Learning Outcomes under Rainfall Shocks: The Role of Norms Around Female Labor Force Participation

Aparajita Dasgupta[*] Anahita Karandikar[‡]

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Abstract

In this paper we examine how exposure to early-life and contemporaneous rainfall shocks shape learning outcomes in rural India by the gender institutions of the setting. Specifically, we leverage the variation in soil texture (loaminess) at the district level that relates to the relative participation of females in agricultural work, to study how gender norms mediate the impact of shocks in shaping children's learning outcomes. We harmonise rich data on learning outcomes for over three million children with high frequency grid level data on rainfall shocks and soil-texture at the district level to employ a difference-in-differences estimation framework. Strikingly, we find contrasting results of shocks on children's schooling outcomes by the soil texture in a district. For relatively high loam areas, early life exposure to positive rainfall shocks significantly benefits schooling and learning outcomes for children. These benefits are further magnified under a contemporaneous positive rainfall shock for children in these regions. In contrast, exposure to early-life positive shocks in low loam areas is associated with a higher likelihood of children dropping out from school. Furthermore, we find the highest learning losses for female children in low loam areas who have faced an early life positive productivity shock. Thus, while early-life positive shocks improve schooling outcomes for both boys and girls in high-loam regions there is no such effect in low-loam regions. We investigate the potential mechanisms by studying the labour market impacts of shocks on children in these regions. Our results have important insights for policy design in addressing climate induced vulnerabilities on learning outcomes. Importantly, we show the gains or losses in learning outcomes are systematic to gender-specific work participation norms in a region, which sets off the relative differences in opportunity cost of schooling under shocks.

JEL classification: I21, I24, I26, I18, J16, J22, J24

Keywords: Learning outcomes, Rainfall shocks, Gender-gap, Female Labour Force Participation, Gender norms

[*]Corresponding author; Ashoka University. Email: aparajita.dasgupta@ashoka.edu.in;

[†]University of British Columbia. Email: ak234@student.ubc.ca;

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1 Introduction

The susceptibility of rural households in developing countries to climatic shocks often manifests in the form of disproportionate negative effects on children's human capital outcomes (Jacoby & Skoufias, 1997; Jensen, 2000). These impacts can multiply over time, through the channels of self-reinforcement and dynamic complementarity (Cunha & Heckman, 2007; Currie & Vogl, 2013). The vulnerability to climatic shocks can be gendered in nature which may have far reaching consequences beyond equity concerns, as they affect fertility and inter-generational outcomes (Bloom et al., 2020; Gandhi Kingdon, 2002).

It is not well understood in the literature how the vulnerability to rainfall shocks might vary by the gender institutions of the setting, especially in relation to norms around female labor force participation. The effects of rainfall shocks have been previously shown to manifest through two contrasting channels. First, a negative productivity shock for rural agrarian households may adversely impact educational investments in children due to a decrease in the household income. Second, as the demand for labour goes down in the face of a negative productivity shock, the opportunity cost of attending school decreases. This predicts that children are *less* likely to drop out and put *more* time in education. Further, these contrasting effects could co-exist, and the timing of the shock could also have bearing on which effect dominates. That is, rainfall shocks in early life might make children more susceptible to effects driven by the income channel. On the other hand, the effect of rainfall shocks in school-going years might be more in line with the predictions of the opportunity cost channel (Shah & Steinberg, 2017).

In the context of the gender-gap in outcomes, there could be a disproportionate reduction in *female* learning outcomes and educational investments if these are more *elastic* to an income shortfall. The opportunity cost channel, on the other hand, can lead to a relative *gain* in female schooling outcomes, especially in areas that favour female work, driven by a greater relaxation of their time from both paid and unpaid work during a negative productivity shock. Importantly, this effect is likely to be relatively stronger in settings in which gender norms favour higher female labour force participation (FLFP) both among adults and children. Hence, the effect of productivity shocks on the gender gap in human capital outcomes is theoretically ambiguous.

In this paper we study how learning outcomes evolve as children are exposed to rainfall shocks in early life and in school going years, and the role norms around female labor force participation play in this dynamic. We leverage the variation by the dominant soil type in a region to examine the relative difference in the impact of rainfall shocks by the relative demand for women's labor. We focus on the share of loamy soil in the district, which contrasts in the extent of female participation in the cultivation process. Next, we examine how early life and contemporaneous rainfall shocks interact in driving the learning outcomes in the long run, and if this is systematic to the predominant soil type. We use rich data on learning outcomes for a sample of around three million children from rural India over the period of 2008 to 2016 to study these effects.

We first show that early life positive rainfall shocks improve test scores and schooling outcomes for both boys and girls in districts with a *higher* share of loamy soil, that is, districts with lower relative FLFP. In contrast, these do not seem to influence learning outcomes of children in districts with high relative FLFP. We find that while children in low FLFP districts are more susceptible to learning losses under positive contemporaneous shocks, the interaction with early life shocks manifests differently in districts with high versus low FLFP. In districts with high FLFP, exposure to positive rainfall shocks in early life exacerbates learning losses under such contemporaneous shocks, while in districts with low FLFP, this exposure mitigates them. Taken together, the relative losses in schooling outcomes are the highest for female children in high FLFP areas, who experience positive rainfall shocks in both the periods (early-life and contemporaneous).

Our study makes several contributions to the literature. First, we contribute to the understanding of the gendered impacts of climatic shocks on human capital outcomes. Second, leveraging the variation in the soil-quality in a district, we examine the role of female labor force participation in the mediation of the shock dynamics. Third, our setting allows us to study the interactions between early-life shocks and those in school-going years (contemporaneous shocks, henceforth) and their impact on human capital outcomes, thereby examining the role of dynamic complementarities. We build on work such as Shah and Steinberg (2017) and Bau et al. (2020) to show that the impact of rainfall shocks is systematically related with the gender institutions of the setting. Lastly, using data on labour force participation from the National Sample Survey (NSS), we are able to look at the possible mechanisms that explain the heterogeneity in the effects.

The rest of the paper is structured as follows: Section 2 provides background and context for our setting. Section 3 describes our data sources and presents summary statistics. Section 4 lays out the empirical strategy and main results. Section 5 concludes.

2 Background and Context

It is well documented that a rainfall shock is also an income shock in rural districts – shocks affect crop production, which is closely linked to agricultural wages (Amare et al., 2018; Auffhammer et al., 2012; Jayachandran, 2006; Kaur, 2019; Mueller & Osgood, 2009; Mueller & Quisumbing, 2011; Shah & Steinberg, 2017; Singh et al., 2011). In the absence of opportunities to smooth consumption, this affects the availability of household resources, which can affect human capital formation. The impact of shocks on human capital attainment depends on how household-level income losses (or gains) translate into resource allocation within the household. A reduction in household income due to a rainfall shock could lead to reduced educational inputs (Groppo & Kraehnert, 2017; Jensen, 2000), reduced health investments (Lohmann & Lechtenfeld, 2015), and poorer calorific intake (Carpena, 2019).

This change in household resources could affect early and later life investments in male and female children differently (Björkman-Nyqvist, 2013; Cameron & Worswick, 2001; Dinkelman, 2016; Maccini & Yang, 2009; Rose, 1999). In the case of India, Kingdon (2005), Chaudhuri and Roy (2006) and Saha (2013) find evidence of gender discrimination in educational expenditure across most states in the country, even in the absence of a rainfall shock. Zimmermann (2020) show that in India, girls in the 8-10 age range are more likely to be taken out of school than boys in case of adverse rainfall shocks. Additionally, female children could be worse-off even in the absence of direct differential treatment by parents. Son-preference and fertility-stopping behaviour by the household could also lead to female children having more siblings overall, and therefore make them more likely to be in environments where there are less resources available per child (Jayachandran & Pande, 2017; Jensen, 2002), which could further exacerbate the impact of a negative rainfall shock.

The changes in wages caused by a rainfall shock may directly affect the value of the outside option for school-going children. As previously shown in the Indian context, a positive rainfall shock has a negative effect on test scores and enrollment for children in the school going age (Shah & Steinberg, 2017). This is driven by the increased opportunity cost of schooling as the positive shock shifts wages upwards, causing school-going children to drop out and move to the labor force (Atkin, 2016; Dumas, 2020; Kruger, 2007; Shah & Steinberg, 2017; Shah & Steinberg, 2019; Trinh et al., 2020). In contrast, a negative rainfall shock could have the opposite effect on scores and enrollment. There is also reason to expect that the impact of the change in the value of the outside option to schooling is gender sensitive. Child labor varies by context and gender – Gustafsson-Wright and Pyne (2002) show that in rural Brazil, boys are more likely to be employed, while Blunch and Verner (1999) and Zapata et al. (2011) show that in Ghana and Bolivia respectively, girls are more likely to be engaged in paid work. Bau et al. (2020) show that in Indian districts with high prevalence of child labor, a positive rainfall shock in early life reduces educational investments, in particular for girls, while outcomes for oldest sons remain relatively protected from the shock.

Rainfall shocks affect wages and labor market participation of adults in the household, which could alter their time-use patterns, and also have a bearing on children. As Dillon (2013) documents in the case of Northern Mali, children are complementary to adult labor in agriculture, but substitutes for adult labor in care-giving. If a rainfall shock causes labor market options in agriculture for adults to shrink for example, these could be substituted by increases in labor supply in the non-agricultural sector or increases in the time spent at home. Chuang (2019) documents that farmers in India increase both agricultural and non-agricultural wage work in the case of a negative rainfall shock. Afridi et al. (2021) present evidence from India that women's workdays reduce to a larger extent than men when faced with a drought shock, as they are more constrained by a lack of opportunities in non-farm work. Maitra and Tagat (2019) show that adults (both men and women) increase participation in non-agricultural labor in the face of *any* rainfall shock. They further find that women tend to also increase time allocated to domestic activities and reduce time attending educational institutions in response to a shock, particularly in districts that cultivate rain-fed rice. In sum, it becomes important to investigate the role gender norms around female labor force participation (of both adult and children) in mediating the impact of rainfall shocks on children's human capital attainment.

One crucial determinant of norms around female labor force participation is the extent of female involvement in agricultural processes, which determines their relative economic value in the labor force, and therefore to the household. Requirements of deep tillage, for example, lead to lower levels of female labor force participation and lower female to male sex ratios (Alesina et al., 2013; Carranza, 2012, 2014). Historical factors - such as the adoption of intensive agriculture, which further influence patrilocality and land inheritance can determine the relative value of sons compared to daughters. These effects are persistent, and immune to temporal changes in the dependence on land, leading to lower present-day female to male sex ratios in cultures with a higher incidence of patrilocality (Ebenstein, 2021). In this study, we use within-country variation in female labor force participation, linked to the extent of loamy soil in the region. Loamy soil is more amenable to deep tillage than clayey soil, leading to increased use of deep tillage equipment and lower female employment in agriculture (Afridi et al., 2021; Carranza, 2014).

We test for how norms surrounding women's work drive impacts of rainfall shocks using data from rural India, where pervasive gender-based discrimination and differences in both human capital attainment and labor force participation are well documented (Jensen & Oster, 2009; Pande, 2003; Sen, 1992). We use granular precipitation data from 1982 to 2016 to capture exogenous variation in district-level rainfall, and classify districts based on whether they experienced below-normal, normal, or above-normal rainfall. In India, below-normal rainfall is considered a negative shock to agricultural productivity, and above-normal rainfall is considered a positive shock to agricultural productivity (Jayachandran, 2006). We further map this information to children's birth years to identify the exposure to positive shocks in the birth year and three years following birth. We estimate the systematic gender difference in the impact of a rainfall shock on a range of measures of human capital, for a sample of about three million children in 472 districts, collated using seven rounds of ASER data. We use data on test scores collected for all children in the school going age range (5-16 years). These data are collected irrespective of the child's school enrollment status. We also use information on schooling, including school type and extra investments in the form of enrollment in tuition support. We utilize data on soil texture from Carranza, 2014, to classify districts as having a larger share of loamy soil. We do this by computing the median share of loamy soil across districts and classifying districts as high versus low depending on whether the share of loamy soil is above or below the sample median.

3 Data

3.1 Cognitive Outcomes and Schooling

We use objective data on schooling and learning outcomes on a sample of approximately three million children collected by Annual Status of Education Report (ASER) for the years 2008 through 2012, 2014 and 2016. The ASER survey, conducted annually since 2005, measures schooling and learning outcomes for children aged 5-16. It is a representative household level survey, covering all rural districts in India.[1] A unique feature of the ASER survey is that children are surveyed at home, meaning that data on test scores is available *irrespective* of school enrollment status.

We use data on reading (in the native language) and math ability. The surveyors code the reading level as a number from 1-5, where 1 indicates that the child cannot read anything, 2 indicates the child can identify letters, 3 indicates the child can read words, 4 indicates the child can read a grade 1 level text, and 5 indicates the child can read a grade 2 level text. In the case of Math, 1 indicates inability to do any arithmetic, 2 indicates ability to recognize numbers from 0-9, 3 indicates ability to recognize numbers from 11-99, 4 indicates ability to do simple subtraction and 5 indicates ability to do division. We convert each of these codes into z-scores by the child's age - comparing children's learning level to other children in their age cohort. The mean reading and math z-scores in our sample are -0.01 and -0.02 respectively. The mean reading z-score is 0.012 for male children, and -0.012 for female children. The corresponding statistics for the math z-score are 0.040 and -0.045.

In addition to learning outcomes, we also know schooling status (currently enrolled, dropped out or never enrolled), school grade (if enrolled) and whether the child attends any extra tuition.[2] 3% of the children in our sample have dropped out of school. The drop-out rate is 3.1% for male children and 3.8% for female children. 21% of the children in our sample are enrolled in extra tuition support. The enrollment in extra tuition support is slightly higher for male children, at 22.4%, and 19.5% for female children.

In our regression specifications, we control for a range of school, household and village level characteristics, available in the ASER data. We also compute a household wealth index, using a principal component analysis of data on household asset ownership - this includes indicators for whether the house is a 'pucca' (fixed) house, a 'kutcha' (temporary) house, owns an electricity connection, a TV or a mobile phone.

[1] For more details on ASER, see http://www.asercentre.org/

[2] Data on monthly tuition expenditure are available, but only for the years 2014 and 2016.

3.2 Rainfall

We use rainfall data from the University of Delaware, for the years 1982 to 2016.[3] These data are available in the form of monthly totals, and are gridded by latitude and longitude. We match each geo-point for which data are available with India's district boundaries, calculate the mean rainfall for all the coordinates that lie within each district's boundary, and assign that as the rainfall for the district. We use the intertemporal variation in rainfall shock *within* a district for our analysis. We define the rainfall shock variable by comparing the total annual rainfall in each district in a given year to the 20th and 80th percentile for the last 10 years in the *same* district. In other words, we compare the rainfall in each district in the year ASER data was collected to the 20th and 80th percentile for that district computed using district-specific data for the last 10 years. The shock variable takes value -1 (Drought or negative shock) if the rainfall in the ASER year is less than or equal to the 20th percentile, value 1 (Flood or positive shock) if the rainfall in the ASER year is greater than or equal to the 80th percentile, and value 0 (Normal) if rainfall lies between the 20th and 80th percentile. This is similar to the definition used in Jayachandran (2006), Shah and Steinberg (2017), Kaur (2019) and Mahajan (2016).

We create a measure of positive shock exposure in early life by computing an index using principal component analysis on data on rainfall shocks in the first 4 years of child i's life, including the child's birth year. The shock indicators for the ASER years are defined at the district-year level, and the indicators for early-life shock are defined at the child level. 25% of the districts in the combined ASER sample are classified as having a drought (negative) shock, 26% are classified as having experienced a flood (positive) shock and 49% as having normal rainfall conditions in the year of the ASER survey.

3.3 Soil Texture

We use data on soil texture from Carranza, 2014. The original data are derived from the *1991 Soils of India*, matched with district boundaries for 2001. These data provide the fraction of district area under loamy, clayey and sandy soil for 358 of India's 584 districts, as of 2001. We use the share of loamy soil in the district – in terms of area – to define a variable *HighLoam* which takes value one for district d if the area under loamy soil in d is greater than the median loamy soil share in our sample, and zero otherwise. We use this variable to introduce exogenous variation in the extent of female participation in paid work – where districts for which *HighLoam* takes value one are also low FLFP districts. In supplementary analysis, we use a continuous measure of fraction of district area under loamy soil instead of the binary variable, and our main results remain unchanged. We retain the binary measure in the analysis for ease of interpretation.

3.4 National Sample Survey Data

We use data from the 61st, 64th, 66th and 68th Employment and Unemployment Surveys of India's National Sample Survey to look at how rainfall shocks affect adult and child labor force participation by gender and crop type.[4] Data are available from households across all of India's districts. We restrict analysis to rural households, and have a combined sample of more than 775,454 individuals. We use data on adult (ages 18-60) and children's (ages 5-17) 'Usual Principal Activity Status' to create indicators for whether

[3] The Willmott and Matsuura (2001) data are available here: https://psl.noaa.gov/data/gridded/data.UDel_AirT_Precip.html

[4] These data are available here: http://microdata.gov.in/nada43/index.php/catalog/EUE. The data were collected in the years 2004-2005, 2007-2008, 2009-2010 and 2011-2012 respectively

each individual is engaged in paid employment, carries out domestic work or performs unpaid work for a family enterprise. We also define an indicator for whether those in paid employment are engaged in non-agricultural casual labor.

4 Empirical Strategy and Results

We exploit the quasi-random variation in the incidence of rainfall shocks within a district in early life and school-going years, and test for the gender differences in shock response by differences in the predominant soil type. We posit that the learning outcomes for female children in low loamy soil areas, should see a higher loss (benefit) in the event of a positive (negative) contemporaneous rainfall shock. Our main outcome variables are test scores and school enrollment. We include a battery of individual, household, school and village level time-varying controls and district-year time trends. We restrict the main analysis to children aged 5 or older, as ASER only records test scores for children in this age bracket. The outcome variables from the ASER data are reading and math z-scores (calculated by age), and an indicator for whether the child has dropped-out of school. The outcomes from the NSS data are indicators for whether the child is engaged in paid employment or doing domestic work full time. The estimating equation is as follows:

$$\begin{aligned} Y_{ihvdt} &= \alpha_{ihvdt} + \beta_1 HighLoam_{dt} + \beta_2 EarlyLifeShock_{ihvdt} \\ &+ \beta_3 HighLoam_{dt} * EarlyLifeShock_{idt} \\ &+ \delta_1 X_{1ihvdt} + \delta_2 X_{2hvdt} + \delta_3 X_{3vdt} \\ &+ \mu_{dt} + \pi_d \text{Year}_t + \epsilon_{ihvdt} \end{aligned} \tag{1}$$

We next estimate the interaction of positive rainfall shock exposure in early life with contemporaneous shock exposure using the following specification:

$$\begin{aligned} Y_{ihvdt} &= \alpha_{ihvdt} + \beta_1 HighLoam_{dt} + \beta_2 EarlyLifeShock_{ihvdt} + \beta_3 RainfallShock_{dt} \\ &+ \beta_4 HighLoam_{dt} * EarlyLifeShock_{idt} \\ &+ \beta_5 HighLoam_{dt} * RainfallShock_{dt} + \beta_6 EarlyLifeShock_{ihvdt} * RainfallShock_{dt} \\ &+ \beta_7 EarlyLifeShock_{ihvdt} * RainfallShock_{dt} * HighLoam_{dt} \\ &+ \delta_1 X_{1ihvdt} + \delta_2 X_{2hvdt} + \delta_3 X_{3vdt} \\ &+ \mu_{dt} + \pi_d \text{Year}_t + \epsilon_{ihvdt} \end{aligned} \tag{2}$$

Y_{ihvdt} represents the outcome variable for child *i* in household *h*, village *v*, district *d*, surveyed in year *t*. $HighLoam_{dt}$ takes value 1 if child *i* resides in a district where share of loamy soil is above the sample median and 0 otherwise. $EarlyLifeShock_{idt}$ is an index computed using principal component analysis on data on rainfall shocks in the first 4 years of child *i*'s life, including the child's birth year. A higher value indicates that the child has faced more positive shocks in early life. $RainfallShock_{dt}$ takes value -1 if district *d*, in the year *t* faced a negative rainfall shock, 1 if it faced a positive rainfall shock and 0 if it was a year with normal rainfall. Coefficient β_2 is the effect of a one unit increase in the value of the rainfall shock variable on outcome Y for male children. The terms $HighLoam_{dt} * EarlyLifeShock_{idt}$ and $HighLoam_{dt} * RainfallShock_{dt}$ represent the interaction between the soil type and the corresponding rainfall shock variable.

X_{1ihvdt} is a vector of child-level controls, including school grade, school type,[5] and an indicator for whether the child's mother has gone to school. School grade and school type are excluded in the specification where we look at the likelihood of drop-out, as these variables are only defined for children who are enrolled in school. X_{2hvdt} is a vector of household level controls, for household h in village v and district d. This includes sibling cohort composition,[6] number of children in the household, an indicator for whether the household has a first-born female child, and a household wealth index constructed using a principal component analysis of the following variables – house type,[7] and indicators for whether the household has an electricity connection, a TV or a mobile device. X_{3vdt} is a vector of village-level controls for village v in district d, and includes indicators for whether the village is connected by a paved road, has electricity supply, a bank and a ration shop. μ_d, represents district fixed effects, and $\pi_d \text{Year}_t$ represents district-specific linear time trends.

To explore our main margin of interest, we test for heterogeneity in the effects by gender and districts where the soil type is characterized by high versus low loaminess. We examine if the effect of a rainfall shock on both male and female children varies by the dominant soil type. We run specifications 1 separately for male and female children. In Table 1 we show that children in districts characterized by low FLFP, irrespective of gender have better learning outcomes than their counterparts in districts characterized by high FLFP, and experience further gains if they have experienced positive shocks in early life. Panel A and B, shows how the effects of experiencing positive shocks in the first four years of life differ for female and male children in districts characterized by higher versus lower FLFP. In the absence of rainfall shocks, both female and male children in districts characterized by low FLFP – "high loam" districts, have better reading and math scores on average. Female children in low FLFP district have reading and math scores that are 0.17 and 0.18 standard deviations (SD) greater than their counterparts in districts that have high FLFP, and are 3.2 percentage points (pp) less likely to have dropped out of school, 14.2pp less likely to be in the age-appropriate grade (on track) and 14.1pp more likely to be enrolled in extra tuition support. Male children in low FLFP districts have reading and math scores that are greater by 0.23 and 0.24 SDs, are 2pp less likely to have dropped out of school, 14.6pp less likely to be on track and 15.4pp more likely to be enrolled in extra learning support than their counterparts in high FLFP districts.

Experiencing positive shocks in early life appear to have no impacts on test scores for children in high FLFP districts. They do, however, cause a 0.23pp and 0.38pp increase in the chances of having dropped out of school for female and male children respectively. Also reducing the chances of being on track in school by 0.7 and 0.6pp respectively, while increasing the chances of being enrolled in paid tuition support by 0.77 and 0.99pp. In contrast, in districts characterized by low FLFP, both female and male children experience additional gains in learning outcomes from positive shocks in early life. For female children, a one SD increase in the incidence of positive shocks in early life translates into a 0.01 and 0.02 SD gain in reading and math scores over female children in their districts who have not experienced early life shocks. They are also 0.6pp more likely to be on track in school, but 0.58pp less likely to be enrolled in extra tuition support. We do not find differences in school enrollment for female children in low FLFP districts who have versus have not experienced positive shocks in early life, suggesting that the gains in test scores are coming from investments in early life that improve performance and not

[5] Categorized as Government, private, Madarsa and other

[6] Defined as 0 = Only Child, 1 = All Female, 2 = All Male, 3 = Mixed

[7] Included as indicators for whether the house is kutcha or pucca

a difference in school enrollment status. The corresponding effects on male children in low FLFP districts, are an improvement in math scores by 0.02 SD, increased likelihood of being on track by 0.54pp and a decreased likelihood of in being enrolled in paid tuition by 0.48pp, for every one SD increase in positive early life shock incidence.

Next, we examine the interaction between early life shocks and contemporaneous rainfall shocks by the district level FLPF and gender of the child. We run equation 2 separately for male and female children and report the results in Table 2. To calculate the difference in outcomes under a negative contemporaneous rainfall shock (drought) with a positive one, we multiple the coefficient on $RainfallShock$ by two. This follows from the definition of the variable, with -1 corresponding to a drought year, 0 corresponding to a normal rainfall year and 1 corresponding to a positive rainfall shock year in the district. Therefore, the coefficient on $RainfallShock$ signifies the effect of a one-step increase in the value of the variable. To compute the difference between a drought and positive shock year, we are interested in a two-step increase in the value, and hence multiply the coefficient by two. For example, in Panel A column 1 in Table 2, we see that for female children in high FLFP districts who have not experienced any positive shocks in early life, reading scores in a year with a positive contemporaneous rainfall shock are 0.05 SD lower than scores in a drought year.

The results we present in Table 2 align with those from Shah and Steinberg, 2017, and show that for all children, test scores in years with a positive rainfall shocks are worse than in years with a drought shock. Children are also more likely to drop out of school, less likely to be on track and enrolled in extra learning support in positive contemporaneous shock years. We focus on how district level FLFP and the incidence of early life shocks interact with contemporaneous shocks to influence learning outcomes. Our results suggest that while children in low FLFP districts are more susceptible to learning losses under positive contemporaneous shocks overall, the interaction with early life shocks manifests differently in low versus high FLFP districts. In the former, exposure to positive shocks in early life mitigates learning losses while in the latter it exacerbates these vulnerabilities. Taken together, learning indicators and schooling for female children in high FLFP districts who have experienced positive shocks in early life worsen to the largest extent under positive contemporaneous rainfall shocks. For every one SD increase in positive shock exposure in early life, female children in high FLFP districts are 3 times more likely to have dropped out of school under a positive contemporaneous shock year as compared to a drought year.

In the absence of any positive shocks in early life, female children in high FLFP districts have reading and math scores that are 0.05 SD lower in positive shock years than in drought years, and they are 0.4pp more likely to have dropped out of school, 0.5pp less likely to be on track and 1.4pp less likely to be enrolled in paid learning support. For every one SD increase in exposure to positive shocks in early life, female children in these districts have reading and math scores that are 0.07 and 0.06 SD lower in positive shock years when compared to drought years. They are 1.25pp more likely to have dropped out of school, 1.26pp less likely to be on track and 2.24pp less likely to be enrolled in paid tuition classes.

Male children in high FLFP districts who have not experienced positive shocks in early life have reading and math scores that are 0.04 SD lower in positive shock years than in drought years, and are 0.4pp more likely to have dropped out of school, 0.6pp less likely to be on track and 1.4pp less likely to receive in paid tuition support. For every one SD increase in positive early life shock exposure, male children in these districts have reading and math scores that are lower by 0.042 and 0.017 SD respectively, and a 1.2pp increase in the likelihood of having dropped out of school, a 1.32pp decrease in the likelihood of being on track and 0.35pp decrease in the likelihood of receiving paid learning support.

In contrast, in low FLFP districts, learning outcomes of children who experience early life shocks are less vulnerable to losses in case of a contemporaneous positive rainfall shock. For female children, in the absence of any early life shocks, reading and math scores under a positive contemporaneous shock are 0.1 and 0.2 SD lower than in drought years. They are 0.12pp more likely to have dropped out of school; conditional on being enrolled, 0.52pp more likely to be on track and 0.72pp more likely to be enrolled in paid tuition support. For every one SD increase in the incidence of positive shocks in early life, female children in low FLFP districts have reading and math scores that are 0.06 and 0.13 SD lower under positive shock years than in drought years. Interestingly, they are 1.24pp more likely to have dropped out of school, 0.6pp more likely to be on track and 2.33pp more likely to be enrolled in paid tuition support.

For male children in low FLFP districts, in the absence of any exposure to positive shocks in early life, reading and math scores are lower by 0.06 and 0.1 SD lower in years with a positive contemporaneous shock than drought years. They are 0.1pp more likely to have dropped out of school, 0.22pp more likely to be on track and 0.4pp more likely to be enrolled in paid tuition support. A one SD increase in the incidence of positive shocks in early life leads to reading and math scores that are 0.04 and 0.1 SD lower in contemporaneous positive shock years as compared to drought years. Male children in these districts are also 0.81pp more likely to have dropped out of school, 0.31pp more likely to be on track (conditional on being enrolled), and 1.5pp more likely to receive paid learning support.

To understand the mechanisms driving the systematic differences in the effects of early life and contemporaneous positive rainfall shocks in high versus low FLFP districts, we look at the labor market impacts of these shocks on children in rural India. Results are presented in Table 3. We show that both male and female children[8] in low FLFP areas are systematically less likely to be engaged in paid employment, unpaid work and full time domestic work in the absence of any positive shocks in early life. A one SD increase in the incidence of early life shocks decreases the likelihood of being engaged in any of these three activities for children in low FLFP areas, while doing the exact opposite for children in high FLFP areas.

For every one SD increase in the incidence of early life shocks, female children in low FLFP (high loam) districts are 0.4pp less likely to be engaged in paid employment or unpaid work on a household enterprise, and 0.8pp less likely to be engaged in full time domestic work, when compared to their counterparts who have not faced shocks in early life. Male children in low FLFP districts are 1.1pp less likely to work for pay and 0.4pp less likely to carry out unpaid work on an household enterprise. In stark contrast, a one SD increase in incidence of positive shocks in early life increases the chances that female children in high FLFP (low loam) districts are engaged in paid employment by 0.7pp. They are also 0.3pp more likely to be engaged in unpaid work on a household enterprise and 1.7pp more likely to be doing domestic work full time. Male children in high FLFP districts are 1.6pp more likely to be employed full-time and 0.7pp more likely to be doing unpaid work on a household enterprise for every one SD increase in the experience of positive shocks in early life.

These labor market results help explain the differences in the impact of early life shocks on learning outcomes. In low FLFP districts, children who face early life shocks are less likely to participate in the labor market, marginally less likely to have dropped out of school and thereby have learning outcomes that are better than their counterparts

[8]Includes children between 5 and 18 years

who have not experienced these positve shocks early-on. On the other hand, in high-FLFP districts, our results that female children are more likely to be engaged in paid employment, unpaid work on a household enterprise and full-time domestic work if they have faced early life positive shocks, aligns with the fact that they are more likely to have dropped out of school, and thereby have worse learning outcomes.

Next, we look at the interaction effects of early and contemporaneous shocks on the out of school activities for children in both high and low FLFP districts. We present results in Table 4. Earlier results continue to hold – indicating that in low FLFP districts children who face positive early life shocks are less likely to be engaged in out of school activities such as paid employment, unpaid work on a household enterprise and full time domestic work – while those in high FLFP districts are more likely to do so. Additionally, our findings suggest that there are no significant differences in children's out of school activities in years with a positive contemporaneous rainfall shock vis a vis a drought shock, for all children except female children in high FLFP districts who have faced positive shocks in early life. For female children in high FLFP districts, positive shocks in early life interact with positive contemporaneous rainfall shocks, to increase both the time spent in paid employment and the time in unpaid work on a household enterprise by 0.4pp. The triple difference term *HighLoam x Rainfall Shock x Early Life Shock* returns a positive and significant coefficient in the case of female children being engaged in domestic work full time. However, when we calculate the cumulative effect on female children in these low FLFP (high loam) districts, we find that the incidence of positive shocks in early life reduces the likelihood of being engaged in domestic duties alone.

Taken together, the labor market results support the findings that positive shocks in early life and contemporaneous rainfall shocks interact to produce greater learning losses among children in high FLFP districts, and female children in particular. They suggest that time allocated to schooling is shifted to paid employment and unpaid work on a household enterprise in years with a positive rainfall shock, and this substitution is higher for girls who have faced positive shocks in early life. This then appears to exacerbate learning losses, and aligns with increased chances of having dropped out of school.

5 Conclusion and Discussion

Reducing the gender-gap in education outcomes is one of the focus areas of the millennium development goals (MDGs), and there has been substantial progress in terms of bridging the gaps in primary school enrollment (Muralidharan & Sheth, 2016). Previous research documents the importance of timely insurance policies in safeguarding human capital outcomes of very young children (Dasgupta, 2017). This is even more crucial in the face of increasing climatic variability. Our analysis sheds light on the gender dynamics that affect the household response to climatic shocks and highlights the important pathways through which exposure to early-life and contemporaneous rainfall shocks impacts the gender gap in learning outcomes. While there exists a growing body of literature that looks at the impact of climatic shocks on human capital formation, there is limited understanding on how gender norms in the labor market can play a role in this dynamic. Using quasi-random variation in the exposure to rainfall shocks within a district over time, we study how the vulnerability of educational outcomes for children vary by the relative demand for female labour. Using the variation in soil loaminess that correlate with levels of female labor force participation (FLFP) in rural India, we examine how exposure to early life and contemporaneous rainfall shocks affects learning outcomes by the gender of the child. Our analysis uses objective measures on learning levels such as test scores and school enrollment.

Our analysis offers support to the relative importance of the opportunity cost channel vis-a-vis the income effect channel, in the mediation of the shock impact. These results complement the findings from Afridi et al. (2021), which documents that women's workdays fall by a larger extent than men's in the face of a negative shock due to constraints to their participation in non-agricultural employment. Our results indicate that this pattern may prove detrimental for female children in areas with higher levels of FLFP and child labor, where positive contemporaneous shocks lead to an added losses in learning outcomes and higher rates of dropping out of school. Our results add to the findings of Shah and Steinberg (2019), Zimmermann (2020) and Afridi et al. (2021) and reveal the role of gender norms surrounding female labor force participation might play in mediating the effects of shocks on children's learning outcomes.

Our results on understanding these dynamics are in line with Bau et al. (2020), which finds that higher early life investment leads to a reduction in schooling in districts with high child labor. From our analysis of the interaction effects between shocks in early life and school going years, we see that in low loam districts (which are characterized by higher FLFP and higher child labor), positive shock exposure in early life exacerbates learning losses during contemporaneous positive shocks, but only in districts characterized by high relative FLFP (low loam).

We also examine possible mechanisms using data on labour force participation from the 61st, 64th, 66th and 68th Employment and Unemployment survey rounds from the Indian National Sample Survey (NSS). We find suggestive evidence that higher positive shock exposure in early life increases the likelihood of being engaged in paid employment full time only in districts characterized by higher relative FLFP, while doing the opposite in low FLFP districts. Additionally, we find that there are no significant differences in children's out of school activities in years with a positive contemporaneous rainfall shock, for all children except female children in high FLFP districts who have faced positive shocks in early life. For female children in high FLFP districts, positive shocks in early life interact with positive contemporaneous rainfall shocks to increase both the time spent in paid employment and the time in unpaid work on a household enterprise.

Our analysis sheds light on the role that norms around FLFP might play in determining the magnitude of the impact of rainfall shocks in early life and school-going years, and how this impact might be gendered in nature. We highlight how differences in FLFP are linked to stark differences in learning outcome levels, and how higher levels of FLFP might interact with contemporaneous rainfall shocks to expose female children to additional vulnerability in the face of rainfall shocks. Additionally, we show that the dynamic complementarities between shocks in early life and later life depends on the gender institutions around female labor force participation in the region.

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Tables and Figures

Table 1

	Reading : Z-Score	Math : Z-Score	Drop Out	On Track	Attends Extra Tuition
Panel A: Female sample					
High Loam	0.1791***	0.1811***	-0.0322***	-0.1428***	0.1409***
	(43.10)	(39.76)	(-52.06)	(-57.09)	(100.77)
Early Life Shock	0.0018	0.0016	0.0023**	-0.0070***	0.0077***
	(0.36)	(0.29)	(2.42)	(-7.07)	(6.14)
High Loam ×	0.0136*	0.0237***	0.0013	0.0062***	-0.0058***
Early Life Shock	(1.87)	(2.86)	(1.05)	(4.25)	(-3.09)
Constant	98.6674***	151.5507***	-0.9260**	-0.2668	10.1722***
	(20.05)	(24.50)	(-2.19)	(-0.45)	(7.95)
Observations	918521	915702	1125817	982891	767458
Mean of Dep. Var.	0.057	-0.003	0.034	0.868	0.201
Panel B: Male sample					
High Loam	0.2318***	0.2441***	-0.0206***	-0.1464***	0.1544***
	(63.18)	(60.17)	(-39.25)	(-77.29)	(109.96)
Early Life Shock	0.0052	0.0049	0.0038***	-0.0060***	0.0099***
	(1.19)	(0.98)	(5.03)	(-6.26)	(8.18)
High Loam ×	0.0079	0.0194**	-0.0011	0.0054***	-0.0048**
Early Life Shock	(1.17)	(2.55)	(-0.95)	(3.83)	(-2.49)
Constant	106.2302***	140.5412***	-0.5248*	1.0128*	7.5790***
	(24.67)	(25.90)	(-1.65)	(1.65)	(5.34)
Observations	1029577	1026469	1274205	1114690	864386
Mean of Dep. Var.	0.062	0.071	0.031	0.851	0.233

Note: * 0.1 ** 0.05 *** 0.01. *t* statistics in parentheses. Standard errors are clustered at the district level. Table **??** shows effects of early life rainfall shocks and FLFP norms on educational outcomes, by gender for the combined sample of children between the ages 5 and 16. Early Life Shock is an index created using principal component analysis of the variables capturing shock in the first 4 years of child's life, including birth year. High Loam takes value 1 if the fraction of area in the district under loamy soil is greater than the sample median. Reading and Math scores are z-scores computed by age. Individual level controls include age, school grade, school type, and for all outcomes except drop out - an indicator for being enrolled in school. Household controls include indicator for whether the mother has gone to school, sibling cohort composition, whether the household has a first born female, number of children and a household wealth index. Village level controls include indicators for whether the village has a pucca road, a bank, a ration shop and electric supply. District and year fixed effects are included.

Table 2

	Reading : Z-Score	Math : Z-Score	Drop Out	On Track	Attends Extra Tuition
Panel A: Female sample					
High Loam	0.1906***	0.1968***	-0.0323***	-0.1423***	0.1432***
	(36.55)	(32.95)	(-45.67)	(-55.45)	(77.86)
Rainfall Shock	-0.0266***	-0.0269***	0.0020**	-0.0025*	-0.0071***
	(-3.60)	(-2.62)	(2.29)	(-1.88)	(-3.00)
High Loam × Rainfall Shock	-0.0135	-0.0459***	-0.0014	0.0051***	0.0107***
	(-1.37)	(-3.73)	(-1.16)	(3.12)	(3.01)
Early Life Shock	0.0020	0.0031	0.0023**	-0.0072***	0.0072***
	(0.40)	(0.54)	(2.44)	(-7.26)	(5.72)
High Loam × Early Life Shock	0.0120*	0.0190**	0.0015	0.0066***	-0.0048**
	(1.67)	(2.35)	(1.20)	(4.46)	(-2.50)
Rainfall Shock × Early Life Shock	-0.0120***	-0.0084	0.0031***	-0.0002	-0.0014
	(-2.64)	(-1.58)	(2.90)	(-0.19)	(-0.92)
High Loam × Rainfall Shock × Early Life Shock	0.0116*	0.0043	0.0006	0.0009	0.0029
	(1.91)	(0.57)	(0.41)	(0.67)	(1.34)
Constant	104.2326***	160.1056***	-1.1781***	-0.3680	10.3964***
	(20.24)	(24.82)	(-2.76)	(-0.58)	(7.79)
Observations	918521	915702	1125817	982891	767458
Mean of Dep. Var.	0.057	-0.003	0.034	0.868	0.201
Panel B: Male sample					
High Loam	0.2423***	0.2590***	-0.0210***	-0.1456***	0.1571***
	(51.96)	(47.43)	(-38.74)	(-75.45)	(87.18)
Rainfall Shock	-0.0202***	-0.0206**	0.0024***	-0.0033***	-0.0074***
	(-2.61)	(-2.00)	(3.40)	(-2.61)	(-2.84)
High Loam × Rainfall Shock	-0.0114	-0.0389***	-0.0019**	0.0044***	0.0094**
	(-1.18)	(-3.32)	(-2.02)	(2.63)	(2.47)
Early Life Shock	0.0053	0.0060	0.0038***	-0.0062***	0.0095***
	(1.22)	(1.19)	(5.09)	(-6.42)	(7.79)
High Loam × Early Life Shock	0.0066	0.0155**	-0.0011	0.0057***	-0.0038*
	(0.99)	(2.06)	(-0.91)	(4.01)	(-1.92)
Rainfall Shock × Early Life Shock	-0.0038	-0.0013	0.0017**	-0.0002	0.0009
	(-0.81)	(-0.22)	(2.47)	(-0.27)	(0.54)
High Loam × Rainfall Shock × Early Life Shock	0.0068	-0.0021	0.0005	0.0009	0.0018
	(1.11)	(-0.28)	(0.46)	(0.67)	(0.78)
Constant	110.3976***	147.3146***	-0.7497**	1.1011*	7.8118***
	(24.15)	(25.79)	(-2.34)	(1.67)	(5.25)
Observations	1029577	1026469	1274205	1114690	864386
Mean of Dep. Var.	0.062	0.071	0.031	0.851	0.233

Note: * 0.1 ** 0.05 *** 0.01. t statistics in parentheses. Standard errors are clustered at the district level. Table **??** shows effects of early life rainfall shocks, contemporaneous rainfall shocks and FLFP norms on educational outcomes, by gender for the combined sample of children between the ages 5 and 16. Early Life Shock is an index created using principal component analysis of the variables capturing shock in the first 4 years of child's life, including birth year. High Loam takes value 1 if the fraction of area in the district under loamy soil is greater than the sample median. Rainfall shock defined as -1 = Drought, 0 = Normal, 1 = Flood. Reading and Math scores are z-scores computed by age. Individual level controls include age, school grade, school type, and for all outcomes except drop out - an indicator for being enrolled in school. Household controls include indicator for whether the mother has gone to school, sibling cohort composition, whether the household has a first born female, number of children and a household wealth index. Village level controls include indicators for whether the village has a pucca road, a bank, a ration shop and electric supply. District and year fixed effects are included.

Table 3

	Employed With Pay	Unpaid Work in HH Enterprise	Domestic Duties Only
Panel A: Female sample			
High	-0.017***	-0.050***	-0.051***
	(-10.57)	(-35.92)	(-15.15)
Early Life Shock	0.007***	0.003***	0.017***
	(4.37)	(3.89)	(9.20)
High × Early Life Shock	-0.004**	-0.004***	-0.008**
	(-2.02)	(-2.97)	(-2.40)
Constant	-0.013***	0.014***	-0.180***
	(-2.63)	(3.58)	(-18.23)
Observations	79986	79986	79986
Mean of Dep. Var.	0.016	0.011	0.081
Panel B: Male sample			
High	-0.019***	-0.038***	-0.002**
	(-7.21)	(-21.96)	(-2.49)
Early Life Shock	0.016***	0.007***	0.000
	(8.73)	(6.92)	(0.85)
High × Early Life Shock	-0.011***	-0.004**	-0.001
	(-4.00)	(-2.42)	(-1.35)
Constant	-0.083***	-0.059***	0.000
	(-13.53)	(-11.89)	(0.05)
Observations	92340	92340	92340
Mean of Dep. Var.	0.038	0.024	0.007

Note: * 0.1 ** 0.05 *** 0.01. Standard errors are in parentheses. Standard errors are clustered at the district level. Table 3 shows effects of early life rainfall shocks and FLFP norms on labour market outcomes, by gender for children (5-18) with the sample split by gender. Early Life Shock is an index created using principal component analysis of the variables capturing shock in the first 4 years of child's life, including birth year. High Loam takes value 1 if the fraction of area in the district under loamy soil is greater than the sample median. Outcomes are indicators defined using Principal Activity Status codes in the NSS data. Individual level controls include age and marital status. Household controls include whether the household owns land, religion, caste, household size and whether the household is an agricultural household. District and survey sub-round fixed effects are included.

Table 4

	Employed With Pay	Unpaid Work in HH Enterprise	Domestic Duties Only
Panel A: Female sample			
High	-0.017***	-0.050***	-0.053***
	(-10.39)	(-34.76)	(-15.93)
Rainfall Shock	0.001	-0.003**	0.005
	(0.47)	(-2.10)	(1.40)
High × Rainfall Shock	-0.000	0.002	0.004
	(-0.02)	(1.37)	(0.93)
Early Life Shock	0.006***	0.003***	0.018***
	(4.00)	(3.17)	(8.80)
High × Early Life Shock	-0.004*	-0.003**	-0.009***
	(-1.84)	(-2.58)	(-2.71)
Rainfall Shock × Early Life Shock	0.002*	0.002**	-0.001
	(1.75)	(2.05)	(-0.68)
High × Rainfall Shock × Early Life Shock	-0.001	-0.001	0.006**
	(-1.02)	(-1.16)	(2.09)
Constant	-0.013***	0.015***	-0.182***
	(-2.66)	(3.81)	(-18.33)
Observations	79986	79986	79986
Mean of Dep. Var.	0.016	0.011	0.081
Panel B: Male sample			
High	-0.018***	-0.037***	-0.004***
	(-6.86)	(-21.83)	(-3.74)
Rainfall Shock	-0.000	0.002	-0.000
	(-0.19)	(1.35)	(-0.14)
High × Rainfall Shock	-0.002	-0.004**	0.004**
	(-0.55)	(-2.16)	(2.59)
Early Life Shock	0.016***	0.007***	0.000
	(8.05)	(6.42)	(0.80)
High × Early Life Shock	-0.011***	-0.005***	-0.001
	(-3.93)	(-2.71)	(-1.55)
Rainfall Shock × Early Life Shock	0.003	0.002**	0.000
	(1.51)	(2.18)	(0.02)
High × Rainfall Shock × Early Life Shock	0.001	0.001	0.001
	(0.32)	(0.56)	(1.30)
Constant	-0.083***	-0.059***	-0.000
	(-13.66)	(-11.88)	(-0.08)
Observations	92340	92340	92340
Mean of Dep. Var.	0.038	0.024	0.007

Note: * 0.1 ** 0.05 *** 0.01. Standard errors are in parentheses. Standard errors are clustered at the district level. Table 4 shows effects of early life rainfall shocks and FLFP norms on labour market outcomes, by gender for children (5-18) with the sample split by gender. Early Life Shock is an index created using principal component analysis of the variables capturing shock in the first 4 years of child's life, including birth year. High Loam takes value 1 if the fraction of area in the district under loamy soil is greater than the sample median. Rainfall shock defined as -1 = Drought, 0 = Normal, 1 = Flood. Outcomes are indicators defined using Principal Activity Status codes in the NSS data. Individual level controls include age and marital status. Household controls include whether the household owns land, religion, caste, household size and whether the household is an agricultural household. District and survey sub-round fixed effects are included.

Appendix

Table 5

Variable	(1) Low Loam N	Mean/SE	(2) High Loam N	Mean/SE	T-test Difference (1)-(2)
Female	1749353	0.466	1891591	0.467	-0.001
		(0.000)		(0.000)	
Age	1749353	10.393	1891591	10.269	0.123***
		(0.002)		(0.002)	
Reading Z-Score	1563583	0.047	1694488	-0.039	0.086***
		(0.001)		(0.001)	
Math Z-Score	1557950	0.016	1687734	-0.014	0.031***
		(0.001)		(0.001)	
Dropped Out	1749353	0.034	1891591	0.032	0.002***
		(0.000)		(0.000)	
Attends Extra Tuition	1253673	0.160	1397623	0.257	-0.097***
		(0.000)		(0.000)	
Public School	1749353	0.665	1891591	0.618	0.047***
		(0.000)		(0.000)	
Wealth Index	1685144	0.127	1815279	-0.085	0.212***
		(0.001)		(0.001)	
HH has First-born Female	1749353	0.487	1891591	0.485	0.003***
		(0.000)		(0.000)	
Mother Gone to School	1687935	0.510	1819454	0.492	0.018***
		(0.000)		(0.000)	
Normal Rainfall	1749353	0.409	1891591	0.322	0.087***
		(0.000)		(0.000)	
Negative Rainfall Shock	1296078	0.205	1391317	0.289	-0.084***
		(0.000)		(0.000)	
Positive Rainfall Shock	1296078	0.243	1391317	0.273	-0.030***
		(0.000)		(0.000)	
Early Life Shock Index	1296078	-0.014	1391317	0.013	-0.027***
		(0.001)		(0.001)	

Notes: The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table 6

Variable	(1) Low Loam N	(1) Low Loam Mean/SE	(2) High Loam N	(2) High Loam Mean/SE	T-test Difference (1)-(2)
Female	289129	0.489	336495	0.490	-0.001
		(0.001)		(0.001)	
Age	289093	28.500	336458	27.539	0.961***
		(0.036)		(0.033)	
Adult Paid Employment (M)	89701	0.760	99030	0.762	-0.003
		(0.001)		(0.001)	
Adult Paid Employment (F)	90176	0.217	101532	0.158	0.059***
		(0.001)		(0.001)	
Child Paid Employment (M)	58176	0.051	72727	0.044	0.007***
		(0.001)		(0.001)	
Child Paid Employment (F)	51076	0.024	63206	0.013	0.011***
		(0.001)		(0.000)	
Adult Unpaid Work on HH Enterprise (M)	89701	0.116	99030	0.105	0.011***
		(0.001)		(0.001)	
Adult Unpaid Work on HH Enterprise (F)	90176	0.137	101532	0.083	0.054***
		(0.001)		(0.001)	
Child Unpaid Work on HH Enterprise (M)	58176	0.031	72727	0.027	0.004***
		(0.001)		(0.001)	
Child Unpaid Work on HH Enterprise (F)	51076	0.015	63206	0.010	0.006***
		(0.001)		(0.000)	
Adult Full-time Domestic Work (M)	89701	0.006	99030	0.007	-0.001***
		(0.000)		(0.000)	
Adult Full-time Domestic Work (F)	90176	0.552	101532	0.669	-0.116***
		(0.002)		(0.001)	
Child Full-time Domestic Work (M)	58176	0.005	72727	0.007	-0.002***
		(0.000)		(0.000)	
Child Full-time Domestic Work (F)	51076	0.083	63206	0.086	-0.004**
		(0.001)		(0.001)	
HH Owns Land	289129	0.939	336495	0.958	-0.019***
		(0.000)		(0.000)	
Agricultural Household	289129	0.521	336495	0.490	0.031***
		(0.001)		(0.001)	
NREGA Operational	289129	0.825	336495	0.860	-0.035***
		(0.001)		(0.001)	

Notes: The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table 7

	Reading : Z-Score	Math : Z-Score	Drop Out	On Track	Attends Extra Tuition
Panel A: Female sample					
Share of loamy	0.1522***	1.1236***	0.0610***	-0.1370***	-0.0417***
soil	(14.08)	(90.56)	(47.22)	(-42.70)	(-13.04)
Early Life Shock	-0.0029	-0.0094	0.0014	-0.0111***	0.0116***
	(-0.36)	(-0.97)	(0.91)	(-8.07)	(5.90)
Share of loamy	0.0173	0.0345**	0.0024	0.0109***	-0.0103***
soil × Early Life Shock	(1.54)	(2.57)	(1.12)	(5.25)	(-3.59)
Constant	98.6053***	150.8003***	-0.9687**	-0.1634	10.1971***
	(20.01)	(24.34)	(-2.29)	(-0.28)	(7.96)
Observations	918521	915702	1125817	982891	767458
Mean of Dep. Var.	0.057	-0.003	0.034	0.868	0.201
Panel B: Male sample					
Share of loamy	0.0046	0.8890***	0.0647***	-0.1527***	-0.0705***
soil	(0.50)	(85.33)	(58.64)	(-63.59)	(-24.14)
Early Life Shock	0.0053	-0.0035	0.0057***	-0.0103***	0.0136***
	(0.72)	(-0.40)	(5.06)	(-7.63)	(7.16)
Share of loamy	0.0057	0.0274**	-0.0038**	0.0107***	-0.0093***
soil × Early Life Shock	(0.54)	(2.23)	(-2.23)	(5.26)	(-3.25)
Constant	106.2666***	139.9495***	-0.5677*	1.1244*	7.6335***
	(24.64)	(25.74)	(-1.78)	(1.84)	(5.38)
Observations	1029577	1026469	1274205	1114690	864386
Mean of Dep. Var.	0.062	0.071	0.031	0.851	0.233

Note: * 0.1 ** 0.05 *** 0.01.

Table 8

	Reading : Z-Score	Math : Z-Score	Drop Out	On Track	Attends Extra Tuition
Panel A: Female sample					
Share of loamy soil	0.1293***	1.0826***	0.0602***	-0.1364***	-0.0417***
	(10.54)	(75.52)	(42.16)	(-41.06)	(-10.17)
Rainfall Shock	-0.0136	0.0229	0.0026	-0.0064***	-0.0079*
	(-1.07)	(1.25)	(1.49)	(-2.89)	(-1.88)
Share of loamy soil × Rainfall Shock	-0.0286*	-0.1058***	-0.0019	0.0095***	0.0095
	(-1.70)	(-4.66)	(-0.86)	(3.36)	(1.56)
Early Life Shock	-0.0014	-0.0041	0.0013	-0.0116***	0.0111***
	(-0.17)	(-0.43)	(0.85)	(-8.34)	(5.62)
Share of loamy soil × Early Life Shock	0.0141	0.0255*	0.0027	0.0116***	-0.0094***
	(1.28)	(1.93)	(1.30)	(5.48)	(-3.25)
Rainfall Shock × Early Life Shock	-0.0198***	-0.0137	0.0042**	0.0002	-0.0031
	(-2.78)	(-1.61)	(2.05)	(0.13)	(-1.15)
Share of loamy soil × Rainfall Shock × Early Life Shock	0.0202**	0.0101	-0.0010	0.0002	0.0046
	(2.18)	(0.87)	(-0.38)	(0.12)	(1.28)
Constant	104.3246***	159.9145***	-1.2350***	-0.3133	10.3863***
	(20.24)	(24.73)	(-2.88)	(-0.49)	(7.73)
Observations	918521	915702	1125817	982891	767458
Mean of Dep. Var.	0.057	-0.003	0.034	0.868	0.201
Panel B: Male sample					
Share of loamy soil	-0.0166	0.8555***	0.0651***	-0.1536***	-0.0735***
	(-1.47)	(62.84)	(56.21)	(-59.70)	(-18.20)
Rainfall Shock	-0.0032	0.0244	0.0037***	-0.0058**	-0.0069
	(-0.23)	(1.33)	(2.89)	(-2.56)	(-1.48)
Share of loamy soil × Rainfall Shock	-0.0329*	-0.0941***	-0.0034**	0.0070**	0.0067
	(-1.92)	(-4.30)	(-2.05)	(2.34)	(1.01)
Early Life Shock	0.0068	0.0010	0.0057***	-0.0107***	0.0131***
	(0.92)	(0.11)	(5.12)	(-7.76)	(6.87)
Share of loamy soil × Early Life Shock	0.0028	0.0197	-0.0037**	0.0111***	-0.0082***
	(0.27)	(1.61)	(-2.22)	(5.39)	(-2.86)
Rainfall Shock × Early Life Shock	-0.0112	-0.0025	0.0021*	-0.0004	-0.0015
	(-1.48)	(-0.27)	(1.73)	(-0.29)	(-0.57)
Share of loamy soil × Rainfall Shock × Early Life Shock	0.0156	-0.0010	-0.0003	0.0010	0.0047
	(1.61)	(-0.08)	(-0.18)	(0.52)	(1.28)
Constant	110.7061***	147.2787***	-0.7858**	1.1838*	7.8573***
	(24.21)	(25.69)	(-2.45)	(1.80)	(5.26)
Observations	1029577	1026469	1274205	1114690	864386
Mean of Dep. Var.	0.062	0.071	0.031	0.851	0.233

Note: * 0.1 ** 0.05 *** 0.01.

Table 9

	Employed With Pay	Unpaid Work in HH Enterprise	Domestic Duties Only
Panel A: Female sample			
loam	-0.103***	0.092***	-0.033***
	(-39.62)	(42.93)	(-6.96)
Early Life Shock	0.010***	0.006***	0.024***
	(4.66)	(4.56)	(7.47)
loam × Early Life Shock	-0.007***	-0.007***	-0.016***
	(-2.99)	(-3.83)	(-2.98)
Constant	0.061***	-0.053***	-0.158***
	(10.12)	(-10.98)	(-13.45)
Observations	79986	79986	79986
Mean of Dep. Var.	0.016	0.011	0.081
Panel B: Male sample			
loam	-0.167***	0.073***	0.008***
	(-47.32)	(25.71)	(7.11)
Early Life Shock	0.024***	0.012***	0.001
	(8.27)	(6.44)	(1.40)
loam × Early Life Shock	-0.019***	-0.010***	-0.002
	(-4.56)	(-3.58)	(-1.45)
Constant	0.035***	-0.112***	-0.006**
	(4.93)	(-19.43)	(-2.00)
Observations	92340	92340	92340
Mean of Dep. Var.	0.038	0.024	0.007

Note: * 0.1 ** 0.05 *** 0.01.

Table 10

	Employed With Pay	Unpaid Work in HH Enterprise	Domestic Duties Only
Panel A: Female sample			
loam	-0.102***	0.088***	-0.030***
	(-36.06)	(35.40)	(-5.58)
Rainfall Shock	0.002	-0.006*	0.002
	(0.72)	(-1.96)	(0.43)
loam × Rainfall Shock	-0.002	0.006*	0.007
	(-0.50)	(1.66)	(0.95)
Early Life Shock	0.009***	0.006***	0.025***
	(4.14)	(3.64)	(7.17)
loam × Early Life Shock	-0.006**	-0.007***	-0.018***
	(-2.57)	(-3.16)	(-3.25)
Rainfall Shock × Early Life Shock	0.004**	0.003	-0.006
	(2.07)	(1.44)	(-1.46)
loam × Rainfall Shock × Early Life Shock	-0.004*	-0.002	0.011**
	(-1.70)	(-0.96)	(2.08)
Constant	0.060***	-0.050***	-0.162***
	(9.83)	(-10.25)	(-13.45)
Observations	79986	79986	79986
Mean of Dep. Var.	0.016	0.011	0.081
Panel B: Male sample			
loam	-0.166***	0.075***	0.008***
	(-42.64)	(23.37)	(5.97)
Rainfall Shock	0.004	0.006**	-0.003**
	(1.05)	(2.21)	(-2.05)
loam × Rainfall Shock	-0.007	-0.009**	0.008***
	(-1.59)	(-2.58)	(2.70)
Early Life Shock	0.024***	0.011***	0.001*
	(8.00)	(6.11)	(1.73)
loam × Early Life Shock	-0.020***	-0.010***	-0.002*
	(-4.62)	(-3.75)	(-1.84)
Rainfall Shock × Early Life Shock	0.000	0.003	-0.001*
	(0.17)	(1.39)	(-1.92)
loam × Rainfall Shock × Early Life Shock	0.003	0.000	0.003**
	(0.96)	(0.10)	(2.03)
Constant	0.035***	-0.114***	-0.006*
	(4.85)	(-19.07)	(-1.96)
Observations	92340	92340	92340
Mean of Dep. Var.	0.038	0.024	0.007

Note: * 0.1 ** 0.05 *** 0.01.

Table 11

	Employed With Pay	Unpaid Work in HH Enterprise	Domestic Duties Only
Panel A: Female sample			
High	-0.082***	-0.202***	0.165***
	(-22.14)	(-77.80)	(38.82)
Constant	0.613***	0.023	0.127***
	(47.08)	(1.65)	(7.24)
Observations	176278	176278	176278
Mean of Dep. Var.	0.196	0.115	0.633
Panel B: Male sample			
High	0.050***	-0.080***	-0.003***
	(17.48)	(-36.48)	(-4.56)
Constant	0.602***	0.118***	0.012***
	(57.26)	(17.26)	(9.17)
Observations	172568	172568	172568
Mean of Dep. Var.	0.786	0.119	0.005

Note: * 0.1 ** 0.05 *** 0.01.

Table 12

	Employed With Pay	Unpaid Work in HH Enterprise	Domestic Duties Only
Panel A: Female sample			
High	-0.084***	-0.203***	0.168***
	(-21.65)	(-71.44)	(35.03)
Rainfall Shock	0.001	-0.009**	0.009
	(0.26)	(-2.18)	(1.40)
High × Rainfall Shock	0.003	0.011**	-0.014*
	(0.57)	(2.13)	(-1.71)
Constant	0.612***	0.025*	0.126***
	(47.20)	(1.79)	(7.10)
Observations	176278	176278	176278
Mean of Dep. Var.	0.196	0.115	0.633
Panel B: Male sample			
High	0.048***	-0.079***	-0.003***
	(15.94)	(-32.48)	(-4.73)
Rainfall Shock	0.001	-0.002	0.000
	(0.31)	(-0.61)	(0.89)
High × Rainfall Shock	0.004	-0.002	0.000
	(1.02)	(-0.45)	(0.03)
Constant	0.602***	0.119***	0.012***
	(57.04)	(17.37)	(9.02)
Observations	172568	172568	172568
Mean of Dep. Var.	0.786	0.119	0.005

Note: * 0.1 ** 0.05 *** 0.01.