthetic control) that is a combination of the control units – a data-driven procedure that calculates 'optimal' weights to be assigned to each state/union territory in the control group based on pre-intervention characteristics – thus making explicit the relative contribution of each control unit to the counterfactual of interest (Abadie and Gardeazabal 2003; Abadie et al. 2010). In SCM, the researcher is forced to demonstrate the affinities between the affected and unaffected units using observed characteristics (Abadie et al. 2010; Abadie and Diamond 2015).[8]

Secondly, when aggregate data are employed (as is the case here) the uncertainty remains about the ability of the control group to reproduce the counterfactual outcome that the affected unit would have exhibited in the absence of the intervention (Abadie et al. 2010). This type of uncertainty is not reflected by the standard errors constructed with traditional inferential techniques for comparative case studies. As Buchmueller et al (2011) explain, in a 'clustering' framework, inference is based on asymptotic assumptions that do not apply in our case as the focus is on one state, <u>Delhi</u>, where the crime took place.

The comparison of a single state against all other states/union territory in the control group collapses the degrees of freedom and results in much larger sample variance compared to the one typically obtained under conventional asymptotic framework. The latter can seriously overstate significance of the treatment (Donald and Lang 2007; Buchmueller et al. 2011). We, therefore, apply the permutations or randomization test (Bertrand et al. 2004; Abadie et al. 2010; Buchmueller et al. 2011; Bohn et al. 2014) that SCM readily provides.

Additionally, Abadie et al (2010) argue that unlike the traditional regression-based difference-in-difference model that restricts the effects of the unobservable confounders to be time-invariant so that they can be eliminated by taking time differences, SCM allows the effects of such unobservables to vary with time. In particular, Abadie et al. (2010) show that with a long pre-intervention matching on outcomes and characteristics, a synthetic control also matches on time-varying unobservables.[9]

Finally, because the construction of a synthetic control does not require access to post-intervention outcomes, SCM allows us to decide on a study design without knowing its bearing on the findings (Abadie et al. 2010). The ability to make decisions on research design while remaining agnostic about how each particular decision affects the conclusions of the study is a safeguard against actions motivated by a 'desired' finding (Rubin 2001).

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[8] Neumarket al (2014), in the context of the impact of minimum wage legislations, point out that in several studies that adopted regression-based models, there were underlying assumptions of similarities across states (for example, categorization by region). Unlike the *ad hoc* strategies with a presumption of affinity, SCM demonstrates affinities of the donor pool states with the exposed state.

[9] As Abadie and Diamond (2015) explain, "only units that are alike in both observed and unobserved determinants of the outcome variable as well as in the effect of those determinants on the outcome variable should produce similar trajectories of the outcome variable over extended periods of time."