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The Power of Lakshmi: Monetary Incentives for Raising a Girl

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Abstract

Worldwide, 1.6 million girls are “missing” at birth every year. One policy tool to improve the sex ratio is a conditional cash transfer that pays parents to invest in daughters, but existing evidence on their effectiveness is sparse. Using a difference-in-differences framework, we evaluate the Dhanlakshmi scheme, an Indian CCT program that strongly encouraged girl births without restricting fertility. Dhanlakshmi improved the sex ratio at birth, with only a small fertility increase. The girl-birth effect was concentrated among the first two parities and partially persisted after the program was discontinued. Post-birth outcomes like immunization and education also improved.

Keywords: conditional cash transfer, son preference, sex ratio, gender bias, India

JEL Codes: D13, H53, I15, I18, J16

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1 Introduction

More than 1.6 million girls worldwide are “missing” at birth every year, a combination of cultural preferences for sons and the diffusion of cheap technology for prenatal sex determination (Bongaarts and Guilmoto, 2015). Economic development and increasing educational attainment have been largely ineffective in reversing this trend because rising incomes and improved information access also reduce the barriers to sex-selective abortions (Jayachandran, 2017; Jha et al., 2011). Prohibiting sex-selective abortions has done little to address the problem (Bhalotra and Cochrane, 2010). In India, for example, illegal ultrasound providers routinely escape detection and prosecution. Governments and non-state actors seeking to normalize the sex ratio among young children therefore need alternative policy tools.

One potentially effective intervention is a conditional cash transfer (CCT) that pays parents for having a girl child if she reaches certain milestones such as immunization or school enrollment. Such programs not only incentivize parents to have a daughter, but also encourage them to invest in her post birth. India provides an ideal context to study the performance of such schemes: The country accounts for one-third of the world’s 126 million missing women and is the only one to have widely experimented with CCTs to reduce sex-ratio imbalances (Bongaarts and Guilmoto, 2015; Kumar and Sinha, 2019; Sekher, 2010). Since the early 1990s, Indian governments have implemented more than 20 girl-child CCTs embodying a variety of designs.

Table 1 provides an overview of Indian girl-child CCT programs by start year, with their spatial coverage and scope. The first girl-child CCTs were introduced in 1992 in Rajasthan and Tamil Nadu. Since then, many others have been launched, some of which have been discontinued.¹ All but two programs explicitly promote girl births and about half provide payments for immunization, education, or marriage delay. Table 2 summarizes the restrictions associated with each scheme’s design. Most limit participation based on income, either through a BPL (below the poverty line) or other specified income cutoff, and restrict the number of girls that can be enrolled from the same family. A number of programs also require proof of terminal family planning methods such as

¹CCTs listed without end dates were still active during our sample period, according to Sekher (2010).

sterilization, or impose a maximum number of children in the household. Households that fail to comply with fertility limits lose their eligibility. Payout timing, frequency and generosity vary widely. The most common structure is a single payment to the girl when she reaches adulthood, usually conditional on having remained unmarried. The payment is typically financed through a government deposit with an insurance company when she is enrolled.²

Despite the frequent use of girl-child CCTs in India, little is known about their effectiveness, let alone the pros and cons of specific design features. One exception is Devi Rupak, a CCT program launched in Haryana in 2002. While the program is relatively generous, paying out meaningful monthly benefits for up to 20 years, it is highly restrictive. Devi Rupak limits benefits to households with either one child or two daughters and no sons, and includes a sterilization requirement, with the objective of improving the sex ratio without increasing fertility.³ S Anukriti (2018) studies the effects of this scheme using a difference-in-differences framework and finds that Devi Rupak actually worsened the sex ratio at first birth by 1 to 2 percent. Her work is a clear warning that imposing restrictions to attenuate the sex ratio-fertility tradeoff may undermine the primary program goal.

S Anukriti's findings for Devi Rupak raise the question whether program designs that do not trade off girl births and family size could be more effective at improving the sex ratio. As Table 2 shows, more recent CCTs have apparently considered the possibility, dropping terminal family planning requirements or number-of-children restrictions. One program that exemplifies this more liberal approach is Dhanlakshmi. This scheme, which was introduced in 2008 and operated through 2013, provided cash payments for giving birth to a girl, immunizing her, enrolling her in school and deferring her marriage until age 18. While its overall generosity was roughly on par with Devi Rupak, Dhanlakshmi did not impose any limits on family size or the number of beneficiaries, nor

²Trust in the payout promise is crucial. One of the earliest programs, Rajasthan's Rajalakshmi scheme, was popular among households in Rajasthan, and some other programs, such as Haryana's Apni Beti Apna Dhan were inspired by it. However, Rajalakshmi had to be terminated in 2000 because the insurance company could not sustain the high promised interest rate (14-17% per year). This experience is said to have undermined the appeal of similar schemes. Rajasthan has not implemented another girl-child CCT since, even though the state has one of the most skewed child sex ratios in India. Because of this structure, most programs only enroll girls shortly after birth or within a window of 3-5 years after birth.

³Sinha and Yoong (2009) study a similarly restrictive program in Haryana from the mid-1990s, Apni Beti Apna Dhan, which requires below-the-poverty line status and limits the number of girl beneficiaries per household.

did it apply a means test. The only eligibility criterion was residency in an area where the program was implemented. In sharp contrast to Devi Rupak, Dhanlakshmi's design put the goal of promoting the birth of girls at odds with the competing policy aim of lowering fertility.

In this paper, we examine whether Dhanlakshmi improved the sex ratio at birth, and if so, whether this change came at the cost of a fertility increase. Our analysis is focused on the state where the scheme was most effectively implemented, Punjab, which also has one of the most skewed sex ratios in India. We draw on data from repeated cross sections of large household surveys, as well as on Census data. Our main analysis compares outcomes for mothers in the treated district of Fatehgarh Sahib with their counterparts in other Punjabi districts before and after the scheme was introduced. Our preferred estimates from the household survey data indicate that Dhanlakshmi increased the probability of a girl birth by 5.5 percentage points relative to the rest of Punjab, while raising the likelihood of any birth by only 0.85 percentage points. Under plausible assumptions about the 2011 Indian Census data for the treated area, these estimates imply that Dhanlakshmi was responsible for over 30 percent of girl births but only 5 percent of total births during the treatment period. All of the gains in girl births occur in the first two birth parities. The effect is concentrated in rural areas where the sex ratio imbalance is more severe and where more than two-thirds of the district population lives. Significantly, we also show that Dhanlakshmi reduced the reported desired preference for a son, and that almost half of the girl-birth effect persists one to three years after the scheme ended. These findings are robust to a variety of specifications and control groups, and are confirmed in the Census data.

The sex-ratio imbalance among young children in India arises not only through sex-selective abortion but also from excess female mortality. Dhanlakshmi's payout structure is clearly designed with this problem in mind. Thus, we follow the cohort that was born under the Dhanlakshmi program through ages 5–7, estimating its impact on immunization, survival to ages 5–7 and primary-school enrollments. We find that the scheme increased immunization rates by up to 7.8 percentage points, the girl share of the 5-year-old age group by 4.5 percentage points and primary-school enrollment rates by 4 percentage points. Dhanlakshmi's payouts also promoted the same post-birth outcomes for girls born before the scheme was introduced. Extending our education outcome analysis to

8–14-year-olds, we show that Dhanlakshmi improved persistence, increasing completed years of schooling by about a third of a year.

We are the first to evaluate the Dhanlakshmi scheme and there are no other comparable studies of similarly designed girl-child CCTs. Our results therefore have important implications for employing CCTs to reduce son preference and raise the status of girls. First, they indicate that it is possible to place all of the incentives on having and caring for daughters without worrying too much about the fertility effects. Dhanlakshmi lowered the impact of son preference largely by inducing the substitution of daughters for sons, implying that many parents chose to carry a female foetus to term rather than aborting the pregnancy to have a son. That we find such sizable effects even in a comparatively rich state like Punjab is encouraging news for many of the other girl-child CCTs currently in operation in India. Most programs that were introduced since the mid-2000s have already done away with sterilization or fertility restrictions (though typically retaining some income restrictions and beneficiary limits), making them more in line with Dhanlakshmi than with Devi Rupak. Our results suggest that this has been a design move in the right direction.

Second, the results suggest that an unrestricted, competently implemented CCT, whose design clearly signals that encouraging girl births and daughter welfare are the goal, may contribute to a persistent cultural change. Dhanlakshmi's lasting effect on girl births and the reduction in expressed son preference are consistent with a reduction in the stigma associated with having a daughter. Dhar et al. (2019) document the significant role parents play in shaping the gender attitudes of their children in India, so such a shift in the revealed fertility preferences may have additional long-run benefits.⁴ Unlike non-monetary interventions such as a discussion and persuasion experiment (Dhar et al., 2018), exposure to cable television (Jensen and Oster, 2009), or the reservation of seats for female politicians (Beaman et al., 2009), Dhanlakshmi shows that monetary incentives for having a girl can also contribute to a change in gender norms. This complements and extends recent evidence that higher financial control for women improves female labor-force participation and gender attitudes (Field et al., 2019).

⁴In other contexts, having a daughter or sister has been shown to in turn shape gender norms. See e.g. Washington (2008) and Healy and Malhotra (2013).

2 The Dhanlakshmi Scheme

2.1 Dhanlakshmi Design: Unrestricted and Generous

The Dhanlakshmi Scheme was launched by the Indian Ministry of Women and Child Development in March 2008 as a pilot program in select areas. All girls born on or after November 19, 2008 were eligible to enroll in the program irrespective of household income or the number of siblings. The only requirement was residency in an area where the program is active. The Indian government chose not to scale up the program to the rest of the country and the policy was discontinued in April 2013. But the financial commitments to the enrolled households continue to be honored.⁵

The scheme provides cash transfers to beneficiary households for every girl from her birth until age 18, conditional on proof of having reached certain milestones. Girls born before November 19, 2008 could still enroll in Dhanlakshmi and benefit from later milestone payouts, starting with the milestones required for their age at enrollment. Table 3 provides an overview of the payments under the program (Brahme and Kumar, 2015). A family received 5000 rupees for showing proof of the birth's registration and 1250 rupees for immunizing the girl. Conditional on their daughter's enrollment in school, the household would be eligible for a total of 3500 rupees for completing primary school and 3750 rupees for completing secondary school up to grade 8. If parents can show that the girl has remained unmarried until her 18th birthday, the girl also receives an insurance maturity cover of 100,000 rupees. To put these payouts in perspective, average monthly household expenditures in Punjab's treatment district Fatehgarh Sahib according to the 2007/08 National Sample Survey were 5397 rupees, 5094 rupees in rural areas and 6971 rupees in urban areas. Thus, registration alone was worth almost a month of household expenditures.

There are no direct monetary costs associated with meeting any milestone. Registration within 21 days after a child's birth is free of charge and children born in hospitals are typically automatically registered. There is no charge for immunizations under India's Universal Immunization Program and children can attend government school up to the 8th grade without having to pay tuition. Consequently, scheme payments can be applied to the indirect costs associated with such milestones,

⁵See Appendix A for details on Dhanlakshmi's discontinuation.

such as transportation expenses, or be used to subsidize a daughter's general upbringing.⁶

2.2 Dhanlakshmi Implementation: Why We Focus on Punjab

Dhanlakshmi was introduced in 11 blocks (the next administrative level below the district) across seven Indian states: Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Odisha, Punjab, and Uttar Pradesh. However, we focus exclusively on the scheme's impact in Punjab for two reasons. First, our primary goal is to determine whether such an unrestricted and generous CCT can improve the sex ratio without significantly increasing fertility, and only Punjab had a severely skewed sex ratio prior to 2008. As we discuss below, Punjab is distinct in other ways as well. Second, severe implementation challenges in the other six states, owing largely to Maoist violence, make causal inference impossible regardless of the goal.

2.2.1 Skewed Sex Ratios and other Punjabi Distinctives

Table 4 summarizes the key characteristics of the 11 treatment blocks, by state and district, using data from the 2001 Census and 2007/08 National Sample Survey.⁷ Unless otherwise noted, all information is reported at the block level. For our purposes, the most important contrast to draw appears in the second row, which reports the district-level child sex ratio (CSR) from the 2001 Census, defined as the number of girls per 1000 boys in the 0–6-year age group. In 2001, Fatehgarh Sahib's CSR was 766, well below that of every other district in the table and the lowest in all of India. In the other districts, the CSR is at or much closer to the expected biological parity. Rae Bareilly had next lowest CSR at 943, which is 23 percent higher than Fatehgarh Sahib's. Further, Fatehgarh Sahib was explicitly chosen as the treated district, and Sirhind as the treated block, because of the high number of 'missing girls' (Ministry of Women and Child Development, 2015). The third row reports the child sex ratio at the block level, showing that Sirhind's CSR in 2001 was 749, substantially below the district average. The bottom line is that Punjab is the only treated state

⁶See Appendix B.1 for details on the scheme's approach to beneficiary recruitment and enrollment.

⁷All figures, with the exception of consumer expenditures, were calculated from the Census data. The National Sample Survey contributed the consumer expenditure information.

that presents an empirical setting suitable for testing Dhanlakshmi's effect on the sex ratio.

Fatehgarh Sahib and Sirhind are distinct from other treated areas in significant ways beyond the CSR as well. From Table 4, we see that Sirhind had a far more urban population, greater female literacy rate and higher average monthly consumption level than every other treated block. No other block besides Jagdalpur had an urban population to speak of. Also, Sirhind had no Scheduled Tribes (ST), while the population of every other treated block (except Shivgarh in Rae Bareilly) had a meaningful share of this disadvantaged minority. The female literacy rate was between a third and five times higher than in the other treated blocks. Similarly, average district monthly consumption levels were between two-thirds and four times higher in Fatehgarh Sahib.⁸

One implication of contrasts in Table 4 is that, while Fatehgarh Sahib was selected for its highly skewed sex ratio, the other 10 treatment areas were chosen primarily because of their low female literacy rates. Many of Dhanlakshmi's milestones relate to education and the program explicitly allows older girls (not born under the scheme) to benefit. Thus, the scheme's goal outside Punjab was to improve educational outcomes of girls rather than affect the sex ratio. In any event, these contrasts reinforce the claim that Punjab should be the focus of our analysis.

2.2.2 Implementation Challenges outside Punjab

Independent of the differences in district characteristics, there were substantial challenges to implementation outside of Punjab. The key concern in most of the states is high levels of Maoist-related violence during the study period. Figure 1 shows the location and intensity of Maoist violence in 2007, the year before Dhanlakshmi was implemented. In 2006, then Prime Minister Manmohan Singh had famously described the insurgency as 'the single biggest internal security challenge ever faced' by India.⁹ The Maoists accuse the Indian government of a systematic disinterest in the economic development of many of its citizens, particularly members of the STs, and seek to overthrow the government to create an independent state. As guerrilla-type fighters, the dense forest cover in many high-ST areas also provides a good hiding ground for the Maoists. At various points

⁸Data in the National Sample Survey (NSS) is only available at the district level.

⁹Hindustan Times, April 13, 2006: Naxalism biggest threat: PM.

in time, the local ST population has been accused by both government forces and the Maoists of supporting the other side. From the mid-2000s onwards, state and private militia groups engaged in large-scale counter-insurgency activities, especially in the Maoist strongholds. These actions have led to massive human rights violations against the tribal population.¹⁰

Figure 1 documents that 5 out of the 7 treatment states were affected by the violence. The most intense conflict activity in 2007 occurred in a cluster of districts at the border of Chhattisgarh, Andhra Pradesh and Odisha, which encompasses the Dhanlakshmi treatment districts from all three states. The treatment areas in Bihar and Jharkhand, which lie directly on opposite sides of the border, were also heavily affected by violence. Among the Dhanlakshmi states, only Punjab and most of Uttar Pradesh were unaffected by Maoist-related violence. The geographical pattern of violence persisted throughout the period of our main analysis, which includes the pre-Dhanlakshmi years 2004-2007 and the program implementation years 2009-2012.¹¹

The Maoist-related violence creates severe internal validity concerns for a difference-in-difference (DID) research design. Figure 2 plots the average number of fatalities for treatment and control groups in all five conflict-affected states. Conflict intensity in the pre-Dhanlakshmi years (2004-2007) follows different trajectories in the treatment and the control group, suggesting that the parallel-trend assumption is likely violated in Andhra Pradesh, Bihar, Chhattisgarh, and Jharkhand. In Odisha, the pre-Dhanlakshmi fatalities follow a close to parallel trend in both groups, but the introduction of Dhanlakshmi coincides with a massive increase in fatalities in the treatment districts. We also observe a similar spike in violence in Bihar. Thus, it would be difficult if not impossible to disentangle Dhanlakshmi's effects from those related changes in conflict intensity in the treated areas.

Additionally, detailed anecdotal reporting on the Dhanlakshmi scheme points to other serious challenges that plagued implementation in both the violence-affected states and Uttar Pradesh. Disinterested governments with other priorities and confusion with similar ongoing schemes led to

¹⁰This includes the burning down of entire villages, abductions, sexual violence and the forced migration of civilians to refugee camps. See for example Sundar (2016) for more details.

¹¹See Appendix figures D.1a to D.2d.

a small and highly uneven enrollment of beneficiaries in these six states.¹²

By contrast, implementation quality in Punjab was high. Sirhind accounted for the largest share of beneficiaries and budgeted allocations among the 11 Dhanlakshmi blocks, and was the only treatment block which consistently recorded beneficiary enrollments. Awareness about registration sites in Punjab was among the highest of all treatment areas, partly because school teachers played a key role in information dissemination (Sekher and Ram, 2015). Registration required relatively little time in Punjab. More than 60 percent of households reported it took less than a week, while in other states the majority of households waited more than four months (Sekher and Ram, 2015). Existing state government schemes in Punjab were small and differed substantially in eligibility, so there was no confusion with other programs. The goals of Dhanlakshmi appear to have been well-understood. In a survey, a significant share of potential beneficiaries in Punjab identified the scheme’s purpose as balancing the sex ratio (Sekher and Ram, 2015).

Given the Maoist violence and other implementation challenges, it is not surprising that we find widespread violations of the parallel trends assumption outside of Punjab in the pre-treatment period. Table 5 reports the results from pre-trend analyses for a girl-birth indicator (*isgirl*), our main outcome of interest. For each state, we test the null of no treatment effect for the years in 2004–2006 relative to 2007, the year before Dhanlakshmi was introduced. Punjab is the only state where we cannot reject the null. In the six other states, the estimated coefficients are large and statistically significantly different from 0 in at least two of the three time periods.

3 Research Design

3.1 Data and Basic Framework

Our research design is based largely on household data from the District Level Household and Facility Survey (DLHS) and the National Family Health Survey (NFHS) (IIPS, 2010, undated, 2017). Both are large-scale surveys of health and fertility outcomes that are representative at the

¹²See Appendix B.2 for a full account of Dhanlakshmi’s national rollout and the challenges presented in each state.

state level. They record all live births to women aged 15-49 for up to four years prior to the interview date. For each birth, the surveys report the sex, birth year, birth order and whether it involved a single child, twins or triplets. For each woman, the survey provides her age, education, caste, and religion, as well as her household's wealth (measured by dwelling type) and location (whether urban or rural). We identify the years a woman was at risk of giving birth over the previous four years (essentially the years she was married), the birth(s) in a given year, and whether a birth was a girl.

Our primary focus is on the effects of Dhanlakshmi on girl births and fertility. The 2007/08 and 2012/13 rounds of the DLHS are the sources for information on children born before and after Dhanlakshmi was introduced.¹³ While the program was announced in early 2008, it did not come into effect until November of that year. We therefore take 2004-2007 as our pre-treatment period and 2009-2012 as our post-treatment period.

Our research design compares the change in each outcome before and after the scheme was introduced in the treated area of Punjab with the changes in areas not covered by the scheme. In our main analysis, the treated area is the district of Fatehgarh Sahib and the other Punjabi districts comprise the control group. Focusing on Punjab has the advantage that state-specific policies, as well as cultural and socio-economic factors, are held constant. Importantly, there were no confounding district-level interventions in Punjab between 2004 and 2012.

Using the household survey data, we formalize the DID setup in terms of a regression model of the form:

$$y_{idt} = \delta DL_d \times Post_t + X_{idt}\gamma + \alpha_d + \pi_t + \varepsilon_{idt}, \quad (1)$$

where y_{idt} is a (girl) birth indicator for woman i in district d and year t , $DL = 1$ for women residing in the treatment area and $Post = 1$ for observations drawn from the treatment period, X_{idt} is a vector of covariates, α_d and π_t are district and year fixed effects. The coefficient of interest is δ . We estimate (1) first without and then with covariates. We assess the robustness of our main findings to alternative control groups comprised of districts in states that are plausible counterparts to Punjab.

¹³DLHS 2012/13 is publicly available from the Indian Ministry of Family Health and Welfare website. The 2007/08 round of the survey is available on request from IIPS (Indian Institute of Population Studies).

We report standard errors that are clustered at the district level. Because our district-level analysis involves a relatively small number of clusters, we also report results using wild-cluster-bootstrap standard errors, employing randomization inference and collapsing the analysis to the district level.

Because Dhanlakshmi was discontinued in 2013, we can extend our DID design to examine whether the effects of the scheme persisted when enrollment ended. For this analysis, we combine the DLHS 2012/13 data with the 2015/16 round of the NFHS. In this case, we compare the changes in attitudes about desired pregnancy outcomes, girl births and fertility from the last three birth years completely covered in the DLHS (2010-2012) with the first three covered in the NFHS (2014-2016) for both Fatehgarh Sahib and the other Punjabi districts. Using the same design, we can also follow the cohorts born under the Dhanlakshmi scheme through age seven to examine its effects on post-birth outcomes through immunizations and enrollment in primary school.

3.2 Analysis Sample

The Punjab sample for our main analysis comprises 36,768 woman-years, 6,701 unique mothers and 10,678 live births. The treated district, Fatehgarh Sahib, contributes 403 mothers, 180 (223) from the pre (post)-treatment period. The other 19 control districts supply 6298 mothers, 3041 (3257) from the pre (post)-periods. The live-birth total breaks down to 619 in Fatehgarh Sahib, 248 (371) pre (post), and 10,059 in the rest of the state, 4524 (5535) pre (post). The left panel of Table 6 provides the summary statistics for the variables used in our analysis.

The two outcomes of primary interest are whether a mother gives birth to a girl, conditional on giving birth (*isgirl*), and whether she gives birth at all (*isbirth*). Comparing the pre/post means for these two variables in the treatment and control districts offers a preview of our main findings. The girl share of births is roughly the same magnitude in Fatehgarh Sahib and the rest of Punjab during the pre-treatment period. However, it rises 4.5 percentage points in Fatehgarh Sahib – from .456 to .501 – while it remains essentially unchanged elsewhere. Fertility is declining across Punjab during this period, but this decrease is slightly greater outside of Fatehgarh Sahib.

The covariates include mother's age and completed grades of schooling, religious affiliation,

and whether a woman is low caste, a member of a Scheduled Tribe, resides in a rural or urban area and lives in an engineered house.¹⁴ The treatment and control groups differ little in terms of many key characteristics. On average, mothers in Fatehgarh Sahib and in the rest of Punjab are similar in age and level of schooling, and the share of rural households is roughly the same. At the same time, Fatehgarh Sahib has a higher share of Sikhs and low-caste households. It also appears slightly wealthier as proxied by house construction type.

To estimate the post-program effects of Dhanlakshmi, we join the 2015/16 round of the NFHS with the 2012/13 round of the DLHS. The Punjab sample for this analysis comprises 15,170 woman-years, 5,269 unique mothers and 5,721 live births. The right panel of Table 6 presents the summary statistics, and the bottom two rows give the breakdown in mothers and births pre/post in Fatehgarh Sahib and the rest of Punjab. DLHS and NFHS are very similar datasets in terms of survey design and sampling method, and are routinely combined in district-level empirical analyses. See S Anukriti (2018) for a recent example. The sample size is larger in the DLHS because it is explicitly meant to be representative at the district level.

The girl share of births in Fatehgarh Sahib declines by only 1.2 percentage points in the post-program period and remains 1.4 percentage points higher than the post-program girl share in the other districts. Consistent with the sample represented in the left panel, we see the same similarities in mother's age and level of schooling as well as the share of rural households in treated and control groups. Likewise, we find the same religious affiliation and wealth differences.

To explore the impact of Dhanlakshmi on the post-birth outcomes of immunization and education, we use the DLHS 2007/08 and 2012/13, as well as the NFHS 2015/16. For immunization outcomes, we combine the DLHS 2007/08 and 2012/13 rounds and restrict the sample to girls who are at least two years old, the age by which children should be fully immunized according to India's Universal Immunization Program (Corsi et al., 2009). For primary-school enrollment, we link the DLHS 2012/13 and NFHS 2015/16 to follow the girls born under Dhanlakshmi (between 2009–2011) through ages 5–7 years-old, the ages at which children typically start school.¹⁵ We

¹⁴We use the house construction type as a proxy for wealth because the DLHS does not collect wealth or income information.

¹⁵Appendix tables D.4 and D.5 provide the summary statistics for these samples.

also draw on DLHS 2012/13 and NFHS 2015/16 to investigate whether Dhanlakshmi improved educational outcomes for 8–14 year-olds who were born before the scheme was implemented (between 2002–2007).

4 Results

First, we present Dhanlakshmi’s effects on birth outcomes – girl births and fertility. Then we turn to the results for the post-birth outcomes of immunization, survival to primary-school age and education.

4.1 Birth Outcomes

In this section, we discuss our main results on girl births and fertility and show how they vary with birth order and residential location. We also provide evidence that Dhanlakshmi’s impact on girl births persisted after the scheme was terminated.

4.1.1 Girl Births and Fertility

Table 7 reports the estimates of Dhanlakshmi’s effects on girl births and fertility from (1) using our sample of mothers from the 2007/08 and 2012/13 DLHS waves. First, consider the female-birth findings for Punjab given in Panel A. The simple DID coefficient estimate reported in Column (1) suggests that Dhanlakshmi increased the likelihood of a girl birth by 4.5 percentage points in Fatehgarh Sahib during the treatment period. Adding district and year fixed effects, along with controls for birth order, mother’s age and education, and household’s caste, religion, residential location and wealth (Column (2)), causes the estimated effect to rise by about a percentage point. In each case, the estimated DID coefficient is statistically significant at the 1-percent level.

As emphasized by S Anukriti (2018), it is reasonable to suppose that promoting girl births may generate higher overall fertility if sons and daughters are imperfect substitutes or if parents desire a minimum number of sons. Devi Rupak was designed to mitigate this tradeoff, limiting benefits

to households with either one child or two daughters and no sons, and requiring sterilization. S Anukriti (2018) shows these restrictions essentially counteract the impact of otherwise generous incentives to have daughters, leading to an unintended rise in the sex ratio.

While Dhanlakshmi improved the prospects for girl births, the lack of any countervailing incentives against higher fertility could potentially undermine its impact on the sex ratio. Panel B of Table 7 reports the estimated effects of Dhanlakshmi on fertility. Columns (1) and (2) repeat the same specifications as in Panel A and show a positive and statistically significant effect of Dhanlakshmi on births, although it is relatively small. The simple DID estimate is about half of a percentage point and the estimate from the fully controlled model is about 0.9 percentage points. The coefficient estimate from the fully controlled model is significant at the 1-percent level, while the simple DID estimate is less precise.

Overall, the message obtained from the Punjab sample is that Dhanlakshmi led to a 5 percentage-point increase in girl births with less than a 1 percentage-point increase in fertility. However, in settings with only one treated cluster, there is a concern that cluster-robust standard errors will tend to over-reject the null hypothesis. We therefore assess the robustness of our results to several alternatives aimed at addressing this concern. Table 8 presents the results.

One commonly suggested solution is to compute standard errors using the wild cluster bootstrap. Panel A reports the p -values associated with the DID coefficient estimates using the restricted (Wild R) and unrestricted (Wild U) wild cluster bootstrap for girl births (Columns (1) and (2)) and fertility (Columns (4) and (5)). For girl births, Wild U rejects the null at close to the 5-percent level and Wild R rejects at the 10-percent level. Both bootstrap procedures fail to reject the null for fertility. We might view these p -values as providing bounds on the true inference because Wild R will under-reject and Wild U will over-reject when there is just one treated cluster (MacKinnon and Webb, 2017).¹⁶

¹⁶Cluster size also matters to the performance of these bootstrap procedures. Both under-reject when cluster sizes vary relative to the equal cluster-sizes case, although the impact of cluster size on rejection frequencies is smaller for Wild U than Wild R (MacKinnon and Webb, 2020). Further, the range of under-rejection for Wild R is narrower when the largest cluster(s) are treated, which is the case here (MacKinnon and Webb, 2017). Fatehgarh Sahib is the third largest cluster overall and the second largest in the post-treatment period. Taken together, these results suggests that the “bounds” provided by the Wild U and Wild R p -values can be viewed as conservative.

Another option is to employ randomization inference (RI) to compute the correct standard errors. A crucial assumption for this approach is that treatment assignment is random, and RI should not be used if it fails (MacKinnon and Webb, 2020). However, as explained in Section 2.2.1, the treatment district of Fatehgarh Sahib was chosen explicitly because it had the worst child sex ratio in all of India in the 2001 Census. Nevertheless, we also report RI p -values in Panel A for the girl-birth (Column (3)) and fertility estimates (Column (6)), which lead to the same conclusions as Wild R.

A more conservative way of dealing with intra-cluster correlation is to collapse the analysis to the district level (Bertrand et al., 2004). Panel B of Table 8 provides the DID estimates for the girl-birth and fertility outcomes from the collapsed specification. The estimated girl-birth effect rises to 8.2 percentage points and we still reject the null at the 5-percent level. The estimated fertility effect is now negative, but it remains small in magnitude and is less precisely estimated than in Table 7. The bottom line is that our main results are quite robust to these alternative approaches, showing a substantial improvement in the sex ratio but no large increase in fertility.

A separate concern with our analysis might be the existence of other girl-child CCTs operating in Punjab contemporaneously with Dhanlakshmi. As indicated in Table 2, Punjab had two such girl-child programs, Kanya Jagriti Jyoti Scheme and Balri Rakshak Yojana. Kanya Jagriti Jyoti had about 8000 beneficiaries per year across the state, according to administrative sources, and there is no evidence of any material changes in the scheme during Dhanlakshmi (Sekher, 2010). Balri Rakshak Yojana had few beneficiaries – only 306 between 2005-10 – and was discontinued in 2014. Overall, Sekher (2010) describes officials in the state of Punjab as generally uninterested in implementing other girl-child CCTs, explaining its low relative enrollment rates. In any event, these ongoing schemes can be held constant in our DID setup.

We also explore the robustness of the results produced by the Punjab sample by carrying out our analysis with control groups constructed from districts in other states. While the existence of ongoing, contemporaneous girl-child CCTs across India limits the pool of alternatives, we assemble three different groups from the states that were included in DLHS 2012/13. The first comprises those states that had no girl-child CCT operating during the period of our analysis: Arunachal Pradesh, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West

Bengal. We label this group “None”. The second uses those states with a girl-child CCT but where the status of the CCT did not change over the analysis period: Haryana, Karnataka and Tamil Nadu. We designate this the “No Changes” group. Clearly, the analysis carried out with the second group is conceptually different, as it compares Fatehgarh Sahib to districts that always had a girl-child CCT. While it is possible that any of the other schemes induced time-varying differences with the treatment area, we have no evidence of any. A potential problem with the “None” and “No Changes” groups is that they contain states that are culturally different from Punjab. Therefore, we construct a third group from states that are culturally more similar, especially in terms of son preference. These are the northwest states of Haryana and Himachal Pradesh, hence the “Northwest” label. This is consistent with the approach of S Anukriti (2018) and Sinha and Yoong (2009), whose main DID analyses use control groups comprising neighboring states on the basis of their similarity to the treated area.

Columns (3)-(5) in panels A and B of Table 7 present the results from the fully controlled model, using the three alternative control groups, “None”, “No Changes” and “Northwest”, respectively. The estimated effects of Dhanlakshmi are remarkably robust across the three alternatives. The DID estimate for female births ranges from 4.7 to 5.4 percentage points; for fertility, the range is 0.3 to 0.8 percentage points. All the coefficient estimates are significant at the 1-percent level. Overall, the findings from the DLHS data strongly suggest that Dhanlakshmi led to more girl births with only a slight rise in fertility.

As an additional robustness check, we also explore whether the effects of Dhanlakshmi are evident in Census data. As discussed in Section 2, the scheme was actually implemented in Sirhind, one of five blocks in Fatehgarh Sahib. An advantage of the Census data is that they are available at the block level, so we can examine the CCT’s effect on Sirhind directly. Specifically, we carry out a DID analysis on the share of girls among children aged 0-6 and the size of the 0-6-year-old population, comparing Sirhind to the other Punjabi blocks in the 2001 and 2011 Censuses. Our Census sample is constructed from the Primary Census abstracts. Using the Census administrative atlas, we reconcile all block boundary changes across the two years, creating a panel of 72 blocks.¹⁷

¹⁷See Table D.1 for the summary statistics.

The controls in this specification include male and female literacy rates, labor-force participation rates by gender, the rural population share and the population shares belonging to Scheduled Castes or Scheduled Tribes. Standard errors are clustered at the block level.

The last column of Table 7 gives the Census results. The DID estimate in Panel A is 0.0062 and significant at the 1-percent level, suggesting that Dhanlakshmi increased the share of girls in the 0–6-year-old population by about 0.62 percentage points. While the Census estimate implies a smaller program effect, it is attenuated relative to the household survey result because the 0–6 age group includes children born between 2005 and early 2011. However, only children born after 2008 could have been born due to Dhanlakshmi. At the same time, we find an imprecisely estimated negative impact of Dhanlakshmi on the 0–6-year-old population, offering further support for the conclusion that the introduction of Dhanlakshmi did not lead to a large fertility increase. As we show below, the number of additional births implied by the household results lies within the confidence interval of the Census fertility results.¹⁸

We also use the block-level information in the Census data to test for spillovers from the treatment area to surrounding control districts or blocks. In principle, we can effectively rule out direct spillovers in the form of payments to non-resident households because beneficiaries must produce a certificate of residence in Sirhind to qualify and they lose coverage if they move away. Indirect influence of gender attitudes in surrounding areas is another matter. We investigate this possibility with the Census data in three ways (results not shown). First, we estimate our fully controlled DID girl-share regression, dropping Sirhind and designating the other four Fatehgarh Sahib blocks as the treated area. This delivers a fairly precise zero; the DID coefficient estimate is 0.0077 with a standard error of 0.0061. Next, we carry out this exercise using the three blocks outside of Fatehgarh Sahib contiguous to Sirhind as the treated area. Again, we find no evidence of a CCT spillover; the DID estimate is only 0.0030 with a standard error of 0.0038. Finally, we

¹⁸The difference between the estimated effects across the two samples is also affected by the implicit weighting scheme. The DLHS is representative at the district level, so more women from larger districts are included in the analysis sample. In the Census data, the block-level regression weights all blocks equally because there is one observation for each block. Unfortunately, information on the number of women of reproductive age is not available in the 2001 Census at this disaggregated level, so we cannot reweight our observations. As we show in Table 8, collapsing the Census data to the district and weighting all districts equally produces the qualitatively same results.

estimate the girl-share regression dropping all blocks contiguous to Sirhind. The estimated effect reported in Column (6) of Table 7 is unchanged; the DID coefficient estimate remains 0.0062 with a standard error of 0.0011.

4.1.2 Birth Order and Residential Location

Now we consider two important dimensions of heterogeneity in the impact of Dhanlakshmi, birth order and residential location. Traditionally, the sex ratio for second births is even more skewed. We test for birth-order effects by interacting the treatment variable with indicators for the second and higher-order children. Column (1) of Table 9 reports the results for the Punjab sample. Dhanlakshmi improved the prospect of a girl birth with the first child by 4.3 percentage points and an additional 5.8 percentage points with the second child. The first and second birth-order effect estimates are significant at the 5-percent level. We find little evidence that Dhanlakshmi influenced the prospect of a girl birth at a birth order of three or higher (results not shown). The estimated coefficient of the interaction between the program and higher (> 2) birth-order indicators is roughly the same magnitude as the main effect, but negative.

In India, sex-ratio imbalances are often more concentrated in urban areas, where there is better access to sex-selection technology and higher incomes to pay for it. However, in Fatehgarh Sahib, the pre-treatment sex-ratio imbalance was larger in rural areas, where more than two-thirds of the district population lives. Columns (2) and (3) show how the impacts of Dhanlakshmi on girl births and fertility vary by urban residency using the Punjab sample. We find the CCT's effect on girl births is highly concentrated in rural areas, where it raised the likelihood of having a daughter by 7.4 percentage points, compared with less than a percentage point in urban areas. Both main and interaction coefficient estimates are significant at the 5-percent level. Consistent with these findings, the overall small, positive fertility effect is also concentrated in rural areas.

4.1.3 Son Preference and Post-Program Effects

Although Dhanlakshmi stopped enrolling new households in 2013, it is plausible that the girl-birth effects documented here could have persisted to some degree through a change in attitudes. To

probe this possibility, we first use the DLHS questions on desired pregnancy outcomes to estimate the effect of Dhanlakshmi on a mother’s stated preference for a boy child. Panel A of Table 10 presents the results from the Punjab sample (Columns (1)-(2)) and alternative control-group samples (Columns (3)-(5)), in parallel with Table 7. Here, we also condition on the number of daughters from previous births. The simple DID estimate produced by the Punjab sample is -0.329 and significant at the 10-percent level; with controls it is -0.539 and significant at the 1-percent level. The implication is that Dhanlakshmi reduced the expressed desire for a boy child by 3.3–5.4 percentage points. The evidence from the alternative control groups is weaker, but it generally supports the claim that the scheme reduced the intensity of son preference. In addition, we find that the son-preference effect does not vary significantly with whether there is a daughter in the household. Panel B of Table 10 repeats the analysis of Panel A, adding an interaction with a “has daughter” indicator. While mothers with daughters are more likely to prefer a son (on the margin), they are not significantly more likely to say so under Dhanlakshmi.

Next, we directly estimate the post-program effects of the scheme, comparing changes in girl births and fertility from 2010-2012 with those from 2014-2016 using the Punjab sample. Table 11 reports the results. For girl births, the simple DID estimate is -0.030 and statistically significant at the 5-percent level. The DID estimate from the fully controlled model is similar in magnitude (-0.023), though less precise (with a t ratio of about 1.5). Taken together, these results imply that almost half of the overall effect on girl births reported in Table 7 persisted one to three years after Dhanlakshmi ended, which is consistent with the attitude change documented in Table 10. In Column (3), we see that the lasting impact lands entirely on the first child, where the prospect of having a daughter is higher by almost 7.7 percentage points. In contrast, the estimated post-program effect on fertility essentially reverses the small positive result shown in Table 7.¹⁹

¹⁹We also estimated the post-program effect by comparing pre-program births from DLHS 2007/08 with post-program births from NFHS 2015/16. The results are qualitatively and quantitatively very similar. See Appendix Table D.3.

4.1.4 Discussion: Effect Sizes and Treatment Intensity

The findings reported in Tables 7-11 clearly point to a Dhanlakshmi-led improvement in Sirhind's child sex ratio. The scheme's impact is sufficiently strong to be picked up at the district level in the household survey data, even though Sirhind is only one of 5 blocks in Fatehgarh Sahib. Here, we provide the results from a simple back-of-the-envelope calculation of the number of girls born in Sirhind because of Dhanlakshmi.²⁰

Based on the simple comparison of means between treatment and control groups before and after the implementation of Dhanlakshmi from Table 6, the program led to one extra birth in Fatehgarh Sahib per year (an increase of 1.64 percent), but to three additional girl births. All of these girls were born due to the improvement in the sex ratio rather than the small fertility increase. Using 2011 district-level Census information to provide a rough translation from the household-survey sample numbers to Fatehgarh Sahib's relevant population age group, this implies an estimated 584 additional children and 1,752 additional girls were born in the 4 years of Dhanlakshmi.²¹ If all of these births came from Sirhind, then Dhanlakshmi accounted for 4.85 percent of all births and 32.13 percent of all girl births.²²

The high treatment intensity implied by these calculations is supported by the descriptive assessments of Dhanlakshmi compiled in Sekher (2010) and Sekher and Ram (2015). When surveying Sirhind residents about Dhanlakshmi, Sekher and Ram (2015) reported that finding non-beneficiary households was a challenge because the scheme had been implemented so well. In a number of villages, they found that all eligible girls had been enrolled in the program. They document continued consistent communication about Dhanlakshmi in Sirhind through print media, electronic media, and posters, with an integral role for health center workers and local government officials. As a summary illustration of Dhanlakshmi's impact on Sirhind Sekher and Ram (2015) offer a quote from one survey respondent: "Dhanlakshmi scheme benefits the girls in a major way.

²⁰For more details, see Appendix C.1.

²¹Keeping in mind that the Census was held in 2011 while the household survey data covers births up to 2012, the corresponding number of additional births is 438. This figure falls inside the 95 percent confidence interval of the DID estimate in Column (6): $[-3680.39, 468.95]$.

²²The evidence presented in Section 4.1.1 for no spillovers outside of Sirhind supports this assumption.

It would help reduce the level of female foeticides. The scheme would help to improve equality in treatment between boys and girls.’’²³

4.2 Post-Birth Outcomes

Dhanlakshmi not only promoted girl births, but their health and education as well. The scheme paid 1,250 rupees if the child received the full complement of immunizations scheduled for the first 24 months and 1,000 rupees if she enrolled in primary school. In addition, there were annual payments of 500 rupees for each primary-school grade completed, another 1,500 rupees for enrolling in middle school and 750 rupees for each middle-school grade completed. Using the DLHS 2012/13 and NFHS 2015/16, we follow the cohorts born under the Dhanlakshmi scheme through age seven, which allows us to examine the program’s effects on immunization, survival to primary-school age and primary-school enrollment.

Table 12 reports our findings for immunization, survival and primary-school enrollment, comparing children born under Dhanlakshmi with birth cohorts whose outcomes could not be influenced by the scheme. Each column coincides with the fully controlled specification using data from Punjab (as in Column (2) of Table 7).²⁴

4.2.1 Immunization

According to Corsi et al. (2009), India’s Universal Immunization Program during our study period included one dose of BCG (tuberculosis), three doses of OPV (polio) and DPT (diphtheria, pertussis and tetanus), and one dose of measles. We bundle these vaccinations into three “rounds”, corresponding roughly to three distinct phases in their age-appropriate classification: BCG + DPT1 (Round 1), DPT 2-3 + OPV 1-3 (Round 2) and measles (Round 3). Round-1 vaccinations are supposed to be given at or shortly after birth and according to Corsi et al. (2009) show the largest gender gap in India. Round-2 vaccinations would occur within a couple of months after birth, with Round-3’s being given at 9 months or later.

²³Appendix C.2 describes their survey and summarizes responses on gender attitudes.

²⁴Appendix Tables D.6 and D.7 provide the results using alternative control groups.

While the Dhanlakshmi program specifies that children should be fully vaccinated by the time they are 24 months old, the age ranges for the individual immunization milestones do not directly map to these recommended age-appropriate immunization rounds. We therefore restrict the sample to girls who are at least 24 months old and test the impact of the CCT on vaccination rates in that sample. We find that Dhanlakshmi increased the probability that a girl received her Round-1 vaccinations by 7.8 percentage points (Column (1)) and the result is statistically significant at the 1-percent level. Columns (2) and (3) indicate that the scheme also improved second and third-round vaccination prospects by about 5 percentage points, although these estimates are slightly less precise. These effects are large given that baseline vaccination rates are around 40 percent in the sample.

4.2.2 Survival

Where son preference is strong, there is commonly a gender disparity in post-natal mortality because some households substantially under-invest in their daughters' care. Guilmoto et al. (2018) calculate the excess female under-5 mortality rates (U5MR) for each Indian state for the 2000–2005 period, just before the introduction of Dhanlakshmi. These U5MR estimates capture the difference between observed and expected (biological) female mortality rates. Guilmoto et al. (2018) report a U5MR in Punjab of 14.3 per 1000 live births. Many of these deaths are believed to be the direct result of low vaccination rates and parental neglect. The staggered Dhanlakshmi immunization and education payouts are clearly designed to combat this discrimination by incentivizing parents to continuously make investments in their daughters, which should improve girls' survival chances.

We explore the effectiveness of these payouts in increasing post-natal survival by repeating the girl-birth analysis for primary-school-age children before and after the scheme was introduced. Specifically, we use the NFHS 2015/16 to follow children born during Dhanlakshmi (between 2009–2011) until they reach primary-school age (5–7 years-old). Likewise, we use the DLHS 2012/13 to follow children born early enough (between 2000–2002) that Dhanlakshmi could not affect their post-birth outcomes. Column (4) reports the estimated effect of Dhanlakshmi on the probability a primary-school-age child is a girl. We find that the girl share of this age group increased by 4.5 percentage points under the scheme, which is over 80 percent of the girl-birth effect given in Table

7. Consistent with the immunization findings, it appears that Dhanlakshmi not only led to a rise in girl births, but also aided their post-natal survival.

4.2.3 Education

Finally, we examine the role Dhanlakshmi played in promoting school enrollment. Both the DLHS 2012/13 and NFHS 2015/16 ask each household whether their school-age children are in school at the time of the survey. Combining these data similarly to the survival sample, we estimate the effect of the scheme on the probability a 5–7-year-old girl was enrolled in school (was “in school now” (*isn*) according to the survey). Column (5) reports the result, which suggests Dhanlakshmi increased the likelihood a girl started primary school by 4 percentage points. Both the estimated survival and education effects are significant at the 5-percent level.

4.2.4 Older Girl Effects

An important feature of Dhanlakshmi’s design was the ability to also enroll older girls who were born before the program was introduced. While those girls could not benefit retroactively from payouts for earlier milestones, they were eligible for any remaining age-appropriate payments. Most of these financial incentives center on school attendance and grade completion through the end of middle school. We investigate Dhanlakshmi’s impact on these older girls, focusing on girls who are 8–14 years-old in the NFHS 2015/16 and their counterparts in the DLHS 2007/08. Children who started school on time should have received the last education payout for 8th-grade attendance (the final year of middle school) at around age 14. Compulsory schooling in India covers 6–14 year-olds, although many girls drop out earlier.

Table 13 reports the estimated effects of Dhanlakshmi on *isn* and completed years of schooling (*yos*). The scheme apparently had no impact on the enrollment of older girls (Column (1)), but it did raise their average years of schooling (Column (2)). The DID estimate of the *yos* effect, which is statistically significant at the 1-percent level, indicates an increase of roughly a third of a year. These findings suggest that enrollment patterns for this age group were set before Dhanlakshmi started, but the scheme successfully encouraged the persistence of those who were already enrolled.

5 Conclusion

In the early 1990s, Amartya Sen coined the term “missing women” to describe the large sex-ratio imbalance between men and women in some countries (Sen, 1990). Since then, the problem has received high levels of attention by researchers, practitioners and policymakers. Despite the scale, salience and urgency of skewed sex ratios in countries such as India, one of the most common policy tools meant to combat son preference – conditional cash transfers – has hardly been studied. India’s earliest girl-child CCTs were introduced in 1992, and to this day Indian governments have implemented more than 20 such programs. Nevertheless, little is known about their effectiveness or best design practices.

In this paper, we study the impact of Dhanlakshmi, one of the most liberal and generous of the Indian CCTs. Using a difference-in-differences empirical strategy, we show that the scheme had a substantial positive effect on girl births, with only a slight increase in fertility. Thus, most of the sex-ratio improvement came from parents substituting daughters for sons. Some parents who would have otherwise pursued abortion or post-birth foeticide apparently chose to have daughters because of the scheme’s monetary incentives. We also show that half of the girl-birth effect persisted even after the program was discontinued, and this persistence coincided with a reduction in self-reported son preference.

Dhanlakshmi not only promoted girl births, but encouraged post-birth investments by providing payments for reaching immunization and education milestones. Girls born under the scheme were more likely to receive their scheduled immunizations, survive to primary-school age and enroll in primary school. These benefits were not limited to girls born under Dhanlakshmi, but also accrued to girls who were alive when the program was implemented.

A key implication of these findings is that in India CCT design can focus squarely on promoting girl births and post-birth investments in daughters and forgo the fertility restrictions and sterilization requirements widely adopted by previous schemes. The limits on fertility are perhaps understandable in the early CCTs introduced in the 1990s, when the national fertility rate was still over 3.5. However, the fertility rate was falling at the time and it has continued to drop, down to 2.2 as of 2019. The

point is that perhaps the fertility limits were largely infra-marginal to other forces driving family size. And, as S Anukriti (2018) suggests, including them may have undermined the main goal of improving the sex ratio. In any event, most girl-child CCTs implemented since the late-2000s have dropped the most severe limits, a move our results support.

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Table 1: Overview of Girl Child CCT Programs

Girl CCT Program	Start Year (1)	End Year (2)	Spatial Coverage (3)	Scope (4)
Rajalakshmi	1992 ^a	2000	Rajasthan	birth
Girl Child Protection Scheme	1992		Tamil Nadu	birth, education
Apni Beti Apna Dhan	1994	1998	Haryana	birth, education, marriage
Kunwarbainu Mameru Yojana	1995		Gujarat	marriage
Girl Child Protection Scheme	1996		Andhra Pradesh	birth, immunization, education, marriage
Kanya Jagriti Jyoti Scheme	1996		Punjab	birth
Balika Samridhi Yojana	1997	2006	National ^b	birth, education, marriage
Devi Rupak	2002		Haryana	birth
Balri Rakshak Yojana	2005	2014	Punjab	birth
Ladli Scheme	2005		Haryana	birth, immunization, education
Bhagyalakshmi	2006		Karnataka	birth, immunization, education, marriage
Mukhya Mantri Kanyadan Yojana	2006		Madhya Pradesh	marriage
Ladli Lakshmi Yojana	2007		Madhya Pradesh	birth, education, marriage
Indira Gandhi Balika Suraksha Yojana	2007		Himachal Pradesh	birth
<i>Dhanlakshmi Scheme</i>	2008	2013	National ^c	birth, immunization, education, marriage
Mukhya Mantri Kanya Vivah Yojana	2008		Bihar	marriage
Mukhya Mantri Kanya Suraksha Yojana	2008		Bihar	birth
Ladli	2008		Delhi	birth, education
Majoni	2009		Assam	birth
Beti Hai Anmol	2010		Himachal Pradesh	birth, education, marriage
Mamta	2011		Goa	birth, immunization, education

^aRevised in 1996-1998; 1999.

^bContinued in Gujarat; continued in Himachal Pradesh until 2010.

^cEleven blocks in 7 states (Punjab, Uttar Pradesh, Andhra Pradesh, Bihar, Jharkhand, Chhattisgarh, Odisha).

Table 2: Overview of Girl Child CCT Programs

Girl CCT Program	Income Restriction (1)	Girls per Family (2)	Fertility Restriction (3)	Maximum Number of Children (4)
Rajalakshmi	- ^a	2	sterilization	2
Girl Child Protection Scheme	BPL	2	sterilization	2 (1 or 2 girls)
Apni Beti Apna Dhan	BPL ^b	3	-	girl is of parity 1, 2 or 3
Kunwarbainu Mameru Yojana	Rs.21,206 ^c	1	-	-
Girl Child Protection Scheme	Rs.24,000 ^d	2	family planning operation	2 ^e (1 girl family or 2-girl family)
Kanya Jagriti Jyoti Scheme	BPL	2	terminal planning method	2
Balika Samridhhi Yojana	BPL	2	-	-
Devi Rupak	Non-taxpayers	1	sterilization	2 (1 child or 2 girl family)
Balri Rakshak Yojana	-	2	sterilization	2
Ladli Scheme	-	1 ^f	-	-
Bhagyalakshmi	BPL	2	sterilization	3
Mukhya Mantri Kanyadan Yojana	econ. backward	-	-	-
Ladli Lakshmi Yojana	Non-taxpayers	2 ^g	sterilization ^h	2
Indira Gandhi Balika Suraksha Yojana	-	2	sterilization	2 (1 girl or 2 girl family)
<i>Dhanlakshmi Scheme</i>	-	-	-	-
Mukhya Mantri Kanya Vivah Yojana	Rs.60,000	- ⁱ	-	-
Mukhya Mantri Kanya Suraksha Yojana	BPL	2	-	-
Ladli	Rs.100,000/year	2	-	-
Majoni	-	2	-	2 (1 or 2 girls)
Beti Hai Anmol	BPL	2	-	-
Mamta	-	2	-	-

^aIn some years, different payout amounts for Scheduled Castes/Scheduled Tribes (SC/ST).

^bOr SC or Other Backward Classes (OBC) if non-taxpayer.

^cRs.21,206 for urban areas, Rs.15,976 for rural areas.

^dRs.24,000 in urban areas, Rs.20,000 in rural areas.

^eNo restriction, but families with one girl younger than 3 given first priority; second priority for families with 2 children where second girl is 3 or less.

^fOnly second girl child is eligible (immediate coverage with twin girls).

^gThree if all-girl triplets.

^hSince 2008 does not apply to first girl, but required for second girl.

ⁱNo restriction in principle, but program severely supply constrained.

Table 3: Dhanlakshmi Payouts with Conditions for Each Milestone

Conditions	Payout (Indian Rupees)
Girls born after Nov 19, 2008 with birth registered	5000
Immunization	
Within first 6 weeks	200
Between 6 - 14 weeks	200
Between 4 - 9 months	200
Between 9 - 16 months	200
Between 16 - 24 months	200
On completion of immunization	250
Education	
On enrollment in Primary school	1000
1st grade + attendance	500
2nd grade + attendance	500
3rd grade + attendance	500
4th grade + attendance	500
5th grade + attendance	500
On enrollment in Middle school	1500
6th grade + attendance	750
7th grade + attendance	750
8th grade + attendance	750
Marriage	
18 years old and unmarried	100,000

Note: The terminal benefit is paid through an insurance maturity cover initiated at the time of birth.

Table 4: Overview of Dhanlakshmi Treatment Areas: District Child Sex Ratios and Block-Level Key Characteristics

	Punjab	Andhra Pradesh		Bihar	Chhattisgarh		Jharkhand		Odisha		Uttar Pradesh
	Fatehgarh Sahib (1)	Khammam (2)	Warangal (3)	Jamui (4)	Bastar (5)	Dantewada (6)	Giridih (7)	Koderma (8)	Malkangiri (9)	Koraput (10)	Rae Bareilly (11)
Treated block	Sirhind	Aswaraopeta Narsampet		Sono	Jagdalpur	Bhopalpattnam	Tisri	Markacho	Kalimela	Semiliguda	Shivgarh
District child sex ratio	766	971	955	963	1009	1014	978	975	982	983	943
Child sex ratio	749	1040	944	961	1009	999	964	999	971	1011	944
Urban	28.1	0	0	0	14.6	0	0	0	0	0	0
ST	0	38.0	13.2	3.3	62.1	80.9	22.9	1.6	48.65	50.88	0
Female literacy	62.6	45.1	47.1	17.6	32.2	21.6	17.2	23.2	22.8	13.3	38.4
District consumer expenditure	5397	3159	3220	2827	1945	1396	2876	3660	1154	1680	2770

Notes: Data comes from 2001 Census, except for consumer expenditure, which is drawn from 2007/08 National Sample Survey and only available at the district level. Census data is reported at the block level. Given that the empirical analysis uses data at the district level, we also report the district-level child sex ratio. Child sex ratio is defined as number of girls per 1000 boys in the 0-6 year age group. Urban is percent of population living in urban areas, ST is percent of population who belong to the Scheduled Tribes. Female literacy is percent of adult female population who is literate.

Table 5: Girl-birth Pre-trends, DLHS 2007-08

	PB isgirl	UP isgirl	AP isgirl	BH isgirl	JH isgirl	CH isgirl	OD isgirl
2004 \times DL	-0.0446 (0.028)	-0.0862*** (0.013)	-0.190*** (0.037)	0.0227 (0.016)	0.0680 (0.046)	0.00115 (0.116)	-0.255* (0.142)
2005 \times DL	-0.0147 (0.028)	0.0292** (0.012)	0.180*** (0.054)	-0.199*** (0.018)	-0.0361 (0.030)	-0.156*** (0.030)	0.00516 (0.031)
2006 \times DL	0.0363 (0.022)	0.0603*** (0.015)	0.148** (0.056)	-0.124*** (0.016)	0.0331* (0.017)	-0.173** (0.071)	-0.105* (0.052)
Observations	4772	18266	3545	8983	4851	3835	4909
R^2	0.017	0.004	0.020	0.009	0.014	0.023	0.011

Notes: The sample consists of all pre-program births to mothers between 2004 and 2007. *isgirl* is a binary indicator for a female birth to the sampled women. DID estimates are from a regression of *isgirl* on interaction dummies for treated district and year with 2007 as the reference category. Controls: child's birth order, mother's age and education, household's caste, religion, location (rural or urban) and an indicator of dwelling construction type (wealth proxy).

Table 6: Summary Statistics for Birth and Fertility Samples, Punjab

	DLHS 07/08 and 12/13				DLHS12/13 and NFHS 15/16			
	Fatehgarh Sahib		Control		Fatehgarh Sahib		Control	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
isgirl	0.456	0.501	0.451	0.452	0.495	0.483	0.451	0.469
isbirth	0.287	0.280	0.298	0.286	0.352	0.373	0.359	0.390
Mother's age	26.15	27.75	26.60	27.06	27.54	27.99	26.68	26.81
	(3.715)	(4.185)	(4.082)	(4.349)	(4.231)	(4.195)	(4.319)	(4.338)
Mothers with primary education	0.144	0.148	0.143	0.177	0.146	0.266	0.179	0.234
Mothers with secondary education	0.278	0.284	0.269	0.256	0.276	0.425	0.255	0.390
Share of Hindus	0.236	0.248	0.353	0.379	0.250	0.275	0.372	0.354
Share of Muslims	0.028	0.027	0.015	0.018	0.019	0	0.0196	0.0190
Share of Christians	0.005	0.006	0.007	0.007	0.004	0	0.007	0.011
Share of Sikhs	0.731	0.716	0.621	0.594	0.724	0.725	0.599	0.615
Share of low caste	0.398	0.459	0.322	0.403	0.463	0.472	0.419	0.431
Share of backward tribes	0.009	0.003	0.003	0.024	0.004	0	0.025	0.001
Share of rural households	0.699	0.662	0.696	0.599	0.660	0.579	0.607	0.637
Share of <i>Kachha</i> houses	0.014	0.024	0.020	0.030	0.030	0	0.033	0.001
Share of <i>Pucca</i> houses	0.782	0.758	0.736	0.663	0.780	0.867	0.656	0.827
Number of mothers	180	223	3041	3257	268	86	3982	1766
Number of live births	248	371	4524	5535	283	87	4285	1827

Notes: *Kachha* and *Pucca* houses refer to unengineered and engineered dwelling-place construction. In the left panel, pre and post refer to the periods 2004-2007 and 2009-2012. In the right panel, pre and post refer to the periods 2010-2012 and 2014-2016.

Table 7: Effects of Dhanlakshmi on Girl Births and Fertility

PANEL A: Female Births						
DLHS 2007/08 & 12/13						Census
	Punjab		None	No Changes	Northwest	Punjab
	(1)	(2)	(3)	(4)	(5)	(6)
DL × post	0.045*** (0.008)	0.055*** (0.009)	0.047*** (0.004)	0.054*** (0.005)	0.050*** (0.007)	0.0062*** (0.0011)
District FE		x	x	x	x	
Year FE		x	x	x	x	
Controls		x	x	x	x	x
Observations	10678	10678	66861	51783	26217	144
R ²	0.000	0.008	0.001	0.002	0.005	0.860

PANEL B: Fertility						
	Punjab		None	No Changes	Northwest	Punjab
	(1)	(2)	(3)	(4)	(5)	(6)
DL × post	0.0051* (0.0026)	0.0085*** (0.0025)	0.0026** (0.0012)	0.0058*** (0.0014)	0.0082*** (0.0022)	-1605.72 (1,040.49)
District FE		x	x	x	x	
Year FE		x	x	x	x	
Controls		x	x	x	x	x
Observations	36768	36768	228656	172360	87744	144
R ²	0.000	0.006	0.004	0.004	0.006	0.233

Notes: DLHS samples. Outcome variables are *isgirl* (Panel A) and *isbirth* (Panel B). DID estimates compare the change in each outcome between 2004-07 and 2009-12 in Fatehgarh Sahib with the corresponding changes in the control districts. Controls: child's birth order, mother's age and education, household's caste, religion, location (rural or urban) and an indicator of dwelling construction type (wealth proxy). Alternative control groups comprise states that were surveyed in 2012/13 and, respectively, had no girl-child CCT operating during the period ("None"); had a girl-child CCT but the status of the CCT did not change ("No Changes"); and are culturally similar to Punjab ("Northwest"). The Punjab sample includes 6,701 mothers; the None sample, 42,114; the No Changes sample, 31,320; and the Northwest sample, 16,146. Standard errors clustered at the district level. Census sample. The outcome variables are share of girls in the 0-6-year-old population (Panel A) and the size of the 0-6 population (Panel B). The DID estimates compare the change in each outcome between 2001 and 2011 in Sirhind with the corresponding changes in the other blocks in Punjab. The controls are male and female literacy rates, labor-force participation by gender, rural population share, and scheduled caste or tribe share, and block fixed effects. The treated area is the Sirhind block and the treatment period is 2011. Standard errors clustered at the block level.

Table 8: Dhanlakshmi Effects on Births and Fertility (Alternative Specifications) Using DLHS 07/08 and 12/13, Punjab Only

PANEL A: Bootstrapping and Randomization Inference						
	isgirl			isbirth		
	(1) Wild U	(2) Wild R	(3) RI	(4) Wild U	(5) Wild R	(6) RI
p-value	0.0543	0.0989	0.1053	0.2513	0.2586	0.2632
PANEL B: District-Collapsed Estimates						
	(1) share of female births		(2) share of mothers giving birth			
DL \times post	0.082** (0.032)		-0.0197* (0.0099)			
District FE	x		x			
Year FE	x		x			
Controls	x		x			
Observations	160		160			
R^2	0.120		0.585			

Note: Panel A reports p-values from (restricted and unrestricted) wild bootstrap and randomization inference (RI) approaches for isgirl and isbirth outcomes in Table 3. As MacKinnon and Webb (2020) emphasize, neither bootstrapping nor RI work well when there is just one treated cluster. See main text for details. In panel B, the outcome variables are the district-level share of female births and the district-level share of mothers giving birth in any given year. The DID estimates compare the change in each outcome between the periods 2004-07 and 2009-12 in Fategarh Sahib with the corresponding changes in the control districts. The controls added include district-level averages of birth parity, mother's age and education, household's caste, religion, location (rural or urban) and an indicator of dwelling construction type (wealth proxy). SE are clustered at the district level.

Table 9: Dhanlakshmi Effects on Girl Births and Fertility by Birth Order and Urban/Rural Residency, DLHS 2007/08 & 2012/13

	(1) isgirl		(2) isgirl	(3) isbirth
DL × post	0.043*** (0.014)	DL × post	0.074*** (0.013)	0.010*** (0.003)
DL × post × bo=2	0.058** (0.022)	DL × post × urban	-0.066** (0.027)	-0.007* (0.004)
DL × post × bo>2	-0.054 (0.033)			
District FE	x		x	x
Year FE	x		x	x
Controls	x		x	x
Observations	10678		10678	36768
R ²	0.008		0.008	0.006

Notes: The DID estimates compare the change in each outcome between the periods 2004-07 and 2009-12 in Fatehgarh Sahib with the corresponding changes in the other Punjabi districts. The controls are the child's birth order, mother's age and education, household's caste, religion, location (rural or urban) and an indicator of dwelling construction type (wealth proxy). The treated area is Fatehgarh Sahib and the treatment period is 2009-2012. The sample includes 6,701 mothers in Punjab. Standard errors clustered at the district level.

Table 10: Dhanlakshmi Effects on Son Preference

Panel A: Overall Son Preference					
	(1) preferson	(2) preferson	(3) preferson	(4) preferson	(5) preferson
DL \times post	-0.0329* (0.0184)	-0.0539*** (0.0162)	-0.0138* (0.0072)	-0.0402*** (0.0117)	0.0206 (0.0165)
District FE		x	x	x	x
Controls		x	x	x	x
Specification	Punjab	Punjab	None	No changes	Northwest
Observations	3020	3020	24404	14945	7099
R^2	0.000	0.436	0.322	0.336	0.402
Panel B: Son Preference by Gender of Older Sibling					
	(1) preferson	(2) preferson	(3) preferson	(4) preferson	(5) preferson
DL \times post \times hasdaughter	0.0354 (0.0289)	0.0195 (0.0327)	-0.0171 (0.0186)	-0.0192 (0.0189)	0.0510** (0.0250)
DL \times post	-0.0554*** (0.0172)	-0.0592*** (0.0197)	0.0003 (0.0087)	-0.0244*** (0.0080)	-0.0056 (0.0134)
hasdaughter	0.7217*** (0.0170)	0.8944*** (0.0220)	0.7731*** (0.0284)	0.8285*** (0.0148)	0.8636*** (0.0171)
District FE		x	x	x	x
Controls		x	x	x	x
Observations	3020	3020	24404	14945	7099
R^2	0.418	0.438	0.324	0.338	0.407

Notes: DLHS sample of mothers who responded to the fertility survey. The outcome variable is a binary indicator for whether a mother desired a son at the next birth. Added controls include the number of daughters from previous births, mother's age, education, religion, caste and a proxy for household wealth.

Table 11: Post-Program Effects of Dhanlakshmi on Girl Births and Fertility Using DLHS 2012/13 & NFHS 2015/16

	(1) isgirl	(2) isgirl	(3) isgirl	(4) isbirth	(5) isbirth
DL \times post	-0.030** (0.013)	-0.023 (0.017)	0.077*** (0.026)	-0.010*** (0.003)	-0.016*** (0.004)
DL \times post \times bo=2			-0.262*** (0.028)		
DL \times post \times bo>2			0.003 (0.056)		
District FE		x	x		x
Year FE		x	x		x
Controls		x	x		x
Observations	6482	6482	6482	17669	17669
R^2	0.001	0.016	0.018	0.001	0.067

Note: The DID estimates compare the change in each outcome between the periods 2010-12 and 2014-16 in Fatehgarh Sahib with the corresponding changes in the control districts. The controls are the child's birth order, mother's age and education, household's caste, religion, location (rural or urban) and an indicator of dwelling construction type (wealth proxy). The treated area is Fatehgarh Sahib and the treatment period is 2014-2016. The sample includes 6,102 mothers in Punjab. Standard errors clustered at the district level.

Table 12: Dhanlakshmi Effects on Immunization, Survival and School Attendance

	(1) Imm 1	(2) Imm 2	(3) Imm 3	(4) isgirl5	(5) isn
DL \times post	0.0775*** (0.0252)	0.0496** (0.0231)	0.0476* (0.0242)	0.045 ** (0.010)	0.040 *** (0.005)
District FE	x	x	x	x	x
Interview Year FE	x	x	x	x	x
Controls	x	x	x	x	x
Observations	2677	2677	2677	9814	4427
R^2	0.046	0.049	0.051	0.003	0.115

Note: DLHS 07/08 and 12/13 samples in columns (1)-(3) span girls aged two years or older in Punjab. Outcome variables Imm 1 - 3 are binary indicators for the recorded vaccine doses. Imm 1 covers BCG and DPT 1; Imm 2 adds DPT 2-3 and Polio 1-3 to the earlier doses; Imm 3 includes all previous doses and the Measles vaccine. DID estimates compare the change in child immunization, and any girl-boy differential therein, between 2004-06 and 2009-11 in Fatehgarh Sahib district with the corresponding changes in the control districts. Controls: child's birth order, mother's age and education, household's caste, religion, location and an indicator of dwelling construction type (wealth proxy). Standard errors clustered at the district level.

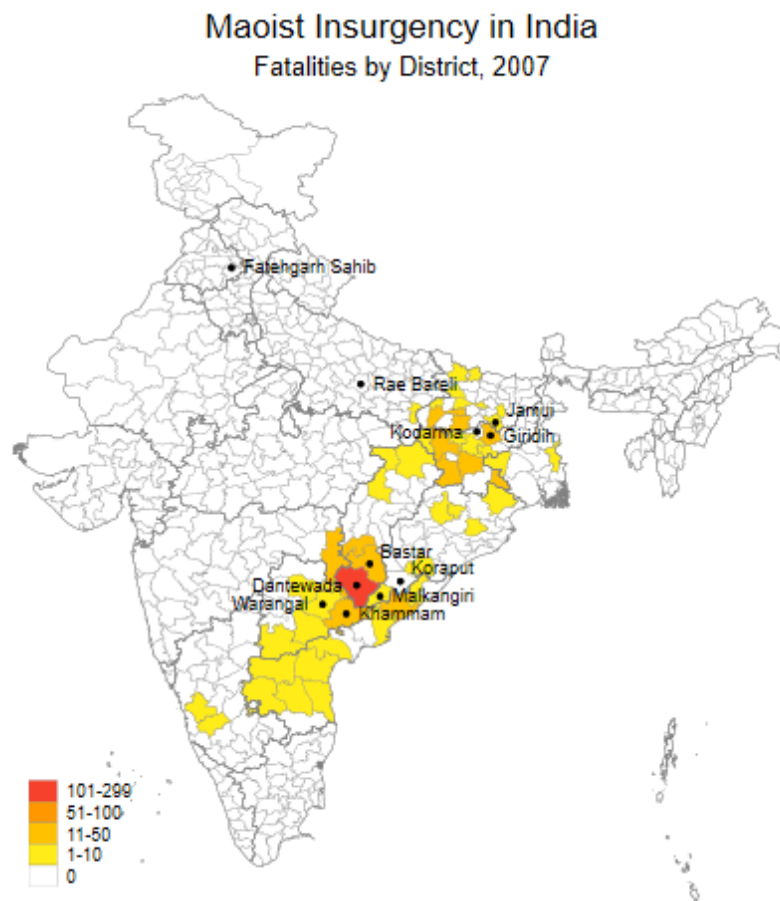
DLHS-NFHS samples in columns (4) and (5) comprise all 5-7-year-olds in the surveyed households. *isgirl5* is the share of girls in the selected age group and *isn* is a binary indicator for whether a girl belonging to this age cohort is currently attending school. DID estimates compare the change in outcomes for birth cohorts between 2000-02 and 2009-11 in Fatehgarh Sahib district with the corresponding changes in the control districts. Controls: child's age, household head's education, caste, religion, location and an indicator of household wealth. Standard errors clustered at the district level.

Table 13: Dhanlakshmi Effects on the Education Outcomes of Older Girls

	(1)	(2)
	isn	yos
DL \times post	-0.0106 (0.010)	0.345*** (0.049)
District FE	x	x
Interview Year FE	x	x
Controls	x	x
Observations	9191	9191
R^2	0.099	0.552

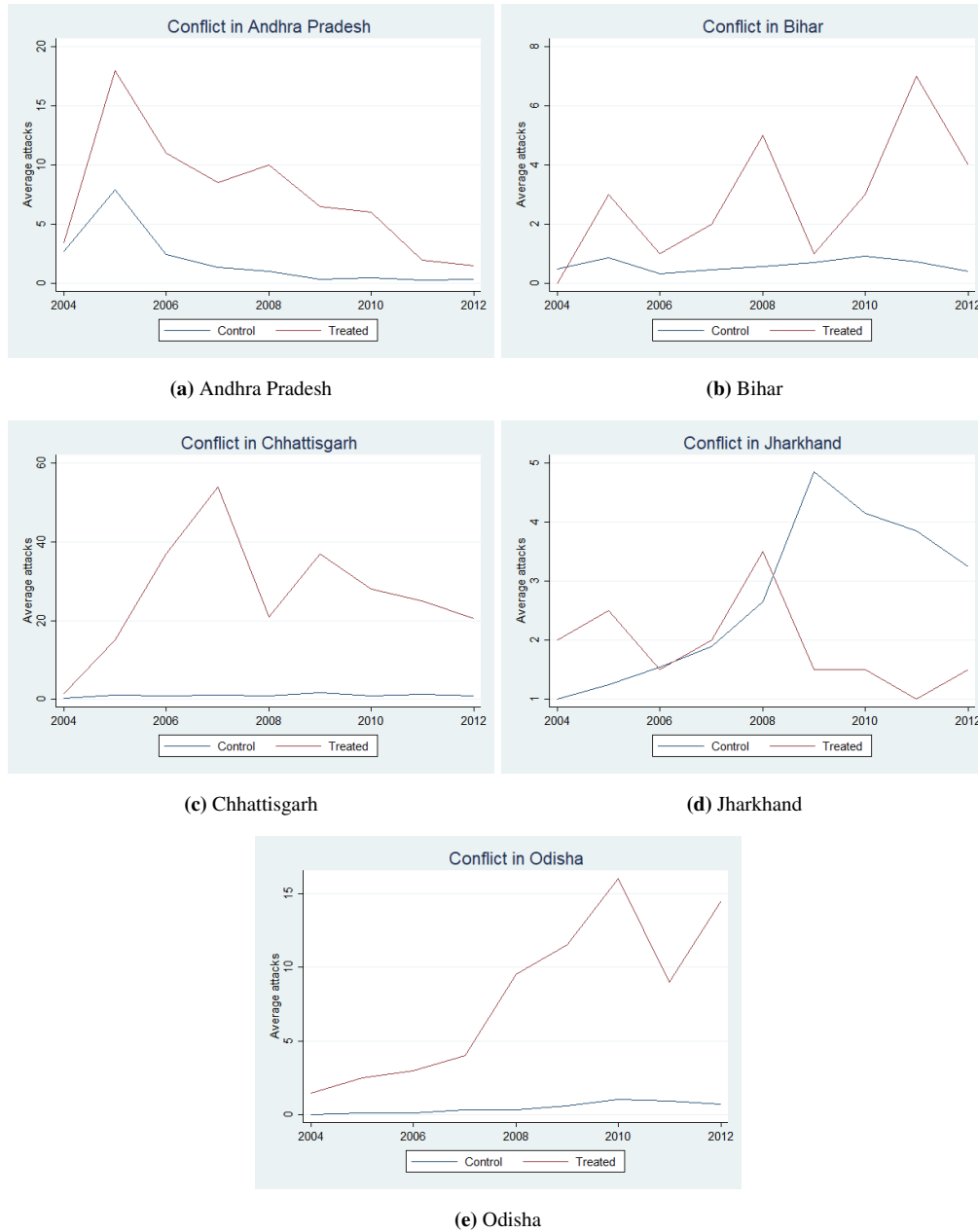
Note: DLHS 07/08 and NFHS 15/16 samples comprising 8-14-year-old girls in the surveyed households. *isn* is a binary indicator for whether a girl belonging to this age cohort is currently attending school and *yos* is grades completed. DID estimates compare the change in outcomes for birth cohorts between 1994-99 and 2002-07 in Fatehgarh Sahib district with the corresponding changes in the control districts. Controls: child's age, household head's education, caste, religion, location and an indicator of household wealth. Standard errors clustered at the district level.

Figure 1: Maoist-Related Violence in 2007



Note: Data from South Asian Terrorism Portal (SATP). Map shows the total number of attacks related to India's Maoist insurgency.

Figure 2: Trends in Maoist-Related Violence over Time



Note: South Asian Terrorism Portal (SATP). Figures plot average number of Maoist-related violent incidents over time separately for treatment and control districts in each of the 5 states Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand and Odisha.

Online Appendices

Appendix A Why Was Dhanlakshmi Discontinued?

Our results suggest that Dhanlakshmi was successful in raising the prospect of girl births without increasing fertility in a meaningful way, at least in Punjab where it was effectively implemented. Nevertheless, it was discontinued in 2013. It is reasonable to ask why.

At the time, there was no existing independent evaluation of the program. The official reason given by the Indian government was that Dhanlakshmi was discontinued “w.e.f. 1/4/2013 as several state governments have schemes for girl children which are more attractive”.²⁵ This exact wording is also repeated in media mentions of the program’s ending.²⁶ Table 1 documents that Assam, Bihar, Delhi, Goa and Himachal Pradesh started initiatives between 2008-13, and several of these states did not previously have a girl-child CCT. So, the officially stated reason for discontinuing Dhanlakshmi is plausible if the goal was to scale up the scheme to the national level, especially considering that a number of additional states had longstanding programs that pre-dated Dhanlakshmi. When it was implemented, Dhanlakshmi was conceptualized as a pilot study, explaining its very limited geographic coverage. Of the states that were covered under Dhanlakshmi, however, only one state, Bihar, introduced a new program.

In addition to the official reason, political calculations likely played a role. The last year of Dhanlakshmi also marked the last year of the United Progressive Alliance (UPA) government before the general elections in April-May 2014, which the incumbent government lost. Potentially, electoral considerations about the political payoff of a program like Dhanlakshmi may have contributed to its stop. As Sekher (2010) documents, many existing state girl-child schemes were popular and had direct buy-in from the Chief Ministers (the heads of the state government), who publicized the initiatives widely and used them in their own election campaigns. This was mostly not the case for Dhanlakshmi, which was generally poorly implemented outside of Punjab (Sekher, 2010).

²⁵Press Information Bureau, Government of India, Ministry of Women and Child Development, February 21, 2014. Available here: <https://pib.gov.in/newsite/PrintRelease.aspx?relid=104044>

²⁶See e.g. IndiaSpend, ‘Govt Incentives For Girls Appear to Work - Somewhat’, June 16, 2016.

This gap in popularity and interest may have led the central government to decide that scaling up Dhanlakshmi was going to be expensive and not the best use of resources.

The party manifestos for the 2014 election for both the main government party and the main opposition party provide circumstantial evidence that a program like Dhanlakshmi was not considered to be a high priority. The main government party's election manifesto (INC) only made a vague reference to how it intended to tackle the issue of skewed sex ratios: "We will launch focused intervention to improve the Child Sex Ratio, within an overall "National Strategy for Care and Protection of the Girl Child" from birth to adolescence."²⁷ It made no direct mention of Dhanlakshmi or a program with similar features. Similarly, while the main opposition party, the BJP, mentioned the girl child in the election manifesto, it too did not focus on a CCT or similar scheme as a suggested policy intervention.²⁸ Both parties therefore did not seem to see a CCT as a priority to improve the child sex ratio and focused more on rhetoric rather than specific policy proposals in their election manifestos.

Appendix B Dhanlakshmi Scheme Details

Appendix B.1 Beneficiary Recruitment and Enrollment

The district administration was responsible for determining the local authorities that would provide proof of milestone achievement. Specifically, Dhanlakshmi required a birth certificate to prove registration, a domicile certificate to ensure that the household lives in a treatment block, and an immunization certificate to provide proof of immunizations. Birth and domicile certificates were both available from the local government (gram panchayat), and local health center (Anganwadi) workers were responsible for certifying the child's immunization record. School principals certify the beneficiary's school attendance and grade. A verification certificate that the girl is still unmarried at age 18 can be obtained from the gram panchayat (Sekher, 2010).

Implementation of the Dhanlakshmi scheme was shared between multiple tiers of government.

²⁷https://www.thehinducentre.com/multimedia/archive/01816/Indian_National_Co_1816826a.pdf

²⁸http://www.thehinducentre.com/multimedia/archive/03226/full_manifesto_eng_3226788a.pdf

Beneficiary households were enrolled at the local level, either in response to surveys in the treatment block, through information provided by local teachers and health workers, or based on households presenting their case at the local government office. In most states Anganwadi workers were told to enroll as many beneficiaries as possible (Sekher and Ram, 2015). A list of beneficiaries was collected at the district level and reported to the state government, which receives money from the central government in a separate account earmarked specifically for the program. Households received a Dhanlakshmi registration card and a booklet containing blank verification certificates. Once households opened a zero-balance account at a bank or post office, the state government authorized those financial institutions to transfer the financial benefits to the recipients once formal proof of reaching a given milestone was produced. If possible, the bank account was supposed to be opened in the name of the child's mother. State- and district-level officials were instructed to provide training and monitor program implementation (Sekher, 2010).

Sekher and Ram (2015) describe Dhanlakshmi's recruitment and enrollment process based on surveys with key stakeholders and beneficiaries. Their Punjab sample included 628 beneficiary households from the treatment block. Nineteen percent of beneficiary girls were less than a year old at the time of enrollment and 32 percent were enrolled within two years of birth. Forty-seven percent were enrolled in primary school and another 19 percent in secondary school. Almost 60 percent of beneficiary girls were the eldest child and about 31 percent were the second child. In Punjab, they note that school teachers played a key role in raising awareness of the program and in enrolling households.²⁹

Appendix B.2 State Challenges to Implementation

Dhanlakshmi was introduced in seven states: Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Odisha, Punjab, and Uttar Pradesh. Overall, implementation was highly uneven. For example, according to administrative sources, the central government had set a target of 100,000 beneficiaries across all treatment areas for the first year, but only about 80,000 were enrolled and 60 percent of

²⁹See their Table 4.6 for the survey results from the other states where Dhanlakshmi was introduced.

the available financial resources had been spent. Disbursement remained an issue even after the first year. Sekher (2010) conducted interviews with state officials, finding that many complained about long delays in the transfer of funds from the central government.

Idiosyncratic state factors played a significant role in implementation effectiveness. In the Eastern states – Bihar, Jharkhand, Chhattisgarh and Odisha – a number of challenges frustrated implementation. There was no state government buy-in or NGO involvement, so creating awareness of the new program proved to be difficult. The treatment areas were also located in blocks affected by a Maoist (Naxalite) insurgency. Post offices refused to open zero-balance bank accounts, substantially delaying payments to households. Program beneficiaries who migrated out of a treatment block, not uncommon in the poor rural areas of East India, automatically lost coverage.

In the South Indian state of Andhra Pradesh, two blocks were chosen for their low level of economic development and widespread custom of child marriage. Dhanlakshmi replaced a well-known state program in the designated blocks, while the pre-existing program remained active in all other areas of the state. This led to widespread confusion about enrollment, program characteristics, and differences in coverage. In one of the two blocks, post offices refused to open zero-balance bank accounts for program beneficiaries, leading to long delays in program enrollment and benefit disbursement (Sekher, 2010).

Some state governments did not make any progress toward implementation in the first two years. Uttar Pradesh did not use any Dhanlakshmi-related resources in the first year and had yet to implement the scheme at all by 2010 (Sekher, 2010). In interviews Sekher (2010) conducted with national and state-level officials about the implementation of Dhanlakshmi in Bihar and Odisha, a similar picture emerges. Bihar did not spend any money on the program in 2008-09, and had not initiated an awareness campaign by 2010. The few beneficiaries that were being enrolled learned about the program through the Anganwadi center or a women's help group and reported long delays in enrollment. Officials also raised concerns that the low program awareness led to manipulation and corruption. The designated treatment block in Bihar had a high rate of migration, which also contributed to the low number of beneficiaries.

In Punjab, on the other hand, the roll-out and implementation avoided most of these problems.

State officials reported that progress was monitored through cooperation across the block, district and state level and program information was disseminated through multiple channels. This activity also included public hearings to directly gather feedback from beneficiaries (Sekher, 2010). School teachers were key to raising awareness of the program and enrolling households, although health centers (Anganwadi or ICDS) also played a role. According to household self-reports, enrollment in Punjab typically took less than a week, whereas registration for the majority of households in other states took more than four months (Sekher and Ram, 2015). Existing state government schemes in Punjab were small and differed substantially in eligibility, so there was no confusion with other schemes. Consistent with these observations, Punjab accounted for the largest number of beneficiaries and budgeted allocations.

Appendix B.3 Fatehgarh Sahib

At the time of the 2001 Census, Fatehgarh Sahib was the least populous of Punjab's 17 districts.³⁰ It had a population of 538,041 or about 2.2 percent of the state population. With an average household size of 5.75, this translates into 93,414 households. About 72 percent of the population lived in rural areas and about 31 percent belonged to the Schedules Castes (SC). By far the largest religious community were Sikhs (75 percent), followed by Hindus (23 percent) and Muslims (2 percent). The literacy rate was 78 percent for men and 68 percent for women. On most of these characteristics, Fatehgarh Sahib was comparable to the typical Punjabi district. One exception its literacy rate, which was 4 percentage points higher for men and 6 percentage points higher for women.

Punjab traditionally has one of the most skewed sex ratios in India. In the last three Censuses of 1991, 2001 and 2011, the number of females per 1000 males in Punjab was 882 (compared with 927 for all of India), 876 (933) and 895 (943), respectively. The sex ratio in Fatehgarh Sahib was even lower: 871 in 1991, 854 in 2001 and 871 in 2011. Those numbers were the 4th lowest sex ratio in 1991, the 3rd lowest in 2001, and the 2nd lowest in 2011.

In addition to the overall sex ratio, which includes all women regardless of age, the Indian

³⁰By 2011, Punjab had created 3 additional districts.

Census also publishes the child sex ratio, defined as the number of females per 1000 males in the 0-6 age group. Fatehgarh Sahib's child sex ratio was 874 in 1991 (compared with 875 for all of Punjab), 766 in 2001 (798), and 842 in 2011 (846). In 2001, Fatehgarh Sahib had the worst child sex ratio in the state. This was the main criterion used for choosing the district as a pilot area for the Dhanlakshmi scheme.

The district of Fatehgarh Sahib is divided into five community development blocks (C. D. Blocks). The block targeted by Dhanlakshmi, Sirhind, consists of an urban area in the north, the town Sirhind Fatehgarh Sahib, and a larger rural area in the south. Sirhind Fatehgarh Sahib is the second largest town in the district, with a population of 49,825 in 2001. The block has one hospital, which is located in Sirhind Fatehgarh Sahib. The town also has a railway station, the only one in the district.

Appendix C Dhanlakshmi Treatment Intensity and Survey Evidence

Appendix C.1 Back-of-the-Envelope Calculation

From Table 6, the baseline birth probability in Fatehgarh Sahib was 0.287. Given the 180 mothers in the baseline period, this translates into an average of 52 births per year. After Dhanlakshmi was introduced, the birth probability in Fatehgarh Sahib fell to 0.280, which implies 62 births per year (0.280×233 mothers). The change in the birth probability in the control group suggests a larger, 1.2 percentage-point decline and 61 births (0.275×223) in the no-CCT counterfactual. The extra birth due to Dhanlakshmi amounts to a relative fertility increase of 1.64 percent.

With a baseline girl-child probability of 0.456, there should be 24 girls among the 52 baseline children. Post-Dhanlakshmi, this probability rose to 0.501, implying 31 of the 62 treatment-period births were girls. However, in the counterfactual, the girl-birth probability rose only 0.01 percentage points, suggesting that without Dhanlakshmi only 28 of the 61 children – three fewer – would have been girls.

These figures also imply that the 3 additional girl births per year occurred because parents chose to have a girl instead of waiting on a boy, rather than from an overall fertility increase. If we ask how many girls would have been born if fertility had changed by the same amount, but the sex ratio had remained at its counterfactual level, we still get about 28 girl births, indicating that the extra girls come from the substitution of sons for daughters. Altogether, these calculations suggest that 4 more children and 12 more girls were born to the DLHS mothers over our four-year sample period.

We can use the Census data to estimate how many girl and total births in Fatehgarh Sahib can be attributed to Dhanlakshmi. In 2011, there were 63,271 children 0-6 years-old in the district. If there were no fertility and child mortality differences between the age cohorts in this group, we would have an average of 9,039 children in each cohort. Thus, each of the 62 annual births implied in the DLHS sample translates into approximately 146 annual births in the Census, for a total of 584 during the sample period. Similarly, the 3 additional girls per year in the DLHS map to 438 additional girls per year in the Census, totaling 1,752 over four years.³¹

What do these calculations imply for Dhanlakshmi's impact on girl births and fertility in Sirhind? The 2011 Census reports 21,055 children in Sirhind aged 0-6, 9,538 of them girls. Adopting the same uniform distribution of births across age cohorts, we have about 3,008 children and 1,363 girls in each. If all of the annual additional births calculated for the district came from Sirhind, we would conclude that Dhanlakshmi accounted for 4.85 percent of all births and 32.13 percent of girl births.³²

Appendix C.2 Survey Evidence on Dhanlakshmi and Gender Attitudes

Sekher and Ram (2015) not only provide valuable information on the implementation of Dhanlakshmi, they also carried out an assessment of the scheme's impact on attitudes towards gender equality and investing in girl children. Their study is based on a survey of beneficiary and non-beneficiary households in five Dhanlakshmi states – Punjab, Bihar, Odisha, Andhra Pradesh and Jharkhand –

³¹This is consistent with the Census fertility result in Table 7. Keeping in mind that the Census was held in 2011 while the household survey data covers births up to 2012, the corresponding number of additional births is 438 (146×3). This figure falls inside the 95 percent confidence interval of the DID estimate in Column (6): $[-3680.39, 468.95]$.

³²We find no clear evidence of spillovers outside of Sirhind, supporting this assumption.

covering eight of the 11 treatment blocks. As much as possible, beneficiary and non-beneficiary households were matched on household characteristics and other factors such as access to education and health facilities. Beneficiary households are households with at least one enrolled girl at the time of the survey. Non-beneficiary households have no enrolled household members, but had at least one girl aged 1-14 years when the survey was conducted. The interviews were conducted between September 2013 and February 2014, at a time when Dhanlakshmi had just been discontinued.

Sekher and Ram (2015) compare beneficiary and non-beneficiary households on attitudes toward gender equality. They find beneficiary households were statistically significantly more likely to agree that: daughters are equally important as sons; boys and girls should be taken to the doctor immediately when they fall sick; girls should be given nutritious food like boys; daughters should be served food along with sons; daughters should be educated equally like sons; it is the responsibility of both sons and daughters to look after their parents in their old age; like sons, daughters can go to college if they wish; daughters can also take up employment outside like sons; like sons, daughters should economically support their parents; daughters and sons should be given equal share in property; like daughters, sons should be taught cooking, cleaning and doing household chores; like sons, daughters should be allowed to perform funeral rites of parents. While program beneficiaries could feel more pressure to agree with gender equality statements because of Dhanlakshmi, their responses are consistent with the behavioral changes implied by our empirical results.

Appendix D Appendix Figures and Tables

Table D.1: Summary Statistics for Census Sample

	Treated		Control	
	Pre	Post	Pre	Post
sgirls06	0.431	0.453	0.444	0.458
pop06	23307	21055	44345.4	43030.5
Share of low caste	0.293	0.311	0.301	0.336
Share of backward tribes	0	0	0	0
Share of literate women	0.676	0.745	0.615	0.692
Share of literate men	0.781	0.835	0.740	0.793
Share of working women	0.226	0.103	0.208	0.142
Share of working men	0.549	0.554	0.535	0.550
Observations	2		142	

Note: The sample consists of all blocks in the state of Punjab with Fategarh Sahib/Sirhind as the treated block. The pre and post samples refer to Census 2001 and 2011, respectively.

Table D.2: Summary Statistics for Birth and Fertility Samples Using DLHS 07/08 and NFHS 15/16

	Fatehgarh Sahib		Control	
	Pre	Post	Pre	Post
isgirl	0.472	0.483	0.454	0.469
isbirth	0.369	0.373	0.372	0.390
Mother's age	25.74 (3.473)	27.99 (4.195)	26.20 (3.972)	26.81 (4.338)
Mothers with primary education	0.156	0.266	0.141	0.234
Mothers with secondary education	0.294	0.425	0.266	0.390
Share of Hindus	0.233	0.275	0.353	0.354
Share of Muslim	0.033	0	0.015	0.019
Share of Christians	0.006	0	0.007	0.011
Share of Sikhs	0.728	0.725	0.621	0.615
Share of low caste	0.394	0.472	0.332	0.431
Share of backward tribes	0.011	0	0.003	0.0006
Share of rural households	0.711	0.579	0.701	0.637
Share of <i>Kachha</i> houses	0.011	0	0.021	0.001
Share of <i>Pucca</i> houses	0.772	0.867	0.729	0.827
Number of mothers	117	61	1963	1327
Number of live births	199	87	3608	1827

Note: Variable means and standard errors in parentheses. The pre and post refer to the period 2005-2007 and 2014-2016, respectively.

Table D.3: Post-Program Effects of Dhanlakshmi on Births and Fertility Using DLHS 2007/08 and NFHS 2015/16, Punjab Only

	(1) isgirl	(2) isgirl	(3) isgirl	(4) isbirth	(5) isbirth
DL \times post	-0.005 (0.015)	0.019 (0.015)	0.097*** (0.021)	-0.011*** (0.003)	-0.005 (0.006)
DL \times post \times bo=2			-0.159*** (0.028)		
DL \times post \times bo>2			-0.111** (0.046)		
District FE		x	x		x
Year FE		x	x		x
Controls		x	x		x
Observations	5721	5721	5721	15170	15170
R^2	0.000	0.016	0.017	0.000	0.078

Note: The DID estimates compare the change in each outcome between the periods 2005-07 and 2014-16 in Fatehgarh Sahib with the corresponding changes in the control districts. The controls are the child's birth order, mother's age and education, household's caste, religion, location (rural or urban) and an indicator of household wealth ranking provided in the surveys. The treated area is Fatehgarh Sahib and the treatment period is 2014-2016. The sample includes 3,468 mothers in Punjab. SE are clustered at the district level.

Table D.4: Summary Statistics for Immunization Samples, Punjab

	DLHS 07/08 and 12/13			
	Fatehgarh Sahib		Control	
	Pre	Post	Pre	Post
imm1	0.400	0.461	0.417	0.387
imm2	0.400	0.412	0.417	0.364
imm3	0.400	0.382	0.417	0.343
Mother's age	26.22	28.75	27.15	27.68
	(3.398)	(4.327)	(3.926)	(4.155)
Mothers with primary education	0.109	0.147	0.175	0.183
Mothers with secondary education	0.291	0.333	0.265	0.263
Share of Hindus	0.309	0.265	0.354	0.371
Share of Muslims	0.0545	0.00980	0.00794	0.0144
Share of Christians	0	0	0.00705	0.00938
Share of Sikhs	0.636	0.725	0.628	0.605
Share of low caste	1	0.971	0.999	0.991
Share of backward tribes	0	0.00980	0.000882	0.000722
Share of rural households	0.582	0.676	0.688	0.581
Share of <i>Kachha</i> houses	0.0182	0.00980	0.0212	0.0253
Share of <i>Pucca</i> houses	0.764	0.745	0.728	0.660
Observations	157		2520	

Note: *Kaccha* and *Pucca* houses refer to unengineered and engineered dwelling-place construction. Pre and post refer to the periods 2004-2007 and 2009-2012.

Table D.5: Summary Statistics for Education Sample, Punjab

	DLHS 07/08 and 12/13			
	Fatehgarh Sahib		Control	
	Pre	Post	Pre	Post
isn	1	0.969	0.997	0.927
Child's age	6.949 (0.807)	6.046 (0.759)	7.013 (0.819)	6.050 (0.802)
Share of Hindus	0.229	0.323	0.321	0.367
Share of Muslims	0.013	0.031	0.019	0.016
Share of Christians	0	0	0.010	0.012
Share of Sikhs	0.745	0.646	0.649	0.604
Share of low caste	0.433	0.477	0.428	0.463
Share of backward tribes	0	0	0.005	0.002
Share of rural households	0.694	0.538	0.728	0.632
Family head with primary education	0.121	0.108	0.116	0.102
Family head with secondary education	0.166	0.138	0.183	0.174
Share of high-income households	0.599	0.615	0.511	0.519
Share of low-income households	0	0.015	0.005	0.014
Observations	222		4205	

Note: Pre and post refer to the periods 2004-2007 and 2009-2012.

Table D.6: Dhanlakshmi Effects on Immunization using Alternate Control Groups

Panel A			
	(1) Imm 1	(2) Imm 1	(3) Imm 1
DL \times post	0.1225*** (0.0138)	0.1087*** (0.0135)	0.1367*** (0.0184)
Specification	None	No changes	Northwest
Observations	19399	13333	6543
R^2	0.023	0.027	0.036
Panel B			
	(1) Imm 2	(2) Imm 2	(3) Imm 2
DL \times post	0.0962*** (0.0138)	0.0773*** (0.0135)	0.1071*** (0.0174)
Observations	19399	13333	6543
R^2	0.027	0.027	0.040
Panel C			
	(1) Imm 3	(2) Imm 3	(3) Imm 3
DL \times post	0.0843*** (0.0135)	0.0661*** (0.0132)	0.0944*** (0.0168)
Observations	19399	13333	6543
R^2	0.031	0.029	0.045

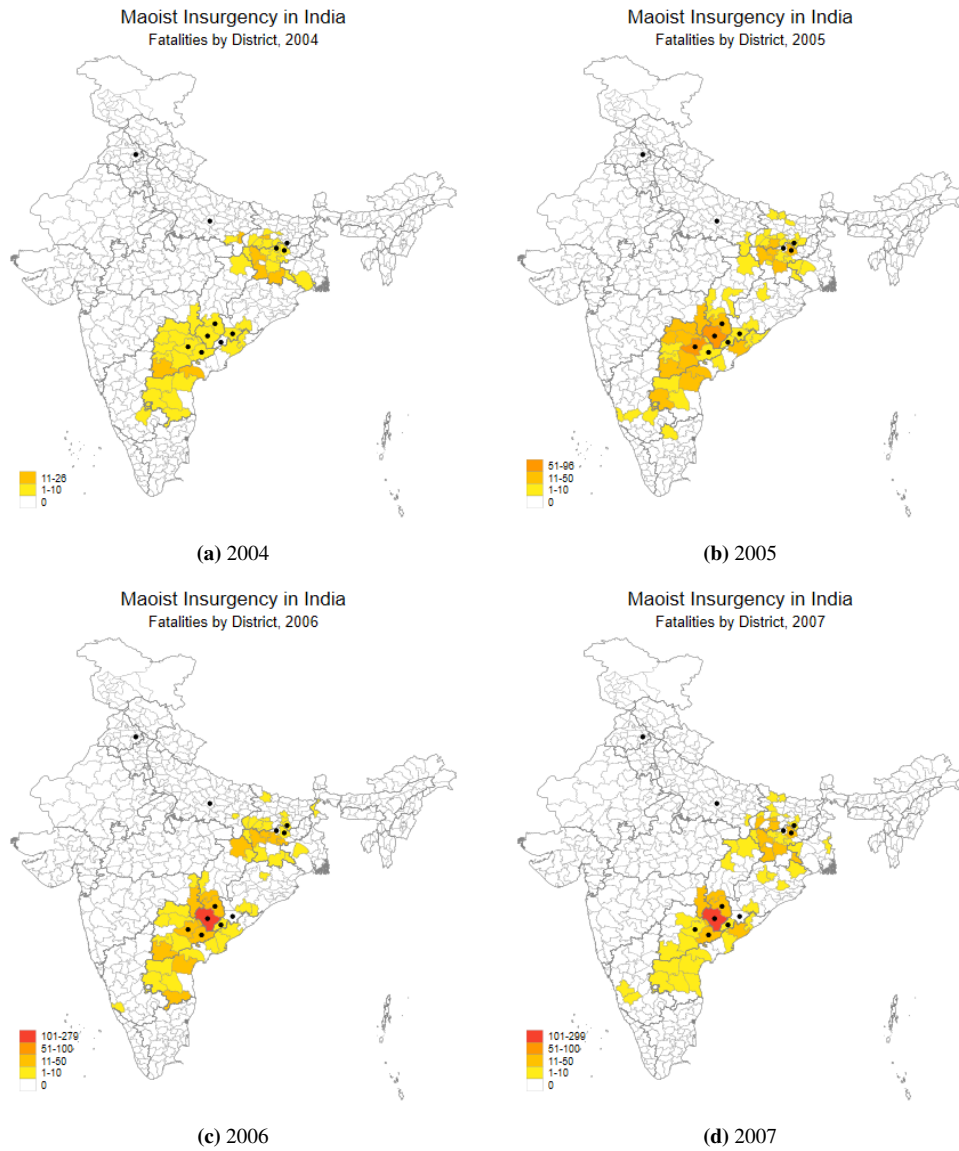
Note: DLHS 07/08 and 12/13 samples in columns (1)-(3) span girls aged two years or older in Punjab. Outcome variables Imm 1 - 3 are binary indicators for the recorded vaccine doses. Imm 1 covers BCG and DPT 1; Imm 2 adds DPT 2-3 and Polio 1-3 to the earlier doses; Imm 3 includes all previous doses and the Measles vaccine. DID estimates compare the change in child immunization, and any girl-boy differential therein, between 2004-07 and 2009-12 in Fatehgarh Sahib district with the corresponding changes in the control districts. All specifications include district and year fixed effects along with controls for the child's birth order and age, mother's age and education, household's caste, religion, location and an indicator of dwelling construction type (wealth proxy). Standard errors are clustered at the district level.

Table D.7: Dhanlakshmi Effects on Survival and Education using Alternate Control Groups

Panel A: Survival			
	(1) isgirl5	(2) isgirl5	(3) isgirl5
DL \times post	0.0307*** (0.007)	0.0428*** (0.009)	0.0369*** (0.010)
Specification	None	No changes	Northwest
Observations	75435	45144	27212
R^2	0.001	0.001	0.001
Panel B: Education			
	(1) isn	(2) isn	(3) isn
DL \times post	0.0824*** (0.009)	0.0357*** (0.006)	0.0272*** (0.005)
Observations	36009	21139	12355
R^2	0.607	0.719	0.640

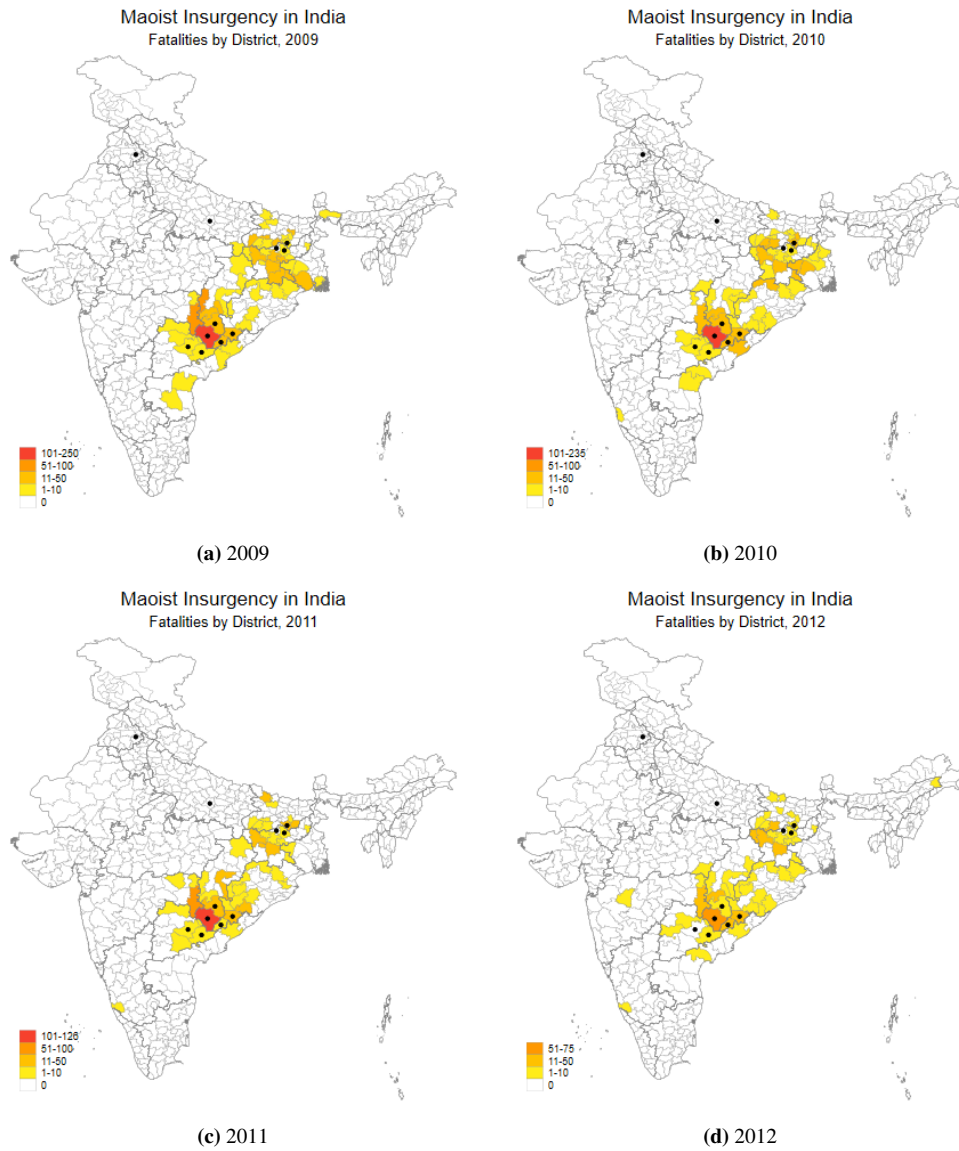
Note: DLHS-NFHS samples in columns (1) - (3) comprise all 5–7-year-olds in the surveyed households. In Panel A, the outcome is *isgirl5*, which is the share of girls in this age group. In Panel B, the outcome is *isn*, a binary indicator for whether a girl in this age group is currently attending school. DID estimates compare the change in outcomes for birth cohorts between 2000-02 and 2009-11 in Fatehgarh Sahib district with the corresponding changes in the control districts. All specifications include district and year fixed effects along with controls for child's age, household head's education, caste, religion, location and an indicator of household wealth. Standard errors are clustered at the district level.

Figure D.1: Maoist-Related Violent Attacks over Time (Pre-Dhanlakshmi)



Note: Data from South Asian Terrorism Portal (SATP). Maps show the district-level number of Maoist-related violent incidents for a given year.

Figure D.2: Maoist-Related Violent Attacks over Time (Post-Dhanlakshmi)



Note: Data from South Asian Terrorism Portal (SATP). Maps show the district-level number of Maoist-related violent incidents for a given year.