Workfare, Marriage and Women's Fertility: Evidence from India

Akanksha Arora

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Abstract

I estimate the effect of an expansion in employment opportunities available to women in India on their marriage and fertility choices. While overall female labour force participation in India has stagnated at very low levels, women's participation in the workfare program, the National Rural Employment Guarantee Act, is fairly high. Using the staggered adoption of this workfare program across Indian districts for identification, I estimate whether the program had an effect on rates of marriage, fertility and sex ratio at birth. In my analysis, conditional on district covariates interacted with time in an age-adjusted model, the introduction of the workfare program led to 7.6 fewer marriages per 1000 women (3.6 fewer marriages based on the heterogeneity-robust estimator). Conceptions ending in live births per 1000 women fell by 19.1 in the 20-24 age group but rose by 15.5 in the 25-29 age group, indicating a shift towards later childbearing which may potentially reduce overall fertility in the long-run.

1 Background

1.1 Female Labour Force Participation in India

Over the past few decades, India has experienced rapid economic growth, averaging 6.2 percent between 1990 and 2019. But despite this growth, the female labour force participation rate, defined as the percentage of working age (15-64 years old) women engaged in paid employment outside the household, has remained low and even fallen below 30 percent in recent years. Despite rising education levels among women, many women opt out of the paid labour force.

There have been a number of reasons posited for why Indian women are conspicuously absent from the labour force. Low labour force participation may reflect women's individual preferences or household preferences for prioritizing domestic work over outside employment. Low participation may also be a rational response to wage discrimination in the labour market. Patriarchal social norms also restrict women's mobility and these may be internalized by women. The lack of suitable outside options further weakens the intra-household bargaining position of women.

There may also be a mismatch between the type of new employment opportunities being created by economic growth and the actual skills possessed by working age women. Indian economic growth in recent decades is largely attributable to the growth of the services sector so there is a lack of suitable jobs for those transitioning out of agriculture. National Sample Survey (NSS) data indicates that there is also a skills gap between men and women, so the latter are more likely to be constrained by the unavailability of unskilled work opportunities. However, according to NSS data, over 30 percent of women who are engaged primarily in domestic activities and not currently counted in the labour force expressed a strong willingness to work if suitable local jobs were available.

The introduction of the National Rural Employment Guarantee Act (NREGA) provides exactly such feasible employment opportunities for women. The NREGA is an Indian workfare program that guarantees 100 days of employment per year to any household that demands it. The nature of the work consists of unskilled manual labour building durable assets within 5 kilometres of the worker's residence. The program also has a wage parity policy which may further induce participation by women who typically face large gender wage gaps in the private sector. Under NREGA, a third of employment is reserved for women, but in many states, actual employment outstrips this which is unsurprising given the latent demand by women for locally available, casual work. In contrast to the national labour market, which is comprised of only 22 percent women overall, 52 percent of NREGA workers were female in 2013-14.

1.2 Female Employment and Fertility Choices

Not only does the low female labour force participation rate translate to a loss of productive efficiency due to the misallocation of talent, it may also have important consequences for household-level decision-making including women's marriage and fertility choices. Demographic transition is regarded as an essential component of economic development. The quality-quantity tradeoff entails that as fertility falls, investment in children rises. This increase in the human capital stock of future generations fosters economic development. In turn, fall in fertility is itself theorized to be an outcome of economic growth. But it's useful to unpack the mechanisms of this latter process. In particular, I plan to focus on the potential impact of an increase in labour market opportunities for women on marriage and fertility choices.

An improvement in women's outside options may result in delayed age of marriage and lowered fertility. These changes could be mediated by increased female autonomy, particularly over contraception; a higher opportunity cost of childcare; and less need to get married and have children, particularly sons, to contribute to the household income. The last factor might be especially pertinent for understanding fertility choices in this context. A preference for sons over daughters is well-documented in India. The worsening sex ratio is indicative of this latent preference as parents selectively abort females or continue to have children in order to have the desired number of males.

While there are many socio-cultural reasons for this phenomenon of son preference, a proximate economic cause is the fact that sons can work and contribute to the household's income while daughters marry and migrate away due to norms of patrilocality. Reinforcing this mechanism are gender-discriminatory cultural norms that restrict young women's mobility and labour force participation. An expansion in women's work opportunities may alleviate the economic need to have sons, but desire for a given family size and increased household income could result in sex-selective abortion if son-biased preferences are invariant. An open empirical question is how an increase in women's labour force participation would affect these fertility patterns and preferences.

2 Literature Review

There is a large literature drawing on long-run historical data from developed countries on the steady rise of women's labour force participation and effect on fertility patterns.

Voigtländer and Voth (2013) document that in the 14th century, the Black Death created land abundance which led to a shift towards animal husbandry where women had a comparative advantage and were often required to remain celibate as part of the terms of employment. In response to better labour market prospects, women delayed marriage which subsequently lowered fertility. The regions west of the "Hajnal line" which stretched from St. Petersburg to Trieste were characterized by this "European Marriage Pattern". For instance, the average female age at marriage in England and Germany in the 17th century was 25-26, with a significant fraction of women never marrying. An estimated 25 to 40 percent of all possible births were avoided in Europe during this period. According to Voigtländer and Voth, it was fertility control which predated the growth in per-capita incomes in Europe and allowed the transition from "Malthus to Solow" to occur.

Greenwood, Seshadri and Vandenbroucke (2005) posit that among US women, the secular decline in fertility over the last 200 years is due to the relentless rise in real wages that increased the opportunity cost of having children, and that the mid-20th century baby boom was due to household technological improvements that lowered the direct costs of having children. Doepke, Hazan and Maoz (2013) suggest a different mechanism for the US baby boom where the increase in women's labour force participation during the Second World War was a major factor. The cohort of women who participated in the labour market and accumulated job experience during the war were able to crowd out younger women in the labour market post-war who lacked that experience. The authors argue that many of these younger women were crowded out of the labour force and decided to start having children earlier instead.

Overall, the relationship between women's labour force participation and economic development is described by Goldin (1994) to be U-shaped. At low levels of development, women have high employment rates, primarily in agriculture or self-employment. As incomes rise, women leave the labour market, in part because of the stigma attached to women engaging in manual labour in industrial jobs. But with greater development, and increases in women's human capital, white-collar service sector opportunities become available and more women enter the labour force.

It's possible that in developing countries, women's agricultural or self-employment work is under-measured in official survey data unlike paid wage labour outside the household. Time use surveys could help rectify this to some extent but data availability is lacking. It is notable that in India, over half the workers in the rural workfare program are women. More recent studies from developing countries look at the effects of the growth in specific manufacturing sector jobs in the garment sector and service sector jobs in business process outsourcing that may be especially amenable to women.

The most relevant papers on the relationship between female labour force participation and fertility in the South Asian context are Heath and Mobarak (2015), Sivasankaran (2014), and Jensen (2012).

Heath and Mobarak (2015) study the effects of the growth of the garment industry in Bangladesh (where nearly 80 percent of workers are young women) on fertility, age at marriage, and girls' educational attainment. The authors estimate a difference-in-differences specification using spatial variation in the proximity of girls' village to a garment factory and temporal variation in years of lifetime exposure. For the effect on education, a comparison of girls with their brothers is also used in a triple difference. Girls that had factory exposure during the critical ages of 10 to 23 are 13 percentage points more likely to work outside the home than girls of the same age in control villages. Discrete time hazard models indicate that the average exposure of 6.4 years to the garment industry lowers probability of marriage in that year by 0.3 percentage points (28 percent lower) and lowers probability of childbearing by 0.23 percentage pints (29 percent lower). The effects are driven by the younger age group who are unlikely to be directly employed by the sector but are more likely to be induced to stay in school in expectation of higher returns to cognitive skills in the garment sector.

Sivasankaran (2014) finds similar effects of textile mill employment in South India. Using variation in tenure created by unanticipated changes to fixed term contracts, this study focuses on the intensive margin of duration of employment. Women who worked longer delayed marriage, without any adverse effect on eventual spousal quality. This also led to fall in women's stated desired fertility. Survey data suggests these effects may be attributed to an increase in female empowerment and autonomy.

Jensen (2012) conducts a randomized control trial in India which allows for clean identification of these effects. Young women in treatment villages are provided with three years of recruiting services for business process outsourcing jobs in rural areas near Delhi, India. Women aged 18 to 24 in treated villages were 4.6 percentage points more likely to have a BPO job, compared to a control mean of 0. The treatment also increased women's stated desire to work before and after marriage, but not after childbirth. Women aged 15 to 21 at baseline from treatment villages were 5.1 percentage points less likely to get married and 5.7 percentage points less likely to have given birth during the three-year period of the study. This suggests that women are more likely to delay childbearing in order to keep working. Primary survey data allows Jensen to conclude that the delay in marriage and childbirth is driven by women's own participation in the labour market due to higher returns. It is not due to other mechanisms such as young women delaying marriage whose working mothers have more bargaining power or need daughters to stay at home to help with household chores. It should be noted that the low take-up rate of the intervention (due to the higher education requirements for BPO job eligibility) raises some concerns over external validity. However, it does lend support to Goldin's contention that increasing girls' education may be key to increasing their later participation in the labour force.

There are also a number of studies in developing countries with strong gender norms that examine the impact of plausibly exogenous changes in the value of women's work on fertility patterns, especially the child sex ratio.

Qian (2008) finds that an exogenous increase in relative female income as a share of household income due to agricultural reforms in China improved the survival rate for girls. The reforms increased the returns to cultivation of tea, in which women had a comparative advantage, and returns to orchards, where men had the advantage. Qian uses a difference-in-differences strategy comparing cohorts exposed to the reforms to earlier cohorts and comparing tea-planting counties proxying for an increase in female income (holding male income fixed) to non-tea counties. A similar DiD is estimated for orchard counties with an increase in relative male income. She finds that during the early 1980s, increasing annual adult female income by USD 7.70 (10 percent of average rural annual household income) while holding adult male income constant increased the fraction of surviving girls by one percentage point. Conversely, increasing male income while holding female income constant decreased survival rates. Qian interprets the results in a non-unitary model with intrahousehold bargaining where women are more likely than men to favour equal treatment of boys and girls resulting in more girls surviving when their bargaining position improves. As there is no effect of agricultural planting or harvesting seasons on fertility, Qian concludes that the results are not likely to be driven by changes in the opportunity cost of women's time.

Carranza (2014) examines the same relationship in India using the fact that deep tillage of soil, which reduces the need for female labour in transplanting, fertilizing and weeding, is only possible in loamy and not in clayey soils. The identification strategy relies on the assumption that the exogenous soil texture fractions affect the rural child sex ratio only through the impact of deep tillage on relative female employment, conditional on state fixed effects and other controls. Both reduced form and instrumental variable estimates (using the exogenous fractions of loamy and clayey soils as instruments) indicate that loamy soils lower women's labour force participation as well as female-to-male sex ratios. Based on the IV estimates, removing the rural deficit of girls in India would require a 5.8 percentage point increase in the average share of female agricultural labourers in the rural labour force. Carranza suggests that the results can be explained by more household resources being allocated to female children in response to a higher return when female earnings and market opportunities improve. While a bargaining model where women have more egalitarian preferences as in Qian would also fit Carranza's empirical findings, survey data from India indicates that mothers exhibit even stronger son preference than fathers. Also, while Qian uses data from an earlier time period before the advent of ultrasound technology, Carranza uses more recent data and in a related paper, shows that sex-selective abortion is a proximate determinant of lower child sex ratios in loamier soils.

Another mechanism that could strengthen women's relative bargaining power is through increasing their control over financial resources, especially their own earnings. This is examined by Field et al. (2021) in a randomized control trial where women's wages from the Indian NREGA workfare program are deposited into their own bank account instead of their husband's. The authors find that this not only increased women's participation in private and public sector work, but also changed social norms, especially among husbands who were most strongly opposed to women working. While this study focuses on already married women's labour supply, it's possible that a similar intervention could also change the labour supply as well as marriage and fertility choices of single women.

Empirical studies on the impact of NREGA such as Azam (2012), Imbert and Papp (2015), Muralidharan, Niehaus and Sukhtankar (2018), Imbert and Papp (2020), Zimmermann (2020) and Cook and Shah (2022) primarily focus on the effects of the program on output, employment, wages, and rural-urban migration. Specifically, Azam (2012) estimates that the introduction of NREGA led to a 2.4% increase in female labor force participation and 8.3% increase in women's wages. Other papers such as Afridi, Mukhopadhyay and Sahoo (2016) and Shah and Steinberg (2019) have focused on impacts of the program rollout on human capital investment in children. The effects of the program on women's marriage and fertility choices have not been previously examined.

3 Data

The NREGA was rolled out across districts in phases as showin in figure 1. The program was implemented in 200 districts around April 2006. In April 2007, a further 130 districts were added, and in April 2008, the program became available in all remaining districts. Data on NREGA program implementation dates across 624 districts is publicly available through India's Ministry of Rural Development. I use this data to create a binary indicator for a district being treated (i.e. NREGA being operational) during a given time period.

I use marriage and fertility data from India's Demographic and Health Survey (DHS), a large-scale nationally representative survey of women aged 15-49 years. While using earlier rounds of the DHS conducted during the NREGA rollout from 2006-08 would be preferable, only DHS 2015-16 includes district identifiers which are required for matching with the NREGA district rollout data.

After dropping urban women, the dataset consists of interviews with 494,861 rural women of reproductive age (15-49 years) about their marriage, birth and health outcomes. I construct retrospective marriage and fertility histories using date of first cohabitation (equivalent to marriage in rural India) and dates of child birth. Dates of child birth are used to determine dates of conception, assuming a gestation period of nine months before birth. A limitation is that this only includes conceptions that end in live births, whereas the treatment could affect miscarriages and abortions. However, this is a common issue in demographic studies using such data.

As I am specifically interested in the effect of NREGA introduction, I consider the time window April 2003 to March 2011, approximately three years before the implementation of the program in any districts and three years post implementation in all districts. I drop women who were too young to be of reproductive age during the time window I consider. For the marriage outcome, I drop women already married before April 2003. I construct a woman-year panel that has one observation per woman for each year of her observed reproductive period, defined as starting at age 15, within the 8-year time window. I drop observations where the woman was younger than 15 in that year. This gives me a sample of 408,414 women and 2,770,312 women-years. I create dummy variables indicating marriage or conception in a given district-year. I also create a dummy for number of males conceived. These are used for my outcome variables – marriage rate (number of marriages in given district-year per 1000 women), conception rate (number of live births conceived in given district-year per 1000 women), and sex ratio at birth (number of males conceived in given district-year per 100 females conceived). I also use data on mother's own date of birth to construct age-specific rates. Figure 2 shows the mean rates of marriage, conceptions and sex ratio at birth during the time window considered.

4 Empirical Strategy

I leverage the staggered adoption of the NREGA to estimate a difference-in-differences specification. Identification relies on the assumption that in the absence of NREGA, the districts that received the program in a specific phase did not have systematically different time patterns in the outcome variables.

A concern for identification is that allocation of the program to districts was based on the government's "backwardness" rankings which were based on pre-program levels of agricultural wages, percent of scheduled caste/scheduled tribe, and agricultural productivity. Imbert and Papp (2015), Shah and Steinberg (2019) and Cook and Shah (2022) rely on the assumption that the program was rolled out based on static characteristics of the districts, rather than underlying trends in fertility. I follow these papers and also show results which include district-level controls interacted with time fixed effects. Since data on the variables used for constructing backwardness rankings is not available for all districts, the sample size is reduced when controls are included.

5 Results

5.1 Two-Way Fixed Effects

First, I estimate an event study with district and year fixed effects.

$$y_{idt} = \alpha + \sum_{j=2}^{J} \beta_j (\text{Lag j})_{dt} + \sum_{k=1}^{K} \gamma_k (\text{Lead k})_{dt} + \mu_d + \lambda_t + \varepsilon_{idt} \tag{1}$$

$(\text{Lag J})_{\text{dt}} : \mathbb{1}[\text{t} \leq \text{Event}_d - J]$

$(\text{Lag j})_{\text{dt}} : \mathbb{1}[\text{t} = \text{Event}_d - J] \text{ for j} \in \{1, ..., J-1\}$

$(\text{Lead K})_{\text{dt}} : \mathbb{1}[\text{t} \geq \text{Event}_d + K]$

$(\text{Lead k})_{\text{dt}} : \mathbb{1}[\text{t} = \text{Event}_d + k] \text{ for k} \in \{1, ..., K-1\}$

μ_{d} : District fixed effects

λ_{t} : Time (Year) fixed effects

y_{idt} : Outcomes (Marriage rate; conception rate; sex ratio at birth)

Table 1 shows estimates from the above two-way fixed effects model and figure 3 shows estimates from the event study. The introduction of NREGA in a district increases the number of marriages per 1000 women by 0.215, the conception rate per 1000 women by 1.636 and the sex ratio (number of male births per 100 female births) by 1.4. None of these effects are statistically significant.

To get a better match on pre-trends, I also estimate this event study regression with age-adjusted marriage and fertility rates, which take into account whether a woman in district d in year t married or conceived a live-born child when she turned age a.

$$y_{idta} = \alpha + \sum_{j=2}^{J} \beta_j (\text{Lag j})_{dt} + \sum_{k=1}^{K} \gamma_k (\text{Lead k})_{dt} + \mu_{da} + \lambda_{ta} + \varepsilon_{idta} \qquad (2)$$

Table 2 and figure 4 show estimates with age-adjusted rates. The introduction of NREGA in a district lowers the number of marriages per 1000 women by 1.279, raises the conception rate per 1000 women by 1.355 and lowers the sex ratio (number of male births per 100 female births) by 0.991. However, none of these effects are statistically significant.

Figure 5 shows estimates (and 95% confidence intervals) by 5-year binned age groups but the effects are not significant.

I also estimate the age-adjusted model with district controls interacted with time fixed effects in table 3 and figure 6. The introduction of NREGA in a district lowers the number of marriages per 1000 women by 7.557, raises the conception rate per 1000 women by 1.641 and raises the sex ratio (number of male births per 100 female births) by 7.846. The effect on the marriage rate is statistically significant at the 5% level.

Splitting the data into 5-year binned age groups, I observe declining marriage rates upto age 35, though only the 30-34 group shows a statistically significant decline of 25.629 (table 4 & figure 7). Conceptions decline by 19.142 in the 20-24 age group but increase in the 25-29 age group, indicating later childbearing (table 5 & figure 7). This may potentially result in many births being averted in the long-run.

I also run another sub-group analysis by estimating effects on women in the bottom 25% (table 6 & figure 8) and top 25% of the household wealth distribution (table 7 & figure 9). The effects are not statistically significant. But it should be noted that the wealth index is post-treatment data from the 2015-16 DHS survey, so it may be endogenous.

5.2 Heterogeneous Treatment Effects

I check for robustness to treatment effect heterogeneity across districts and over years by examining negative weights in the two-way fixed effects regressions. I find that for the marriage outcome regression, 990 ATTs have negative weights out of 2402, summing to -0.52 whereas for births, 990 ATTs have negative weights out of 2402, summing to -0.44. The large number of negative weights implies that the two-way fixed effects estimator is biased.

Hence, I use the estimator by de Chaisemartin and D'Haultfœuille (2020) which is robust to heterogeneous treatment effects and allows for estimation of dynamic effects. Estimates from regression with district and year fixed effects are shown in table 8, event study estimates figure 10. The average effect on the marriage rate is -3.620 and significant at the 10% level. The effect on the conception rate is 1.729 and sex ratio is -1.947 but not statistically significant. It is not possible to compute age-specific rates with this estimator, which restricts my model to the inclusion of only district and time fixed effects.

5.3 Conclusion

In the models without district controls, I find imprecisely estimated null effects. Null effects may be reasonable in this context since only a small percentage of the population is employed through NREGA, even though the entire adult rural population is eligible. Implementation problems and lack of awareness also reduced take-up in the initial stages of the program. General equilibrium effects through spillover on private sector employment and wages may also take time to emerge.

However, conditional on the inclusion of district covariates interacted with time fixed effects in an age-adjusted model, I find that the introduction of the workfare program led to 7.6 fewer marriages per 1000 women. With the de Chaisemartin & D'Haultfœuille estimator, the average effect is 3.6 fewer marriages per 1000 women. Conceptions ending in live births per 1000 women fell by 19.1 in the 20-24 age group but rose by 15.5 in the 25-29 age group, indicating later childbearing which may potentially reduce overall fertility in the long-run. A longer term analysis of the effect of female labor force participation on fertility may be able to confirm this.

References

Afridi, Farzana, Abhiroop Mukhopadhyay, and Soham Sahoo. 2016. "Female labor force participation and child education in India: evidence from the National Rural Employment Guarantee Scheme." *IZA Journal of Labor and Development*, 5: 1–53.

Azam, Mehtabul. 2012. "The Impact of Indian Job Guarantee Scheme on Labor Market Outcomes: Evidence from a Natural Experiment."

Carranza, Eliana. 2014. "Soil Endowments, Female Labor Force Participation, and the Demographic Deficit of Women in India." *American Economic Journal: Applied Economics*, 6: 197–225.

Cook, C. Justin, and Manisha Shah. 2022. "Aggregate Effects from Public Works: Evidence from India." *Review of Economics and Statistics*, 104: 797–806.

de Chaisemartin, Clément, and Xavier D'Haultfœuille. 2020. "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects." *American Economic Review*, 110: 2964–2996.

Doepke, Matthias, Moshe Hazan, and Yishay D. Maoz. 2013. "The baby boom and world war II: A macroeconomic analysis." *Review of Economic Studies*, 82: 1031–1073.

Field, Erica, Rohini Pande, Natalia Rigol, Simone Schaner, and Charity Moore. 2021. "On Her Own Account: How Strengthening Women's Financial Control Impacts Labor Supply and Gender Norms." *American Economic Review*, 111: 2342–75.

Goldin, Claudia. 1994. "The U-Shaped Female Labor Force Function in Economic Development and Economic History."

Greenwood, Jeremy, Ananth Seshadri, and Guillaume Vandenbroucke. 2005. "The baby boom and baby bust." *American Economic Review*, 95: 183–207.

Heath, Rachel, and A. Mushfiq Mobarak. 2015. "Manufacturing growth and the lives of Bangladeshi women." *Journal of Development Economics*, 115: 1–15.

Imbert, Clément, and John Papp. 2015. "Labor market effects of social programs: Evidence from India's employment guarantee." *American Economic Journal: Applied Economics*, 7: 233–263.

Imbert, Clément, and John Papp. 2020. "Short-term Migration, Rural Public Works, and Urban Labor Markets: Evidence from India." *Journal of the European Economic Association*, 18: 927–963.

Jensen, Robert. 2012. "Do Labor Market Opportunities Affect Young Women's Work and Family Decisions? Experimental Evidence from India." *The Quarterly Journal of Economics*, 127: 753–792.

Muralidharan, Karthik, Paul Niehaus, and Sandip Sukhtankar. 2018. "General Equilibrium Effects of (Improving) Public Employment Programs: Experimental Evidence from India." *NBER Working Paper*, 1–76.

Qian, Nancy. 2008. "Missing Women and the Price of Tea in China: The Effect of Sex-Specific Earnings on Sex Imbalance." *Quarterly Journal of Economics*, 123: 1251–1285.

Shah, Manisha, and Bryce Millett Steinberg. 2019. "Workfare and Human Capital Investment: Evidence from India." *Journal of Human Resources*, 1117–9201R2.

Sivasankaran, Anitha. 2014. "Work and Women's Marriage, Fertility and Empowerment: Evidence from Textile Mill Employment."

Voigtländer, Nico, and Hans-Joachim Voth. 2013. "How the West "Invented" Fertility Restriction." *American Economic Review*, 103: 2227–2264.

Zimmermann, Laura. 2020. "Why Guarantee Employment? Evidence from a Large Indian Public-Works Program."

6 Figures and tables

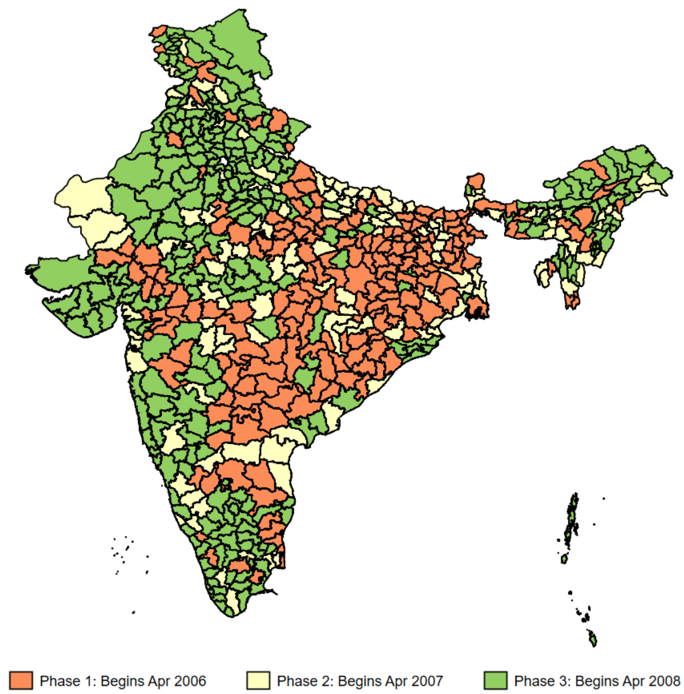


Figure 1: NREGA implementation phases

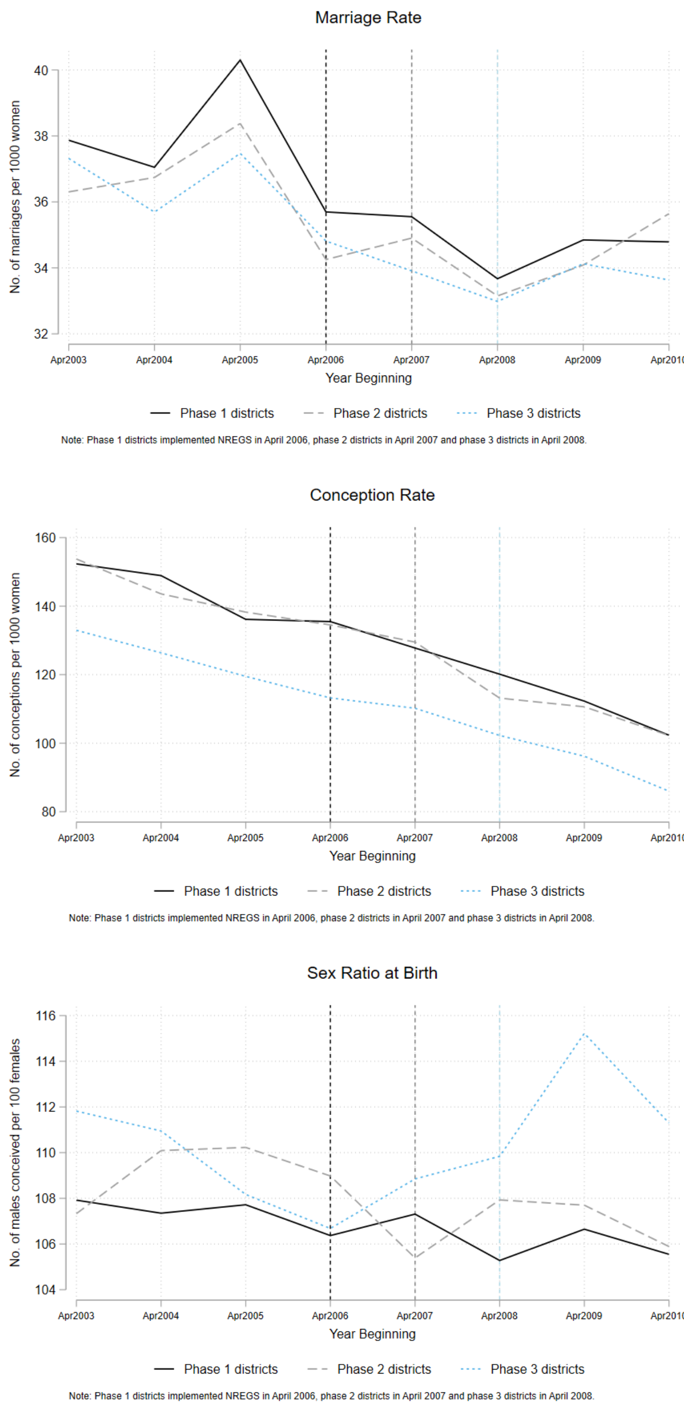


Figure 2: Mean rates of marriage, conception and sex ratio at birth

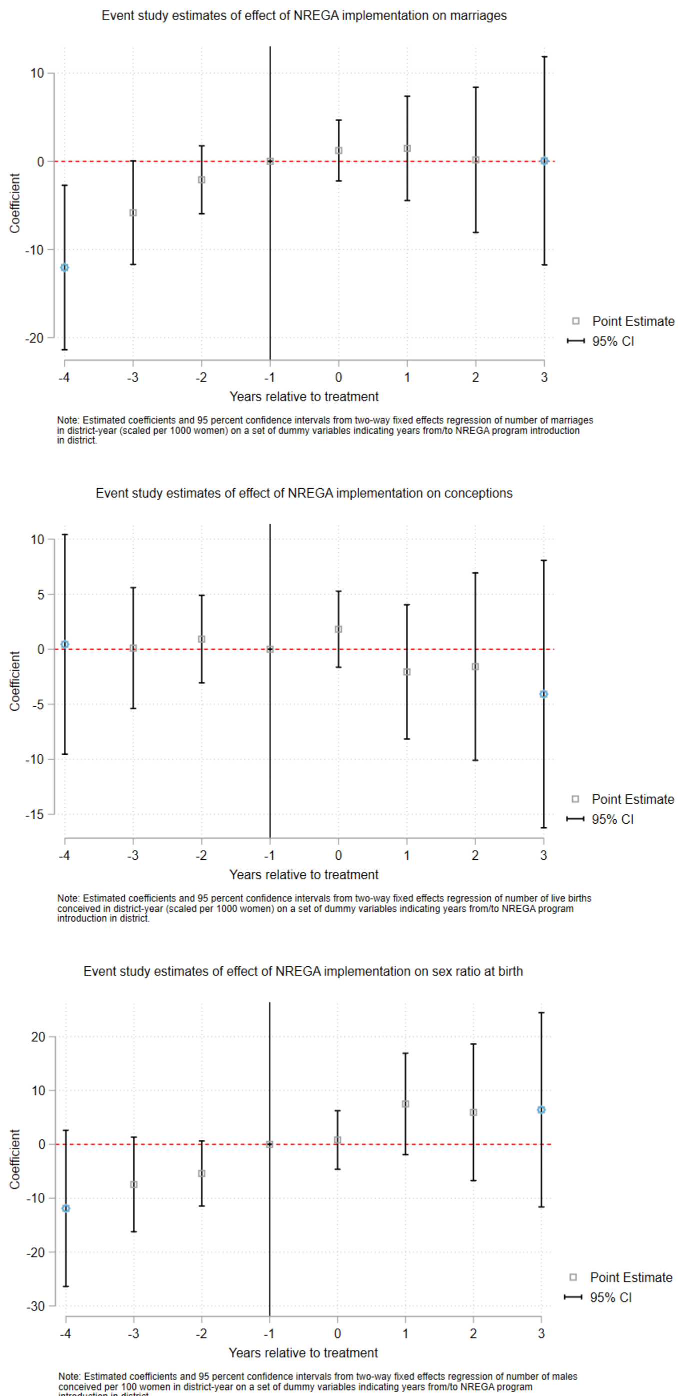
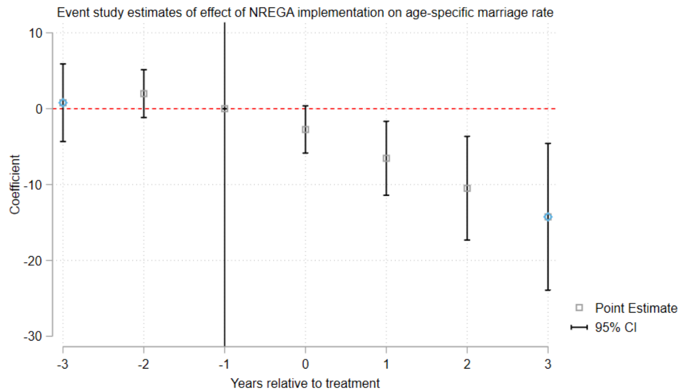
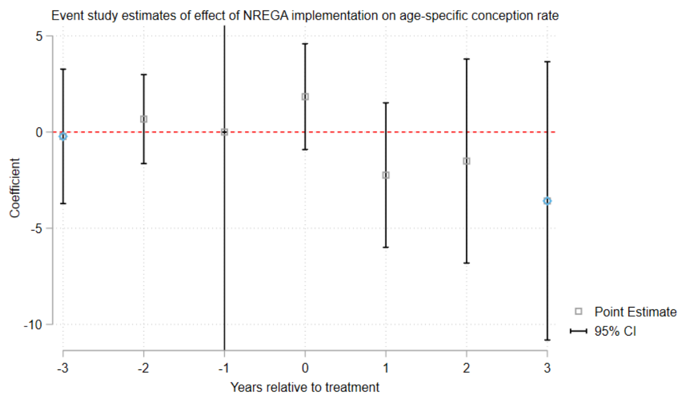


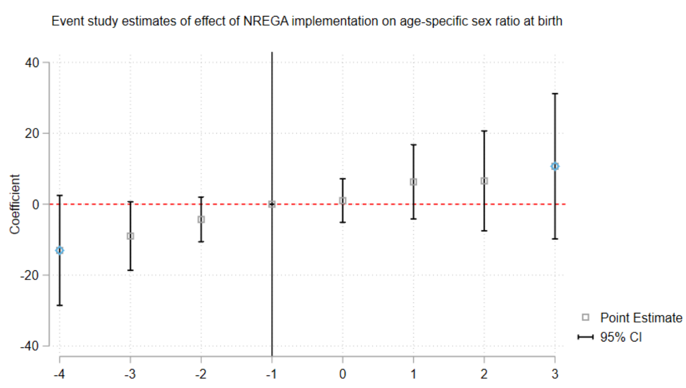
Figure 3: Event study



Note: Estimated coefficients and 95 percent confidence intervals from two-way fixed effects regression of age-specific marriage rate in district-year (scaled per 1000 women) on a set of dummy variables indicating years from/to NREGA program introduction in district. Includes district-age fixed effects and year-age fixed effects. District-age cells are weighted by the number of woman-year observations they represent.



Note: Estimated coefficients and 95 percent confidence intervals from two-way fixed effects regression of age-specific conception rate in district-year (scaled per 1000 women) on a set of dummy variables indicating years from/to NREGA program introduction in district. Includes district-age fixed effects and year-age fixed effects. District-age cells are weighted by the number of woman-year observations they represent.



Note: Estimated coefficients and 95 percent confidence intervals from two-way fixed effects regression of number of males conceived per 100 women in district-year on a set of dummy variables indicating years from/to NREGA program introduction in district. Includes district-age fixed effects and year-age fixed effects. District-age cells are weighted by the number of woman-year observations they represent.

Figure 4: Event study: age-adjusted estimates

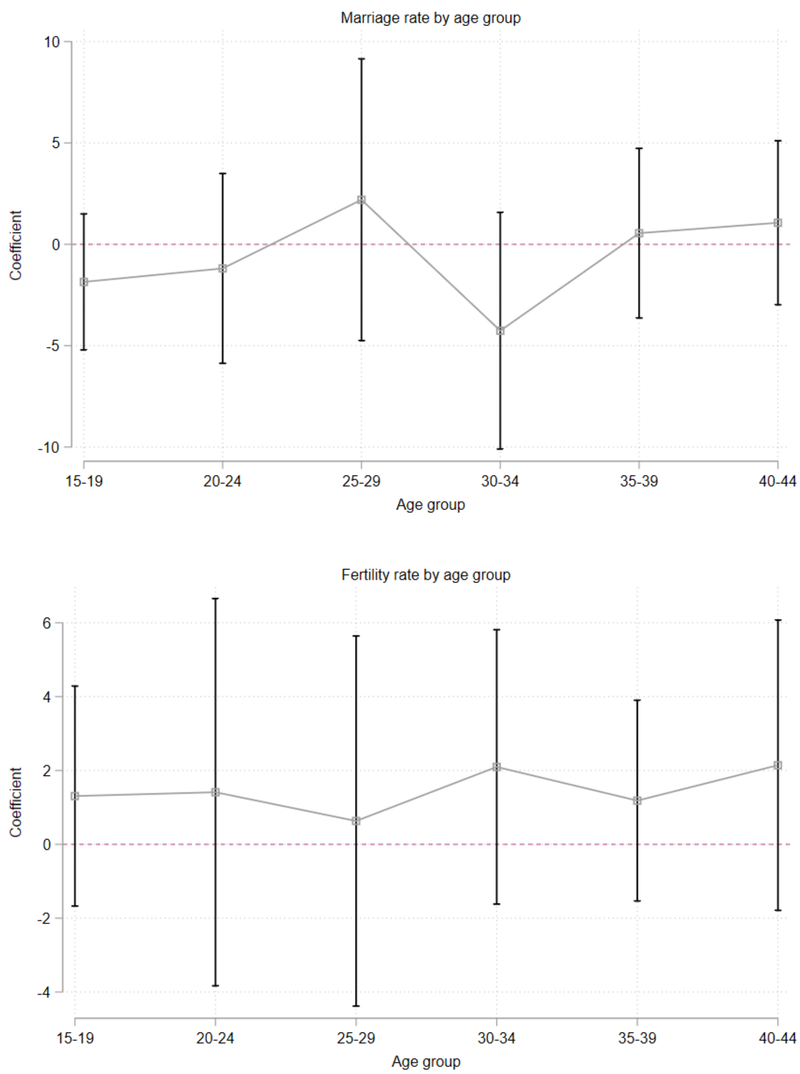
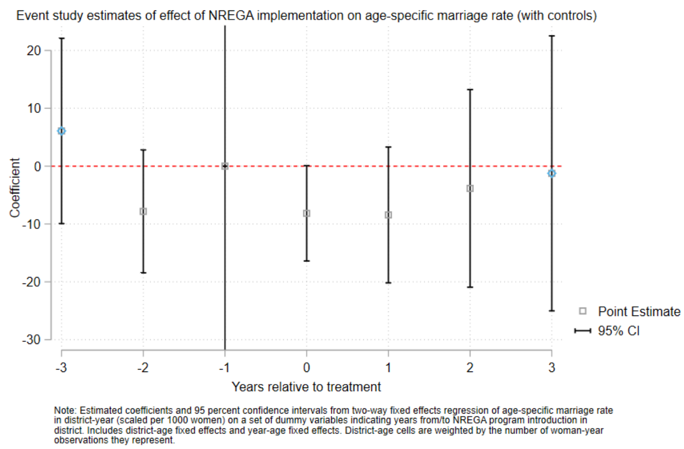
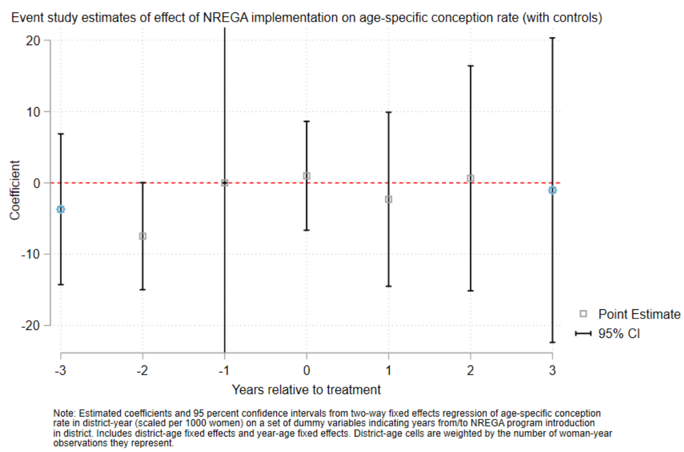


Figure 5: Age-adjusted two-way fixed effects estimates (and 95% confidence intervals) of marriage & conception rates by 5-year binned age groups





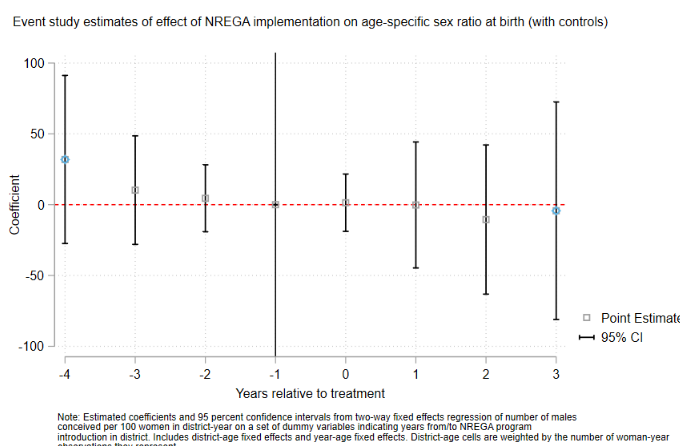


Figure 6: Event study: age-adjusted estimates with controls

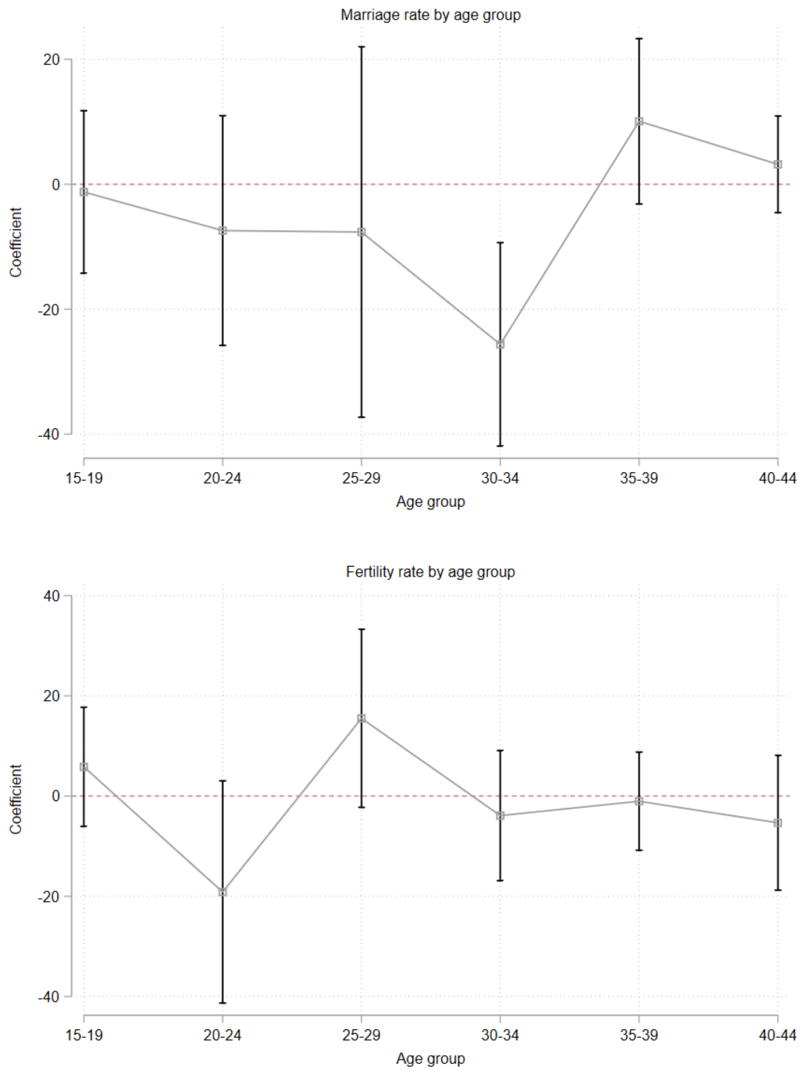
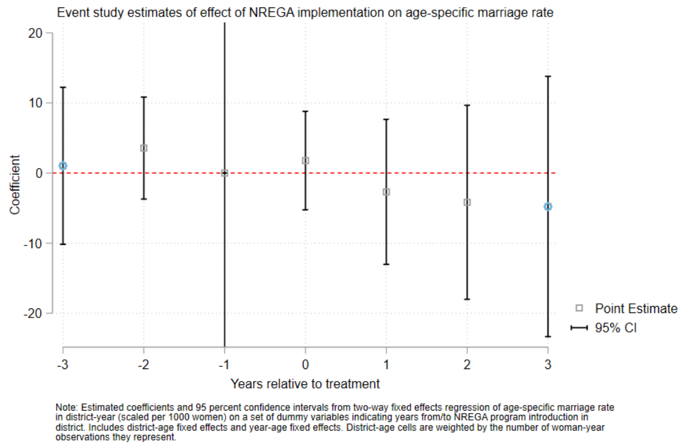
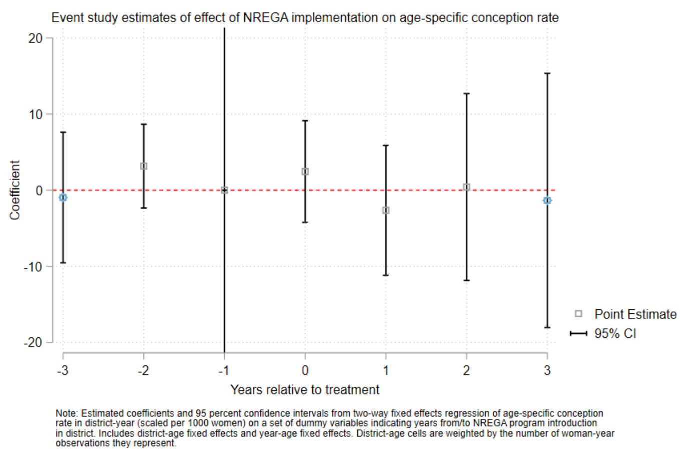


Figure 7: Age-adjusted two-way fixed effects estimates (and 95% confidence intervals) with controls of marriage & conception rates by 5-year binned age groups





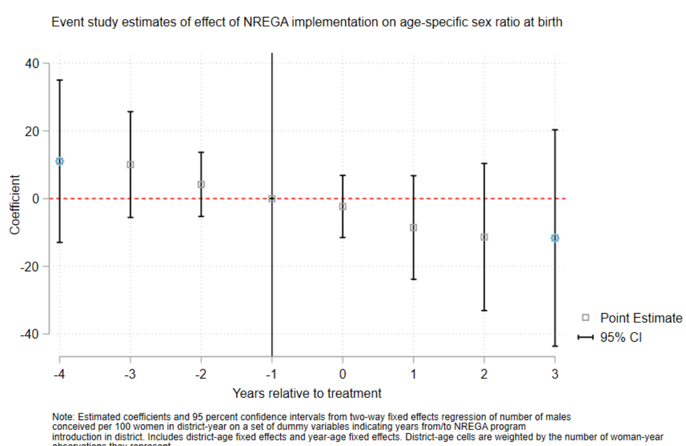
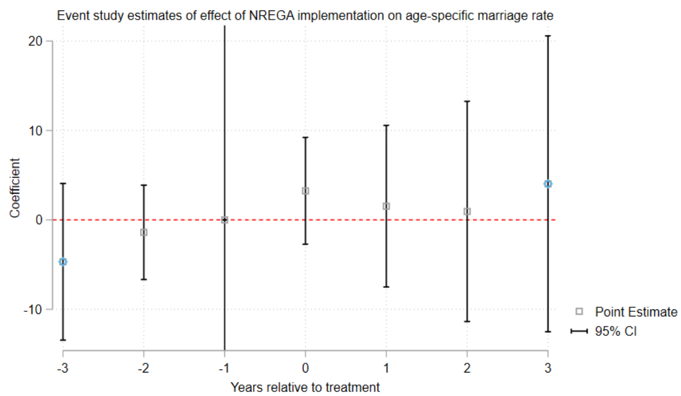
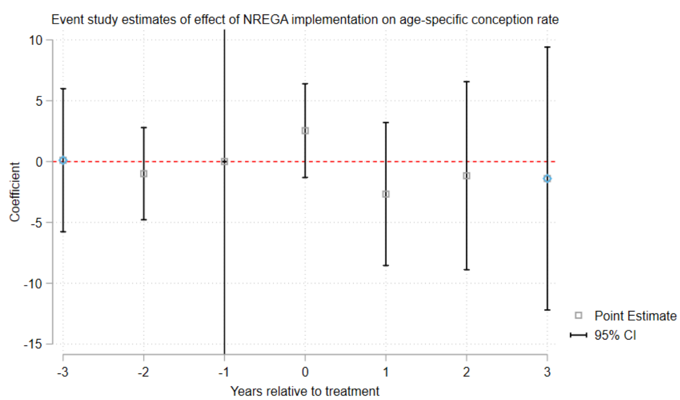


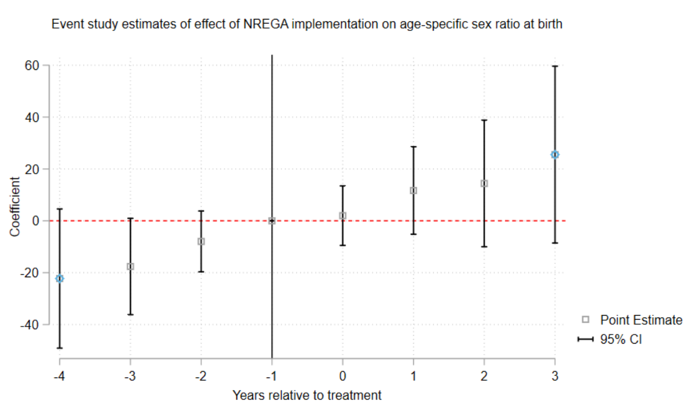
Figure 8: Event study: age-adjusted estimates (poorest quartile)



Note: Estimated coefficients and 95 percent confidence intervals from two-way fixed effects regression of age-specific marriage rate in district-year (scaled per 1000 women) on a set of dummy variables indicating years from/to NREGA program introduction in district. Includes district-age fixed effects and year-age fixed effects. District-age cells are weighted by the number of woman-year observations they represent.



Note: Estimated coefficients and 95 percent confidence intervals from two-way fixed effects regression of age-specific conception rate in district-year (scaled per 1000 women) on a set of dummy variables indicating years from/to NREGA program introduction in district. Includes district-age fixed effects and year-age fixed effects. District-age cells are weighted by the number of woman-year observations they represent.



Note: Estimated coefficients and 95 percent confidence intervals from two-way fixed effects regression of number of males conceived per 100 women in district-year on a set of dummy variables indicating years from/to NREGA program introduction in district. Includes district-age fixed effects and year-age fixed effects. District-age cells are weighted by the number of woman-year observations they represent.

Figure 9: Event study: age-adjusted estimates (richest quartile)

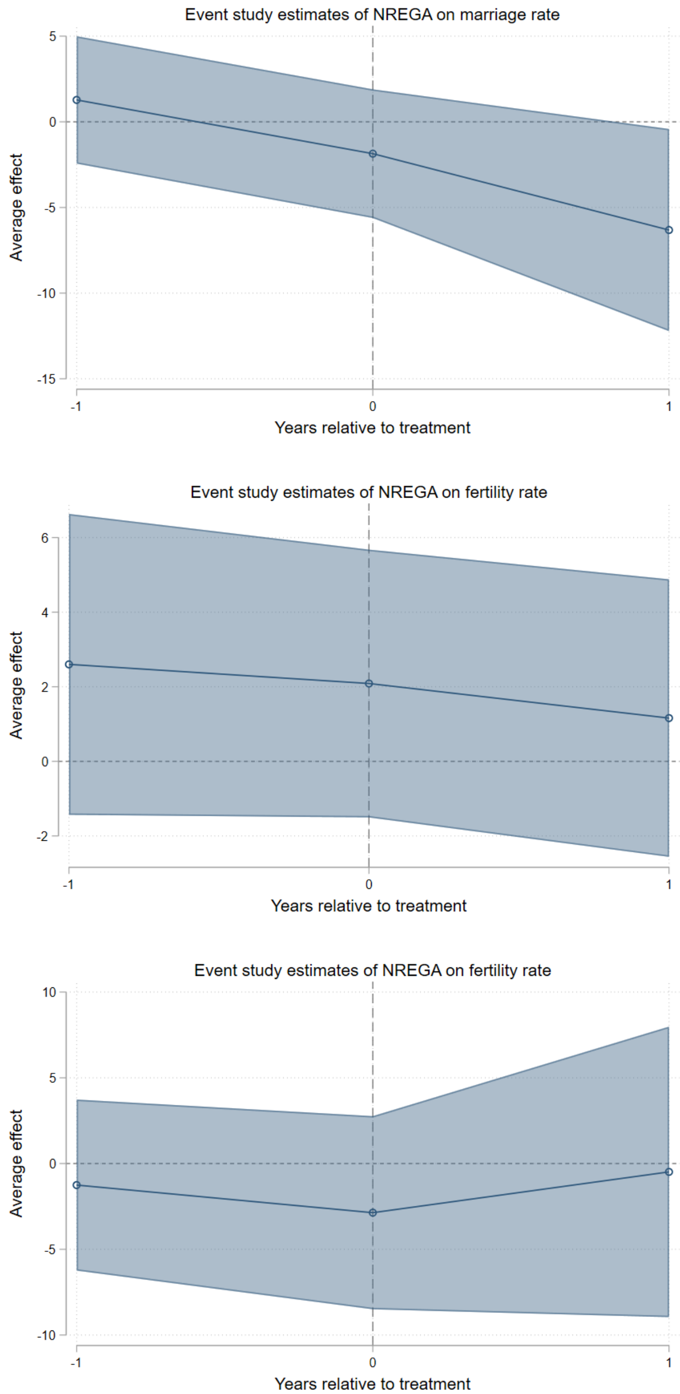


Figure 10: Event study: de Chaisemartin-D'Haultfœuille

Table 1: Effect of NREGA Implementation on Marriage and Fertility

	(1) Marriage rate	(2) Conception rate	(3) Sex ratio
NREGA	0.215	1.636	1.400
	(1.161)	(1.034)	(1.974)
Women-Years	1,241,020	2,770,312	2,770,146
Women	216,744	408,414	408,414
Marriages/Births/Sons	97,962	330,073	171,725

Table presents estimates from regression of dependent variable on indicator for NREGA existing, with district and year fixed effects. Dependent variables in columns (1) and (2) are the district-year means based on indicators for marriage or conception occurring in a given district-year, multiplied by 1000. Dependent variable in (3) is sex ratio at birth – number of males conceived per 100 females. Standard errors, presented in parenthesis, are clustered at the district level. p-values: * 0.10 ** 0.05 *** 0.01

Table 2: Effect of NREGA Implementation on Marriage and Fertility (age-adjusted)

	(1) Age-specific marriage rate	(2) Age-specific conception rate	(3) Age-specific sex ratio
NREGA	-1.279	1.355	-0.991
	(1.187)	(1.017)	(2.243)
Women-Years	1,240,580	2,770,271	1,697,541
Women	216,744	408,414	408,414
Marriages/Births/Sons	97,962	330,073	171,725

Table presents estimates from regression of dependent variable on indicator for NREGA existing, with district-age and year-age fixed effects. Dependent variable in columns (1) and (2) is an indicator for marriage or conception occurring in a given district-year, multiplied by 1000. Dependent variable in (3) is sex ratio at birth – number of males conceived per 100 females. Standard errors, presented in parenthesis, are clustered at the district level. p-values: * 0.10 ** 0.05 *** 0.01

Table 3: Effect of NREGA Implementation on Marriage and Fertility (with controls)

	(1) Age-specific marriage rate	(2) Age-specific conception rate	(3) Age-specific sex ratio
NREGA	-7.557**	1.641	7.846
	(3.520)	(3.285)	(8.001)
Women-Years	853,113	1,987,692	1,212,239
Women	151,858	294,056	294,056
Marriages/Births/Sons	70,836	240,382	125,304

Table presents estimates from regression of dependent variable on indicator for NREGA existing, with district-age fixed effects, year-age fixed effects and pre-program static control variables interacted with time fixed effects. Dependent variable in columns (1) and (2) is an indicator for marriage or conception occurring in a given district-year, multiplied by 1000. Dependent variable in (3) is sex ratio at birth – number of males conceived per 100 females. Standard errors, presented in parenthesis, are clustered at the district level. p-values: * 0.10 ** 0.05 *** 0.01

Table 4: Effect of NREGA Implementation on Marriage by Age Group (with controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Age Group:	15-19	20-24	25-29	30-34	35-39	40-44
NREGA	-1.237	-7.417	-7.649	-25.629***	10.080	3.184
	(6.635)	(9.377)	(15.125)	(8.304)	(6.752)	(3.948)
Women-Years	445,494	243,554	80,052	37,649	31,952	13,802
Women	128,718	76,614	28,726	12,825	9,003	4,887
Marriages	41,797	23,955	4,217	686	160	20

Table presents estimates from regression of dependent variable on indicator for NREGA existing for binned age groups, with district-age and year-age fixed effects and district controls interacted with time. Dependent variable is an indicator for marriage occurring in a given district-year, multiplied by 1000. p-values: * 0.10 ** 0.05 *** 0.01

Table 5: Effect of NREGA Implementation on Fertility by Age Group (with controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Age Group:	15-19	20-24	25-29	30-34	35-39	40-44
NREGA	5.827	-19.142*	15.509*	-3.902	-1.034	-5.340
	(6.060)	(11.309)	(9.068)	(6.624)	(4.999)	(6.862)
Women-Years	488,797	420,534	364,482	327,416	272,306	111,764
Women	146,713	129,670	112,746	101,794	77,051	38,719
Births	48,476	96,679	57,717	25,536	10,401	1,559

Table presents estimates from regression of dependent variable on indicator for NREGA existing for binned age groups, with district-age and year-age fixed effects and district controls interacted with time. Dependent variable is an indicator for conception occurring in a given district-year, multiplied by 1000. p-values: * 0.10 ** 0.05 *** 0.01

Table 6: Effect of NREGA Implementation on Marriage and Fertility (poorest quartile)

	(1) Age-specific marriage rate	(2) Age-specific conception rate	(3) Age-specific sex ratio
NREGA	0.940	0.238	-0.883
	(2.804)	(2.292)	(3.239)
Women-Years	286,340	703,016	377,731
Women	50,541	102,730	102,730
Marriages/Births/Sons	25,731	116,860	59,991

Table presents estimates from regression of dependent variable on indicator for NREGA existing, with district-age and year-age fixed effects for bottom 25% of households in wealth distribution. Dependent variable in columns (1) and (2) is an indicator for marriage or conception occurring in a given district-year, multiplied by 1000. Dependent variable in (3) is sex ratio at birth – number of males conceived per 100 females. Standard errors, presented in parenthesis, are clustered at the district level. p-values: * 0.10 ** 0.05 *** 0.01

Table 7: Effect of NREGA Implementation on Marriage and Fertility (richest quartile)

	(1) Age-specific marriage rate	(2) Age-specific conception rate	(3) Age-specific sex ratio
NREGA	1.693	1.877	-2.783
	(2.446)	(1.595)	(4.570)
Women-Years	341,754	700,950	184,391
Women	58,582	103,280	103,280
Marriages/Births/Sons	24,147	57,037	30,426

Table presents estimates from regression of dependent variable on indicator for NREGA existing, with district-age and year-age fixed effects for top 25% of households in wealth distribution. Dependent variable in columns (1) and (2) is an indicator for marriage or conception occurring in a given district-year, multiplied by 1000. Dependent variable in (3) is sex ratio at birth – number of males conceived per 100 females. Standard errors, presented in parenthesis, are clustered at the district level. p-values: * 0.10 ** 0.05 *** 0.01

Table 8: Effect of NREGA Implementation on Marriage and Fertility

	(1) Marriage rate	(2) Conception rate	(3) Sex ratio
NREGA	-3.620*	1.729	-1.947
	(2.070)	(1.627)	(3.032)
Women-Years	1,241,020	2,770,312	2,770,312
Women	216,744	408,414	408,414

Table presents estimates from regression of dependent variable on indicator for NREGS existing, with district and year fixed effects using de Chaisemartin & D'Haultfœuille estimator. Dependent variables in columns (1) and (2) are the district-year means based on indicators for marriage or conception occurring in a given district-year, multiplied by 1000. Dependent variable in (3) is sex ratio at birth – number of males conceived per 100 females. Standard errors, presented in parenthesis, are clustered at the district level. p-values: * 0.10 ** 0.05 *** 0.01