

Can Workfare Increase Agricultural Productivity? Evidence from India^{*}

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Abstract

Departing from a large literature that documented wage increases triggered by India's National Rural Employment Guarantee Scheme (NREGS), this paper explores initial size-differentiated implications of such wage growth for agricultural productivity. We show that, before 2008, exposure to the program allowed marginal farmers to greatly increase use of family labor on their own parcels, cultivate riskier crops, and rent somewhat more machinery and irrigation services. These changes in input use, presumably attributable to the wage income and implicit safety net provided by NREGS, translated into modest productivity gains. Large farmers, in turn, sharply reduced labor use and shifted towards cultivation of higher value crops as well as more intensive use of other purchased inputs, especially fertilizer, in a type of induced innovation. Though less rigorous analytically, 2007-15 data point towards a positive link between intensity of program implementation and productivity gains in favor of all farm size classes that could be indicative of a positive, but less targeted, impact of the public goods constructed under the program.

Keywords: Workfare program, NREGS, Agriculture, Labor market, India

JEL classification: J21, J22, J23, O12, Q12, Q13

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1 Introduction

Rural workfare programs have recently gained popularity in developing countries as, by attaching a work requirement to income support, they make such support self-targeting and use program labor to generate public goods. Supporters highlight that the disutility of work will improve targeting of such support to those in real need (Besley and Coate, 1995) while also contributing to the creation of public infrastructure that can trigger sustained agricultural productivity improvements. Detractors contend that, largely because local governments lack the capacity to transparently implement such programs (Dutta et al., 2012) or to identify productive investments with high social payoffs (Alik-Lagrange and Ravallion, 2018), these advantages are unlikely to materialize in practice. To inform this debate, there is a need to account for the fact that workfare will affect net sellers and net buyers differently and to assess the longer-term impact of the public goods it provides.

In this paper, we focus on the agricultural productivity effects of India’s National Rural Employment Guarantee Scheme (NREGS), one of the largest workfare programs globally. The impacts of NREGS on agricultural wages and labor markets have been extensively documented. However, only a few studies explore how the availability of an employer of last resort affects labor supply and demand by farms of different sizes, their choice of crops and technology, and their yields. Detailed data on labor use, technology choice, and output allow us to provide new insights on this issue and, in doing so, contribute to the literature. We show that limited short-term impacts on productivity may conceal variation across farm size classes that has thus far received limited attention in the literature and provide evidence suggestive of a positive impact of the generation of local public goods, possibly facilitated by increased local capacity for project selection and implementation in the medium term.

Our main evidence relies on data from a panel survey that covered farms in 1998/99, i.e. before NREGS, and 2007/08 when some but not all of the districts had received the program. We use a difference-in-differences model to find evidence that small farmers increased the use of family labor on their own land and shifted towards riskier crops, plausibly helped by the income and implicit insurance provided by the program. Decreased supply of labor to large farmers in turn seems to have triggered a significant reduction in labor use, a shift to higher value crops, and increased use of non-labor purchased inputs such as fertilizer.

Although it cannot be interpreted as causal evidence in any way, information on the same households from the 2014/15 survey round points towards a positive correlation between the intensity of program implementation and agricultural productivity outcomes for all farm sizes, suggestive of positive impacts from the provision of public goods and presumably higher capacity for program selection and implementation by some local governments. Beyond the short term for which our data provides rigorous evidence, program-induced construction of public goods thus emerges as a possible second benefit, the incidence of which is more equally distributed across different farm size groups.

Extensive prior research has shown that NREGS has led to positive outcomes across various dimensions, including increased wages (Azam, 2011; Berg et al., 2014; Muralidharan et al., 2023; Merfeld, 2019), income (Cook and Shah, 2022; Muralidharan et al., 2023), food security (Ravi and Engler, 2015), migration (Imbert and Papp, 2020), female empowerment (Afridi et al., 2016; Rodriguez, 2022), school enrollment, and scores (Shah and Steinberg, 2021), and mitigation of poverty (Muralidharan et al., 2023), as well as conflicts (Fetzer, 2020) and violence against women (Rodriguez, 2022). There is also evidence that the program serves as a safety net during shocks (Imbert and Papp, 2015), contributing to reductions in infant mortality (Banerjee and Maharaj, 2020), stunting (Dasgupta, 2017), and improving the accumulation of human capital (Garg et al., 2020), improved welfare by raising seasonal consumption and increasing adolescents' school attendance (Klonner and Oldiges, 2022). However, the program also generated negative externalities and increased the frequency of crop-residue burning due to labor shortages and a resulting move to mechanize parts of the production process (Behrer, 2023).

Yet, although most of India's rural poor are engaged in farming, rigorous evidence on the agricultural productivity effects of NREGS is limited and mostly focused on aggregate effects. Program-induced wage increases triggered the adoption of small-scale labor-saving technologies nationally (Bhargava, 2023). In Andhra Pradesh, the safety net provided by NREGS helped smooth consumption in response to shocks and allowed farmers to adopt more risky crops with higher returns (Gehrke, 2019). Public irrigation infrastructure provided by the program also has been shown to have generated positive externalities by deepening water tables that helped increase agricultural productivity and resilience (Behrer and Pullabhotla, 2025). More descriptive studies focus on gender-differentiated impact on agricultural wages (Nagaraj et al., 2016); the fact that increased labor demand did, in the

program's early phases, not trigger a response in terms of mechanization (Channaveer et al., 2011), and limited impacts on crop yields in the face of NREGS-induced irrigation investment (Varshney et al., 2018).

Conceptually, NREGS can affect agricultural production through three channels. First, availability of guaranteed (off-season) employment provides *implicit insurance* that may prompt greater risk taking by resource constrained farmers who earlier did not have access to safety nets (Godfrey-Wood and Flower, 2018). Second, *higher labor demand* and the ability to receive a minimum wage, even if only during the off-season, will benefit net sellers of labor but will impose additional cost on net buyers, i.e., medium, and large farmers, who may reduce their hired labor use (Santangelo, 2016). Finally, the program aims to support agricultural productivity in the long term via *public goods* created by program-induced projects to improve minor irrigation, roads, or land improvement, the impact of which may also vary by farm sizes.¹

We assess farm-level impacts of NREGS on agricultural productivity, proxied by real output per acre drawing on rich data from 1998/99 and 2007/08 rounds of the nationwide Rural Economic and Demographic Survey (REDS) panel household survey. A difference-in-differences (DID) approach similar to that used in Imbert and Papp (2015) and Bhargava (2023), which exploits variation due to the program's phase-wise rollout between 2006 and 2008 allows us to compare farmers in early phase districts (treatment) to those in later phase districts (control) to assess program impact and in particular to explore if and to what extent NREGS-supported works may have affected agricultural productivity.²

We find that NREGS affected agricultural input use differently for marginal and large farmers: the program is estimated to have led to a 29-day increase in total labor use by marginal farmers, compared to a reduction of about 20 days in large farmers' labor use. For marginal farmers, this effect is entirely due to an increase in family labor that can plausibly be attributed to a combination of greater risk-bearing capacity and higher levels of off-season labor income due to NREGS access. While

¹The size and distribution of these effects will depend on the nature of the work undertaken: projects such as land improvement or irrigation are often targeted towards small producers (Ranaware et al., 2015) whereas general-purpose investments such as road improvements are likely to benefit producers in proportion to the scale of their production operations.

²NREGS was implemented in a phased manner. In 2006, the program was initially introduced in the first 200 poorest districts. Subsequently, in 2007, the program was extended to an additional 136 poorest districts. In April 2008, the scheme was expanded to cover the remaining districts.

we do not find significant effects for farms in the 2.5 to 10-acre size range, large farmers reduce input use of both family and hired labor, with the relative decrease estimated to be slightly larger for the former.

These changes in labor demand are accompanied by changes in crop choice. We find evidence of size-differentiated changes in the types of crops grown as one of the channels that are likely to trigger such changes in labor demand: while there is no increase in the likelihood of growing riskier high-value crops overall, the likelihood of medium and large farmers engaging in cultivation of high cash crops (sugarcane, cotton, and saffron) that require processing increased by 5–6 percentage points, possibly reflecting a type of induced innovation to make more effective use of more costly labor. We also find evidence of a small and marginally significant increase in the likelihood of growing more risky crops (pulses, oilseeds, tapioca, and fruit) not covered by public procurement guarantees among marginal, small, and medium producers, plausibly as a result of higher program-induced risk-bearing capacity and tolerance.

In line with the above, NREGS led to a significant increase of about 260 kg/acre or about 45% in fertilizer use by large farms at the extensive margin. While no such increase is visible for other farm size categories, we find the program had marginally significant effects on increased intensity of irrigation and machinery use by marginal farmers, possibly as an effective use of additional income generated by the program.

A reflection of the above is that exposure to NREGS triggered a marginally significant (at 10%) increase in agricultural productivity by 13.6 percentage points that is driven by marginal producers whose productivity is estimated to have increased by 17.3 percentage points (significant at 5%).

Supplemental data collected in 2014/15 for a subset of states also allows us to explore the extent to which variation in the intensity of NREGS implementation affected program-induced provision of public goods. Although information on the nature, location, and quality of public goods resulting from NREGS work would be preferable, such data is difficult to obtain and we use information on labor days and resources spent on NREGS at village level in the 2007-15 period as alternative. As nature and intensity of program implementation are endogenously determined, such correlations between outcomes and the intensity of program implementation cannot be interpreted in a causal sense. They do, however, support the notion that, possibly after some of the initial problems had been

resolved, public goods provided via NREGS labor made a positive contribution to agricultural productivity. Such productivity benefits seem to have been distributed more broadly and were less likely to accrue to marginal farmers than the insurance- and wage-effects arising from program access in our main analysis.

Our paper contributes to two strands of literature. First, there has been an active debate on the advantages and disadvantages of workfare programs compared to cash transfers (Dreze and Sen, 1990; Ravallion, 2022). While this issue is of interest in many countries (Gehrke and Hartwig, 2018), it is particularly salient in India in light of broader efforts to re-purpose subsidies by re-directing resources from non-productive spending towards ways that enhance productivity more directly (Coady and Prady, 2018; Khosla et al., 2018). We show that, by creating a safety net that to some extent can substitute for the absence of insurance, workfare can improve rural factor market functioning and generate size-differentiated productivity benefits that are particularly pronounced for marginal farmers. On the other hand, we find clear evidence of large farmers reducing labor use and shifting towards higher value crops.

Second, our paper adds to the small body of literature exploring effects of NREGS on agricultural productivity by elucidating different channels through which such impacts occur, including public works performed by the program. While our findings regarding mechanization and risk mitigation are in line with previous studies such as Gehrke (2019), and Taraz (2023), as well as recent contributions that emphasize NREGS's role as a safety net, they highlight that, in the short term, most benefits accrue to marginal and small farmers. We also find that NREGS-backed projects aimed at supporting agricultural production have a positive productivity impact. While more evidence will be needed on the magnitude of such productivity gains, they could at least in part offset the cost of program implementation.

The rest of the paper is structured as follows: Section 2 describes program characteristics and potential impact pathways. Section 3.1 discusses the data used in the paper. In section 3.2, we discuss the empirical approach, the method used to evaluate it, the identification strategy, and the extent to which it is supported by pre-program parallel trends between the treatment and control groups. In section 4, we present the estimated impacts of NREGS on agricultural productivity and mechanism: labor use, mechanization, and input use. Section 5 concludes with policy implications.

2 Program Characteristics

2.1 Program characteristics and roll-out

India's National Rural Employment Guarantee Scheme (NREGS) is one of the largest workfare programs globally. Building on the country's long tradition of food-for-work schemes (Dutta et al., 2012; Subbarao, 1997)³, NREGS guarantees employment of up to 100 days per year to households who register locally to obtain a job card and have applied for jobs⁴. Most of the work is supposed to be performed in the agricultural off-season to prevent bidding up of agricultural wages and reductions in hired labor supply to larger agricultural producers in the main season (Basu and Sen, 2015; Sheahan et al., 2015; Zimmermann, 2020). Anybody can apply for a job card or a job, and once a job application is lodged, authorities are obliged to provide work opportunities within 15 days or provide an unemployment allowance. NREGS also explicitly encourages female participation by paying equal wages to men and women by requiring work to be provided in ways attentive to women's needs and a gender quota of one-third. Wages paid are equal between men and women, and public goods for women are expected to improve female participation.

While the program is formally implemented by states that are responsible for setting up rules and ensuring transparent execution⁵, most aspects of implementation are delegated to villages (*panchayats*). NREGS was implemented in a phased manner, starting from the 200 poorest districts where the program was introduced in February 2006, extending to the next 136 districts on a national poverty scale in April 2007, and covering the entire nation by April 2008⁶.

³The work requirement differentiates NREGS from conditional cash transfer programs such as PROGRESA (Attanasio et al., 2012) or Bolsa Escola (Glewwe and Kassouf, 2012) that focus on education or from unconditional cash transfers.

⁴Applicants are eligible to receive a job card containing photos of all adult household members free within 15 days of application. Job-card holders' indicative work demand leads to the elaboration of an annual plan which, once ratified by the village assembly, is transmitted for consolidation at the district level, although in practice, a more top-down process is often followed, based on central budget allocations.

⁵Use of electronic payments and social audits had a major impact on the program. The electronic payment system delivered faster, more predictable, and less corrupt NREGS payments without reducing program access (Muralidharan et al., 2016)

⁶The selection of districts was based on a poverty index developed by the Planning Commission using data from the 1993/94 National Sample Survey, a routine survey used to produce among others estimates of poverty.

2.2 Documented impacts and implications for impact pathways

A large body of literature has pointed to short term NREGS effects by providing implicit insurance; increasing wages and income (differentially for net sellers and buyers), and a public goods channel.

Insurance channel. By providing implicit insurance, NREGS increases households' resilience to shocks. Recent studies show the program allowed to reduce impacts of shocks on infant mortality ([Banerjee and Maharaj, 2020](#)), child development ([Dasgupta, 2017](#)), and cognition ([Garg et al., 2020](#)). Program access also reduced adverse impacts of drought on agricultural yields ([Taraz, 2019](#)). In Andhra Pradesh, the program allowed a shift towards riskier but more remunerative crops ([Gehrke, 2019](#)) by small farmers⁷.

Wage and income channel. Many studies find NREGS increased wages. Monthly wage data for 2000-2011 suggest NREGS increased the growth of real agricultural wages by 4.3% during the peak season, with gender wage gaps and skilled wages remaining unaffected ([Berg et al., 2014](#))⁸. National Sample Survey (NSS) data point towards program-induced wage increases of about 5 points overall and 9 points in 'star' states characterized by good program implementation ([Azam, 2011](#); [Imbert and Papp, 2015](#)). Such increases have been shown to be confined to the dry season, reinforcing the notion of NREGS acting as a safety net ([Imbert and Papp, 2020](#)). Results from regression discontinuity design (RDD) for the transition from phase II to III and NSS 64th round data, suggests limited or no impact on labor market outcomes, wages, or on closing of the gender wage ([Zimmermann, 2020](#)).

Positive wage effects are consistent with reports of the program having reduced short-term 'distress' migration by unskilled workers in the dry season, in addition to, directly and indirectly, enhancing the returns to small and medium farmers' assets through water-conservation structures and improving liquidity without affecting long-term migration by the higher-skilled ([Reddy et al., 2014](#)). Econometric evidence from data specifically collected for this purpose supports the notion of a program-induced reduction in short-term dry-season migration but no effect on long-term migration

⁷[Varshney et al. \(2018\)](#) uses NSS data and find some evidence of change in cropping pattern but no effect on yield overall.

⁸A 2005-10 district panel that combines NSS data with information on rainfall and NREGS- induced asset generation suggests that, partly due to the assets generated by NREGS, the sensitivity of wages to rainfall shocks decreased by some 10 points ([Berg et al., 2014](#))

(Coffey, 2013; Imbert and Papp, 2020).

In the short run, labor demand from alternative employment opportunities will reduce labor supply to agriculture and tradable sectors, increasing agricultural production cost (Santangelo, 2016). The direction of associated income effects will depend on individuals' labor market position: income will increase for net sellers of labor but may decrease for net buyers who can respond by substituting family for hired labor; investing in labor-saving mechanical technology; or changing the output mix including the possibility of reducing output.

In line with the notion that program-induced wage increases will provide the biggest benefit to net sellers of labor, Muralidharan et al. (2023) find that NREGS increased wages and income, though most of the income gain was due to higher private sector wages and employment. Moreover, NSS data point towards large season-specific effects for scheduled castes and tribes (SCs and STs) but not the general population⁹, as NREGS enabled these groups to smooth consumption across seasons (Klonner and Oldiges, 2022)¹⁰.

In Andhra Pradesh, one of the better-performing states, panel data suggest that NREGS was well targeted, improving food consumption and asset accumulation by the poor (Deininger and Liu, 2019). This is likely to be the mechanism driving positive impacts on food security, savings, and health outcomes by the poor (Ravi and Engler, 2015), and particularly women whom the program empowers (Afridi et al., 2016), leading to reductions in gender-based violence (Amaral et al., 2015), especially for poor groups. Positive investment effects are suggested by increased school participation by primary-aged children (Islam and Sivasankaran, 2015) and better primary achievement scores and grade progression (Mani et al., 2014). Effects on enrollment and test scores for those in secondary school are, however, negative, most likely because at this age children can substitute for adult labor (Shah and Steinberg, 2021)¹¹.

Public goods channel. Few studies tried to assess the impact of infrastructure constructed via NREGS. Desai et al. (2015) report that about 51% of program-related works are 'completed' but fail

⁹Data from the India Human Development Survey (IHDS) have been used to argue that NREGS increased income and wages for the unskilled, reduced poverty by up to 32% and prevented 14 million from falling into poverty (Desai et al., 2015).

¹⁰A back-of-the-envelope cost-benefit analysis suggests that consumption smoothing benefits for the SC/ST population would have been sufficient to justify the wage outlays incurred by NREGS (Klonner and Oldiges, 2014).

¹¹The program is also shown to have affected election outcomes (Zimmermann, 2021) and local violence (Khanna and Zimmermann, 2017).

to provide information on quality. While effects of such infrastructure were limited in Andhra Pradesh (Deininger and Liu, 2019), high quality of NREGS works was found to increase the share of area devoted to cash crops (Shah, 2012) and NREGS works helped to improve groundwater access in rural areas (Behrer and Pullabhotla, 2025).

If the program is implemented as directed, the public infrastructure created by NREGS could further enhance agricultural productivity. Variation in NREGS implementation is likely to affect the quality and longevity of any structures built under the program. Moreover, the size and incidence of benefits from such structures will depend on location and type: while the effects of water conservation projects may be highly localized, investments such as roads that aim to facilitate market access will, if they are maintained, likely to benefit all producers in proportion to their level of market participation. NREGS guidelines allow land improvement and minor irrigation activities to be conducted on marginal farmers' private land (Babu et al., 2014), an option that was widely utilized and rather well-targeted even in states not known for high-quality implementation.

3 Data and Empirical Strategy

3.1 Data

We use data from two rounds of the ARIS/REDS survey, conducted by India's National Council of Applied Economic Research, for a sample of 7,474 and 8,659 households in 242 villages spanning 17 major states in 1998/99 and 2007/08, respectively.¹²¹³ The REDS builds on the Additional Rural Income Survey (ARIS), first conducted in 1969 and 1971 that provides comprehensive information on labor supply and wage receipts by each household member and inputs and outputs from agricultural production for 4,257 households in 259 villages located in 17 major Indian states representative of

¹²Political unrest precluded data collection in Jammu & Kashmir and Assam in 2006 and is, thus, dropped from our analysis. Also, delayed survey implementation in Kerala implied that, when the 2006 REDS questionnaire was administered, all the state's districts had already been covered by NREGS, forcing us to drop observations from this state.

¹³Additional Rural Incomes Survey/Rural Economic Demographic Survey: Until 1981–82, the survey was conducted as the Additional Rural Income Survey. The REDS 2006 survey started in 2006 with a listing of all households in sample villages. As agricultural data refer to the 2007/08 season, we refer to this survey as 2007/08 throughout.

India's rural population in higher-potential areas at the time the sample was drawn.^{14 15}

The survey is well suited for our purpose as it contains detailed information on inputs and outputs from agricultural production at parcel level and on labor supply and wages at member level. At the time of the 2007/08 REDS round, NREGS had been implemented in phase I and II districts, but not yet in phase III ones (figure A.1).¹⁶ We thus assign households from phase I and II districts to the treatment and not yet treated ones from phase III districts to the control.¹⁷ To complement the analysis, we also use data from the Socio- Economic Profile of India (SEPRI), conducted between 2014 and 2015, a follow-up on the REDS in 13 states that, in addition to household-level data on inputs and outputs from agricultural production, contains detailed village level information on labor and resource use in different types of NREGS projects.¹⁸ The SEPRI collects information for each village in our survey since the inception of NREGS on employment and project spending under different types of NREGS infrastructure projects, including water conservation and harvesting, flood control, drought proofing, irrigation facilities, agriculture-related works, livestock and fisheries-related works, rural connectivity, drainage, sanitation, and construction and maintenance of community infrastructure, among others.

Key household and agricultural production statistics for 1998/99 and 2007/08 and in treatment and control districts are in Table 1. Overall, household size and land endowment declined over the period from 6.7 to 5.8 persons and from 6 to 5.1 acres, largely through subdivision. A modest increase in the incidence of irrigation from 55% to 60% of land. Control areas exhibit higher mean land endowment and a greater share of irrigated land. Data on agricultural production point to modest increases in real output value, from Rs. 7,784 to Rs. 8,717 per acre. Use of labor increased. Summary statistics by farm size group are in table A1 and, using baseline values only, in table A3. Although NREGS-related work is not separately identified in our data for the main analysis, we have detailed

¹⁴Unfortunately, data from the first round, which was based on a frame including one district per state in the Intensive Agricultural District Program (IADP) and a random sample of other districts

¹⁵We present a comparison of key variables to highlight degree of similarities between the REDS and NSS datasets in table A8

¹⁶REDS collected detailed information on agricultural inputs and outputs for the 2007–08 crop year (July 2007 to June 2008). The sample covers 103 districts, of which 56 were included in NREGS Phases I and II, while the remaining 47 districts were included in Phase III

¹⁷The sample includes all of a household's descendants who still reside in the village in case of a split

¹⁸The SEPRI was conducted in 13 Indian states, namely Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. Unlike the extensive questionnaire used in the REDS survey, SEPRI uses a subset of questions from REDS with some additional questions on NREGS while sampling the entire population of the REDS survey villages

information on the number of days devoted to crop cultivation by male and female family members and hired workers.

While a key element of the NREGS is to provide an employment guarantee, it also aims to generate durable productive assets including access roads, minor water harvesting structures, or land improvements, by combining labor with public resources. to build productive assets. Approximately 60% and 28% of NREGS work is performed by landless (68% of them women) or marginal farmers, highlighting the self-targeting nature of the program (Figure A.2 and A.3).¹⁹ Most NREGS work focused on roads or land improvement including water conservation that can affect agricultural productivity directly or indirectly with other types of services such as rural drinking water or sanitation work making up less than 20% (Figure A.4).

3.2 Main empirical Strategy

DID for farm-level outcomes As discussed above, the phased rollout of the National Rural Employment Guarantee Scheme (NREGS) allows us to employ a difference-in-differences (DID) research design. The 1998/99 round of the Rural Economic and Demographic Survey (REDS) was conducted well before NREGS was even conceived, whereas by the time the 2007/08 round was fielded, some districts had already been covered by NREGS (Phases I and II), while others had not and therefore serve as a control group. Let i index households, v villages, and d districts, and let t denote the time period, with $t = 0$ corresponding to the 1998/99 REDS round and $t = 1$ corresponding to the 2007/08 round. We estimate the following specification:

$$Y_{ivdt} = \alpha + \beta \text{NREGS}_{dt} + \delta (X_v \times \tau_{07/08}) + \theta Z_{vt} + \mu_d + \gamma_t + \phi_{sn} + \omega_{st \times t} + \varepsilon_{ivdt} \quad (1)$$

where Y_{ivdt} is the outcome variable of interest—such as output per acre or input use per acre—for farmer i in village v , district d , and year t . NREGS_{dt} is an indicator variable equal to one if NREGS was implemented in district d in year t (i.e., if district d was eligible for NREGS in year t), and zero otherwise. X_v is a vector of pre-treatment, time-invariant village-level control variables constructed using data from the 1999 REDS and the 2001 Census; these controls are interacted with a year dummy,

¹⁹Marginal, small, medium, and large farmers are defined as owning < 2.5 acres, 2.5–5 acres, 5–10 acres, and > 10 acres, respectively.

$\tau_{07/08}$, where $\tau_{07/08} = 1$ for the 2007/08 period and $\tau_{07/08} = 0$ for the 1998/99 period. Z_{vt} is a vector of time-varying controls, such as village-level rainfall. μ_d denotes district fixed effects, γ_t denotes year fixed effects, and ε_{ivdt} is the idiosyncratic error term. In most specifications, we additionally include crop-by-season fixed effects, ϕ_{sn} , to control for differences across crop-season combinations, such as crops grown, input requirements, and cultivation practices, as well as state-by-year fixed effects, $\omega_{st \times t}$, to account for state-specific changes, such as agricultural policies, subsidy programs, and differential state level growth. We estimate variations of equation (1) to account for other sources of differential changes when necessary. The main coefficient of interest is β , which measures the impact of NREGS exposure on the outcome variable of interest. Standard errors are clustered at the district level throughout.

For identification, the DID design requires that outcome variables in treated and control districts would have followed similar trajectories in the absence of the treatment. Although we cannot test this directly, we use pre-treatment data from the 1982 and 1999 REDS rounds to test for parallel trends pre-treatment (see Table 2).²⁰ We find no statistically significant differential pre-trends for our main outcomes—including land cultivated, crop area, output, machinery use, fertilizer use, irrigation, pesticide expenditure, other input use, and labor use. We further test for pre-trends using the same survey rounds (1982 and 1999) by farm-size categories. Consistent with the aggregate results, we find no evidence of significant differences in pre-treatment trends by farm-size groups for most outcomes, with the exception of irrigation among large farmers (Table A4).²¹

3.3 Supplemental analysis

For the 2007/08–2014/15 period, village-level data on the intensity of NREGS implementation are available from the Socio-Economics Profile of India (SEPRI) survey for a subset of states within our sample. These data are based on digitization of village records rather than official data entered by officials in the NREGA Management Information System (MIS). The data provide detailed information on NREGS, including the number of days individuals spent under the scheme and the types of activities

²⁰We also report the means for the control and treatment groups using baseline data from 1999 in table A2.

²¹Although we find no statistically significant differential pre-trends, we acknowledge that the power to reject the null hypothesis is low. Nonetheless, these results provide some evidence that there were no meaningful differential parallel trends across the main outcomes (Rambachan and Roth, 2023)

undertaken. We have data on employment generated and total investment (both capital and labor expenditure) in NREGS programs across 191 villages in 13 states. One method of assessing the effects of public goods created under NREGS on agricultural productivity is to include information on village-level employment generation and investment in the NREGS program as a shifter. To achieve this, we estimated the reduced-form equation of the following form.

$$Y_{ivt} = \alpha + \beta \text{Infra}_{vt} + \delta (X_v \times \tau_{14/15}) + \theta Z_{vt} + \mu_v + \gamma_t + \phi_{sn} + \omega_{st \times t} + \varepsilon_{ivt} \quad (2)$$

where Y_{ivt} is the logarithm of output value per acre produced by farm i in village v at time t . Infra_{vt} is the logarithm of either (i) employment generated under NREGS or (ii) per capita expenditure in NREGS-related projects in village v at time t . X_v is a vector of pre-treatment, time-invariant village-level control variables constructed using data from the 1999 REDS and the 2001 Census; these controls are interacted with a year dummy, $\tau_{14/15}$, where $\tau_{14/15} = 1$ for the 2014/15 period and $\tau_{14/15} = 0$ for the 2007/08 period. Z_{vt} is a vector of time-varying village controls such as rainfall. μ_v denotes village fixed effects, γ_t year fixed effects, ϕ_{sn} crop by season fixed effects, and $\omega_{st \times t}$ state-by-year fixed effects. ε_{ivt} is the idiosyncratic error term. The parameter of interest, β , can be interpreted as the elasticity of agricultural output with respect to NREGS employment (or expenditure per capita). Unlike earlier estimates, this specification captures actual implementation arrangements and investment intensity within villages, making it more comparable to an average treatment effect (a dose-response relationship) rather than an intention-to-treat effect. Standard errors are clustered at the village level throughout.

4 Results

4.1 Farm level results from DID regressions

Labor use We find that the NREGS program affected agricultural input use differently for marginal and large farmers. Table 3 shows that NREGS is estimated to have led to a 29-day increase in total labor use by marginal farmers, compared to a reduction of about 20 days in large farms' labor use about 60% and 40% of which can be attributed to a reduction in family and hired labor, respectively.

For marginal farms, this effect can be entirely explained by an increase in family labor, plausibly attributable to greater risk-bearing capacity and higher levels of income due to NREGS. No statistically significant effects are estimated for farms in the 2.5 to 10 acre size range. Moreover, we observe significant heterogeneity in labor use by types of labor. The increase in family labor among marginal farmers is driven by a rise in male family members working on the farm (see Table A5)), which is consistent with the negative correlation reported in Tables A6 and A7, as male household members are typically the ones who migrate out for work from rural to urban areas. For large farmers, the reduction in total labor use reflects a decline in female hired labor days as well as decreases in both male and female family labor days (see Table A5).

Crop choice Tables 4 and 5 point to size-differentiated changes in the types of crops grown as one channel triggering such changes in labor demand. Diversification of output beyond the traditional staples of rice and wheat and increases in cropping intensity have long been identified as essential for Indian agriculture to achieve higher levels of productivity and competitiveness. Crops other than rice and wheat are, however, riskier as they are not covered by government-imposed floor price schemes. Especially if grown in the off-season, they are also more vulnerable to climatic risk.

Intensification via multi-cropping requires liquidity for the timely provision of inputs (including field preparation) and, where water is scarce, involves higher risk and the need to coordinate water supply. Changes in the extent to which they grow non-traditional crops can thus be due to farmers' higher ability to move to a higher risk-reward portfolio. Table 4 shows a small and marginally significant increase in the likelihood of growing more risky crops that is concentrated among marginal and small and medium producers, plausibly as a result of the increase in risk-bearing capacity attributable to the program and the fact that widely recognized rental market frictions make an expansion of area more difficult.

Table 5 shows that, while there is no increase in the likelihood of growing high value crops overall, the likelihood of medium and large farms engaging in the cultivation of high value cash crops (sugarcane, cotton, and saffron) increased by 5–6 percentage points. This could possibly reflect a type of induced innovation to make more effective use of more costly labor.

Non-labor input use In line with the above findings, table 6 shows that, at the intensive margin, NREGS led to a significant increase (by about 260 Rs/acre or about 45%) by large farms in fertilizer use. While no such increase is visible for other farm size categories, we find marginally significant effects on increased intensity of irrigation and machinery rental by marginal farmers triggered by the program, most likely due to additional income generated by the program.

Panel B of Table 6 reports estimated program effects on irrigation intensity. Results suggest NREGS increased use of irrigation of 198 Rs/acre and 157 Rs/acre for marginal and small farmers, respectively (at 10% level of significance), equivalent to a 71 and 96 percent increase compared to the control mean. This large magnitude of increase for marginal and small size farmers but not for medium and large farmers is likely due to the NREGS induced income effects of these two groups. The increase in irrigation coupled with an increase in family labor use for marginal farmers is also consistent with the notion that irrigation is almost entirely carried out by men since it requires complementary physical laborers (Foster and Rosenzweig, 2022).

Although imprecisely estimated, the increase in machinery rental changes suggested by regression coefficients in panel C of table 6 is equivalent to a 22% increase compared to the mean in control districts. Although the coefficients are positive for large farms as well, they are not statistically significant. These results suggest that expansion of rental equipment use was more pronounced for marginal farmers than for large farmers, consistent with the notion that the marginal labor-saving effects of using small-scale equipment are highest for marginal producers (Bhargava, 2023).

Productivity As a reflection of the above, table 7 shows that exposure to NREGS triggered a marginally significant (at 10%) increase in overall agricultural productivity by 13.6 percentage points. This effect is driven by marginal producers whose productivity is estimated to have increased by 17.3 percentage points (significant at 5%).

4.2 Public good provision

A key potential advantage of NREGS as a public work rather than a cash transfer program is its scope to help create productivity-enhancing public good infrastructure such as watersheds, rural roads, land improvement, and minor irrigation works (see figure A.4). A lack of data on the location and

quality of such works and the rather unreliable nature of data on labor input provided by the NREGS management information system (Bose, 2017; Bose and Das, 2018) has traditionally made it difficult to study this issue. Instead, we use total employment generated due to NREGS or total NREGS related expenditure as a proxy for program intensity on public good investments and explore the correlation between NREGS induced investment in public good provision and output elasticities.

The estimated results using equation 2 are reported in Table 8. Panel A and B report results for regressions where village-level NREGS intensity is measured by employment generated or spending, respectively with coefficients for the overall sample in column 1 and those for marginal, small, medium, and large farmers in columns 2-5, respectively. As availability of NREGS can induce demographic shifts, we use 2001 population to express expenditure in per capita terms.

Results in column (1) of Table 8 point towards a positive correlation between the elasticities of yield and the intensity of input use by NREGS and employment days with estimated elasticities ranging from 0.017 (Panel A) to 0.04 (Panel B). In other words, we find that a one percent increase in total NREGS employment (equivalent to 42 days), was associated with an increase of agricultural productivity by 1.7 percent overall (equivalent to 853 Rs/ac) while a one percent increase in NREGS related per capita investment expenditure was associated with an agricultural productivity increase of 3 percent. Both results are robust to the inclusion of controls, suggesting that effective NREGS-induced public good provision could potentially offset some of the program's implementation cost.

Heterogeneity explored in columns (2)–(5) of Table 8 reveals no differences in the relationship between NREGS-related investment and productivity by farm size. The estimated elasticities of output per acre with respect to employment days are modest and tightly clustered, ranging from 0.013 to 0.025 (Panel A), while those with respect to investment spending range from 0.03 to 0.04 (Panel B). The relationships are most consistently positive for small and medium farms, and are less robust for marginal farms (significant only for Spending at the 10% level). For large farms, the results are mixed. Overall, these results indicate that the longer-term correlation between NREGS investments and productivity is positive with little heterogeneity by farm size, in contrast to the short-term gains identified earlier, which were concentrated among marginal farms.

5 Conclusion and policy implications

This paper explored the short-term productivity effects of NREGS using a DID strategy on national farm-level data. While aggregate productivity effects are muted (in line with much of the literature), NREGS is estimated to have increased agricultural productivity for marginal farms by 17.3 percent. This effect seems to be driven by more intensive use of family labor a shift towards riskier crops, and more intensive use of rented machinery and to some extent irrigation.

Further data would be required to assess to what extent the estimated productivity effect could offset program cost. We note, however, that it is more tightly targeted to marginal farmers than any benefits that might be attributable to NREGS-induced provision of public works. Furthermore, the positive effect of NREGS on agricultural productivity has the potential to stimulate additional economic activity. By increasing the demand for local non-tradable goods and services, the program can contribute to the growth of non-agricultural employment (Deininger et al., 2018; Emerick, 2018), and promote ongoing development in rural areas (Cook and Shah, 2022). Exploring such longer-term impacts is left to future research.

References

- Afridi, F., Mukhopadhyay, A., and Sahoo, S. (2016). Female labor force participation and child education in india: evidence from the national rural employment guarantee scheme. *IZA Journal of Labor & Development*, 5(1):1–27.
- Alik-Lagrange, A. and Ravallion, M. (2018). Workfare versus transfers in rural india. *World Development*, 112:244–258.
- Amaral, S., Bandyopadhyay, S., and Sensarma, R. (2015). Employment programmes for the poor and female empowerment: The effect of nregs on gender-based violence in india. *Journal of interdisciplinary economics*, 27(2):199–218.
- Attanasio, O. P., Meghir, C., and Santiago, A. (2012). Education choices in mexico: using a structural model and a randomized experiment to evaluate progresra. *The Review of Economic Studies*, 79(1):37–66.
- Azam, M. (2011). The impact of indian job guarantee scheme on labor market outcomes: Evidence from a natural experiment. *Available at SSRN 1941959*.
- Babu, V. S., Dheeraja, C., Kanth, G. R., and Rangacharyulu, S. (2014). Frequently asked questions on mgnrega operational guidelines. *Ministry of Rural Development, Government of India*, page 02.

- Banerjee, R. and Maharaj, R. (2020). Heat, infant mortality, and adaptation: Evidence from india. *Journal of Development Economics*, 143:102378.
- Basu, P. and Sen, K. (2015). *Welfare implications of india's employment guarantee programme with a wage payment delay*. SSRN.
- Behrer, A. and Pullabhotla, H. (2025). Spilling over: The benefits of public works projects for ground-water in india. *Journal of Environmental Economics and Management*, 133:103218.
- Behrer, A. P. (2023). Man or machine? environmental consequences of wage driven mechanization in indian agriculture.
- Berg, E., Bhattacharyya, S., Rajasekhar, D., and Manjula, R. (2014). Can public employment schemes increase equilibrium wages? evidence from a natural experiment in india.
- Besley, T. and Coate, S. (1995). The design of income maintenance programmes. *The Review of Economic Studies*, 62(2):187–221.
- Bhargava, A. K. (2023). Do labor market interventions incentivize technology adoption? unexpected impacts of the world's largest rural poverty program. *Economic Development and Cultural Change*, 71(2):567–620.
- Bose, N. (2017). Raising consumption through india's national rural employment guarantee scheme. *World Development*, 96:245–263.
- Bose, N. and Das, S. (2018). Political reservation for women and delivery of public works program. *Review of Development Economics*, 22(1):203–219.
- Channaveer, H. L., Hugara, L. B., Deshmanya, J. B., and Goudappa, S. B. (2011). Impact of mgnrega on input-use pattern, labour productivity and returns of selected crops in gulbarga district, karnataka. *Agricultural Economics Research Review*, 24:517–523.
- Coady, M. D. and Prady, D. (2018). *Universal basic income in developing countries: Issues, options, and illustration for India*. International Monetary Fund.
- Coffey, D. (2013). Children's welfare and short-term migration from rural india. *The journal of development studies*, 49(8):1101–1117.
- Cook, C. J. and Shah, M. (2022). Aggregate effects from public works: Evidence from india. *The Review of Economics and Statistics*, 104(4):797–806.
- Dasgupta, A. (2017). Can the major public works policy buffer negative shocks in early childhood? evidence from andhra pradesh, india. *Economic Development and Cultural Change*, 65(4):767–804.
- Deininger, K., Jin, S., Liu, Y., and Singh, S. K. (2018). Can labor-market imperfections explain changes in the inverse farm size–productivity relationship? longitudinal evidence from rural india. *Land Economics*, 94(2):239–258.
- Deininger, K. and Liu, Y. (2019). Heterogeneous welfare impacts of national rural employment guarantee scheme: Evidence from andhra pradesh, india. *World Development*, 117:98–111.

- Desai, S., Vashishtha, P., Joshi, O., et al. (2015). Mahatma gandhi national rural employment guarantee act: A catalyst for rural transformation. Technical report.
- Dreze, J. and Sen, A. (1990). *Hunger and public action*. Clarendon Press.
- Dutta, P., Murgai, R., Ravallion, M., and Van de Walle, D. (2012). Does india's employment guarantee scheme guarantee employment? *Economic and Political Weekly*, pages 55–64.
- Emerick, K. (2018). Trading frictions in indian village economies. *Journal of Development Economics*, 132:32–56.
- Fetzer, T. (2020). Can workfare programs moderate conflict? evidence from india. *Journal of the European Economic Association*, 18(6):3337–3375.
- Foster, A. D. and Rosenzweig, M. R. (2022). Are there too many farms in the world? labor market transaction costs, machine capacities, and optimal farm size. *Journal of Political Economy*, 130(3):636–680.
- Garg, T., Jagnani, M., and Taraz, V. (2020). Temperature and human capital in india. *Journal of the Association of Environmental and Resource Economists*, 7(6):1113–1150.
- Gehrke, E. (2019). An employment guarantee as risk insurance? assessing the effects of the nregs on agricultural production decisions. *The World Bank Economic Review*, 33(2):413–435.
- Gehrke, E. and Hartwig, R. (2018). Productive effects of public works programs: What do we know? what should we know? *World development*, 107:111–124.
- Glewwe, P. and Kassouf, A. L. (2012). The impact of the bolsa escola/familia conditional cash transfer program on enrollment, dropout rates and grade promotion in brazil. *Journal of development Economics*, 97(2):505–517.
- Godfrey-Wood, R. and Flower, B. C. (2018). Does guaranteed employment promote resilience to climate change? the case of india's mahatma gandhi national rural employment guarantee act (mgnrega). *Development Policy Review*, 36:O586–O604.
- Imbert, C. and Papp, J. (2015). Labor market effects of social programs: Evidence from india's employment guarantee. *American Economic Journal: Applied Economics*, 7(2):233–63.
- Imbert, C. and Papp, J. (2020). Short-term migration, rural public works, and urban labor markets: Evidence from india. *Journal of the European Economic Association*, 18(2):927–963.
- Islam, M. and Sivasankaran, A. (2015). How does child labor respond to changes in adult work opportunities? evidence from nrega. *Harvard University, Cambridge, MA*.
- Khanna, G. and Zimmermann, L. (2017). Guns and butter? fighting violence with the promise of development. *Journal of Development Economics*, 124:120–141.
- Khosla, S. et al. (2018). *India's Universal Basic Income: Bedeviled by the Details*. Carnegie Endowment for International Peace Washington.
- Klonner, S. and Oldiges, C. (2014). Safety net for india's poor or waste of public funds? poverty and welfare in the wake of the world's largest job guarantee program. Technical report, Discussion Paper Series.

- Klonner, S. and Oldiges, C. (2022). The welfare effects of india's rural employment guarantee. *Journal of Development Economics*, 157:102848.
- Mani, S., Behrman, J. R., Galab, S., and Reddy, P. (2014). Impact of the nregs on schooling and intellectual human capital.
- Merfeld, J. D. (2019). Spatially heterogeneous effects of a public works program. *Journal of Development Economics*, 136:151–167.
- Muralidharan, K., Niehaus, P., and Sukhtankar, S. (2016). Building state capacity: Evidence from biometric smartcards in india. *American Economic Review*, 106(10):2895–2929.
- Muralidharan, K., Niehaus, P., and Sukhtankar, S. (2023). General equilibrium effects of (improving) public employment programs: Experimental evidence from india. *Econometrica*, 91(4):1261–1295.
- Nagaraj, N., Bantilan, C., Pandey, L., and Roy, N. S. (2016). Impact of mgnrega on rural agricultural wages, farm productivity and net returns: an economic analysis across sat villages. *Indian Journal of Agricultural Economics*, 71(02):176–190.
- Rambachan, A. and Roth, J. (2023). A more credible approach to parallel trends. *Review of Economic Studies*, 90(5):2555–2591.
- Ranaware, K., Das, U., Kulkarni, A., and Narayanan, S. (2015). Mgnrega works and their impacts: A study of maharashtra. *Economic and Political Weekly*, pages 53–61.
- Ravallion, M. (2022). On the gains from tradable benefits-in-kind: Evidence for workfare in india. *Economica*.
- Ravi, S. and Engler, M. (2015). Workfare as an effective way to fight poverty: The case of india's nregs. *World Development*, 67:57–71.
- Reddy, D. N., Reddy, A. A., and Bantilan, M. (2014). The impact of mahatma gandhi national rural employment guarantee act (mgnrega) on rural labor markets and agriculture. *India Review*, 13(3):251–273.
- Rodriguez, Z. (2022). The power of employment: Effects of india's employment guarantee on women empowerment. *World development*, 152:105803.
- Santangelo, G. (2016). Firms and farms: The impact of agricultural productivity on the local indian economy. *Unpublished Manuscript*.
- Shah, M. and Steinberg, B. M. (2021). Workfare and human capital investment evidence from india. *Journal of Human Resources*, 56(2):380–405.
- Shah, V. (2012). Managing productivity risk through employment guarantees: Evidence from india. *Unpublished, India School of Business, Hyderabad*.
- Sheahan, M., Liu, Y., Narayanan, S., and Barrett, C. B. (2015). Disaggregated labor supply implications of guaranteed employment in india.
- Subbarao, K. (1997). Public works as an anti-poverty program: An overview of cross-country experience. *American journal of agricultural economics*, 79(2):678–683.

- Taraz, V. (2019). Weather shocks, social protection, and crop yields: Evidence from india. *Social Protection, and Crop Yields: Evidence from India (October 11, 2019)*.
- Taraz, V. (2023). Public works programmes and agricultural risk: Evidence from india. *Australian Journal of Agricultural and Resource Economics*.
- Varshney, D., Goel, D., and Meenakshi, J. (2018). The impact of mgnrega on agricultural outcomes and the rural labour market: A matched did approach. *The Indian Journal of Labour Economics*, 61:589–621.
- Zimmermann, L. (2020). Why guarantee employment? evidence from a large indian public-works program. Technical report, GLO Discussion Paper.
- Zimmermann, L. (2021). The dynamic electoral returns of a large antipoverty program. *Review of Economics and Statistics*, 103(5):803–817.

Table 1: Summary Statistics of Key Variables by Treatment Status and Year

	Control		Treatment		Year==1998-99		Year==2007-08	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Panel A: Household characteristics								
Male head	0.95	0.22	0.94	0.24	0.96	0.19	0.93	0.26
head's age	50.82	13.21	51.29	13.06	49.76	13.35	52.54	12.71
Married head	0.90	0.31	0.89	0.31	0.90	0.30	0.88	0.32
Head's education	4.38	4.14	5.14	4.55	4.33	3.71	5.32	4.98
Household size	6.26	3.09	6.32	3.43	6.72	3.58	5.82	2.84
Working male	2.17	1.28	2.14	1.33	2.29	1.41	2.01	1.17
Working female	2.01	1.13	2.05	1.23	2.09	1.27	1.96	1.09
Total cropped area	8.10	9.39	6.69	10.79	7.21	9.34	7.44	11.09
Land owned	5.65	6.42	5.47	8.83	5.95	8.57	5.10	6.94
Irrigated land	3.86	5.65	2.69	4.76	3.30	5.47	3.12	4.90
Panel B: Agricultural Inputs and output per acre								
<i>Value (Rs.) per acre...</i>								
Harvest value	9087.31	7805.25	7400.42	6400.45	7784.68	7049.41	8717.14	7253.44
Seed	724.49	1449.22	589.15	1117.20	425.58	785.04	928.03	1666.32
Manure	738.72	1926.10	543.63	1517.27	206.37	459.79	1153.88	2413.59
Machinery	314.74	368.17	226.09	327.79	206.45	290.74	343.07	398.35
Fertilizer	611.42	505.11	578.50	507.97	630.09	531.64	551.29	471.87
Irrigation	183.28	457.51	153.70	652.36	113.71	369.92	232.85	732.69
Bullock	49.34	152.96	49.03	147.56	55.39	157.02	41.73	141.17
Other inputs	256.04	470.68	134.34	307.40	257.11	470.99	115.29	269.73
<i>Labor per acre...</i>								
Hired labor	16.07	21.43	20.51	24.07	16.21	20.90	20.98	24.94
Family labor	37.08	40.83	35.68	38.18	34.65	38.02	38.39	41.07
Total labor	55.65	52.32	58.40	50.15	53.11	47.45	61.84	55.02
Male hired labor	8.14	12.14	10.21	14.04	7.46	11.74	11.33	14.49
Female hired labor	7.17	11.88	9.17	12.98	7.73	12.00	8.80	13.06
Male family labor	29.07	32.12	29.27	31.26	25.60	28.43	33.47	34.69
Female family labor	12.50	17.41	11.03	15.41	11.91	15.63	11.53	17.31
Net cropped area per season	2.98	3.78	2.80	3.92	2.73	3.59	3.07	4.14
Net seller of labor	0.36	0.48	0.40	0.49	0.40	0.49	0.36	0.48
Net buyer of labor	0.56	0.50	0.56	0.50	0.51	0.50	0.62	0.48
Sh. of high value crops	0.22	0.41	0.29	0.24	0.27	0.44	0.23	0.42
Risky crop index	0.64	2.20	0.68	1.67	0.69	2.30	0.62	1.43

Note: Our own calculation from Rural Economics and Demographic Survey

Table 2: Testing for Parallel Trend Assumption Using 1982-99 REDS Data

	(1) Land	(2) Crop Output	(3) Machinery	(4) Fertilizer
Panel A:				
Pre-Parallel Trend	0.373 (0.781)	0.043 (0.090)	-21.462 (28.280)	-18.637 (58.077)
R^2	0.235	0.627	0.328	0.576
Dep. Mean	9.398	7.490	101.247	473.675
Observations	16894	16970	16927	16927
	(5) Irrigation	(6) Pesticides	(7) Other	(8) Labor
Panel B:				
Pre-Parallel Trend	-10.764 (12.442)	-1.858 (15.576)	27.929 (35.042)	-71.778 (47.306)
R^2	0.253	0.278	0.356	0.465
Dep. Mean	51.430	78.089	135.379	464.505
Observations	16927	16927	16927	16927

Notes: Each column reports the coefficients of interest from separate regressions. Dependent variable in column 2-8 are per acre crop output and inputs. All regressions include district, year, state by year, and crop-season fixed effects throughout and standard errors are clustered at the district level. Pre-parallel test by farm size is reported in Appendix Table A4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Effects of NREGS on Total Hired and Family Labor Days

	(1) All	(2) Marginal	(3) Small	(4) Medium	(5) Large
Panel A: Total Labor					
NREGS x Post	6.446 (8.986)	28.788** (12.202)	0.494 (11.130)	2.417 (9.086)	-19.996*** (7.362)
R^2	0.275	0.288	0.313	0.316	0.384
Dep. Mean	61.211	79.176	61.921	52.372	41.230
Observations	14813	4780	3655	3500	2874
Panel B: Hired Labor					
NREGS x Post	-3.825 (2.952)	-0.392 (4.108)	-5.277 (4.705)	-4.101 (3.900)	-8.249** (3.520)
R^2	0.301	0.271	0.395	0.424	0.404
Dep. Mean	19.680	20.353	19.779	19.851	18.217
Observations	14813	4780	3655	3500	2874
Panel C: Family Labor					
NREGS x Post	11.951 (10.020)	37.844** (15.668)	4.540 (12.290)	2.620 (9.625)	-12.973** (5.570)
R^2	0.170	0.203	0.237	0.214	0.198
Dep. Mean	43.859	63.445	43.879	33.540	23.873
Observations	14813	4780	3655	3500	2874

Notes: Dependent variable is labor days per acre throughout. NREGS is a dummy and takes on the value one if districts are from phases 1 and 2; otherwise, zero. Each column reports the coefficients of interest from separate regressions. Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. All regressions include district and year-fixed effects throughout. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-treatment village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population and number of schools, constructed from Census 2001 and REDS 1999, interacted with year. District fixed effects, year fixed effects, state-by-year, season by crop fixed effects are included throughout. Standard errors are clustered at the district level.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effects of NREGS on Farmers' Adoption of Risky Crops

	(1) All	(2) Marginal	(3) Small	(4) Medium	(5) Large
NREGS x Post	0.696* (0.387)	0.242* (0.126)	0.747* (0.416)	1.018* (0.596)	1.447 (0.910)
R^2	0.298	0.311	0.415	0.400	0.390
Dep. Mean	0.661	0.343	0.557	0.782	1.147
Observations	13495	4241	3325	3227	2698

Notes: Each column reports the coefficients of interest from separate regressions. The dependent variable is the risk index, constructed following Gehrke (2019). The risk index for household i given land allocation l to crop c is defined as $R_i = \frac{\sum_c r_c l_c}{\sum_c l_c}$, where r_c is the coefficient of variation of the yield of crop c . Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. High value crops include saffron, cotton, and sugarcane. All regressions include district and year-fixed effects throughout. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-treatment village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population and number of schools, constructed from Census 2001 and REDS 1999, interacted with year. District fixed effects, year fixed effects, state-by-year, season by crop fixed effects are included throughout. Standard errors are clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effects of NREGS on Whether Farmers Grew High-Value Crops

	(1) All	(2) Marginal	(3) Small	(4) Medium	(5) Large
NREGS x Post	0.018 (0.015)	0.006 (0.014)	-0.009 (0.017)	0.051** (0.021)	0.057** (0.027)
R^2	0.172	0.172	0.176	0.232	0.185
Dep. Mean	0.070	0.045	0.063	0.087	0.100
Observations	14813 (0.002)	4780 (0.002)	3656 (0.003)	3501 (0.003)	2874 (0.003)

Notes: Each column reports the coefficients of interest from separate regressions. Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. High value crops include saffron, cotton, and sugarcane. All regressions include district and year-fixed effects throughout. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-treatment village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population and number of schools, constructed from Census 2001 and REDS 1999, interacted with year. District, year, state-by-year, season fixed effects are included throughout. Standard errors are clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Effects of NREGS on Agricultural Inputs Use on Intensive Margin

	(1) All	(2) Marginal	(3) Small	(4) Medium	(5) Large
Panel A: Fertilizer					
NREGS x Post	111.967 (100.159)	-13.867 (120.710)	366.027 (340.718)	110.468 (104.997)	263.029*** (87.139)
R^2	0.084	0.137	0.089	0.234	0.235
Dep. Mean	684.102	792.008	693.821	605.362	588.360
Observations	14813	4780	3655	3500	2874
Panel B: Irrigation					
NREGS x Post	82.200 (62.403)	197.924* (111.144)	157.367* (89.317)	-46.657 (41.750)	-16.934 (26.485)
R^2	0.152	0.241	0.116	0.243	0.249
Dep. Mean	172.465	277.809	164.650	109.424	84.093
Observations	14813	4780	3655	3500	2874
Panel C: Machinery					
NREGS x Post	41.356 (40.948)	71.116* (39.660)	49.400 (51.330)	-19.345 (62.894)	56.827 (62.597)
R^2	0.291	0.400	0.398	0.309	0.242
Dep. Mean	274.729	329.317	280.860	266.568	185.991
Observations	14813	4780	3655	3500	2874

Notes: The dependent variable is total Machinery, Fertilizer, and Irrigation value per acre throughout. NREGS is a dummy and takes on the value one if districts are from phases 1 and 2; otherwise, zero. Each column reports the coefficients of interest from separate regressions. Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. All regressions include district and year-fixed effects throughout. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-treatment village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population and number of schools, constructed from Census 2001 and REDS 1999, interacted with year. District fixed effects, year fixed effects, state-by-year, season by crop fixed effects are included throughout. Standard errors are clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Effects of NREGS on Agricultural Productivity by Farm Sizes

	(1) <u>All Farms</u>	(2) <u>Marginal</u> < 2.5	(3) <u>Small</u> 2.5-5	(4) <u>Medium</u> 5-10	(5) <u>Large</u> >10
NREGS $\times$ Post	0.136* (0.079)	0.173** (0.080)	0.040 (0.124)	0.100 (0.092)	0.158 (0.132)
R^2	0.431	0.408	0.454	0.499	0.499
Dep. Mean	8.713	8.827	8.701	8.659	8.604
Observations	14813	4780	3655	3500	2874
District FEs	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable is the log of output value per acre throughout. NREGS is a dummy and takes on the value one if districts are from phases 1 and 2; otherwise, zero. Each column reports the coefficients of interest from separate regressions. Each column reports the coefficients of interest from separate regressions. Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-program village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population schools, etc., constructed from census 2001 and REDS 1999, interacted with year. District fixed effects, year fixed effects, state-by-year, season by crop fixed effects are included throughout. Standard errors clustered at district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Effects of Village-Level NREGS Spending and Employment Generation on Agricultural Productivity

	(1) All	(2) Marginal	(3) Small	(4) Medium	(5) Large
Panel A: Village Level NREGS Employment Days					
NREGS Days	0.017** (0.008)	0.016 (0.014)	0.013* (0.007)	0.019** (0.010)	0.025** (0.011)
R^2	0.472	0.454	0.524	0.554	0.514
Dep. Mean	9.375	9.449	9.363	9.347	9.141
Observations	13587	5936	3556	2660	1398
Panel B: Village Level NREGS spending					
NREGS Spending	0.040*** (0.014)	0.040* (0.024)	0.036*** (0.010)	0.037** (0.018)	0.030 (0.021)
R^2	0.473	0.455	0.525	0.554	0.513
Dep. Mean	9.375	9.449	9.363	9.347	9.141
Observations	13587	5936	3556	2660	1398

Notes: Dependent variable is the log of output per acre throughout. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-treatment village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population schools, etc., constructed from census 2001 and REDS 1999, interacted with year. Village, year, season and crop by season fixed effects are included throughout. We also include state by year fixed effects. Standard errors are clustered at the village level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Figures and Tables

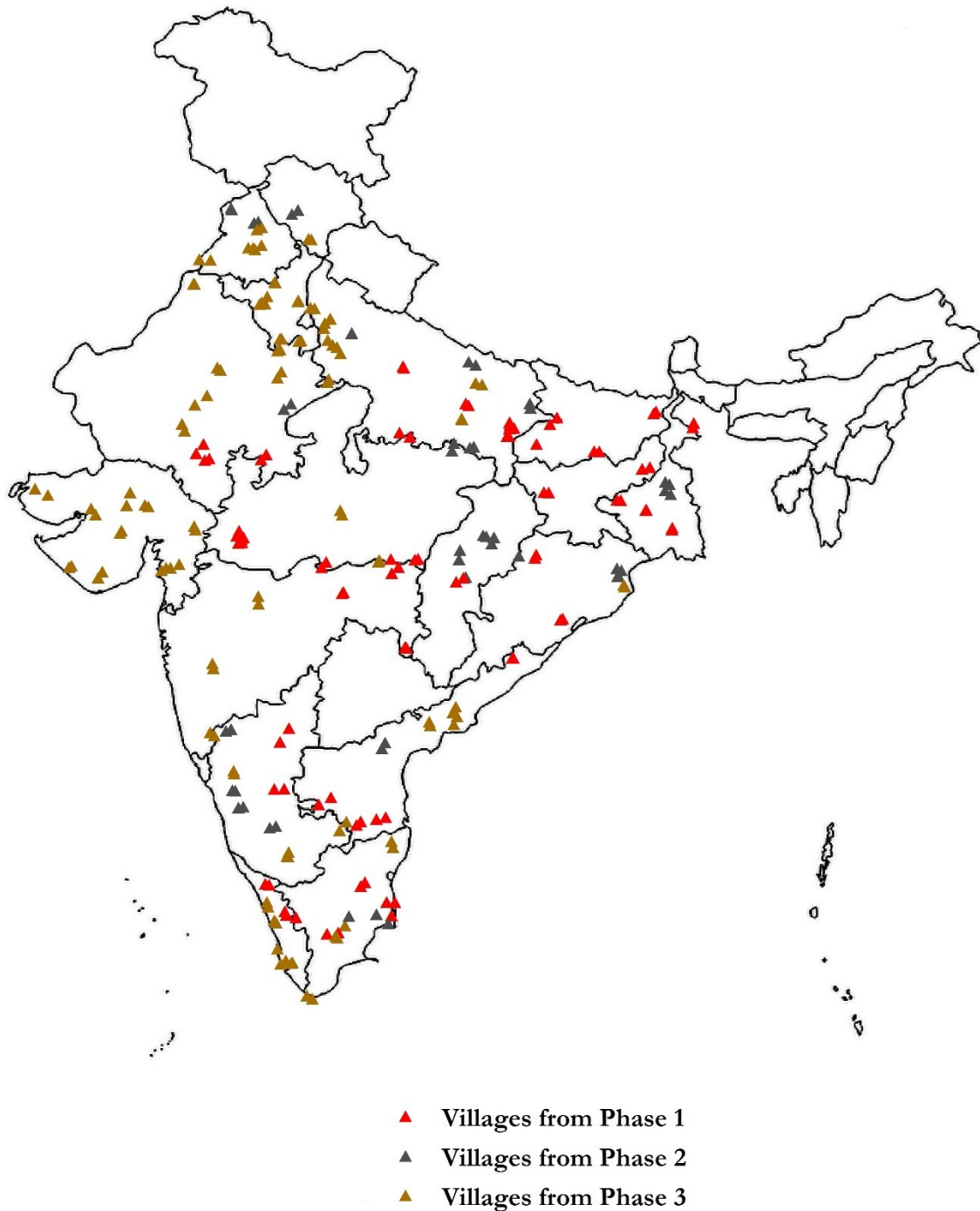


Figure A.1: Location of Sample REDS Villages by Phase of NREGS Implementation (2007–08 Survey Round)

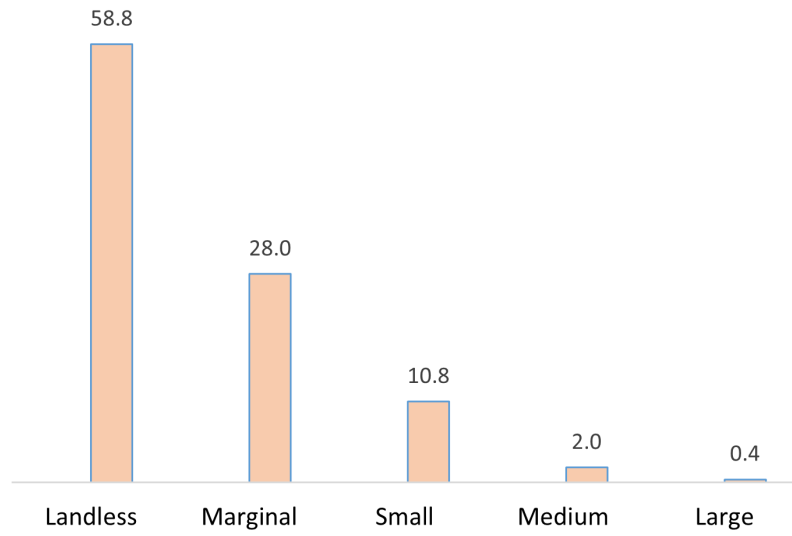


Figure A.2: Distribution of Workers in NREGS Projects by Landholding Type (2014/15 SEPRI Survey)

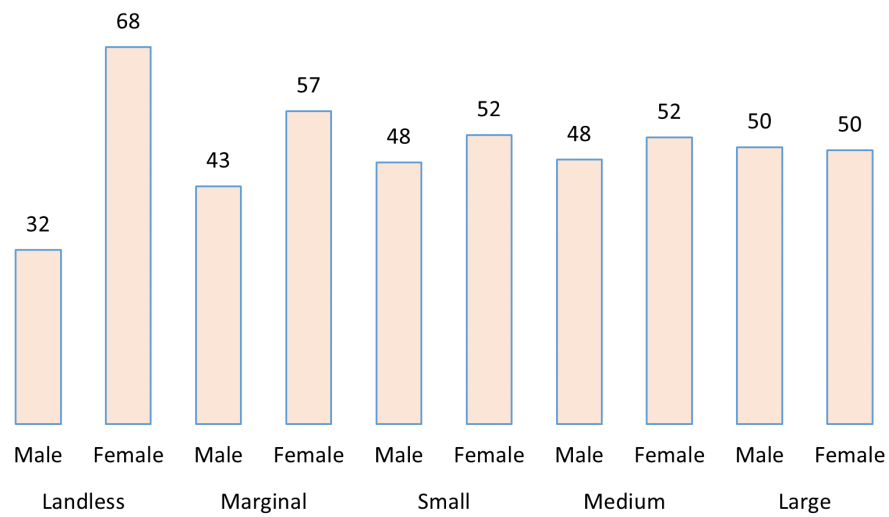


Figure A.3: Distribution of Workers by Sex in NREGS Projects by Landholding Type (2014/15 SEPRI Survey)

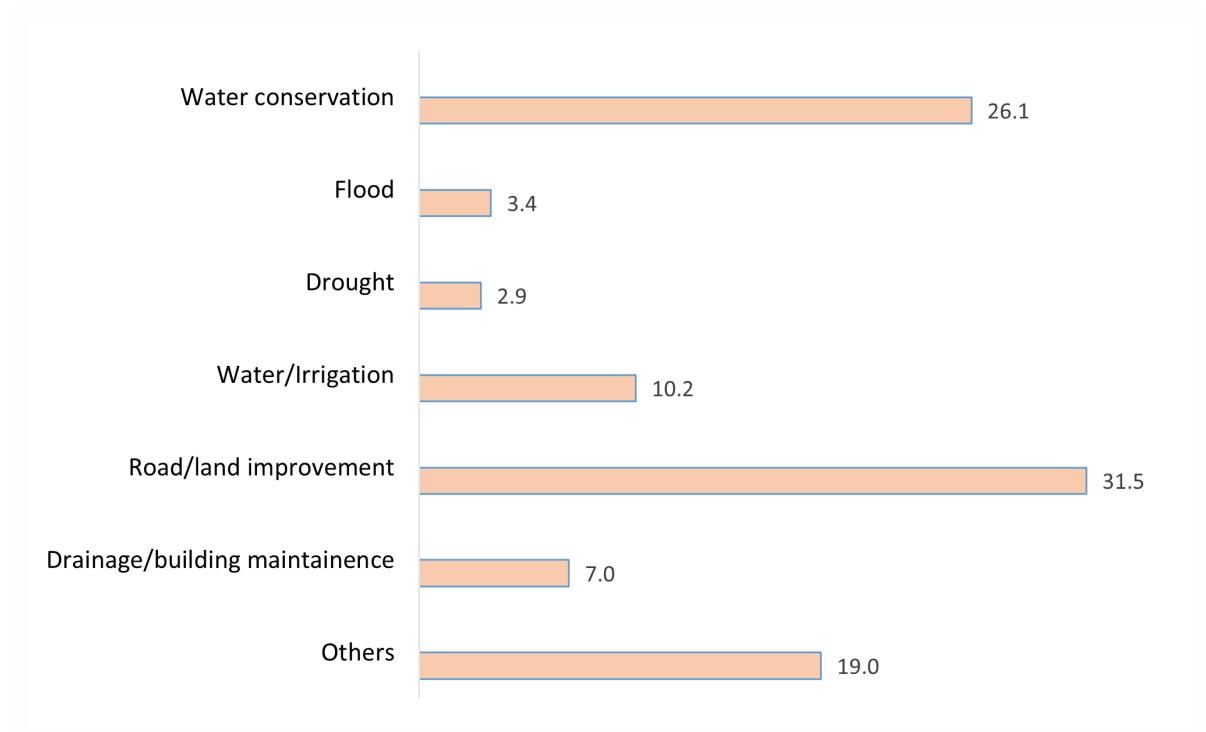


Figure A.4: Share of NREGS Projects Across Different Types of Development Activities (2014/15 SEPRI Survey)

Table A2: Summary Statistics of Household and Agricultural Variables Using Baseline Data only

	Control		Treatment	
	Mean	SD	Mean	SD
Panel A: Household characteristics				
Male head	0.97	0.18	0.96	0.20
Head's age	49.10	13.38	49.53	13.27
Married head	0.90	0.29	0.90	0.30
Head's education	4.06	3.53	4.59	3.83
Household size	6.51	3.32	6.61	3.50
Working male	2.22	1.34	2.24	1.39
Working female	1.98	1.17	2.09	1.26
Land owned	5.82	6.67	5.53	8.19
Irrigated land	3.85	6.00	2.65	4.72
Total cropped area	7.60	7.86	6.31	7.85
Panel B: Agricultural inputs and output per hectare				
Net cropped area per season	2.78	3.13	2.58	3.23
<i>Value (Rs.) per hectare...</i>				
Harvest value	8735.54	7593.83	6969.65	6153.96
Seed	460.55	865.29	387.75	672.21
Fertilizer	700.70	662.72	648.20	639.90
Manure	218.12	522.59	200.18	424.40
Machinery	279.76	368.73	163.81	279.87
Irrigation	143.13	380.22	88.02	237.01
Bullock	53.66	153.22	59.14	163.24
Other inputs	354.83	547.51	167.46	367.45
<i>Labor per hectare...</i>				
Hired labor	13.83	21.98	19.11	25.91
Family labor	41.98	61.37	34.39	47.28
Total labor	56.85	69.34	53.96	55.75
Male hired labor	6.87	13.07	9.19	15.75
Female hired labor	6.84	13.26	9.65	15.37
Male family labor	28.59	42.63	23.95	32.76
Female family labor	12.84	23.02	10.38	18.40
Total male labor	36.08	47.49	33.61	38.48
Total female labor	20.15	28.76	20.25	25.13
Net seller	0.38	0.49	0.44	0.50
Net buyer	0.49	0.50	0.52	0.50

Note: Author's own calculation from Rural Economics and Demographic Survey.

Table A1: Summary Statistics of Key Variables by Farm Size

	Marginal		Small		Medium		Large	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Panel A: Household characteristics								
Male head	0.93	0.25	0.94	0.24	0.96	0.21	0.97	0.18
Head's age	49.37	12.71	50.17	12.69	51.35	13.25	55.62	13.40
Married head	0.88	0.33	0.90	0.30	0.90	0.30	0.90	0.30
Head's education	4.35	4.19	4.48	4.29	5.03	4.61	5.89	4.40
Household size	5.85	2.91	6.04	2.96	6.33	3.09	7.54	4.25
Working male	1.96	1.17	2.06	1.23	2.21	1.30	2.61	1.56
Working female	1.84	1.08	1.95	1.11	2.06	1.15	2.48	1.44
Total cropped area	2.66	3.31	5.04	4.20	8.63	5.99	18.57	18.50
Land owned	1.74	1.93	3.51	2.09	6.31	3.85	15.45	14.06
Irrigated land	1.05	1.65	2.07	1.93	3.77	4.02	8.66	9.30
Panel B: Agricultural inputs and output per acre								
Net cropped area per season	1.24	1.46	2.02	1.94	3.21	2.80	5.84	6.36
<i>Value (Rs.) per acre...</i>								
Harvest value	8921.50	7569.69	8244.03	7275.13	7721.08	6320.51	7740.05	7257.26
Seed	797.00	1554.20	656.73	1314.09	591.36	1126.36	524.59	968.87
Manure	864.07	2116.29	713.48	1865.42	488.93	1377.30	400.93	1190.88
Machinery	321.58	377.62	282.06	353.58	263.01	341.71	184.98	298.11
Fertilizer	680.89	526.78	585.65	503.51	559.92	487.30	524.22	488.21
Irrigation	280.45	673.50	165.52	780.88	108.79	276.37	82.81	217.49
Bullock	71.87	180.82	53.96	158.65	32.25	113.99	31.48	122.42
Other inputs	156.99	394.63	185.08	382.97	205.58	386.39	236.34	431.42
<i>Labor per acre...</i>								
Hired labor	18.54	24.66	18.68	23.78	18.92	22.35	17.17	19.91
Family labor	52.27	46.08	38.31	39.50	29.92	34.61	19.31	22.28
Total labor	73.74	56.94	58.88	50.61	50.16	46.48	39.78	40.40
Male hired labor	9.80	14.45	9.00	13.49	9.20	12.75	8.71	11.40
Female hired labor	7.66	12.97	8.59	12.80	8.79	12.69	7.86	11.15
Male family labor	40.37	36.04	30.15	31.14	24.18	27.45	18.24	24.49
Female family labor	16.46	19.55	12.55	16.23	9.71	14.10	6.54	11.76
Net seller of labor	0.58	0.49	0.44	0.50	0.27	0.44	0.17	0.37
Net buyer of labor	0.36	0.48	0.49	0.50	0.68	0.47	0.79	0.41
Sh. of high value crops	0.17	0.37	0.25	0.42	0.29	0.46	0.33	0.47
Risky crop index	0.34	0.69	0.55	1.37	0.78	2.04	1.15	3.26

Note: Author's own calculation from Rural Economics and Demographic Survey.

Table A3: Summary Statistics of Household and Agricultural Variables Using Baseline Data

	Marginal		Small		Medium		Large	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Panel A: Household characteristics								
Male head	0.96	0.19	0.95	0.21	0.97	0.18	0.97	0.18
Head's age	47.40	12.81	48.14	12.85	49.78	13.72	55.12	13.01
Married head	0.89	0.32	0.91	0.28	0.91	0.29	0.90	0.30
Head's education	4.03	3.47	4.07	3.59	4.59	3.95	5.24	3.93
Household size	6.00	2.88	6.22	3.05	6.61	3.17	8.35	4.66
Working male	2.00	1.20	2.11	1.27	2.29	1.36	2.88	1.68
Working female	1.81	1.07	1.91	1.11	2.12	1.19	2.68	1.50
Land owned	1.30	0.68	3.44	0.60	6.52	1.37	18.11	12.20
Irrigated land	0.80	0.78	2.00	1.59	3.78	3.08	9.76	10.19
Total cropped area	2.32	2.04	4.70	2.16	8.47	3.84	18.74	12.47
Panel B: Agricultural inputs and output per hectare								
Net cropped area per season	1.12	0.93	1.80	1.12	2.98	2.01	5.61	5.37
<i>Value (Rs.) per hectare...</i>								
Harvest value	8729.26	7255.85	7733.38	6889.93	7197.77	6032.53	7289.34	7340.02
Seed	434.35	813.39	420.70	795.90	390.81	614.53	443.43	835.90
Fertilizer	804.46	675.14	650.01	619.06	604.11	626.28	597.19	658.31
Manure	248.14	479.31	228.42	566.03	175.16	328.50	166.98	474.31
Machinery	241.69	341.95	232.91	342.56	228.48	343.93	155.07	265.03
Irrigation	193.24	359.25	108.12	369.10	74.68	253.91	55.63	183.29
Bullock	83.40	186.03	55.03	158.94	39.70	132.60	40.40	137.91
Other inputs	193.92	477.42	241.58	442.64	291.74	464.84	318.98	490.01
<i>Labor per hectare...</i>								
Hired labor	16.27	26.34	17.01	25.10	17.07	23.08	16.12	21.40
Family labor	55.25	67.68	39.00	52.99	29.75	42.15	21.85	39.38
Total labor	72.89	76.11	56.70	61.92	47.11	50.07	38.39	46.93
Male hired labor	9.15	17.35	7.76	14.82	7.61	12.87	7.61	11.57
Female hired labor	6.82	14.08	9.11	15.50	9.32	14.63	8.28	13.32
Male family labor	38.91	46.91	26.30	36.21	19.71	28.93	15.40	28.20
Female family labor	15.92	26.00	12.12	19.74	9.96	17.65	6.46	14.77
Total male labor	49.13	53.20	34.64	42.24	27.50	32.28	23.20	31.62
Total female labor	23.30	31.29	21.55	26.60	19.38	24.78	15.07	21.67
Net seller	0.64	0.48	0.45	0.50	0.29	0.45	0.18	0.38
Net buyer	0.28	0.45	0.44	0.50	0.63	0.48	0.75	0.43

Note: Author's own calculation from Rural Economics and Demographic Survey.

Table A4: Testing for Parallel Trend Assumption by Farm Size Using 1982–99 REDS Data

	(1) Land	(2) Output	(3) Machinery	(4) Fertilizer	(5) Irrigation	(6) Pesticides	(7) Other Inputs	(8) Labor
Panel A: Marginal (< 2.5 ac.)								
Pre-Parallel Trend	0.047 (0.102)	0.019 (0.181)	-5.805 (28.293)	21.560 (112.479)	15.780 (24.178)	-15.418 (27.314)	-3.103 (39.350)	-83.378 (107.287)
R^2	0.183	0.608	0.482	0.632	0.377	0.494	0.485	0.638
Dep. Mean	1.490	7.866	119.131	650.835	88.961	96.548	107.916	634.283
Observations	3549	3549	3521	3521	3521	3521	3521	3521
Panel B: Small (2.5-5 ac.)								
Pre-Parallel Trend	0.041 (0.087)	0.117 (0.115)	-62.491 (41.011)	3.732 (72.657)	-8.466 (20.606)	-30.992 (19.485)	6.476 (42.575)	-45.570 (69.525)
R^2	0.220	0.677	0.439	0.593	0.322	0.482	0.382	0.547
Dep. Mean	3.708	7.685	115.450	516.524	61.506	78.380	133.460	514.903
Observations	3846	3846	3841	3841	3841	3841	3841	3841
Panel C: Medium (5-10 ac.)								
Pre-Parallel Trend	-0.180 (0.246)	0.007 (0.111)	-37.966 (31.071)	-12.522 (60.203)	-13.203 (15.633)	-3.430 (20.269)	69.898 (51.109)	24.989 (70.810)
R^2	0.148	0.658	0.351	0.573	0.222	0.181	0.402	0.445
Dep. Mean	7.260	7.604	118.723	496.934	45.466	87.821	174.770	480.546
Observations	4562	4562	4556	4556	4556	4556	4556	4556
Panel D: Large (> 10 ac.)								
Pre-Parallel Trend	0.300 (2.049)	0.087 (0.101)	-26.421 (43.099)	-96.966 (63.095)	-44.386** (17.830)	14.033 (28.292)	-14.972 (49.393)	-105.164 (83.462)
R^2	0.204	0.609	0.280	0.581	0.252	0.377	0.391	0.353
Dep. Mean	21.569	6.961	61.362	292.027	22.355	55.608	118.502	287.693
Observations	4905	4981	4976	4976	4976	4976	4976	4976

Notes: Dependent variables are in per-acre units except land. NREGS is a dummy equal to one for districts in phases 1 and 2. Each panel reports coefficients from separate regressions by farm size category. Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. All regressions include district, year, state-by-year, and crop-by-season fixed effects. Standard errors are clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Effects of NREGS on Male-Female Hired and Family Labor Days

	(1) All	(2) Marginal	(3) Small	(4) Medium	(5) Large
Panel A: Hired Labor (Male)					
NREGS x Post	-1.520 (1.886)	1.239 (2.654)	-1.711 (3.024)	-2.298 (2.123)	-3.074 (2.327)
R^2	0.281	0.264	0.353	0.416	0.391
Dep. Mean	10.361	11.331	10.030	10.085	9.501
Observations	14813	4780	3655	3500	2874
Panel B: Hired Labor (Female)					
NREGS x Post	-2.856** (1.379)	-2.763 (1.768)	-4.378* (2.317)	-1.537 (2.155)	-5.867*** (1.783)
R^2	0.328	0.301	0.414	0.431	0.417
Dep. Mean	9.099	8.682	9.591	9.592	8.562
Observations	14813	4780	3655	3500	2874
Panel C: Family Labor (Male)					
NREGS x Post	8.482* (4.926)	22.937*** (7.383)	4.783 (6.073)	6.174 (5.298)	-8.969** (3.995)
R^2	0.242	0.271	0.303	0.281	0.340
Dep. Mean	28.684	40.170	28.797	22.547	16.936
Observations	14813	4780	3655	3500	2874
Panel D: Family Labor (Female)					
NREGS x Post	0.230 (2.362)	2.837 (3.045)	-0.357 (2.769)	0.146 (2.307)	-3.876** (1.598)
R^2	0.260	0.328	0.282	0.253	0.436
Dep. Mean	11.670	16.762	11.933	9.392	5.654
Observations	14813	4780	3655	3500	2874

Notes: Dependent variable is labor days per acre throughout. NREGS is a dummy and takes on the value one if districts are from phases 1 and 2; otherwise, zero. Each column reports the coefficients of interest from separate regressions. Marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. The vector of controls includes rainfall for each village and survey year. It also includes time-constant pre-treatment village-level controls such as distance to the nearest town, access to the local market, distance to district HQ, log of the population and number of schools, constructed from Census 2001 and REDS 1999, interacted with year. District, year, state-by-year, season, and crop-by-season fixed effects are included throughout. Standard errors are clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Cross-Sectional Correlates of Migration and Village-Level NREGS Spending and Employment

	(1) All	(2) Landless	(3) Marginal	(4) Small	Medium	Large
Panel A: Village Level NREGS Employment Generated						
NREGS	-0.008*** (0.003)	-0.006*** (0.002)	-0.010*** (0.003)	-0.004 (0.003)	-0.001 (0.006)	0.007 (0.006)
R^2	0.108	0.085	0.137	0.102	0.083	0.116
Dep. Mean	0.036	0.023	0.052	0.038	0.023	0.026
Observations	228523	98817	79978	35906	9525	4297
Panel A: Village Level NREGS Spending						
NREGS	-0.001* (0.001)	-0.001* (0.001)	-0.001** (0.001)	-0.002** (0.001)	-0.002** (0.001)	-0.003** (0.001)
R^2	0.108	0.085	0.137	0.102	0.084	0.117
Dep. Mean	0.036	0.023	0.052	0.038	0.023	0.026
Observations	228523	98817	79978	35906	9525	4297

Notes: Dependent variable is an indicator for whether a person migrated in the last year. Landless are households with no land, and marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. The vector of controls includes the marital status of the migrant, age, gender, average education of the household, number of working males, number of working females, number of children in the household, household size, caste group, religion, and whether the household has a job card. The controls also include rainfall for each village and survey year. In addition, we control for time-invariant pre-treatment village-level characteristics, such as distance to the nearest town, access to the local market, distance to the district headquarters, and the log of population and schools, constructed from the 2001 Census and REDS 1999, interacted with year. District fixed effects are included throughout, and standard errors clustered at the village level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Cross-Sectional Correlates of Migration and Household Level NREGS Participation

	(1) All	(2) Landless	(3) Marginal	(4) Small	Medium	Large
HH NREGS	-0.013*** (0.003)	-0.010*** (0.003)	-0.015*** (0.004)	-0.017*** (0.006)	-0.019** (0.007)	0.021 (0.025)
R^2	0.113	0.091	0.141	0.109	0.112	0.135
Dep. Mean	0.036	0.023	0.052	0.038	0.023	0.026
Observations	228523	98817	79978	35906	9525	4297

Notes: Dependent variable is an indicator for whether a person migrated in the last year. Landless are households with no land, and marginal, small, medium, and large farmers are defined as owning less than 2.5 acres, 2.5–5 acres, 5–10 acres, and more than 10 acres, respectively. HH NREGS is a dummy for household if any member of household participated in NREGS. The vector of controls includes the marital status of the migrant, age, gender, average education of the household, number of working males, number of working females, number of children in the household, household size, caste group, religion, and whether the household has a job card. The controls also include rainfall for each village and survey year. In addition, we control for time-invariant pre-treatment village-level characteristics, such as distance to the nearest town, access to the local market, distance to the district headquarters, and the log of population and schools, constructed from the 2001 Census and REDS 1999, interacted with year. District fixed effects are included throughout, and standard errors clustered at the village level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: Comparison of NSS 2007–08 and REDS 2007–08 Summary Statistics

	NSS 2007–08		REDS 2007–08
	All States	Restricted States	
<i>Social Group</i>			
SC	14.87	16.68	16.50
ST	16.48	9.98	8.11
OBC	39.34	43.57	46.63
Others	29.29	29.75	28.76
<i>Religion</i>			
Hindu	78.75	85.54	88.68
Muslim	9.92	9.09	5.96
Others	11.34	5.38	5.36
<i>Household Characteristics</i>			
Household Size	5.26	5.29	5.16
Male Head	90.67	90.55	89.39
Age of HHH	47.93	48.01	50.54
Married Head	88.04	88.02	86.48
<i>Education of Head of Household</i>			
No school	31.52	33.90	39.24
Below Primary	13.03	12.23	10.08
Up to Primary	14.17	14.12	12.46
Secondary	34.06	33.13	32.70
College	7.22	6.63	5.52
<i>Land Possession</i>			
Land ≤ 1 HA	61.15	59.47	58.34
Land >1 & ≤ 4	31.05	31.31	31.44
Land >4	7.77	9.18	10.22

Notes: Authors own calculation. Second column from NSS only restrict the data for States that were covered in REDS. These states are Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa (Odisha), Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. NSS data s restricted only to rural India.