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Essays on the Externalities of the Mahatma Gandhi National Rural Employment Guarantee Act of India

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ESSAYS ON THE EXTERNALITIES OF THE MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT OF INDIA

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This dissertation is dedicated to my parents Bipasha and Pranab Kumar Das…

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Abstract

In this dissertation, I offer two distinct studies on the welfare externalities of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) of India. The MGNREGA is an employment guarantee scheme implemented in rural India since 2006 and is the world's largest public works project. In the first study, I look at the effects of the MGNREGA on crime in India. I use crime statistics from National Crime Records Bureau of India to create a district level panel between 2002 and 2012 to estimate the effects of the program on various violent and property crimes. I also create a district level panel of annual rainfall and investigate the relationship between rainfall, crime, and the MGNREGA program. In the second study, I use a micro level sample survey called the District Level Household Survey to investigate the effects of the program on use of various methods of contraception among rural couples. I use a difference in difference empirical design to isolate the effect of MGNREGA on contraception.

Chapter 1. Introduction

This dissertation consists of two distinct essays which look at the welfare effects of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) of India. The MGNREGA is a public works program being implemented by the Government of India since 2006. The program guarantees one hundred days of employment per year at a stipulated minimum to every rural household in the country. It is the largest public works program in the world with an annual outlay of about $10 billion and generates about 2.5 billion person days of employment each year. About one third of India's rural households get employment through the program each year.

In a country like India where majority of the working population is dependent on agriculture and allied activities, agricultural shocks can be one of the leading causes of employment and income volatility. Public works programs can function as insurance or safety nets against such volatilities in an agrarian economy (Dev 1995; Subbarao 1997.) In the case of the MGNREGA program, it has been found to have increased rural wages especially for women, household assets, and reduced poverty (Berg, et al. 2012; Imbert and Papp 2013; M. Azam 2012; L. Zimmermann 2013; Klonner and Oldiges 2012.) I investigate whether there are important secondary welfare benefits of the program. Specifically, I look at the impact on the program on crime rates, the analysis of which is consisted in Chapter 2., and the impact of the program on the use of contraception which is in Chapter 3. I use different data sets and empirical procedures in the two analysis.

1.1 Analyzing the Impact of the World's Largest Public Works Project on Crime

This chapter investigates the effect of the MGNREGA program on rates of various crime categories. Using a distict level panel spanning 2002 to 2012, and exploiting the heterogeneity in the timing and intensity of the program across districts, I identify the impact of the employment generated by the program on various types of crime. In addition to standard crime categories such as theft,

burglary, robbery, and murder, I am able analyze kidnapping and unlawful assembly and riots. The crime data is obtained from the Crime in India statistics published by National Crime Records Bureau and the MGNREGA data is obtained from the Ministry of Rural Development, Government of India. I use a fixed effects empirical model within an intent to treat framework to identify the effects. In additional, I also use the Census of India 2001 and 2011 to obtain data on various district level socio-economic indicators which are used as controls.

I show that an increase rainfall has a negative impact on employment provided by the program, confirming that the program intends to act as a safety net for those who suffer from rural joblessness during periods of negative income shocks. Rainfall has also a direct impact on crime, and controlling for rainfall, an increase in employment per rural household due to the program has a negative impact on crimes, with elasticities in the range of 0.03 to 0.08 for property crimes, and in the range of 0.02 to 0.04 for violent crimes. While the magnitude of the impact of the program on crime is small, it should be noted that the program provides temporary, not permanent employment, and that it has been shown by previous research that the program affects mostly female employment. The fact that the goal of the program is to provide temporary relief from poverty and that crime is not a concern of the program provides a fraemwork where standard endogeneity concerns are avoided, which also indicates that crime reduction is a positive externality of this public works project. To the extent that criminal activity has a negative impact on legal human capital formation and that legal human capital is a vital ingredient in development, it is an important aspect of this program.

1.2 Analyzing the Impact of the World's Largest Public Works Project on the use of Contraception

The third chapter investigates the effects of the MGNREGA program on use of contraception among rural couples. I use two rounds of a micro-level sample survey called the District Level Household Facility Survey, the first round conducted in 2002-2004 and the second round conducted in 2007-2008, to analyze the impact of the program. A part of the survey asks married women about their

and their partner's use of contraception. The first round of the survey has been conducted before the start of the MGNREGA program but the second round was conducted when the program has been started in some of the districts but has not been started in others. I use a difference-in-difference empirical strategy to use this heterogeneity in the timing of implementation of the program to isolate its effects on the use of various methods of contraception. The dataset also allows me to control for a rich set of personal characteristics of women which can affect use of contraception. I find that the program has had a significant positive impact on the use of contraceptive pills, inter-uterine contraceptive devices, and female sterilization. I further show that my results are not being driven by the non-random implementation of the MGNREGA program. The program was implemented in such a way that poorer districts get chosen first into the program. I find that the effect of the program on contraception use is larger for individuals from districts which are socio-economically closer to each other. I discuss the various channels through which the program can affect contraception but data limitation does not allow me to empirically isolate each of those channels. Still, I am able to provide limited evidence that one of the channels through which the program can affect the use of contraception is the income channel i.e. the program makes contraceptives more affordable to households by increasing the income and therefore increases their use.

Some of the previous studies investigating the relationship employment, income, and contraceptive use have had endogeneity issues (Pitt, et al. 1999.) By utilizing an exogenously determined treatment in an intent to treat framework, I avoid those pitfalls. Increased use of contraceptives can help couples plan their births better which can help avoid undesired pregnancies. This can lead to a fall in fertility, and increased investment on each child. Increased use of contraceptives can also lead to fall in sexually transmitted diseases like AIDS. The findings from these two investigations are summarized in Chapter 4.

Chapter 2. Analyzing the Impact of the World's Largest Public Works Project on Crime

2.1 Introduction

The Mahatma Gandhi National Rural Employment Guarantee Act of India (henceforth MGNREGA) was enacted in August 2005 and implemented in three phases starting in 2006, covering all districts of the country within three years. The program quarantees 100 days of employment per year at a stipulated minimum wage to each rural household with the goal of providing relief for joblessness and poverty. MGNREGA is the largest public works program in the world with annual outlays of about $10 billion per year, generating more than 2.5 billion person days of employment each year. On average 55 million households are provided employment through the program, which is about one-third of 167 million rural households in the country. In this analysis I exploit the design of this enormous public employment project to investigate the extent to which various types of crimes, ranging from burglary to kidnapping, are impacted by employment generated through this program.

The relationship between legal labor market conditions and crime is well-determined theoretically, based on the seminal works of Gary Becker and Isaac Ehrlich (Becker 1968, Ehrlich 1973), and their recent extensions (e.g. Mocan et al. 2005, Lochner 2004). A large body of empirical work has analyzed aggregate data sets and reported a positive impact of unemployment on crime (Altındağ 2012, Mocan and Bali 2010, Lin 2008, Öster and Agell 2007, Raphael and Winter-Ebmer 2001), and a negative impact of legal market wages on crime (Corman and Mocan 2005, Machin and Meghir 2004, Gould et al. 2002), confirming theoretical predictions.[1]

[1] Identifying the causal effect of an individual's own joblessness or own wages on his/her criminal propensity is arguably more challenging using micro data. Issues surrounding the endogeneity of wages and employment status, and reverse causality from criminal activity to labor market opportunity are hard challenges to resolve. Nevertheless, studies that employed micro data proposed instrumental variables or used reduced form specifications to tackle these issues (Mocan and Unel 2015, Grogger 1998).

The overwhelming majority of the literature analyzing the relationship between crime and economic opportunity has focused on developed countries, although there are exceptions. Miguel (2005) investigated the impact of negative economic shocks on murder of the elderly in Tanzania; Fafchamps and Minten (2006) analyzed the impact of poverty on crop theft in Madagascar. Dube and Vargas investigated the impact of income shocks on armed conflict in Colombia (2012); Prasad (2012) analyzed the impact of trade liberalization on violent crime in India.

The goal of this study is to identify the impact on crime of MGNREGA, which provides employment to rural workers on demand. India consists of 28 states and each state is divided into districts, yielding a total of 641 districts. There is a federal governance structure with separate legislatures for the states and the central government.[2] The central government and the state governments have separate budgets and tax revenues. The implementation and management of the MGNREGA program is at the local level, but the funding of the program is provided by the central government. This feature of the program is important as it provides a setting where the implementation of the program is not endogenous to local conditions such as the fiscal health of the state or that of the district. I provide the details of the program and the governance structure in Section 2.2.

The channels through which this nation-wide public employment program can impact crime are threefold. First, it can affect crime by directly reducing joblessness in rural areas. Second, the program can have a general equilibrium effect by raising rural wages and therefore rural income as labor demand and overall employment can be increased through the program (Imbert and Papp 2013). Third, various public works projects implemented under the program can improve rural infrastructure, thereby increasing agricultural productivity in the long run. This can further lead to an increase in assets of rural households (Bhargava 2014). On the other hand, it is also possible that such massive public sector hiring may crowd-out private sector work, including self-employment. Furthermore, it

[2] The central legislature is the Parliament, the members of which are elected every five years through a national election. Each state has its own legislature which is elected every five years.

should be kept in mind that the program does not provide permanent employment; rather, it is designed much like an insurance scheme to provide some employment security to rural workers whose job opportunities are subject to fluctuation because of (mainly weather-related) shocks in agricultural production. I show in the study that the employment rate in the program is influenced by rainfall.

Several recent papers have reported a positive impact of the MGNREGA program on women's welfare on such domains as nutrition, health, women's voice in household decisions, and participation in local governance (Das 2012, Holmes et al 2010, Jandu 2008, Nayak and Khera 2009 etc.) It has also been shown that the program had a significant impact on women's employment and wages while the impact on male employment and wages has been negligible (Zimmermann 2012, Azam 2012). If the impact of the program is concentrated on women, its influence on crime may be limited by the fact that males have a higher propensity to participate in illegal activities. On the other hand, an increase in female employment will have a positive impact on total household income and a negative impact on poverty (Klonner and Oldiges 2014, Imbert and Papp 2013), thereby negatively influencing men's propensity for criminal activity.[3]

I create a district level panel between 2002 and 2012 for various crimes ranging from murder to kidnapping, from robbery to political/religious riots. I control for a number of district characteristics, as well as the amount of rainfall, which is shown to impact agricultural economic activity and rural poverty by previous research. I have information not only on the timing of the program implementation, but also on the number of households that are enrolled in this program[4]. By exploiting

[3] There has been some work on the impact of the program on violence. Zimmermann and Khanna (2014) and Dasgupta et al. (2014) have investigated the effect of the MGNREGA program on Maoist insurgency in India. The Maoist insurgency is prevalent in some of the poorest districts in India. The Maoist militia, which aspires to overthrow the Constitution through armed revolution, has been able to garner local support because of lack of development in those areas. The papers argue that because the MGNREGA program aims at reducing poverty, it should reduce the local support for the Maoists and should increase public's support of the government, thereby increasing the success of anti-insurgency operations of the police and reduce Maoist activities. They find evidence of a negative relationship between the MGNREGA and Maoist related violence.

[4] The program has no capacity constraint; i.e. anyone who seeks employment obtains employment on demand with the proviso that total number of days of employment cannot exceed 100 for the households.

the variation in the timing and the intensity of implementation of the program across districts, I identify the impact of employment generated by the program on crime.

The study contributes to the literature in a number of ways. First, it identifies the relationship between crime and economic opportunity for the poor using a quasi-natural experiment and therefore arguably avoiding standard endogeneity issues. More specifically, as explained below, the specific purpose of the MGNREGA program is to reduce rural unemployment and poverty, but criminal activity has not been a concern of the program. I show in the study that pre-program crime trends are in fact unrelated to program implementation. Second, it contributes to the literature that investigates the determinants of criminal activity in a developing country setting. This is important because it enables me to investigate whether or not the impact of economic conditions on crime is similar between developing and developed countries. To the extent that criminal activity has an impact on the formation of both legal and criminal human capital (Mocan and Bali 2010, Bayer et al. 2009, Mocan et al. 2005), and that legal human capital is a vital ingredient of economic development (Hanushek and Kimko 2000), investigation of the determinants of crime is particularly important in developing countries.

Data from India also allow me to analyze crimes that are not typical or prevalent in developed countries such as kidnapping, and unlawful assembly and riots.[5] Finally, the results can provide insights into a positive externality (reduction in crime) that can be generated by public works projects in developing countries.

The results show that the MGNREGA program acts as an insurance program in rural districts as I demonstrate that an increase in rainfall lowers the demand for employment through the MGNREGA program. Controlling for rainfall, employment generated by the program has a negative impact on both property and violent crimes, ranging from burglary to kidnapping, to unlawful

[5] The only existing research on economics determinants of kidnapping is Detotto, Cannon and Vannini (2015) who analyzed the impact of sanctions on kidnapping in Italy.

assembly & riots. The crime elasticities with respect to employment are small, which is not surprising because, as mentioned earlier, the program provides only limited and temporary employment as a safety net against negative shocks in agricultural production.

The chapter is organized as follows: Section 2.2 describes the MGNREGA program and its implementation, Section 2.3 explains the data, Section 2.4 presents the empirical specification, Section 2.5 reports the analysis of pre-program trends. Section 2.6 presents the results, and Section 2.7 is the conclusion.

2.2 The Details of the Mahatma Gandhi National Rural Employment Guarantee (MGNREGA) Program

The MGNREGA is a rural employment guarantee act, enacted by the Indian Parliament in August 2005. The implementation started in 2006. The program provides legal guarantee of 100 days of work to any member of a rural household at minimum wage. The program is demand driven, and there is no capacity constraint. That is, any adult in rural India is entitled to obtain work under the program. Anyone who is 18 or older can join, leave and re-join the program at any time during the year provided that the total number of days worked by all members of his/her household does not exceed 100. The type of the work is of a casual labor and there are no minimum qualifications or training required for the jobs. The typical jobs are digging ponds and wells, digging irrigation canals, paving of roads and so on.

The only conditions that apply to an adult who wants to work under the program are: they must live in a rural area and they must be willing to undertake unskilled manual work for which they will receive the minimum wage. Job seekers need to furnish their name, age and address to the village council (Gram Panchayat), which issues a job card to each household containing details of adult members of the household. Applicants who are provided with employment are informed by a letter which is mailed to the address mentioned on the job card and a public notice of employment is displayed at the Panchayat office. By law, the work has to be provided within 10 km of the home of the

job seeker. If that is not possible, then the work must be within the Block (a subdivision of a district) of the residence of the job seeker and an extra 10 percent of the wage of the worker must be paid for travel expenses. Wages must be paid within 15 days of the completion of the work. If an applicant is not provided a job within 15 days upon the receipt of an application then the applicant is eligible for unemployment allowance for each day after the 15 days when he/she isn't employed until the state finds work for him/her. This unemployment allowance cannot be less than $1/4^{th}$ of the wage rate in the first 30 days of the financial year and 3/4th of the wage rate in the remaining period of the financial year. The minimum wage varies between states but remains the same across districts in a particular state. Typically, the minimum wage is equivalent to between two to three dollars per day.[6]

Local government is obligated to provide employment upon the request of the applicants, but the full cost of wages is borne by the central government. In addition, the central government covers 3/4 of the cost of materials while the rest is funded the state governments. This is important because it indicates that other outlays of the state government, such as expenditures on police, are not impacted by the MGNREGA spending.

The program has been implemented nationally since 2006. Implementation was rolled out in three phases, starting in 2006 with 200 districts of Phase-I. In 2007, the program was extended to include another 130 districts (Phase-II). In 2008 the program covered all rural districts of the country. Districts of India vary in their size and population density. The largest district is Kachh, with a land area of over 45,000 square kilometers, which is twice the size of the state of New Jersey or one-fourth the size of Uruguay. Population density of districts varies from a few dozen to 4,500 per square km.[7]

[6] To monitor the progress of the program social audits are carried out by independent non-government organizations.

[7] The most densely populated districts are those that are completely urban, such as Kolkata. The population density in such districts can be as high as 20,000 people per square km. These districts are excluded from my analysis because they are fully urban and the MGNREGA program provides employment in rural areas only.

By design of the program, at least one district from each state participates in each of the three phases of the program. In this phased implementation, economically poorer districts are chosen to participate in the earlier phases of the program. In India each district of the country is assigned an index of "backwardness" by the central government, which specifies the lack of economic development in the district.[8] In Phase-I of the program the number of district chosen from each state was determined by the overall economic condition of the state, where poorer states contributed more districts.[9] Once the number of districts from a state is determined, the decision to choose specific districts from that state is made by ranking the districts by their backwardness index: poorer districts are given priority. All these decisions are made by the central government. The same procedure is followed in Phase II; and all districts are covered in Phase III.[10]

I exclude some districts from the analysis because the MGNREGA program is not relevant for these districts. For example, because the program targets the rural poor, districts which are entirely urban (such as Kolkata) are not part of the program, and are omitted from the analysis. Similarly, I exclude all Northeastern states except Assam because these states receive special grants from the Central Government under various schemes, and therefore will effectively be different from the other states in many aspects. I also exclude the Union Territories as they are directly under central

[8] The backwardness index is the sum of three sub-indices measuring agricultural output, agricultural wages and proportion of the population that belongs to the Scheduled Tribe/Scheduled Caste groups (official designations given to various historically disadvantaged indigenous people) groups. Indian government ranks districts based on the value of the index. The lower the value, the more underdeveloped or backward a district is.

[9] Although the Planning Commission, the body which was responsible for planning the program, did not explicitly mention the algorithm used to choose the districts, it can be assumed that they used the same algorithm which had been used in roll-out of previous government program like the Rashtriya Sam Vikas Yojna (Zimmermann 2012). According to the algorithm, the number of districts to be chosen from each state depends on the percentage of population below poverty line in a state; then the districts from a given state is chosen according to the economic condition of the districts with poorer districts being given priority.

[10] Fraud and corruption in implementation can result in disparities between official data and the situation on the ground. Although the program has an built-in auditing system based on independent private auditors, incidences of corruption, poor implementation by local governments, capturing of the benefits of the program by less deprived households through political manipulation and incorrect targeting of the program such that the benefits do not reach the poorest households has proven to be widespread (IBN Live, 2013; Jha, et al. 2009 and 2010; Shariff 2009; Dutta, et al. 2012; etc.). But despite that, extensive surveys have shown that the program has had a sizable impact on poverty and income (Hindustan Times, 2013).

administration and have different mechanism of governance. I exclude Maharashtra because it has its own rural employment guarantee scheme since 1977 which is similar to the MGNREGA and therefore will not register the same impact as other states. I exclude the state of Jammu and Kashmir because this state has historically faced insurgency which escalated in the 1990s; thus the military has a big presence there which would influence the crime rate in that state. Lastly, I also drop districts which have been divided or newly created between 2001 and 2012.[11]

In the universe of all 624 districts that are covered by the program, 200 districts entered the in Phase-I, which is 32 percent of all districts. One hundred thirty districts entered in Phase II (21 percent), and the remaining 46 percent entered in Phase III. Because I dropped some districts due to the reasons mentioned above, my sample contains 417 districts from 18 states. Of these 417 districts, 150 entered the program in Phase I (36 percent), 92 districts entered in Phase II (22 percent), and 175 districts (42 percent) entered in Phase III.[12] Of the 132 backward districts identified by the Planning Commission of the central government, I have 75 in my sample. My sample covers 130 million rural households of the 165 million reported in the 2010-11 census. The number of worker days created by the program in 2010 is about 2.5 billion days, and my sample covers over 2.1 billion days.

2.3 Data

Crime Data

The data on crime are collected from the annual reports of the National Crime Records Bureau, called Crime in India (CI) from 2002 to 2012. The CI provides the total number of reported crimes committed in a year under various categories in each district. I analyze murder, kidnapping and

[11] Coincidentally, by excluding districts which have undergone divisions between 2001 and 2012 I also exclude the districts that are most affected by the Maoist insurgency (supra note 3). Only 29 percent of deaths caused by Maoist violence took place in the districts I analyze (South Asian Terrorism Portal-www.satp.org).

[12] Of the 206 districts that I lose, 125 are dropped because I have to eliminate the state with which they are affiliated for the reasons mentioned above, while 81 districts are lost due to re-division.

abduction, robbery, burglary, theft, and unlawful assembly and rioting (these generally take place due to political and religious reasons.)[13] I also group these crimes as *Violent* (the sum of murder, kidnapping, riots and robbery) and *Property* (the sum of theft and burglary). Crime rates are calculated per 100,000 residents, using district populations. Full definitions of crimes (according to the Indian Penal Code) are provided in Appendix 1 and the time-series behavior of *Violent* and *Propert* crime rate is displayed in Figure 2.1. Descriptive statistics are provided in Table 2.1. Although it is problematic to compare crime rates across countries because of differences in classification and reporting, murder is one particular crime category which should be recorded accurately in most countries (Soares 2004). The average murder rate in India is about 3 per 100,000 population and there are substantial differences in murder rates between countries. For example, the murder rate is 9.2 in Russia, 4.7 in the U.S., and 1.2 in France. Among Asian countries the murder rate ranges from 9.0 in Kazakhstan to 0.2 in Singapore.[14] The average kidnapping rate in India is about 2.5, which is one of the highest in the world (UNODC). There are, on average about 5.5 incidents of unlawful assembly and rioting that are reported per 100,000 population. Murders, kidnappings and riots are three crime categories that are reported arguably accurately. On the other hand, most other crimes in India are subject to underreporting (Dreze and Khera 2000).[15] Thus, the other three crimes, (robbery, burglary and theft) are likely underreported, but following the standard approach I use the logarithms of crimes as dependent variables. Under the assumption that reported crime rates are proportional to true crimes rates, the logarithm of the reported crimes are good proxies of the actual crime rates (Ehrlich 1996).

[13] There are other crime types, including banditry, criminal breach of trust, cheating, counterfeiting, arson, hurt, dowry death, molestation, sexual harassment, cruelty by husband and relatives, importation of girls, causing death by negligence. I do not analyze these crimes primarily because reporting is negligible. When multiple charges are filed against a single perpetrator, only the most serious offense is reported in the data. So for example if a victim is murdered while being robbed then the crime records will only show murder and not robbery.

[14] Data from U.S. Bureau of Justice Statistics, and United Nations Office on Drugs and Crime.

[15] This is especially the case for crimes against women, for petty crimes, and for crimes which are difficult to prove such as "cheating or breach of trust." Police stations will often discourage complainants from filing a complaint in case of small crimes just to decrease their work-load.

Furthermore, the time period of the analysis is short enough that the reporting rates as not expected to have changed systematically; nor are they expected to be impacted by the MGNREGA program.

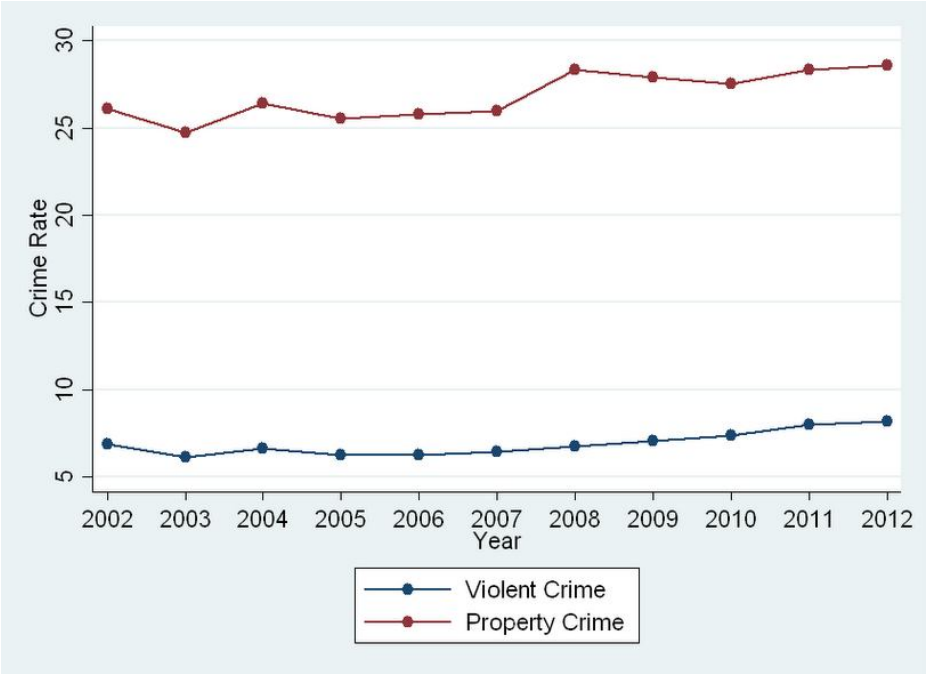

Figure 2.1: Time-series Behavior of the *Violent* and *Property* Crime Rates of All Districts.

Crime data are available at the district level, but they are not categorized as rural vs. urban crime, while the MGNREGA is implemented in rural areas. This is not an issue regarding big metropolitan cities which form their own separate districts (such as Calcutta), or big cities that contain multiple urban districts within them (such as Mumbai). These metropolitan cities are not part of the MGNREGA program and therefore they are dropped from the analysis. On the other hand, almost all districts, even those that are highly rural, contain some urban areas (such as small cities and district towns). Since crimes are recorded at the district level, the crime data I use contain offenses committed both in cities and in the rural areas of a district. Urban areas are different from rural areas in many dimensions including population density and income, and districts that have bigger urban areas are expected to have more crime per capita. Such districts are also less intensely impacted by the

MGNREGA program because of their smaller rural populations, thereby weakening the estimated impact of MGNREGA on crime.[16]

Table 2.1: Summary Statistics of Distict-level Crimes

Crime rates per 100,000 people	**2002-2005**	**2006-2012**	**2002-2012**
Murder	3.10	2.84	2.93
	(1.62)	(1.38)	(1.47)
Kidnapping	1.97	2.81	2.50
	(1.59)	(2.19)	(2.04)
Robbery	1.51	1.63	1.59
	(1.37)	(1.63)	(1.54)
Riot	5.70	5.43	5.52
	(5.81)	(8.62)	(7.72)
Burglary	8.28	7.59	7.85
	(7.18)	(6.35)	(6.67)
Theft	17.19	19.51	18.67
	(15.03)	(18.20)	(17.15)
Violent	6.59	7.27	7.02
	(3.43)	(3.74)	(3.65)
Property Crime	26.98	28.73	28.10
	(21.22)	(23.82)	(22.92)
N	1,664	2,911	4,575

The standard deviations are in parentheses.

To account for urbanization differences between districts, in empirical models I control for the percentage of urban population in each district. Importantly, I also derive the relationship between the impact of the program on district-level crime (which I estimate econometrically) and the impact of the program on district's *rural* crime. Using this relationship I am able to provide upper and lower bounds of the program's impact on rural crime. This procedure is explained in Section 3.4 below.

[16] It is also the case that the location of a crime may not coincide with the residence of the perpetrator, and some of the crimes committed in urban localities may be perpetrated by a transient from a rural area.

MGNREGA Data

The data on the employment intensity of the MGNREGA program in each district are obtained from the Ministry of Rural Development (MoRD). Each district reports the annual number of jobs in worker-days generated under the program to the MoRD. Since the program targets household employment (100 days of employment per household is guaranteed by the program) I divide the number of total worker-days generated in each district in a year by the number of rural household in that district in that year to obtain the intensity of the program for a particular year. The summary statistics of the program intensity is provided in Table 2.2.

Table 2.2: Intensity of the MGNREGA Program
Annual Worker-days of Employment Per Rural Household

Phase I Districts (2006-2012)	19.81
Phase II Districts (2007-2012)	12.98
Phase III Districts (2008-2012)	11.57
All Districts after their introduction of the program.	15.37
All Districts in the sample period (2002-2012)	8.30

Phase-I, Phase-II and Phase-III identifies the districts which were selected for the implementation of the program in 2006, 2007 and 2008 respectively.

Rainfall Data

The rainfall data are obtained from the University of Delaware website which compiles monthly terrestrial rainfall data between 1950 and 2010 collected from weather stations across the globe. The rainfall is measured in millimeters and is available for every latitudinal and longitudinal grid of 0.5 degrees by 0.5 degrees. I use a GIS map to identify the centroid of each district and find its latitudes and longitudes. Then I match the latitudes and longitudes of each district centroid with the nearest rainfall database grid. Following Iyer and Topalova (2014), I use logarithm of total annual rainfall as the measure of rainfall for each district.

Data from the Census of India

The data on district level variables such as demographics, social and economic indicators are collected from the Census of India. I use data from the censuses of 2001 and 2011. The district level demographic variables include total population, total number of households, number of rural households, population density, percentage of Scheduled Tribal people in total population, percentage of Scheduled Caste in total population, and percentage of urban population. Scheduled Castes and Scheduled Tribes are official designations given to various historically disadvantaged indigenous people in India as per the constitution of India. According to the Census of 2010-11 the Scheduled Castes and Scheduled Tribes constituted about 16.6 percent and 8.6 percent of India's population, respectively.

The social indicator variables obtained at the district level are the literacy rate and the sex ratio. The economic indicators at the district level that are the percentage of houses that have been classified to be in "good condition" by census data collectors, the percentage of households that use electricity as the main source of lighting, the percentage of households that own a television, and the percentage of households that own a motorcycle or scooter. I also collect data on the percentage of agricultural workers in the total working age population.

The other economic indicator variables which are available in the Census but I do not use are: the percentage of households having bank accounts, the percentage of households having drinking water facility, the percentage of households having bicycle, the percentage of households having transistor radio, the percentage of households having telephone connection, the percentage of households having mobile phones and the percentage of households having cars. The reason of not including drinking water and bank penetration in my analysis is because these variables are expected to be highly correlated with the program. A lot of the work under MGNREGA has been done to harvest

rain and ground water for irrigation as well as human use. This will lead to the districts which performed well in implementing MGNREGA to have better water supply to households as well.

Also, under the MGNREGA program each worker who gets a job card also automatically gets a bank account in his name and the wage she earns under the program is directly transferred to her account by the government to prevent leakages along the way. As a result the districts with better implementation of MGNREGA are also expected to have better bank penetration. I check for the correlation between the intensity of the program and these variables and find that they are highly positively correlated; the results have not been included in this analysis.

The reason for dropping bicycle ownership from the regression is that the relationship between bicycle ownership and economic development may not be linear. The percentage of households having bicycles rise in the poorer districts with economic prosperity but with higher levels of income people tend to shift to motorcycles, so the percentage of bicycles is low for the poorest and richest districts in the data. The percentage of households owning motorcycles and scooters is therefore a better absolute measure of economic prosperity of a district.

I exclude radio transistors because television replaces transistors for higher levels of income and thus television is a better absolute measure of prosperity. Landline telephone penetration is low in the rural areas and although it increased over time before 2001, between 2001 and 2011 mobile phones replaced landlines and its penetration fell. The Census did not collect data on mobile phone users before 2011 and so I cannot use mobile phones as a measure of economic indicator. As a result both telephones and mobile phones are not included in measures of economic development of a district. The summary statistics of the census data and rainfall are presented in Table 2.3. Since the census data are only available for the two years 2001 and 2011, I interpolate the data for the other years.[17]

[17] I restrict my analysis to the period 2002 - 2012 as I use the Census of 2001 and 2011 to identify the geographical boundaries of the districts. Indian districts undergo changes in boundaries periodically and if I extended the sample to periods before 2001 I would had to depend on the Census of 1991 to identify the districts. This would have led to the loss

Table 2.3: Summary Statistics of District-level Control Variables

Variables	Phase-I	Phase-II	Phase-III
Population	2,000,332	2,182,332	2,037,855
	(1,295,100)	(1,455,185)	(1,287,175)
Number of rural households	325,300	339,519	246,266
	(210,114)	(207,874)	(130,746)
Literacy rate	63.30	66.58	73.71
	(9.89)	(11.50)	(9.55)
Population density	462.81	596.83	574.42
	(367.51)	(415.14)	(518.54)
Urbanization rate	15.13	18.72	31.17
	(9.42)	12.82)	(17.76)
Sex ratio	953.40	944.11	937.74
	(46.11)	(47.18)	(67.72)
% "Good houses"*	43.73	45.77	54.69
	(14.19)	(13.75)	(13.28)
Electricity use**	44.44	50.73	72.93
	(28.18)	30.19)	(21.87)
% Households with television	24.82	30.85	49.58
	(16.69)	(20.75)	(18.55)
% Households with two-wheelers^{+}	10.56	13.16	21.07
	(10.56)	(9.26)	(10.89)
% Scheduled Caste^{++}	17.12	17.65	17.44
	(8.16)	(7.77)	(7.25)
% Scheduled Tribe^{++}	17.71	7.55	4.01
	(21.31)	(10.96)	(8.95)
% Workers involved in agriculture	69.76	63.25	50.63
	(11.95)	(16.45)	(18.03)
Log of annual total rainfall	6.94	6.95	6.71
	(0.45)	(0.59)	(0.67)
Number of Districts	150	92	175

Phase-I, Phase-II and Phase-III identifies the districts which were selected for the implementation of the program in 2006, 2007 and 2008 respectively. The standard deviations are in the parentheses. *: Percentage of Households living in dwellings categorized to be in "Good condition" by census observers. **: Percentage of Households using electricity as the main source of lighting. +: Two-wheelers consist of motorcycles and scooters. ++: Scheduled Castes and Scheduled Tribes are official designations given to various historically disadvantaged indigenous people in India as per the Constitution of India. The various groups of such people are designated in one or the other of the categories. Total annual rainfall is the total rainfall received in a district in a year measured in millimeters.

of a large number of districts from my sample due to boundary changes. I exclude 2001 as the district level crime data for 2001 is based on the district demarcation defined in Census of 1991.

2.4 Empirical Implementation

I employ a district level panel spanning the years 2002 to 2012 to identify the impact of employment, generated by the MGNREGA program, on crime. There is variation between districts in the year of introduction of the program, and there are differences in the intensity of implementation of the program across districts. More specifically, I exploit the fact that districts are enrolled in the program in a step-by-step manner between 2006 and 2008, and that employment intensity of the program has varied both between districts and within districts over time.

I estimate versions of Equation (1) below

$$1) \quad y_{ict} = \alpha + \beta_c(MGNREGA_{it}) + X'_{it}\gamma + \delta_i + \theta_t + \varepsilon_{it}$$

where, y_{ict} is the logarithm of crime type *c* per 100,000 people in district *i* in the year *t*, where *c* stands for murder, burglary, kidnapping, riots, etc. $MGNREGA_{it}$ represents the intensity of the MGNREGA program in district *i* in year *t*. It is measured as the number of worker-days generated under the MGNREGA program per rural household in district *i* and year *t*. X_{it} is a vector of district-specific demographic and socio-economic controls. δ_i stands for a vector of district dummies, θ_t is a vector of year dummies and ε_{it} is the error term. The district specific socio-economic and demographic controls include literacy rate, sex ratio, population density, urbanization, percentage of Scheduled Caste in district population, percentage of Scheduled Tribe in district population, and district-specific controls for economic condition such as electricity usage, housing conditions, percentage of houses with a television set, percentage of households having two wheelers (motorcycles or scooters), and percentage of workers involved in agriculture in the district. The inclusion of these variables is justified based on economic theory of crime. For example, I control for the literacy rate at the district level, because human capital, approximated by average education of the district, is expected to impact crime (Machin et al. 2011, Lochner and Moretti 2004). Housing conditions, ownership of motorcycles

and scooters, having a TV set in household are indicators of household wealth in India, and they are expected to be related to crime through various channels.[18] I also control for the sex ratio because male-biased sex ratio is shown to be an indicator of systemic cultural bias against women (Carranza 2014, Sen 1990, Dyson and Moore 1983) and such cultural traits may be correlated with other harmful behavior, including the propensity for delinquency. District dummies control for time-invariant factors that may affect crimes at the district level, such as institutions and culture which do not change in short periods of time. Some districts may have higher propensity for criminal activity because of a variety of reasons. For example, the efficiency of public institutions may vary between districts. District dummies also control for potentially differential tendency of crime reporting. Year dummies account for year-specific shocks, such as droughts or floods that may be correlated with crime.[19] Standard errors are clustered at the treatment-district level. The models are estimated both with and without weighting by district population, which provided very similar results.

Deterrence indicators such as the arrest rate or the police force are available at the state level, not at the district level. However, the size of the police force is not related to the MGNREGA program, because as mentioned earlier, MGNREGA program is funded by the central government. Therefore program spending has no impact on the state budget; hence it cannot influence state spending on police. Between-state differences in law enforcement are absorbed by district fixed effects.

The program provides employment only in rural areas of a district, without impacting the urban areas of the same district. Thus, if the program has an impact on crime, it would impact rural crime, but it should have little or no impact on urban crime.[20] The dependent variable y_{ict} , however, measures the crime rate (for type c crime) in the entire district *i* because crime data are not broken down by

[18] For example, to the extent that they are indicators of wealth, they should be negatively related to crime. On the other hand, availability or TV sets, motorcycles and scooters may increase the opportunities for theft of these items.

[19] As explained below, I include state specific time trends in some specifications which eliminate much of the variation in these slowly-evolving annual crime data.

[20] Urban crime can be impacted if the MGNREGA program impacts migration from rural to urban areas, or it impacts the behavior of potential criminals who reside in rural areas but commit crime in nearby urban communities.

urban-vs-rural crime. This means that the estimated coefficient β_c in Equation (1) captures the impact of the program on district's total crime (committed in both urban and rural locations) for that crime category. Total crime for any crime category in the district is the sum of urban and rural crime in that category (e.g. total burglaries in the district is the sum of urban burglaries and rural burglaries). That is, $C_T = C_U + C_R$, where C_T stands for total crime in the district in a given crime category, C_U stands for the number of crimes committed in that category in urban areas and C_R represents crimes committed in rural areas. Dividing by total district population Pop_T gives $\frac{C_T}{Pop_T} = \frac{C_U}{Pop_T} + \frac{C_R}{Pop_T}$, where the left-hand-side of the equation is the crime rate in the district. This equation can be re-written as

$$(2) \qquad CR_T = CR_U.\theta_U + CR_R.\theta_R ,$$

where CR_T stands for the crime rate in the district, θ_u is the share of urban population in total district population (Pop_U/Pop_T), θ_R stands for the share of rural population in total district population (Pop_R/Pop_T). CR_U represents the crime rate in urban areas ($CR_U = \frac{C_U}{Pop_U}$), and CR_R is the crime rate in rural areas ($CR_R = \frac{C_R}{Pop_R}$).

Equation (2) can be re-arranged as

$$(3) \quad \ln CR_T = \ln CR_R + \ln\left(\frac{CR_U.\theta_U}{CR_R} + \theta_R\right)$$

For notational simplicity, let the MGNREGA program be represented by *x*. The impact of MGNREGA on the crime rate in the district can be found by differentiating Equation (3) with respect to *x*. Assuming that the MGNREGA program has no impact on urban crime ($\frac{\partial CR_U}{\partial x} = 0$) and that it has no impact on the share of the population residing in either urban or rural areas ($\frac{\partial \theta_U}{\partial x} = 0$ and $\frac{\partial \theta_R}{\partial x} = 0$) , differentiating Equation (3) with respect to *x* gives

(4) $$\frac{\partial \ln CR_T}{\partial x} = \frac{\partial \ln CR_R}{\partial x} - \left(\frac{CR_R}{CR_T} . \frac{CR_U \theta_U}{CR_R} \right) . \frac{\partial \ln CR_R}{\partial x}$$

Note that a regression of total crime on MGNREGA, such as the one in Equation (1), produces the coefficient $\hat{\beta}_T$. That is, $\frac{\partial \ln CR_T}{\partial x} = \hat{\beta}_T$, where $\hat{\beta}_T$ is the impact of MGNREGA program on total district crime rate. Similarly, $\frac{\partial \ln CR_R}{\partial x} = \hat{\beta}_R$, where $\hat{\beta}_R$ is the estimated impact of MGNREGA on the *rural crime rate*. Thus, equation (4) can be written as

(5) $$\hat{\beta}_R = \hat{\beta}_T \left(\frac{CR_T}{CR_T - CR_U \theta_U} \right)$$

Equation (5) provides the relationship between $\hat{\beta}_T$ (the impact of the program on district crime rate), and $\hat{\beta}_R$ (the impact of the program on rural crime rate of the district). Although $\hat{\beta}_R$ cannot be directly estimated by running a regression due to lack of data on rural crime, it can nevertheless be calculated using Equation (5). Since the urban crime rate is positive (CR_U>0), and because the proportion of the district population living in urban areas (θ_U) is greater than zero in all districts (even the most rural districts contain small urban areas), $\left(\frac{CR_T}{CR_T - CR_U \theta_U} \right)$ >1. This implies that $\hat{\beta}_R > \hat{\beta}_T$. In other words, the impact of the MGNREGA program on the crime rate in rural areas is always larger than its impact on total district crime. As explained in Section 3, I place bounds on $\hat{\beta}_R$ using equation (5). The detail of the mathematical derivation is provided in Appendix 3.

2.5 Analysis of Pre-Program Trends

As discussed earlier, poorer districts were given priority while selecting districts for the program. The assumption of parallel trend in crime rates among the treated and the non-treated districts prior to the selection of the districts into the program is crucial for my results to be unbiased. That is, it

is possible that the crime rates were rising (or declining more slowly) in poorer districts in comparison to other districts prior to the implementation of the program. In that case, differential trends in crime rates between poor and non-poor districts may have prompted the central government to enrol the poorer districts earlier. In other words, it is possible that the poor districts which entered the program in Phase I (rather than in Phase II or in Phase III) had their crime rates rising in comparison to late-entering districts. Similarly, Phase-II districts may have their crime rates rising compared to Phase-III districts before entering the program. Relatedly, if districts which were selected in the earlier phases of the program had falling crime rates (relative to the districts that were enrolled later) even before the policy had been implemented then at least some of the effect of this trend would be attributed to the policy.

To address this concern I present graphs to compare the trends in crime rates in districts before and after their entry to the program. I group the districts by their phase of entry (Phase-I, II, or III) and calculate the crime rates for each group in each year. I combine individual crime categories into *Violent* (the sum of murder, kidnapping, and robbery) and *Property* (burglary and theft), although I obtained the same inference by analyzing individual crimes categories separately.

In Figures 2.2 and 2.3, I compare the trends of *Violent* and *Property* crimes respectively, among Phase-I and Phase-III districts for the years 2002 to 2007. The vertical lines in Figures 2.2 and 2.3 are located between 2005 and 2006. Recall that Phase-I districts entered the program in 2006, indicating that the "treatment" of Phase-I districts started in 2006. Phase III districts entered the program in 2008. Thus, during the period of 2002-2007 the Phase-III districts *were not yet enrolled in the program*. In other words, the impact of the MGNREGA program on crime in Phase-III districts does not exist between 2002 and 2007. Thus, they are the "control" districts in Figures 2.2 and 2.3. As Figures 2.2 and 2.3 demonstrate, the trends in either the *Violent* crime or the *Property* crime are not different between Phase-I and Phase-III districts before 2006.

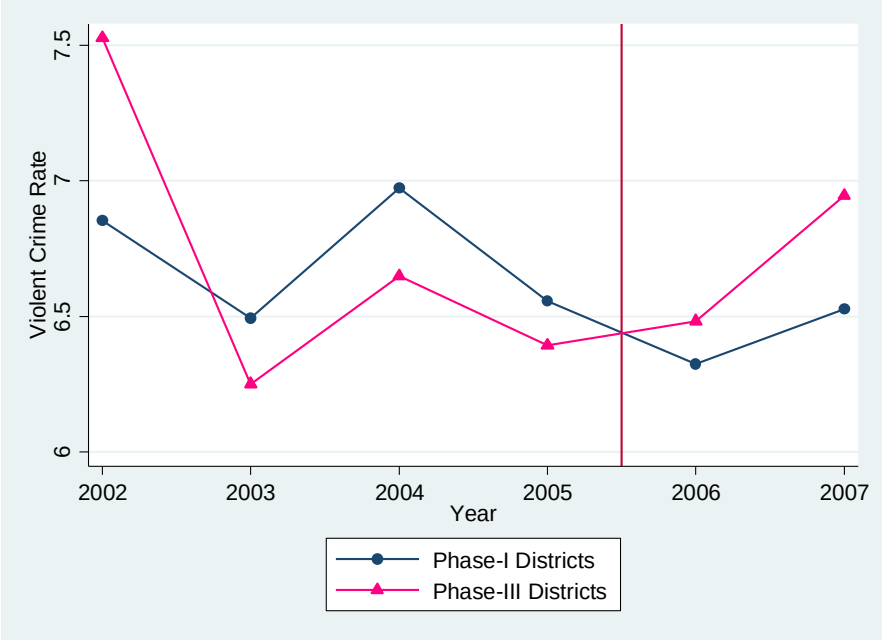

Figure 2.2: Trends in *Violent Crimes* of the Phase-I (Treated), and Phase-III (Control) Districts. The vertical line demarcates the pre- and post- program periods for the treatment group.

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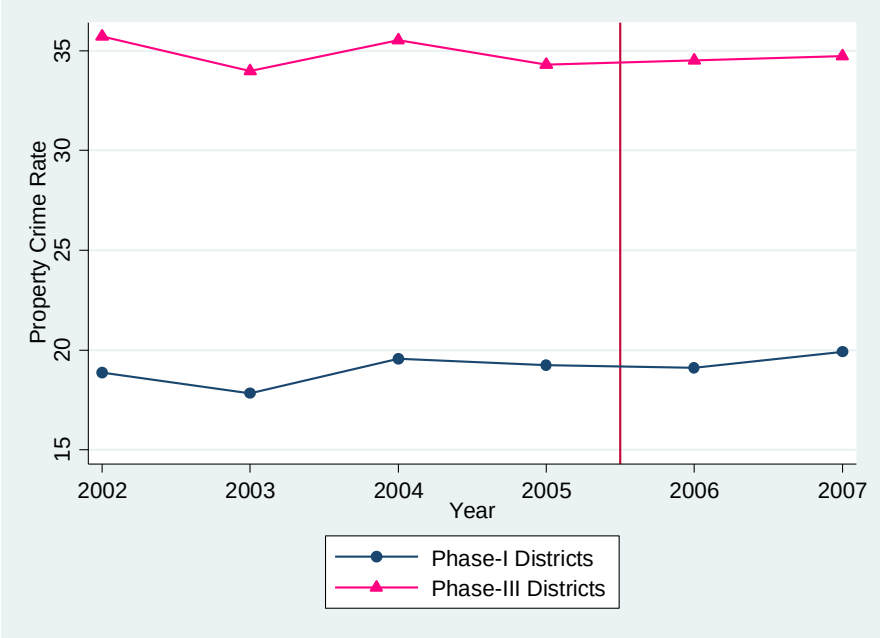

Figure 2.3: Trends in *Property Crimes* of Phase-I (Treated), and Phase-III (Control) Districts. The vertical line demarcates the pre- and post- program periods for the treatment group.

Figures 2.4 and 2.5, display the trends in *Violent* and *Property* crimes in Phase-II (treated) and Phase-III (control) districts during the same period. Phase-II districts entered the program in 2007; so the vertical lines in these figures delineate the pre- and post- program years for Phase-II districts.

Phase III districts are the "control" group in these graphs as they were not treated by the program until 2008. Once again, the trends in *Violent* crime (Figure 2.4) and *Property* crime (Figure 2.5) are similar between the two groups of districts before Phase-II districts entered the program in 2007.

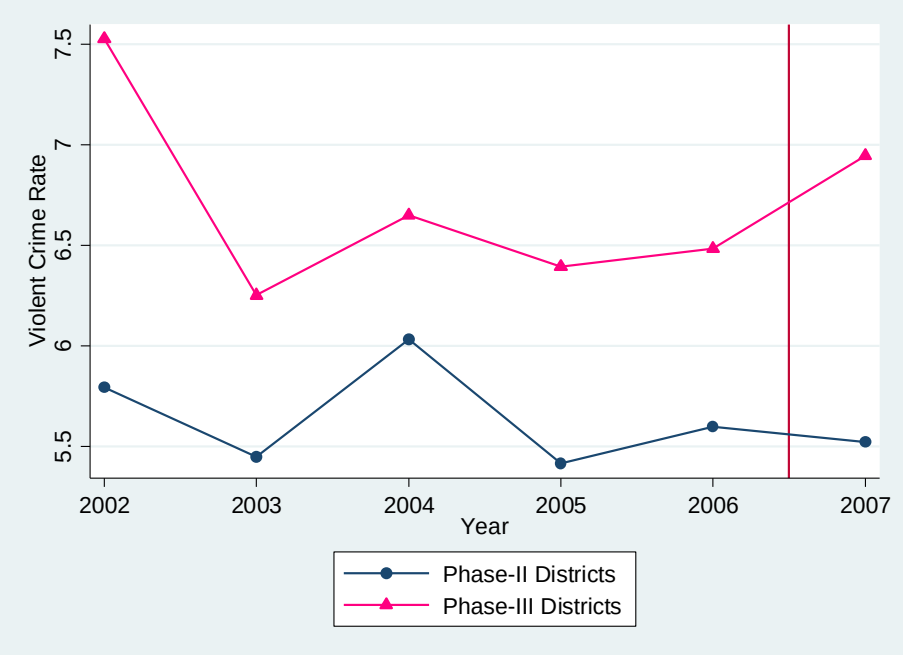

Figure 2.4: Trends in *Violent Crimes* of the Phase-II (Treated), and Phase-III (Control) Districts. The vertical line demarcates the pre- and post- program periods for the treatment group.

There is also a possibility that time-series behavior of crime rates may include a cyclical component and districts may have been selected into the program when their crime rates were at the peak of the cycle. In such a case the natural mean reversal of the crime trend would be captured as an effect of the program and therefore would confound the analysis of the program's impact on crime. To investigate if such a pattern exists, I plotted the crimes rates of Phase-I, II, and III districts by their year of entry into the program. In Figures 2.6 and 2.7 the horizontal axes display the distance (in years) relative to the year in which the program was first introduced to that group of districts. For example, Phase-I districts entered the program in 2006; so 0 represents the year 2006 in case of Phase-I districts and -1 stands for the year 2005: the year before Phase-I districts entered the program. Phase-II districts

entered the program in 2007; so 0 represents 2007: the year of entry in case of Phase-II districts and -1 represents the year before the entry; and so on.

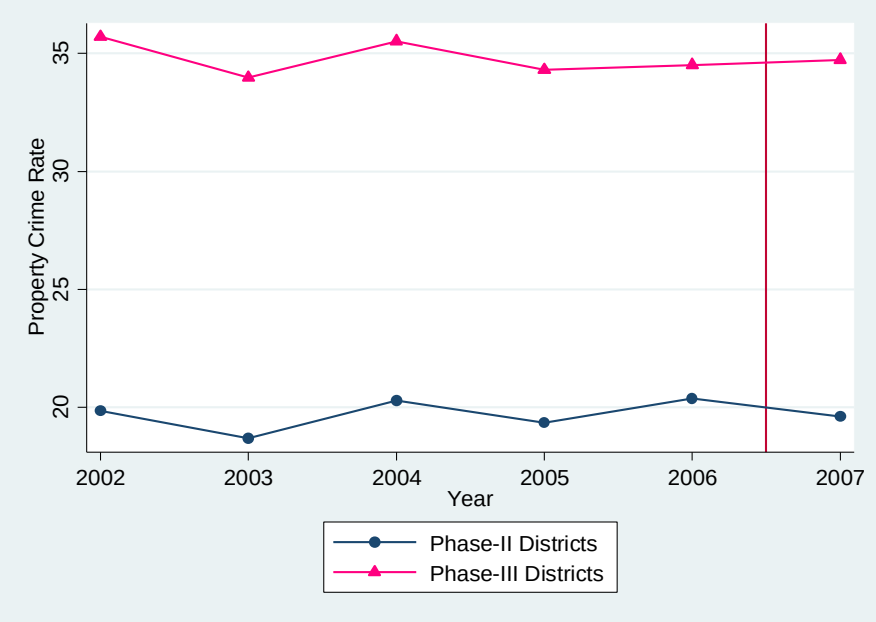

Figure 2.5: Trends in *Property Crimes* of Phase-II (Treated), and Phase-III (Control) Districts. The vertical line demarcates the pre- and post- program periods for the treatment group.

As Figures 2.6 and 2.7 demonstrate, there is no indication that the crime rates peaked before entry into the program. For example, Figure 2.6 shows that the violent crime rate in Phase-I districts was fluctuating around 6.7; the rate was about 5.6 in Phase-II districts during the 5 years before they entered the program. Similarly, there is no obvious time-series pattern in Phase-III districts before their entry into the program. Interestingly, the violent crime rates exhibit a positive trend in all three groups of districts after they enter the program. But, the upshot of Figures 2.6 and 2.7 is that there is no clear pattern in either *Violent* (Figure 2.6) or *Property* (Figure 2.7) crime rates prior to districts' entry to the program.

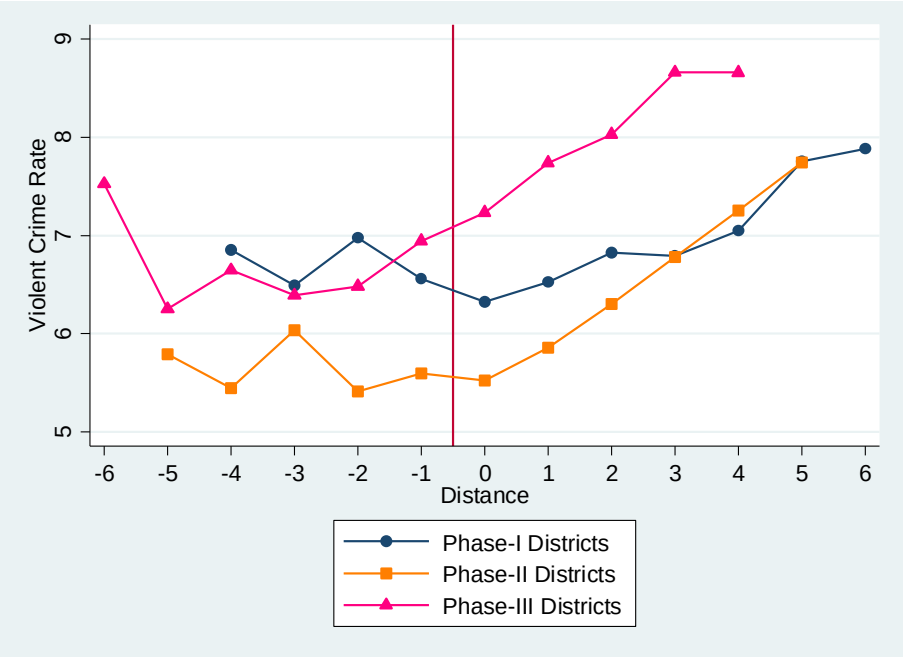

Figure 2.6: Trends in *Violent Crimes* of the Phase-I, II and III Districts.
The horizontal axis represents distance in years from the introduction of the program in the respective phases. The vertical line demarcates the pre and post program periods for each phase.

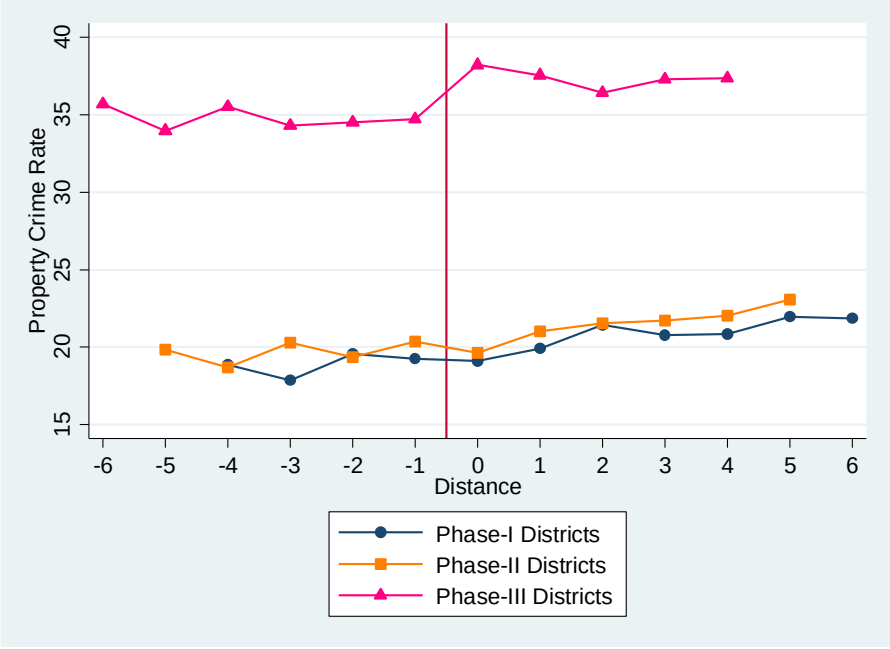

Figure 2.7: Trends in *Property Crimes* of the Phase-I, II and III Districts.
The horizontal axis represents distance in years from the introduction of the program in the respective phases. The vertical line demarcates the pre and post program periods for each phase.

Murder is an important violent crime to investigate. It is also a crime category which is recorded with minimum reporting error. I present in Figure 2.8 the behavior of the murder rate in Phase I, II and III districts. Although the level of the murder rate is different between the three groups, they share a common downward trend which does not exhibit any visible divergence or convergence.

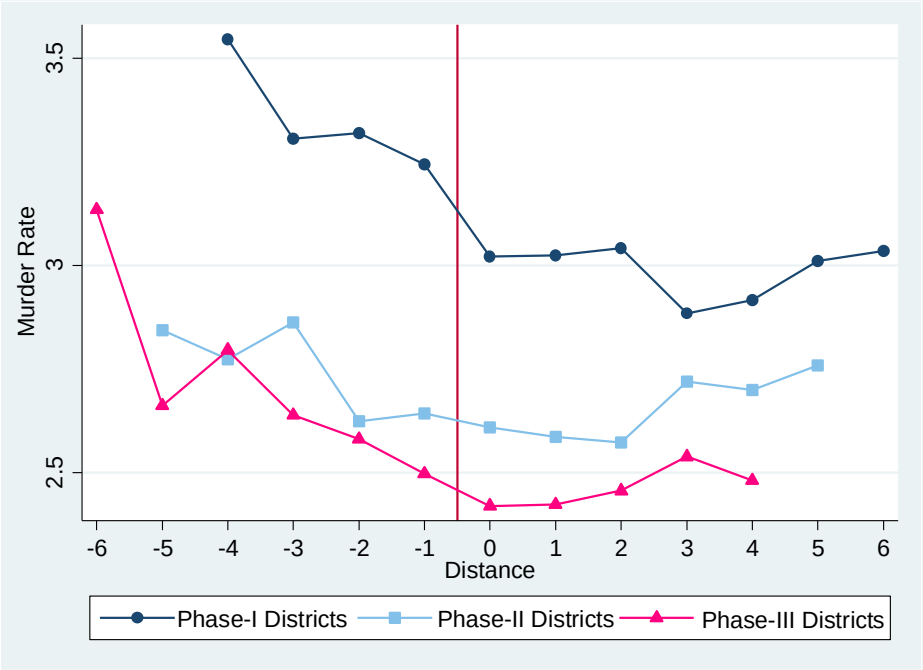

Figure 2.8: Trends in the Murder Rates of Phase-I, II and III Districts.
The horizontal axis represents distance in years from the introduction of the program in the respective phases. The vertical line demarcates the pre and post program periods for each phase.

As discussed earlier, the central government of India gave priority to poorer districts in the MGNREGA program. Poorer districts entered the program earlier and therefore they are "treated" with extra years of the program as well as with higher intensity (more worker-hours enrolled**).** Table 2.2 shows that the program generated an average of about 20 worker days per rural household per year in Phase-I districts. As described in Section 2.2, this group by design contains the poorest districts of the country. The average worker days employed per rural household is about 13 in Phase-II districts, and it is 11.5 in Phase III districts. Thus, Table 2.2 indicates that, not surprisingly, rural households in poorer districts have enrolled in the program at a higher rate. To investigate the pre-program crime patterns

between the poorest districts and the rest, I identified the 100 districts which had been explicitly mentioned by the Planning Commission as the most "backward." All of these districts had entered the program in Phase-I. I divide the 150 districts that entered the program in Phase-I into two groups as the poorest (most backward) 100, and the less poor (less backward) 50. The mean number of man days generated under the MGNREGA program for the most backward and less backward districts in Phase-I are 22.5 and 15.3 respectively, suggesting that economic backwardness is positively correlated with the intensity of the take-up of the program.

Figures 2.9 and 2.10 display the *Property* and *Violent* crime rates for the period 2002-2012 in the most backward 100 districts of Phase-1, and the rest of the Phase-I districts. Despite the fact that implied poverty rates and the enrolment rates per rural household are different between these two groups, their crime patterns was similar before they entered the program.

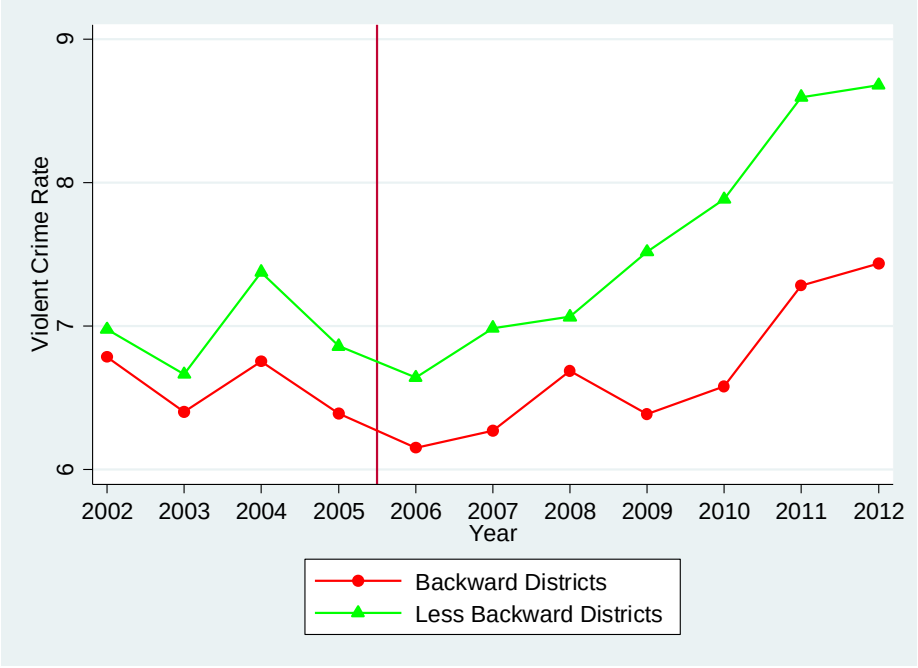

Figure 2.9: Trends in *Violent Crimes* of Backward and Less Backward Districts in Phase-I of the Program.
The vertical line demarcates the pre- and post- program periods.

Finally, in Figures 2.11 and 2.12 I compare the behavior of the crime rates between high-enrolment and low-enrolment districts of Phase-I. I define high-enrolment districts as those where employment generated per rural household is greater than the program median among Phase-I districts. Each district entered the program in 2006, but more worker-hours are generated in the former group of districts because of their higher joblessness. Once again, crime rates do not exhibit differential patterns before the initiation of the program in 2006.

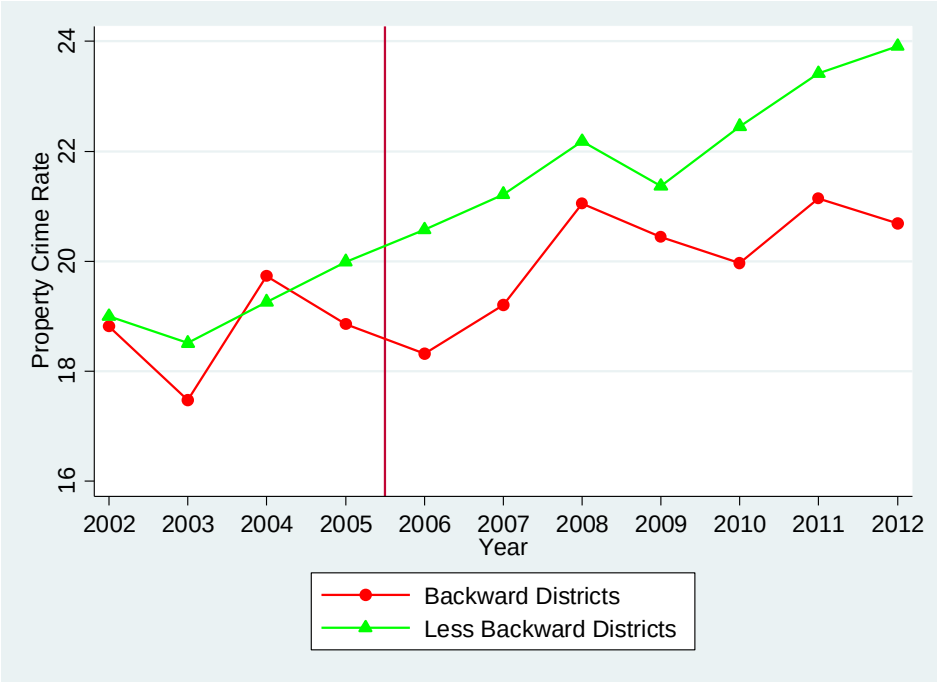

Figure 2.10: Trends in *Property Crimes* of Backward and Less Backward Districts in Phase-I of the Program.
The vertical line demarcates the pre- and post- program periods.

In summary, the graphical evidences presented in Figures 2.2 to 2.12 are consistent with the hypothesis that the districts which were chosen to enter the program in earlier years would have had similar changes in crime rates in comparison to districts that entered the program in later years. When I test econometrically whether the crime rates were diverging 1 or 2 years before the entry into the program, I find no evidence for differential pre-trends or abrupt changes in the crime rates before the districts enter the program. This is discussed later in the chapter.

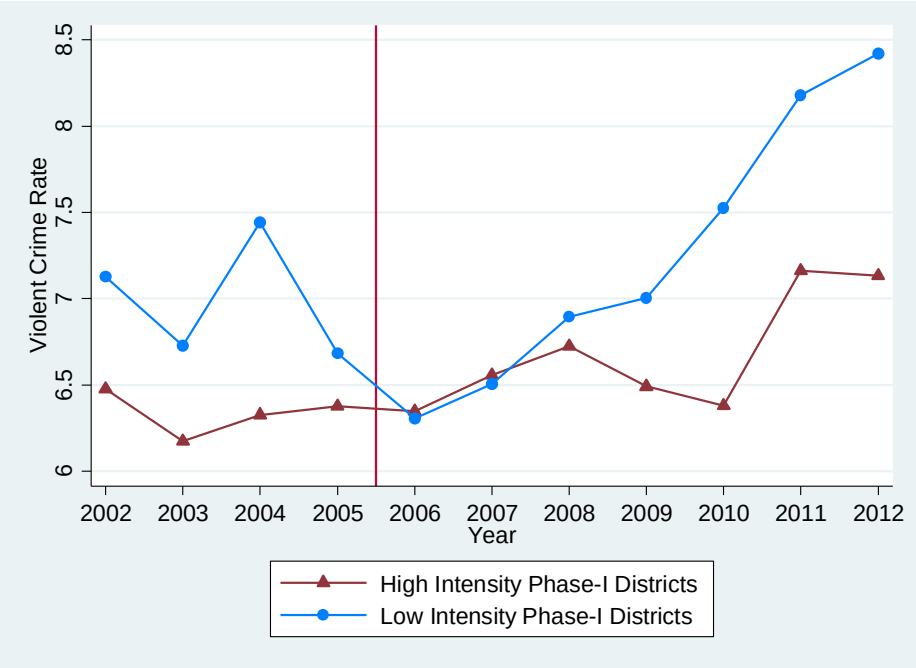

Figure 2.11: Trends in *Violent Crimes* of High and Low Program Intensity Districts in Phase-I of the Program.
The vertical line demarcates the pre- and post- program periods.

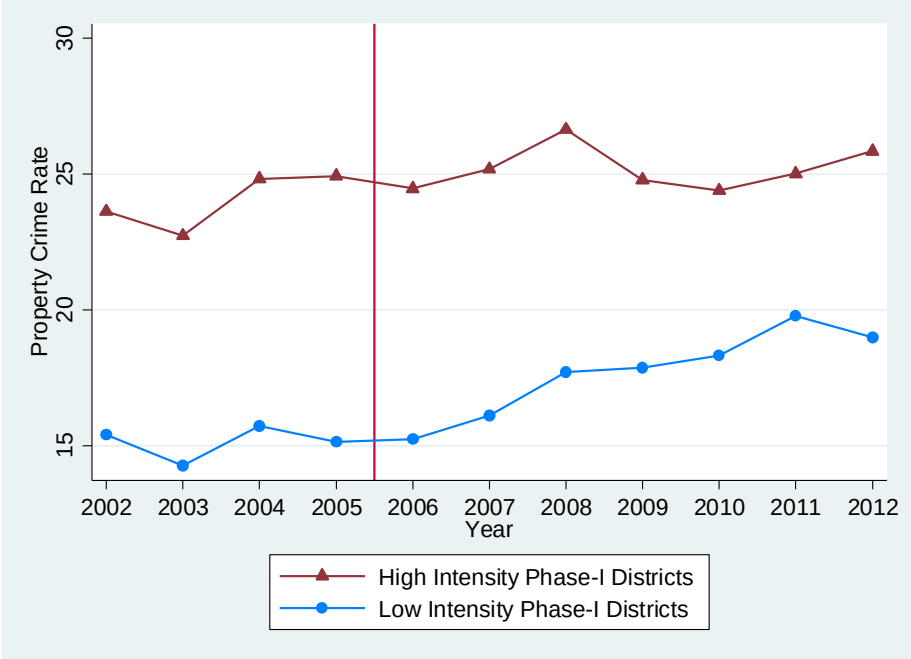

Figure 2.12: Trends in *Property Crimes* of High and Low Program Intensity Districts in Phase-I of the Program.
The vertical line demarcates the pre- and post- program periods.

2.6 Results

The results of the baseline specification for various crimes are presented in Table 2.4. The estimated coefficient of worker days per rural household generated by the program (Worker days per HH) is negative for all crimes, and they are statistically different from zero with the exception of the murder regression. The magnitudes imply that one additional worker day of employment per rural household generated by the MGNREGA program reduces kidnappings by 0.3 percent, riots by 0.6 percent, robberies by 0.2 percent, thefts by 0.26 percent and burglaries by 0.17 percent. When these crimes are grouped as violent and property crimes in the last two columns of Table 2.4, I obtain similar results. One additional worker day of employment per rural household generated under the program reduces *Violent crimes* by 0.2% and *Property crimes* by 0.25%. Models in Table 2.4 are weighted regressions. They are weighted by district populations. Unweighted models provide almost identical results; they are displayed in Appendix 2 in Table A2.1. Among the control variables, literacy rate has a significant relationship with murder, robbery, and riots. It has a negative significant effect on murder and robbery but a positive significant effect on riots. Sex ratio has significant negative effect only on murders. Urbanization rate has a positive significant effect on riots. Population density and use of electricity has a significant positive relationship with almost all crimes. Condition of dwellings and ownership of two wheelers have negative significant effect on most crimes.

When the models include state-by-year fixed effects in addition to all control variables, much of the variation in crime is eliminated. Consequently, the estimated impact of the program becomes smaller. Table 2.5 summarizes the results obtained from this model. The top panel reports results from weighted regressions, the bottom panel displays the results from unweighted regression. The coefficients, both in magnitude and in statistical significance are similar between the two panels and they are generally consistent with those reported in Table 2.4, although there are differences. For example, the coefficient of interest (Worker days per household) is significant in murder equations

Table 2.4: The Impact of Employment Generated by the MGNREGA on Crime (Weighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0006**	**-0.0029*****	**-0.0021***	**-0.0064*****	**-0.0026*****	**-0.0017****	**-0.0020*****	**-0.0025*****
	(0.0004)	(0.0007)	(0.0012)	(0.0016)	(0.0006)	(0.0007)	(0.0005)	(0.0006)
Literacy rate	-0.0177***	0.0089*	-0.0412***	0.0210**	-0.0019	-0.0078	-0.0132***	-0.0082**
	(0.0028)	(0.0048)	(0.0072)	(0.0093)	(0.0042)	(0.0047)	(0.0034)	(0.0039)
Sex ratio	-0.0038***	0.0034*	-0.0011	0.0040	-0.0009	-0.0006	-0.0004	-0.0002
	(0.0010)	(0.0018)	(0.0026)	(0.0031)	(0.0015)	(0.0016)	(0.0014)	(0.0013)
Urbanization rate	0.0049	0.0091	0.0112	0.0415***	-0.0034	-0.0054	0.0111*	-0.0049
	(0.0051)	(0.0070)	(0.0097)	(0.0087)	(0.0053)	(0.0075)	(0.0065)	(0.0055)
Population density	-0.0001	0.0002**	0.0003	0.0006**	0.0006***	0.0005***	0.0001	0.0006***
	(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
% "Good houses"$^{+}$	-0.0039**	-0.0194***	-0.0206***	-0.0093*	0.0033	0.0035	-0.0125***	0.0007
	(0.0018)	(0.0036)	(0.0050)	(0.0053)	(0.0025)	(0.0030)	(0.0027)	(0.0025)
Electricity Use	0.0073***	0.0102***	0.0044	0.0003	0.0149***	0.0044	0.0065***	0.0135***
	(0.0019)	(0.0032)	(0.0046)	(0.0051)	(0.0027)	(0.0028)	(0.0024)	(0.0024)
Television^{++}	-0.0010	-0.0042	0.0152***	0.0074	-0.0140***	0.0053**	0.0009	-0.0089***
	(0.0014)	(0.0028)	(0.0046)	(0.0058)	(0.0023)	(0.0025)	(0.0021)	(0.0022)
Two wheelers‡	-0.0043	-0.0435***	0.0101	-0.0811***	0.0008	-0.0181**	-0.0151**	-0.0008
	(0.0046)	(0.0080)	(0.0118)	(0.0170)	(0.0064)	(0.0080)	(0.0062)	(0.0060)
% of Scheduled Caste	0.0181	0.0008	0.0140	-0.0026	-0.0037	0.0134	-0.0001	-0.0082
	(0.0118)	(0.0278)	(0.0261)	(0.0342)	(0.0190)	(0.0285)	(0.0190)	(0.0188)
% of Scheduled Tribe	0.0026	-0.0065	0.0034	-0.0615**	-0.0149	-0.0080	-0.0104	-0.0184
	(0.0084)	(0.0225)	(0.0175)	(0.0257)	(0.0125)	(0.0222)	(0.0145)	(0.0126)
% Agricultural workers $^{\#}$	0.0076*	-0.0210***	-0.0024	-0.0256**	-0.0191***	-0.0117*	-0.0025	-0.0113*
	(0.0044)	(0.0079)	(0.0097)	(0.0115)	(0.0067)	(0.0068)	(0.0060)	(0.0061)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4,567	4,538	4,485	4,350	4,575	4,570	4,570	4,575

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. *Worker days per HH* stands for employment generated by MGNRGEA program, measured as worker days per household. +: % of households living in dwellings categorized to be in "Good condition"; ++: % of households with Television; ‡: % of households with motorcycles and scooters. #: % of workers involved in agriculture. All models are weighted by district population. Standard errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

in Table 2.5, while it was not significantly different from zero in Table 2.4. The reverse is true for kidnapping, riots and theft. The impact of the program on crimes aggregated as violent and property, continue to be significantly different from zero. [21]

Table 2.5: The Impact of Employment Generated by the MGNREGA on Crime
(Controlling for State-by-year Fixed Effects)

		Weighted Regressions		
	Murder	**Kidnapping**	**Robbery**	**Riot**
Worker days per HH	-0.0012**	-0.0006	-0.0046***	-0.0017
	(0.0005)	(0.0008)	(0.0013)	(0.0015)
N	4,567	4,538	4,485	4,350
	Theft	**Burglary**	**Violent**	**Property**
Worker days per HH	-0.0008	-0.0014	-0.0025***	-0.0013**
	(0.0007)	(0.0009)	(0.0005)	(0.0006)
N	4,575	4,570	4,570	4,575
		Unweighted Regressions		
	Murder	**Kidnapping**	**Robbery**	**Riot**
Worker days per HH	-0.0009*	-0.0007	-0.0040***	-0.0013
	(0.0005)	(0.0007)	(0.0012)	(0.0015)
N	4,567	4,538	4,485	4,350
	Theft	**Burglary**	**Violent**	**Property**
Worker days per HH	-0.0009	-0.0011*	-0.0019***	-0.0013**
	(0.0006)	(0.0006)	(0.0005)	(0.0005)
N	4,575	4,570	4,570	4,575

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. *Worker days per HH* stands for employment generated by MGNRGEA program, measured as worker days per household. All models include the same explanatory variables as those reported in Table 4. District populations are used as weights in weighted regressions. Standard errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

The Impact of Rainfall

Sekri and Storeygard (2014) analyzed district level data and reported that rainfall had a negative impact on dowry deaths (murder of a bride for bringing in insufficient dowry) in India. Iyer and Topalova (2014) showed that consumption spending was influenced by rainfall and by an indicator of trade liberalization in India. They also ran district-level property crime and violent crime regressions

[21] Because weighted and unweighted models provide very similar results, I report only the weighted regressions in the rest of the chapter. The full tables, showing all the controls for both weighted and unweighted regressions are in the Appendix tables 2.B2 to 2.B5.

and found that an increase in rainfall had a negative impact on crime. I run the benchmark models, shown in Table 2.4, by replacing the variable that measures district-level employment generated by MGNREGA (*Worker days per household)* with the logarithm of total rainfall in the district, but keeping all other control variables. The results, displayed in Table 2.6, show that rainfall has a significant negative impact on crime in the data set as well, presumably because a decrease in annual rainfall is associated with a decline in agricultural output and an increase in poverty.

Table 2.6: The Impact of Rainfall on Crime

	Murder	**Kidnapping**	**Robbery**	**Riot**
Log of Total Rainfall	-0.0765***	0.0090	-0.0373	-0.2633***
	(0.0204)	(0.0311)	(0.0476)	(0.0529)
N	3,729	3,703	3,668	3,569
	Theft	**Burglary**	**Violent**	**Property**
Log of Total Rainfall	-0.0328	0.0266	-0.0453**	-0.0242
	(0.0228)	(0.0370)	(0.0217)	(0.0212)
N	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. Total rainfall is rainfall received in a district in a year, measured in millimeters. Apart from Log Total Rainfall, all models include the same explanatory variables as those reported in Table 4 except worker-days generated under the program. District populations are used as weights. Standard errors are clustered at the district level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

If rainfall is negatively correlated with joblessness and poverty in India, this would imply that a decline in rainfall would generate a higher demand for enrolment in the MGNREGA program. Put differently, to the extent that the program aims to provide insurance against joblessness (at least temporarily) and given that enrolment in the program is acquired on demand, it is expected that high rainfall in a district should diminish the demand for the program in that district. Table 2.7 reports the regression results where district-level annual enrolment in the MGNREGA program is explained by the same set of district attributes as before, with the addition of total rainfall in that district in that year.

The estimated impact of rainfall is about -4 and highly significant. This implies that a 10 percent increase in rainfall reduces per household worker days of employment by 0.4, which translates

into an elasticity of 0.48. In other words, if total rainfall were to increase by 10 percent, the demand for the MGNRGEA program would decline by 4.8 percent.

Table 2.7: The Impact of Rainfall on Employment Generated by the MGNREGA

	Worker Days per Rural Household	**Worker Days per Rural Household**
Log of Total Rainfall	-4.1241***	-3.6057***
	(1.0601)	(1.2393)
Literacy rate	2.2028***	2.5073***
	(0.4064)	(0.5120)
Sex ratio	0.3034***	0.2368*
	(0.1083)	(0.1259)
Urbanization rate	0.3722	0.6040
	(0.5496)	(0.5779)
Population density	0.0132	0.0167
	(0.0121)	(0.0152)
% "Good houses"+	0.2972	0.3275
	(0.2793)	(0.2622)
Electricity use	0.1027	0.1112
	(0.2867)	(0.2605)
Television++	1.9165***	2.0628***
	(0.2438)	(0.2432)
Two wheelers‡	-0.1026	-0.4804
	(0.7228)	(0.7190)
% of Scheduled Caste	-0.6492	-1.4963
	(1.5773)	(1.6862)
% of Scheduled Tribe	-0.0547	-0.6754
	(1.3026)	(1.3064)
% Agricultural workers#	-0.2536	-0.7483
	(0.5255)	(0.6438)
District and Year Fixed Effects	Yes	Yes
Regression Weighted	No	Yes
N	1,640	1,640

The dependent variable is the number of worker-days generated under the MGNREGA program after it has been introduced in a district. Total rainfall is total rainfall received in a district in a year, measured in millimeters. + : % of households living in dwellings categorized to be in "Good condition." ++: % of households with Television. ‡: % of households with motorcycles and scooters. #: % of workers involved in agriculture. The model in the first (second) column reports the (un)weighted regression. District populations are used as weights in the weighted regression. Errors are clustered at the Treatment-District level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

In summary, I find that rainfall has an impact on crime, presumably due to its impact on agricultural employment and poverty. Consistent with the premise that rainfall has an impact on joblessness in rural areas, I also find that rainfall has an impact on enrolment in the MGNREGA program. If rainfall has a direct impact on crime in addition to its indirect influence (through MGNRGEA), this implies that crime regressions should include rainfall as an additional control variable. Table 2.8 reports the results of the models that include both workers-days per rural household and rainfall (in addition to all other control variables). Two observations can be made about Table 2.8. First, the estimated coefficients of MGNREGA (*worker days per HH*) are slightly larger in absolute value (more negative) in comparison to the models that did not include rainfall (Table 2.4). This is meaningful because rainfall and *Worker days per HH* are negatively related (Table 2.7), and rainfall has a separate negative impact on crime. Thus, models that do not control for rainfall provide estimates of MGNREGA that are biased towards zero. Second, rainfall has a separate, direct impact on murder, riots and on violent crimes.[22]

Elasticities

The results in Table 8 indicate that if employment generated by the program goes up by one day per *rural household*, this reduces violent crimes *in the district* by 0.24 percent, and property crimes by 0.25 percent. Since the sample mean of worker days of employment per rural household is 8.3, this implies crime elasticities of employment is about 0.02. As discussed in Section 2.4, the estimated coefficients of *worker days per rural household* reported in Table 2.8 are the estimates of $\hat{\beta}_T$, which represent the impact of the program on total district crime. To recover $\hat{\beta}_R$ (the impact of the program on rural crime), I use Equation (5).

[22] The full set of coefficients of the regressions reported in Table 2.8 and their unweighted versions are reported in Appendix 2.B, tables 2.B6 and 2.B7.

Table 2.8: The Impact of Employment Generated by the MGNREGA on Crime
(Controlling for Rainfall)

	Murder	**Kidnapping**	**Robbery**	**Riot**
Worker days per HH	-0.0010**	-0.0030***	-0.0029**	-0.0079***
	(0.0004)	(0.0007)	(0.0012)	(0.0016)
Log of Total Rainfall	-0.0744***	0.0152	-0.0315	-0.2509***
	(0.0192)	(0.0281)	(0.0451)	(0.0457)
N	3,729	3,703	3,668	3,569
	Theft	**Burglary**	**Violent**	**Property**
Worker days per HH	-0.0024***	-0.0016**	-0.0024***	-0.0025***
	(0.0006)	(0.0007)	(0.0005)	(0.0005)
Log of Total Rainfall	-0.0279	0.0298	-0.0406**	-0.0191
	(0.0218)	(0.0350)	(0.0194)	(0.0201)
N	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. *Worker days per HH* stands for employment generated by MGNRGEA program, measured as worker days per household. Total rainfall is total rainfall received in a district in a year, measured in millimeters. All models include the same explanatory variables as those reported in Table 4. District populations are used as weights. Standard errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

In my sample 22.5 percent of the population lives in urban areas. Thus, I set θ_U=0.225 in Equation (5). Under the assumption that the urban crime rate is the same as the total crime rate (CR_T=CR_U), equation (5) implies that $\hat{\beta}_R = 1.29\hat{\beta}_T$ which provides the lower bound for $\hat{\beta}_R$. To obtain the upper-bound of $\hat{\beta}_R$, I use the crime rates in 37 metro cities in India as an estimate for the urban crime rate in all district (CR_U).[23] Clearly, the crime rates in these big cities are higher than the crime rates in towns and small cities; thus attributing big city crime rates to CR_U in Equation (5) provides an upper bound for $\hat{\beta}_R$. Using this procedure I generate bounds for $\hat{\beta}_R$. For example, in case of robbery I can bind $\hat{\beta}_R$ between -0.004 and -0.011, which in turn provides the elasticity of rural robbery with respect to employment generated by the program in the range of 0.03 to 0.09. Elasticities of other crimes are calculated similarly, and reported in Table 2.9.

[23] The crime rates in India's biggest 37 cities are as follows: Murder: 2.82, Kidnapping: 4.99, Robbery: 5.22, Burglary: 15.54, Theft: 78.55, Riots: 7.74, Violent Crime:16.62, and Property Crime: 94.09.

Table 2.9: Elasticity of Crime Rates with Respect to Worker-days Generated by the MGNREGA Program (Absolute Values)

	Murder	**Kidnapping**	**Robbery**	**Riot**
Upper Bound	0.01	0.05	0.09	0.10
Lower Bound	0.01	0.03	0.03	0.09

	Theft	**Burglary**	**Violent**	**Property**
Upper Bound	0.36	0.02	0.04	0.08
Lower Bound	0.03	0.02	0.03	0.03

The crimes are defined as number of crimes reported per 100,000 people in a district in a year.

Using state panels from the U.S. Raphael and Winter-Ember (2001, p.271) find that the elasticity of property crime with respect to the unemployment rate is about 0.14. Corman and Mocan (2005) report that in New York City the elasticity of burglaries with respect of unemployment rate is about 0.17, and it is about 0.14 in case of motor vehicle thefts. Öster and Agell (2007) report that in Sweden the elasticity of burglary with respect to unemployment rate is 0.25, and it is 0.35 in case of auto theft. The results of Buonanno and Montolio (2008) imply a property crime elasticity with respect to youth unemployment of 0.13 in Spain. Altındağ (2012) employs panel data from 33 European counties and finds that the property crime elasticity of the unemployment rate is in the range of 0.20 to 0.32. The elasticities I report (displayed in Table 2.9) are significantly smaller than those reported in developed countries, but it should be noted that they are not directly comparable to unemployment elasticities because these elasticities pertain to an increase in short-lived employment that is shown to impact mostly female joblessness.

Extensions

Although the graphical analyzes presented in Figures 2-12 do not show any sign of differential pre-trends between treatment and control districts, I perform a formal test to investigate if crime rates increased before districts entered the program. Specifically, I create a lead indicator which takes a value 1 for two years prior to a district being included in the program and zero otherwise. I run the same models for property and violent crimes, summarized in Table 2.8, with the addition of the lead

dummy. The coefficient of the lead dummy is insignificant except for riots as reported in the top panel of Table 2.10, indicating that there is no evidence of differential movements in crime trends prior to the selection of the districts into the program. To test whether there is evidence of cyclical movement of crime rates and a rise in crime rates prior to the selection of a district into the program I create a "dip dummy" which takes a value 1 since a year prior to the selection of a district into the program. For example, for Phase-I districts which entered the program in 2006 the dummy takes the value 1 for the period 2005 and onward; for Phase-II districts 2007 and onward etc. The results are presented in the bottom panel of Table 2.10. The results indicate that there has been a rise in violent crime rates just prior to the selection of a district into the program. This is not a problem for my analysis as it is clear from the graphical evidence in Figure 2.6 that violent crime rate has shown an in general upward trend since for the period under consideration. It is this upward trend which has resulted in the positive value of the dip dummy and not cyclical movement.

Poverty is positively correlated with criminal propensity, and poverty should induce higher enrollment in the program. Given that disticts' level of poverty cannot be measured fully with the available data, including the poorest (most backward) districts in the analysis should weaken the estimated impact of the program on crime. To investigate this conjecture, I removed Phase-I dictricts from the sample and re-ran the regressions using Phase-II and Phase-III districts only. The Phase-I group includes the most backward districts and they have higher employment creation (Table 1). The results are presented in Table 2.11. Although the estimates become larger in absolute value for riots, theft, burglary, and property crime (which is the sum of theft and burglary), the elasticities remain same for theft and are marginally higher for property crime. The elasticties in this sample is significantly higher for burglary and riots. This indicates that the downward bias imparted by the poorer districts is limited.

Table 2.10: Formal Test for Differential Movement in Crime Trends and Ashenfelter's Dip.

Checking for Differential Movement in Crime Trends

	Murder	**Kidnapping**	**Robbery**	**Riot**
Worker days per HH	-0.0012***	-0.0029***	-0.0025*	-0.0089***
	(0.0005)	(0.0007)	(0.0013)	(0.0016)
Lead Dummy	-0.0128	0.0087	0.0378	-0.0797***
	(0.0121)	(0.0192)	(0.0272)	(0.0286)
N	3,729	3,703	3,668	3,569
	Theft	**Burglary**	**Violent**	**Property**
Worker days per HH	-0.0025***	-0.0018**	-0.0023***	-0.0026***
	(0.0006)	(0.0007)	(0.0005)	(0.0006)
Lead Dummy	-0.0084	-0.0146	0.0034	-0.0054
	(0.0142)	(0.0261)	(0.0127)	(0.0129)
N	3,735	3,730	3,732	3,735

Checking for Ashenfelter's Dip

	Murder	**Kidnapping**	**Robbery**	**Riot**
Worker days per HH	-0.0010**	-0.0030***	-0.0029**	-0.0079***
	(0.0004)	(0.0007)	(0.0012)	(0.0016)
Dip Dummy	0.0136	0.0009	0.0669	0.0549
	(0.0162)	(0.0272)	(0.0395)	(0.0362)
N	3,729	3,703	3,668	3,569
	Theft	**Burglary**	**Violent**	**Property**
Worker days per HH	-0.0024***	-0.0016**	-0.0024***	-0.0025***
	(0.0006)	(0.0007)	(0.0005)	(0.0005)
Dip Dummy	0.0126	0.1169**	0.0383**	0.0181
	(0.0201)	(0.0540)	(0.0169)	(0.0177)
N	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. Worker days per HH stands for employment generated by MGNRGEA program, measured as worker days per household. Total rainfall is total rainfall received in a district in a year, measured in millimeters. All models include the same explanatory variables as those reported in Table 2.4. District populations are used as weights. Standard errors are clustered at the Treatment-District level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.11: The Impact of Employment Generated by the MGNREGA on Crime Using Phase II and III Districts Only. (Controlling for Rainfall)

	Murder	**Kidnapping**	**Robbery**	**Riot**
Worker days per HH	-0.0001	-0.0034***	-0.0020	-0.0132***
	(0.0006)	(0.0008)	(0.0019)	(0.0026)
Log of Total Rainfall	-0.0844***	0.0331	-0.0615	-0.2550***
	(0.0224)	(0.0309)	(0.0539)	(0.0562)
N	2,380	2,369	2,341	2,230

	Theft	**Burglary**	**Violent**	**Property**
Worker days per HH	-0.0041***	-0.0033***	-0.0017**	-0.0038***
	(0.0007)	(0.0009)	(0.0007)	(0.0007)
Log of Total Rainfall	-0.0115	0.0558	-0.0455**	-0.0010
	(0.0237)	(0.0417)	(0.0211)	(0.0222)
N	2,385	2,381	2,382	2,385

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. *Worker days per HH* stands for employment generated by MGNRGEA program, measured as worker days per household. Total rainfall is total rainfall received in a district in a year, measured in millimeters. All models include the same explanatory variables as those reported in Table 4. District populations are used as weights. Standard errors are clustered at the Treatment-District level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.7 Conclusion

Since 2006, India has been implementing a massive public works project titled the Mahatha Gandi National Rural Employment Gurantee Act (MGNREGA). The program aims to provide employment to rural households on demand with the proviso that each household is entitled to 100 days of work per year at minium wage. MGNREGA is primarily designed to reduce poverty and joblessness that emerges because of drops in agricultural output due to negative weather shocks such as droughts. The program generates more than 2.5 billion person-days of employment to more than 55 million households each year. In this study I investigate the impact of employment, generated by MGNREGA, on crime.

The program has been implemented in three phases, where at least one district from each state participated in each of the three phases. The first group of disticts were enrolled in 2006, the second phase followed in 2007, and the entire country was covered in 2008. The selection of districts from the

various states to enrol in the program in each of the pheses is made by the central government which also provides the funding of the program. This indicates that local governments had no influence on implementation. I show in this study that pre-program crime trends were similar between the district that entered the program earlier and those who entered later. The same is true for very poor disticts and other districts.

Using a distict level panel spanning 2002 to 2012, and exploiting the heterogeneity in the timing and intensity of the program across districts, I identify the impact of the intensity of employment generated by the program on various types of crime. In addition to standard crime categories such as theft, burglary, robbery, and murder, I am able analyze kidnapping and unlawful assembly and riots.

I show that an increase rainfall has a negative impact on employment provided by the program, confirming that the program intends to act as a safety net for those who suffer from rural joblessness during periods of negative income shocks. Rainfall has also a direct impact on crime, and controlling for rainfall, an increase in employment per rural household due to the program has a negative impact on crimes, with elasticities in the range of 0.03 to 0.08 for property crimes, and in the range of 0.02 to 0.04 for violent crimes. While the magnitude of the impact of the program on crime is small, it should be noted that the program provides temporary, not permanent employment, and that it has been shown by previous research that the program affects mostly female employment. The fact that the goal of the program is to provide temporary relief from poverty and that crime is not a concern of the program provides a fraemwork where standard endogeneity concerns are avoided, which also indicates that crime reduction is a positive externality of this public works project. To the extent that criminal activity has a negative impact on legal human capital formation and that legal human capital is a vital ingredient in development, it is an important aspect of this program.

Chapter 3. Analyzing the Impact of the World's Largest Public Works Project on the use of Contraception

3.1 Introduction

India has the world's second largest population with more than 1.3 billion people, with annual population growth rate of 1.15 percent, and population density of 441 people per square kilometre (United Nations 2015).[24] Such a large population can create pressure on scarce resources in a developing country like India and family planning has been a priority of health policy of the government since independence (Chandrasekhar 1968). India launched the world's first comprehensive family planning program in 1952 and currently there are seven different family planning programs operational in the country.[25] These programs have had some success with knowledge of family planning now being nearly universal and fertility rate dropping from 4.8 in 1981 to 2.4 in 2014 (United Nations 2015). However, several constraints to achieving the goals of family planning and fertility, such as reducing the fertility rate and achieving better spacing between births remain. In a survey conducted by World Health Organization in 2009 reported that 76 percent of married women had some difficulties in accessing modern contraceptive methods. Also, fertility rates in rural areas remain substantially higher than urban areas, and less developed states have much higher fertility rates than the national average (Haub 2009).

Poverty can play a role in determining fertility rates through various channels. First, more children means more hands for work in the future and is a way of increasing future household income (Schultz 1980; Foster and Roy 1997). Children can also be considered as precautionary assets against economic shocks since they can become labor resource for the household (Kim and Prskawetz 2009;

[24] India ranks twenty second in the world in terms of population density and seventeenth if we do not count the city states such as Hong Kong, Macau etc. India's population growth is higher than the world average which is 1.18. The population growth rate of U.S. is 0.75. (United Nations 2015.)

[25] Examples of currently operational family planning programs in India are *IUCD 380A, Antara, Chaya, Mala-N* etc.

Pörtner 2001.) This is especially important in a poor rural setting (DeGraff 1991). Second, poor households may not have the income or education required to practice modern methods of contraception and birth control (Amin, Li and Ahmed 1996; Pitt, et al. 1999; Ainsworth et al. 1996); and third, poor couples may not be able to afford proper child care and so a higher birth rate may insure them against loss of children due to improper care (Ben Porath 1976; Sah 1991; DaVanzo, et al. 1986; Kaufman 1998).

Given such a relationship between poverty and fertility, alleviation of poverty should reduce the fertility goals of couples because of the above discussed reasons and therefore should encourage them to use contraception. Furthermore, alleviation of poverty will make contraceptives accessible to poor couples and therefore will increase their use. In India a survey conducted in 2007 showed that only 37 percent of families belonging to the bottom two quintiles on a wealth index use any modern methods of contraception compared to about 55 percent of those belonging to the top two quintiles (Ministry of Health and Family Welfare, 2010). Therefore, it is an interesting research question to investigate in what ways public works programs, which are used to alleviate employment and income volatility, can affect the use of contraception among rural households. I use micro-level data on rural households in India to investigate the effect of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) public works program on usage of family planning methods among rural women.

In developing countries with large rural populations, the biggest source of income and employment volatility in the rural sector is shocks to agricultural output. Adverse agricultural conditions can lead to unemployment and decline in income (Dell, Jones and Olken 2014), malnutrition (Foster 1995; Jensen 2004), higher infant mortality (Flatø and Kotsada 2014) and social frictions (Miguel, et al. 2004; Angrist and Kugler 2008). This concern has led the governments in many developing countries to implement public works programs to counter such effects (L. Zimmermann 2014). In India, the MGNREGA is one such program which aims to alleviate

employment volatility in rural areas. The program was started in 2006, and since then has become the most important anti-poverty initiative of the Government of India. Under the program, the local government bodies of villages, called Gram Panchayats, are mandated to provide unskilled work of up to 100 days a year at a stipulated minimum wage to every rural household asking for work. The program was implemented in three phases, starting in 2006, with 200 districts across the country being selected in the first phase; 130 further districts were added to the program in 2007, and in 2008 the program was extended to all 624 rural districts in the country. The MGNREGA is the largest public works program in the world with annual outlays of about $10 billion and generates 2.5 billion person days each year. Government figures indicate that about 55 million households gets job through the program every year. To contextualize the scale of the program, note that India had 167 million rural households in 2010-11. Therefore about a third of the rural households in India are provided jobs under the program each year.[26]

I investigate the impact of the MGNREGA program on the practice of contraception among couples living in rural areas. Several earlier papers have investigated and have found that the program has been effective in reducing unemployment and increasing wages, especially of women (Berg, et al. 2012; Imbert and Papp 2013; M. Azam 2012; L. Zimmermann 2013). The program has also been found to increase household consumption in rural areas (Engler and Ravi 2013; Deininger and Liu 2013; Klonner and Oldiges 2012). My study will analyze whether a welfare scheme such as this, which is targeted at alleviating income volatility, has secondary benefits with regards to contraception. The practice of contraception or family planning not only helps reduce growth rates of population in overpopulated countries but can also have positive effects on health and education of children. Couples

[26] Fraud and corruption in implementation can result in disparities between official data and the situation on the ground. Although the program has an built-in auditing system based on independent private auditors, incidences of corruption, poor implementation by local governments, capturing of the benefits of the program by less deprived households through political manipulation and incorrect targeting of the program such that the benefits do not reach the poorest households has proven to be widespread (IBN Live, 2013; Jha, et al. 2009 and 2010; Shariff 2009; Dutta, et al. 2012; etc.). But despite that, extensive surveys have shown that the program has had a sizable impact on poverty and income (Hindustan Times 2013).

who are better able to space their child births and avoid unwanted pregnancies can spend more resources on health and education of each of their children (Schultz 1980.) While a program like MGNREGA, which provides temporary relief against income volatility, may not be enough to change the desired number of children, it can nevertheless encourage contraception use by supplementing income of poor families and by making contraceptives like condoms and pills affordable to them. Thus, the program can impact the optimal timing of pregnancy. It can also help poor families to spend more on pre-natal and post-natal care which may decrease infant mortality and rate of unsuccessful pregnancies. This may also encourage couples to practice contraception as there will be less uncertainty over the survival of their children.

To study the effects of MGNREGA on family planning, I use data from two rounds of the District Level Households Facility Survey (DLHS) conducted in 2002-04 and 2007-08, respectively. A part of these datasets consist of a married women's self reported history of reproductive life, and practice of various methods of contraception by them or their husbands. I use a Difference-in-Difference empirical strategy which exploits the phased implementation of the MGNREGA program to identify the effects of it on the use of family planning techniques among married couples. The data do not contain information about whether a particular respondent participated in the program, so the assumption is that all individuals living in the rural areas of a district are exposed to the general equilibrium effects of the program.

The relationship between income and contraception is empirically not well established in prior literature. Da Vanzo et al. (1986) analyzed micro level data from peninsular Malaysia but did not find any evidence of a rise in income on the overall use of contraceptives after controlling for education and other individual characteristics. On the other hand, Schuler and Hashemi (1994), and Amin, et al. (1996) analyzed the effect of micro-credit programs on contraceptive use in rural Bangladesh and found that participation in the programs increased the use of contraception. However, Pitt, et al. (1999) raised endogeneity concerns and sample selection bias with those studies because of individuals self

selecting themselves into those micro-credit programs. After correcting for those issues Pitt, et al. (1999) did not find any effect of women participation in micro-credit programs on the use of contraception and a small effect of male participation on contraceptive use. In this study, by using the exogenously determined heterogeneity in the treatment, I avoid some of the pitfalls of endogeneity caused by self selection.

The data also allow me to control for a rich set of individual level characteristics which may affect individual's use of contraception. I find that the program has increased the use of any method of contraception, which can be rephrased as overall use of contraception by 6.2%, the use of modern methods of contraception by 5.4%, contraceptive pills by 18.5%, use of IUD loops[27] by 24.2%, and female sterilization by 3.6%. These results show that public works program can have important effects on increasing the use of contraception. Although the limitations of the data do not allow me to find the channels through which the program affects contraception, I will provide some evidence that one of the ways in which the program affects it is by increasing income and therefore affordability of contraceptives of poor households. I also show that my results are not driven by non-random selection of the districts for the program in each phase of implementation. A development index of districts created by the Planning Commission of Government of India was used to select districts for the assignment of the treatment in each phase, with less developed districts getting priority (Zimmermann 2013.) I use this index to identify districts which are close to each other in terms of development parameters, among which some got selected into the program while some others did not. Then I show that the program has had a significant effect on the use of various methods of contraception in the reduced sample as well.

This study contributes to the literature on effects of public works program in general and MGNREGA in particular. There is a growing literature on the externalities of the MGNREGA

[27] IUD or Intrauterine Device is a small, 'T'-shaped contraceptive device which is inserted into the uterus and acts as a reversible birth control.

program. Dasgupta (2013) and Thomas (2015) have investigated the effect of the program on health outcomes; Li and Sekhri (2013), and Afridie, et al. (2012) on education of children; Jacob (2008) on migration; Dasgupta, et al. (2014) on civil conflict; and Das and Mocan (2016) on crime. This analysis will be an addition to those studies. The rest of the paper is organized as follows. Section 3.2 describes the program and why it can affect the practice of family planning. Section 3.3 discusses the empirical strategy. Section 3.4 explains the dataset that is used. Section 3.5 reports the results and Section 3.6 concludes.

3.2 The MGNREGA Program

The MGNREGA is a rural employment guarantee act, enacted by the Indian Parliament in August 2005. The implementation started in 2006. The program provides legal guarantee of 100 days of work to any adult (18 years and older) member of a rural household at minimum wage. The program is demand driven, and there is no capacity constraint. That is, any adult in rural India is entitled to obtain work under the program. Anyone who is 18 or older can join, leave and re-join the program at any time during the year provided that the total number of days worked by all members of his/her household does not exceed 100. The type of the work is of a casual labor and there are no minimum qualifications or training required for the jobs. The typical jobs are digging ponds and wells, digging irrigation canals, building rudimentary dams, paving of roads and so on.

The only conditions that apply to an adult who wants to work under the program are: they must live in a rural area and they must be willing to undertake unskilled manual work for which they will receive the minimum wage. The job seekers need to furnish their name, age and address to the village council (Gram Panchayat), which issues a job card to each household containing details of adult members of the household. Applicants who are provided with employment are informed by a letter which is mailed to the address mentioned on the job card and a public notice of employment is displayed at the Panchayat office. By law, the work has to be provided within 10 km of the home of the job seeker. If that is not possible then the work must be within the Block (a subdivision of a district) of

the residence of the job seeker and an extra 10 percent of the wage of the worker must be paid for travel expenses. Wages must be paid within 15 days of the completion of the work. If upon the receipt of an application a person is not provided a job within 15 days then the applicant is eligible to an unemployment allowance for each day after the 15 days when he/she isn't employed until the state finds work for him/her. This unemployment allowance cannot be less than 1/4th of the wage rate in the first 30 days of the financial year and 3/4th of the wage rate in the remaining period of the financial year. The minimum wage varies between states but remains the same across districts in a particular state. Typically, the minimum wage is equivalent to between two to three dollars per day.[28] Note that the local government is obligated to provide employment upon the request of the applicants, but that the full funding of program is provided by the central government. In addition, the central government covers 3/4 of the cost of materials while the rest is funded the state governments. This is important because it indicates that other outlays of the state government, such as expenditures on health and education, are not impacted by the MGNREGA program participation.

The program has been implemented nationally since 2006. Implementation was rolled out in three phases, starting in 2006 with 200 districts of Phase-I. In 2007, the program was extended to include another 130 districts (Phase-II). In 2008 the program covered all rural districts of the country. By design of the program, at least one district from each state participates in each of the three phases of the program. In this phased implementation, economically poorer districts are chosen to participate in the earlier phases of the program. In India each district of the country is assigned an index of "backwardness" by the central government, which specifies the level of relative poverty of the district. In Phase-I of the program the number of district chosen from each state was determined by the overall economic condition of the state, where poorer states contributed more districts.[29] Once the number of

[28] To monitor the progress of the program social audits are carried out by independent non-government organizations.

[29] Although the Planning Commission, the body which was responsible for planning the program, did not explicitly mention the algorithm used to choose the districts, it can be assumed that they used the same algorithm which had been used in roll-

districts from a state is determined, the decision to choose specific districts from that state is made by ranking the districts by their backwardness index: poorer districts are given priority. All these decisions are made by the central government. The same procedure is followed in Phase II; and all districts are covered in Phase III.

The government aims to achieve two goals through the program. The first goal is to provide employment security to families, which depend on agriculture and whose income is subject to rainfall fluctuations. Rural income in India is affected by rainfall fluctuations (Iyer and Topalova 2014). Also, rural households in India face a yearly agricultural dry season during which they have very little income inflow from agriculture. The aim of the MGNREGA is to provide rural households with an alternative employment avenue to agriculture during the dry season and a safety net during rainfall shocks. The second aim is to build infrastructural assets in rural areas. The work that is provided under the MGNREGA is unskilled manual labor on rural infrastructure projects such as building of roads, irrigation canals, building of dams, rainwater harvesting etc. These infrastructural capabilities will further enable economic development of the rural areas in the long run. Another important feature of the program is that it pays women equal wages as men. A large gender gap in rural wages exists in India and the equality of wages under the program has been effective in attracting large number of female workers to the program. As of 2012, women comprised 54% of the beneficiaries employed in the program.

3.3 Relationship between MGNREGA and Contraception

There have been several studies on the economic and social impact of the MGNREGA program. Zimmermann (2012) and Azam (2012) are two studies which investigated the effect of the program on rural employment and wages. In spite of using different empirical methodologies, both

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out of previous government programs (Zimmermann 2013). According to the algorithm, the number of districts to be chosen from each state depends on the percentage of population below poverty line in a state; then the districts from a given state is chosen according to the economic condition of the districts with poorer districts being given priority.

studies reached the same conclusion that the program has had significant impact of women's employment and wages while the impact on male employment and wages has been negligible. Several papers have also reported significant positive impact of the program on women's welfare dimensions such as nutrition, health, women's voice in household decisions and participation in local governance (Das 2012; Holmes, et al. 2010; Jandu 2008; Nayak and Khera 2009 etc.). The fact that the program had a significant impact on many outcomes related to women has implications for my study; a point which is later discussed in the chapter. Apart from its impact on women the program has also been found to have effects on poverty and household wealth. Klonner and Oldiges (2013) found an impact of the program on poverty using district level consumption data from National Sample Survey. Imbert and Papp (2013) also used the same dataset to find a positive effect of the program on rural private wages as well as significant reduction in poverty, especially among poorest households. Bhargava (2014) found evidence that the program reduced poverty and increased asset creation among poor households by increasing agricultural productivity through land improvement.

There are five plausible channels through which the MGNREGA program may affect contraception. First, as discussed above, the program has been found to have increased women's labor force participation and women's wages in rural areas. This shall lead to an increase in the opportunity cost of staying at home to take care of newborn children; therefore, leading to a decrease in the demand for children for an optimizing household as the *price of children* has gone up. On the other hand, the increase in labor force participation and wages may also lead to an income effect with couples wanting more children as they are now better able to afford it. However, as Schultz (1980), and Joshi and Schultz (2014) argued that in the case of a rise in income and opportunity for women it is the price effect which dominates over the income effect, thus reducing the fertility of women when economic opportunities for them increase.

The second channel is that the program can increase the affordability of contraceptives. Some modern family planning methods like condom and contraceptive pills may be too costly for poor

families. An increase in the household income as a result of the MGNREGA program may make these methods affordable to poor families and therefore increase their use. Also, the program can have a positive impact on the overall village economy and increase the demand for condoms and pills, thereby inducing shops to store such items which they didn't previously because of lack of demand. This can increase the availability of such items in the rural areas and therefore increase their consumption by those families which may not have directly benefited from the MGNREGA program as well.

The third channel through which the program can affect family planning is by reducing child mortality and therefore decreasing the need to have more children. As discussed above the program has been found to increase income of poor households and the status of women both inside as well as outside the home. This can lead to higher expenditure on health and nutrition of infants as well as mothers thereby reducing the rate of infant mortality. Dasgupta (2013) has found positive effect of the program on child health. Thomas (2016) found that the program increased investment in child health like breast feeding, institutional delivery and immunization. She also found that the program caused a drop in child mortality by 6%. The reduction in child mortality means more households will be closer to their optimal number of children and so will use contraception in order to avoid unwanted pregnancies. Several earlier studies have shown that child mortality may affect contraceptive use (Benefo and Schultz 1996; DaVanzo, et al. 1986; Kaufman 1998.)

The fourth channel is that the program can increase women empowerment and their voice in determining household expenditure. This may happen because the program has a larger impact on women as discussed and also, because the program bring women to the labor force it increases the interaction with other women in the community and may help in the spread of knowledge about contraceptives among them. The program has been found to increase women's participation in local governance (Jandu, 2008.) An increase in women empowerment can increase the use of contraception (Amin, et al. 1996.) Finally, the fifth channel is that there is also the possibility that by reducing income and employment volatility caused by agricultural shocks the program may reduce transitory

demand for children. Some studies have shown that parents use children as insurance against transitory economic shocks and a negative shock can temporarily increase fertility (Kim and Prskawetz 2009; Pörtner 2001.) The data I use limit my ability to identify the specific channel through which the MGNREGA program affects family planning outcomes and their magnitudes. I am able to estimate reduced form effects of the program on family planning outcomes.

3.4 Empirical Strategy

The dataset consists of two cross-sections of married women repeated from all the districts, the first being observed in 2002 and 2004 while the second being observed between 2007 and 2008. Therefore, the first cross section of individuals (2002-04) have been observed before the MGNREGA program was implemented in any districts while the second cross section (2007-08) has been observed after the Phase-I and Phase-II districts have already been exposed to the MGNREGA program but the Phase-III districts are yet to be exposed to the program. I employ a Difference-in-Difference empirical strategy to estimate the effects of the program on the use of contraception after controlling for individual, households, and village level variables which may have an impact on family planning. Accordingly, I estimate versions of Equation (1) below:

1) $$y_{ihvdst} = \alpha + \gamma(Round_t) + \beta(Treatment_d * Round_t) + X'_{it}\varphi + Z'_{ht}\pi + H_{vt}\omega + \rho_d + \sigma_{st} + \varepsilon_{ihvdst}$$

where, the outcome variable y_{ihvdst} is a dummy identifying various methods of contraception currently being used by married couples as reported by woman i, living in household h, of village v, of district d affiliated with state s, in the year t. The outcomes that I analyze are “Currently using any method of contraception”, “Currently using condoms”, “Currently using contraceptive pills”, “Currently using IUD Loop”, “Female sterilization”, “Male sterilization” and “Currently using any modern method of contraception.” Modern methods of contraception include condoms, pills, IUD, female sterilization, male sterilization, and “other modern methods” as defined by the survey questionnaire. Apart from the

modern methods, "any method of contraception" also includes traditional methods of family planning as defined by the survey questionnaire. The traditional methods include rhythm techniques; withdrawal etc.

$Treatment_d$ is an indicator variable which identifies the districts that have been "treated" under the MGNREGA program. The second round of DLHS had been conducted between November 2007 and October 2008. This implies that Phase-I districts, which entered the program in March 2006 had already been subjected to 20 to 30 months of treatment, whereas while the Phase-II districts, which entered the program in April 2007 had only faced 7 to 14 months of treatment. The Phase-III districts on the other hand were yet to receive the program. To account for this differential exposure to treatment the $Treatment_d$ dummy takes a value of 1 for Phase-I districts and 0.5 for Phase-II districts.[30] [31] The Phase-III districts are used as control and therefore the dummy takes a value of zero for those districts. $Round_t$is an indicator variable denoting whether an individual has been observed in DLHS-2 or DLHS-3. The coefficient β is the one of interest as it will provide the estimated Difference-in-Difference effect of the MGNREGA program on the use of various methods of contraception.

X_{it} is a vector of individual characteristics which can affect a couple's decision to practice family planning. Age of women is a determinant of fertility and therefore affects use of contraception (Menken 1985.) Previous studies have found that a rise in age increases the use of contraceptives (Mihn and Anh 2002; Chen and Guilkey 2003; McNay, Arokiasamy and Cassen 2003; etc.) However, there has also been evidence of a non linear relationship between age and fertility, and therefore between age and the use of contraception (DaVanzo, et al. 1986; Feyisetan and Ainsworth 1996.)

[30] For Phase-III districts the second round of the survey coincides with start of MGNREGA program in those districts. To clearly identify the control and the treatment groups I drop all observations which have been interviewed after May 2008 in Phase-III districts as the program started in the Phase-III districts from April 2008. This eliminates only 8% of the observations of Phase-III districts which had been interviewed in the second round of DLHS.

[31] I also assign values of 0.6, and then 0.4 in place of 0.5 to the indicator variable for the Phase-II districts but the results do not change significantly. The results for those specifications are in the appendix.

Accordingly, I control for age as well as age square of the women respondent in the regressions. Women's schooling increases contraceptive demand because first, it may increase the opportunity cost of staying at home; and second, it can increase the knowledge about effective use of contraceptives (Ainsworth, et al. 1996; Joshi and Schultz 2014). Partner's education is also found to have an effect on contraceptive use (Ezeh 1993). Joshi and Schultz (2014) found a non-linear relationship between education of husbands and fertility, with demand for children rising with years of schooling at low levels of husband's education and falling at high levels of education. Threfore, I control for a quadratic of husband's education.

While a couple's number of children certainly determines their additional demand for children and therefore their use of contraception (Bhargava, et al. 2005; Gereltuya, et a. 2007; Yamaguchi 1989), inclusion of the number of children a woman has in this equation as an independent variable will obviously make the relationship endogenous because of reverse causality (Joshi and Schultz 2014). Thus, I do not control for the number of children. This can be an issue if there were any relationship between the number of children and the treatment. However, since the treatment was exogenously determined and a couple's number of children can have no effect on the implementation of the treatment, excluding the number of children of a couple from the empirical specification should not have any effect on my results. I include a dummy among the individual controls which identifies if an individual has any children. Since I already control for age and education, this dummy should only capture the effect of any medical condition which might make child bearing impossible for a couple. The number of male children may also have an effect on fertility and use of contraception (Aly and Shields 1991; Yamaguchi 1989). This can be more important in India which has a strong gender bias towards male child (Sen 1990). Since I cannot control for the number of children because of the reasons already mentioned, I control for a dummy which takes the value one if a woman has a male child.

Several studies have found a relationship between child mortality and family planning. While Benefo and Schultz (1996) had found infant mortality to increase fertility, DaVanzo (1986) and Kaufman(1998) had found child mortality to increase the use of contraceptives. Thus, I control for a dummy which identifies if a mother has ever lost a child. I also add a dummy which identifies if the last pregnancy was unsuccessful as the last pregnancy may have additional effect on future family planning decisions. The age of consummation of marriage is one of the determinants of fertility (Becker 1960) and therefore is expected to have an effect on contraceptive use. Barber (2007) also found empirical evidence on the effect of age of marriage on contraceptive use. As a result I control for age of consummation of marriage in my specification.

Z_{ht} is a vector of household characteristics which indicates the social position, standard of living, and assets of the household. Community-based social norms have been shown to determine fertility and contraceptive use (Munshi and Myaux 2006.) As a result, I control for indicator dummy variables for Scheduled Caste or Scheduled Tribe household[32], and religious affiliation of the head of the household. I also include dummy variables in Z_{ht}which indicate if the fuel used for cooking is electricity or Liquid Petroleum Gas, if the source of drinking water is covered and protected, if the dwelling of the household is a brick structure, if the household has regular access to toilets, if the household owns an electric fan, sewing machine, transistor radio, television, bicycle, motor cycle or scooters, car, and tractor. These variables are used as controls for economic condition of the household to which the individual belongs to.

Access to family planning centres, and quality of health facilities available in the community can play a role in determining use of contraception (Barber 2007; DaVanzo, et al. 1986.) Thus, I control for a measure of health facility available at the community level. H_{vt} is an index of the availability of health facilities in and around the village. The village questionnaire asks about whether

[32] Scheduled Castes and Scheduled Tribes are official designations given to various historically disadvantaged indigenous people of India.

a particular health facility is available in the village and if the answer to that question is negative it asks what is the nearest distance to that facility. I create the index by assigning increasing values to a village based on the level of the facility in the village and the distance to a nearest facility with rudimentary facilities getting a lower value and advanced facilities getting higher. This index gives an overall description of the accessibility to health care of an individual. The details about the index are in Appendix 4.

The vector of district fixed effects are represented by ρ_d, and σ_{st} stands for a vector of state specific time trends. Mohanty, et al. (2016) has found that initial rates of fertility, female literacy, and mortality at the district level explains to a large degree the convergence of fertility rates across districts in India. As explained earlier, the implementation of the MGNREGA program also depended on the initial development levels of the districts. It is therefore important to control for district fixed effects in the equation. Mohanty, et al. (2016) also detected a downward trend in fertility rate over the years. The state specific time trend will control for any such effects. I follow Joshi and Schultz (2007) and weight the regressions by the number of respondents from each district. As the DLHS provides individual sample weights for each observation, I calculate the weighted aggregate number of respondents from each district to get a measure of the actual district population. I also estimate the models without weights, and then by weighting the models by individual sample weights, the results of these specifications are in the appendix. I cluster the errors at district level. I also report the models with robust standard errors in separate tables.[33]

3.5 Data

I use two rounds of District Level Household and Facility Survey conducted in 2002-04 and 2007-08 respectively, (DLHS-2 and DLHS-3) for the analysis. A section of the survey in DLHS-2 interviewed all currently married women in the households between the ages of 15 and 44. It collected

[33] I did a Wild Bootstrap test of the coefficients and I got similar p-values for the coefficients as with the cluster standard errors. I don't report the results in the paper.

information about their reproductive life for the past four years, and the methods of contraception currently being used by them or their husbands. In DLHS-3 the survey was conducted on all ever married women. I only analyze currently married women between the age 15 and 44 from DLHS-3. It also gives information about the date of interview, age and years of schooling of the women, their village of residence, district, whether they live in rural or urban areas, the years of schooling of husbands, the caste and religion of the household head, and several indicators of quality of living and assets of the household.

By taking each female interviewed as a separate observation, I create a dataset of repeated cross sections of female individuals of whom, one group was interviewed in DLHS-2 (2002-04) and another group was interviewed in DLHS-3 (2007-08.) There is a section of the DLHS which includes a village level survey on the availability of healthcare facility in and around the villages. I merge the village level health facility survey with my dataset. The drawback of the DLHS survey is that it does not contain any information about income and consumption of the household or an individual. It also does not ask whether a household or an individual participated in the MGNREGA program. Thus, the empirical analysis on health provides intent-to-treat estimates of the effects of the MGNREGA on contraception.

I exclude all North-Eastern states except Assam because these states receive special grants from the Central Government under various schemes, and therefore will effectively be different from the other states in many aspects. I also exclude the Union Territories as they are directly under Central administration and have different mechanism of governance. I exclude Maharashtra because it had its own rural employment guarantee scheme since 1977 which is similar to the MGNREGA and therefore will not register the same impact as other states. I exclude the state of Jammu and Kashmir because this state has historically faced insurgency which escalated in the 1990s and also enjoys special status and therefore receives special programs from the Government. I also drop districts which have been divided or newly created between 2001 and 2012. In the universe of all 624 districts that are covered

by the program, 200 districts entered the in Phase-I, which is 32 percent of all districts. One hundred and thirty districts entered in Phase II (21 percent), and the remaining 46 percent entered in Phase III. Because I dropped some districts due to the reasons mentioned above, my sample contains 466 districts from 18 states. Of these 466 districts, 171 entered the program in Phase I (37 percent), 96 districts entered in Phase II (21 percent), and 189 districts (41 percent) entered in Phase III.[34] Finally, I drop all individuals which do not reside in rural areas. This leaves me with 241,608 individuals in DLHS-2 and 265,412 individuals in DLHS-3. The summary statistics of all variables used are provided in Table 3.1.

Clearly, there are differences between the Phase-I, II, and III districts in the propensity to use contraception. The proportion of women using contraceptive pills, IUD, and female sterilization is significantly higher in case of Phase-III districts. As mentioned earlier, the districts were not chosen for the program randomly, instead poorer districts had been given priority. The table shows that couples in poorer districts also have lower propensity to use contraception. Other individual level characteristics like education and child mortality also differ among the districts from various phases. Both women and men in Phase-I districts have lower average years of schooling than those in Phase-II, and men and women living in Phase-II districts have lesser average years of schooling than those in Phase-III. In terms of child mortality, children in Phase-I districts have the highest mortality and those in Phase-III have the lowest. The household level characteristics also indicate towards the differences in the economic conditions among the districts with the households in Phase-III districts having higher average levels of assets like electric fan, motorcycles/scooters, cars, and tractors. These again point towards the difference in the level of development among the districts selected in different phases.

[34] Of the 158 districts that we lose, 125 are dropped because we have to eliminate the state with which they are affiliated for the reasons mentioned above, while 33 districts are lost due to re-division. Our sample covers 142 million rural households in 2010 out of 165 million in the population (Census 2010.)

Table 3.1 Summary Statistics

	Phase-I	Phase-II	Phase-III	All Districts
Outcomes analyzed				
Proportion of women who report:				
They or their husbands currently using any method of contraception	0.514 (0.49)	0.539 (0.49)	0.615 (0.49)	0.552 (0.49)
They or their husbands currently using any modern method of contraception[$]	0 .443 (0 .49)	0.455 (0.49)	0.537 (0.49)	0.476 (0.49)
Their husbands currently using condoms	0.025 (0.16)	0.032 (0.18)	0.052 (0.22)	0.035 (0.18)
They are currently using contraceptive pills	0.037 (0.19)	0.041 (0.019)	0.027 (0.17)	0.035 (0.18)
They are currently using IUD	0.007 (0.08)	0.009 (0.01)	0.018 (0.14)	0.011 (0.10)
They are sterilized (Female sterilization)	0.362 (0.48)	0.366 (0.48)	0.431 (0.49)	0.384 (0.49)
Their husbands are sterilized (Male sterilization)	0.012 (0.11)	0.005 (0.07)	0.007 (0.08)	0.009 (0.93)
Individual Characteristics				
Wife's age	29.77 (7.49)	30.02 (7.54)	30.53 (7.53)	30.07 (7.46)
Wife's education[∈]	2.572 (3.80)	2.988 (3.99)	3.609 (4.23)	3.005 (4.02)
Husband's education[∈]	5.037 (4.53)	5.314 (4.49)	6.130 (4.39)	5.458 (4.50)
If any child[∈∈]	0.894 (0.31)	0.895 (0.31)	0.905 (0.29)	0.897 (0.30)
If any son[©]	0.764 (0.42)	0.763 (0.43)	0.781 (0.41)	0.769 (0.42)
If any child dead	0.246 (0.43)	0.229 (0.42)	0.208 (0.41)	0.230 (0.42)
Last pregnancy unsuccessful[^]	0.022 (0.15)	0.024 (0.15)	0.025 (0.16)	0.024 (0.15)
Age of consummation	16.74 (2.74)	17.01 (2.91)	17.56 (2.99)	17.07 (2.88)
Number of Districts	171	96	189	466

[$] Modern methods include use of condoms, contraceptive pills, IUDs, female sterilization, male sterilization and "other modern methods" as defined by survey. [∈] Measured in years of schooling. [∈∈] Proportion of women having a child. [©] Proportion of mothers having at least one son. [^]Proportion of individual whose last pregnancy did not culminate in a live birth.

Table 3.1 Continued

Household Characteristics	Phase-I	Phase-II	Phase-III	All Districts
Proportion of S.C./S.T.	0.407	0.294	0.260	0.332
	(0.49)	(0.46)	(0.44)	(0.47)
Proportion of Hindus	0 .881	0.851	0.848	0.863
	(0 .32)	(0.36)	(0.36)	(0.34)
Proportion of Muslims	0.087	0.123	0.085	0.095
	(0.28)	(0.33)	(0.28)	(0.29)
Proportion of Other Religion*	0.031	0.027	0.067	0.041
	(0.17)	(0.16)	(0.25)	(0.19)
Cooking Fuel**	0.047	0.065	0.102	0.069
	(0.21)	(0.25)	(0.30)	(0.25)
Source of drinking water[+]	0.790	0.857	0.823	0.817
	(0.41)	(0.35)	(0.38)	(0.39)
Type of house[++]	0.551	0.451	0.264	0.435
	(0.49)	(0.49)	(0.44)	(0.49)
Toilet facility[#]	0.165	0.241	0.314	0.231
	(0.37)	(0.43)	(0.46)	(0.42)
Owning electric fan[##]	0.276	0.348	0.525	0.373
	(0.45)	(0.48)	(0.49)	(0.48)
Owning radio-transistor[##]	0.238	0.267	0.303	0.266
	(0.43)	(0.44)	(0.46)	(0.44)
Owning sewing machine[##]	0.091	0.126	0.233	0.145
	(0.29)	(0.33)	(0.42)	(0.35)
Owning television[##]	0.223	0.284	0.424	0.302
	(0.42)	(0.45)	(0.49)	(0.46)
Owning bicycle[##]	0.568	0.590	0.537	0.564
	(0.49)	(0.49)	(0.49)	(0.50)
Owning motorcycle/scooter[##]	0.097	0.122	0.175	0.128
	(0.29)	(0.33)	(0.38)	(0.33)
Owning car/jeep[##]	0.008	0.012	0.021	0.013
	(0.09)	(0.11)	(0.14)	(0.11)
Owning tractor[##]	0.023	0.036	0.060	0.038
	(0.15)	(0.19)	(0.24)	(0.19)
Village Level Health Facility Index[@]	9.97	10.33	10.68	10.28
	(8.92)	(8.62)	(8.78)	(8.81)

* Other religion include Christians, Sikhs, Zorastrians, Jews etc. ** Proportion of households using electricity and LPG as cooking fuel. [+] Source of drinking water is covered. [++] Proportion of dwellings which are *Kaccha*[35]. Proportion of households having regular access to toilets. [##] Proportion of households. [@] The calculation of the index is explained in Appendix 4. All are weighted means.

[35] *Kachcha* houses are dwellings which are not made of brick and mortar.

These differences in the outcome variables and indicators of socio-economic condition of the districts can have implications for identifying the effect of the MGNREGA program on contraception as it shows the selection of the districts for the program was not random. One of the ways in which the problem can be mitigated is by controlling for district fixed effects which controls for all pre-program differences in the levels of various parameters. However, there can still be some issues like pre-program differences in the levels of various parameters may determine how these parameters move in the future. For example, districts which are poorer and that have lower average propensity to use various contraceptives may have higher growth rates in contraceptive use than districts which are less poor. In other words, there can be a convergence in economic development and use of contraception among the districts. In such a case the difference-in-difference estimates of the effects of the program may be catching some of the effects of this convergence. This will make the estimates of the effects of the program upwardly biased. The way I deal with this issue is explained in the next section.

3.6 Results

The results from the basic specification are presented in Table 3.2. The results indicate that the program has increased the use of all methods of contraception except male sterilization. The difference-in-difference coefficient of the MGNREGA program's effect shows that the use of any method of contraception increases by 0.034 on a base of 0.55, which is an increase of 6.2%. For modern methods of contraception, the program increases their use by 5.4%. The program also increases use of contraceptive pills by 18.5%, IUD by 24.2%, and female sterilization by 3.6%. The coefficients for the program's effect are statistically significant for use of some method of contraception and use of modern methods of contraception at 1%, for IUD use and female sterilization at 5%, and for use of contraceptive pills at 1%. For male sterilization and condom use, the coefficient of the program's effect is statistically not different from zero. The models whose results are presented in Table 3.2 use standard errors which are clustered at the district. The results of the models with

robust standard errors are presented in appendix Table A5.1. If I use robust standard errors the significance of the coefficients increases.

The effect of wife's age is positive and significant on various methods of contraception except for male sterilization. The coefficient of the square of wife's age is negative and significant for all types of contraception. It shows that use of contraception increases with wife's age but the rate of increase slows down as age increases. This is consistent with previous literature (Menken 1985; McNay, et al. 2003.) The point of inflexion of wifes'age for any type of contraception appears to be about 39 years of age, i.e. the use of contraception start declining with wife's age after that.

Wife's education, measured in years of schooling, has a significant positive effect on all contraception techniques except female sterilization. This may be explained by the fact that more educated women substitute female sterilization by other methods of family planning. Less educated women may not have the required information to use modern contraception techniques properly (Ainsworth, et al. 1996), and therefore may choose female sterilization. Husband's years of schooling has a significant positive effect on female sterilization but has a negative significant effect on use of condoms and IUD. Square of husband's education has the opposite effect. This is consistent with Joshi and Schultz's (2014) findings that at low levels of education an increase in husband's education may increase fertility because of an income effect, but at higher levels of education increase in husband's education decreases fertility.

The coefficient of whether the couple has a child is positive and significant for all methods of contraception except female sterilization, for which it is negative. This is expected as couples who don't have any child are either too young or are incapable of having a child due to medical reasons and therefore are less likely to use family planning. The effect of having male children is positive for all methods of contraception except for condoms, for which it is negative and significant. Condoms are likely to be used by more educated couples who may not have a gender preference for their children;

therefore it is likely that the coefficient of having a male child is catching the effects of "having any children" on condom use.

Age at consummation of marriage has a negative significant effect on female sterilization. This is expected since those who get married earlier are likelier to be close to their fertility goals and therefore, expected to use more contraception. However, it has a positive significant effect on use of modern contraceptive methods like condoms, contraceptive pills and IUDs. This can be explained by the following: age of consummation is likely to be increasing with education and family income and since the use of modern contraceptive techniques is expected to increase with education and income, the coefficient of age of consummation is catching some of the effects of education and income.

Mortality of child has a significant negative effect on traditional methods of contraceptives and female sterilization. Mortality of child will induce couples to try for more children as replacement for the dead child and so will lead to a fall in the use of contraceptive methods which stops fertility permanently (DaVanzo, et al. 1986). However, child mortality has a significant and positive effect on condom, pill, and IUD use. These three techniques are used for spacing child birth rather than stopping child birth completely. It is likely that couples who have suffered death of a child may want to space the births of their next child more carefully. The effect of an unsuccessful last pregnancy is similar as well and can be explained on the same line. Moreover, an unsuccessful last pregnancy may have some psychological costs and therefore leads to a rise in methods of contraception like condoms, pills, and IUDs which are used to delay the next birth. The effect of health facilities is positive and significant for condom and female sterilization but numerically small, it is statistically not different from zero for the rest of the outcomes. I do not report the household level socio-economic characteristics in the tables.

Table 3.2: Basic Specification (Clustered Standard Errors)

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills	Currently using IUD	Female Sterilization	Male Sterilization
Dif-in-Dif	**0.0340*****	**0.0252*****	**0.0038**	**0.0063*****	**0.0029****	**0.0136****	**-0.0005**
	(0.0107)	(0.0094)	(0.0034)	(0.0023)	(0.0012)	(0.0069)	(0.0025)
Wife's age	0.0769***	0.0754***	0.0017***	0.0033***	0.0015***	0.0687***	-0.0001
	(0.0018)	(0.0020)	(0.0004)	(0.0005)	(0.0002)	(0.0022)	(0.0003)
Wife's age square	-0.0010***	-0.0010***	-0.0001***	-0.0001***	-0.0001***	-0.0008***	0.0001***
	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Wife's education	0.0059***	0.0042***	0.0035***	0.0024***	0.0011***	-0.0028***	-0.0001
	(0.0003)	(0.0004)	(0.0002)	(0.0002)	(0.0001)	(0.0004)	(0.0001)
Husband's education	0.0060***	0.0068***	-0.0025***	0.0003	-0.0006***	0.0100***	-0.0003*
	(0.0007)	(0.0007)	(0.0003)	(0.0003)	(0.0001)	(0.0008)	(0.0002)
Husband's ed. square	-0.0002***	-0.0004***	0.0003***	0.0001	0.0001***	-0.0008***	0.0001**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
If any child^{+}	0.1317***	0.0762***	0.0368***	0.0383***	0.0116***	-0.0116*	0.0002
	(0.0093)	(0.0080)	(0.0024)	(0.0037)	(0.0009)	(0.0060)	(0.0008)
If any sons^{++}	0.2223***	0.2257***	-0.0041***	0.0021	0.0021***	0.2225***	0.0024***
	(0.0057)	(0.0053)	(0.0011)	(0.0014)	(0.0006)	(0.0057)	(0.0005)
Age at consummation	-0.0142***	-0.0159***	0.0023***	0.0010***	0.0006***	-0.0194***	-0.0004***
	(0.0005)	(0.0005)	(0.0002)	(0.0002)	(0.0001)	(0.0005)	(0.0001)
If any child died	-0.0564***	-0.0634***	0.0019***	0.0017**	0.0007*	-0.0665***	-0.0014**
	(0.0022)	(0.0022)	(0.0007)	(0.0007)	(0.0004)	(0.0021)	(0.0006)
Last pregnancy*	-0.0459***	-0.0678***	0.0227***	0.0186***	0.0040***	-0.1131***	-0.0006
	(0.0061)	(0.0053)	(0.0027)	(0.0029)	(0.0013)	(0.0045)	(0.0005)
Health facility	0.0002	0.0004***	0.0001**	0.0001	0.0001	0.0003**	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
N	486,739	486,739	486,739	486,739	486,739	486,739	486,739

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. Household characteristics like religion, caste, measures of standard of living, and assets are controlled for. The models control for district fixed effects and state specific time trends. $^{+}$Takes the value 1 if mother has any children. $^{++}$ Takes the value 1 if any of the child is a son. * Takes the value 1 if the last pregnancy was unsuccessful. Standard errors are clustered at the district. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

When I use 0.4, and 0.6 in place of 0.5 for the value of the *Treatment* variable for Phase-II districts, the results do not change appreciably and they are reported in appendix Tables A5.2 and A5.3. I also report the basic specification, with the models being weighted by sample weights and then without weights. The results are reported in appendix Tables A5.4 and A5.5. I also report results from specifications which controls for state by year fixed effects instead of state specific trend in Table 3.B6.

Non-random selection of districts for treatment

The issue with the design of the MGNREGA program is that the districts were not selected at random. As discussed earlier, the central government has chosen the districts on the basis of an algorithm which has given priority to poorer districts. Therefore poorer districts have been chosen earlier into the program. As is clear from the summary statistics in Table 3.1, the first phase districts differ considerably from the second and the third phase districts in terms of various socio economic measures. This non-random selection of districts can bias difference-in-difference estimates if the poorer districts are just "catching up" with the better off districts due to overall economic development and the difference-in-difference estimates of the impact of the program is capturing that "catching up" effect. A study by Mohanty, et al. (2016) has shown that a large part of the fall in aggregate fertility rate at the district level in India can be explained by convergence among the districts over various socio-economic parameters like female literacy rate, child mortality rate etc.

To test whether this is the case I restrict my sample to compare districts which are socio-economically closer to each other. I restrict the sample to just those Phase-II and Phase-III districts which are close to each other in terms of socio economic parameters. I use the Backwardness Index created by Planning Commission to measure the level of underdevelopment in the districts. The Backwardness Index is the sum of three sub-indices measuring agricultural output, agricultural wages and proportion of the population that belongs to the Scheduled Tribe/Scheduled Caste group. The

districts are ranked based on the value of the index. Lower the value, more underdeveloped or backward a district is. This index has been implicitly used while choosing the districts for Phase-I and II of the MGNREGA program (Zimmermann 2013.) I restrict my sample to those districts which have Backwardness Index value of greater than the median for Phase-II and less than the median for Phase-III districts.

The idea is that these districts will be closer to each other in terms of the socio economic conditions that were considered while selecting districts for the program and the selection of some of these districts into the program is random over this reduced sample of districts. The mean value of the Backwardness Index for these above-median Phase-II districts is 1.18 and for that of below-median Phase-III districts is 1.07. This shows that in this restricted sample the districts are similar in terms of socio-economic indicators. If the socio economic conditions are driving the results then the coefficients of the effect of the program on the use of various methods of contraception should be smaller than those in Table 3.2 and statistically not different from zero. The results are presented in Table 3.3 and 3.4. Clearly, the coefficients are larger than those in Table 3.2 and are statistically significant, providing evidence that the non-random selection of districts for the program is not driving the results.

Table 3.3: Limiting the Sample to Only those Phase-II and Phase-III Districts where the Phase-II Districts have Backwardness Index Value of Greater than Median and Phase-III has Backwardness Index Value Less than Median (Clustered Standard Errors)

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0489*	0.0376*	0.0065	0.0068**
	(0.0278)	(0.0223)	(0.0105)	(0.0033)
N	125,232	125,232	125,232	125,232
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0070**	0.0171	-0.0008	
	(0.0033)	(0.0111)	(0.0015)	
N	125,232	125,232	125,232	

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. All the models control for the same variables as Table 3.2. Standard errors are clustered at the district. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3.4: Limiting the Sample to Only those Phase-II and Phase-III Districts where the Phase-II Districts have Backwardness Index Value of Greater than Median and Phase-III has Backwardness Index Value Less than Median (Robust Standard Errors)

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0489***	0.0376***	0.0065**	0.0068***
	(0.0070)	(0.0068)	(0.0031)	(0.0021)
N	125,232	125,232	125,232	125,232
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0070***	0.0171***	-0.0008	
	(0.0017)	(0.0064)	(0.0011)	
N	125,232	125,232	125,232	

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. All the models control for the same variables as Table 3.2. Standard errors are robust. * p < 0.1, ** p < 0.05, *** p < 0.01.

Placebo Tests

I also undertake some Placebo tests to check if the results are being driven by the "catching up" effects. If the coefficient of the difference-in-difference dummy is being confounded by the "catching up" effect then the difference-in-difference estimates of the effect of the program should also be significant for other socio economic indicators which are not supposed to be impacted by the MGNREGA program but are expected to show an overall improvement over time. I choose two socio economic indicators to test this – age of consummation of marriage for women and education of the husband. The age of consummation should not be affected by the MGNREGA program directly. Overall socio economic progress can have an effect on it as is clear from Table 3.1 with Phase-III having a higher age of consummation while Phase-I has the lowest. Husband's years of schooling is also expected to increase with overall economic progress but since the MGNREGA program does not require any educational qualification there is no reason why husband education should increase with exposure to MGNREGA. I present the results for both these models in Table 3.7. As expected the coefficient is insignificant for age of consummation and husband's years of schooling.

Table 3.5: Placebo Tests

	Age of consummation	Husband's Education
Dif-in-Dif	0.0147	-0.0291
	(0.0105)	(0.0440)
Wife's age	0.0024***	-0.0305***
	(0.0002)	(0.0021)
Wife's education	0.0276***	0.4590***
	(0.0004)	(0.0062)
Husband's education	0.0060***	X
	(0.0003)	
Caste	-0.0147***	-0.5594***
	(0.0028)	(0.0318)
N	495,298	495,298

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. Household's socio-economic characteristics are controlled for. District fixed effects, and State specific trends are added as control. The standard errors are clustered at the district. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Extension

One of the problems of the DLHS data is that in the DLHS-II (2002-04), the survey does not ask those who are not using contraception about their future family plans. This makes it impossible to test whether the program increases the use of contraception because it has increased the opportunity cost of staying at home for mothers. It also makes it impossible to test whether the poverty alleviating effect of the program reduces the demand for children as insurance against economic shocks.

Thomas (2016) showed that the program has reduced child mortality, which is also another channel through which fertility and contraception can be affected. Another avenue through which the program can increase the use of contraception is the women empowerment channel, and although the limitations of the data do not permit a direct analysis of this channel, the fact that the program does not have an effect on male sterilization and a weak effect on condom use should make us apprehensive about the empowerment effect. A United Nations sponsored survey (Nanda, et al. 2014) on women empowerment in India had found that one of the major reasons behind couples not using condoms was

husband's unwillingness to use them. If the program increases contraceptive use through the empowerment effect then we expect it to have an effect on condom use.

The remaining channel through which the program may be increasing the use of contraception is by reducing the unmet need of family planning because it makes contraceptives affordable and accessible to those couples who want to use them but don't have enough money to buy them regularly or have some other difficulty to access them. To test this conjecture, first I consider a sample of women who do not use any contraceptives. Then I create an indicator variable which takes the value 1 if the couple does not plan to have any children within the next two years. Therefore, the indicator variable identifies those couples who should be using contraceptives but does not use them. In other words these are the couples who have "Unmet need of family planning." Then I regress this indicator variable on the same variables as in equation (1). Next, I follow the same steps by considering a sample of women who do not use any modern contraceptives. The results are reported in Table 3.6.

The column (1) in Table 3.6 reports the effect of the program on the probability of being an individual who does not use any method of contraception and does not plan to have children within next two years. The column (2) reports the effect of the program on the probability of being an individual who does not use any modern method of contraception and does not plan to have any children within next two years. If there is impact of the program on family planning through the affordability channel, then I expect the coefficient reported in column (2) to be bigger in absolute terms and more statistically significant than the coefficient reported in column (1).

Those people who are currently not using any traditional, costless method of contraception but do not want children in the immediate future are behaving in that way because of reasons which may be unrelated with economic parameters like income. On the other hand, those people who are currently not using any modern methods of contraception which requires financial resources and do not want any children in the immediate future are doing so because they may not have the required income to

purchase modern contraceptive methods. If the MGNREGA increases the affordability of the modern contraceptive methods by supplementing the incomes of the poor households, then I expect it to have an impact on the second group of people mentioned above and no effect on the first group. Therefore, the coefficient reported in column (2) in Table 3.6 should be bigger in absolute value and more significant than the one reported in column (1).

Table 3.6: Unmet Need of Family Planning

	Dependent variable=1 if not using any contraception and do not want to have more children	Dependent variable=1 if not using any modern contraception and do not want to have more children
	(1)	(2)
Dif-in-Dif	-0.0048	-0.0409***
	(0.0111)	(0.0125)
N	220,144	257,128

The dependent variable is a dummy. All the models are weighted by the weighted aggregate number of respondents in a district. All individual and household controls that are in Table 3.2 are applied. Standard errors are clustered at the district. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

3.7 Conclusion

In this paper I investigate the impact of the MGNREGA program on the use of various methods of contraception among rural households in India. The MGNREGA program is a job guarantee scheme implemented in rural India since 2006. Previous studies have shown that the program has increased wages and decreased poverty in rural India. I use a large, nationally representative micro level dataset and implement a difference-in-difference empirical strategy to isolate the effect of the program on contraception. The dataset allows me to control for a rich set of individual and household level characteristics which may affect an individual's participation contraceptive demand. The exogeneity of the treatment and the intent-to-treat framework allows me to avoid the pitfalls of self selection which has been a problem in some studies investigating the effect of economic programs on contraception. I find that the program has a significant positive effect of 6.2% on overall use of contraception. I also find that the program increased the use of contraceptive pills by 18.5%, IUD by 24.2% and female

sterilization by 3.6%. The program does not seem to have a statistically significant effect on the use of condoms.

I also show that these results are not being driven by the non-random way in which the program was implemented. Specifically, I analyze the individuals who live in districts that entered the program in different years but also are similar to each other socio-economically. I find that the effect of the program is stronger in districts which are closer to each other in terms of socio-economic characteristics. I also do Placebo tests to show that the non-random implementation of the program is not driving the results as there are no effects of the program on socio-economic characteristics which are unlikely to be affected by the MGNREGA program, at least in a short term. The dataset I use does not allow me to isolate the channels through which the program may affect contraceptive use but I provide limited evidence that at least some of the effect may be through the affordability and accessibility channel, i.e. the extra income generated through the program allows couples to use contraceptives which they would not have been able to afford or access previously.

The evidence provided in this study shows that affordability and accessibility of contraceptives may be one of the reasons behind their low rate of use in developing countries, and if family planning programs are coupled with income generating programs they may have a larger impact on reducing fertility and population growth. Higher use of contraceptives have also been shown to increase investment in children as couples are better able to space their children so the benefit of the MGNREGA program may be inter-generational as well.

Chapter 4. Conclusion and Comments

4.1 Analyzing the Impact of the World's Largest Public Works Project on Crime

The second chapter of this dissertation presents estimates of the impact of the MGNREGA program on crime rates. I use a district level panel data on various crimes such as murder, robbery, burglary, theft, kidnapping and rioting, and the heterogeneity in the timing and intensity of the MGNREGA program across districts to isolate the effect. I also control for various district level socio economic indicators and district level fixed effects which can affect the implementation of the MGNREGA program as well as crimes. Additionally, I show that rainfall is associated with the number of jobs generated under the program confirming, that the program is used by rural households as safety nets against weather induced agricultural shocks. I control for rainfall in the crime regressions. The district level crime data cannot be separated into urban crimes and rural crimes but the MGNREGA program should mostly affect rural unemployment and income. This can lead to underestimation of the effect of the program on crime. I try to resolve this issue by deriving a relationship between the impact of the program on district-level crime (which I estimate econometrically) and the impact of the program on district's rural crime. Using this relationship I am able to provide upper and lower bounds of the program's impact on rural crime.

I find that the elasticity of jobs generated by the program on crime are 0.01 for murder, between 0.03 and 0.09 for robbery, between 0.09 and 0.1 for burglary, between 0.03 and 0.36 for theft, between 0.09 and 0.1 for riots, and between 0.03 and 0.05 for kidnapping. While the magnitude of the impact of the program on crime is small, it should be noted that the program provides temporary, not permanent employment, and that it has been shown by previous research that the program affects mostly female employment. In addition, I present graphical evidence that the non-random selection of the districts for the program implementation is unrelated with crime trends in years prior to the start of

the program. I show that pre-program crime trends were similar between the district that entered the program earlier and those who entered later. The same is true for very poor disticts and other districts. The fact that the goal of the program is to provide temporary relief from poverty and that crime is not a concern of the program or its implementation provides a fraemwork where standard endogeneity concerns are avoided, which also indicates that crime reduction is a positive externality of this public works project. To the extent that criminal activity has a negative impact on legal human capital formation and that legal human capital is a vital ingredient in development, it is an important aspect of this program.

4.2 Analyzing the Impact of the World's Largest Public Works Project on the use of Contraception

In chapter three I investigate the effects of the MGNREGA program on the use of contraception among couples living in rural areas. I use two rounds of a micro-level dataset called the DLHS namely, DLHS-II (2002-04) and DLHS-III (2007-08.) The first round of the survey had been conducted before the start of the MGNREGA program and the second round was conducted after some districts had started implementing the program (Phase-I and Phase-II districts) while other districts were yet to start (Phase-III.) I use a difference-in-difference empirical strategy to isolate the effects of the program on various contraceptive usage outcomes like "Currently using any method of contraception", "Currently using condoms", "Currently using contraceptive pills", "Currently using IUD Loop", "Female sterilization", "Male sterilization" and "Currently using any modern method of contraception." I also control for various individual characteristics like age, education, partner's education, child mortality, household's socio-economic condition, and accessibility to health facilities. The results indicate that the program has increased overall use of contraception by 6.2%, the use of modern method of contraception by 5.4%, contraceptive pills by 18.5%, IUD by 24.2% and female sterilization by 3.6%. It did not have a significant effect on male sterilization and condom use.

I further show that the non-random selection of districts for the program, specifically the priority to poorer districts to enter the program is not driving my results by analyzing individuals who live in districts that entered the program in different years but who are similar to each other socio-economically. I do this using the "Backwardness Index" developed by the Planning Commission which had been used to prioritize districts for the program. I find that the effects of the program are stronger if only individuals from comparable districts are used as sample. I also present Placebo tests which show that the program does not affect other socio-economic characteristics which are unlikely to be affected by the program. The limitation of the data does not allow me to identify the channels through which the program can affect contraceptive use. However, I provide limited evidence that one of the avenues through which the program is affecting contraceptive use is the affordability channel i.e. couples are using more contraceptives because they are better able to afford it because of the program.

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Appendix 1. Official Definitions of Crimes According to the Indian Penal Code (IPC)[36]

Burglary or house trespass (Sections 442 to 460 of the IPC):

> "Whoever commits criminal trespass by entering into or remaining in any building, tent or vessel used as a human dwelling or any building used as a place for worship, or as a place for the custody of property, is said to commit burglary or house- trespass. Explanation- The introduction of any part of the criminal trespasser's body is entering sufficient to constitute house- trespass. Burglary includes house breaking and house lurking."

Theft (Sections 378 to 382 of the IPC):

> "Whoever, intending to take dishonestly any movable property out of the possession of any person without that person' s consent, moves that property in order to such taking, is said to commit theft."

Robbery (Sections 390 & 392 to 395 of the IPC)

> "In all robbery there is either theft or extortion. When theft is robbery—Theft is" robbery" if, in order to the committing of the theft, or in committing the theft, or in carrying away or attempting to carry away property obtained by the theft, the offender, for that end, voluntarily causes or attempts to cause to any person death or hurt or wrongful restraint, or fear of instant death or of instant hurt, or of instant wrongful restraint. When extortion is robbery—Extortion is" robbery" if the offender, at the time of committing the extortion, is in the presence of the person put in fear, and commits the extortion by putting that person in fear of instant death, of instant hurt, or of instant wrongful restraint to that person or to some other person, and, by so putting in fear, induces the person, so put in fear then and there to deliver up the thing extorted."

Kidnapping and Abduction (Sections 359 to 373 of the IPC):

> Kidnapping from lawful guardianship: "Whoever takes or entices any minor under sixteen years of age if a male, or under eighteen years of age if a female, or any person of unsound mind, out of the keeping of the lawful guardian of such minor or person of unsound mind, without the consent of such guardian, is said to kidnap such minor or person from lawful guardianship."
>
> Abduction: "Whoever by force compels, or by any deceitful means induces any person to go from any place, is said to abduct that person."

[36] The I.P.C. is a public document. The document was accessed through a legal services website named www.indiankanoon.org.

Unlawful Assembly and Rioting (Sections 141 to 160 of the IPC):

Unlawful Assembly: “An assembly of five or more persons is designated an" unlawful assembly", if the common object of the persons composing that assembly is- (i) to overawe by criminal force, or show of criminal force, (ii) to resist the execution of any law, or of any legal process; (iii) to commit any mischief or criminal trespass, or other offence; (iv) by means of criminal force, or show of criminal force, to any person to take or obtain possession of any property, or to deprive any person of the enjoyment of a right of way, or of the use of water or other incorporeal right of which he is in possession or enjoyment, or to enforce any right or supposed right; (v) by means of criminal force, or show of criminal force, to compel any person to do what he is not legally bound to do, or to omit to do what he is legally entitled to do.”

Rioting: “Whenever force or violence is used by an unlawful assembly, or by any member thereof, in prosecution of the common object of such assembly, every member of such assembly is guilty of the offence of rioting.”

Rape (Sections 375 and 376 of the IPC):

“A man is said to commit" rape" who, except in the case hereinafter excepted, has sexual intercourse with a woman under circumstances falling under any of the six following descriptions:- (i) against her will; (ii) without her consent; (iii) with her consent, when her consent has been obtained by putting her or any person in whom she is interested in fear of death or of hurt; (iv) with her consent, when the man knows that he is not her husband, and that her consent is given because she believes that he is another man to whom she is or believes herself to be lawfully married; (v) with her consent, when, at the time of giving such consent, by reason of unsoundness of mind or intoxication or the administration by him personally or through another of any stupefying or unwholesome substance, she is unable to understand the nature and consequences of that to which she gives consent; and (vi) with or without her consent, when she is under sixteen years of age. Exception- Sexual intercourse by a man with his wife, the wife not being under fifteen years of age, is not rape.”

Culpable homicide (Sections 299 to 306, 313, 314 & 316 of the IPC):

“Whoever causes death by doing an act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death, or with the knowledge that he is likely by such act to cause death, commits the offence of culpable homicide.”

Culpable homicide not amounting to murder (Sections 304 to 306, 313 and 314of the IPC): “This consists of abetment to suicide, death by negligence, causing miscarriage etc.”

Murder (Sections 300 to 303 of the IPC): “All culpable homicides except those mentioned in culpable homicide not amounting to murder.”

Appendix 2. Supplementary Tables for Chapter 2

Table A2.1: The Impact of Employment Generated by the MGNREGA on Crime (Unweighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0005**	**-0.0027*****	**-0.0024****	**-0.0047*****	**-0.0025*****	**-0.0022*****	**-0.0018*****	**-0.0025*****
	(0.0004)	(0.0006)	(0.0010)	(0.0014)	(0.0006)	(0.0006)	(0.0004)	(0.0005)
Literacy rate	-0.0113***	0.0109**	-0.0339***	0.0245***	0.0002	-0.0114**	-0.0103***	-0.0060*
	(0.0027)	(0.0045)	(0.0059)	(0.0073)	(0.0038)	(0.0048)	(0.0029)	(0.0035)
Sex ratio	-0.0020*	0.0037**	-0.0007	0.0033	0.0006	-0.0013	0.0003	0.0003
	(0.0010)	(0.0017)	(0.0024)	(0.0024)	(0.0012)	(0.0014)	(0.0012)	(0.0011)
Urbanization rate	0.0041	-0.0026	0.0096	0.0249***	-0.0037	-0.0044	0.0049	-0.0044
	(0.0044)	(0.0061)	(0.0095)	(0.0077)	(0.0050)	(0.0063)	(0.0055)	(0.0051)
Population density	-0.0001	0.0002*	0.0002	0.0006***	0.0008***	0.0006***	0.0002*	0.0008***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0001)	(0.0002)
% "Good houses"$^{+}$	0.0008	-0.0147***	-0.0178***	0.0004	0.0079***	0.0040	-0.0071***	0.0049**
	(0.0019)	(0.0033)	(0.0043)	(0.0042)	(0.0024)	(0.0027)	(0.0024)	(0.0022)
Electricity Use	-0.0007	0.0070**	-0.0000	-0.0048	0.0061**	-0.0007	0.0003	0.0051**
	(0.0022)	(0.0034)	(0.0040)	(0.0041)	(0.0026)	(0.0027)	(0.0026)	(0.0024)
Television^{++}	0.0008	-0.0030	0.0194***	0.0094**	-0.0115***	0.0043*	0.0029	-0.0068***
	(0.0014)	(0.0027)	(0.0039)	(0.0044)	(0.0019)	(0.0022)	(0.0019)	(0.0018)
Two wheelers‡	0.0063	-0.0152**	0.0082	-0.0475***	0.0180***	-0.0038	0.0030	0.0153***
	(0.0044)	(0.0074)	(0.0094)	(0.0121)	(0.0056)	(0.0064)	(0.0053)	(0.0053)
% of Scheduled Caste	0.0099	-0.0380*	0.0097	-0.0165	0.0033	0.0065	-0.0284*	-0.0050
	(0.0117)	(0.0229)	(0.0225)	(0.0282)	(0.0162)	(0.0214)	(0.0161)	(0.0159)
% of Scheduled Tribe	0.0013	-0.0172	0.0051	-0.0572**	-0.0083	-0.0072	-0.0195	-0.0147
	(0.0084)	(0.0213)	(0.0138)	(0.0240)	(0.0120)	(0.0205)	(0.0145)	(0.0123)
% Agricultural workers $^{\#}$	0.0070*	-0.0231***	-0.0141*	-0.0346***	-0.0224***	-0.0134**	-0.0079	-0.0171***
	(0.0041)	(0.0067)	(0.0085)	(0.0103)	(0.0059)	(0.0064)	(0.0048)	(0.0054)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4,567	4,538	4,485	4,350	4,575	4,570	4,570	4,575

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. *Worker days per HH* stands for employment generated by MGNRGEA program, measured as worker days per household. +: % of households living in dwellings categorized to be in "Good condition"; ++: % of households with Television; ‡: % of households with motorcycles and scooters. #: % of workers involved in agriculture. Standard errors are clustered at the Treatment-District level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A2.2: Controlling State-by-year Fixed Effect (Unweighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0009***	**-0.0007**	**-0.0040*****	**-0.0013**	**-0.0009**	**-0.0011***	**-0.0019*****	**-0.0013****
	(0.0005)	(0.0007)	(0.0012)	(0.0015)	(0.0006)	(0.0006)	(0.0005)	(0.0005)
Literacy rate	0.0077**	0.0183***	-0.0159*	0.0235**	0.0035	-0.0069	0.0073*	-0.0022
	(0.0036)	(0.0057)	(0.0091)	(0.0112)	(0.0054)	(0.0064)	(0.0037)	(0.0051)
Sex ratio	-0.0002	0.0000	-0.0005	0.0002	-0.0013	-0.0031**	-0.0005	-0.0014
	(0.0009)	(0.0015)	(0.0021)	(0.0021)	(0.0010)	(0.0013)	(0.0010)	(0.0009)
Urbanization rate	-0.0028	-0.0117**	0.0102	-0.0111	-0.0002	0.0026	-0.0026	-0.0006
	(0.0038)	(0.0059)	(0.0087)	(0.0071)	(0.0048)	(0.0053)	(0.0047)	(0.0045)
Population density	0.0001	0.0003**	0.0004**	0.0008***	0.0004**	0.0003**	0.0003***	0.0004***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
% "Good houses"[+]	0.0059*	-0.0095*	0.0016	-0.0165**	0.0065	-0.0000	0.0039	0.0045
	(0.0033)	(0.0053)	(0.0078)	(0.0068)	(0.0044)	(0.0056)	(0.0041)	(0.0041)
Electricity use	-0.0009	0.0032	0.0091*	-0.0002	0.0054*	0.0032	-0.0002	0.0053**
	(0.0020)	(0.0038)	(0.0050)	(0.0051)	(0.0029)	(0.0033)	(0.0023)	(0.0026)
Television[++]	-0.0012	0.0043	0.0042	0.0066	0.0068*	0.0076	0.0005	0.0052
	(0.0026)	(0.0059)	(0.0076)	(0.0066)	(0.0038)	(0.0047)	(0.0039)	(0.0037)
Two wheelers[‡]	0.0087*	-0.0101	-0.0061	0.0258**	0.0256***	0.0055	0.0035	0.0221***
	(0.0047)	(0.0085)	(0.0105)	(0.0109)	(0.0058)	(0.0066)	(0.0057)	(0.0054)
% of Scheduled Caste	-0.0336***	-0.0226	-0.0524**	-0.0165	-0.0232*	-0.0069	-0.0444***	-0.0306**
	(0.0096)	(0.0201)	(0.0236)	(0.0281)	(0.0132)	(0.0188)	(0.0126)	(0.0131)
% of Scheduled Tribe	-0.0189**	-0.0084	-0.0156	-0.0461*	-0.0143	0.0022	-0.0235**	-0.0190*
	(0.0076)	(0.0198)	(0.0150)	(0.0238)	(0.0109)	(0.0159)	(0.0115)	(0.0104)
% Agricultural worker[#]	-0.0064*	-0.0110*	-0.0240***	-0.0179*	-0.0114**	-0.0090	-0.0116***	-0.0086*
	(0.0036)	(0.0064)	(0.0087)	(0.0107)	(0.0051)	(0.0061)	(0.0044)	(0.0046)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State by Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4,567	4,538	4,485	4,350	4,575	4,570	4,570	4,575

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. [+] % of households living in dwellings categorized to be in "Good condition." [++] % of households with Television. [‡] % of households with motorcycles and scooters. [#] % of workers involved in agriculture. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2.3: Controlling State-by-year Fixed Effect (Weighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0012****	**-0.0006**	**-0.0046*****	**-0.0017**	**-0.0008**	**-0.0014**	**-0.0025*****	**-0.0013****
	(0.0005)	(0.0008)	(0.0013)	(0.0015)	(0.0007)	(0.0009)	(0.0005)	(0.0006)
Literacy rate	0.0073*	0.0209***	-0.0148	0.0092	0.0087	-0.0036	0.0101*	0.0017
	(0.0044)	(0.0062)	(0.0118)	(0.0113)	(0.0058)	(0.0066)	(0.0053)	(0.0055)
Sex ratio	-0.0017*	-0.0017	-0.0006	-0.0007	-0.0028**	-0.0018	-0.0014	-0.0019
	(0.0009)	(0.0014)	(0.0027)	(0.0025)	(0.0014)	(0.0018)	(0.0012)	(0.0013)
Urbanization rate	-0.0060	-0.0052	0.0042	-0.0091	0.0014	0.0106	-0.0031	0.0001
	(0.0039)	(0.0060)	(0.0102)	(0.0088)	(0.0054)	(0.0078)	(0.0055)	(0.0053)
Population density	0.0001	0.0003***	0.0005***	0.0008***	0.0002**	0.0002	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
% "Good houses"[+]	0.0050	-0.0117**	0.0056	-0.0182**	0.0022	0.0016	0.0049	0.0031
	(0.0035)	(0.0050)	(0.0092)	(0.0078)	(0.0048)	(0.0062)	(0.0046)	(0.0047)
Electricity use	0.0004	0.0027	0.0079	0.0038	0.0086***	0.0056	0.0000	0.0078***
	(0.0020)	(0.0036)	(0.0056)	(0.0053)	(0.0032)	(0.0035)	(0.0025)	(0.0029)
Television[++]	-0.0006	0.0122**	0.0089	0.0024	0.0080*	0.0086	0.0052	0.0076*
	(0.0023)	(0.0058)	(0.0087)	(0.0074)	(0.0042)	(0.0055)	(0.0040)	(0.0039)
Two wheelers[‡]	0.0083*	-0.0314***	-0.0046	0.0282**	0.0262***	-0.0029	-0.0082	0.0217***
	(0.0044)	(0.0083)	(0.0144)	(0.0131)	(0.0066)	(0.0080)	(0.0064)	(0.0063)
% of Scheduled Caste	-0.0305***	0.0093	-0.0417*	-0.0096	-0.0241	0.0003	-0.0214*	-0.0291*
	(0.0097)	(0.0213)	(0.0249)	(0.0307)	(0.0171)	(0.0279)	(0.0128)	(0.0166)
% of Scheduled Tribe	-0.0213***	-0.0028	-0.0153	-0.0531**	-0.0230**	-0.0002	-0.0166	-0.0243**
	(0.0076)	(0.0191)	(0.0173)	(0.0236)	(0.0108)	(0.0188)	(0.0112)	(0.0106)
% Agricultural worker[#]	-0.0080**	-0.0130**	-0.0186*	-0.0218*	-0.0104*	-0.0083	-0.0106**	-0.0056
	(0.0039)	(0.0065)	(0.0095)	(0.0116)	(0.0059)	(0.0067)	(0.0051)	(0.0054)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State by Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4,567	4,538	4,485	4,350	4,575	4,570	4,570	4,575

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. [+] % of households living in dwellings categorized to be in "Good condition." [++] % of households with Television. [‡] % of households with motorcycles and scooters. [#] % of workers involved in agriculture. All the models are weighted by the mean population of district. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2.4: Rainfall and Crime (Unweighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Log Total Rainfall	**-0.0854*** **	**-0.0070**	**-0.0110**	**-0.2404*** **	**-0.0385***	**-0.0068**	**-0.0397** **	**-0.0260**
	(0.0202)	(0.0285)	(0.0440)	(0.0522)	(0.0229)	(0.0317)	(0.0193)	(0.0212)
Literacy rate	-0.0171***	0.0103	-0.0428***	0.0150	-0.0040	-0.0186***	-0.0176***	-0.0119**
	(0.0045)	(0.0073)	(0.0088)	(0.0128)	(0.0060)	(0.0067)	(0.0045)	(0.0053)
Sex ratio	-0.0032**	0.0047*	-0.0018	0.0030	-0.0001	-0.0005	-0.0008	-0.0002
	(0.0016)	(0.0025)	(0.0037)	(0.0039)	(0.0020)	(0.0020)	(0.0018)	(0.0016)
Urbanization rate	0.0072	0.0018	0.0228	0.0282**	0.0017	-0.0032	0.0109	-0.0001
	(0.0071)	(0.0102)	(0.0153)	(0.0123)	(0.0086)	(0.0109)	(0.0092)	(0.0088)
Population density	-0.0002	0.0002	-0.0001	0.0007**	0.0008**	0.0007***	0.0001	0.0008**
	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0002)	(0.0003)
% "Good houses"[+]	0.0023	-0.0085	-0.0136**	0.0104	0.0081*	0.0062	-0.0030	0.0058
	(0.0030)	(0.0053)	(0.0067)	(0.0065)	(0.0043)	(0.0044)	(0.0035)	(0.0038)
Electricity Use	0.0005	0.0058	-0.0019	-0.0051	0.0058	0.0019	-0.0009	0.0052
	(0.0031)	(0.0048)	(0.0061)	(0.0065)	(0.0040)	(0.0040)	(0.0036)	(0.0035)
Television[++]	-0.0013	-0.0005	0.0121**	0.0050	-0.0110***	0.0014	0.0015	-0.0079***
	(0.0024)	(0.0042)	(0.0061)	(0.0064)	(0.0034)	(0.0035)	(0.0029)	(0.0030)
Two wheelers[‡]	0.0132*	-0.0174	-0.0040	-0.0503***	0.0242**	-0.0033	0.0046	0.0197**
	(0.0070)	(0.0115)	(0.0144)	(0.0184)	(0.0096)	(0.0103)	(0.0079)	(0.0087)
% of Scheduled Caste	0.0297	-0.0162	0.0172	-0.0216	0.0198	0.0192	-0.0126	0.0058
	(0.0183)	(0.0335)	(0.0378)	(0.0481)	(0.0265)	(0.0327)	(0.0228)	(0.0250)
% of Scheduled Tribe	0.0130	-0.0066	0.0102	-0.0544	0.0054	0.0016	-0.0112	-0.0079
	(0.0120)	(0.0270)	(0.0252)	(0.0385)	(0.0224)	(0.0272)	(0.0159)	(0.0177)
% Agricultural worker[#]	0.0085	-0.0219**	-0.0108	-0.0329**	-0.0096	-0.0069	-0.0051	-0.0058
	(0.0065)	(0.0105)	(0.0137)	(0.0161)	(0.0093)	(0.0097)	(0.0074)	(0.0085)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,729	3,703	3,668	3,569	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. [+] % of households living in dwellings categorized to be in "Good condition." [++] % of households with Television. [‡] % of households with motorcycles and scooters. [#] % of workers involved in agriculture. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2.5: Rainfall and Crime (Weighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Log Total Rainfall	**-0.0765*** **	**0.0090**	**-0.0373**	**-0.2633*** **	**-0.0328**	**0.0266**	**-0.0453** **	**-0.0242**
	(0.0204)	(0.0311)	(0.0476)	(0.0529)	(0.0228)	(0.0370)	(0.0217)	(0.0212)
Literacy rate	-0.0240***	0.0064	-0.0494***	0.0089	-0.0021	-0.0119	-0.0211***	-0.0103*
	(0.0049)	(0.0080)	(0.0112)	(0.0159)	(0.0062)	(0.0074)	(0.0056)	(0.0059)
Sex ratio	-0.0043**	0.0044	-0.0034	0.0042	-0.0027	-0.0007	-0.0009	-0.0017
	(0.0017)	(0.0029)	(0.0040)	(0.0052)	(0.0022)	(0.0025)	(0.0022)	(0.0020)
Urbanization rate	0.0095	0.0153	0.0250	0.0431***	0.0054	-0.0009	0.0174	0.0031
	(0.0079)	(0.0117)	(0.0163)	(0.0146)	(0.0094)	(0.0134)	(0.0108)	(0.0100)
Population density	-0.0001	0.0003*	0.0000	0.0008**	0.0005**	0.0006**	0.0001	0.0006***
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
% "Good houses"+	-0.0035	-0.0126**	-0.0155*	0.0033	0.0055	0.0068	-0.0074*	0.0034
	(0.0031)	(0.0058)	(0.0082)	(0.0081)	(0.0043)	(0.0051)	(0.0042)	(0.0042)
Electricity Use	0.0087***	0.0098**	0.0025	0.0031	0.0124***	0.0066	0.0058*	0.0125***
	(0.0032)	(0.0048)	(0.0070)	(0.0075)	(0.0038)	(0.0042)	(0.0035)	(0.0035)
Television++	-0.0030	-0.0030	0.0082	0.0020	-0.0131***	0.0024	-0.0005	-0.0097***
	(0.0025)	(0.0046)	(0.0073)	(0.0084)	(0.0036)	(0.0042)	(0.0033)	(0.0035)
Two wheelers‡	-0.0017	-0.0445***	-0.0026	-0.0845***	0.0042	-0.0201	-0.0136	0.0004
	(0.0080)	(0.0124)	(0.0195)	(0.0256)	(0.0106)	(0.0123)	(0.0094)	(0.0102)
% of Scheduled Caste	0.0304	0.0253	0.0234	-0.0079	0.0030	0.0370	0.0155	-0.0034
	(0.0190)	(0.0445)	(0.0436)	(0.0579)	(0.0319)	(0.0472)	(0.0289)	(0.0316)
% of Scheduled Tribe	0.0101	0.0037	0.0089	-0.0623	-0.0204	-0.0017	-0.0011	-0.0237
	(0.0144)	(0.0332)	(0.0302)	(0.0430)	(0.0203)	(0.0325)	(0.0199)	(0.0195)
% Agricultural worker#	0.0102	-0.0161	-0.0005	-0.0184	-0.0065	-0.0068	0.0029	-0.0006
	(0.0073)	(0.0123)	(0.0152)	(0.0173)	(0.0105)	(0.0100)	(0.0089)	(0.0094)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,729	3,703	3,668	3,569	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. + % of households living in dwellings categorized to be in "Good condition." ++ % of households with Television. ‡ % of households with motorcycles and scooters. # % of workers involved in agriculture. All the models are weighted by the mean population of district. Errors are clustered at the Treatment-District level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A2.6: Impact of MGNREGA on Crime After Controlling for Rainfall (Unweighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0008***	**-0.0025*****	**-0.0033*****	**-0.0055*****	**-0.0023*****	**-0.0023*****	**-0.0021*****	**-0.0025*****
	(0.0004)	(0.0006)	(0.0010)	(0.0013)	(0.0006)	(0.0005)	(0.0004)	(0.0005)
Log Total Rainfall	-0.0841***	-0.0025	-0.0057	-0.2338***	-0.0347	-0.0030	-0.0363**	-0.0219
	(0.0183)	(0.0271)	(0.0409)	(0.0455)	(0.0217)	(0.0291)	(0.0173)	(0.0194)
Literacy rate	-0.0177***	0.0083	-0.0453***	0.0109	-0.0055	-0.0202***	-0.0190***	-0.0136***
	(0.0035)	(0.0056)	(0.0070)	(0.0094)	(0.0046)	(0.0051)	(0.0035)	(0.0041)
Sex ratio	-0.0033***	0.0044**	-0.0023	0.0024	-0.0004	-0.0008	-0.0011	-0.0006
	(0.0012)	(0.0019)	(0.0029)	(0.0030)	(0.0016)	(0.0016)	(0.0014)	(0.0013)
Urbanization rate	0.0069	0.0004	0.0213*	0.0259***	0.0006	-0.0042	0.0100	-0.0012
	(0.0053)	(0.0078)	(0.0118)	(0.0090)	(0.0063)	(0.0084)	(0.0067)	(0.0064)
Population density	-0.0002	0.0002	-0.0001	0.0005**	0.0008**	0.0007***	0.0001	0.0008***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)
% "Good houses"[+]	0.0021	-0.0094**	-0.0149***	0.0079	0.0073**	0.0055	-0.0037	0.0050*
	(0.0024)	(0.0039)	(0.0053)	(0.0051)	(0.0032)	(0.0034)	(0.0027)	(0.0028)
Electricity use	0.0008	0.0069*	-0.0004	-0.0029	0.0067**	0.0028	-0.0001	0.0062**
	(0.0025)	(0.0036)	(0.0049)	(0.0049)	(0.0031)	(0.0031)	(0.0028)	(0.0027)
Television[++]	-0.0014	-0.0008	0.0115**	0.0038	-0.0113***	0.0010	0.0012	-0.0083***
	(0.0019)	(0.0031)	(0.0048)	(0.0049)	(0.0026)	(0.0027)	(0.0022)	(0.0023)
Two wheelers[‡]	0.0128**	-0.0186**	-0.0053	-0.0502***	0.0230***	-0.0045	0.0035	0.0184***
	(0.0053)	(0.0084)	(0.0115)	(0.0133)	(0.0070)	(0.0078)	(0.0058)	(0.0063)
% of Scheduled Caste	0.0293**	-0.0178	0.0157	-0.0220	0.0188	0.0182	-0.0134	0.0048
	(0.0138)	(0.0258)	(0.0279)	(0.0352)	(0.0194)	(0.0251)	(0.0169)	(0.0181)
% of Scheduled Tribe	0.0144	-0.0026	0.0162	-0.0443	0.0095	0.0056	-0.0077	-0.0035
	(0.0097)	(0.0207)	(0.0191)	(0.0294)	(0.0170)	(0.0206)	(0.0125)	(0.0134)
% Agricultural worker[#]	0.0086*	-0.0218***	-0.0106	-0.0314***	-0.0094	-0.0067	-0.0050	-0.0057
	(0.0049)	(0.0078)	(0.0105)	(0.0120)	(0.0069)	(0.0074)	(0.0055)	(0.0062)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,729	3,703	3,668	3,569	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. [+] % of households living in dwellings categorized to be in "Good condition." [++] % of households with Television. [‡] % of households with motorcycles and scooters. [#] % of workers involved in agriculture. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2.7: Impact of MGNREGA on Crime After Controlling for Rainfall (Weighted Regressions)

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0010****	**-0.0030*****	**-0.0029****	**-0.0079*****	**-0.0024*****	**-0.0016****	**-0.0024*****	**-0.0025*****
	(0.0004)	(0.0007)	(0.0012)	(0.0016)	(0.0006)	(0.0007)	(0.0005)	(0.0005)
Log Total Rainfall	-0.0744***	0.0152	-0.0315	-0.2509***	-0.0279	0.0298	-0.0406**	-0.0191
	(0.0192)	(0.0281)	(0.0451)	(0.0457)	(0.0218)	(0.0350)	(0.0194)	(0.0201)
Literacy rate	-0.0250***	0.0036	-0.0522***	0.0015	-0.0044	-0.0134**	-0.0232***	-0.0127***
	(0.0037)	(0.0060)	(0.0086)	(0.0111)	(0.0048)	(0.0058)	(0.0043)	(0.0045)
Sex ratio	-0.0045***	0.0040*	-0.0038	0.0034	-0.0030*	-0.0009	-0.0012	-0.0020
	(0.0013)	(0.0021)	(0.0031)	(0.0038)	(0.0017)	(0.0019)	(0.0016)	(0.0015)
Urbanization rate	0.0087	0.0129	0.0228*	0.0374***	0.0036	-0.0021	0.0157**	0.0012
	(0.0057)	(0.0089)	(0.0122)	(0.0102)	(0.0069)	(0.0117)	(0.0078)	(0.0073)
Population density	-0.0001	0.0003*	0.0000	0.0007**	0.0005*	0.0005*	0.0001	0.0005**
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
% "Good houses"[+]	-0.0038	-0.0134***	-0.0164***	0.0002	0.0048	0.0064	-0.0081***	0.0026
	(0.0023)	(0.0043)	(0.0063)	(0.0062)	(0.0032)	(0.0044)	(0.0031)	(0.0031)
Electricity use	0.0092***	0.0113***	0.0040	0.0070	0.0136***	0.0074**	0.0070***	0.0138***
	(0.0024)	(0.0036)	(0.0053)	(0.0056)	(0.0029)	(0.0035)	(0.0026)	(0.0026)
Television[++]	-0.0031*	-0.0033	0.0078	0.0005	-0.0134***	0.0022	-0.0008	-0.0099***
	(0.0019)	(0.0034)	(0.0056)	(0.0061)	(0.0027)	(0.0034)	(0.0025)	(0.0026)
Two wheelers[‡]	-0.0015	-0.0437***	-0.0017	-0.0787***	0.0049	-0.0197*	-0.0130*	0.0010
	(0.0060)	(0.0090)	(0.0148)	(0.0176)	(0.0078)	(0.0114)	(0.0069)	(0.0074)
% of Scheduled Caste	0.0299**	0.0238	0.0221	-0.0112	0.0019	0.0363	0.0145	-0.0045
	(0.0143)	(0.0326)	(0.0330)	(0.0416)	(0.0234)	(0.0398)	(0.0209)	(0.0230)
% of Scheduled Tribe	0.0120	0.0091	0.0143	-0.0476	-0.0159	0.0013	0.0033	-0.0190
	(0.0110)	(0.0249)	(0.0232)	(0.0326)	(0.0153)	(0.0268)	(0.0150)	(0.0146)
% Agricultural worker[#]	0.0102*	-0.0161*	-0.0005	-0.0172	-0.0065	-0.0068	0.0029	-0.0005
	(0.0055)	(0.0090)	(0.0117)	(0.0129)	(0.0078)	(0.0084)	(0.0066)	(0.0070)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,729	3,703	3,668	3,569	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. [+] % of households living in dwellings categorized to be in "Good condition." [++] % of households with Television. [‡] % of households with motorcycles and scooters. [#] % of workers involved in agriculture. All the models are weighted by the mean population of district. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2.8: Checking for Differential Movements in Crime Rates

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0012*****	**-0.0029*****	**-0.0025***	**-0.0089*****	**-0.0025*****	**-0.0018****	**-0.0023*****	**-0.0026*****
	(0.0005)	(0.0007)	(0.0013)	(0.0016)	(0.0006)	(0.0007)	(0.0005)	(0.0006)
Lead Dummy	**-0.0128**	**0.0087**	**0.0378**	**-0.0797*****	**-0.0084**	**-0.0146**	**0.0034**	**-0.0054**
	(0.0121)	(0.0192)	(0.0272)	(0.0286)	(0.0142)	(0.0261)	(0.0127)	(0.0129)
Log Total Rainfall	-0.0752***	0.0157	-0.0291	-0.2563***	-0.0284	0.0290	-0.0404**	-0.0194
	(0.0192)	(0.0281)	(0.0449)	(0.0460)	(0.0219)	(0.0350)	(0.0194)	(0.0202)
Literacy rate	-0.0253***	0.0038	-0.0512***	-0.0005	-0.0046	-0.0137**	-0.0232***	-0.0128***
	(0.0038)	(0.0060)	(0.0085)	(0.0109)	(0.0048)	(0.0059)	(0.0043)	(0.0045)
Sex ratio	-0.0045***	0.0040*	-0.0038	0.0035	-0.0030*	-0.0009	-0.0012	-0.0020
	(0.0013)	(0.0021)	(0.0031)	(0.0038)	(0.0017)	(0.0019)	(0.0016)	(0.0015)
Urbanization rate	0.0085	0.0130	0.0233*	0.0362***	0.0035	-0.0023	0.0157**	0.0012
	(0.0057)	(0.0090)	(0.0122)	(0.0101)	(0.0069)	(0.0119)	(0.0078)	(0.0073)
Population density	-0.0001	0.0003*	0.0000	0.0007**	0.0005*	0.0005*	0.0001	0.0005**
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
% "Good houses"$^{+}$	-0.0037	-0.0135***	-0.0166***	0.0005	0.0048	0.0064	-0.0081***	0.0027
	(0.0023)	(0.0043)	(0.0063)	(0.0061)	(0.0032)	(0.0044)	(0.0031)	(0.0031)
Electricity use	0.0092***	0.0113***	0.0040	0.0070	0.0136***	0.0073**	0.0070***	0.0138***
	(0.0024)	(0.0036)	(0.0053)	(0.0056)	(0.0029)	(0.0035)	(0.0026)	(0.0026)
Television^{++}	-0.0031*	-0.0033	0.0078	0.0003	-0.0134***	0.0022	-0.0008	-0.0099***
	(0.0019)	(0.0034)	(0.0056)	(0.0061)	(0.0027)	(0.0034)	(0.0025)	(0.0026)
Two wheelers‡	-0.0010	-0.0440***	-0.0031	-0.0750***	0.0052	-0.0192	-0.0131*	0.0012
	(0.0060)	(0.0090)	(0.0147)	(0.0174)	(0.0078)	(0.0119)	(0.0069)	(0.0075)
% of Scheduled Caste	0.0298**	0.0238	0.0223	-0.0116	0.0018	0.0362	0.0145	-0.0046
	(0.0143)	(0.0326)	(0.0329)	(0.0414)	(0.0234)	(0.0398)	(0.0209)	(0.0230)
% of Scheduled Tribe	0.0121	0.0091	0.0142	-0.0472	-0.0159	0.0013	0.0033	-0.0190
	(0.0110)	(0.0249)	(0.0232)	(0.0324)	(0.0153)	(0.0267)	(0.0150)	(0.0146)
% Agricultural worker$^{\#}$	0.0103*	-0.0162*	-0.0007	-0.0165	-0.0065	-0.0067	0.0029	-0.0005
	(0.0055)	(0.0090)	(0.0117)	(0.0128)	(0.0077)	(0.0084)	(0.0066)	(0.0070)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,729	3,703	3,668	3,569	3,735	3,730	3,732	3,735

The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. $^{+}$ % of households living in dwellings categorized to be in "Good condition." $^{++}$ % of households with Television. ‡ % of households with motorcycles and scooters. $^{\#}$ % of workers involved in agriculture. All the models are weighted by the mean population of district. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

TableA2.9: Checking for Ashenfelter's Dip

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
Worker days per HH	**-0.0010****	**-0.0030*****	**-0.0029****	**-0.0079*****	**-0.0024*****	**-0.0016****	**-0.0024*****	**-0.0025*****
	(0.0004)	(0.0007)	(0.0012)	(0.0016)	(0.0006)	(0.0007)	(0.0005)	(0.0005)
Dip Dummy	**0.0136**	**0.0009**	**0.0669***	**0.0549**	**0.0126**	**0.1169****	**0.0383****	**0.0181**
	(0.0162)	(0.0272)	(0.0395)	(0.0362)	(0.0201)	(0.0540)	(0.0169)	(0.0177)
Log Total Rainfall	-0.0744***	0.0152	-0.0316	-0.2510***	-0.0279	0.0297	-0.0406**	-0.0191
	(0.0192)	(0.0281)	(0.0451)	(0.0457)	(0.0218)	(0.0353)	(0.0195)	(0.0201)
Literacy rate	-0.0250***	0.0036	-0.0519***	0.0017	-0.0043	-0.0130**	-0.0231***	-0.0126***
	(0.0037)	(0.0060)	(0.0086)	(0.0111)	(0.0048)	(0.0059)	(0.0043)	(0.0045)
Sex ratio	-0.0045***	0.0040*	-0.0038	0.0034	-0.0030*	-0.0010	-0.0013	-0.0020
	(0.0013)	(0.0021)	(0.0031)	(0.0038)	(0.0017)	(0.0019)	(0.0016)	(0.0015)
Urbanization rate	0.0087	0.0129	0.0229*	0.0375***	0.0036	-0.0019	0.0157**	0.0013
	(0.0057)	(0.0089)	(0.0122)	(0.0102)	(0.0069)	(0.0117)	(0.0078)	(0.0073)
Population density	-0.0001	0.0003*	0.0000	0.0007**	0.0005*	0.0005**	0.0001	0.0005**
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
% "Good houses"[+]	-0.0038	-0.0134***	-0.0165***	0.0001	0.0047	0.0061	-0.0082***	0.0026
	(0.0023)	(0.0043)	(0.0063)	(0.0062)	(0.0032)	(0.0043)	(0.0031)	(0.0031)
Electricity use	0.0092***	0.0113***	0.0041	0.0070	0.0136***	0.0075**	0.0070***	0.0138***
	(0.0024)	(0.0036)	(0.0053)	(0.0056)	(0.0029)	(0.0035)	(0.0026)	(0.0026)
Television[++]	-0.0031*	-0.0033	0.0078	0.0005	-0.0134***	0.0022	-0.0008	-0.0099***
	(0.0019)	(0.0034)	(0.0056)	(0.0061)	(0.0027)	(0.0034)	(0.0025)	(0.0026)
Two wheelers[‡]	-0.0015	-0.0437***	-0.0021	-0.0791***	0.0048	-0.0205*	-0.0133*	0.0009
	(0.0060)	(0.0090)	(0.0148)	(0.0176)	(0.0078)	(0.0114)	(0.0069)	(0.0074)
% of Scheduled Caste	0.0299**	0.0238	0.0221	-0.0110	0.0019	0.0364	0.0145	-0.0045
	(0.0143)	(0.0326)	(0.0329)	(0.0416)	(0.0234)	(0.0396)	(0.0209)	(0.0230)
% of Scheduled Tribe	0.0121	0.0091	0.0147	-0.0472	-0.0159	0.0018	0.0035	-0.0189
	(0.0110)	(0.0249)	(0.0233)	(0.0325)	(0.0153)	(0.0267)	(0.0151)	(0.0146)
% Agricultural worker[#]	0.0102*	-0.0161*	-0.0006	-0.0173	-0.0065	-0.0070	0.0028	-0.0006
	(0.0055)	(0.0090)	(0.0117)	(0.0128)	(0.0078)	(0.0084)	(0.0066)	(0.0070)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,729	3,703	3,668	3,569	3,735	3,730	3,732	3,735

Notes: The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. [+] % of households living in dwellings categorized to be in "Good condition." [++] % of households with Television. [‡] % of households with motorcycles and scooters. [#] % of workers involved in agriculture. All the models are weighted by the mean population of district. Errors are clustered at the Treatment-District level. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2.10: Dropping Phase-I Districts

	Murder	Kidnapping	Robbery	Riot	Theft	Burglary	Violent	Property
MGNREGA	**-0.0000**	**-0.0034*****	**-0.0020**	**-0.0132*****	**-0.0041*****	**-0.0033*****	**-0.0017****	**-0.0038*****
	(0.0006)	(0.0008)	(0.0019)	(0.0026)	(0.0007)	(0.0009)	(0.0007)	(0.0007)
Log Total Rainfall	-0.0844***	0.0331	-0.0615	-0.2550***	-0.0115	0.0558	-0.0455**	-0.0010
	(0.0224)	(0.0309)	(0.0539)	(0.0562)	(0.0237)	(0.0417)	(0.0211)	(0.0222)
Literacy rate	-0.0218***	0.0014	-0.0423***	0.0074	-0.0035	-0.0134**	-0.0209***	-0.0109**
	(0.0050)	(0.0070)	(0.0111)	(0.0145)	(0.0055)	(0.0063)	(0.0055)	(0.0051)
Sex ratio	-0.0030*	0.0072**	-0.0010	0.0126**	-0.0017	-0.0010	0.0013	-0.0009
	(0.0016)	(0.0028)	(0.0045)	(0.0054)	(0.0020)	(0.0026)	(0.0022)	(0.0019)
Urbanization rate	-0.0020	-0.0039	0.0023	0.0156	-0.0064	-0.0172**	-0.0010	-0.0123**
	(0.0054)	(0.0075)	(0.0141)	(0.0111)	(0.0060)	(0.0074)	(0.0075)	(0.0061)
Population density	0.0000	0.0006***	0.0004	0.0009***	0.0005**	0.0007**	0.0004**	0.0006**
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
% "Good houses"$^{+}$	0.0043	-0.0061	-0.0071	0.0123	0.0038	0.0096**	0.0004	0.0033
	(0.0026)	(0.0053)	(0.0081)	(0.0085)	(0.0040)	(0.0045)	(0.0037)	(0.0037)
Electricity use	0.0045	0.0014	-0.0081	-0.0037	0.0138***	0.0066	0.0006	0.0139***
	(0.0032)	(0.0048)	(0.0071)	(0.0076)	(0.0034)	(0.0053)	(0.0035)	(0.0032)
Television^{++}	0.0027	0.0079*	0.0290***	0.0049	-0.0118***	0.0094**	0.0096***	-0.0064**
	(0.0023)	(0.0041)	(0.0065)	(0.0081)	(0.0032)	(0.0037)	(0.0031)	(0.0031)
Two wheelers‡	0.0026	-0.0469***	-0.0072	-0.0708***	0.0108	-0.0134	-0.0138*	0.0086
	(0.0063)	(0.0105)	(0.0178)	(0.0196)	(0.0088)	(0.0106)	(0.0078)	(0.0083)
% of Scheduled Caste	0.0595***	0.0014	-0.0221	-0.0218	0.0051	0.0260	0.0024	-0.0082
	(0.0201)	(0.0357)	(0.0502)	(0.0772)	(0.0285)	(0.0331)	(0.0247)	(0.0273)
% of Scheduled Tribe	-0.0033	-0.0438*	-0.0497	-0.1233***	-0.0085	-0.0325	-0.0337**	-0.0195
	(0.0119)	(0.0245)	(0.0327)	(0.0408)	(0.0148)	(0.0234)	(0.0150)	(0.0137)
% Agricultural worker$^{\#}$	0.0041	-0.0095	-0.0042	-0.0236	-0.0034	-0.0117	-0.0006	0.0020
	(0.0072)	(0.0113)	(0.0151)	(0.0180)	(0.0086)	(0.0106)	(0.0083)	(0.0081)
District and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,380	2,369	2,341	2,230	2,385	2,381	2,382	2,385

Notes: The dependent variables are natural logarithms of crimes per 100,000 people in a district in a year. $^{+}$ % of households living in dwellings categorized to be in "Good condition." $^{++}$ % of households with Television. ‡ % of households with motorcycles and scooters. $^{\#}$ % of workers involved in agriculture. All the models are weighted by the mean population of district. Errors are clustered at the Treatment-District level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix 3. Derivation of the Rural Elasticity

Total Crime = Urban Crime + Rural Crime

$$C_T = C_U + C_R$$

Dividing throughout by total population (Pop_T)

$$\frac{C_T}{Pop_T} = \frac{C_U}{Pop_T} + \frac{C_R}{Pop_T}$$

$$or, \frac{C_T}{Pop_T} = \frac{C_U}{Pop_U}.\frac{Pop_U}{Pop_T} + \frac{C_R}{Pop_R}.\frac{Pop_R}{Pop_T}$$

where Pop_U is urban population and Pop_R is rural population

$$or, CR_T = CR_U.\theta_U + CR_R.\theta_R$$

where CR is crime rate and θ is population proportion

$$or, CR_T = CR_R\left(\frac{CR_U.\theta_U}{CR_R} + \theta_R\right)$$

Taking logarithms on both sides

$$\ln CR_T = \ln CR_R + \ln\left(\frac{CR_U.\theta_U}{CR_R} + \theta_R\right) \qquad (i)$$

Differentiating equation (i) with respect to x (NREGA)

$$\frac{\partial \ln CR_T}{\partial x} = \frac{\partial \ln CR_R}{\partial x}$$

$$+\frac{1}{\left(\frac{CR_U.\theta_U}{CR_R} + \theta_R\right)}.\left(\frac{\theta_U}{CR_R}.\frac{\partial CR_U}{\partial x} + \frac{CR_U}{CR_R}.\frac{\partial \theta_U}{\partial x} - \frac{CR_U.\theta_U}{{CR_R}^2}.\frac{\partial CR_R}{\partial x} + \frac{\partial \theta_R}{\partial x}\right) \qquad (ii)$$

Assuming that NREGA has no effect on urban crime rate, and urban and rural population ratios i.e.

Putting $\frac{\partial CR_U}{\partial x} = 0$ $\frac{\partial \theta_U}{\partial x} = 0$ and $\frac{\partial \theta_R}{\partial x} = 0$ in equation (ii) we get

$$\frac{\partial \ln CR_T}{\partial x} = \frac{\partial \ln CR_R}{\partial x} + \frac{1}{\left(\frac{CR_U.\theta_U}{CR_R} + \theta_R\right)}.\left(\frac{-CR_U.\theta_U}{{CR_R}^2}\right).\frac{\partial CR_R}{\partial x}$$

$$or, \frac{\partial \ln CR_T}{\partial x} = \frac{\partial \ln CR_R}{\partial x} - \left(\frac{CR_R}{CR_U\theta_U + CR_R\theta_R} . \frac{CR_U\theta_U}{CR_R} \right) . \frac{1}{CR_R} . \frac{\partial CR_R}{\partial x}$$

$$\text{Writing } \frac{1}{CR_R} . \frac{\partial CR_R}{\partial x} = \frac{\partial \ln CR_R}{\partial x} \text{ and } CR_U\theta_U + CR_R\theta_R = CR_T$$

$$\frac{\partial \ln CR_T}{\partial x} = \frac{\partial \ln CR_R}{\partial x} - \left(\frac{CR_R}{CR_T} . \frac{CR_U\theta_U}{CR_R} \right) . \frac{\partial \ln CR_R}{\partial x}$$

$$\text{Putting } \frac{\partial \ln CR_T}{\partial x} = \hat{\beta}_T,$$

$$\hat{\beta}_T = \frac{\partial \ln CR_R}{\partial x} . \left(1 - \frac{CR_U\theta_U}{CR_T} \right)$$

$$or, \hat{\beta}_T = \hat{\beta}_R . \left(\frac{CR_T - CR_U\theta_U}{CR_T} \right)$$

$$or, \hat{\beta}_R = \hat{\beta}_T . \left(\frac{CR_T}{CR_T - CR_U\theta_U} \right) \quad (iii)$$

Now the Mean of Total Crime Rates (Urban + Rural) in the sample are the following:

Total (Urban + Rural)							
Murder	**Kidnap**	**Robbery**	**Burglary**	**Theft**	**Riots**	**Violent**	**Property**
2.9	2.5	1.6	7.8	18.7	5.5	7.04	28.1

And the crime rates of the 37 cities all taken together (in 2011) are the following:

Crime Rates of 37 Cities							
Murder	**Kidnap**	**Robbery**	**Burglary**	**Theft**	**Riots**	**Violent**	**Property**
2.82	4.99	5.22	15.54	78.55	7.74	16.62	94.09

The share of urban population in our sample is 22.5%. The 37 cities accounted for 7.8% of the total sample population in 2011. Therefore, to get the Lower Bound of our estimates for the rural population we apply the total Crime Rates of the sample to the urban population as well. That implies putting $CR_T = CR_U$ in Equation (iii). We also put $\theta_U = 22.5$ in Equation (iii). Then Equation (iii) simplifies to $\hat{\beta}_R = 1.3 * \hat{\beta}_T$ for all crime heads.

To get the Upper Bound we assume that the crime rates of the 37 cities, representing 7.8% of the population is representative of all the urban population (22.5%) in the sample. If we assume that then $\hat{\beta}_R = \eta * \hat{\beta}_T$ where η takes the following values for the respective crime heads:

Multipliers

Murder	Kidnap	Robbery	Burglary	Theft	Riots	Violent	Property
1.3	1.8	3.8	1.8	18.2	1.5	2.1	4.1

Our Baseline Estimates of $\hat{\beta}_T$ are the following:

Murder	Kidnap	Robbery	Burglary	Theft	Riots	Violent	Property
-0.001	-0.003	-0.0029	-0.0016	-0.0024	-0.0079	-0.0024	-0.0025

Therefore the Upper and Lower bounds of $\hat{\beta}_R$ will be :

LB	UB	LB	UB	LB	UB	LB	UB
Murder		**Kidnap**		**Robbery**		**Burglary**	
-0.001	-0.001	-0.004	-0.005	-0.004	-0.01	-0.002	-0.003
Theft		**Riots**		**Violent**		**Property**	
-0.003	-0.044	-0.010	-0.012	-0.003	-0.005	-0.003	-0.01

The implied Elasticities for rural crimes are (Absolute values):

LB	UB	LB	UB	LB	UB	LB	UB
Murder		**Kidnap**		**Robbery**		**Burglary**	
0.01	0.01	0.03	0.05	0.03	0.09	0.09	0.10
Theft		**Riots**		**Violent**		**Property**	
0.03	0.36	0.09	0.1	0.03	0.04	0.03	0.08

Appendix 4. Details of the Health Index

The village questionnaire asks about the accessibility to health facility in the village, starting from government assigned health worker to a government hospital. If a particular facility is not available in the village the questionnaire asks about the distance to the nearest facility. I first assign values of 1 to 6 to all individuals in a village depending on the level of facility available in the village, with a child health worker, which is also called Integrated Child Development Service provider (ICDS) getting the lowest value and a hospital getting the highest. For a facility which is less than 5 kilometers from the village I assign a value of 0.5 less than the value assigned for that particular facility if it had been in the village. For example, if a government hospital is available in the village it gets a value of 6 but if a government hospital is less than 5 kilometers from the village then the village gets a value of 5.5. This method of assigning values accounts for the fact that a village with a ICDS worker but far away from a hospital will have less access to health facilities compared to a village which does not have any health facility in it but is less than 5 kilometre away from a government hospital. Then I add up the values for each village to create the health facility index. This index provides a measure of the overall health facility environment around the village. The index takes a value from 0 to 34. The various kind of health facilities that are accounted for, their score in the index and the percentage of villages with each type of facility is detailed in Table-3.A1.

Table A4.1: Description of the Health Index

Type of health facility	% of villages with the facility	Score given	% of villages <5 km from the facility	Score given
ICDS	88.7	1	7.3	0.5
Health Sub Centre	40.7	2	34.5	1.5
Primary Health Centre	15.9	3	26.4	2.5
Indian System of Medicine	11.7	3	16.9	2.5
Community Health Centre	5.7	4	12.9	3.5
Government Dispensary	9.4	5	16.9	4.5
Private Clinic	21.8	5	21.5	4.5
Government Hospital	5.1	6	7.5	5.5
Private Hospital	7.2	6	12.6	5.5

Appendix 5. Supplementary Tables for Chapter 3

Table A5.1: Basic Specification with Robust Standard Errors

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0259**	0.0207**	0.0023	0.0052**
	(0.0102)	(0.0087)	(0.0032)	(0.0022)
N	486,739	486,739	486,739	486,739
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0025**	0.0121*	-0.0009	
	(0.0012)	(0.0067)	(0.0026)	
N	486,739	486,739	486,739	

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. All the models control for the same variables as Table 3.2. Standard errors are robust. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5.2: Assigning Treatment = 0.4 for Phase-II

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0351***	0.0263***	0.0036	0.0070***
	(0.0110)	(0.0096)	(0.0036)	(0.0023)
N	486,739	486,739	486,739	486,739
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0029**	0.0143**	-0.0008	
	(0.0013)	(0.0070)	(0.0026)	
N	486,739	486,739	486,739	

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. All the models control for the same variables as Table 3.2. Standard errors are clustered at the district. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5.3: Assigning Treatment=0.6 for Phase-II

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0322***	0.0237***	0.0038	0.0055**
	(0.0103)	(0.0091)	(0.0032)	(0.0023)
N	486,739	486,739	486,739	486,739
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0028**	0.0127*	-0.0002	
	(0.0011)	(0.0067)	(0.0023)	
N	486,739	486,739	486,739	

The dependent variables are dummies. All the models are weighted by the weighted aggregate number of respondents in a district. All the models control for the same variables as Table 3.2. Standard errors are clustered at the district. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5.4: Basic Specifications Weighted by Sample Weights

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0259**	0.0207**	0.0023	0.0052**
	(0.0102)	(0.0087)	(0.0032)	(0.0022)
N	486,739	486,739	486,739	486,739
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0025**	0.0121*	-0.0009	
	(0.0012)	(0.0067)	(0.0026)	
N	486,739	486,739	486,739	

The dependent variables are dummies. All the models are weighted by individual sample weights. All the models control for the same variables as Table 3.2. Standard errors are clustered at the district. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5.5: Basic Specification with No Weights

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0276***	0.0246***	0.0029	0.0061***
	(0.0101)	(0.0084)	(0.0032)	(0.0021)
N	486,739	486,739	486,739	486,739
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0025**	0.0141**	-0.0004	
	(0.0012)	(0.0064)	(0.0020)	
N	486,739	486,739	486,739	

The dependent variables are dummies. All the models control for the same variables as Table 3.2. Standard errors are clustered at the district. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5.6: Basic Specification with State-by-year Fixed Effects.

	Currently using any method of Contraception	Currently using any modern method of Contraception	Currently using condoms	Currently using pills
Dif-in-Dif	0.0279**	0.0260***	0.0051	0.0059***
	(0.0114)	(0.0099)	(0.0036)	(0.0020)
N	486,739	486,739	486,739	486,739
	Currently using IUD	Female Sterilization	Male Sterilization	
Dif-in-Dif	0.0032***	0.0131*	-0.0005	
	(0.0012)	(0.0072)	(0.0024)	
N	486,739	486,739	486,739	

The dependent variables are dummies. All the models are weighted by individual sample weights. All the models control for the same variables as Table 3.2. Standard errors are clustered at the district. * p < 0.1, ** p < 0.05, *** p < 0.01.

Vita

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