Public Sector Job Guarantees and Family Planning Choices in Rural India

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Abstract

We exploit the staggered timing of an employment guarantee program in rural India to investigate how providing work opportunities affects women's use of family planning methods. Using survey data from rural India, we employ a difference-in-differences strategy and inverse probability of treatment weighting techniques to estimate causal effects. Results suggest an increase of 2 percentage points (a 3% increase) in the use of modern family planning methods among married women with the introduction of an employment guarantee program. Analysis of heterogeneous impacts suggest that our main results are driven by women of all age groups and wealth categories. We also find that the women's average age at first birth increases by 0.1 years while family member opposition to contraception falls. These results provide empirical evidence that employment guarantees that include women's employment can affect family planning choices, with important implications for economic development outcomes.

Keywords: workfare programs, family planning, contraceptive use, India

JEL Codes : I38, J13

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1. Introduction

In rural areas of developing countries, family planning has important implications for human capital investments (Miller 2010), labor market decisions (Jensen 2012; Van den Broeck 2020), and economic development outcomes (Canning and Schultz 2012). According to the United Nations (UN), contraceptive prevalence is a key indicator for measuring improvements in reproductive health and is an indicator used to assess progress towards the UN Sustainable Development Goals. Yet, in developing countries, contraceptive use often remains low. For example, in India in 2019, just 67 percent of married women of reproductive age used contraception of any form, compared with 82 percent in the Republic of Korea in 2018 (United-Nations 2022).[3] Explanations for this low use of contraceptives include lack of information about contraceptive methods, barriers to accessing modern contraception (Cleland et al. 2006), women's perception of husband opposition (Ashraf, Field, and Lee 2014), intimate partner violence (McCarthy 2019), women's preference for large families (Gage 1995), income constraints (Palamuleni 2013), and lack of financial autonomy for women (Westeneng and d'Exelle 2015; Van den Broeck 2020).

Van den Broeck (2020) demonstrates that labor market participation, particularly off-farm wage employment for rural women can overcome some factors limiting contraceptive use in developing countries. This occurs because women who work add to total household income while increasing their share of total income. As a result, women experience greater autonomy and improved bargaining power in household decisions related to safe sex and reproduction.

Across the developing world, there are several examples of public workfare programs that provide employment opportunities and act as a source of employment and income for the poor.[4] For example, Ethiopia has the Productive Safety Net Program, Argentina has the Programa de Jefes y Jefas de Hogar, and Rwanda has Umereng Vision 2020. Finally, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in India is the largest workfare program in the world, with a total expenditure of 696.18 billion Indian

[3] Data are available at https://www.un.org/development/desa/pd/data/world-contraceptive-use

[4] In the past, developing countries have used public workfare programs to lift poor people out of poverty. For example, the Maharashtra Employment Guarantee Scheme in India, 1975-89, and Food for Work Program in Bangladesh, 1987-88, have provided major relief in response to drought and famine (Ravallion 1991)

rupees (8.5 billion US dollars using 2023 exchange rates) in the 2018-2019 fiscal year (Ministry of Rural Development, Government of India). Importantly, MGNREGA stipulates that at least one-third of beneficiaries be women who are paid wages equal to those of men. Further, women participating in MGNREGA receive wages directly in a personal bank account. Therefore, the creation of job opportunities and income controlled directly by women has the potential to affect choices about family size and the timing of childbirth while increasing the role of women's' preferences in decisions (Jensen 2012; Van den Broeck 2020).

Despite the potential for job programs to influence family planning decisions, to our knowledge, this has not been demonstrated empirically. To bridge this gap, we explore the impacts of a government-sponsored job guarantee program on the use of contraception in rural India. To estimate the impact of MGNREGA on contraceptive use, we use data from the largest demographic and health survey carried out in India, the District Level Household and Facility Survey (DLHS). Following Chari et al. (2019), we exploit the phased roll out of MGNREGA at the district level to estimate a difference-in-differences (DiD) model. Because the MGNREGA rollout was targeted rather than random, treatment endogeneity complicates the estimation of causal impacts. We address this challenge by using the inverse probability of treatment weighting technique (Hirano, Imbens, and Ridder 2003). We also demonstrate robustness to other methods, including propensity score matching, and coarse exact matching. We also discuss the possible causal pathways that link workfare programs to reproductive choices.

We find that married women in rural districts increased their use of modern methods of family planning after the introduction of MGNREGA by an average of 2 percentage points. Analysis of heterogeneous impacts suggest that our main results are driven by women of all ages and from all wealth categories. Women's average age at first birth increases by 0.1 years while opposition to contraception from husbands (and other family members) falls. Finally, we demonstrate that this result holds using alternative matching methods and an event study design. Likely mechanisms for this impact include reduced unemployment for women compared to men, increased wages paid to women, and the facilitation of migration in states that poorly implemented the program (Merfeld 2019).

Our paper builds on three important areas of research in development economics. First, a wide range of studies has explored how labor market participation, particularly among female household members, influences contraceptive use in developing countries. For example, in Togo, Gage (1995) found that women who work outside the home are significantly more likely to use modern methods of contraception. Anderson and Eswaran (2009), in Bangladesh, found that women working outside the home have greater bargaining power in household reproductive decisions. More recently, Van den Broeck (2020) found that employed Ugandan women are more likely to use contraceptive methods. Additional studies in developing countries have found that women's economic power leads to safer sexual relations with husbands and an increase in the intention to use family planning services (Gage 1995; Hogan, Berhanu, and Hailemariam 1999). Here, we build on this literature by exploring if jobs created as part of workfare program impact contraceptive use in similar ways.

Second, there is a broader development economics literature examining contraceptive use and family planning decisions in developing countries. This literature has revealed how family planning programs impact contraceptive use (Karra et al. 2022), birth rates (Joshi and Schultz 2013; McCarthy 2019), and other economic outcomes (Canning and Schultz 2012). For example, D'Exelle and Ringdal (2022) demonstrate that involvement in family planning meetings at a health center in rural Tanzania increases the uptake of contraceptives.

Third, we contribute to a sizeable literature that studies the wide array of outcomes associated with public workfare/job guarantee programs. For example, existing literature has explored MGNREGA's impact on labor markets (Azam 2011; Imbert and Papp 2015; Zimmermann 2012; Muralidharan, Niehaus, and Sukhtankar 2017; Berg et al. 2018; Deininger and Minten 2002; Merfeld 2020), health (Chatterjee and Merfeld 2021; Chari et al. 2019; Dasgupta 2017), conflict (Fetzer 2020), agricultural productivity (Varshney, Goel, and Meenakshi 2018; Gazeaud and Stephane 2020), and human capital accumulation (Ajefu and Abiona 2019). Specifically, Ajefu and Abiona (2019) found that MGNREGA increased women's engagement in the labor market and reduced children's engagement in school in response to rain shocks. Chatterjee and Merfeld (2021) found that MGNREGA decreased sex-selection in children during lean agricultural seasons. Chari et al. (2019) found that

MGNREGA increased neonatal mortality and Imbert and Papp (2015) and Zimmermann (2012) use different econometric methods – the former used a difference in difference strategy and the latter used regression discontinuity – to reveal that MGNREGA raised private sector wages, especially for women.[5] In combination with the literature that has revealed the impact of labor market participation on family planning, the estimated impacts of MGNREGA reveal several pathways through which MGNREGA could affect contraceptive use across rural India.

By bridging the gap between workfare programs and contraceptive use, we highlight a previously unrecognized unintended consequence of workfare programs. By exploiting the exogeneity of labor market opportunities created by MGNREGA, we also provide insight into how labor market opportunities that include women's employment more generally can contribute to family planning in rural areas of developing countries. As rural economies diversify, this has potentially broad consequences for the future of agrarian economies across the globe.

The rest of this paper is organized as follows. In the next section, we provide relevant details on MGNREGA in India and how it may impact family planning and contraceptive choices. Then, we introduce the data and the empirical strategy followed by results. Finally, we discuss our results and provide conclusions.

2. Institutional background and impact pathways

In this section, we describe details of MGNREGA to further motivate how it could impact family planning and contraception decisions. We also describe the various impact pathways through which work programs can affect family planning. These details demonstrate the diverse pathways that can ultimately lead workfare programs to impact family planning and contraceptive use.

2.1. National Rural Employment Guarantee Act

The National Rural Employment Guarantee Act, established in 2005, had the primary objective of enhancing livelihood security for households in rural areas of India by providing

[5] See (Sukhtankar and others 2016) for a synthesis of the literature on MGNREGA.

at least 100 days of guaranteed minimum wage employment in every fiscal year.[6] Common public work activities include water conservation and harvesting, drought-proofing for agricultural purposes, building irrigation canals, renovation of traditional water bodies, land development, flood control and protection, and rural transportation infrastructure improvements. The conditions of rural employment guaranteed by MGNREGA include that at least a third of the beneficiaries must be women with wages equal to those of men.[7] [8] The central government bears the major cost of the program, which includes the payment of wages and up to three-fourths of the material costs for public works. The state government is liable for unemployment allowances and one-fourth of the material costs of the public works.

The scheme was rolled out in three phases across three years (2006, 2007 and 2008). In the first phase, 200 districts were included in the scheme, and 130 and 270 districts were included in the second and third phase respectively. The rollout was not random. The scheme targeted poor districts first. Critical to the empirical strategy of this article is the way MGNREGA was rolled out. We exploit this variation in implementation timing to estimate the impact of MGNREGA on the use of family planning methods among currently married women. Figure 1 shows a map of the three phases of the scheme roll out as well as how we group districts into treatment and control groups for our empirical analysis.

According to the Ministry of Rural Development in India, women constituted 54.54 percent of program participants in 2021-22 of participants in MGNREGA, up from 40% in 2006-2007.[9] Existing evidence suggests that women's share of work under MGNREGA is greater than their share of work in the labor market across all states (Shah et al. 2015).[10] These findings suggest that MGNREGA had higher effects on employment for rural women

[6] The program was renamed to the Mahatma Gandhi National Rural Employment Guarantee Act in 2009.
[7] In 2012, the Government of India, mandated that MGNREGA wages be deposited directly to the bank accounts of workers to avoid corruption and leakages. Available at https://nrega.nic.in/Circular_Archive/archive/Operational_guidelines_4thEdition_eng_2013.pdf
[8] Other conditions include: a. The adult members of each household who live in rural areas and are willing to do unskilled manual labour may submit their names, age and household address to the village governing body (Gram Panchayat) at the village level for the issue of a job card. b. Each adult member who has a job card is guaranteed employment for up to 100 days in a given fiscal year within 15 days of the request for work. c. A minimum of 14 days of continuous employment with no more than 6 days per week.
[9] Available at https://rural.nic.in/en/press-release/participation-rural-women-mgnregs
[10] Available at https://nrega.nic.in/Circular_Archive/archive/MGNREGA_SAMEEKSHA.pdf

than for rural men. Our goal is to examine if this led to changes in the use of contraceptives across rural India.

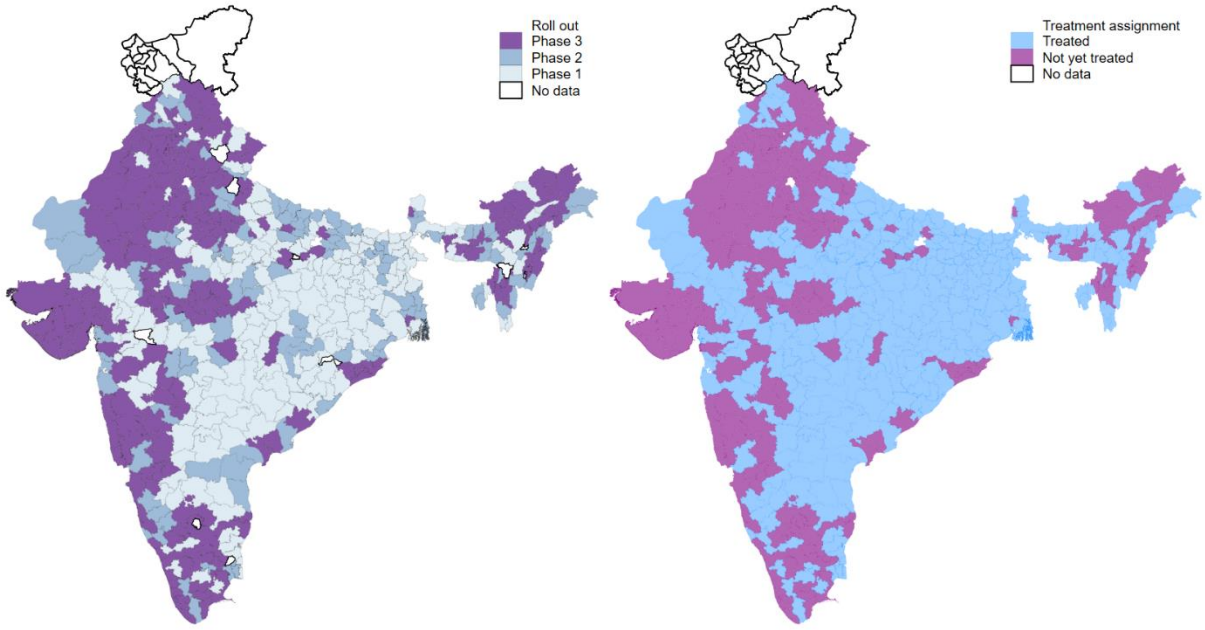

Figure 1a (left). The three phases of MGNREGA scheme roll out. Rural Indian districts color-coded to distinguish different phases. Source: Own calculation based on 2001 census boundaries. **Figure 1b (right).** Treatment assignment: Districts in Phases 1 and 2 are classified as treated, while districts in Phase 3 are classified as not yet treated (and serve as a control group in our analysis).

2.2. Impact pathways: jobs programs and contraceptive use

This subsection provides insight into the pathways through which MGNREGA may influence contraceptive use, and ultimately the number of children and the timing of births (see Figure 2). In Figure 2, the arrows indicate different impact pathways that connect MGNREGA to the use of contraceptives. The boxes label intermediate outcomes while the numbered arrows describe 5 different pathways that we hypothesize based on evidence in the existing

literature. These pathways include 1) increased household income, 2) changes in female labor market participation, financial autonomy, and bargaining power, 3) changes in norms and attitudes towards contraception, in household income, 4) composition effects and selection, and 5) changes in the nature of work and demand for children. In the Appendix section B, we explore these pathways using our data.

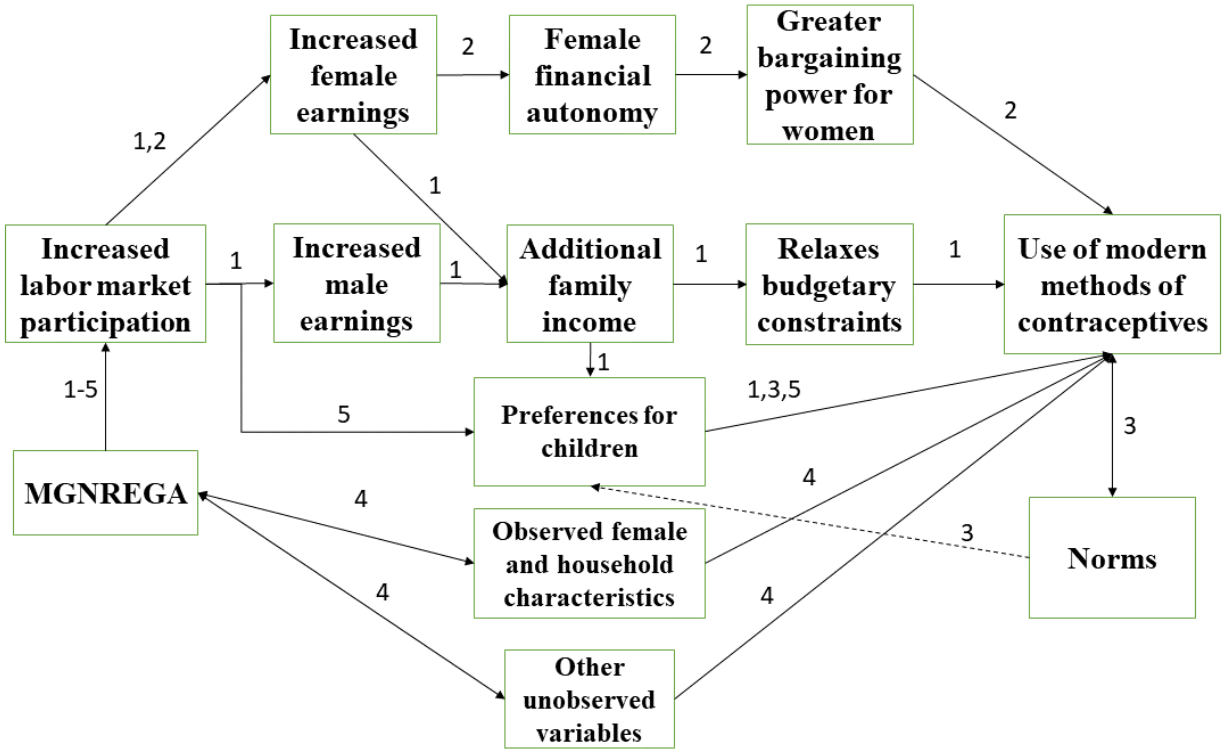

Figure 2. Mechanisms through which MGNREGA affects contraceptive use.

Note: Figure describes the pathways through which a job guarantee program can affect use of contraceptives. The boxes describe intermediate outcomes along each pathway while the numbers on the arrows label the 5 pathways: 1) increased household income, 2) changes in female labor market participation, financial autonomy, and bargaining power, 3) changes in norms and attitudes towards contraception, in household income, 4) composition effects and selection, and 5) changes in the nature of work and demand for children.

3. Data

This section details the data used in our analysis. Our primary data source is the District Level Household and Facility Survey (DLHS), which provides data on women's reproductive health. We combine data from multiple sources to construct district-level variables used in the analysis (see Appendix Table A1 for a list of sources).

3.1. Data

We use the District Level Household and Facility Survey (DLHS) collected by the Ministry of Health and Family Welfare, Government of India to study the reproductive and maternal health, including the use of family planning methods by married women. The DLHS is one of the largest demographic and health surveys carried out at regular intervals in India. The DLHS data sets are available from the International Institute for population Sciences. In rural areas, DLHS employs a two-stage (many villages in a district) stratified probability proportional to size sampling design.[11] Households are primary sampling units in the DLHS. We use rounds 2 and 3, collected in 2002-2004 and 2007-2008.[12][13] The surveys are repeated cross-sections of households which cover detailed questionnaires on topics of maternal and child health, family planning and other reproductive health services. The DLHS round 2 (2002-2004) is pre-treatment year and the DLHS round 3 (2007-2008) comes after the implementation of the first phase of treatment and before the implementation of third phase. DLHS datasets have outcome variables that include family planning methods, women's age at first birth, surviving number of children, and the timing of last pregnancy.

3.2. MGNREGA districts: Treated versus not-yet-treated

As previously mentioned, MGNREGA was implemented in three phases. The first phase was rolled out in 2006, the second phase occurred in 2007, and the third phase was implemented in 2008. In order to combine DLHS data with MGNREGA treatment timing, we label districts in the first and second phases as treated (282 districts) and the districts in the third phase (198 districts) as not yet treated. Figure 1b shows a map of the treated and not yet treated districts. We apply Inverse Probability of Treatment Weighting (IPTW) to match districts based on observable characteristics. We follow literature to include pre-program

[11] More information about the DLHS sample selection is obtained at rchiips.org

[12] DLHS-2 reference period is from January, 1999-2001 to survey date and DLHS-3 reference period is from January 2004 to survey date

[13] We do not include first round of DLHS data set. The first round took place from 1998 to1999. From 1998 to 2008, many districts and state geographical boundaries changed. Parent districts were divided into many child districts and hence, assigning treatment and control groups becomes difficult. Therefore, we use DLHS-2 only as pre-treatment period and DLHS-3 as post treatment period.

district-level characteristics such as total population, percent rural, district area, percent scheduled castes and tribes, percent literate, average monthly per capita consumption expenditure, average casual wage, labor force participation rate (and female), rainfall and growing degree days (growing season is June through September). Then we exploit the variation in timing of the treatment to employ a difference-in-differences (DiD) estimator. This DiD strategy compares the outcomes in households in districts included in first and second phases (Early) to the households in districts included in the third phase (Late).

3.3. Family Planning Methods

This section reviews the contraceptive methods available to women in the sample and their characteristics. The main dependent variable used in this analysis indicates if a married woman uses any family planning methods. This information was obtained from a question on contraception and fertility preferences in the individual woman's questionnaire in the DLHS. Women were asked the question: Are you/your husband currently doing something or using any method to delay or avoid getting pregnant? If the woman reported that she was using any method, she was coded 1; if she reported she was not, she was coded 0.

To augment the analysis, we categorize the types of planning methods into modern and traditional family planning methods. Modern methods include permanent contraceptives, such as female and male sterilization; Long-acting reversible contraceptives (LARCs), such as injectables and intrauterine devices: IUD/Copper-t/Loop; and Oral pills, female condom and a male condom (*Nirodh*). Traditional methods include the use of rhythm, periodic abstinence, and withdrawal.

According to DLHS round 3 (2007-2008), about 72% of the users of modern contraceptive methods paid money to buy contraceptives such as intra-uterine devices, daily or weekly pills, female or male condoms, and injectables. Murro et al. (2021) shows that the annual cost of contraception varies between 11 and 397 Indian rupees (US $0.16 to $5.41) depending on the types of contraceptives used. In India, modern methods of contraceptives including oral pills, and female and male condoms do not require medical prescriptions and can be available over the counter but may require husband and or family members (especially the mother-in-law) approval, for example in the case of sterilization. Not all modern methods are easily accessible in rural areas depending on the socio-culture norms and the community

access to health care services. Therefore, there may be concern for supply constraints in rural areas of the country. For example, it is possible that birth control supplies changed at the same time as MGNREGA. However, according to the third round of the DLHS (2007-2008), less than 4% of contraceptive users in rural India ever faced difficulty in getting any methods of family planning. This provides suggestive evidence that supply is rarely the constraining factor in observed use of contraceptives. We also know of no national level program expanding contraceptives supplies that systematically correlated with the roll out of MGNREGA.

According to the DLHS-3, about 43 percent of contraceptive users obtained contraception from government hospitals, followed by primary health centers and pharmacies and private hospitals (43%, 15% and 10%, respectively). Among the members of rural Indian households that have ever used contraceptives, a little less than three-fourths have paid money in 2007-2008 for pills, female and male condoms, and injectables. Therefore, MGNREGA wages would allow the purchase of contraceptives.

4.1.3. Descriptive Statistics

In the second round of the DLHS (2002-2004), data were collected on 507,622 women aged 15 to 44 who are currently married. In the third round of the DLHS (2007-2008), data were collected on 643,944 ever-married women aged 15 to 49 and 166,620 unmarried women aged 15 to 24. From this data, we focus on the sample of currently married women aged 15 to 44 who are not currently pregnant. Under the MGNREGA Act of 2005, individuals 18 years of age or older are eligible to work under the program. Therefore, we restricted the sample to people 18 years of age and older. The resulting sample includes 292,810 women in 2002-2004, and 350,210 women in 2007-2008.

Table 1 presents the individual summary statistics, IP-weighted, by treatment groups. More than half of currently married women in treatment and untreated districts used family planning methods. About 48% used modern contraception in treated districts and about 44% in untreated districts. Fewer than 10% of currently married women used traditional contraceptive methods in both treated and untreated districts. In our sample, women's sterilization is the most common modern method and men's sterilization is the least common method of contraception. Oral pills, and male and female condoms remain very low at less

than 8% in rural areas. Intrauterine device (IUD) for currently married women is less than 5% in both treated and untreated districts. The traditional method of contraception is about 12% in treatment districts and 14% in untreated districts. Appendix Table A2 presents individual summary statistics before the match.

Table 1. Individual Summary Statistics

	Pre-Program (2002-2004)		
	Treated	Control	Diff. (p-val.)
Outcomes (including all women in the sample)			
Any family planning methods	0.551	0.517	0.282
	(0.497)	(0.499)	
Any modern methods	0.478	0.438	0.179
	(0.500)	(0.496)	
Any traditional methods	0.074	0.079	0.638
	(0.261)	(0.269)	
Among women who are currently taking contraceptives			
Female sterilization	0.663	0.630	0.260
	(0.473)	(0.483)	
Male sterilization	0.022	0.018	0.365
	(0.147)	(0.133)	
Intrauterine Devices (IUDs)	0.033	0.044	0.128
	(0.180)	(0.204)	
Oral pills	0.071	0.081	0.446
	(0.256)	(0.273)	
Condom	0.072	0.073	0.928
	(0.258)	(0.260)	
Rhythm/Periodic abstinence/Withdrawal	0.122	0.144	0.234
	(0.327)	(0.351)	
Individual-level characteristics			
Women age in years	30.466	30.701	0.097
	(7.262)	(7.230)	
Women can read or write	0.466	0.449	0.524
	(0.499)	(0.497)	
Spouse can read or write	0.713	0.698	0.407
	(0.452)	(0.459)	
Number of children	2.671	2.762	0.275
	(1.664)	(1.755)	
Household-level characteristics			
Religion: Hindu	0.800	0.710	0.085
	(0.399)	(0.456)	
Scheduled Castes/Tribes	0.351	0.393	0.347
	(0.477)	(0.489)	

Note: The IP-weighted mean is reported. Standard deviations are in parentheses. Sample is restricted to common support region. Treated includes phase one and two districts, and control includes phase three districts. The third

column, difference, is calculated with WLS regressions and clustered standard errors at the district level. Source: DLHS round 2 (2002-2004).

While there are many variables that may influence contraceptive use, for the purpose of our analysis, we focus on women's age, reading or writing ability, number of surviving children, social groups, and religion. On average, the age of women is about 30 years old and less than half of them can read or write. Slightly less than three-fourths of husbands in the sample can read or write. 35% of households in treated districts belong to scheduled castes while 39% do in untreated districts[14]. Married women in rural areas bore just under 3 children, on average, in both treated and untreated districts. About 42% (39%) of modern methods of contraception are used by married woman under the age of 35 years in treated (untreated) districts. About 62% (55%) of modern methods of contraception are used by married women aged 35 years and older in treated (untreated) districts.

Table 2 presents district-level summary statistics. There are 282 districts in the treated group and 198 districts in the control group. Examining point estimates, treatment districts tend to be slightly larger and more populated on average. Compared to control districts, treated districts have a slightly greater percentage of scheduled castes, but a lesser percentage of scheduled tribes. Both groups have similar literacy rates. Additionally, households in both groups have similar average monthly per capita consumption expenditures (MPCE) of around 3,500 Indian rupees. the labor force participation rate is about two thirds in both groups. Control districts have more rainfall than treated districts on average. The p-value in column 3 of Table 2 indicates that district-level variables do not statistically differ across treated and untreated districts.

Table 2. District Summary Statistics

	Pre-Program (2002-2004)		
	Treated	Control	Diff. (p-val.)
Propensity score	0.540	0.580	0.412
	(0.309)	(0.264)	
Total Population (in thousands)	1685.455	1423.395	0.125
	(1374.647)	(1140.525)	
Percent rural	0.791	0.799	0.674
	(0.145)	(0.114)	
Area (in square km)	116.355	109.100	0.650

[14] Scheduled castes or tribes represent the groups of marginalized castes in Indian society.

	(143.130)	(135.001)	
Percent Scheduled Castes	0.157	0.141	0.282
	(0.088)	(0.094)	
Percent Scheduled Tribes	0.143	0.218	0.209
	(0.223)	(0.344)	
Percent Literate	0.547	0.535	0.457
	(0.118)	(0.100)	
Average MPCE	3524.572	3466.498	0.704
	(1057.067)	(1076.334)	
Average casual wage	329.410	334.066	0.671
	(134.240)	(133.176)	
Labor force participation rate	0.657	0.669	0.493
	(0.089)	(0.105)	
Female labor force participation rate	0.201	0.220	0.225
	(0.095)	(0.106)	
Rainfall (mm)	1217.950	1404.769	0.268
	(712.139)	(1113.264)	
Growing degree days	2366.131	2251.824	0.207
	(462.101)	(603.619)	
Number of observations	152,370	104,455	571,080
Number of districts	282	198	480

Note: Standard deviations are in parentheses. Sample restricted to common support region. Treated includes phase one and two districts, and control includes phase three districts. The third column, difference, is calculated with WLS regressions and clustered standard errors at the district level. MPCE refers to the monthly per capita consumption expenditure. Average MPCE and casual wage are in 2004-2005 prices.

4. Econometric Specification and Identification

We estimate the impact of MGNREGA on family planning decisions by exploiting the rollout of MGNREGA at the district level within a difference-in-difference model. As mentioned before, districts in Phases 1 and 2 are in the treated group, while districts in Phase 3 are in the control group. In addition to heterogeneity in our main treatment impact, we explore other outcomes that result from MGNREGA, such as the age of women at first birth, the number of children born, the year of the last pregnancy, and attitudes of husbands (and family members) towards contraception.[15] Our main estimating equation is given by

$$y_{ihdt} = \beta_0 + \beta_1 MGNREGA_d * Post_t + \xi X_{ihdt} + \alpha_d + \phi_{st} + \lambda_{mt} + \varepsilon_{ihdt} \quad (1)$$

where y_{ihdt} is the use of family planning methods for (female) individual i in household h in district d at time t; $MGNREGA_d$ is a dummy variable, equal to 1 if the public workfare

[15] We also investigate heterogeneous effects that are based on the percentage of agricultural workers, lean and peak agricultural seasons, education level, castes and tribes. The results are available upon request.

program is available in district d in (or prior to) 2002-2004 (it represents our treatment designation); $Post_t$ is a dummy variable equal to one for DLHS round 3 (2007-2008) when MGNREGA had been implemented in treatment districts ; X_{ihdt} includes a set of individual and household-level controls. Individual characteristics include the age of women, an indicator of whether women can read or write, an indicator of whether their husband can read or write, and the number of children they have given birth to that survived. Household characteristics include religious and social groups. α_d are district fixed effects, which control for time-invariant characteristics of each district that could impact the use of contraceptives ($MGNREGA_d$ is absorbed by this fixed effect); ϕ_{st} are state-year fixed effects which controls for common time-varying shocks at the state level (this includes $Post_t$). For example, because healthcare is a state-level service in India, different states have different health-related policies, infrastructure, and services that change over time. λ_{mt} is a fixed effect for the month and year that survey data were collected; and ε_{ihdt} is the error term. We cluster the standard errors at the level of treatment (district).

The coefficient of interest is β_1, which measures the average effect of MGNREGA on the outcome of interest and is interpreted as the intention to treat (ITT) because in the DLHS dataset, we do not directly observe who participated in MGNREGA. Our identification strategy compares treated districts that received MGNREGA in 2007-2008 to those that had not yet received it in 2007-2008. Our data include observations from 2002-2004 (DLHS-2, when no districts have been treated) and 2007-2008 (DLHS-3, Phase 1 and 2 districts have been treated, but Phase 3 districts have not yet been treated).

4.1.Identification strategy

The major threat to identification is that confounding variables that determine treatment may also affect the outcome variable. By including additional observable controls in our main estimating equation (1), we take into account the observable confounding variables but there may still exist unobserved confounding variables that could bias coefficient estimates.

As MGNREGA was targeted toward poor districts rather than randomly allocated, finding a credible counterfactual is difficult. So, the first threat to identification arises from non-random assignment of treatment districts. In the absence of a credible counterfactual, the

treatment and control groups may not be equivalent in their characteristics and, therefore, a simple difference in the outcome variable may bias the estimates. In the literature (e.g., Merfeld (2020)), the above concern has been addressed by including the variables used to rank districts to determine program eligibility- the proportion of scheduled castes/tribes, the agricultural productivity, and the agricultural wages - on the right hand side of the econometric equation. We go further and use IP-weighted matching methods to match district characteristics in the main econometric specification. The IP-weighted technique is a propensity score-based method which aims to achieve a balanced distribution of confounding factors across treatment groups. The result is more robust and produces less biased estimates of the impact of treatment (Allan et al. 2020).

We estimate this specification using weighted-least-squares, where the weights are determined by the inverse probability of treatment weighting techniques. Weighted Least Square (WLS) estimator is used for all regressions. In the following sub-section, we explain how we implement this estimator.

4.1.1. Inverse probability of treatment weighting

Following Gazeaud and Stephane (2020), we use the logit estimator to compute the inverse probability of treatment weighting:

$$Treated_d = \beta_0 + X_d'\beta + \varepsilon_d \quad (2)$$

where X_d is a vector of district-level variables. As mentioned earlier, rollout was targeted at poor districts which were defined on the basis of variables at the district level. Following Zimmermann (2012) and Merfeld (2020), we include total population from the 2001 Census, as well as the percent rural, area (in square km), percent scheduled castes, percent scheduled tribes, percent literate, average monthly per capita consumption expenditure (2004-2005 prices), average casual wage (2004-2005 prices), labor force participation rate, female labor force participation rate, rainfall, and growing degree days for 2004. We use logistic regression to calculate the propensity scores and then derive the inverse probability (IP) of treatment weighting. Appendix Table A3 shows the logistic regression predicting treatment.

Figure 3 shows the distribution of propensity score by treatment groups. The area within the dashed line represents the common support. The highest propensity score for untreated is 0.96 and the lowest propensity score for treated is 0.04. The presence of high propensity scores for untreated groups and low propensity scores for treated groups may cause concern. We address this issue by restricting our sample size to the common support region , which eliminates very high and low propensity scores from the sample.[16]

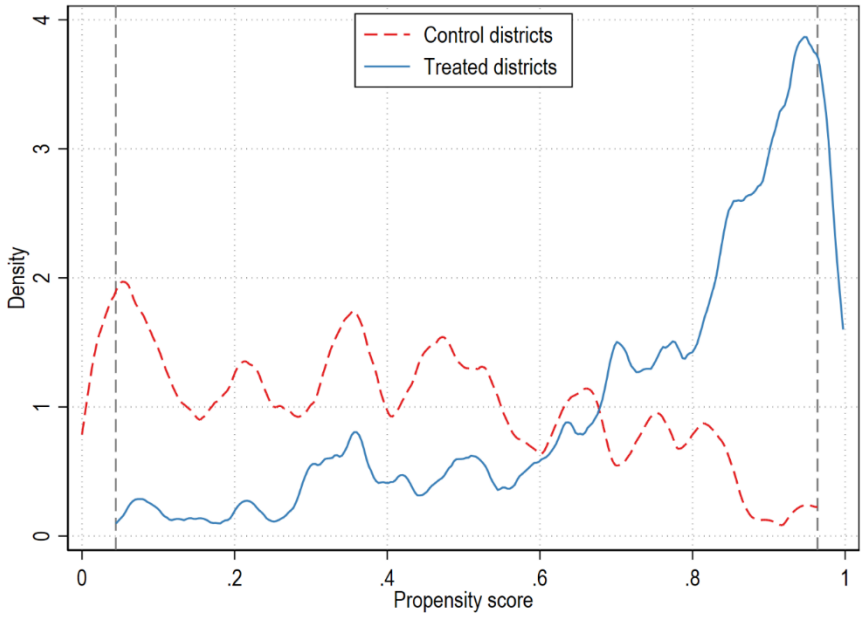

Figure 3. Propensity score distribution by treatment groups.

Note: The area within the dashed lines represents the common support. The highest propensity score for untreated is 0.964 and the lowest propensity score for treated is 0.044.
Source: Own calculation.

4.1.2. Event study specification

The identification strategy requires that the trend in outcomes of the treatment group moves in parallel with the comparison group. Appendix Figure A1 shows the pre-program trends for two family planning methods using Rounds 1 (1998-1999) and 2 (2002-2004). There is evidence to support a parallel trend in contraceptive outcomes of interest.

[16] About 10% of data is excluded when restricted to common support.

To further investigate pre-program differences, we re-evaluate equation (1) but use Round 2 (2002-2004) as post and Round 1 (1998-1999) as pre-program.

Finally, we include rounds 1-3 in a single specification and performing an event-study in addition to the traditional DiD. The specification for an event-study regression is given by

$$y_{it} = \sum_{j=-2, j\neq -1}^{1} \beta_j int_{it}^{j} + \alpha_d + \phi_{st} + \lambda_{mt} + \varepsilon_{it} \quad (3)$$

where j denotes leads and lags of the event of interest. int_{it}^{j} represents an interaction term between year and treatment status. The terms are defined as in Equation (1).

5. Econometric Results

In this section, we describe our empirical results, including our main results describing the total impact of MGNREGA on contraceptive use in rural India. We also explore the impacts on the age of first birth for mothers, the number of surviving children and the occurrence of last pregnancy in our study region. Finally, we present tests for heterogeneous impacts. We support the causal inference in our results by providing evidence of parallel trends and using an event-study regression. The Appendix contains a supplementary analysis that performs sub-sample analyses (Appendix Table A8) and additional robustness checks (Appendix Tables A5-A7).

5.1. Main results

Our main results consist of the impacts of MGNREGA on the use of contraceptives and how this impacts family outcomes including the age of mothers at first birth and the number of children per household.

5.1.1. Use of contraceptives

Table 3 presents the main results from Equation (1) using IP-weights and restricted to the common support region (See Appendix Table A4 for unweighted results). The results suggest an increase of 1.8 percentage points (approximately a 3% increase) in the use of family planning methods in treated districts. Specifically, the use of modern methods shows an increase of 1.4 percentage points (approximately 3% increase). The point estimate for any traditional methods of family planning is not different from zero.

These main results are robust to a number of robustness checks. First, we perform a matched DID with coarsened exact matching algorithm. Second, as the dependent variables are binary, we use the probit specification to estimate the impact of MGNREGA on the use of family planning methods. Third, we include the estimated propensity score of being in the treated district on the right-hand side of the main regression Equation (1) as an additional variable. Appendix Tables A5, A6 and A7 provide the respective results. The findings are unchanged.

Table 3. Effect of MGNREGA on the use of family planning methods

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	0.018**	0.014**	0.004
	(0.008)	(0.006)	(0.005)
Individual- and household- level controls			
Women's age in years	0.014***	0.014***	-0.0002*
	(0.0004)	(0.0004)	(0.0001)
Women can read or write	0.057***	0.043***	0.014***
	(0.005)	(0.004)	(0.001)
Spouse can read or write	0.056***	0.048***	0.008***
	(0.003)	(0.003)	(0.001)
Number of children	0.043***	0.038***	0.005***
	(0.003)	(0.003)	(0.001)
Religion: Hindu	0.094***	0.090***	0.004
	(0.012)	(0.012)	(0.003)
Scheduled castes/tribes	-0.042***	-0.039***	-0.003**
	(0.005)	(0.006)	(0.001)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.558	0.486	0.072
SD dependent variable	0.497	0.500	0.259
Observations	570,193	570,193	570,193
Number of districts	480	480	480
R-square	0.220	0.227	0.091

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). Sample is restricted to common support and excludes currently pregnant women. WLS estimator is used for all regression. Post is a dummy variable indicating that the observation is from the 2007/08 round. All dependent variables are binary (1/0). Any methods refer to individuals who are currently using any family planning methods. Modern methods include sterilization of women and men, IUDs/copper-t/loop, oral pills, male and female condoms, and others. Traditional methods include using rhythm, periodically abstinence, withdrawal, and others.

5.2. Heterogeneous impacts

In this section, we present the impact of MGNREGA on contraceptives use by age and household wealth index.

5.2.1. Heterogeneity by Age

The need for contraceptives among married women can depend on their age group because of preferences about the timing of pregnancy. We construct a dummy variable for women in the age group of 35 years and older and use it in an interacted model. Age 35 years and older is coded as 1 and 0 if not. Table 4 presents results after including the triple interaction term MGNREGA*Post*Age 35 years and older in the main specification. Results suggest that all forms of contraception increased by 1.5 percentage points and that the results did not differ for women ages 35 and older. Interestingly, women above 35 are more likely to use traditional contraceptive methods after MGNREGA.

Table 4. Heterogeneity by age

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post x Age 35	0.007	-0.009	0.016***
years and older	(0.015)	(0.015)	(0.006)
MGNREGA x Post	0.015*	0.016**	-0.001
	(0.009)	(0.008)	(0.005)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.558	0.486	0.072
SD dependent variable	0.497	0.500	0.259
Observations	570,193	570,193	570,193
Number of districts	480	480	480
R-square	0.228	0.235	0.091

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors in parentheses are clustered at the level of treatment (district). Age 35 years and older is coded as 1 and 0 if not. The sample is restricted to common support and excludes current pregnant women. WLS estimator is used across all regressions. All regressions include controls at the individual and household level.

5.2.2. Heterogeneity by wealth index

MGNREGA is a poverty-alleviation program whose main objective is to increase the well-being of poor households. But non-poor households can participate in MGNREGA. For example, Dutta et al. (2012) found that non-poor households participated in MGNREGA in response to the agricultural productivity shock, such as the rainfall shock.

To estimate heterogeneity by wealth index, a composite measure of a household's cumulative standard of living, we split the data into low (poor) and high (non-poor) wealth indices. We observe the wealth index variable in the DLHS Dataset. About 58percent of the sample in DLHS-2 (2002-2004) falls into the category of low wealth. This falls to about 41percent in DLHS-3 (2007-2008).

Table 5 presents results after including the interaction term MGNREGA*Post*Poor in the main specification. The results suggest a 2-percentage point increase (a 4% increase) in family planning methods, particularly modern methods of contraceptives, with the introduction of MGNREGA. Due to MGNREGA wages, women from poor households can afford the high upfront costs of modern contraceptives.

Table 5. Heterogeneity by household wealth index

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post x Poor	-0.007	-0.016	0.009
	(0.011)	(0.010)	(0.006)
MGNREGA x Post	0.019**	0.019***	0.0003
	(0.008)	(0.007)	(0.005)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.558	0.486	0.072
SD dependent variable	0.497	0.500	0.259
Observations	570,193	570,193	570,193
Number of districts	480	480	480
R-square	0.223	0.229	0.091

Note: Levels of significance: p<0.01***, p<0.05**. Robust standard errors in parentheses are clustered at the level of treatment (district). Poor is coded as 1 for low wealth and 0 if not. The sample is restricted to common support and excludes current pregnant women. WLS estimator is used across all regressions. All regressions include controls at the individual and household level.

Immediate impacts of increased contraceptive use

5.2.3. Women's age at first birth, family size and last pregnancy

Next, we show how MGNREGA's availability is associated with the timing of a woman's first birth. Table 6 reports the impact of MGNREGA on women's age at first birth. The results suggest an increase in women's age at first birth in treated districts by 0.11 years or 1.32 months. This finding implies that MGNREGA may have raised the costs of the first

birth. These costs may include forgoing desired sexual activity and negotiating sexual behavior and fertility with husbands (Miller 2010). The potential for employment for rural women through MGNREGA to add to their household income can offer a plausible explanation for delaying pregnancy through the use of contraceptives. The results indicate that MGNERGA's presence allows women to work for more years before having their first child. To examine the effect of MGNERGA on the last pregnancy recorded in the DLHS datasets, we construct a dummy variable as an outcome variable, with 1 representing the last pregnancy as of January 2004 for the DLHS-3 and as of January 1999 for the DLHS-2 and 0 representing otherwise. The coefficient for the treatment variable is not statistically different from zero.

Table 6. Effect of MGNREGA on female age at first birth, number of surviving children and last pregnancy.

	Woman's age at first birth	Number of children born	Last pregnancy
MGNREGA x Post	0.110**	0.025	-0.001
	(0.051)	(0.020)	(0.005)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	19.365	3.071	0.446
SD dependent variable	3.208	1.691	0.497
Observations	525,175	525,175	525,175
Number of districts	480	480	480
R-square	0.184	0.374	0.437

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). The sample is restricted to common support and excludes current pregnant women. WLS estimator is used for all regressions. Both individual- and household- level controls are included in the regression. Column (2) shows the number of children born to women who survived. Column (3) is a dummy variable, 1 for the last pregnancy as of January 2004 for the DLHS-3 (2007-2008) and as of January 1999 for the DLHS-2 (2002-2004) and 0 otherwise.

5.3 Impact on attitudes towards contraception

Recent studies in developing countries (see e.g., the systematic review of Maxwell et al. (2015)) have shown that various forms of intimate partner violence, including reproductive coercion, are associated with lower use of contraceptives. Indian women in rural areas exposed to domestic violence have a lower level of autonomy and have limited access to family planning services and, as a result, unable to negotiate around fertility and

contraceptive use (Stephenson, Jadhav, and Hindin 2013). We do not observe direct spousal violence in the DLHS dataset, but we do observe opposition to women's contraception from the husband and other family members. According to the DLHS round 3, 11% of women who did not use contraception said their husband opposed it and 0.5% said other family members opposed it.

Women who work outside the home for cash may receive backlash on contraceptive use from husband and other family members. To explore this further, we construct a dummy variable, 1 for husband's and other family members opposition as a reason not to use contraceptives and 0 otherwise. Table 7 reports the results. The sign on the average treatment effect coefficient suggests that the introduction of MGNREGA had resulted in reducing opposition from the husband and other family members as a reason not to use contraceptives. However, the magnitude is very small and statistically significant at the 10 percent significance level. The results suggest that the attitude of the husband and other family members to contraception is the same as that of women.

Table 7. MGNREGA's effect on the husband and other family members attitudes towards contraception

	Husband and family members opposition to female contraception
MGNREGA x Post	-0.004*
	(0.003)
District FEs	Yes
State-year FEs	Yes
Interview month-year FEs	Yes
Mean dependent variable	0.018
SD dependent variable	0.133
Observations	570,193
Number of districts	480
R-square	0.045

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors in parentheses are clustered at the level of treatment (district). The sample is restricted to common support and excludes current pregnant women. Dependent binary variable, 1 for opposition from husband and other family members as reason for not using contraceptives and 0 otherwise. Both individual- and household- level controls are included in the regression.

5.3.Further robustness checks

First, as mentioned in the data section, the distribution of propensity scores for treated and untreated districts are skewed. This may arise from the presence of very high propensity scores for untreated and very small propensity score for treated and may influence the estimates. The trimming process addresses the above concern by removing very high and low propensity scores from the sample. We calculate the 5th centile of the propensity score in the treated and 95th centile in the untreated and remove all observations that are not within these limits. Appendix Table A8 presents the effect of trimming at the fifth centile on the IP-weighted estimate. The results remain the same.

Second, matching reduces selection bias but does not remove it entirely because we limited to matching on observable variables. Therefore, changes in other confounding factors that could produce a deviation from parallel trends could remain. Coefficient stability with and without controls provides suggestive evidence that omitted factors are not driving results. For example, if coefficient estimates do not vary with and without controls, then the omitted variables would have to correlate with the arrival of MGNREGA and not the included controls (Schlenker, Hanemann, and Fisher 2007). Therefore, we estimate our main specification with and without including controls. We report these regression results in Table A9 in the appendix. Specifically, we regress the outcome variable on treatment with and without individual- and household-level controls. We then repeat the regressions for matched samples using the inverse probability weighted for treatment. Results remain robust across the specifications.

Third, there is a concern that districts with greater female labour force participation rates (LFPRs) already expect to use family planning methods. We address this concern by including the triple interaction MGNREGA*Post*High female LFPR into the main specification. We construct a dummy variable indicating high female labour force participation rate (LFPR), equal to 1 for values higher than or equal to the average of the female LFPR and 0 for the others.[17] Appendix Table A10 presents the effect of MGNREGA on women use of family planning methods by female labor force participation rate. The

[17] The sample used to identify the districts with a higher female workforce participation rate includes both the urban and the rural residents whereas, MGNREGA is implemented only in rural areas.

coefficients on the impact of treatment are insignificant at the 5 percent significance level, suggesting that there is no impact on our results.

Finally, as mentioned previously in the empirical strategy section, we combined Phase 1 and Phase 2 districts to build treated districts. In order to explore if this is of concern, we investigate the differential effects of MGNREGA across phase 1 and phase 2 on the use of family planning methods. Appendix Table A11 reports how the results differ across treated districts in phase 1 and in phase 2. The results show an impact of MGNREGA on the use of modern methods of contraception for married women in the districts treated in phase 1. We find no effect for the districts treated in phase 2. This suggests that the impacts take time. In addition, we fail to reject the equality of DID estimates across phase 1 and phase 2. Therefore, the results provide no evidence of differential effects of MGNREGA in the Phase 1 and in Phase 2 districts.

5.4.Event study

Figure 4 shows an event-study coefficients and 95% confidence intervals for any family planning methods and any modern methods, respectively. Event-study regression results show that for the pre-treatment period, the coefficient of interest is statistically insignificant. This evidence further supports that the control and treated groups were statistically the same before the workfare program was implemented, strengthening the DiD framework.

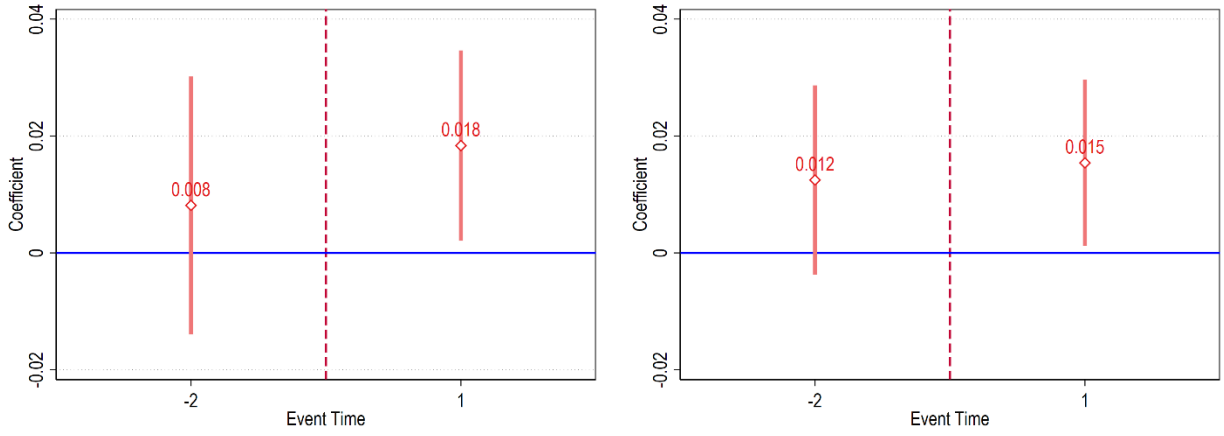

Figure 4. Event-study regression.

Note: Any methods (left) and modern methods (right). The omitted category is DLHS-2 (Event Time = -1).

5.5.Placebo Test

Table 8 presents a placebo analysis. The coefficients are nonsignificant at the 5 percent significance level suggesting that pre-treatment trends are not driving the results. Moreover, the coefficients for falsification test on any current use of contraception and the use of modern methods of contraception is opposite sign relative to the main treatment effect. This may raise a concern for mean reversion, but the size of the coefficients is small and hence not a serious problem for the purposes of my analysis. The placebo test excludes the possibility that MGNREGA was adopted in districts where birthrates were already increasing.

Table 8. Effect of MGNREGA on the use of family planning methods – Placebo

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	-0.011	-0.012	0.001
	(0.011)	(0.008)	(0.007)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.484	0.422	0.062
SD dependent variable	0.500	0.494	0.241
Observations	549,059	549,059	549,059
Number of districts	422	422	422
R-square	0.150	0.146	0.097

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors are in parentheses and clustered at the district level. The sample is restricted to common support. WLS estimator is used across all regressions. Post is a dummy variable indicating that the observation is from the 2002/04 round. All dependent variables are binary (1/0). Any methods refer to individuals who are currently using any family planning methods. Modern methods include sterilization of women and men, IUDs/copper-t/loop, oral pills, male and female condoms, and others. Traditional methods include using rhythm, periodically abstinence, withdrawal, and others.

6. Discussion and conclusion

This paper examines the impact that workfare programs have on family planning decisions within households. Exploiting the rollout of MGNREGA at the district level within a difference-in-difference model, we document that MGNREGA increased the use of any family planning methods by 1 percentage point (15% increase) among married women across all age and wealth groups. This has important economic consequences because women with contraception remain in the labor market after reaching the desired fertility. In addition, the woman's age at first birth increased by 1.3 months from the 19.36-year-old sample mean with the introduction of MGNREGA. Therefore, the ability to acquire modern methods of

contraceptives can result in fewer births for women in their lifetime. In Appendix section B, we present evidence on possible mechanisms through which MGNREGA affects contraceptive use among rural Indian women. Overall, the results of the paper provide new evidence and inform policy makers about the impact of MGNREGA on women's family planning methods.

One contribution of our article is to offer a causal relation between work programs and family planning decisions. The link between workfare and family planning decisions includes changes in female participation in the labor market, financial autonomy, higher earnings for women, and improved bargaining power. In addition, there are variations in short-term migration patterns for men that affect the use of contraception. MGNREGA facilitates short-term migration. In the Appendix section B, we explore these mechanisms using our data. This study contributes to the literature that demonstrates that providing women with opportunities to generate income affects their reproductive decision-making within the household. Increased family planning methods could address maternal morbidity and negative impacts on child health in rural areas in low- and middle-income countries (Miller 2010).

A key limitation of this study is related to various sources of measurement errors. First, reporting on contraceptive use might be inaccurate. That may arise because in traditional societies such as in rural India, the discussion on sex and sex-related subjects is regarded as taboo. Second, our study includes only currently married women in the sample that may bias downward the prevalence of contraceptives. Third, the cultural setting also influences the reproductive decision-making along with the position of individual women. Therefore, any detailed examination of contraceptive practice requires variables on cultural practices and social norms which are missing in the national datasets including DLHS. For our results, this means that the treatment effect is a lower bound of the true impact. Finally, we take a note of the short time span of the DLHS data for MGNREGA to affect family planning decisions.

Nevertheless, we demonstrate that providing job opportunities through a workfare program that includes women’s employment increases the use of family planning methods. Contraceptive use increases and we find a change in families’ attitudes towards modern

contraceptives. Our findings are robust to several specifications. These results contribute to our understanding of workfare programs, labor markets, and contraceptive use.

The yearly cost of work guarantee programs like MGNREGA is enormous for low-income countries such as India. MGNREGA competes with other Indian social safety net programs. This paper points out a positive unintended consequence of MGNREGA, which is the uptake of family planning methods in rural areas. Our findings confirm that increasing women's work opportunities leads to increased use of contraceptives. Therefore, in low- and middle-income countries, job guarantee programs can be viewed as complementary to family planning programs.

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Appendix A: Additional Figures and Tables

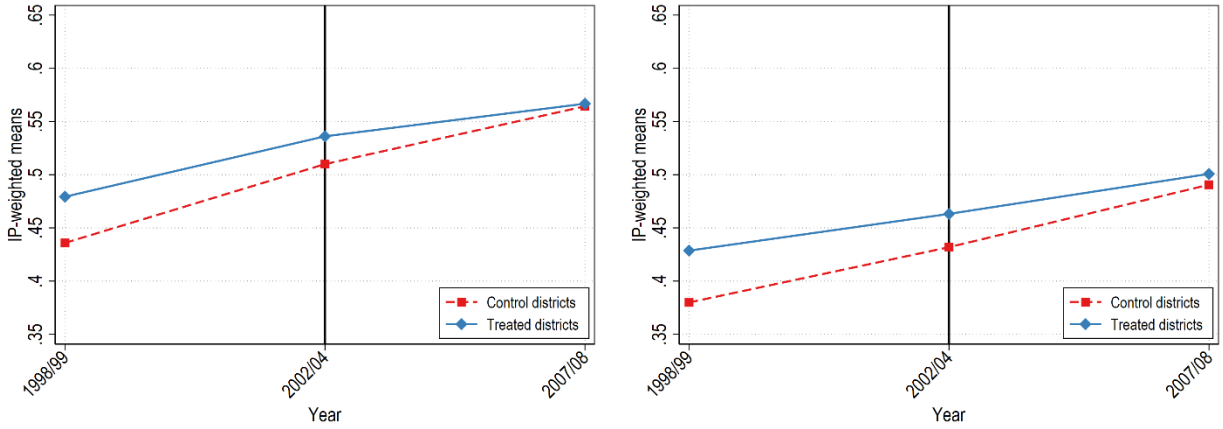

Figure A1. Pre-program trends in the use of family planning methods.

Note: The y-axis on the left measures the IP-weighted mean of any methods of contraception, while the y-axis on the right measures the IP-weighted mean of any modern methods of contraception. DLHS round 1 (1998/99) and round 2 (2002/04) represent pre-program, while DLHS round 3 (2007/08) represents post-program. The IP-weighted mean is restricted to common support region.

Table A1. District-level variables

Variable	Source
Total Population	2001 Census
Percent rural	2001 Census
Area (in square km)	2001 Census
Percent Scheduled Castes	2001 Census
Percent Scheduled Tribes	2001 Census
Percent Literate	2001 Census
Average monthly per capita consumption expenditure	2004/05 NSSEUS
Average casual wage (2004/05 prices)	2004/05 NSSEUS
Labor force participation rate	2004/05 NSSEUS
Female labor force participation rate	2004/05 NSSEUS
Rainfall (2004)	NCMRWF
Growing degree days (2004)	NCMRWF

Note: We use the socioeconomic high-resolution rural-urban geographic platform for India (SHRUG) to construct 2001 census variables (Asher et al. 2021). NSSEUS refer to the National Sample Surveys on Employment and Unemployment Situation in India. NCMRWF refer to the National Centre for Medium Range Weather Forecasting (Rani et al. 2021). We use growing season (June through September) in a given year to construct rainfall and growing degree days.

Table A2. Individual summary statistics before matching

	Pre-Program (2002-2004)		
	Treated	Control	Diff. (p-val.)
Outcomes			
Any family planning methods	0.500	0.589	0.000
	(0.500)	(0.492)	
Any modern methods	0.428	0.512	0.000
	(0.495)	(0.499)	
Any traditional methods	0.072	0.077	0.506
	(0.259)	(0.267)	
Among women who are currently taking contraceptives			
Female sterilization	0.681	0.660	0.321
	(0.466)	(0.474)	
Male sterilization	0.022	0.018	0.378
	(0.148)	(0.135)	
Intrauterine Devices (IUDs)	0.022	0.045	0.000
	(0.147)	(0.208)	
Oral pills	0.075	0.063	0.134
	(0.263)	(0.242)	
Condom	0.051	0.079	0.000
	(0.220)	(0.270)	
Rhythm/Periodic abstinence/Withdrawal	0.126	0.125	0.901
	(0.332)	(0.330)	
Individual-level characteristics			
Women age in years	30.169	30.708	0.000
	(7.296)	(7.201)	
Women can read or write	0.388	0.489	0.000
	(0.487)	(0.499)	
Spouse can read or write	0.650	0.738	0.000
	(0.477)	(0.440)	
Number of children	2.743	2.653	0.013
	(1.723)	(1.630)	
Household-level characteristics			
Religion: Hindu	0.824	0.764	0.021
	(0.381)	(0.424)	
Scheduled Castes/Tribes	0.396	0.317	0.000
	(0.489)	(0.465)	

Note: Standard deviations are in parentheses. Treated includes phase one and two districts, and control includes phase three districts. The third column, the difference, is computed using OLS regressions and standard errors clustered at the district level. Source: DLHS round 2 (2002-2004).

Table A3. Logistic regression predicting treatment

	Treatment
Total Population	1.000***
	(0.000)
Percent rural	186.748***
	(7.485)
Area (in square km)	1.000***
	(0.000)
Percent Scheduled Castes	1905.793***
	(111.530)
Percent Scheduled Tribes	123.363***
	(2.849)
Percent Literate	0.074***
	(0.003)
Average MPCE	0.999***
	(0.000)
Average casual wage	0.995***
	(0.000)
Labor force participation rate	0.030***
	(0.002)
Female labor force participation rate	8.851***
	(0.657)
Rainfall (mm)	1.000***
	(0.000)
Growing degree days	1.000***
	(0.000)
Observations	631,152

Note: Standard errors are in parentheses. Odds ratios are reported.

Table A4. Effect of MGNREGA on the use of family planning methods: Unweighted results

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	0.025***	0.021***	0.004
	(0.008)	(0.006)	(0.005)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.554	0.481	0.073
SD dependent variable	0.497	0.500	0.260
Observations	630,173	630,173	630,173
Number of districts	480	480	480
R-square	0.218	0.227	0.090

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). OLS estimator is used for all regression. All dependent variables are binary (1/0). Any methods refer to individuals who are currently using any family planning methods. Modern methods include sterilization of women and men, IUDs/copper-t/loop, oral pills, male and female condoms, and others. Traditional methods include using rhythm, periodically abstinence, withdrawal, and others.

Table A5. Robustness check: Coarsened Exact Matching method

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	0.020***	0.017***	0.003
	(0.008)	(0.006)	(0.003)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.583	0.508	0.075
SD dependent variable	0.493	0.500	0.263
Observations	450,442	450,442	450,442
Number of districts	536	536	536
R-square	0.206	0.219	0.095

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). WLS estimator is used across all regressions. Controls at the individual and household level are included in every regression. The coarse variables used were age of women, literacy of women and spouses, religion, scheduled castes/tribes, number of children and wealth index. The match summary consists of 225,420 matched on 242,257 observations for control and 225,420 matched on 388,895 for treatment.

Table A6. Robustness check: Probit regression

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	0.058**	0.041***	0.050
	(0.024)	(0.020)	(0.042)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.588	0.486	0.073
SD dependent variable	0.497	0.500	0.260
Observations	570,183	570,183	570,183
Number of districts	480	480	480

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. This table reports probit regression estimates. IP weight is applied across all regressions. Sample is restricted to common support. Robust standard errors in parentheses are clustered at the level of treatment (district). Controls at the individual and household level are included in every regression.

Table A7. Robustness check: Propensity score

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	0.025***	0.021***	0.004
	(0.008)	(0.006)	(0.005)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.554	0.481	0.073
SD dependent variable	0.497	0.500	0.260
Observations	630,173	630,173	630,173
Number of districts	536	536	536
R-square	0.218	0.227	0.090

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). Controls at the individual and household level are included in every regression. See note to Table 4 for other details.

Table A8. Effect of trimming at the fifth centile on the IP-weighted estimate

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post	0.020*	0.019*	0.002
	(0.011)	(0.010)	(0.006)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.582	0.512	0.070
SD dependent variable	0.493	0.500	0.256
Observations	297,492	297,492	297,492
Number of districts	252	252	252
R-square	0.204	0.227	0.121

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors in parentheses are clustered at the level of treatment (district). Controls at the individual and household level are included in every regression. See note to Table 4 for other details.

Table A9. Regression results for various econometric specifications

	Any methods	Any modern methods	Any traditional methods
Panel A: without controls			
MGNREGA x Post	0.029***	0.025**	0.004
	(0.008)	(0.007)	(0.005)
Mean dependent variable	0.554	0.481	0.073
SD dependent variable	0.497	0.500	0.260
Observations	631,148	631,148	631,148
Number of districts	536	536	536
R-square	0.113	0.131	0.088
Panel B: with controls			
MGNREGA x Post	0.025***	0.021***	0.004
	(0.008)	(0.006)	(0.005)
Mean dependent variable	0.554	0.481	0.073
SD dependent variable	0.497	0.500	0.260
Observations	630,173	630,173	630,173
Number of districts	536	536	536
R-square	0.218	0.227	0.090
Panel C: without controls (match)			
MGNREGA x Post	0.019**	0.015**	0.004
	(0.008)	(0.007)	(0.005)
Mean dependent variable	0.558	0.485	0.072
SD dependent variable	0.497	0.500	0.259
Observations	571,076	571,076	571,076
Number of districts	480	480	480
R-square	0.122	0.138	0.090
Panel D: with controls (match)			
MGNREGA x Post	0.018**	0.014**	0.004
	(0.008)	(0.006)	(0.005)
Mean dependent variable	0.558	0.486	0.072
SD dependent variable	0.497	0.500	0.259
Observations	570,193	570,193	570,193
Number of districts	480	480	480
R-square	0.220	0.227	0.091

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors in parentheses are clustered at the level of treatment (district). The sample is restricted to common support in Panels C and D. District, state-year, and interview month-year fixed effects are included in all regressions.

Table A10. Effect of MGNREGA on the use of family planning methods by female labor force participation rate: Triple difference

	Any methods	Any modern methods	Any traditional methods
MGNREGA x Post x	-0.004	-0.003	-0.00003
Female LFPR	(0.015)	(0.014)	(0.011)
MGNREGA x Post	0.020	0.015*	0.004
	(0.012)	(0.009)	(0.010)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.558	0.486	0.072
SD dependent variable	0.497	0.500	0.259
Observations	570,193	570,193	570,193
Number of districts	480	480	480
R-square	0.220	0.227	0.091

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). The sample is restricted to common support and excludes current pregnant women. WLS estimator is used across all regressions. All regressions include controls at the individual and household level. See note to Table 4 for other details.

Table A11. Differential impacts of MGNREGA on the use of family planning in the Phase 1 and in the Phase 2 districts

	Any methods	Any modern methods	Any traditional methods
Phase 1 x Post	0.037***	0.029***	0.008
	(0.009)	(0.007)	(0.005)
Phase 2 x Post	0.008	0.010	-0.002
	(0.010)	(0.008)	(0.007)
District FEs	Yes	Yes	Yes
State-year FEs	Yes	Yes	Yes
Interview month-year FEs	Yes	Yes	Yes
Mean dependent variable	0.554	0.481	0.073
SD dependent variable	0.497	0.500	0.260
Observations	630,173	630,173	630,173
Number of districts	536	536	536
R-square	0.218	0.227	0.090
p-val[Phase 1 x Post = Phase 2 x Post]	0.285	0.227	0.090

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the level of treatment (district). Individual- and household-level controls are included in all regressions. The row 'p-val[Phase 1 x Post = Phase 2 x Post]' reports the p-value of the test of difference in the coefficient across the interaction terms between Phase 1 and Post and Phase 2 and Post.

Appendix B

An empirical exploration of mechanisms

6.1.Pathways

In this section, we provide evidence for our five pathways through which MGNREGA may affect the family planning methods in rural India. To empirically examine these pathways, we combine DLHS datasets with the National Sample Survey for Employments and Unemployment Situations (NSSEUS) in India.

6.1.1. Changing labor market participation

In our conceptual framework, we noted that the direct way in which MGNREGA affects outcomes in the economy is through changes in labor market participation. All pathways flow from this direct impact. Therefore, we present evidence that MGNREGA affects labor market participation. In Appendix Table B1, we summarize the effect of MGNREGA on women's labor market outcomes. Our empirical results support the existing evidence in the literature (Imbert and Papp 2015; Zimmermann 2012; Berg et al. 2018; Deininger and Minten 2002; Merfeld 2020) that shows that MGNREGA did in fact alter labor market participation in rural India. We now examine how this direct impact affected contraceptive use through the 5 pathways hypothesized in our conceptual framework.

Table B1. Effect of MGNREGA on women's labor market outcomes

	(1) Self-employed: Farm	(2) Self-employed: Non-Farm	(3) Public Laborer	(4) Private Laborer: Farm	(5) Private Laborer: Non-Farm	(6) Unemployed: Sought work	(7) Unemployed: did not seek work	(8) Unpaid Family Labor	(9) Not in Labor force
MGNREGA X Post x Female	0.012	0.004	-0.001	0.007	-0.005	-0.011***	0.000	0.002	-0.009
	(0.013)	(0.005)	(0.001)	(0.009)	(0.004)	(0.004)	(0.001)	(0.007)	(0.016)
MGNREGA x Post	-0.006	-0.007	0.002	-0.004	0.009***	0.009**	0.000	0.007	-0.018
	(0.012)	(0.006)	(0.002)	(0.008)	(0.004)	(0.004)	(0.001)	(0.011)	(0.011)
District FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. variable	0.113	0.053	0.002	0.060	0.029	0.030	0.005	0.105	0.258
SD dep. variable	0.272	0.201	0.041	0.201	0.147	0.142	0.055	0.261	0.382
Observations	429120	429120	429120	429120	429120	429120	429120	429120	429120
R-squared	0.111	0.050	0.019	0.067	0.042	0.036	0.021	0.043	0.283

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. Robust standard errors in parentheses are clustered at the district level. The dependent variable is the share of employment and unemployment at the district-year-

quarter triplets. Inverse Hyperbolic transformation is applied to all dependent variables. The share of each employment is calculated as the ratio between the number of days spent in each employment in the last 7 days at the time of survey and the total number of days, 7. Individual controls include dummy variables for education levels (higher secondary and above), religion (Hindu), caste (scheduled castes and tribes, and other backward castes) and age. We use round 61 (2004/05, before treatment) and round 64 (2007/08, after treatment) data from the National Sample Survey (NSS) for Employment and Unemployment Situations in India. Post is a dummy variable indicating that observation is from the round 64 (2007/08). The sample is restricted to common support. The sample is also restricted to rural areas and individuals aged 18 to 59.

6.1.2. Household income

We first explore the extent to which MNREGA increased household incomes, potentially relaxing budget constraints and allowing household to buy costly modern contraceptive methods. A study by (Gehrke 2019) shows that farmers have generated higher returns by producing high-value crops. MGNREGA has enabled farmers to switch to high-value (but riskier) crops and, as a result, to higher profits. Although this study is based on only one state in India: Andhra Pradesh.

We do not observe the household income in our dataset. While we observe the monthly consumption expenditure of households per capita (MPCE) and use it as a measure of household income. We use round 61 (2004/05, before treatment) and round 64 (2007/08, after treatment) data from the NSSEUS. The dependent variable is log deflated monthly consumption expenditure per capita. The MPCE is calculated by dividing monthly household consumer expenditures by household size. MPCE is deflated using the India-level monthly average price index for agricultural laborers from the Indian Labor Bureau. Appendix Table B2 presents the impact of MGNREGA on the monthly consumption spending of rural households per capita. The coefficient on the impact of treatment does not differ statistically from zero. While another study, (Varman and Kumar 2020), using different data from the India Human Development Survey (IHDS) shows an increase in monthly per capita consumption expenditure by MGNREGA participating households. In our context, the null effect of MGNREGA on monthly consumption spending or rural households may be due to overall averaging, which masks the heterogeneity of program implementation performance.

Table B2. MGNREGA,s impact on per capita monthly rural household consumption expenditure

	Log (MPCE)
MGNREGA x Post	-0.004
	(0.026)
District FEs	Yes
Year-quarter FEs	Yes
Mean dependent variable	5.110
SD dependent variable	0.469
Observations	429,120
Number of districts	483
R-square	0.344

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors in parentheses are clustered at the level of treatment (district). The dependent variable is log deflated monthly consumption expenditure per capita (MPCE). The MPCE is calculated by dividing monthly household consumer

expenditures by household size. MPCE is deflated using the India-level monthly average price index for agricultural laborers from the Indian Labor Bureau. Individual controls include dummy variables for education levels (higher secondary and above), religion (Hindu), caste (scheduled caste and tribes, other backward caste) and age. We use round 61 (2004/05, before treatment) and round 64 (2007/08, after treatment) data from the National Sample Survey (NSS) for Employment and Unemployment Situations in India. Post is a dummy variable indicating that observation is from the round 64 (2007/08). The sample is restricted to rural areas and to persons 18 to 59. The sample also excludes MGNREGA participants.

6.1.3. Changes in female labor market participation, financial autonomy, and bargaining power

Next, we explore changes in female labor market participation (Appendix Table B1) and earnings (Appendix Table B3) that resulted from MGNREGA. We test the effect of MGNREGA on the number of days worked, unemployed and not in labor force. We find a net positive impact on the number of days spent unemployed. This unemployment outcome for women is a bit confusing, although not inconsistent with the increase in labor market participation itself. Much of the employment in India is self-employment and there is evidence showing that MGNREGA crowds out possibility of potential self-employment. Setting up of long-term self-employment has high transactional costs and individuals can delay this because of short-term employment opportunities offered by MGNREGA. We show an increase in the non-agricultural private female labor force and a net increase in the number of jobs in demand by women.

Casual individual earnings are available in the NSSEUS dataset. We use round 61 (2004/05, before treatment) and round 64 (2007/08, after treatment) data from the NSSEUS. Table 8 reports the impact of MGNREGA on married women's daily casual earnings. The dependent variable is log of daily wage rate. The daily wage rate is calculated by dividing the casual earnings and the number of days worked in the last 7 days at the time of the survey. For our purposes, we restrict our sample to married women because, as already mentioned, contraception information is only available for married women. The results suggest that, on average, the daily wage rate for married women rose by 7% after MGNREGA was introduced (Appendix Table B3).

Table B3. Impact of MGNREGA on married women's daily wages

	Log (Daily wage rate)
MGNREGA x Post x Female	0.065*
	(0.035)
MGNREGA x Post	-0.017
	(0.030)
District FEs	Yes
Year-quarter FEs	Yes
Mean dependent variable	3.027
SD dependent variable	0.787
Observations	66,075
Number of districts	483
R-square	0.550

Note: Levels of significance: $p<0.01^{***}$, $p<0.05^{**}$, $p<0.10^{*}$. Robust standard errors in parentheses are clustered at the level of treatment (district). The dependent variable is log of daily wage rate. The daily wage rate is calculated by dividing the casual earnings and the number of days worked in the last 7 days at the time of the survey. Casual earnings are deflated using the India-level monthly average price index for agricultural laborers from the Indian Labor Bureau. Individual controls include dummy variables for education levels (higher secondary and above), religion (Hindu), caste (scheduled caste and tribes, other backward caste) and age. We use round 61 (2004/05, before treatment) and round 64 (2007/08, after treatment) data from the National Sample Survey (NSS) for Employment and Unemployment Situations in India. Post is a dummy variable indicating that observation is from the round 64 (2007/08). The sample is restricted to common support and excludes workers engaged in MGNREGA workers and not in labor force. The sample is restricted to rural areas and to married persons 18 to 59. The sample also excludes MGNREGA participants.

6.1.4. Composition and selection effects

Most village men migrate to major cities for most of the year and only return to their villages for short periods of time during festivals and as a result, women may not need to use temporary contraceptive methods. However, according to round 3 of DLHS (2007-2008), fewer than 1.5% of rural married women reported not using contraceptives because their husbands were away from the village to work or seek employment.

The NSS data for employment and unemployment includes the migration module for just two years: 1999-2000 and 2007-2008. In the 1999-2000 NSS survey, the question was asked whether people have moved away from the village for 60 days or more within the last 365 days to find work. The 2007-2008 NSS asks whether people moved from the village for one month or more, but less than six months within the last 365 days to find work. We use this question to construct the dummy variable for the short-term out-migration. We then use the DID technique using NSS 1999-2000 (pre-treatment period) and NSS 2007-2008 (post-treatment period) to estimate the effect of MGNREGA on the short-term out-migration.[18] Appendix Table B4 shows the impact of MGNREGA on short-term job search migration. On average, 2% of people aged 18 to 59 left the village temporarily last year to find work, suggesting that MGNREGA facilitates migration.

From a labor market perspective, the shift from agricultural to non-agricultural activities may affect contraceptives. There is evidence in the literature of a connection between fertility and agriculture, the rural agricultural population has high fertility in low- and middle-income countries. Using the NSS for the employment and unemployment dataset, we test this compositional effect (transition from agriculture to agriculture). The treatment effect (MGNERGA x Post) has a negative sign on the coefficient representing farming and a positive sign representing non-farming activities, although none of them is statistically significant.

To sum up, we find empirical evidence that is consistent with our hypothesized pathways. First, MGNREGA through changes in labor market participation, in particular, we find that

women have found off-farm paid work and that unemployment among women looking for work during our study period has decreased. This change in women's labor market participation may have had an impact on household income. However, unlike other studies, we found no effect on the impact of treatment on monthly consumption expenditure for rural households. Second, we explored the impact of MGNREGA on women's earnings and found an increase in the daily wage rate for our sample. This supports our pathway that suggests that women who work for cash contribute to the total household income, and an increased in women's income leads to higher levels of autonomy within a household and therefore bargaining power in safer sexual relations with husbands. Third, MGNREGA has a positive impact on the attitude towards contraception of the husband and other family members. Forth, MGNERGA has facilitated short-term migration, which suggests that husbands who are away from home in search of employment may have changed the need for women to use contraceptives.

Table B4. Impact of MGNREGA on short-term migration in search of employment

	Migrate for job search
MGNREGA x Post	0.019***
	(0.007)
District FEs	Yes
Year-quarter FEs	Yes
Mean dependent variable	0.037
SD dependent variable	0.176
Observations	392,298
Number of districts	488
R-square	0.056

Note: Levels of significance: p<0.01***, p<0.05**, p<0.10*. The binary dependent variable is the inverse hyperbolic sine transformation of people who have moved away from the village in the last 365 days for employment or job search. Individual controls include dummy variables for education levels (higher secondary and above), religion (Hindu), caste (scheduled caste and tribes, other backward caste) and age. We use the migration module from rounds 55 (1999/00, before treatment) and 64 (2007/08, after treatment) of the National Sample Survey (NSS) on Employment and Unemployment Situations in India. Post is a dummy variable indicating that observation is from the round 64 (2007/08). The sample is restricted to common support. The sample is restricted to rural areas and people aged 18-59.