

Female Labor Force Participation and Child Education in India: Evidence from the National Rural Employment Guarantee Scheme

Farzana Afridi ^a
Abhiroop Mukhopadhyay ^b
Soham Sahoo ^c

July, 2013

Abstract

We exploit the implementation of India's National Rural Employment Guarantee Scheme to identify exogenous shifts in mothers' labor force participation and its impact on their children's educational outcomes. Using child level panel data, we find that mother's participation in the labor force results in almost two additional months of attendance in a school year by her children and reduces the gap between a child's actual and ideal grade by more than a quarter. These effects are robust for less landed households and for girls. We find evidence of greater household decision-making power of working mothers as an explanation of our results.

Keywords: labor, education, gender, bargaining

JEL classification: D1, I21, I38, J16

^{a,b,c} Indian Statistical Institute, Economics and Planning Unit, 7, S.J.S. Sansanwal Marg, New Delhi –110016, India.

Email: ^a fafridi@isid.ac.in; ^b abhiroop@isid.ac.in; ^c soham9r@isid.ac.in

We would like to thank Deborah DeGraff, Taryn Dinkelman, Andreas Georgiadis, Priscila Hermida, seminar and conference participants at the ISI (Delhi), the Indian School of Business (Hyderabad), NEUDC (Dartmouth), IZA-World Bank Conference (Delhi), the Asian Meeting of the Econometrics Society (Delhi), the German Economic Association AEL Conference (Munich), University of Heidelberg, YLS conference (Oxford) and an anonymous reviewer for their comments. The authors are grateful to Young Lives for financial support and for providing the dataset. The usual disclaimers apply.

1. Introduction

The World Development Report (World Bank, 2012), focusing on gender equality, highlights the fact that women in the poorer regions of the world continue to suffer from disadvantages in the economic sphere. Although, significant progress has been made in reducing gender disparities in health and educational outcomes, economic opportunities remain limited for women. Research suggests that variation in women's labor force participation is associated with changes in individual and household behavior on several fronts including marriage (eg: van der Klaauw, 1998), fertility (eg: Goldin and Katz, 2002), and intra-household resource allocation (eg: Luke and Munshi, 2011). Thus, the policy priority of closing the gender differences in access to economic opportunities is critical for not only reducing poverty but also for improving individual and household welfare in developing countries.

In this paper we exploit the exogenous, temporal variation in the intensity of implementation of India's National Rural Employment Guarantee Scheme (NREGS) to identify shifts in rural women's participation in the labor market and the latter's impact on their children's educational outcomes. While the NREGS's main objective is to alleviate rural poverty by providing employment to households on local public works, it has the potential to increase women's access to labor market opportunities.

From a gender perspective, there are two interesting features of this program. First, the wage rate offered in the scheme is uniform across gender, and second, it gives priority to female employment on public works and mandates one-third of the program beneficiaries to be women. Thus, NREGS not only brings employment opportunities to

rural women's doorstep, the equal wage rates provided in the program can reduce any gender disparity prevalent in the rural labor markets.

While an increase in parental labor supply could improve children's outcomes purely due to an income effect, labor force participation of mothers could impact children's education through additional channels. First, mothers are likely to have more alternative uses of their time than fathers – market work, household chores and leisure. If children's time in doing household chores substitutes for mother's time then an increase in labor force participation of mothers may lead to a *decline* in the educational attainment of her children. However, if mother's and children's time are not close substitutes and child care services in the market are either unavailable or unaffordable, then it is possible that schools substitute for child-care services and children attend school when mothers are at work. Note, however, that this mechanism is unlikely to hold if child-care services are available within the household in the form of older members (viz. grandparents). It is also less likely to be applicable for older children, particularly girls, whose time often substitutes for the mothers' time on household chores.

Second, a working mother's say in household resource allocation decisions may be greater due to her higher earned income. Research suggests that this is likely to have a *positive* effect on her children's schooling. If an increase in mother's earned income translates into greater weight being attached to her preferences in resource allocation decisions of the household and mothers prefer to invest more in their children's health and education relative to fathers (Blumberg, 1988; Thomas, 1990; Hoddinott and Haddad, 1995; Thomas et al., 2002; Quisumbing and Maluccio, 2003), then we should see an improvement in child outcomes.

To sum, the net impact of mother's participation in the labor force on her children's time allocation and, thereby, schooling depends on which of these effects dominate – the negative substitution effect or the positive effects discussed above.¹

There exists relatively little empirical research on the impact of parental labor supply on children's time allocation, particularly in a developing country context. Skoufias (1993) shows that an increase in female wages (and thereby female labor supply) in rural India reduces the time in school significantly but only for girls. Similar results are found by Grootaert and Patrinos (1999) in a cross-country study. However, Ilahi (1999) does not find any impact of female wages on children's time use in Peru.

In contrast to the sparse literature on time allocation effects, there is considerable empirical evidence suggesting that households' resource allocation decisions are made in a 'collective' (Chiappori, 1988) or a bargaining framework (McElroy and Horney, 1981) where the final allocation usually depends on the bargaining power or weights attached to the preferences of the members of the household. The importance of labor income as a determinant of women's bargaining power within the household has been highlighted recently by Anderson and Eswaran (2009). Using data from Bangladesh, the authors show that the effect of earned income on female autonomy is far greater than that of unearned income. Women who work on the household farm have no more autonomy than those who are housewives, while those who earn independent income have considerably greater autonomy. Luke and Munshi (2011) exploit data from tea plantations in South

¹ We are abstracting from any long term effects of changes in fertility due to increased labor force participation of women since we are looking at these changes over 2 to 3 years only.

India where women are employed in permanent wage labor, to find that a relative increase in female income has a positive effect on their children's education. Qian (2008) shows that a change in agricultural pricing policy in post-Mao China, which increased female labor income, raised the educational attainment of all children. However, when the policy increased male labor income, educational attainment of girls decreased but had no effect on boys.

We utilize child and household level panel data from the Young Lives Study in the state of Andhra Pradesh to assess the effect of mother's participation in the labor force on three educational outcomes of her children – time spent in school, grade attainment and test scores - between 2007 and 2009-10. To identify exogenous shifts in mothers' labor force participation and household income we take advantage of the temporal variation in the amount of funds allocated for the implementation of the NREGS and rainfall shocks within sub-districts. Lagged values of these two variables are used as instruments in a 2SLS framework. The analysis accounts for unobservable child characteristics, time trends and difference in district trends by baseline primary school enrollment rates and economic development.

Our results suggest that participation of mothers in the workforce results in more time spent in school by their children. A positive change in mother's participation in the workforce leads to almost two additional months of school attendance by her children. Further, we find that this increase in time spent in school translates into higher grade attainment of children. Labor force participation by the mother reduces the gap between the child's actual and ideal grade by more than a quarter. These effects are robust for households with less than median landholding and for girls. For a subsample of children

who were administered cognitive tests, we find better performance on standardized PPVT and math test score when their mothers work.

In order to understand the mechanisms through which these effects occur, we exploit household level data on education expenditures and on household members' say in decision-making and control over income from various sources. The analysis of the household level panel data on education expenditures show that mother's participation in the workforce significantly increased the share of total household education expenditures, including variable costs of schooling such as stationary, in less landed households. Moreover, cross-sectional 2SLS analysis suggests that the probability that mothers have a say or control over utilization of household earnings from different sources increases when they participate in the labor force.

These results suggest that greater weightage on working mothers' preferences in household decision making could be among the primary drivers of the improvements in educational attainment of their children. While we cannot completely rule out the possibility that schools serve as child care centers while mothers work, this mechanism cannot account for all of our results: the impact of mother's labor force participation on children's time spent in school is robust to the presence of older members or potential child care givers in the household and is significant for older children (and girls) as well. Our findings can, hence, be explained within the framework of a bargaining model of household resource allocation.

This study not only informs us about the relevance of women's labor supply to intra-household outcomes but it also addresses the broader policy issue of the role of the design of public programs in improving household outcomes in developing countries.

Specifically, our paper extends the debate on the effect of workfare programs on household and individual welfare (Jalan and Ravallion, 2003; Ravi and Engler, 2009; Imbert and Papp, 2011) and finds evidence which suggests that mandating women's participation in public programs has consequences beyond those immediately intended by policy makers.

The remainder of the paper is organized as follows. Section 2 gives the background on the National Rural Employment Guarantee Scheme and motivates the study. Section 3 describes the data and methodology used in this paper. Section 4 discusses the results and section 5 concludes.

2. Background

The National Rural Employment Guarantee Act (2005) of India provides a legal guarantee for up to 100 days of annual employment at a predetermined wage rate to rural households willing to supply manual labor on local public works.² As mentioned earlier, the Act mandates equality of wages for men and women and one-third of program beneficiaries to be women. It was operationalized through the National Rural Employment Guarantee Scheme (NREGS) which began in 2006. Initially restricted to 200 "poorest" districts of India (February 2006), it was extended to 130 additional districts in May 2007 and to all districts in the country by 1st April, 2008.

² <http://nrega.nic.in/rajaswa.pdf>

Our study is focused on Andhra Pradesh (AP) - India's fifth largest state in terms of population and among the leading states in the generation of employment under the NREGS. We utilize data from the Young Lives Study (YLS) – a child and household level panel from six districts of AP – to assess the effect of mothers' labor force participation on their children's educational attainment. To date, there have been three rounds of YLS surveys. We use data from rounds 2 (2007) and 3 (2009-10) of the YLS for reasons of comparability and exclude round 1 data (2002). The survey years coincide with the initial implementation of NREGS (four YLS districts in Phase 1), followed by nation-wide coverage by 2008 (an additional YLS district each in Phases 2 and 3).³

We categorize a mother as being part of the labor force if she is self-employed (farm or non-farm), wage employed (farm or non-farm) or in salaried employment. As discussed above, we expect changes in mothers' labor force participation to be influenced by exogenous variation in the intensity of the NREGS.

Using household level data from the YLS, we find that mothers' labor force participation rate increased substantially between 2007 and 2009-10. Figure 1 shows the labor force participation of mothers by children's age cohort (5 to 10 and 11 to 14 years) during this period for all sampled districts and by the NREGS phase of districts. In Phase 1 districts, mothers' participation in work was higher than in Phase 2 and 3 districts in 2007. In 2009, participation rates rose in both types of districts but significantly more in Phase 2 and 3 districts. This increase in the participation rate was not significantly

³ Anantapur, Cuddapah, Karimnagar and Mahbubnagar implemented the NREGS in 2006. Srikakulam and West Godavari were the two districts that came under NREGS in 2007 and 2008, respectively.

different between the two child age cohorts and may have been driven by increased participation by mothers in public works, specifically, the NREGS.⁴

Figure 2 shows mothers' labor force participation rate in NREGS by the phase of the program and children's age cohort. Recall that NREGS had already been introduced in the Phase 1 districts by the time of the survey in 2007. Therefore we observe that mothers' participation in NREGS was quite high in 2007 in those districts. On the contrary, in Phase 2 & 3 districts, no mother worked on NREGS projects in 2007 since the program had not been introduced by then. Thus, as sampled districts transitioned to implementing the NREGS between the two rounds of the survey, there was a substantial rise in mothers' participation rate in the NREGS in 2009-10 for both age cohorts. This was accompanied by a rise in the overall labor force participation rate of mothers as discussed above.

To pin down the relationship between the implementation of the NREGS and mothers' labor force participation, we plot the sub-district or mandal level average labor force and NREGS participation rates of mothers in Figure 3.⁵ The figure suggests a positive relationship, implying that the implementation of the NREGS affected mothers' decision to participate in paid work on the extensive margin significantly. In particular, of the 1019 mothers who did not work in 2007, almost 72 percent entered the labor force in 2009-10. Of these mothers, more than 66 percent worked on NREGS projects in 2009-10.

⁴ Men's participation in paid labor (approximately 98 percent) was largely unchanged during this period.

⁵ A mandal (sub-district) is an administrative unit consisting of several gram panchayats or village councils. A gram panchayat typically consists of 1-3 villages.

This preliminary evidence suggests that the introduction of the NREGS lead to an exogenous shift in the demand for female labor.

The increase in mothers' labor force participation rate was accompanied by an improvement in the educational indicators of their children. Figure 4 depicts the average time spent in school by children in the age cohorts of 5 to 10 and 11 to 14 years, across all the sampled districts and by NREGS phase. We find that the average time spent in school has substantially increased in all the districts. Children in both age cohorts show greater time spent in school in 2009-10 relative to 2007. As expected, the figure also shows that the younger cohort spent more time in school as compared to the older cohort in both the years.

The preliminary analysis, thus, suggests that during the period under study the proportion of mothers participating in the workforce, in general, and the NREGS, in particular, rose in AP. This was accompanied by a rise in children's time spent in school. However, it would be incorrect to draw a causal link between mothers' labor force participation and children's educational outcomes since there might be several other factors that could simultaneously affect both outcomes. In the next section, therefore, we describe in detail our empirical strategy to establish the causal relationship between mothers' participation in the workforce and their children's schooling.

3. Data and Methodology

We conduct our empirical analysis at the level of the child using the two comparable waves of the YLS surveys - 2007 and 2009-10. The sample is restricted to children who were 5 to 14 years old, the school going age group, in 2007. In order to construct our data

set we use the following exclusion rules: first, we only include households living in rural areas in both periods. Thus children in households whose sentinel site changed from rural to urban between the two rounds (less than 1 percent of our sample) were dropped. Of the remaining sample, 2.8 percent of the children in 2007 were not present in the subsequent round and were, therefore, dropped. Finally, we exclude children for whom there is some missing information on relevant covariates in either of the years. Our data set, after these exclusions, contains information on 3275 children for both years.

Table 1 describes the summary statistics for 2007 and 2009-10. The time spent in school by children in the reference period (a typical day in the last week) went up from 5.8 hours in 2007 to almost 7 hours in 2009-10. This increase in time spent in school is largely reflective of more regular school attendance. Children in the survey, who reported attending school regularly, spent almost two hours more in school than those who reported going to school irregularly, on a typical day. We can, therefore, interpret greater time spent in school by a child as an indicator of greater number of days of school attendance. The rise in time spent in school was accompanied by a rise in the highest grade completed as well as the average grade progression during this period.⁶ Enrollment rates also rose by 8 percentage points, largely a result of most 5 year olds joining school by 2009-10.

During the same period, there has been a substantial rise in the proportion of children whose mothers were working in any kind of activity, as discussed in the previous section. This was accompanied by a 34 percentage point increase in the

⁶ We measure grade progression as the ratio of actual grade completed to the ideal grade for age. More details in section 4C.

proportion of children whose mothers' were participating in NREGS projects during this period. On the other hand, almost all children had their fathers working in both the survey rounds.⁷ The real, average annual household income (in 2009 rupees) also increased during this period, primarily due to a rise in non-agricultural income. Note that the average household size remained more or less unchanged.

B. Methodology

In this section we specify our empirical model and discuss the estimation strategy we adopt to examine the causal link between mothers' labor market participation and their children's education. We focus on time spent in school (TSS) as the dependent variable here but a similar methodology will be followed for other child education outcomes discussed later.⁸ More formally, we estimate the following specification:

$$TSS_{chmdt} = \alpha_0 + \alpha_{chmd} + \delta_1 t + \delta_2 D_{NREGS_I} * t + \delta_3 Enrol_{d0} * t + \beta \mathbf{X}_{chmdt} + \delta \mathbf{Z}_{hmdt} + \varphi_1 INC_{hmdt} + \varphi_2 MOTHER_WORK_{chmdt} + \rho Soc_audits_{md} * t + \varepsilon_{chmdt}$$

⁷ There was a rise in fathers' participation rate in NREGS during this period as well. Since overall labor force participation rate of fathers did not change, this suggests that fathers may have taken up NREGS work as an additional activity.

⁸ The time spent in school is recorded as hours spent in school on a typical day in the previous week. The total time spent on education on a typical day consists of time spent in school and time spent on studying outside school (private tuition and at home). The average time spent on education outside the school in the sample is less than 20 percent of the total time spent on education on a typical day.

where the subscript c refers to a child in household h in mandal m in district d . t refers to time, which takes the value 0 for the year 2007 and 1 for the period 2009-10. \mathbf{X} denotes the vector of child specific time variant variables that could affect TSS.⁹ Older children are more likely to spend time working outside or looking after their siblings. We allow for this effect to be non-linear in age by including age and square of age in \mathbf{X} . \mathbf{Z} is a vector of household variables that may change over time, viz. household wealth represented by asset quartiles and land ownership.¹⁰ Since households' optimization process is a function of the size of the household we include the number of household members in \mathbf{Z} as well. Our analysis also controls for whether the household's reference week was during school holidays.¹¹ INC is total annual household income from all

⁹ One of the factors that could affect temporal changes in participation in schooling is changes in the quality of schools, specifically a shift from public to private schools. The YLS contains information on the type of school the child is enrolled in for only a subset of our sample. Community level data on the type of schools is not comparable between the two survey rounds. Our results are, however, robust to the inclusion of a dummy variable for whether a private school at any level existed in the locality in 2007 and 2009-10.

¹⁰ Asset quartiles were generated from an asset index which was constructed by principal component analysis of binary variables indicating ownership of durable consumer goods by the household viz., television, radio, car, motorbike, bicycle, telephone, mobile phone, refrigerator, fan, electric oven, table and chair, sofa and bedstead.

¹¹ Our results also hold up when we restrict our sample to only those children for whom the previous week was not a school holiday.

sources. It includes parental income from participation in any paid work, including the NREGS.¹² *MOTHER_WORK* is a dummy variable that takes the value 1 if the mother participates in the labor market and 0 otherwise. Thus our main coefficient of interest is φ_2 .

While the variables included in \mathbf{Z} and \mathbf{X} are observable, there may be unobservables at the geographic (district, mandal and village), household and child level. If these unobservables are correlated with the regressors on the right hand-side and they also affect time spent in school, it would lead to inconsistency of our estimates. Our specification, therefore, includes time invariant child characteristics viz. ability (α_{chmd}).¹³ As noted earlier, districts where NREGS was implemented earlier (Phase I) have shown different trends in mothers' labor market participation rate and time spent in school. Hence we allow phase 1 districts to have a different time trend from phase 2 & 3 districts by including the variable $D_{NREGS_I} * t$ in our specification, where D_{NREGS_I} equals 1 if the child belongs to a phase 1 district, otherwise it is 0. Further, to allow for trends in time spent in school to differ by the initial level of school attendance, we interact time with the average primary school enrolment rate (for children aged 5 – 10

¹² Whether the income effect is significant or not is a function of the cost of schooling as well. If physical access to schooling is relatively easy and costs of schooling are subsidized (as is the case for public primary schools), any effect of an increase in household income may be muted for the age group under study here.

¹³ Note that child fixed effects subsume household, village, mandal and district fixed effects.

years) at the district level, in 2004-05, ($Enrol_{do} * t$).¹⁴ We also control for a secular time trend t that allows for increases in demand for and supply of schooling during the period of our study.

The NREGS mandates the conduct of regular audits of program projects by local stakeholders.¹⁵ Since one of the objectives of the audits is to make beneficiary households aware of their rights and entitlements, it is possible that a higher frequency of these audits leads to a greater demand for access to better quality schools by parents as well as a rise in women's participation in the NREGS and in the workforce. Hence any observed relationship between mother's labor market participation and children's time in school could be driven by a rise in households' awareness levels. To control for this, we allow the trend to depend on the number of social audits that have taken place in the mandal between the two survey rounds ($Soc_audits_{md} * t$).

Given this specification, and using data on a balanced panel of children over the two time periods, we estimate a child fixed effects model. In doing so, we eliminate α_{chmd} . If we assume that the deviations of the observed variables from their mean values

¹⁴ We source this information from the question on the "status of current attendance (enrollment) in educational institutions" in the 2004-05 employment and unemployment round of the National Sample Survey.

¹⁵ A novel feature of the NREGS is the introduction of compulsory 'social' audits of projects carried out under the program by beneficiary households (and therefore referred to as 'social') at regular intervals. The AP government has institutionalised the conduct of these audits in the state since the inception of the NREGS in 2006.

are not correlated with the deviation of the error term from its mean, this estimation procedure would yield consistent estimators of φ_2 .

The main concern with our estimation strategy is that household income and mothers' labor supply decisions are likely to be determined simultaneously with investments in children's education. To address this simultaneity issue, we adopt a 2SLS estimation procedure using temporal variation in rainfall shocks in the previous agriculture year and in the intensity of the NREGS program at the mandal level as instruments. We describe our instruments and discuss their validity next.¹⁶

C. Validity of instruments

Using the YLS data we find that the crop which the largest proportion of rural households cultivate (almost 36 percent across rounds 2 and 3) is rice.¹⁷ The cultivation of rice is highly water-intensive. Rice seedlings are grown in nurseries which are then manually transplanted into the flooded fields. It is therefore expected that rainfall will promote the development of rice seedlings enabling farmers to increase their cultivation of rice which in turn could raise agricultural incomes. Furthermore, studies suggest that rural women's labor force participation in India may be higher when households face adverse shocks. Women, for instance, could be expected to contribute to household income when agricultural employment opportunities and earnings are lower for men during a drought

¹⁶ Please refer to Table A1 in the Appendix on the reference period for the endogenous variable and the instruments to follow the discussion on "validity of instruments".

¹⁷ Groundnut is a distant second, with about 16 percent of rural households engaged in its cultivation.

(Himanshu, 2011). Weather shocks could, therefore, carry implications for women labor force participation as well. Hence we use mandal level rainfall shock as one of the instruments.

We define rainfall shock as the deviation of actual rainfall from the long term average rainfall, divided by the long term standard deviation, at the mandal level.¹⁸ Corresponding to the reference period for agricultural income in each YLS survey round, we calculate rainfall shocks during June 2005 to May 2006 (for the 2007 YLS survey or round 2) and during June 2008 to May 2009 (for the 2009-10 YLS survey or round 3). Note that the reference period for children's time spent in school is the previous week - January to July, 2007 in round 2 of the YLS and August 2009 to March 2010 for round 3. Thus rainfall shock is lagged with respect to children's educational outcomes. This obviates any direct effect of contemporaneous rainfall shocks on children's time in school.

¹⁸ The variable capturing rainfall shocks is constructed from the precipitation data available from the Centre for Climatic Research at the University of Delaware. The data include monthly precipitation values at 0.5 degree intervals in latitude and longitude. To match this data at the mandal level, the nearest latitude-longitude to each mandal headquarter is taken. To construct the rainfall shock at the mandal level, we calculate the long term (1990-91 to 2008-09) average mandal level rainfall in the months of an agriculture year. Standard deviation of rainfall for the same period is also calculated at the mandal level. Then rainfall shock is defined as the deviation of actual rainfall in the reference period from the long term average, divided by the standard deviation.

However, if rainfall shocks affect children's health outcomes contemporaneously and the latter persist into subsequent years, then previous rainfall shocks could directly impact current schooling outcomes. We use data on school attendance in the last 12 months for a subset of 'indexed' children to investigate this link.¹⁹ We find that conditional on being enrolled, approximately 11 percent of these children reported missing school due to illness or injury in each round. To check whether missing school due to current morbidity is correlated with past rainfall shocks, we run a pooled OLS regression of a dummy variable for whether a child missed school due to an illness on lagged rainfall shock. The coefficient on lagged rainfall shock is insignificant. This provides suggestive evidence that in our sample past rainfall shock is unlikely to directly impact children's current time in school but should affect it via the impact on past household income.

Our second instrument is lagged NREGS funds sanctioned at the beginning of each financial year (April) for a mandal in 2009 rupees.²⁰ Note that the NREGS is envisaged as a demand-driven program: households are expected to apply for work to the village council (or gram panchayat, GP) and once a critical mass of demand is generated in a GP (a collection of 1 to 3 villages) in a mandal, a project has to be selected from the

¹⁹ The YLS has been collecting more detailed information on these children since the first round of the study in 2002.

²⁰ Data on the sanctioned funds at the mandal level were obtained from the Department of Rural Development, Government of Andhra Pradesh.

approved list of works and sanctioned by the district administration.²¹ Thus to avoid any reverse causality, i.e. current NREGS funds being determined by current demand for work, we use lagged NREGS funds as an instrument. Since the NREGS was initiated only in 2006-07, we use the 2006-07 financial year sanctioned program funds as an instrument for round 2 data. For the 2009-10 survey (round 3), we take a one year lag with respect to the households' reference period for work activities and use the sanctioned funds in the financial year 2007-08 as the instrument.²²

The concern that remains then is whether temporal changes in awareness of NREGS entitlements (including demanding work; Khera, 2011) is correlated with

²¹ Although the NREGA envisages a demand driven program, the reality is quite different according to several recent studies. Imbert and Papp (2011) report that “many people are unaware of their full set of rights under the program”; “in practice, very few job card holders formally apply for work while the majority tend to wait passively for work to be provided.” Other research on Andhra Pradesh (Ravi and Engler, 2009; Afridi et al., 2013) also indicate that the program is supply rather than demand driven.

²² Note that an overwhelming proportion of NREGS funds have been utilized for irrigation and water conservation projects since the program's inception in AP: soil and water conservation; drought proofing and afforestation; micro and minor irrigation works; rehabilitation of tanks and traditional water bodies; land levelling and bush and jungle clearance. It is, unlikely, therefore that the program could directly affect access to schools or children's allocation of time to household chores, viz. fetching drinking water.

http://nrega.ap.gov.in/Nregs/FrontServlet?requestType=Common_Ajax_engRH&actionVal=Display&page=WorkCatog_eng.

intensity of the NREGS and are accompanied with changes in the demand for public schooling (quality or quantity). On the other hand, say there is no increase in awareness but the administration is learning how to implement NREGS, which improves between 2006-09 along with the quantum of sanctioned funds and this learning spills over to the provision of the public good of interest to us – education. In either case, our IV will not meet the exclusion restriction as it would have a direct effect on educational outcomes.

We address the latter concern first. In Andhra Pradesh, school participation is near universal.²³ According to the Annual Survey of Education Report (ASER, 2006), the percentage of out of school rural children in the 6-14 age group was between 0 to 5 percent in all the YLS districts except West Godavari where it was between 5 to 10 percent in 2006. Learning levels were higher than the average for the country and have remained more or less steady during this period (ASER, 2006 and 2009). Thus any administrative “learning” with respect to public schooling would be minimal, if at all. Second, while it is quite likely that administrative capacity and NREGS implementation improved over time, it is unlikely that this was accompanied by administrative improvements in public schooling. The administrative machinery that has been created for the NREGS implementation at the grass roots level and which helps expand capacity for the program is different and delinked from that required for public schooling. Third, elections to village councils for a five year term were held in 2006. Since there were no changes in local governments during the period of our study there are unlikely to have

²³ Enrollment of children in 6-10 years age group was almost 93 percent in both round 2 and round 3 while enrollment in the 11-14 age group was almost 81 percent in round 2 and 86 percent in round 3 in our sample.

been significant changes in local political will for implementation of public programs during 2007-10.

To address the former concern, we use data from the YLS to check whether political participation or participation in community led demand for certain public goods was correlated with the intensity of ‘social’ audits of NREGS projects.²⁴ Since the timing, frequency and conduct of these audits in a mandal is determined centrally by an independent body – the Society for Social Audit, Accountability and Transparency (SSAAT) – in Andhra Pradesh, the number of audits conducted in a mandal should be exogenous to the village and household. We find an insignificant effect of the occurrence of social audits on two indices of households’ awareness levels between the second and third round of the YLS surveys in a household fixed effects model (see Table A3, columns 5 and 6 in the appendix). However, since it has a positive and significant effect on a component of the indices - the probability that a household would “take action on a community problem”- we include a variable “number of social audits that took place in the mandal between the two survey rounds” and interact it with time in all our baseline regressions as discussed above.

Finally, our third instrument is the interaction of lagged rainfall shock with lagged NREGS funds. This allows for the effect of rainfall shock on household income and mothers labor force participation to vary with NREGS funds. For instance, the effect on household income of a drought may be lower if there are more NREGS funds allocated to provide local employment in a mandal.

²⁴ The intensity of audits could increase households’ awareness of their entitlements and also be correlated with the volume of NREGS funds allocated to a mandal.

4. Results

A. Overall impact on children's time in school

Table 2 shows the results for child's time spent in school. The coefficient on 'mother is working' is positive and significant in column 1. If the mother works, her child's time spent in school goes up by 0.27 hours in a day. However, as pointed out above, this specification does not account for the possible endogeneity of labor force participation of mothers and household income.

To address the endogeneity issue, we conduct a 2SLS analysis reported in column 2. Before we move to the second stage, let us discuss the first stage results. Results in Table A2 (in the appendix) suggest that our instruments are good predictors of the endogenous variables (F statistics ranging from 58 to 69). The coefficient on rainfall shock is positive and significant for annual household income in column (1). An increase in the lagged funds sanctioned for NREGS projects in a mandal increases the household income significantly. In times of good rainfall, however, the sanctioned funds have a lower marginal effect on the total income (as indicated by the negative coefficient of the interaction term). For the endogenous variable 'mother is working' the coefficient on rainfall shock is significantly negative in column (2). This result lines up with the existing literature which suggests that in India women are more likely to work during periods of distress such as droughts. While the coefficient on lagged funds is insignificant, the interaction term is positive and significant in column (2) thus implying that the effect of NREGS on mother's work force participation depends on the level of rainfall shock. To elaborate, at the mean rainfall shock the total effect of NREGS funds on mother's labor force participation is significantly positive. The instruments perform

well in an over-identification test which does not reject the null hypothesis of exogeneity of instruments (p value of 0.16 for the Hansen J statistic).

Moving back to the second stage results in column (2) of Table 2, we find that the coefficient on the dummy for mother working continues to be positive, significant and has a higher coefficient than in the OLS-FE specification.²⁵ When a mother works it leads to her children attending school 5.89 hours a day more. This effect is over and above the income effect from working, the point estimate of which is positive but not significant. While this effect is large, it is perhaps a little deceptive of the impact that the change in mother's work has had over the two years, since even in 2007, 69 percent of the mothers were already in the labor force. To estimate the impact of mother's work between 2007 and 2009-10, note that proportion of mothers working has gone up by 19 percentage points during this period. The estimated coefficient of 5.89 therefore implies that, on average, the time spent in school by children has gone up by 1.12 hours per day (5.89×0.19). Given that the average time spent in school in 2007 was 5.8 hours, this effect is equivalent to attending school about a fifth of a day more. If we extrapolate this impact

²⁵ The higher coefficient on mother working in the 2SLS, as compared to the OLS model, could be due to attenuation bias. The two surveys rounds are not strictly comparable in terms of the data on work activities of household members. While in round 2 all the activities of an adult (mother) are recorded, in round 3 only the three most important activities are recorded. This could lead us to underestimate labor force participation rates of an adult (mother) in round 3. Another explanation would be selection bias - households in which women work tend to be socio-economically more disadvantaged and are more likely to have poor child outcomes.

over a typical academic year of 200 days (20 days over 10 months), we can view this effect as an increase of 38 days in the academic year (0.19×200) or almost two additional school months.²⁶

While the child's age drops out as it is collinear with time, we find that there is a non-linear effect of age. The square of age turns out to be negative in columns (1) and (2). Thus, the older the child, the smaller is the increase in time spent in school. This reflects the higher opportunity cost of time in school for older children. As pointed out, children's time spent in school and parental NREGS participation may co-vary because of increasing awareness through social audits. Both the OLS-FE and the 2SLS-FE specifications show this effect to be positive and significant as indicated by the coefficient on 'number of NREGS social audits in the mandal between the two survey rounds x time'. The coefficient on time is positive and significant in columns 1 and 2. In both cases, the point estimates are large representing the effect of increasing age of the child over time. The negative coefficient on the initial district level average enrollment rate in both the OLS-FE as well as 2SLS-FE specifications, together with the positive

²⁶ We recognize that any additional time spent in school could be substituted by less time spent studying outside school leading to an insignificant effect of mother's work on total time spent on education on a typical day. In an alternate specification, therefore, we consider the total time spent on education (including time spent studying outside the school) as the dependent variable. Our results are unchanged.

coefficient on time, suggests that in districts where school participation was high prior to 2007 there was a smaller increase in time spent in school between 2007 and 2009-10.²⁷

B. Heterogeneity of impact on children's time in school

The reported average effect of mothers' labor force participation may hide large heterogeneity of impact across households belonging to different socio-economic groups. To address this issue we run our regressions by household and child characteristics in Table 3.

In columns (1) and (2) we classify households into those whose land ownership in 2007 was less or more than the median land ownership (1.04 acres based on the distribution of land in the pooled sample). The results suggest that the effect of mother working is significant for households which had lower than median land ownership in 2007. There is no significant impact of mother's working status in households with higher than median land ownership. This indicates that the overall result which we observed in the last section is driven by the sub-sample of children who belonged to poorer households in 2007. Moreover, if we look at the change in the proportion of mothers working over time, we see that it has gone up more for households belonging to the lower than median landholding group – 26 compared to 12 percentage points.

²⁷ Lagged rainfall shock may force children to drop out of school in the year previous to our reference period. To check that our results are robust to this possibility we include a dummy for whether a child is enrolled in school as an endogenous regressor in our main specification (2SLS-FE). Our results do not change.

Next, we analyze whether the effect of mother's working status differs by the characteristics of the child. In columns (3) and (4) we disaggregate the overall analysis by the gender of the child. The coefficient on the 'mother is working' suggests a positive impact for both male and female children. The marginal effects on girls and boys are comparable.²⁸ This suggests that our results are unlikely to be driven by any changes in the quality of schools: data available on the type of school the child was enrolled in for a sub-sample of the YLS suggests that there was a 7 to 9 percentage point increase in enrollment in private schools between 2007- 09 and this change was greater for boys than girls (Young Lives, 2011).²⁹ .

Columns (5) and (6) further disaggregate the effect of mothers working by the age of the child in 2007. We divide the sample of children into two groups: 5-10 years and 11-14 years old in 2007. The coefficient on 'mother is working' is positive and significant for both cohorts. Moreover, there is no statistically significant difference in the magnitude of this coefficient between the two samples.³⁰

²⁸ We conduct a t-test of the null that the difference between the coefficients of 'mother working' in the sample of boys and girls is zero. The difference in coefficients is 0.967 and the standard error of the difference is 1.97: we cannot reject the null that the difference between the two coefficients is zero.

²⁹ The over identification test in columns (1) and (3) in Table 3 are weak and rejected. However, our conclusions here are robust given the results for other outcomes presented in the next section.

³⁰ In a t-test of difference between the two coefficients we obtain a t value of 0.405: we cannot reject the null hypothesis that the difference between the two coefficients is zero.

C. Impact on children’s grade progression and test scores

While we find that the time spent in school has risen due to mother’s participation in the workforce, a pertinent question to ask is whether the increase in school attendance has translated into higher educational attainment of a child. We, therefore, conduct our analysis for grade attainment by a child. The dependent variable now is actual grade attainment of a child divided by ideal completed grade for age. We define ideal completed grade for age by assuming that at the age of 6, a child should have completed grade one. Thereafter, the ideal grade completed increases by one for every incremental year. The sample for this outcome, therefore, consists of children aged 6 – 14 years. We follow the specification outlined in equation 1, with one exception, since the date of household interview falling during the school summer vacation does not affect grade progression, we exclude the dummy for summer holiday.

Results for OLS-FE and 2SLS-FE models are reported in Table 4.³¹ The coefficient on the dummy for mother working is positive and significant in OLS-FE specification in column (1) and for 2SLS-FE in column (2). Given that mother’s labor force participation rate rose from 70 percent in 2007 to 89 percent in 2009-10, the coefficient estimated by 2SLS-FE model implies a 9 percent increase in grade attainment (over the mean of 0.76 in 2007). To conceptualise this better, the average gap between the ideal grade and the actual grade was lower by more than a quarter in 2009-10 compared to 2007 if the child’s mother was working after 2007.

When we stratify the sample by households’ land ownership in 2007 in columns (3) and (4), we find that the coefficient on the dummy for mother working is positive and

³¹ We use the same instruments as in our main specification for TSS.

significant for households with lower than median landownership in column (3), echoing the results on time spent in school in Table 3. The effect of mother working is insignificant for households with higher than median land ownership in column (4). Moreover we find a large and significant positive effect of the mother working on female children's grade attainment when we stratify the sample by the gender of the child in columns (5) & (6). The coefficient on mother working in column (6) reflects a 10 percent increase in grade attainment (as compared to the mean value of 0.759 in 2007) or a lowering of the gap between the ideal grade and grade achieved by about one-third for girls. We also have significant effects for both the younger and older age cohorts in columns (7) and (8) but the effect on younger children is significantly larger.³²

To sum, our analysis for both the time spent in school and grade attainment suggest that the effect of having a mother who participates in the labor force is significant for households which are less endowed. Our results are also more robust for girls' educational outcomes.³³

³² A t-test of the difference in coefficients of mother working in columns (7) and (8) yields a t value of 2.2. Thus we can reject the null that the coefficients are similar.

³³ There are certain caveats to interpreting the effect of mothers' working status on children's grade progression. First, the highest grade completed is right censored for the sub-sample of children who are still enrolled in school. This is not the case, however, for children who have completed schooling (17 year olds in 2009-10) or have dropped out by the time of the survey interview. Second, the effect of parental labor market activities may not be reflected completely in grade attainment for those households which are interviewed before April (March is the last month of an academic year) since the highest

Next we investigate whether higher participation in school due to mothers' working also translates into better educational performance for her children. In order to do so we consider a sub-sample of children who were administered cognitive tests in the YLS: the 'indexed' children who belong to two cohorts - younger cohort (aged 5 years in 2007) and older cohort (12 years in 2007). Our outcome of interest is a child's z-score on two types of tests: PPVT and Math.³⁴ For each of these tests, the dependent variable is constructed by calculating the z-score of the raw test score in each year, separately for children belonging to the younger cohort and the older cohort. We run the specification

grade attained by children in these households would be right censored. Finally, the highest grade completed is a stock variable that may be determined not just by current labor force participation of mothers but also their participation between 2007 and 2009-10.

³⁴ The Peabody Picture Vocabulary Test (PPVT) is a standard test of receptive vocabulary of a child. In this test, a child is given a set of pictures and asked to select the picture which best represents the meaning of a stimulus word presented orally by the examiner. The data on PPVT test score of each child is based on 204 test items in each round. For the mathematics achievement test, we consider only the older cohort of index children because the test was not conducted on the younger cohort in 2007. The math test in 2007 was based on 10 items that focused only on numerical problems. In 2009-10, the format of this test was changed and it was based on 30 items which included numeracy (addition, subtraction, square root etc.), data interpretation, measurement and basic geometry.

outlined in equation 1 for each indexed cohort separately for the PPVT tests.³⁵ The Math test scores are available only for the older cohort.

Our results in column (1) of Table 5 show that when a mother participates in the workforce, the PPVT scores of the children in the younger cohort go up by 3.18 standard deviations whereas the scores of the children in the older cohort go up by 2 standard deviations as shown in column (2). We also find the Math test score of the older cohort in column (3) rises by 2.02 standard deviations when the mother participates in the labor force. Since the sample of indexed children is small we are unable to obtain precise results when we stratify the data by household or child characteristics. The test score results are, nevertheless, consistent with our earlier findings and suggest that mothers' participation in the workforce has implications both for the quantity and quality of her children's education.

D. Discussion of results

Our results establish that when a mother works, there is a significant positive impact on her children's educational attainment: time spent in school, grade for age and test scores. There are three likely explanations for the results we observe.

³⁵ We use the same specification and the same set of instruments for the test score regressions except that the summer vacation dummy is excluded since it is not relevant for test scores. Also, note that although the regressions are carried out for the 5 year old and the 12 year old cohorts, the squared age term is not collinear with time. This is because within each of these cohorts there exists variation in age (in years): the age band for the younger cohort is 4-6 years and for the older cohort it is 11-13 years.

First, as we have discussed above, the increase in mothers' participation in the work force, in our sample, is largely driven by the increase in their NREGS participation. Hence it is possible that some provision of NREGS itself drives our results for children's education. In particular, a likely explanation of our results may be the mandatory provision of child care facilities at NREGS work sites. Mothers who participated in NREGS work may have had better access to child care facilities. This would free up the time of school-going age siblings, particularly girls, who could then attend school more regularly. However, in our sample only 1 percent of households report using on-site child care facilities in 2007 while more than 80 percent of households report absence of child care facilities at the last work-site in 2009-10.³⁶ We, therefore, do not consider this as a valid explanation of our findings.

The second mechanism that could explain the effects we are seeing is a possible increase in mothers' say in household decision-making. If this is the case, we should see a positive effect of mother's labor force participation on other schooling indicators besides children's time in school and grade attainment. We, therefore, provide more direct evidence on investment in children using household level data on education expenditures to test our hypothesis. Results are reported in Table 6.

Our specification is now run at the household level (since these data are not available at the child level) with additional controls for the number of children in the 5-17

³⁶ The 2007 YLS survey respondents were asked whether the NREGS participant had "benefited from child care facilities at the worksite". In the 2009-10 survey, the respondents were asked: "Were there child care facilities in the last (NREGS) worksite?"

age group and the gender composition of this group in the household.³⁷ Our main coefficient of interest is working status of the mother of the indexed child and his/her siblings in the household. Thus the dependent variable captures the aggregate expenditure on all the children who belong to the age group of 5-17 years in the household. Note that indexed children and their direct siblings constitute almost 94 percent of the sample of all children in 5-17 age group.

We report findings only for households with less than median landownership given our results in the previous section. The analysis suggests that mothers' participation in the labor force increases schooling expenses related to more regular attendance (i.e. books and uniform, columns (1) and (3)) for the less landed households. Moreover, consistent with results on time spent in school, we find a positive impact on school fees (column 2). This indicates that mother's labor force participation is indeed leading to more investment in education in less landed households. We do not find any significant effects for the overall sample.

To explore the bargaining power mechanism further we use data available in the second round of the YLS to analyze whether participation in the labor market led to improvements in mothers' decision-making abilities within households.³⁸ Our dependent variable is the binary response to two questions, each, for three sources of household income:

³⁷ We drop the baseline, district enrollment trends since they are not relevant for this dependent variable.

³⁸ These data were not collected in round 3 of the YLS. Our analysis, therefore, is cross-sectional.

a. “Is the caregiver responsible for making the key decisions about any of the plots (*Land*) / work for wages activities (*Wage activities*)/ business and self-employment activities (*Business and self-employment*)?”

b. “Does the caregiver control the use of the earnings from the sale of goods or rent from any of these plots (*Earnings from land*) / from any work for wages activities (*Earnings from wage activities*) / from any business and self-employment activities (*Earnings from business and self-employment*)?”

The sample is restricted to caregivers who are mothers in age group 16-60 years. Our main variable of interest is whether the mother works. Results for the 2SLS specification are reported in Table 7.³⁹ The positive and significant coefficient on ‘mother is working’ across all outcomes, suggests that greater participation of mothers in the labor market does increase the say and control these women have on important decisions being made within the household. In a rural setting earnings from land, wages and business and self-employment activities are likely to be the most important sources of income for households. This result, therefore, bolsters our claim that an increase in work opportunities for women is likely to have a positive effect on their decision-making abilities within the household.

While our results in Tables 6 and 7 suggest that an increase in mother’s say in decision-making within the household contributed to an improvement in the educational

³⁹ The additional control variables included in this specification are: annual income of the household, age and age squared of mother, mother’s education, household size, asset and land holding of the household, household’s religion and caste, and a dummy variable indicating whether the household belonged to NREGS phase-1 district.

outcomes of her children, there may exist yet another mechanism that could have influenced our outcomes. If children's time does not substitute for mother's time on household chores and mothers who work leave their children at school in the absence of day care or other family support it would produce an unintended, positive consequence of mothers working on children's educational attainment.

To test for the possibility that schools substitute for day care for working mothers we control for the demographic composition of the household. The effect of mothers working on children's time in school should be insignificant if there are older siblings or grandparents in the household to take care of the younger ones. But the interpretation of our results is unchanged when we control for the presence of older siblings and of household members in the 60+ age group (see Table A4 in the appendix for details).⁴⁰

Moreover, recall the results from the previous section on the effects by child's age and gender. While it is possible that schools serve as child-care centres for younger children, it is unlikely that the rural children aged 12-16 years would use day care facilities. Furthermore, the theoretical literature predicts close substitutability of mother's time with that of female children and thus adverse effects of mother's labor force participation on girls relative to boys. But we find that girls tend to benefit more in terms of grade attainment. Thus the fact that we find significant increases in the educational outcomes of older children and larger effects for girls, suggests that schools serving as

⁴⁰ The t ratios of a t test of the null that the coefficient of 'mother is working' in column (2) of Table 2 are the same as those in columns (1), (2) and (3) in Table A4 are 0.08, 0.07 and 0.17, respectively.

day care centres cannot fully explain the effects we observe of mother's workforce participation on schooling outcomes.

Thus while we are unable to completely rule out the possibility that women who work send their children to school more regularly due to other constraints such as lack of alternative child care facilities, the weight of the evidence we have supports the mechanism of greater bargaining power of working women leading to an improvement in their children's educational outcomes.

5. Conclusion

We utilize the variation in the intensity of the National Rural Employment Guarantee Scheme (NREGS) and in rainfall shocks within districts in Andhra Pradesh (AP) to determine the effect of exogenous changes in the demand for labor on women's labor force participation and thereby their children's educational outcomes.

Using panel data from the Young Lives Study for 2007 and 2009-10, we find that participation of mothers in the work force has a positive effect on her children's time in school. Moreover we find that this effect is largely on children in the poorest wealth group and for girls in the household. Our findings of the positive effect of mothers working on children's time spent in school carries implications for the latter's educational attainment as well. Our results suggest that grade attainment of children, particularly of those from poorer households and girls, and test scores improve due to mothers' labor force participation. These findings imply that more time in school translates into better educational outcomes.

We find evidence that suggests that the positive impact of mothers' participation in work could be due to her improved position in household decision-making. Our assertion is supported by recent qualitative evidence on the empowering effects of NREGS on rural women (Pankaj and Tankha, 2010; Khera and Nayak, 2009).

Although our results are contextual and specific to AP - a state which has traditionally exhibited high rates of women's participation in work relative to the national average and has also been among the best implementers of the NREGS since its inception – they provide strong evidence of the benign effects of increasing women's participation in the labor force. Furthermore, the findings suggest that the design of public programs matter and have consequences beyond those intended by policy makers.

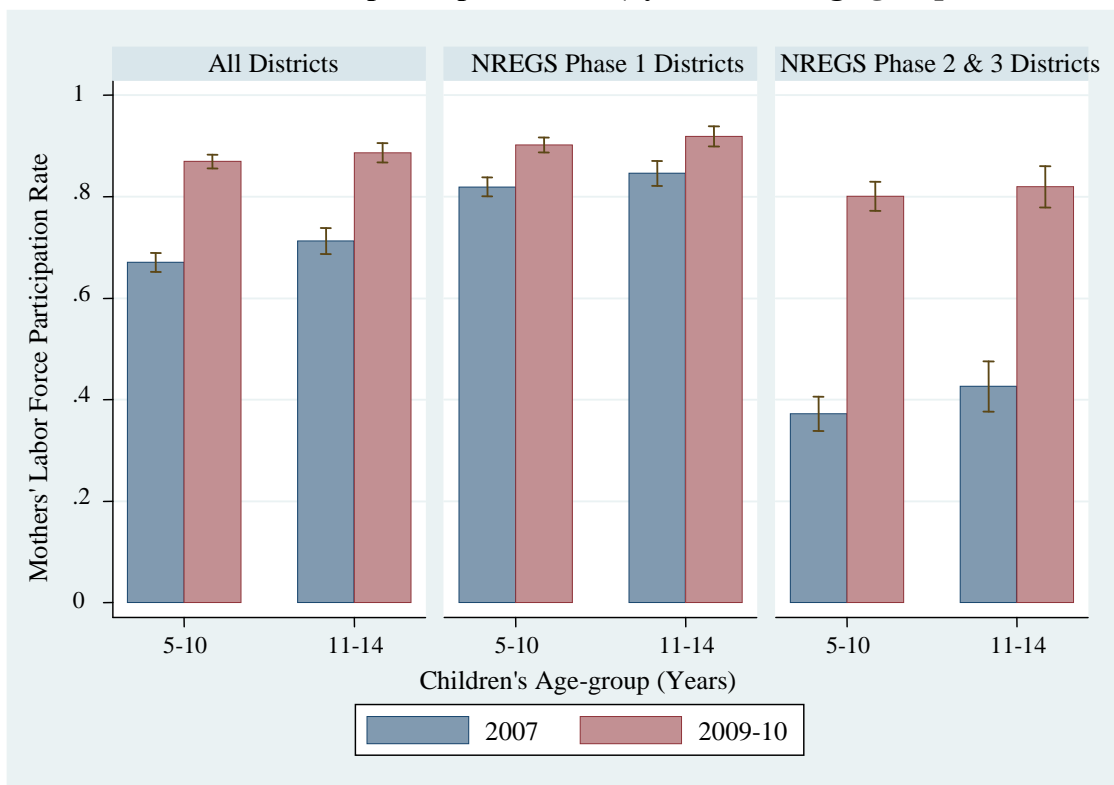
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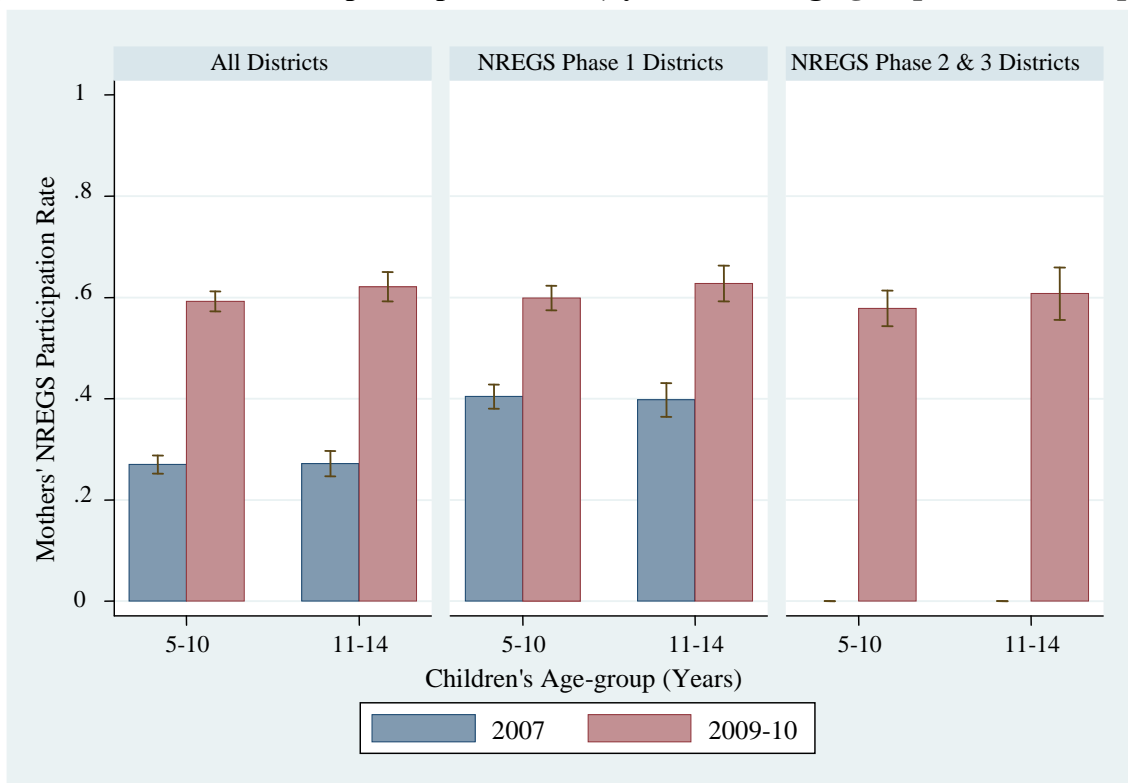
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Figure 1: Mothers' labor force participation rate (by children's age-group and NREGS phase)



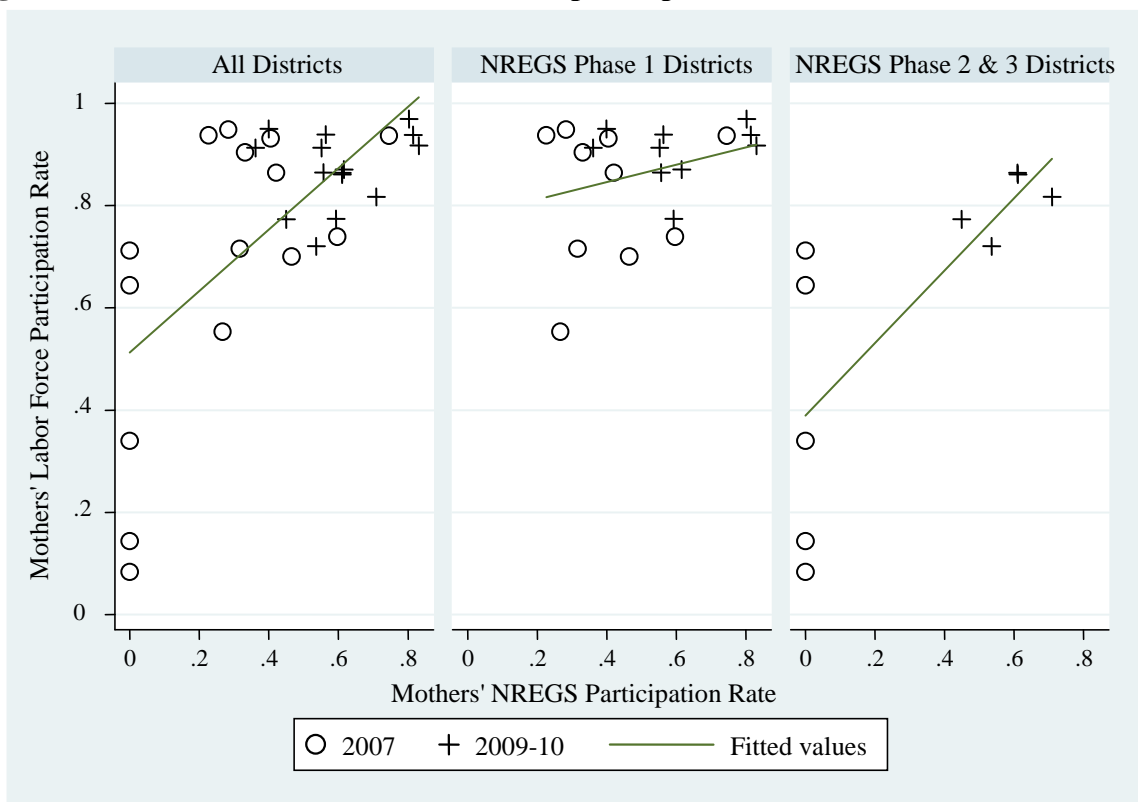
Source: Authors' calculations from YLS.

Figure 2: Mothers' NREGS participation rate (by children's age-group and NREGS phase)



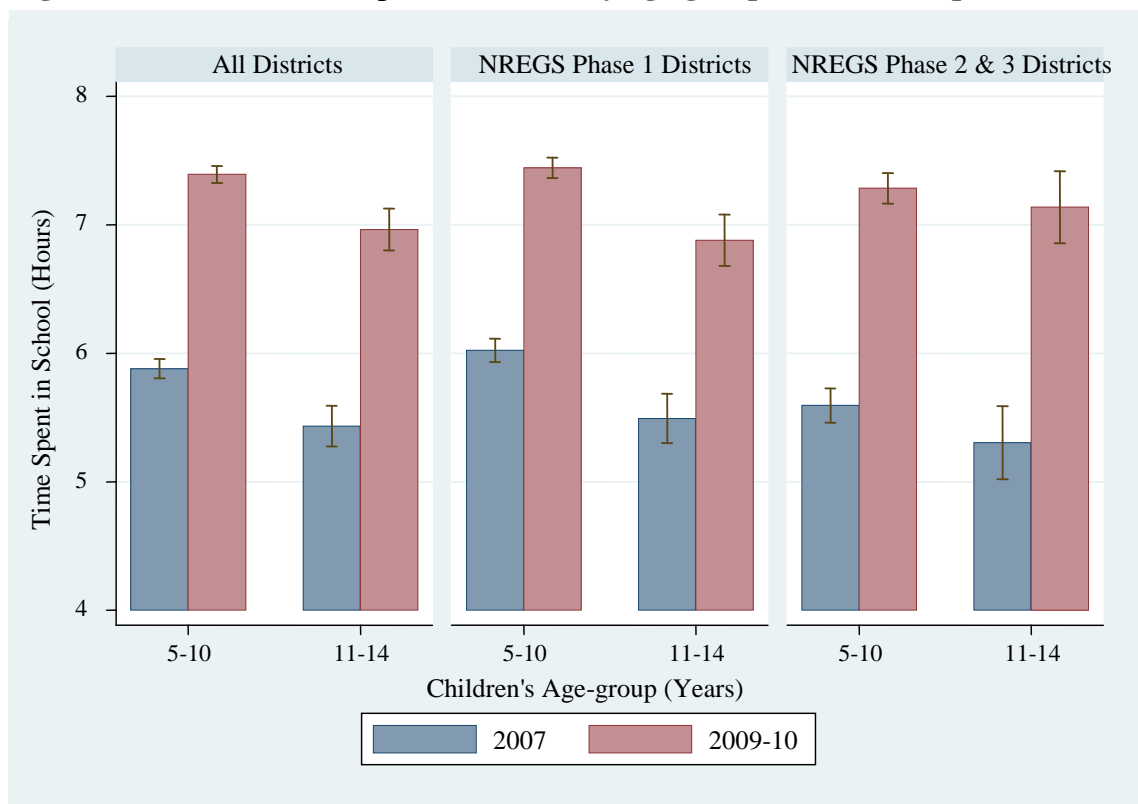
Source: Authors' calculation from YLS.

Figure 3: Mothers' labor force and NREGS participation rate (sub-district level average)



Source: Authors' calculation from YLS.

Figure 4: Children’s time spent in school (by age-group and NREGS phase)



Source: Authors’ calculation from YLS.

Table 1: Summary statistics

Variable	2007			2009-10		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
<i>Child Characteristics</i>						
Sex (female=1, male=0)	3275	0.51	0.50	3275	0.51	0.50
Age (years)	3275	8.35	3.01	3275	11.35	3.01
Enrolment	3275	0.79	0.41	3275	0.87	0.34
Time spent in school	3275	5.78	2.20	3275	6.93	2.64
Highest grade completed	2165	3.92	2.33	2165	6.29	2.58
Grade progression	2165	0.76	0.33	2165	0.78	0.22
<i>Mother's Characteristics</i>						
Mother's age (years)	3275	30.56	5.64	3275	33.52	5.59
Mother's education (highest grade completed)	3270	1.86	3.28	3270	1.86	3.28
Whether mother is working	3275	0.69	0.46	3275	0.88	0.32
Whether mother has worked in NREGS	3272	0.28	0.45	3228	0.62	0.49
<i>Father's Characteristics</i>						
Father's age (years)	3127	36.34	6.36	3101	39.26	6.29
Father's education (highest grade completed)	3126	3.91	4.51	3126	3.91	4.51
Whether father is working	3121	0.99	0.10	3095	0.98	0.14
Whether father has worked in NREGS	3121	0.25	0.43	3073	0.48	0.50
<i>Household Characteristics</i>						
Annual non-agricultural income (Rs.)	3275	28349	30452	3275	41404	46015
Annual agricultural income (Rs.)	3275	4100	21489	3275	8258	38656
Total income (Rs.)	3275	32449	36312	3275	49662	58843
Household size	3275	5.70	2.10	3275	5.71	2.19
Land owned by household (acres)	3275	2.11	3.21	3275	3.38	38.59
Survey during school summer vacation dummy	3275	0.09	0.28	3275	0.00	0.00

Source: Young Lives Study

Table 2: Effect of mother's work status on child's time spent in school

Variable	OLS-FE	2SLS-FE
	(1)	(2)
Annual household income in thousands (Rs.)	0.0009* (0.0005)	0.019 (0.014)
Mother is working	0.265*** (0.100)	5.888*** (1.040)
Square of age of child	-0.040*** (0.003)	-0.035*** (0.004)
Household size	-0.009 (0.031)	-0.038 (0.079)
Asset quartile 2	0.033 (0.106)	0.161 (0.140)
Asset quartile 3	-0.149 (0.119)	-0.042 (0.167)
Asset quartile 4	-0.130 (0.158)	-0.056 (0.243)
Land owned by household (acres)	0.002*** (0.0007)	0.0016 (0.0012)
Date of interview during summer vacation	-0.455** (0.184)	-0.316 (0.246)
Number of social audits in mandal x Time	0.161* (0.094)	0.312* (0.164)
NREGS Phase 1 district x Time	-0.995*** (0.121)	0.204 (0.285)
Baseline enrolment rate in the district x Time	-7.598*** (0.773)	-13.600*** (1.490)
Time	10.919*** (0.792)	13.765*** (1.175)
Child Fixed Effects	Yes	Yes
Observations	6,550	6,550
Number of Children	3,275	3,275
R-squared	0.254	
Overidentification test (Hansen J Statistic)		1.959
P-value of overidentification test		0.162

Notes: Robust standard errors clustered at the child level in parentheses.

* significant at 10%, ** 5% and *** 1%.

Table 3: Decomposition of effect on time spent in school by land ownership, gender and age-group (2SLS-FE)

Variable	Land		Gender		Age-group	
	Land ≤ Median	Land > Median	Male	Female	5-10 years	11-14 years
	(1)	(2)	(3)	(4)	(5)	(6)
Annual household income in thousands (Rs.)	0.007 (0.020)	0.109 (0.137)	0.001 (0.013)	0.022 (0.024)	0.054* (0.030)	-0.001 (0.017)
Mother is working	3.722*** (0.717)	26.701 (28.004)	4.939*** (1.465)	5.906*** (1.327)	6.827*** (1.843)	5.835*** (1.608)
Square of age of child	-0.030*** (0.004)	-0.054*** (0.020)	-0.034*** (0.005)	-0.036*** (0.006)	-0.032*** (0.009)	-0.033 (0.024)
Household size	-0.096 (0.127)	0.091 (0.323)	0.065 (0.073)	-0.075 (0.128)	-0.132 (0.162)	-0.095 (0.149)
Asset quartile 2	0.159 (0.173)	-0.336 (0.805)	0.152 (0.172)	0.106 (0.205)	0.258 (0.186)	0.093 (0.293)
Asset quartile 3	-0.108 (0.201)	0.691 (1.118)	0.057 (0.201)	-0.122 (0.292)	0.235 (0.255)	-0.411 (0.336)
Asset quartile 4	0.017 (0.380)	1.687 (2.249)	0.321 (0.287)	-0.374 (0.400)	-0.366 (0.440)	-0.012 (0.442)
Land owned by household (acres)	0.046 (0.088)	0.0003 (0.004)	-0.043 (0.032)	0.002 (0.002)	-0.068 (0.058)	0.003** (0.001)
Date of interview during summer vacation	-0.670** (0.310)	1.704 (2.352)	-0.500* (0.268)	-0.061 (0.417)	-0.703* (0.391)	0.198 (0.494)
Number of social audits in mandal x Time	0.153 (0.197)	1.715 (1.896)	0.365* (0.194)	0.191 (0.254)	0.463 (0.284)	0.419 (0.265)
NREGS Phase 1 district x Time	0.177 (0.362)	-1.683 (1.652)	0.255 (0.368)	0.069 (0.414)	0.055 (0.431)	-0.010 (0.555)
Baseline enrolment rate in the district x Time	-9.373*** (1.612)	-39.748 (34.491)	-12.566*** (2.077)	-13.556*** (1.955)	-14.926*** (2.996)	-13.568*** (2.377)
Time	10.216*** (1.598)	34.217 (24.787)	13.168*** (1.534)	13.917*** (1.670)	14.011*** (2.233)	13.961*** (2.753)
Child Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,456	3,094	3,200	3,350	4,464	2,086
Number of Children	1,728	1,547	1,600	1,675	2,232	1,043

Notes: Robust standard errors clustered at the child level in parentheses. * significant at 10%, ** 5% and *** 1%.

Table 4: Effect of mother's work status on child's grade progression

Variable	Overall		Heterogeneity (2SLS-FE)					
	OLS-FE	2SLS-FE	Land		Gender		Age-group	
			Land ≤ Median	Land > Median	Male	Female	6-10 years	11-14 years
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Annual household income in thousands (Rs.)	0.00004 (0.00008)	0.001 (0.001)	0.002 (0.002)	-0.001 (0.003)	0.00004 (0.001)	-0.0004 (0.001)	0.003 (0.002)	0.0001 (0.001)
Mother is working	0.057*** (0.014)	0.361*** (0.091)	0.344*** (0.086)	0.318 (0.524)	0.214 (0.159)	0.415*** (0.105)	0.594*** (0.181)	0.162** (0.070)
Square of age of child	-0.002*** (0.001)	-0.001** (0.001)	-0.000 (0.001)	-0.002*** (0.001)	-0.002** (0.001)	-0.001 (0.001)	0.002 (0.002)	-0.002*** (0.001)
Household size	-0.005 (0.005)	-0.004 (0.009)	-0.020 (0.018)	0.008 (0.009)	-0.004 (0.009)	0.004 (0.013)	-0.009 (0.019)	-0.007 (0.005)
Asset quartile 2	-0.024* (0.013)	-0.014 (0.015)	-0.005 (0.022)	-0.015 (0.021)	-0.010 (0.023)	-0.027 (0.020)	-0.017 (0.028)	-0.004 (0.012)
Asset quartile 3	-0.040*** (0.014)	-0.036** (0.017)	-0.038 (0.026)	-0.024 (0.026)	-0.013 (0.022)	-0.072*** (0.026)	-0.044 (0.035)	-0.008 (0.012)
Asset quartile 4	-0.041** (0.020)	-0.028 (0.023)	-0.038 (0.034)	-0.037 (0.061)	-0.003 (0.038)	-0.054* (0.030)	-0.049 (0.044)	-0.004 (0.018)
Land owned by household (acres)	-0.00001 (0.00001)	-0.00001 (0.00006)	-0.001 (0.010)	0.00006 (0.00008)	-0.0001 (0.003)	0.0001 (0.0001)	-0.004 (0.006)	0.00004 (0.00004)
Number of social audits in mandal x Time	0.012 (0.012)	0.016 (0.014)	0.010 (0.021)	0.038 (0.035)	0.002 (0.020)	0.016 (0.021)	0.007 (0.029)	0.029** (0.011)
NREGS Phase 1 district x Time	0.052*** (0.016)	0.125*** (0.028)	0.116*** (0.045)	0.117*** (0.036)	0.106*** (0.039)	0.149*** (0.041)	0.189*** (0.057)	0.043* (0.023)
Baseline enrolment rate in the district x Time	-0.137 (0.101)	-0.442*** (0.146)	-0.241 (0.231)	-0.370 (0.578)	-0.391 (0.244)	-0.455** (0.195)	-0.620** (0.310)	-0.321*** (0.106)
Time	0.207* (0.107)	0.338*** (0.126)	0.080 (0.227)	0.351 (0.377)	0.380** (0.193)	0.318* (0.184)	0.211 (0.283)	0.396*** (0.110)
Child Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,330	4,330	2,264	2,066	2,044	2,286	2,240	2,090
Number of children	2,165	2,165	1,132	1,033	1,022	1,143	1,120	1,045
R-squared	0.032							

Notes: Robust standard errors clustered at the child level in parentheses. * significant at 10%, ** 5% and *** 1%.

Table 5: Effect of mother's work status on child's test score (2SLS-FE)

Variable	PPVT		Math
	Younger Cohort (5 year olds)	Older Cohort (12 year olds)	Older Cohort (12 year olds)
	(1)	(2)	(3)
Annual household income in thousands (Rs.)	0.008 (0.018)	-0.013 (0.008)	-0.005 (0.008)
Mother is working	3.177*** (0.990)	2.000*** (0.704)	2.023*** (0.677)
Square of age of child	0.086 (0.137)	0.011 (0.021)	0.034* (0.020)
Household size	-0.007 (0.078)	-0.025 (0.054)	0.028 (0.055)
Asset quartile 2	-0.048 (0.133)	0.052 (0.118)	-0.069 (0.125)
Asset quartile 3	0.157 (0.145)	-0.054 (0.157)	-0.240 (0.152)
Asset quartile 4	-0.024 (0.357)	0.223 (0.186)	-0.002 (0.200)
Land owned by household (acres)	0.018 (0.038)	0.0005 (0.0005)	0.001* (0.0004)
Number of social audits in mandal x Time	0.249 (0.199)	0.002 (0.109)	0.216** (0.109)
NREGS Phase 1 district x Time	1.278*** (0.337)	1.126*** (0.274)	0.842*** (0.260)
Baseline enrolment rate in the district x Time	0.773 (1.641)	-0.402 (1.087)	0.882 (1.035)
Time	-6.025 (5.305)	-1.493 (1.901)	-4.638** (1.876)
Child Fixed Effects	Yes	Yes	Yes
Observations	2,070	1,202	1,228
Number of children	1,035	601	614

Notes: Robust standard errors clustered at the child level in parentheses.

* significant at 10%, ** 5% and *** 1%.

Table 6: Effect of mother's work status on household's education expenditure (2SLS-FE)

Variable	Land < Median					
	Books & stationery	School fees/donations	School uniform	Private tuition	Transport to school	Total
	(1)	(2)	(3)	(4)	(5)	(6)
Annual household income in thousands (Rs.)	1.31 (6.41)	3.89 (52.09)	-1.75 (4.00)	21.61 (13.61)	13.97 (10.52)	37.45 (59.93)
Mother is working	297.67* (174.87)	1,660.99** (816.23)	269.77** (116.15)	-174.34 (562.48)	-133.19 (564.76)	1,878.13 (1,417.66)
Average age of children in school going age	11.25 (18.07)	-110.57 (126.68)	1.73 (10.61)	-14.77 (30.15)	-16.15 (25.26)	-122.54 (144.62)
Number of boys of school going age	-32.92 (31.35)	-319.44 (264.25)	-41.79* (23.02)	45.03 (63.88)	38.47 (64.23)	-318.03 (313.77)
Number of girls of school going age	-54.22 (42.24)	-484.56 (374.92)	-54.96* (30.41)	142.38 (111.80)	-63.24 (88.33)	-521.03 (425.77)
Household size	-1.92 (30.12)	96.28 (206.08)	8.56 (20.17)	-84.23 (82.67)	-94.45 (88.45)	-65.26 (267.48)
Asset quartile 2	-21.06 (31.44)	-114.29 (125.24)	7.78 (20.91)	47.35 (62.13)	45.22 (53.59)	-41.09 (181.40)
Asset quartile 3	13.91 (38.39)	17.97 (196.71)	24.03 (22.82)	-67.09 (106.13)	60.77 (78.96)	45.09 (282.50)
Asset quartile 4	-0.59 (102.90)	-218.33 (941.62)	66.34 (70.60)	-379.33 (246.31)	-58.09 (156.49)	-580.67 (1,056.13)
Land owned by household (acres)	13.60 (29.96)	-124.71 (230.91)	14.81 (17.97)	-16.95 (55.49)	-20.81 (38.73)	-130.91 (267.65)
Number of social audits in mandal x Time	-137.34** (55.93)	-31.59 (438.16)	-34.98 (32.52)	82.62 (103.15)	189.72 (116.34)	71.74 (506.58)
NREGS Phase 1 district x Time	333.33** (143.15)	566.14 (1,104.57)	187.67** (85.57)	-242.69 (297.09)	-212.84 (297.69)	635.02 (1,298.02)
Time	-62.23 (89.81)	-227.84 (490.44)	-48.20 (60.84)	-50.16 (295.99)	-137.03 (259.44)	-508.15 (767.55)
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,010	2,002	2,000	2,004	2,012	1,998
Number of households	1,005	1,001	1,000	1,002	1,006	999

Notes: Robust standard errors clustered at the child level in parentheses. * significant at 10%, ** 5% and *** 1%.

Table 7: Effect of work status of mothers on their decision-making within household (2SLS)

Variable	Land	Earnings from Land	Wage Activities	Earnings from Wage Activities	Business & Self-employment	Earnings from Business & Self-employment
	(1)	(2)	(3)	(4)	(5)	(6)
Annual household income (Rs.)	0.005 (0.005)	0.003 (0.005)	-0.0004 (0.006)	-0.001 (0.007)	0.003 (0.007)	0.005 (0.009)
Mother is working	1.053*** (0.317)	1.306*** (0.359)	1.001*** (0.274)	1.425*** (0.366)	0.829** (0.355)	1.133*** (0.387)
Mother's age	0.007 (0.015)	-0.011 (0.017)	0.030* (0.016)	0.018 (0.019)	0.008 (0.050)	-0.003 (0.056)
Mother's age squared	-0.00001 (0.0002)	0.0002 (0.0002)	-0.0004* (0.0002)	-0.0002 (0.0002)	-0.0001 (0.001)	0.00004 (0.001)
Mother's highest grade passed	0.001 (0.006)	0.003 (0.006)	0.002 (0.006)	0.008 (0.008)	0.001 (0.006)	0.006 (0.007)
Household size	-0.030 (0.022)	-0.021 (0.022)	-0.008 (0.019)	-0.017 (0.021)	-0.025 (0.045)	-0.027 (0.053)
Asset quartile 2	0.035 (0.041)	0.061 (0.041)	0.009 (0.040)	0.036 (0.044)	-0.019 (0.078)	-0.024 (0.089)
Asset quartile 3	0.014 (0.057)	0.088 (0.057)	-0.029 (0.067)	0.036 (0.072)	-0.027 (0.087)	-0.030 (0.112)
Asset quartile 4	-0.020 (0.222)	0.076 (0.211)	0.114 (0.313)	0.266 (0.369)	-0.033 (0.185)	-0.056 (0.227)
Household's land ownership	-0.008 (0.006)	-0.001 (0.006)	-0.012 (0.007)	-0.010 (0.010)	-0.005 (0.007)	-0.013 (0.010)
Muslim	0.306*** (0.118)	0.267* (0.147)	0.043 (0.116)	0.343** (0.144)	0.466*** (0.181)	0.681*** (0.203)
Christian	0.025 (0.152)	-0.153 (0.144)	-0.181 (0.162)	-0.387** (0.160)	0.587** (0.258)	0.809*** (0.304)
SC	-0.162*** (0.062)	-0.191*** (0.065)	0.003 (0.082)	0.029 (0.079)	-0.129 (0.114)	-0.192 (0.136)
ST	-0.208* (0.111)	-0.291** (0.129)	-0.013 (0.107)	-0.082 (0.124)	-0.009 (0.183)	-0.071 (0.210)
Backward caste	-0.057 (0.047)	-0.020 (0.051)	0.059 (0.071)	0.134* (0.072)	0.073 (0.064)	0.139* (0.084)
Mixed caste	-0.477 (0.371)	-0.499 (0.463)	-0.075 (0.129)	-0.162 (0.190)		
NREGS Phase 1 district	-0.409** (0.172)	-0.521*** (0.201)	-0.203 (0.146)	-0.467** (0.202)	-0.161 (0.163)	-0.284 (0.180)
Constant	-0.238 (0.218)	-0.057 (0.259)	-0.410 (0.259)	-0.349 (0.312)	-0.110 (0.809)	-0.035 (0.938)
Observations	1,881	1,908	1,498	1,472	452	450

Notes: Robust standard errors clustered at the community level in parentheses. * significant at 10%, ** 5% and ***1%. The same set of instruments (rainfall shock, lagged amount fund sanctioned in NREGS, and their interaction) are used for annual household income and working status as in Table 2, column 2.

Appendix

Table A1: Reference period

Variable	Reference period		
	Survey	Rainfall shock instrument	NREGS funds instrument
<i>YLS Round 2</i>			
Time spent in school	January 2007–July 2007	June 2005–May 2006	April 2006–March 2007
Mother's working status	January 2006–July 2007		
Agricultural income	June 2005–May 2006		
<i>YLS Round 3</i>			
Time spent in school	August 2009–March 2010	June 2008–May 2009	April 2007–March 2008
Mother's working status	August 2008–March 2010		
Agricultural income	June 2008–May 2009		

Note: Almost 97 percent of the households in our sample were surveyed during January–April 2007 in round 2 and during August–December 2009 in round 3.

Table A2: First stage regressions (for overall results in Table 2, column 2)

Variable	Time Spent in School	
	Real annual household income in thousands (Rs.)	Mother is working
	(1)	(2)
Rainfall shock	6.842** (2.976)	-0.232*** (0.023)
Lagged amount of sanctioned NREGS funds (Rs.)	0.507** (0.197)	-0.001 (0.001)
Rainfall shock x Lagged amount of sanctioned NREGS funds (Rs.)	-0.541*** (0.088)	0.006*** (0.001)
Square of age of child	-0.051 (0.053)	-0.001* (0.0004)
Household size	4.624*** (1.388)	-0.009 (0.006)
Asset quartile 2	-0.457 (1.407)	-0.022 (0.016)
Asset quartile 3	-2.135 (2.342)	-0.007 (0.018)
Asset quartile 4	10.021*** (2.824)	-0.034 (0.025)
Land owned by household (acres)	0.067*** (0.005)	-0.0001*** (0.00002)
Date of interview during summer vacation	-0.864 (3.368)	-0.013 (0.024)
Number of social audits x Time	-3.285 (2.248)	-0.069*** (0.017)
NREGS Phase 1 district x Time	12.538*** (4.196)	-0.138*** (0.030)
Baseline enrolment rate in the district x Time	-3.780 (24.712)	2.077*** (0.169)
Time	16.531 (28.077)	-1.772*** (0.191)
Child Fixed Effects	Yes	Yes
Observations	6,550	6,550
Number of Children	3,275	3,275
R-squared	0.125	0.291
F-Stat	58.75	69.37
Overidentification Test (Hansen J Statistic)		1.959
Weak Identification Test (Cragg-Donald Wald F Statistic)		6.379

Notes: Robust standard errors clustered at the child level in parentheses. * significant at 10%, ** at 5% and *** 1%. F-stat for joint significance of the three instruments is 14.07 (p-value 0.0001) for column 1, and 38.99 (p-value 0.0001) for column 2.

Table A3: Effect of social audits on households' awareness (OLS-FE)

Variable	Taken action on a community problem	Participated in awareness campaign	Participated in protest march / demonstration	Voted in local elections	Index 1 [#]	Index 2 ^{##}
	(1)	(2)	(3)	(4)	(5)	(6)
Number of social audits in mandal x Time	0.052** (0.021)	0.021 (0.020)	-0.019 (0.014)	-0.025*** (0.008)	0.095 (0.084)	0.101 (0.084)
Average age of the household (years)	0.002 (0.003)	-0.002 (0.002)	0.000 (0.001)	0.000 (0.001)	0.000 (0.009)	0.000 (0.009)
Household size	0.003 (0.007)	0.011** (0.006)	0.002 (0.004)	0.000 (0.002)	0.030 (0.024)	0.030 (0.024)
Land owned by household (acres)	0.000 (0.000)	-0.000 (0.000)	-0.000** (0.000)	0.000 (0.000)	-0.001 (0.001)	-0.001 (0.001)
Asset Quartile 2	0.040* (0.022)	0.021 (0.022)	-0.003 (0.015)	-0.003 (0.009)	0.099 (0.091)	0.099 (0.091)
Asset Quartile 3	0.040* (0.024)	0.055** (0.024)	0.007 (0.017)	-0.002 (0.009)	0.184* (0.099)	0.185* (0.099)
Asset Quartile 4	0.067** (0.032)	0.073** (0.033)	0.005 (0.022)	-0.009 (0.011)	0.256* (0.133)	0.259* (0.133)
NREGS Phase 1 district x Time	-0.000 (0.024)	-0.083*** (0.023)	0.057*** (0.014)	0.006 (0.008)	-0.015 (0.094)	-0.017 (0.094)
Time	-0.016 (0.023)	0.064*** (0.022)	0.008 (0.014)	0.018** (0.007)	0.117 (0.086)	0.112 (0.086)
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,212	4,214	4,216	4,222	4,206	4,206
Number of Households	2,106	2,107	2,108	2,111	2,103	2,103
R-squared	0.029	0.022	0.020	0.009	0.028	0.028

Notes: Robust standard errors in parentheses. * significant at 10%, ** 5% and *** 1%.

Index 1 is obtained by principal component analysis (PCA) of the dependent variables in column 1, 2, 3 and 4.

Index 2 is obtained similarly by PCA of the dependent variables in column 1, 2, and 3 (excluding 4).

Table A4: Effect of mother's work status on child's time spent in school (2SLS-FE)

Variable	(1)	(2)	(3)
Annual household income in thousands (Rupees)	0.021 (0.014)	0.019 (0.014)	0.021 (0.015)
Mother is working	6.008*** (1.066)	5.992*** (1.065)	6.147*** (1.104)
Square of age of child	-0.037*** (0.004)	-0.035*** (0.004)	-0.036*** (0.005)
Household size		-0.040 (0.086)	
<i>Number of 0-4 years old females in household</i>	0.087 (0.212)		0.031 (0.218)
<i>Number of 0-4 years old males in household</i>	0.307 (0.214)		0.362* (0.218)
<i>Number of 5-9 years old females in household</i>	0.021 (0.151)		-0.039 (0.157)
<i>Number of 5-9 years old males in household</i>	0.215 (0.204)		0.308 (0.212)
<i>Number of 10-15 years old females in household</i>	-0.284* (0.164)		-0.355** (0.175)
<i>Number of 10-15 years old males in household</i>	0.038 (0.182)		0.130 (0.192)
<i>Number of females above 15 years of age in household</i>	-0.135 (0.155)		-0.263 (0.185)
<i>Number of males above 15 years of age in household</i>	-0.014 (0.137)		0.104 (0.150)
<i>Number of females above 60 years of age in household</i>		0.425* (0.234)	0.302 (0.222)
<i>Number of males above 60 years of age in household</i>		-0.363 (0.255)	-0.348 (0.258)
Asset Quartile 2	0.143 (0.141)	0.162 (0.141)	0.137 (0.142)
Asset Quartile 3	-0.060 (0.168)	-0.040 (0.169)	-0.069 (0.170)
Asset Quartile 4	-0.101 (0.246)	-0.049 (0.245)	-0.108 (0.250)
Land owned by household (acres)	0.001 (0.001)	0.002 (0.001)	0.001 (0.001)
Date of interview during summer vacation	-0.340 (0.251)	-0.308 (0.247)	-0.335 (0.252)
Number of social audits x Time	0.302* (0.163)	0.310* (0.165)	0.301* (0.164)
NREGS Phase 1 districts x Time	0.216 (0.288)	0.234 (0.289)	0.251 (0.294)
Baseline enrolment rate in the district x Time	-13.731*** (1.526)	-13.675*** (1.511)	-13.820*** (1.557)
Time	14.058*** (1.216)	13.789*** (1.184)	14.071*** (1.230)
Child Fixed Effects	Yes	Yes	Yes
Observations	6,550	6,550	6,550
Number of Children	3,275	3,275	3,275

Notes: Robust standard errors clustered at the child level in parentheses. * significant at 10%, ** 5%; *** 1%. Controls for households' demographic composition in italics.

In column 3, age group above 15 years is defined as above 15 but below 60 years of age.