

Impact of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) on Agriculture

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Abstract

This paper is motivated by concerns about potential adverse impacts of the MGNREGA on agriculture; acting by bidding up the price of labour, leading to its scarcity, and thereby inducing shifts in cropping patterns. First, a district level panel dataset is used to study impacts of the scheme on gross irrigated area, agricultural wages, cropping patterns and crop yields. Next, unit-record data from the Employment Unemployment Surveys are used to estimate impacts on time spent across various employment categories and on casual wages. A unique contribution of our paper is that it compares two sets of impacts: impact on poorer districts (Phase 1 and 2 districts) under partial implementation of the scheme with richer districts (Phase 3 districts) under full implementation. Identification is achieved using a difference-in-differences method. We also report the pre-programme trends for each impact variable, to provide a check on the validity of the use of difference-in-difference method.

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Keywords: MGNREGA, Irrigation, Cropping Patterns, Crop Yields, Wages, Employment

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1. Introduction

The Mahatma Gandhi National Rural Employment Guarantee Act (hereafter referred to as MGNREGA or Scheme), enacted by the Central Government of India in September 2005, provides a legal guarantee of one hundred days of employment per year in unskilled works to each rural household. Although livelihood security for rural households is its main objective, it also envisages the creation and maintenance of rural infrastructure, with a significant focus on agriculture (GOI 2005). The scheme was initially implemented in February 2006 in the poorest 200 districts, termed the 'Phase 1' districts; it was extended to another 130 'Phase 2' districts in April 2007; and in April 2008 it was implemented in the remaining 'Phase 3' districts as well.²

Since its implementation, concerns have been voiced that MGNREGA is affecting agriculture adversely by bidding up agricultural wages, and causing farmers to switch to less labour intensive crops or to quit agriculture altogether (Rangarajan, Kaul and Seema 2011; Jakhar 2012).³ If these concerns are true, then, all else remaining the same, labour use in agriculture should be declining. However, given that irrigation accounts for a significant share of the works undertaken under MGNREGA, it is also reasonable to expect that cropping patterns may be shifting toward more water-intensive crops that typically also demand more labour. Therefore, the net effect of MGNREGA on labour use in agriculture and on cropping patterns needs to be examined more closely. Although there have been several studies that have attempted to capture the impact of MGNREGA on a range of outcomes, including employment and wages (Azam 2012; Berg et al. 2012; Zimmermann 2013; Imbert and Papp 2014), income (Jha, Gaiha, and Pandey 2009), consumption (Ravi and Engler, 2013), welfare (Deininger and Liu 2013; Imbert and Papp 2014), women's empowerment (Khera and Nayak 2009), and child health (Uppal 2009), there has been little attention paid thus far to the impact of the scheme on agriculture, (exceptions include Berg et al. 2012 and Mahajan 2014 on agricultural wages; and Bhargava 2014 on labour saving technology in agriculture). The present paper attempts to contribute to this literature with a specific focus on the impact of MGNREGA on outcomes in the agriculture sector.

² Some district boundaries were redrawn during this period, and new districts created. In February 2006, the total number of districts in the country was 612. This increased to 633 by April 2008. Care has been taken to account for these changes in the empirical analysis.

³ Rangarajan, Kaul, and Seema (2011) find that between 1999/2000 and 2004/5 about 19 million people were added to the agricultural work force, while between 2004/5 and 2009/10 about 21 million people moved out of it. They also note a greater fall in share of agricultural employment in the total work force between 2004/5 and 2009/10 as compared to 1999/2000 to 2004/05.

Since the scheme gives priority to construction of irrigation structures, it is reasonable to expect that the MGNREGA may have improved the availability of water for irrigation.⁴ Improved irrigation facilities may mean that farmers are able to cultivate a second crop in areas where second season crops were not normally cultivated (CSE 2008). Additionally, even if gross area under irrigation does not increase, increased water availability may result in a shift from low to high water intensive crops within the same season, or may translate into higher yields for existing crops. A direct impact of MGNREGA on agriculture may therefore be assessed by examining changes in gross irrigated area, in cropping patterns, and in crop yields.⁵

Independent of an impact through improvement in irrigation infrastructure, another channel through which MGNREGA may affect cropping patterns and crop yields is via its impact on agricultural wages. Given that agricultural wages are typically lower than the MGNREGA wage (MORD 2012), and that MGNREGA is a guaranteed employment scheme, it may result in increasing the bargaining power of hired labour, thereby raising their reservation wage. In fact, MGNREGA works are often carried out during the agricultural off-peak season so that labour use in agriculture during the peak season is not adversely affected due to higher wages.⁶ Even if MGNREGA works are confined to the off-peak season, the institution of a higher MGNREGA wage may still push up agricultural wages in the peak season by setting a new floor for what is considered as an acceptable minimum wage. Besides, the MGNREGA may directly compete with agricultural activities in the peak season because of inappropriate timing of implementation of MGNREGA works, and may thus lead to an increase in agricultural wages in the peak season. In either event, the upward pressure on agricultural wages may result in changes in cropping patterns and a shift toward less labor-intensive crops in one or both seasons.

⁴The scheme focuses on the following works in order of their priority; water conservation and water harvesting, drought proofing (including afforestation and tree plantation), irrigation canals including micro and macro irrigation works, provision of irrigation facility to land owned by Scheduled Castes and Scheduled Tribes (SC/STs), renovation of traditional water bodies including de-silting of tanks, land development, flood control and protection works including drainage in water logged areas and rural connectivity (GOI 2005).

⁵ It would also be useful to look at the impact of MGNREGA on volume of water for irrigation, as this may be a mechanism via which yields are affected. However, we are unable to study this as to the best of our knowledge data on irrigation volumes is not available.

⁶Agricultural peak season refers to the period when sowing, transplanting, and harvesting are carried out and consequently, labour demand is high. Appendix table A.1. presents the season wise distribution of time shares for casual labour employment across sectors. The table lists states according to successful MGNREGA implementation and reveals the counter-seasonality of public works in states that have better implementation: Time spent in public works is higher in the Dry season (January through June), compared to the Rainy season (July through December). The Dry and Rainy seasons, roughly correspond to off-peak and peak agricultural seasons.

The first objective of this paper is thus to evaluate whether MGNREGA has engendered changes in gross irrigated area, wages in agriculture, cropping patterns and crop yields. We view the first two of these, namely, gross irrigated area and agricultural wages, as potential channels through which the scheme may ultimately affect cropping patterns and crop yields. In particular, the paper examines whether farmers are shifting to crops with lower labour and/or higher water requirements, and also whether crop yields have improved as a consequence of the MGNREGA.

The second objective of this paper is to assess the impact of MGNREGA on employment and wages, disaggregating between sectors (agriculture and non-agriculture), and between gender. When studying employment we also disaggregate between types of labour contract (casual, regular/salaried, and self-employed).⁷ Given that MGNREGA offers unskilled manual work on a voluntary basis, a priori we do not expect regular wages to be affected by MGNREGA. We therefore restrict our analysis to studying the impact on casual wages only, and do not look at wages earned in the regular/salaried sector.

Much of the literature that has considered labour market outcomes thus far has focused on private sector employment as a whole, aggregating over agricultural and non-agricultural employment, and also across contract types. A more detailed analysis focusing on employment in agriculture, and specifically on casual labour employment within agriculture, is warranted for several reasons. For instance, as noted above, to the extent that improvement in irrigation leads to changes in cropping patterns and to cultivation of additional of more water intensive crops, this in turn has implications for agricultural labour demand. It is possible that by only looking at employment in the private sector as a whole any change in composition within private employment between agriculture and non-agriculture may not be discerned. Furthermore, unlike labour use in non-agriculture, agricultural labour use by its very nature is seasonal and more likely to benefit from the consumption smoothing opportunities offered by MGNREGA. Also, since, typically, non-agricultural wages are higher than agricultural wages and MGNREGA wages, those working in the non-agricultural sector are less likely to offer themselves for public works employment.⁸ For these reasons, it is reasonable to believe that MGNREGA might have a

⁷ Casual wage labour is a person casually engaged in others farm or non-farm enterprises and getting in return wage according to the terms of the daily or periodic work contract, while regular salaried/wage employees are persons working in others farm or non-farm enterprises and getting in return salary or wages on a regular basis, but not on the basis of daily or periodic renewal of work contract (NSSO 2006).

⁸ Table 11A, shows that for Phase 1 and 2 districts in 2007/8, a period when MGNREGA had been implemented in these districts, wages for males in non-agriculture are higher than wages in both agriculture and in public works (which includes MGNREGA work).

greater impact on labour use in agriculture, and only a limited impact on labour use in non-agriculture. It is therefore important to study them separately.

Looking at different contract types within agriculture, compared to regular salaried and to self-employed with well-established enterprises, casual laborer, self-employment (with petty businesses) are most likely to be impacted given the self-targeted nature of the MGNREGA. Those who are in regular/ salaried jobs, or those who have a large enough asset base (for example, farmers with mid- to large-sized holdings who work on their own farms), are unlikely to offer themselves for short-term employment offered under the scheme. Hence it is also important to distinguish between contract types when studying the impact of the scheme.

The MGNREGA is also likely to have differentiated impact by gender. There are several reasons to expect that, compared to men, the scheme may disproportionately increase the labour force participation by women. First, labour force participation rates for women are very low in India.⁹ Further, the Act mandates that at least one-third of employment be accounted for by women. It also provides for crèche facilities at each worksite so that women with young children can participate. Finally, women who are reluctant to travel outside their village in search of employment because of social taboos can now find opportunities locally. Compared to men, therefore, these features may draw in a larger proportion of women into the labour market who were otherwise engaged in domestic duties or were otherwise not in the labour force. With men the draw in from those who are not in the labour force is likely to be weaker: any switch to MGNREGA employment could equally come from within the labour force: Those who were either unemployed or working in other sectors. Correspondingly, there may be a greater impact on female casual wage. We therefore specifically look at impact of MGNREGA on female labour use and female casual wage rates.

The conceptual framework and empirical strategy employed in this paper extends that set out in Azam (2012) and Imbert and Papp (2014). The empirical strategy exploits the phase wise roll out of MGNREGA and uses a Difference-in-Differences, DID, framework to estimate the causal effect of the MGNREGA on the various outcome indicators. As noted above, while in 2004/5 MGNREGA had not been implemented anywhere in the country, by 2007/8 implementation had been completed in the

⁹In 2004/5, labour force participation rate for males in rural India was 545 persons per thousand persons, while the corresponding figure for females was 287 (NSSO 2006).

Phase 1 and 2 districts.¹⁰ By 2009/10 the scheme had been effectively rolled out in all districts, including in Phase 3 districts.¹¹ The roll out was not random across districts: As first noted by Gupta (2006), the Phase 1 and 2 districts were characterized by lower agricultural productivity, higher share of Scheduled Castes, SC, and Scheduled Tribes, ST, and lower agricultural wages. As we explain in the empirical strategy section, it is important to account for this non-random selection when estimating the causal impacts of the scheme.

Motivated by the phase wise roll out of the scheme across vastly distinct geographies, two sets of impacts are estimated in this paper. The first of these, termed as the *impact on Phase 1 and 2 districts under partial implementation*, assesses the initial impact of MGNREGA on the Phase 1 and 2 districts at a time when the scheme had yet to be rolled out in the Phase 3 districts. This set of impacts is estimated by looking at outcomes in 2004/5 and in 2007/8 for Phase 1 and 2 districts, and comparing the change over this period relative to the change over the same period in Phase 3 districts. Note that Phase 3 districts, which act as the control districts, did not have MGNREGA in either comparison year; hence the term 'partial implementation' is used. The second set of impacts assesses whether the same effects, both in magnitude and direction, are observed in the richer Phase 3 districts once these districts had also been covered under the scheme. This is termed as the *impact on Phase 3 districts under full implementation*. It is obtained by looking at outcomes in 2007/8 and in 2011/12 for Phase 3 districts, and comparing the change over this period relative to the change over the same period in Phase 1 and 2 districts. Note that Phase 1 and 2 districts act as the control districts in this case, and unlike in the previous set of impacts, these districts had the scheme in both comparison years; hence the term 'full implementation'. It is important to note the difference between the partial and the full regimes: In case of partial implementation the control districts do not have the program in either comparison year, while in case of full implementation the control districts have the program in both comparison years. Differences, if found, between these two sets of impacts, namely, Phase 1 and 2 under partial implementation and Phase 3 under full implementation, may be attributed either to the differences in the socio-economic conditions between Phase 1 and 2 districts and Phase 3 districts, or to the partial versus full roll out of the scheme.

¹⁰2004/5 refers to the agricultural year which begins in July 2004 and extends till June 2005. Unless noted otherwise, this reference is to be adopted for other years as well.

¹¹Although implementation of the MGNREGA in Phase 3 districts was officially initiated in April 2008, as noted in Imbert and Papp (2014), effective employment creation is likely to have been weak in the initial months since implementation. Therefore, in the empirical analysis, Phase 3 districts are assumed to be immune to the scheme in the last three months of 2007/8.

The DID estimator relies on the assumption of invariance of changes over time across treatment and control regions in the absence of program implementation. In case of an evaluation of MGNREGA, it is likely that this assumption might not be met because the districts that first received the scheme were not randomly selected and may therefore be on different growth trajectories. We therefore examine pre-programme changes in each outcome over the period 1999/2000 and 2004/5.

The paper extends the existing literature in several ways. The first is its comprehensive focus on agricultural outcomes—including area under irrigation, cropping patterns, crop yields, as well as casual labour market outcomes within agriculture. Second, we examine labour market outcomes by gender, and thus contribute to the relatively limited evidence that does so. Finally, the estimation of two different sets of impacts, comparisons across which show whether geography and scale of program implementation matter.

The rest of the paper is organized as follows. The second section presents a brief literature review. The third section describes the datasets used in this paper and provides a ranking of states according to successful MGNREGA implementation. This ranking is used to select the top three states, in order to provide separate impact estimates for them. The fourth section presents the empirical strategy. The fifth section presents summary statistics followed by causal impact results for our first set of outcome variables, namely, gross irrigated area, agricultural wages, cropping patterns and crop yields, using a district level dataset. The sixth section does the same for our second set of outcomes variables, namely, ten mutually exclusive and exhaustive employment categories and casual wages, using an individual level dataset.¹² The final section presents the main conclusions.

¹² We study wages from two different datasets. The first, namely, agricultural wage at the district level does not distinguish between contract types; it is an average wage paid to unskilled labour employed in agriculture. The second, namely, casual wage in agriculture at the individual level is restricted to wages paid to persons according to the terms of a daily or a periodic (but not regular) work contract. It excludes wages paid to labour engaged in agriculture but paid on a regular basis.

2. Literature Review

We present the literature in two sub-sections corresponding to two sets of outcome variables. Given the vast literature in the area, the review is necessarily restricted.

2.1. Irrigation, Cropping Patterns and Crop Yields

Since there are relatively few rigorous evaluations that examine the *causal* impact of MGNREGA on agricultural outcomes. This review includes studies that have looked at these outcomes using other methodologies as well.

Kareemulla et al. (2009) study six villages of Anantpur district in Andhra Pradesh. They find that only about 25 percent of the ponds that were taken up under MGNREGA were being utilized for irrigation; the main reason for such low utilization was that there was no provision of channeling water to the farm plots. They note however that the investment in ponds was helping in recharging ground water IIFM (2010) look at five districts of Madhya Pradesh and finds a substantial increase in irrigated area as a consequence of the irrigation structures built through the MGNREGA.

Tiwari et al. (2011) study irrigation and land development assets created under MGNREGA in Chitradurga district of Karnataka. They report a significant improvement in ground water level in three out of the six study villages, and an increase in total cropped area where land development works were undertaken through MGNREGA.

Verma and Shah (2012) examine the potential of the irrigation assets constructed through MGNREGA in Bihar, Gujarat, Rajasthan and Kerala for the year 2009/10. Using cost benefit analysis the study finds that 80 percent of the assets created recovered their investment in the first year itself.

A study undertaken by the Indian Institute of Science (2013) finds a significant improvement in ground water levels and irrigation facilities for farmers as a consequence of MGNREGA in Andhra Pradesh, Karnataka, Madhya Pradesh and Rajasthan.

Comparatively little evidence is available on the effect of the scheme on cropping patterns and crop yields. CSE (2008) examines the impact of MGNREGA on irrigation and cropping patterns in a single district each of Orissa and Madhya Pradesh. The study finds that respondents reported an improvement in irrigation in Madhya Pradesh, and a change in cropping patterns as a result, but this was not the case in Orissa.

Aggarwal, Gupta, and Kumar (2012) evaluate cultivation costs, profits, and cropping intensity arising from wells constructed under MGNREGA. Their analysis, based on a gram panchayat of Ranchi district in Jharkhand, shows that improved irrigation led to multiple cropping and higher yields of crops.

2.2. Employment and Wages

There have been several rigorous impact evaluations that examine the effect of the scheme on employment and wages; of these only a few of the more relevant studies are reviewed here.

Azam (2012) examines the impact of MGNREGA on labour force participation and on participation in public works. His was one of the first papers to use the phase wise roll out of the MGNREGA to identify causal impacts using a DID estimator. He finds a positive impact of the scheme on labour force participation, and also notes that this was driven mainly through an increase in female participation. He also finds an increase in participation in public works in Phase 1 and 2 districts, but the magnitude is modest: MGNREGA led to a 2.5 percentage point increase in the probability of engaging in public works where in Phase 1 and 2 districts in 2004/5.

Imbert and Papp (2014) examine the impact of MGNREGA on employment in public and private works. While they also use the DID strategy to estimate causal impacts, in contrast to Azam's study, they examine the impact of the scheme on the *composition* of employment between public and private works, and also disaggregate the analysis by season. They find a 1.04 percentage points increase in the fraction of days spent in public works during the Dry season (defined as being from January to June), and a decline of 1.23 percentage points in private work in the same season. They interpret this finding as evidence to suggest that private sector employment is being substituted by public works employment in the Dry season. In the Rainy season (defined as being from July to December), they do not find any significant difference in employment in either the private or the public sector. While Imbert and Papp disaggregate the labour market into private and public sectors, they do not further disaggregate the private sector into agriculture and non-agriculture, nor do they examine casual labour separately. Also, in terms of methodology, although they have several time-varying (household and district-specific) controls, they do not account for differential time trends that may exist across agro-ecological zones.

Zimmermann (2013) examines the impact of MGNREGA on private casual wage employment, public works employment and self-employment using unit record data for 2007/8, and adopting a regression discontinuity approach. Her findings suggest that MGNREGA has had an insignificant effect on public

works employment. She also finds evidence that suggests that people moved out of private casual wage employment into self-employment due to the MGNREGA.

As for wages, Azam (2012), Berg et al. (2012) and Imbert and Papp (2014) all suggest that the scheme has had a positive effect on casual wages. Azam (2012) reports a 5 percent increase in casual wages over the period 2004/5 to 2007/8, mainly driven by female wages: An 8 percent increase in wages for females as compared to the 1 percent increase for males. For the same period, Imbert and Papp (2014) report a 4.7 percent increase in casual wages in the dry season and an insignificant change in the rainy season. Once again using a DID strategy, but using monthly data for the period 2000 to 2011, Berg et al. (2012) find that MGNREGA raised casual wages in agriculture by 5.3 percent. Thus all three studies find that MGNREGA led to an increase in casual wages, and the magnitude of increase is comparable across these studies. Zimmerman (2013) finds no impact on private casual wages. However, when disaggregating by gender, she finds that the MGNREGA had an insignificant impact on wages for women.

3. Datasets and Selection of States

For the first objective, which evaluates changes in gross irrigated area, agricultural wages, cropping patterns and crop yields, we construct a *district-level* dataset for the years 2000/1 through 2009/10. We refer to this as the crop-wage dataset. This dataset was collated from a large number of sources, not all of which are readily available in the public domain. While it is meaningful to undertake the analysis of gross irrigated area and agricultural wages at the all-India level, for examining the impact on cropping patterns and crop yields, is evaluated at the state-season level. This is because, given the diversity in agro climatic conditions across the country, and across seasons within a state, identification of competing crops is more meaningful within a state-season strata. This is done for top three states in terms of successful MGNREGA implementation, and is done at the state-season level.

For the second objective, which examines changes in employment and casual wages, we use *unit record* data at the individual level from four rounds of the National Sample Survey Organization's Employment-Unemployment Surveys, corresponding to the years 1999/2000, 2004/5, 2007/8 and 2011/2. We refer to this as the EUS dataset. Construction and definition of variables for both the datasets are explained in Appendix B.

In the paper we use two different, but related, characterisations of seasons within an agricultural year. When discussing impacts on employment and wages we divide the year into the Dry and Rainy seasons.

The Dry season refers to the months from January through June, while the Rainy season from July through December. When discussing impacts on cropping patterns and crop yields, we change terminology and talk about seasons in terms of the Kharif and the Rabi. Although the exact months comprising the Kharif and Rabi seasons vary by state and by crop, in most parts of India, sowing for the Kharif crops begins in July, and harvesting is done by October or November. Sowing for the Rabi crops begins in mid-November, and harvesting is completed by April or May. Thus, the Rainy season roughly corresponds to the agricultural peak season because in most states it includes the sowing and harvesting of Kharif crops, and the sowing of Rabi crops, all of which are highly labour intensive. On the other hand the Dry season may be considered as the agricultural off-peak season as the only labour intensive operation during this period is the harvesting of Rabi crops.

3.1 Ranking of States according to MGNREGA Implementation

Dutta et al. (2012), and Liu and Barret (2013), find substantial interstate variation in the implementation of the MGNREGA. Liu and Barret (2013) find effective targeting in only about half of all the Indian states. It is possible that effects are more pronounced, these may be seen when we focus on only the states that have more successfully implemented the scheme than at the all India level.

The selection of the top three states is based on a composite index, CI, defined as the product of intensity, I, and coverage, C, of MGNREGA. For each state, intensity is the average (over participating households) of the number of days of employment in a year provided to each household. Coverage is the share of total households in rural areas that obtained employment through the MGNREGA. The composite index, CI, for a given year is therefore defined as:

$$CI_t = \frac{\sum_i P_{ti} \sum_i H_{ti}}{\sum_i H_{ti} \sum_i R_{ti}}$$

where t denotes the year (either 2008/9 or 2009/10),¹³ and i denotes the household. P denotes the number of person-days that household i worked in MGNREGA conditional on its participation in the scheme at time t. H is a participation dummy and takes the value 1 if the household i worked in MGNREGA at time t, else it takes the value 0. Similarly, R is a dummy for rural household. The final composite index for a state is the average of the composite indices for the two years, 2008/9 and 2009/10.

¹³ Annual data for construction of the index refers to the financial year from April to March.

Table 1 presents the ranking of states based on this composite index. For the country as a whole, for the years 2008/9 and 2009/10, conditional on participation in the scheme, the average number of person-days of employment generated through MGNREGA per rural household per year is about 50. Further, 33 percent of the rural households participated in the scheme.¹⁴ The top performing states in terms of MGNREGA implementation are Rajasthan, Andhra Pradesh, and Madhya Pradesh, which had intensity figures of 57, 34 and 33, respectively, and coverage rates of 79, 56 and 60 percent, respectively.

4. Empirical Strategy

As noted in the introduction, the empirical strategy exploits the phase wise roll out of the MGNREGA to compute the Difference-in-Differences, DID, estimates of impact, as has been done in several other papers, notably Azam (2012) and Imbert and Papp (2014). This section explains each of the two sets of impact estimates. In our explanations we present the empirical specifications in the context of regressions run using EUS data. Similar specifications, with minor modifications, were used when using the crop-wage data.¹⁵

4.1. Impact on Phase 1 and 2 districts under Partial Implementation

The impact on Phase 1 and 2 districts under partial implementation, assesses the initial impact of MGNREGA on the Phase 1 and 2 districts over the period 2004/5 to 2007/8, a period when the scheme had not yet been implemented in the Phase 3 districts.

The DID framework allows us to identify impact under the maintained hypothesis that, conditional on covariates, there is no difference in time trends between Phase 1 and 2 and Phase 3 districts in the absence of the scheme. As noted earlier, these two sets of districts differed in their socio-economics characteristics even before MGNREGA was implemented anywhere in the country. Appendix table A2 also confirms this: In 2004/5, compared to Phase 3 districts, Phase 1 and 2 districts have a larger share of less educated individuals, larger share of SC/ST households, receive higher rainfall in the rainy season and have lower urban wages. It is therefore not immediately obvious that the trends over time across

¹⁴ Overall, our ranking compares well with that of Dutta et al. (2012) who provide estimates of unmet demand in the MGNREGA.

¹⁵ The earliest year for EUS specifications is 1999/2000, whereas for the crop-wage dataset it is 2000/1. Thus, in all specifications discussed subsequently in this section, wherever 1999/2000 has been mentioned for specifications using EUS, it was replaced by 2000/1 for specifications using the crop-wage dataset. Similarly, the latest year for EUS specifications is 2011/2, whereas for the crop-wage dataset it is 2009/10.

these two sets of districts would have been the same before MGNREGA was ever implemented. Therefore, for each outcome variable, we examine the data for the pre-MGNREGA years, 1999/2000 and 2004/5, to check whether changes over these years were significantly different across the two sets of districts. The impact on Phase 1 and 2 districts under partial implementation is given by the following equation:

$$Y_{idst} = \alpha_0 + \alpha_1(T07_t * Phase1\&2_d) + \sum_{k=1, \dots, 5} \alpha_{2s}(T07_t * AEZk_s) + \alpha_3 X_{idst} + \alpha_4 Z_{dt} + \{\mu_d\} + \varepsilon_{idst}$$

Equation 1

Where i stands for individual, d for district, s for Agro Ecological Zone, AEZ, and t for year. In this specification, t is either 2004/5 or 2007/8.

When studying outcomes from the EUS dataset, Y stands for one of the following outcome variables:

- (a) Time share in one of the ten employment categories listed in section B2 of appendix B. For each category, Y is a value between 0 and 1, and captures the fraction of time spent in that category during the reference week.¹⁶
- (b) Logarithm of casual wage in agriculture (and separately in non-agriculture).

When using the crop-wage dataset, Y stands for one of the following:¹⁷

- (a) Logarithm of share of gross irrigated area in total cropped area.
- (b) Logarithm of agricultural wage
- (c) Share of crop acreage in total cropped area¹⁸
- (d) Logarithm of crop yield

The right hand side variables are as follows:

- (a) $T07$ is a dummy variable for the year 2007/8.
- (b) $Phase1\&2$ is a dummy variable for whether the district is a Phase 1 or a Phase 2 district.

¹⁶ For example, if in the reference week of 7 days, a person spends 4.5 days as casual labour in agriculture and 2.5 days in domestic work, then Y takes values 0.64 and 0.36 for these two categories, respectively, and it takes the value 0 for all other categories. Note that this outcome variable is not in logarithms as for a given individual many of the categories take the value 0.

¹⁷ In specifications for the crop-wage dataset, the subscript i is not applicable as the unit of observation is a district and not an individual.

¹⁸ Again, this variable is not in logarithms because even within a state-season strata, there are several districts which do not grow a particular major crop and therefore have 0 values for those crops.

(c) $\{AEZ_k\}$ is a set of dummy variables, one for each of the five Agro Ecological Zones in India: Coastal, Arid, Hills, Irrigated, and Rain fed (Saxena, Pal, and Joshi 2001). The interaction between year and zone dummies allows for different time trends in each AEZ. The motivation in including AEZ-specific time trends is that there is a greater likelihood of meeting the common time trend assumption in the two sets of districts after allowing for different trends across AEZs.¹⁹

(d) X stands for individual covariates included to increase precision of causal estimates.²⁰ These include a dummy for whether the individual is SC/ST, age, age squared, and a set of education dummies.

(e) Z stands for time varying controls at the district level. It includes seasonal or annual rainfall.²¹ To account more fully, but admittedly, not completely, for the possible impact of migration induced by exogenous changes in surrounding urban areas of a district, we also include average casual wage prevailing in urban areas of the district.²²

(f) μ is a set of district fixed effects and ϵ is the error term.

In the absence of a significant difference in change in the outcome over the period from 1999/2000 to 2004/5 (pre-programme period) between the two sets of districts, α_1 is the DID impact estimator for Phase 1 and 2 districts under partial implementation. Robust standard errors, clustered at the district-year level, are used in this and all other specifications mentioned in this section.

4.2 Impact on Phase 3 Districts under Full Implementation

The impact on Phase 3 under full implementation assesses the impact on Phase 3 districts over the period from 2007/8 to 2011/12, a period, throughout which, MGNREGA was already present in Phase 1 and 2 districts.²³

The impact on Phase 3 districts under full implementation is given by the following equation :

¹⁹ For the two outcomes analysed at the state-season level, namely, share of crop acreage in total cropped area and crop yield, AEZs are replaced by Agro Ecological Zone Production Systems (AEZPSs). Each AEZPS is a homogenous group of districts with similar cropping pattern that falls within a single AEZ (Saxena, Pal, and Joshi 2001).

²⁰ There are no X (individual) controls for specifications using the crop-wage dataset as the data is at the district level.

²¹ For the Dry season, the rainfall is computed as the cumulative rainfall over the months from January to May. For the Rainy season, rainfall over the months June to December. The Dry season rainfall is used in specifications for the Kharif season, and the Rainy season rainfall for the Rabi season.

²² For the agricultural wage outcome in the crop-wage dataset, Z also includes the proportion of SC/ST population and the literacy rate, both at the district level.

²³ For impact on Phase 3 under full using the crop-wage dataset the period of study is from 2007/8 to 2009/10.

$$Y_{idst} = \gamma_0 + \gamma_1(T11_t * Phase3_d) + \sum_{k=1, \dots, 5} \gamma_{2s}(T11_t * AEZk_s) \\ + \gamma_3 X_{idst} + \gamma_4 Z_{dt} + \{\mu_d\} + \varphi_{idst}$$

Equation 2

where the subscripts are as defined in Equation 1. In this specification, t is either 2007/8 or 2011/2. $T11$ is a dummy variable for the year 2011/12, and $Phase3$ is a dummy variable for Phase 3 districts. All other variables are similarly defined as in Equation 1.

In the absence of a significant difference in change in the outcome over the period from 1999/2000 to 2004/5 (pre-programme period) between the two sets of districts, γ_1 is the DID impact estimator for Phase 3 districts under full implementation.

Another, confounding issue is that intensity of implementation of the scheme in Phase 1 and 2 districts could itself vary in moving from 2007/8 to 2011/12. This would also confound the effect of the scheme on Phase 3 districts under full implementation.

5. Impact on Gross Irrigated Area, Agricultural Wages, Cropping Patterns and Crop Yields using Crop-wage dataset

Before we present the impact estimates for MGNREGA, we discuss some results based on panel data analysis to examine time trends over the decade from 2000/1 through 2009/10.

5.1 Summary statistics using crop-wage data:

In addition to providing statistics on averages for each of the outcomes for the three years, 2004/5 (no MGNREGA anywhere in the country), 2007/8 (MGNREGA only in Phase 1 and 2 districts) and 2009/10 (MGNREGA in all districts), we also compute time trends in these outcomes, comparing MGNREGA districts with on-MGNREGA districts using a time series from 2000/1 through 2009/10 available from the crop-wage dataset. To compute time trends, we employ the following specification:

$$Y_{dt} = \lambda_0 + \lambda_1 T_t + \lambda_2 MGNREGA_{dt} + \lambda_3 MGNREGA_{dt} * T_t + \{\mu_d\} + \vartheta_{dt}$$

Equation 3

Where d stands for district and t for year. Y is one of the outcome variables discussed earlier for the crop-wage dataset; T takes values 1, 2, ..., 10 and indexes years from 2000/1 to 2009/10,

respectively.²⁴ MGNREGA is a dummy that takes value 1 if MGNREGA had been implemented in district d in year t , and 0 otherwise. Note that this definition of the MGNREGA dummy is different from the Phase 1 and 2, and Phase 3, dummies used in earlier equations. It neither stands for Phase 1 and 2 districts nor for Phase 3 districts, but gets its value depending on the year in which the scheme was actually implemented in a particular district. As before, $\{\mu_d\}$ is the set of district fixed effects. λ_1 captures the average time trend in the outcome variable common to all districts in the absence of the scheme (non-MGNREGA districts). $\lambda_1 + \lambda_3$ captures the average time trend in districts that have the scheme (MGNREGA districts). These trends in outcome variables are not vested with any causal interpretation, but are useful nonetheless as they provide the context within which to interpret the causal impact estimates, presented next.

Panel A of table 2 presents the average share of gross irrigated area in total cropped area. As expected, in 2004/5, the average share of gross irrigated area in Phase 1 and 2 districts is lower than that in Phase 3 districts by 10 percentage points. *A priori*, this strengthens the rationale to use a DID approach to estimate impacts, rather than a single cross-sectional comparison of the two sets of districts. This difference in the share of gross irrigated area in total cropped area across the two sets of districts is maintained in subsequent years as well. It is interesting to note that the difference continues to persist in 2009/10 even when the scheme has been fully implemented in the country. Panel B of table 2 presents estimates of growth rate of share of gross irrigated area in total cropped area for MGNREGA and non-MGNREGA districts. For India as a whole (the 19 states listed in table 1), over the period from 2000/1 to 2009/10, the share of gross irrigated area in total cropped area grew at a positive rate in the non-MGNREGA districts, but there was no growth in the MGNREGA districts: the point estimate although positive for MGNREGA districts, is not statistically significant. However, there is no statistically significant difference in rates of growth between the two sets of districts. In the top 3 states, namely, Rajasthan, Andhra Pradesh and Madhya Pradesh, we see a similar picture: While there was a positive growth of 3.7 percent per year in the share of gross irrigated area in total cropped area in the non-MGNREGA districts, there was no growth in the MGNREGA districts, however, unlike for all-India, the difference between the two sets of districts is statistically significant for the top 3 states. This is contrary to expectation given that improvement in irrigation infrastructure is one of the main works undertaken under the scheme. However, as noted earlier these growth rates are summary trends and are not to be

²⁴ We also experimented with formulations which include a quadratic in time, but do not report the results as they are qualitatively similar to those presented here.

interpreted as the impact of the scheme. Other differences between MGNREGA and non-MGNREGA districts could be driving these results.

Turning to real agricultural wages in table 3(panel A) we see that agricultural wages in Phase 1 and 2 districts were lower than those in Phase 3 districts, in all three years: This is true for both men and women, and in both the Dry and the Rainy seasons: the difference ranges from 7 to 16 rupees per day (in 2004/5 prices). In panel B, over the period from 2000/1 to 2009/10, real agricultural wages grew at a faster rate in MGNREGA districts compared to non-MGNREGA districts, for both genders and in both seasons. This is consistent with the expectation that the minimum wages guaranteed under MGNREGA pushed up agricultural wages for casual labour, although, as noted above, we do not ascribe a causal interpretation to these time trends as there could be other factors driving the faster growth in agricultural wages in MGNREGA districts. A more nuanced picture is presented in section 5.3 which reports DID impact estimates.

For reasons explained in section 3, analysis of changes in cropping patterns is done at the state-season level. Panel A of table 4 presents the seasonal cropping patterns for each of the top 3 states identified earlier. It presents the crop shares in total cropped area, separately, for Phase 1 and 2 and for Phase 3 districts. Within a state-season, we restrict ourselves to studying the set of crops with the largest crop acreages that together cover at least 90 percent of total cropped area between 2000/1 and 2005/6. If the set of such crops is greater than five in number, then we restrict ourselves to top five crops. Crops shares for Phase 1 and 2 districts and Phase 3 districts are comparable in Rajasthan, while they are unfortunately somewhat different in Andhra Pradesh and Madhya Pradesh. This raises some concerns about whether cropping patterns are comparable across the two sets of districts in these two states.

Panel B of table 4 shows the difference in the changes in crop shares per year, expressed in percentage points (p.p.) between MGNREGA and non-MGNREGA districts. In Rajasthan, there was a greater increase (or smaller decrease) in the crop share of Jowar in MGNREGA districts compared to non-MGNREGA districts: crop share of Jowar increased (decreased) by 0.3 p.p. more (less) per year in MGNREGA districts compared to non-MGNREGA districts.²⁵ In the Rabi season, MGNREGA districts saw a greater

²⁵ A positive estimate for λ_3 in equation 5 does not always imply that there was an increase in that crop share in MGNREGA districts. For example, it is possible to have a positive estimate of λ_3 even when crop shares in both sets of districts were declining provided the decline was smaller in MGNREGA districts compared to non-MGNREGA districts. We will use the terminology of a 'greater increase' whenever λ_3 is positive, and a 'smaller increase' whenever λ_3 is negative. It is to be borne in mind that the 'increase' can itself be positive or negative.

increase in Mustard (5.9 p.p. higher) and Barley (0.7 p.p. higher), and a smaller increase in Wheat (6.6 p.p. lower).

In Andhra Pradesh, in the Kharif season, crop share of Cotton saw a greater increase in MGNREGA districts compared to non-MGNREGA districts (2.4 p.p. higher), while Paddy, the main Kharif crop in this state, saw a smaller increase in MGNREGA districts (1.4 p.p. lower). In the Rabi season, Groundnut saw greater increase in MGNREGA districts (0.5 p.p. higher), while Gram saw a smaller increase (1.5 p.p. lower).

In Madhya Pradesh, in the Kharif season, there is no difference in changes in crop shares between MGNREGA districts and non-MGNREGA districts. In the Rabi season, MGNREGA districts exhibit a greater increase in share of Mustard compared to non-MGNREGA districts (0.7 p.p. higher).

Table 5 presents summary statistics for crop yields for the same set of crops studied in table 4. Panel A shows that, as expected, crop yields are typically lower (or statistically no different) in Phase 1 and 2 districts compared to Phase 3 districts. Panel B shows the difference in growth rates per year of crop yields between MGNREGA and non-MGNREGA districts. In Rajasthan, in the Kharif season, growth rates in crop yield for all five major crops showed a smaller increase in MGNREGA districts compared to non-MGNREGA districts. In the Rabi season, this was true for gram, and there was no statistically significant difference in growth rates of crop yield for the other major crops.

In Andhra Pradesh, in the Kharif season, the growth rate in Arhar yield showed a smaller increase in MGNREGA districts compared to non-MGNREGA districts, while the increase in growth rates for other crops was identical for the two sets of districts. In the Rabi season, growth rate of Groundnut yield was lower in MGNREGA districts, while it was identical for other crops.

In Madhya Pradesh, in the Kharif season, the growth rates for yields of Soyabean, Maize and Jowar were higher in MGNREGA districts compared to non-MGNREGA districts, while they were identical for the remaining crops. In the Rabi season, growth rate for Mustard yield was higher in MGNREGA districts, while growth rates were identical for yields of other crops.

Thus, except for Madhya Pradesh, the trends in crop yields in Rajasthan and Andhra Pradesh suggest an adverse effect of MGNREGA on crop yields. Once again though, these trends are not to be interpreted as causal in nature. Next, we look at impact estimates for outcomes using the crop-wage dataset.

5.2. DID Estimates of impact on Gross Irrigated Area using Crop-Wage Data

Table 6 presents the impact estimates for the share of gross irrigated area in total cropped area.²⁶ We did not find evidence of different pre-programme changes between 2000/1 and 2004/5 in the share of gross irrigated area for the two sets of districts.

At the all-India level, we do not see any impact of MGNREGA on share of gross irrigated area in total cropped area. However, when we focus on the top 3 states, namely, Rajasthan, Andhra Pradesh and Madhya Pradesh, the picture changes.

In the top three states for Phase 1 and 2 districts under partial implementation, we find no impact of MGNREGA on share of gross irrigated area between 2004/5 and 2007/8. Thus, in spite of the heavy focus of the scheme on investment in water works, this does not manifest as an increase in gross irrigated when we look at the years soon after the scheme was started. For Phase 3 districts under full implementation between 2007/8 and 2009/10, we find that MGNREGA resulted in a smaller growth (lower by 12.7 p.p.) in the share of gross irrigated area in Phase 3 districts compared to Phase 1 and 2 districts. At first glance this result seems contrary to expectation. However, it can be explained if we believe that the effect of MGNREGA on gross irrigated area appears only with a lag. In other words we would see a negative coefficient if water works under the scheme are ineffective in increasing gross irrigated area initially, but improvements to existing infrastructure make these investments effective in raising gross irrigated area subsequently. As an example, ponds and water reservoirs get built, but the connecting channels to plots of land are only constructed later on (this is suggest by Kareemulla et al. 2009). If this is indeed the case, then from 2007/8 to 2009/10, when MGNREGA is being implemented for the first time in Phase 3 districts and is continuing in Phase 1 and 2 districts, the scheme would result in higher growth in gross irrigated area in Phase 1 and 2 districts relative to Phase 3 districts. None of these results preclude the possibility that MGNREGA may have improved the volume of water available for irrigation.

5.3 DID estimates of Impact on Agricultural Wages using Crop-Wage data

Table 7 presents estimates of impact on real agricultural wages, disaggregated by gender and by season. Once again, for agricultural wages we do not find evidence of pre-programme differences in time

²⁶In this discussion, we sometimes refer to share of gross irrigated area in total cropped area as simply the share of gross irrigated area.

changes between the two sets of districts and therefore use the conventional DID estimator to calculate impacts.

At the all-India level, we do not find evidence that agricultural wages were affected by the scheme.

Next, we discuss the impact of MGNREGA on the top 3 states, first in the Dry season and then in the Rainy season.

Dry Season: For Phase 1 and 2 districts under partial implementation, MGNREGA resulted in a higher growth rate of agricultural wages in Phase 1 and 2 districts compared to Phase 3 districts in the Dry season: Between 2004/5 to 2007/8 the growth rate in male agricultural wages in Phase 1 and 2 districts was 9 p.p. higher compared to Phase 3 districts, while it was 15.8 p.p. higher for female agricultural wages. Given gender inequality in wages in India (Singh and Meenakshi 2004), our study suggests that MGNREGA may be reducing male-female wage gap in agriculture.

For Phase 3 districts under full implementation, MGNREGA did not result in any difference in growth rates of agricultural wages between Phase 3 and Phase 1 and 2 districts between 2007/8 and 2009/10. This result seen in Phase 3 districts under full implementation is compatible with two alternative scenarios, both of which are plausible. It could arise if the scheme stabilized wages in Phase 1 and 2 districts (after an initial increase between 2004/5 and 2007/8), with no further increase between 2007/8 and 2009/10 in Phase 1 and 2 districts, and at the same time the scheme did not result in any increase in wages in Phase 3 districts between 2007/8 and 2009/10 (presumably because agricultural wage rates in Phase 3 districts were already higher than Phase 1 and 2 districts and also comparable to MGNREGA wages). Alternately, it could also arise if the scheme increased wages in both sets of districts at the same rate between 2007/8 and 2009/10 (that wages grew in Phase 3 districts over this period could be due to first time implementation of the scheme, and that they continued to increase in Phase 1 and 2 districts could be due to increased intensity of implementation of the scheme in Phase 1 and 2 districts).

Rainy Season: For Phase 1 and 2 districts under partial implementation, there was no impact in the Rainy season (female wages showed a greater growth in Phase 1 and 2 districts compared to Phase 3 districts at a 10 percent level of significance, l.o.s.). To the extent that the Rainy season largely coincides with the peak season of agricultural operations, this result allays concerns about MGNREGA leading to an increase in wages that may adversely affect male labour use in agriculture during the peak season. For

Phase 3 districts under full, our results show that in the Rainy season, MGNREGA did not result in any difference in growth rates of agricultural wages between the two sets of districts.

5.4 DID estimates of Impact on Cropping Patterns using Crop-Wage data

Tables 8A through 8C present the DID impact estimates for cropping patterns in each of the top three states, separately for Kharif and Rabi seasons. In the following paragraphs we discuss the impacts for each state separately, first for the Kharif season and then for the Rabi season. As pointed out earlier, the Kharif season roughly coincides with the Rainy season, while the Rabi season with the Dry season.

Rajasthan Kharif Season: Looking at the top five crops grown in the state during the Kharif season, it is clear that MGNREGA has had no impact on these crop acreages in Phase 1 and 2 districts under partial implementation. This is expected if one takes into account that for Phase 1 and 2 districts under partial equilibrium there was no impact either on agricultural wages in the Rainy season, or on gross irrigated area. For Phase 3 districts under full implementation, while there is no impact on four out of the five major crops, MGNREGA led to a greater increase in Jowar acreage in Phase 3 districts compared to Phase 1 and 2 districts: there is a 1.8 p.p. greater increase in Jowar cultivation in Phase 3 districts between 2007/8 and 2009/10. This increase in Jowar acreage cannot be explained through the wage channel as growth rates in wages between the two sets of districts were identical during this period. As seen in appendix table A3, relative to other main crops grown in Rajasthan in the Kharif season, Jowar is water intensive. Given that between 2007/8 and 2009/10 gross irrigated area in Phase 1 and 2 districts increased faster than in Phase 3 districts, it is puzzling to see an increase in Jowar acreage in Phase 3 districts. Perhaps, increase in volume of water maybe one explanation for this result.

Rajasthan Rabi Season: Turning to the Rabi season, for Phase 1 and 2 districts under partial implementation, MGNREGA adversely affected Wheat and Barley: Between 2004/5 and 2007/8, the scheme resulted in a 12 p.p. lower increase in Wheat and a 2.2 p.p. lower increase in Barley, in Phase 1 and 2 districts relative to Phase 3 districts. As seen in table A3, both these crops are highly labour intensive compared to other competing crops. We conjecture that crop acreage under Wheat and Barley may have been adversely impacted in Phase 1 and 2 districts due to the increase in agricultural wage rates in these districts in the Dry season. For Phase 3 districts under full implementation, MGNREGA resulted in a 7.5 p.p. lower increase in crop acreage of Gram in Phase 3 districts relative to Phase 1 and 2 districts, while it had no impact on crop shares of the three other major crops. Again as seen in table A3, Gram is not water intensive and at this point we are unable to explain this result.

Andhra Pradesh Kharif Season: During the Kharif season, for both sets of impact estimates, there is no evidence of MGNREGA affecting shares of major crops, including Paddy.

Andhra Pradesh Rabi Season: In the Rabi season also, except for an impact on Ground nut for Phase 3 under full, there is no evidence of the scheme affecting other crop shares. Crop acreage under Ground nut increased by 2.6 p.p. more in Phase 3 districts relative to Phase 1 and 2 districts over the period 2007/8 to 2009/10. Overall, we find no support for the evidence presented in Bhaskar (2012) of a switch from Paddy towards Cotton.

Madhya Pradesh Kharif Season: During the Kharif season, for both sets of impact estimates, there is no evidence of MGNREGA affecting shares of major crops, including Soyabean.

Madhya Pradesh Rabi Season: In the Rabi season also, except for an impact on Jowar for Phase 3 under full, there is no evidence of the scheme affecting other crop shares. Crop acreage under Jowar increased by 1.3 p.p. more in Phase 3 districts relative to Phase 1 and 2 districts over the period 2007/8 to 2009/10. At the same time, in case of Jowar we find a significant difference in pre-programme trends in the treatment and control districts.

From a food security point of view, we find evidence that MGNREGA adversely affected Wheat acreage in Rajasthan during the Rabi season, at the same time the scheme had no impact on Paddy cultivation in Andhra Pradesh.

5.4. DID estimates of Impact on Crop Yields using Crop-Wage Data

Tables 9A through 9C present the DID impact estimates for crop yields in each of the top three states, separately for Kharif and Rabi seasons. The crops considered are the same as those discussed in tables 8A through 8C.

Rajasthan: During the Kharif season, MGNREGA had a positive impact on Moth yield for Phase 1 and 2 districts under partial implementation: Growth in Moth yield was 0.92 p.p. higher in Phase 1 and 2 districts relative to Phase 3 districts over the period from 2004/5 to 2007/8. At the same time, we find a significant difference in pre-programme trends in the treatment and control districts in Moth yield.

Other than this there is no evidence that MGNREGA had any impact on yields of other major crops in either the Kharif or the Rabi season for both sets of impacts.

Andhra Pradesh: MGNREGA did not impact crop yields in the Kharif season. In the Rabi season it adversely affected Gram yield in Phase 1 and 2 districts under partial implementation: Gram yield grew at 0.7 p.p. lower rate of growth in Phase 1 and 2 districts compared to in Phase 3 districts.

Madhya Pradesh: Crop yields were unaffected by the scheme for this state.

Thus, except for Moth in Rajasthan and Gram in Andhra Pradesh under partial implementation, MGNREGA has not had any effect on yields of main crops when looking at the top three states according to MGNREGA implementation.

6. Impact on Employment and Casual Wages using EUS dataset

6.1. Summary Statistics for Employment and Casual Wages using EUS data

Tables 10A and 10B present the average time shares across ten mutually exclusive and exhaustive categories of labour market participation for the target population for males and females, respectively. For males, in 2004/5, the top two categories according to time shares are self-employment in agriculture (37 percent) and self-employment in non-agriculture (20 percent). For females, in the same year, these are domestic works (59 percent) and self-employment in agriculture (20 percent). Thus, there is a significant difference in what men and women do with their time. Public works accounts for a relatively small share of peoples' time in rural areas. For males, the time shares in public works are 0.2 percent in 2004/5, 0.8 in 2007/8 and 1.2 in 2011/12 (for females these figures are 0.1, 0.4 and 0.9, respectively). Over the years, the increase in time spent on public works is small in absolute terms, this is still a substantial increase when viewed in light of initial shares in 2004/5, and presumably is a reflection of increasing implementation of MGNREGA. That the absolute share of time spent in public works is small, limits its potential to cause major changes in time shares in other categories. This needs to be kept in mind while interpreting the ability of MGNREGA to influence labour market outcomes.

For both males and females, share of time spent as casual labour in agriculture increased in the period from 2004/5 to 2007/8, (for males, from 11 percent to 18 percent), and then decreased from 2007/8 to 2011/12 (for males, from 18 percent to 8.4 percent). Between 2004/5 and 2011/12 the most remarkable

status shifts for the males have been for the self-employed in agriculture, and for casual labour in non-agriculture categories: over this period, the share of time spent in self-employment in agriculture decreased (from 37 percent to 31 percent) and the share of time spent in casual labour in non-agriculture went up (from 8 percent to 15 percent) magnitude. For the females over this period the most remarkable change has been an increase in share of time spent in domestic works (from 59 percent to 68 percent).

Table 11 shows summary statistics for real wages, separately for males and females. Wages for females are lower than that for males, in all years, in all sector-contract types. As might be expected, there are substantial differences in wages across sectors and contract types. In 2004/5, before MGNREGA was implemented, in Phase 1 and 2 districts, wages in public works were higher than wages in casual agriculture, casual non-agriculture and regular agriculture, for both males and females. For Phase 3 districts, wages in public works were higher only to wages in casual agriculture, for both males and females. These differences in wage rates across sectors suggests that once MGNREGA is instituted, there might be a greater incentive to shift to public works from contract types where wages are lower, although for regular workers who are on long-term contracts, the difference would need to be large enough to compensate for the short term nature of employment that MGNREGA offers. By 2011/12, for males in Phase 1 and 2 districts, casual wages in agriculture caught up with wages in public works, while in Phase 3 districts, they over shot public wages. For women, the difference between wages for casual work in agriculture and public works narrowed considerably by 2011/12 in both sets of districts.

Appendix Table A1 presents evidence on the seasonality in MGNREGA implementation. It reports time shares spent by casual labour in public works, private agriculture, and private non-agriculture in 2007/8, in the Dry and Rainy seasons. Employment shares in public works in the Dry season exceed that in the Rainy season in almost all states. For all states taken together, the average time share of casual labour in public works was 1 percent in the Dry season, while it was 0.3 percent in the Rainy season. When we look at casual labour in private agriculture, it was 13.4 and 14.6 in the Dry and Rainy seasons, respectively. As mentioned earlier, the Rainy season corresponds loosely to the peak season, and this is therefore suggestive of counter seasonality in MGNREGA employment in most states. Based on this, one would expect there to be a greater impact of MGNREGA in the Dry season, relative to the Rainy season.

6.2. DID estimates of Impact on Employment Time Shares using EUS data

Tables 12A through 12D present the DID estimates of the effect of MGNREGA on time shares spent across the ten categories of labour market participation for the four gender-season combinations, male-dry, female-dry, male-rainy and female-rainy, respectively. The average time shares in each category are also given (the rows for average shares add up to one). The impact estimates refer to difference in change in time shares between the two sets of districts over the comparison years. Thus the rows must add up to zero.²⁷We first discuss the results for the Dry season, and then for the Rainy season.

6.2.1. Dry Season Impact Estimates for Time shares

The estimates for time shares at the all-India level and for the top 3 states are different. We present tables of results for both, but discuss results only for the top 3 states. For Phase 1 and 2 districts under partial implementation, MGNREGA led to a significant increase in the time share spent in public works for both males and females: For males the increase in time spent on public works was 0.033 fraction of time greater in Phase 1 and 2 districts compared to Phase 3 districts, and for females the corresponding figure is 0.032. This increase in share of public works was accompanied by a decrease in employment in private agriculture: For males, time spent in regular employment in agriculture and in casual work in agriculture, both showed a smaller increase (of 1.1 p.p. and 6.6 p.p. respectively) in Phase 1 and 2 districts compared to Phase 3 districts. For females also, time spent in casual work in agriculture showed a smaller increase (of 3.5 p.p.) in Phase 1 and 2 districts compared to Phase 3 districts. These results seem to corroborate some of the concerns that MGNREGA has reduced casual labour use in private agriculture. Besides these impacts, for males, the scheme also led to a larger increase (of 2.1 p.p.) in time spent out of the labour force in Phase 1 and 2 districts relative to Phase 3 districts.

For Phase 3 districts under full implementation, estimates show no impact. That there is no impact on time spent in public works employment over the years 2007/8 to 2011/12 suggests that either MGNREGA was not effective in increasing time spent in public works in Phase 3 districts during this period, or that better implementation of MGNREGA in Phase 1 and 2 districts over this time period matched any increase in public works employment in Phase 3 districts.

Thus, for the top three states according to successful MGNREGA implementation, over the period 2004/5 to 2007/8, in Phase 1 and 2 districts in the Dry season, MGNREGA increased time spent in public works at the cost of time spent as casual labour in private agriculture.

²⁷In some cases, due to correction for pre-programme differences in changes over time between the two sets of districts, the columns do not sum up to 0 but the figures are close to this value.

6.2.2. Rainy Season Impact Estimates for Time shares

For the Rainy season also, we only discuss the results for the top three states. For Phase 1 and 2 districts under partial implementation, for males, MGNREGA resulted in a greater increase (0.8 p.p. greater) in time spent on public works in Phase 1 and 2 districts compared to Phase 3 districts. This is a much smaller impact on public works compared to the Dry season where the corresponding estimate was 3.3 p.p. and points to the counter cyclical nature of the scheme. Accompanied with this marginal increase in public works for males, the scheme also led to a smaller increase in time spent in regular non-agriculture, and a larger increase in time spent being unemployed, in Phase 1 and 2 districts relative to Phase 3 districts. For females, MGNREGA resulted in a greater increase (0.5 p.p. greater) in time spent on public works in Phase 1 and 2 districts compared to Phase 3 districts. But, it is important to note that we also found a significant difference in pre-programme trends in treatment and control districts. At the same time, MGNREGA resulted in a smaller increase in self-employment in agriculture (8.7 p.p.) and a greater increase in domestic works (11.3 p.p.) in Phase 1 and 2 districts compared to Phase 3 districts. For Phase 3 districts under full implementation, MGNREGA did not have an impact on time spent in public works for either males or females. It led to a greater increase (of 5.5 p.p.) in self-employment in non-agriculture of males in Phase 3 districts relative to Phase 1 and 2 districts.

Thus, in the Rainy season, which roughly corresponds to the peak season, for all three sets of impact estimates, MGNREGA did not affect casual labour in private agriculture.

6.3. DID estimates of Impact on Casual Wages using EUS data

Tables 13A and 13B present the DID estimates of the effect of MGNREGA on casual wages in agriculture and casual wages in non-agriculture, respectively. Although we also present impact estimates at the all-India level in the tables, here we discuss only the results for top 3 states. We first discuss impacts on casual wages in agriculture followed by the impact on casual wages in non-agriculture.

6.3.1. Impact on Casual Wages in Agriculture

Table 13A presents impacts on casual wages in agriculture. There is no impact of the scheme on casual wages in agriculture, in either season, for either males or females and for either partial or full

implementation. This is not what we had seen using the crop wage dataset. At this point we do not have an explanation for why the results from the two datasets differ so much.

6.3.2. Impact of Casual Wages in Non-Agriculture

Table 13B presents impact estimates for casual wages in non-agriculture. For Phase 1 and 2 districts during partial implementation, MGNREGA did not have a positive impact on male wages in non-agriculture in dry season. For rainy season, MGNREGA had a positive impact of (increase of 14.5 p.p.) in casual wages for males in non-agriculture in Phase 1 and 2 districts compared to Phase 3 districts. There was no impact of MGNREGA on casual wages in non-agriculture for females in dry season. In rainy season, MGNREGA had a positive impact of (increase of 54.1 p.p.) in casual wages for females in non-agriculture in Phase 1 and 2 districts compared to Phase 3 districts.

Turning to impact estimates for Phase 3 districts under full implementation, MGNREGA did not lead to a different impact on Phase 3 districts relative to Phase 1 and 2 districts during full implementation.

7. Conclusions

Our results suggest that MGNREGA impacts vary widely across states. This is reflected in the qualitatively differences in impacts when looking at results for all-India and for top three states. For the top three states according to MGNREGA implementation we find the following results.

The scheme did not have an immediate impact on raising share of gross irrigated area in total cropped area, but results suggest that investments in water works became more productive in increasing gross irrigated area subsequently.

MGNREGA led to an increased growth in both male and female agricultural wages in the Dry season in Phase 1 and 2 districts between 2004/5 and 2007/8, under partial implementation of the scheme. No such impact was seen in the Rainy season. The Rainy season roughly coincides with the peak agricultural season and therefore our results allay fears of the scheme raising wages during the peak season. Also, in the Dry season, the magnitude impact was higher for female wages suggesting that the scheme may

have contributed to reducing the gender wage gap in agriculture. MGNREGA did not lead to a difference in growth rates between the two sets of districts between 2007/8 and 2009/10 under full implementation of the scheme.

Turning to cropping pattern, we find evidence that between 2004/5 and 2007/8 MGNREGA adversely affected Wheat acreage in Phase 1 and 2 districts of Rajasthan under partial implementation in the Rabi season. This we expect is an outcome of the impact of MGNREGA on raising agricultural wages. At the same time the scheme had no impact on Paddy cultivation in Andhra Pradesh suggesting that Paddy cultivation is somewhat inelastic to changes in wages and irrigation infrastructure. Also, the scheme did not affect crop yields of major crops including Wheat, Paddy or Cotton.

For impacts on time use for the rural working age population, in the Dry season during partial implementation of the scheme, MGNREGA led to an increase in public works employment at the cost of employment in private agriculture for both males and females. However, for the Rainy season, we do not find evidence of this kind of crowding out.

There is no evidence that MGNREGA resulted in an increase in casual wages in agriculture. This is not consistent with the results we see using crop-wage dataset.

Reference

- Aggarawal, A., A. Gupta, and G. Kumar. 2012. "Evaluation of NREGA Wells in Jharkhand." *Economic and Political Weekly* 47(35): 24-27.
- Azam, M. 2012. "The Impact of Indian Job Guarantee Scheme on Labor Market Outcomes: Evidence from a Natural Experiment." IZA Discussion Paper 6548. Bonn, Germany: Institute for the Study of Labor.
- Berg, E., S. Bhattacharyya, R. Durgam, and M. Ramachandra. 2012. "Can Rural Public Works Affect Agricultural Wages? Evidence from India." Working Paper 2012-05. Oxford, UK: Centre for the Study of African Economies.
- Bhargava, A. 2014. "The Impact of India's Rural Employment Guarantee on Demand for Agricultural Technology." Working Paper. Davis, USA: University of California.
- Bhaskar, B. 2012. "Farmers switching from paddy to cotton." *The Hindu*, June 23.
- CSE (Centre for Science and Environment). 2008. *An Assessment of the Performance the National Rural Employment guarantee in terms of its potential for creation of Natural wealth in villages*. New Delhi.
- Deininger, K., and Y. Liu. 2013. *Welfare and Poverty Impacts of India's National Rural Employment Guarantee Scheme: Evidence from Andhra Pradesh*. IFPRI Discussion Paper 01289. Washington, DC: International Food Policy Research Institute.
- Dutta, P., R. Murgai, M. Ravallion, and D.V.D. Walle. 2012. "Does India's Employment Guarantee Scheme Guarantee Employment." *Economic and Political Weekly* 47(16): 55-64.
- GOI (Government of India) 2005. *The National Rural Employment Guarantee Act: The Gazette of India, Extraordinary*. New Delhi.
- Gupta, S. 2006. "Were District Choices for NFFWP Appropriate?" *Journal of Indian School of Political of Political Economy* 18(4): 641-648.
- IIFM (Indian Institute of Forest Management). 2010. *Impact assessment of NREGA activities for Ecological and Economic Security*. Bhopal.
- IISc (Indian Institute of Science). 2013. *Environmental Benefits and Vulnerability Reduction through Mahatma Gandhi National Rural Employment Guarantee Scheme*. Bangalore.
- Imbert, C., and J.Papp. 2014. "Labor Market Effects of Social Programs: Evidence from India's Employment Guarantee." Working Paper. Paris: Paris School of Economics.
- Jakhar, A. 2012. "Provide 100 days employment only during lean agricultural season." *The Hindu*, January 2.
- Jha, R., R. Gaiha, and M. Pandey. 2009. "Net Transfer Benefits under India's National Rural Employment Guarantee Scheme." *Journal of Policy Modelling* 34: 296-311.

Kareemulla, K., K.S. Reddy, C.A.R. Rao, S.Kumar, B.Venkateswarlu. 2009. "Soil and Water Conservation Works through National Rural Employment Guarantee Scheme in Andhra Pradesh -Analysis of Livelihood Impact." *Agricultural Economics Research Review* 22: 443-50.

Khera, R., and N. Nayak. 2009. "Women Workers and perceptions of the National rural employment Guarantee act." *Economic and Political Weekly* 44(43): 49-57.

Liu, U., and C.B. Barret. 2013. "Heterogenous Pro-Poor Targeting in the National Rural Employment Guarantee Scheme." *Economic and Political Weekly* 48(10): 46-53.

Mahajan, K. 2014. "Farm wages and Public works: How robust are the impacts of National Rural Employment Guarantee Act?" New Delhi: mimeo, Indian Statistical Institute.

MORD (Ministry of Rural Development).2012. *MGNREGA Sameeksha: An Anthology of Research Studies on the Mahatma Gandhi National Rural Employment Guarantee Act, 2005, 2006–2012*. Government of India. New Delhi.

NSSO (National Sample of Survey Organization) 2006. *Employment and Unemployment Situation in India, 2004-05 (Part-I)*. Technical Report. Ministry of Statistics and Programme Implementation, Government of India. New Delhi.

Rangarajan, C., P.I. Kaul, and Seema. 2011. "Where is the missing labor force?" *Economic and Political Weekly* 46 (39): 68-72.

Ravi, S., and M.Engler.2013. "Workfare in Low Income Countries: An Effective Way to Fight Poverty? The Case of NREGS in India." ISB Working Paper. Hyderabad, India: Indian School of Business.

Saxena, R., S.Pal, and P.K. Joshi. 2001. *Delineation and Characterisation of Agro-Eco Region*. Task Force on Prioritization, Monitoring and Evaluation 6. New Delhi: Indian Council of Agricultural Research

Singh, J., and J.V.Meenakshi.2004. "Understanding the Feminisation of Agricultural Labour." *Indian Journal of Agricultural Economics* 59(1): 1-17.

Tiwari, R., H.I. Somashekhar, V.R. Ramakrishna Parama, I.K. Murthy, M.S. Mohan Kumar, B.K.Mohan Kumar, H. Parate, M. Varma, S. Malaviya, A.S. Rao, A. Sengupta, R. Kattumuri, N.H. Ravindranath. 2011. "MGNREGA for environmental service enhancement and vulnerability reduction: Rapid appraisal in Chitradurga district." *Economic and Political Weekly* 46(20): 39-47.

Uppal, V. 2009. "Is the NREGS a Safety Net for Children? Studying the access to the National Rural Employment Guarantee Scheme for Young Lives families, and its impact on child outcomes in Andhra Pradesh." Master of Science (M.Sc) Thesis, Economics for Development, University of Oxford, United Kingdom.

Verma, S., and T. Shah.2012. "Beyond Digging and Filling Holes: Lessons from Case Studies of Best-performing MGNREGA water assets." Water Policy Research Highlight: International Water Management Institute (IWMI) - TATA Water Policy Program.

Zimmermann, L. 2013. "Why Guarantee Employment? Evidence from a Large Indian Public-Works Program." UM Working Paper. Michigan, USA: University of Michigan

Table 1: Ranking of states according to successful MGNREGA implementation in 2008/9 and 2009/10

State	Average Intensity, (I)	Average Coverage, (C)	Composite Index, (C*I)	Rank
Rajasthan	72.38	0.79	57.3	1
Andhra Pradesh	61.13	0.56	34.0	2
Madhya Pradesh	55.21	0.60	33.3	3
Karnataka	52.13	0.52	27.1	4
Chhattisgarh	49.70	0.51	25.2	5
Jharkhand	44.75	0.51	22.7	6
Tamil Nadu	50.37	0.43	21.8	7
Himachal Pradesh	46.63	0.39	18.4	8
Assam	43.35	0.35	15.2	9
Uttar Pradesh	49.92	0.23	11.7	10
Uttaranchal	30.44	0.33	10.2	11
West Bengal	35.30	0.28	9.9	12
Gujarat	36.37	0.21	7.5	13
Kerala	33.82	0.19	6.3	14
Orissa	24.89	0.22	5.8	15
Bihar	42.98	0.13	5.6	16
Punjab	26.71	0.12	3.1	17
Haryana	40.08	0.06	2.5	18
Maharashtra	39.03	0.05	1.9	19
All India (19States)	50.37	0.33	16.5	

Source: Computed using Delivery Monitoring Unit (DMU) reports collected from MGNREGA website, Ministry of Rural Development, Government of India. (accessed on 15th May 2012)

http://164.100.129.6/Netnrega/mpr_ht/nregampr_dmu.aspx?flag=1&page=1&month=Latest&fin_year=2008-2009

Notes: Intensity is the average number of person-days of employment provided to each participating household in a year. Coverage is the ratio of number of households that received employment through MGNREGA in a year and the total number of rural households. Figures in the table are the average over figures in 2008/9 and 2009/10. Ranking of states is according to the composite index.

Table 2: Summary statistics on share of gross irrigated area in total cropped area (crop-wage data set)

Panel A: Average share (in percent) of gross irrigated area in total cropped area		
	Average share	No. of districts
2004/5 All India (19 states)	47	
Phase 1 and 2 districts (a)	43	197
Phase 3 districts (b)	53	133
Difference (a)-(b)	-10***	
2007/8 All India (19 states)	49	
Phase 1 and 2 districts (c)	45	197
Phase 3 districts (d)	55	133
Difference (c)-(d)	-10***	
2009/10 All India (19 states)	49	
Phase 1 and 2 districts (e)	46	197
Phase 3 districts (f)	55	133
Difference (e)-(f)	-9***	
Panel B: Rate of growth (in percent per year) in share of gross irrigated area in total cropped area for the period 2000/1 through 2009/10		
	Rate of growth	No. of districts
All India (19 states)		
MGNREGA districts (a)	0.88(0.56)	
Non-MGNREGA districts (b)	1.83***(0.21)	
Difference (in percentage points) (a)-(b)	-0.95(0.59)	436
Top 3 states		
MGNREGA districts (c)	-0.99(0.99)	
Non-MGNREGA districts (d)	3.67***(0.57)	
Difference (in percentage points) (c)-(d)	-4.66***(1.08)	96

Notes: The set of MGNREGA districts differ from year to year. In any given year it refers to the collective of those districts which had the scheme in that year. The growth rate estimate is the weighted average of rates over districts that had the scheme in each year. In 2007/8, MGNREGA districts are the phase 1 and 2 districts, and by 2009/10, MGNREGA districts include all districts in the country. Top 3 states are Rajasthan, Andhra Pradesh and Madhya Pradesh. Rate of growth in share of gross irrigated area in total cropped area in MGNREGA districts (rows (a) and (c) in panel (B)) refers to $(100 * (\lambda_1 + \lambda_3))$ in equation 3, where the dependent variable is logarithm of share of gross irrigated area in total cropped area. Similarly, rate of growth in share of gross irrigated area in total cropped area in non-MGNREGA districts (rows (b) and (d) in panel (B)) refers to $(100 * (\lambda_1))$ in equation 3. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 3: Summary statistics on agricultural wage (crop-wage data set)

Panel A :Average agricultural wage(INR per day in 2004/5 prices)						
	Male			Female		
	Dry season	Rainy season	No. of districts	Dry season	Rainy season	No. of districts
2004/5 All India (19 states)	57	55		46	44	
Phase 1 and 2 districts (a)	53	51	75	42	41	75
Phase 3 districts (b)	65	61	42	53	50	42
Difference (a)-(b)	-12***	-10***		-11***	-9***	
2007/8 All India (19 states)	68	58		52	48	
Phase 1 and 2 districts (c)	65	53	121	49	45	121
Phase 3 districts (d)	76	69	55	59	55	55
Difference (c)-(d)	-11***	-16***		-10***	-10***	
2009/10 All India (19 states)	69	68		55	62	
Phase 1 and 2 districts (e)	65	62	125	52	49	125
Phase 3 districts (f)	76	78	74	59	56	74
Difference (e)-(f)	-11***	-16***		-7***	-7***	
Panel B : Rate of growth (in percent per year)in real agricultural wage for the period 2000/01 through 2009/10						
	Male			Female		
	Dry season	Rainy season	No. of districts	Dry season	Rainy season	No. of districts
All India (19 states)						
MGNREGA districts (a)	5.1*** (0.5)	3.9*** (0.5)		7.1*** (0.4)	5.0*** (0.4)	
Non-MGNREGA districts (b)	-0.2 (0.2)	0.7*** (0.2)		0.4* (0.2)	1.0*** (0.2)	
Difference (in percentage points) (a)-(b)	5.3*** (0.5)	3.2*** (0.5)	338	6.7*** (0.4)	4.0*** (0.4)	313
Top 3 states						
MGNREGA districts (c)	5.8*** (0.6)	6.7*** (0.6)		7.4*** (0.7)	4.9*** (0.7)	
Non-MGNREGA districts (d)	0.9*** (0.2)	1.1*** (0.2)		0.3 (0.2)	0.6** (0.2)	
Difference (in percentage points) (c)-(d)	4.9*** (0.5)	5.6*** (0.6)	94	7.1*** (0.7)	4.3*** (0.7)	93

Notes: The set of MGNREGA districts differ from year to year. In any given year it refers to the collective of those districts which had the scheme in that year. The growth rate estimate is the weighted average of rates over districts that had the scheme in each year. In 2007/8, MGNREGA districts are the phase 1 and 2 districts, and by 2009/10, MGNREGA districts include all districts in the country. Top 3 states are Rajasthan, Andhra Pradesh and Madhya Pradesh. Rate of growth in agricultural wages in MGNREGA districts (rows (a) and (c) in panel (B)) refers to $(100 * (\lambda_1 + \lambda_3))$ in equation 3, where the dependent variable is logarithm of agricultural wage. Similarly, rate of growth in agricultural wages in non-MGNREGA districts (rows (b) and (d) in panel (B)) refers to $(100 * (\lambda_1))$ in equation 3. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 4: Summary statistics on cropping patterns in top 3 states (crop-wage data set)

Panel A: Average share (in percent) of crop acreage in total cropped area for the period 2000/1 through 2005/6											
	Kharif season					Rabi season					No. of districts
Rajasthan	Bajra	Maize	Soyabean	Jowar	Moth	Wheat	Mustard	Gram	Barley		
Phase 1 and 2 districts (a)	48	13	8	6	3	45	43	11	1		9
Phase 3 districts (b)	44	11	9	8	8	41	37	16	5		20
Difference (a)-(b)	5	2	-1	-3	-6**	4	5	-5*	-4***		
Andhra Pradesh	Paddy	Groundnut	Cotton	Arhar	Maize	Paddy	Jowar	Urad	Gram	Groundnut	
Phase1 and 2 districts (c)	35	18	15	8	7	35	17	11	13	13	19
Phase 3 districts (d)	76	2	5	2	2	44	0	29	0	4	3
Difference (c)-(d)	-41***	16*	10**	6**	5*	-9	16***	-18***	13**	9**	
Madhya Pradesh	Soyabean	Paddy	Maize	Jowar	Bajra	Wheat	Gram	Mustard			
Phase1 and 2 districts (e)	30	34	10	9	2	60	27	7			28
Phase 3 districts (f)	64	10	6	4	9	50	38	11			17
Difference (e)-(f)	-33***	24***	3**	5***	-7***	10***	-10***	-4*			
Panel B: Difference (in percentage points per year) in change in crop shares between MGNREGA and non-MGNREGA districts for the period 2000/01 through 2009/10											
	Kharif season					Rabi season					No. of districts
Rajasthan	Bajra	Maize	Soyabean	Jowar	Moth	Wheat	Mustard	Gram	Barley		
Difference in change in crop shares	-1.1* (0.5)	0.4 (0.4)	-0.5 (0.3)	0.3** (0.1)	-0.1 (0.1)	-6.6*** (1.0)	5.9*** (1.0)	-0.3 (1.1)	0.7** (0.2)		29
Andhra Pradesh	Paddy	Groundnut	Cotton	Arhar	Maize	Paddy	Jowar	Urad	Gram	Groundnut	
Difference in change in crop shares	-1.4** (0.6)	-0.0 (0.4)	2.4*** (0.6)	-0.1 (0.1)	-0.6* (0.4)	1.5 (1.0)	0.3 (0.6)	-0.3 (0.7)	-1.5** (0.5)	0.5** (0.2)	22
Madhya Pradesh	Soyabean	Paddy	Maize	Jowar	Bajra	Wheat	Gram	Mustard			
Difference in change in crop shares	0.1 (0.8)	0.7 (0.7)	-0.2 (0.2)	-0.4 (0.3)	-0.1* (0.1)	-0.2 (0.2)	-0.4 (0.2)	0.7** (0.2)			45

Notes: The crops chosen in each state-season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The set of MGNREGA districts differ from year to year. In any given year it refers to the collective of those districts which had the scheme in that year. The growth rate estimate is the weighted average of rates over districts that had the scheme in each year. In 2007/8, MGNREGA districts are the phase 1 and 2 districts, and by 2009/10, MGNREGA districts include all districts in the country. Difference in change in crop shares between MGNREGA and non-MGNREGA districts (rows (a), (b) and (c) in panel (b)) refers to $(100 \cdot \lambda_3)$ in equation 3, where the dependent variable is the share of crop acreage in total cropped area. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 5: Summary statistics on crop yields in top 3 states (crop-wage data set)

Panel A: Average crop yield (in tonnes per hectare) for the period 2000/1 through 2005/6											
	Kharif season					Rabi season					No. of districts
Rajasthan	Bajra	Maize	Soybean	Jowar	Moth	Wheat	Mustard	Gram	Barley		
Phase 1 and 2 districts (a)	0.92	0.21	1.36	0.67	.14	2.26	1.00	0.78	2.16		9
Phase 3 districts (b)	0.83	0.30	1.41	0.64	.20	2.66	1.02	0.76	2.14		20
Difference (a)-(b)	0.09	-0.09	-0.05	0.03	-0.06	-0.39***	-0.02	0.02	0.02		
Andhra Pradesh	Paddy	Groundnut	Cotton	Arhar	Maize	Paddy	Jowar	Urad	Gram	Groundnut	
Phase1 and 2 districts (c)	2.60	0.85	1.68	0.45	2.77	2.79	1.10	0.49	1.25	1.65	19
Phase 3 districts (d)	2.44	1.23	2.46	0.48	2.32	3.23	1.61	0.68	1.97	2.16	3
Difference (c)-(d)	0.16	-0.38***	-0.78***	-0.03	0.46	-0.44*	-0.51*	-0.19***	-0.72***	-0.52***	
Madhya Pradesh	Soybean	Paddy	Maize	Jowar	Bajra	Wheat	Gram	Mustard			
Phase1 and 2 districts (e)	0.74	0.74	1.51	0.90	0.75	1.40	0.80	0.53			31
Phase 3 districts (f)	1.00	0.89	1.84	1.23	1.11	2.05	0.93	0.84			17
Difference (e)-(f)	-0.26***	-0.15*	-0.33***	-0.33***	-0.36***	-0.65***	-0.13***	-0.30***			
Panel B: Difference (in percentage points per year) in rate of growth in crop yield between MGNREGA and non-MGNREGA districts for the period 2000/1 through 2009/10											
	Kharif season					Rabi season					No. of districts
Rajasthan	Bajra	Maize	Soybean	Jowar	Moth	Wheat	Mustard	Gram	Barley		
Difference in rate of growth	-0.60*** (0.14)	-0.20** (0.10)	-0.15*** (0.03)	-0.86*** (0.19)	-1.17*** (0.25)	0.03 (0.02)	0.04 (0.03)	-0.07** (0.03)	0.03* (0.02)		29
Andhra Pradesh	Paddy	Groundnut	Cotton	Arhar	Maize	Paddy	Jowar	Urad	Gram	Groundnut	
Difference in rate of growth	-0.02 (0.02)	-0.03 (0.04)	-0.01 (0.05)	-0.10** (0.03)	-0.01 (0.03)	-0.00 (0.01)	0.01 (0.03)	-0.00 (0.03)	0.01 (0.02)	-0.15** (0.04)	22
Madhya Pradesh	Soybean	Paddy	Maize	Jowar	Bajra	Wheat	Gram	Mustard			
Difference in rate of growth	0.06** (0.02)	0.84 (0.87)	0.15*** (0.02)	0.09*** (0.02)	0.04 (0.04)	0.07** (0.03)	0.10*** (0.02)	0.00 (0.01)			48

Notes: The crops chosen in each state-season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The set of MGNREGA districts differ from year to year. In any given year it refers to the collective of those districts which had the scheme in that year. The growth rate estimate is the weighted average of rates over districts that had the scheme in each year. In 2007/8, MGNREGA districts are the phase 1 and 2 districts, and by 2009/10, MGNREGA districts include all districts in the country. Difference in rates of growth in crop yield between MGNREGA and non-MGNREGA districts (rows (a), (b) and (c)) in panel (b) refers to $(100 \cdot (\lambda_3))$ in equation 3, where the dependent variable is logarithm of crop yield. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Impact of MGNREGA on gross irrigated area (crop-wage data set): Difference (in percentage points over time) in rates of growth in share of gross irrigated area in total cropped area between treatment and control districts

	All India		Top 3 states	
	Difference in rates of growth	No. of districts	Difference in rates of growth	No. of districts
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-2.5 (2.2)	319	-8.9 (6.9)	96
Impact on phase 3 under full (2007/8 and 2009/10)	-2.8 (2.0)	320	-12.7** (5.6)	96

Notes: Top 3 states are Rajasthan, Andhra Pradesh and Madhya Pradesh. The dependent variable is the logarithm of share of gross irrigated area in total cropped area. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 7: Impact of MGNREGA on real agricultural wage (crop-wage data set): Difference (in percentage points over time) in rates of growth in real agricultural wage between treatment and control districts

	Male			Female		
	Dry season	Rainy season	No. of districts	Dry season	Rainy season	No. of districts
All India						
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	3.4 (3.1)	2.7 (5.2)	204	5.7* (3.1)	5.4 (4.7)	204
Impact on phase 3 under full (2007/8 and 2009/10)	2.0 (3.4)	3.6 (2.4)	231	2.7 (3.8)	0.1 (3.2)	231
Top 3 states						
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	9.1** (4.3)	5.3 (4.0)	71	15.8** (6.8)	10.9* (6.2)	71
Impact on phase 3 under full (2007/8 and 2009/10)	-2.6 (5.2)	-1.8 (4.0)	89	-10.5 (6.3)	-5.6 (4.9)	89

Notes: Top 3 states are Rajasthan, Andhra Pradesh and Madhya Pradesh. The dependent variable is the logarithm of real agricultural wage. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 8A: Impact of MGNREGA on cropping pattern in Rajasthan (crop-wage data set)

Kharif season	Bajra	Maize	Soyabean	Jowar	Moth
	Average crop share in total cropped area (in percent) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (a)	48	13	8	6	3
Phase 3 districts (b)	44	11	9	8	8
Difference (a)-(b)	5	2	-1	-3	-6**
	Impact estimates : Difference (in percentage points) in change in crop shares between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-1.3 (1.2)	1.2 (2.3)	-0.5 (1.7)	0.9 (1.4)	0.7 (1.0)
Impact on phase 3 under full (2007/8 and 2009/10)	1.4 (2.3)	-0.1 (0.8)	-2.7* (1.5)	1.8** (0.7)	0.0 (0.2)
Rabi season	Wheat	Mustard	Gram	Barley	
	Average crop share in total cropped area (in percent) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (c)	45	43	11	1	
Phase 3 districts (d)	41	37	16	5	
Difference (c)-(d)	4	5	-5*	-4***	
	Impact estimates : Difference (in percentage points) in change in crop shares between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-12.0** (3.3)	4.9 (6.7)	9.3* (5.4)	-2.2** (0.9)	
Impact on phase 3 under full (2007/8 and 2009/10)	1.7 (3.6)	4.2 (3.7)	-7.5*** (1.7)	1.6 (1.1)	

Notes: The crops chosen for each season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The dependent variable is the share of crop acreage in the total cropped area. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 8B: Impact of MGNREGA on cropping pattern in Andhra Pradesh (crop-wage data set)

Kharif season	Paddy	Groundnut	Cotton	Arhar	Maize
	Average crop share in total cropped area (in percent) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (a)	35	18	15	8	7
Phase 3 districts (b)	76	2	5	2	2
Difference (a)-(b)	-41***	16*	10**	6**	5*
	Impact estimates : Difference (in percentage points) in change in crop shares between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	7.4 (4.5)	-0.5 (1.3)	-0.5 (1.3)	1.6 (1.3)	-0.6 (0.5)
Impact on phase 3 under full (2007/8 and 2009/10)	-2.8 (2.4)	0.0 (0.6)	-2.0 (1.6)	-0.1 (1.1)	-0.1 (0.7)
Rabi season	Paddy	Jowar	Urad	Gram	Groundnut
	Average crop share in total cropped area (in percent) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (c)	35	17	11	13	13
Phase 3 districts (d)	44	0	29	0	4
Difference (c)-(d)	-9	16***	-18***	13**	9**
	Impact estimates : Difference (in percentage points) in change in crop shares between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-15.2* (8.5)	-0.1 (2.7)	11.6 (9.4)	1.6 (1.8)	0.1 (1.9)
Impact on phase 3 under full (2007/8 and 2009/10)	-15.3 (9.4)	-1.1 (1.5)	12.2 (7.5)	2.1* (1.0)	2.6** (0.9)

Notes: The crops chosen for each season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict ourselves to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The dependent variable is the share of crop acreage in the total cropped area. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 8C: Impact of MGNREGA on cropping pattern in Madhya Pradesh (crop-wage data set)

Kharif season	Soyabean	Paddy	Maize	Jowar	Bajra
	Average crop share in total cropped area (in percent) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (a)	30	34	10	9	2
Phase 3 districts (b)	64	10	6	4	9
Difference (a)-(b)	-33***	24***	3**	5***	-7***
	Impact estimates : Difference (in percentage points) in change in crop shares between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-5.5 (4.9)	-2.2* (1.3)	1.9 (1.6)	1.3 (1.2)	1.3 (1.0)
Impact on phase 3 under full (2007/8 and 2009/10)	-1.8 (1.8)	1.1 (1.9)	0.1 (0.3)	1.3** (0.6)	1.3 (0.8)
Rabi season	Wheat	Gram	Mustard		
	Average crop share in total cropped area (in percent) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (c)	60	27	7		
Phase 3 districts (d)	50	38	11		
Difference (c)-(d)	10***	-10***	-4*		
	Impact estimates : Difference (in percentage points) in change in crop shares between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-3.0 (2.7)	-2.4 (2.0)	5.3 (3.5)		
Impact on phase 3 under full (2007/8 and 2009/10)	0.6 (2.5)	-0.9 (2.4)	0.1 (0.5)		

Notes : The crops chosen for each season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict ourselves to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The dependent variable is the share of crop acreage in the total cropped area. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 9A: Impact of MGNREGA on crop yield in Rajasthan (crop-wage data set): Difference (in percentage points over time) in rates of growth in crop yields between treatment and control districts

Kharif season	Bajra	Maize	Soyabean	Jowar	Moth
	Average crop yield (in tonnes per hectare) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (a)	0.92	0.21	1.36	0.67	0.14
Phase 3 districts (b)	0.83	0.30	1.41	0.64	0.20
Difference (a)-(b)	0.09	-0.09	-0.05	0.03	-0.06
	Impact estimates: Difference in rates of growth in crop yield between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.33* (0.16)	0.08 (0.15)	0.25* (0.13)	-0.26 (0.25)	0.92** (0.38)
Impact on phase 3 under full (2007/8 and 2009/10)	0.30 (0.41)	-0.08 (0.30)	-0.19 (0.14)	1.00 (0.73)	-0.31 (0.54)
Rabi season	Wheat	Mustard	Gram	Barley	
	Average crop yield (in tonnes per hectare) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (c)	2.26	1.00	0.78	2.16	
Phase 3 districts (d)	2.66	1.02	0.76	2.14	
Difference (c)-(d)	-0.39***	-0.02	0.02	0.02	
	Impact estimates: Difference in rates of growth in crop yield between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.18 (0.18)	0.07 (0.19)	-0.22 (0.19)	-0.02 (0.08)	
Impact on phase 3 under full (2007/8 and 2009/10)	-0.07 (0.07)	0.18 (0.10)	-0.21 (0.20)	-0.12 (0.10)	

Notes: The crops chosen for each season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict ourselves to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The dependent variable is the logarithm of crop yield. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 9B: Impact of MGNREGA on crop yield in Andhra Pradesh (crop-wage data set): Difference (in percentage points over time) in rates of growth in crop yields between treatment and control districts

Kharif season	Paddy	Groundnut	Cotton	Arhar	Maize
	Average crop yield (in tonnes per hectare) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (a)	2.60	0.85	1.68	0.45	2.77
Phase 3 districts (b)	2.44	1.23	2.46	0.48	2.32
Difference (a)-(b)	0.16	-0.38***	-0.78***	-0.03	0.46
	Impact estimates: Difference in rates of growth in crop yield between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.04 (0.08)	-0.21 (0.16)	-0.07 (0.22)	-0.26* (0.15)	-0.09 (0.37)
Impact on phase 3 under full (2007/8 and 2009/10)	-0.15 (0.16)	-0.37 (0.30)	-0.20 (0.20)	0.00 (0.20)	-0.15 (0.30)
Rabi season	Paddy	Jowar	Urad	Gram	Groundnut
	Average crop yield (in tonnes per hectare) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (c)	2.79	1.10	0.49	1.25	1.65
Phase 3 districts (d)	3.23	1.61	0.68	1.97	2.16
Difference (c)-(d)	-0.44*	-0.51*	-0.19***	-0.72***	-0.52***
	Impact estimates: Difference in rates of growth in crop yield between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.06 (0.12)	NA	0.16 (0.29)	-0.71** (0.32)	0.38 (0.26)
Impact on phase 3 under full (2007/8 and 2009/10)	-0.09 (0.10)	NA	0.14 (0.60)	-0.97 (1.10)	-0.33 (0.20)

Notes: The crops chosen for each season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The dependent variable is the logarithm of crop yield. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 9C: Impact of MGNREGA on crop yield in Madhya Pradesh (crop-wage data set): Difference (in percentage points over time) in rates of growth in crop yields between treatment and control districts

Kharif season	Soyabean	Paddy	Maize	Jowar	Bajra
	Average crop yield (in tonnes per hectare) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (a)	0.74	0.74	1.51	0.90	0.75
Phase 3 districts (b)	1.00	0.89	1.84	1.23	1.11
Difference (a)-(b)	-0.26***	-0.15*	-0.33***	-0.33***	-0.36***
	Impact estimates: Difference in rates of growth in crop yield between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.04 (0.12)	-0.04 (0.12)	0.13 (0.09)	0.11* (0.07)	-0.04 (0.10)
Impact on Phase 3 under full (2007/8 and 2009/10)	-0.16* (0.09)	0.34 (0.30)	-0.08 (0.10)	-0.08 (0.10)	-0.08 (0.30)
Rabi season	Wheat	Gram	Mustard		
	Average crop yield (in tonnes per hectare) for the period from 2000/1 through 2005/6				
Phase 1 and 2 districts (c)	1.40	0.80	0.53		
Phase 3 districts (d)	2.05	0.93	0.84		
Difference (c)-(d)	-0.65***	-0.13***	-0.30***		
	Impact estimates: Difference in rates of growth in crop yield between treatment and control districts				
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.14* (0.07)	0.02 (0.07)	-0.01 (0.09)		
Impact on Phase 3 under full (2007/8 and 2009/10)	0.03 (0.07)	0.08 (0.10)	-0.09 (0.10)		

Notes: The crops chosen for each season together cover at least 90 percent of the total cropped area between 2000/1 and 2005/6. If the set of such crops is more than five in number, then we restrict to the top five crops. Crops are arranged in descending order from left to right, in terms of average share of crop acreage over the period 2000/1 to 2005/6. The dependent variable is the logarithm of crop yield. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Robust standard errors in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 10A: Summary statistics for time shares (in fractions of unit time) for males, (EUS data set)

	Agriculture			Non-agriculture			Public works	Domestic works	Unemployment	Not in labour force	No. of individuals
	Self	Regular	Casual	Self	Regular	Casual					
2004/5 All India (19 States)	0.374	0.010	0.110	0.199	0.076	0.081	0.002	0.014	0.063	0.071	
Phase 1 and 2 districts (a)	0.380	0.008	0.115	0.208	0.066	0.077	0.002	0.017	0.058	0.069	44686
Phase 3 districts (b)	0.365	0.013	0.102	0.185	0.091	0.088	0.002	0.011	0.071	0.073	30375
Difference (a)-(b)	0.015***	-0.005***	0.013***	0.023***	-0.025***	-0.011***	0.000	0.006***	-0.013***	-0.004*	
2007/8 All India (19 States)	0.356	0.009	0.180	0.128	0.060	0.097	0.008	0.016	0.080	0.066	
Phase 1 and 2 districts (c)	0.357	0.008	0.190	0.125	0.047	0.098	0.011	0.017	0.084	0.063	47697
Phase 3 districts (d)	0.354	0.010	0.162	0.133	0.083	0.096	0.003	0.014	0.072	0.072	26340
Difference (c)-(d)	0.003	-0.002*	0.028***	-0.008***	-0.036***	0.002	0.008***	0.003***	0.012***	-0.009***	
2011/12 All India (19 States)	0.306	0.005	0.084	0.228	0.090	0.147	0.012	0.009	0.042	0.076	
Phase 1 and 2 districts (e)	0.308	0.004	0.093	0.239	0.072	0.146	0.015	0.009	0.040	0.073	29036
Phase 3 districts (f)	0.303	0.006	0.073	0.210	0.116	0.149	0.007	0.009	0.045	0.081	19973
Difference (e)-(f)	0.005	-0.002***	0.020***	0.029***	-0.044***	-0.003	0.008***	0.000	-0.005***	-0.008***	

Notes: Target population consists of individuals residing in rural areas, between 18 and 60 years of age, and with secondary education or less. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 10B: Summary statistics for time shares (in fractions of unit time) for females, (EUS data set)

	Agriculture			Non-agriculture			Public works	Domestic works	Unemployment	Not in labour force	No. of individuals
	Self	Regular	Casual	Self	Regular	Casual					
2004/5 All India (19 States)	0.204	0.003	0.061	0.046	0.015	0.012	0.001	0.593	0.025	0.040	
Phase 1 and 2 districts (a)	0.185	0.002	0.065	0.052	0.014	0.011	0.001	0.604	0.024	0.042	50898
Phase 3 districts (b)	0.231	0.003	0.056	0.038	0.018	0.012	0.001	0.576	0.027	0.037	33807
Difference (a)-(b)	-0.046***	-0.001***	0.009***	0.014***	-0.004***	-0.001	0.000	0.028***	-0.003***	0.005***	
2007/8 All India (19 States)	0.153	0.002	0.085	0.028	0.012	0.014	0.004	0.648	0.022	0.034	
Phase 1 and 2 districts (c)	0.140	0.001	0.089	0.027	0.009	0.014	0.005	0.658	0.023	0.034	53278
Phase 3 districts (d)	0.176	0.002	0.077	0.029	0.016	0.012	0.002	0.630	0.021	0.035	30383
Difference (c)-(d)	-0.036***	-0.001	0.012***	-0.003*	-0.007***	0.002**	0.004***	0.028***	0.002*	-0.001	
2011/12 All India (19 States)	0.136	0.002	0.045	0.041	0.018	0.015	0.009	0.678	0.012	0.044	
Phase 1 and 2 districts (e)	0.124	0.001	0.049	0.045	0.016	0.014	0.009	0.689	0.010	0.044	33572
Phase 3 districts (f)	0.156	0.003	0.042	0.036	0.021	0.016	0.010	0.657	0.015	0.043	22917
Difference (e)-(f)	-0.032***	-0.002***	0.007***	0.009***	-0.005***	-0.002	-0.001	0.032***	-0.005***	0.001	

Notes: Target population consists of individuals residing in rural areas, between 18 and 60 years of age, and with secondary education or less. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 11: Summary statistics for real wages (in INR per day in 2004/5 prices), (EUS data set)

	Casual agriculture		Casual non-agriculture		Regular agriculture		Regular non-agriculture		Public works	
	Mean	No. of individuals	Mean	No. of individuals	Mean	No. of individuals	Mean	No. of individuals	Mean	No. of individuals
Males										
2004/5 All India (19 States)	51		72		70		131		77	
Phase 1 and 2 districts (a)	46	6835	62	4349	70	379	135	2964	83	108
Phase 3 districts (b)	61	4156	84	3431	71	395	127	2764	67	66
Difference (a)-(b)	-15***		-22***		-1		8*		16	
2007/8 All India (19 States)	54		77		71		120		61	
Phase 1 and 2 districts (c)	50	11387	70	5571	64	401	115	2245	61	659
Phase 3 districts (d)	61	5345	90	3067	80	265	126	2185	65	112
Difference (c)-(d)	-11***		-20***		-16**		-11***		-4**	
2011/12 All India (19 States)	76		102		91		155		70	
Phase 1 and 2 districts (e)	70	3185	91	4863	89	112	155	2101	70	531
Phase 3 districts (f)	87	1767	118	3476	92	127	154	2317	70	186
Difference (e)-(f)	-17***		-27***		-3		1		0	
Females										
2004/5 All India (19 States)	34		44		48		59		47	
Phase 1 and 2 districts (a)	32	4751	40	792	43	101	56	691	46	56
Phase 3 districts (b)	38	2717	51	568	48	115	63	593	49	31
Difference (a)-(b)	-7***		-11***		-4		-7		-3	
2007/8 All India (19 States)	40	9859	53	1431	66	142	64	995	60	444
Phase 1 and 2 districts (c)	39	6614	50	954	48	79	62	506	59	369
Phase 3 districts (d)	42	3245	59	477	89	63	65	489	64	75
Difference (c)-(d)	-3***		-9***		-41		-3		-5**	
2011/12 All India (19 States)	54	3390	67	1047	61	108	78	1052	60	783
Phase 1 and 2 districts (e)	52	2084	62	571	71	37	82	530	58	425
Phase 3 districts (f)	58	1261	74	444	56	70	74	488	62	342
Difference (e)-(f)	-6***		-12***		14		8		-3**	

Notes: Target population consists of individuals residing in rural areas, between 18 and 60 years of age, and with secondary education or less. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 12A: Impact of MGNREGA on time shares for males in the dry season, (EUS data set)

	Agriculture			Non-agriculture			Public works	Domestic works	Unemployment	Not in labour force
	Self	Regular	Casual	Self	Regular	Casual				
All India: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.360	0.008	0.111	0.215	0.065	0.088	0.003	0.019	0.062	0.070
Phase 3 districts in 2004/5	0.354	0.012	0.099	0.188	0.093	0.094	0.003	0.012	0.069	0.077
All India Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.017 (0.013)	-0.000 (0.003)	-0.029** <i>(0.009)</i>	-0.005 (0.008)	-0.004 (0.005)	0.003 (0.006)	0.016*** <i>(0.003)</i>	-0.008** (0.003)	0.007 (0.005)	-0.006 <i>(0.009)</i>
Impact on phase 3 under full (2007/8 and 2011/12)	0.041** (0.014)	-0.004* (0.003)	-0.051*** <i>(0.013)</i>	-0.001 (0.009)	-0.001 (0.006)	0.001 (0.009)	0.003 <i>(0.004)</i>	-0.006** (0.003)	0.010* (0.006)	0.008 <i>(0.006)</i>
Top 3 states: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.382	0.011	0.115	0.195	0.070	0.094	0.008	0.007	0.058	0.060
Phase 3 districts in 2004/5	0.424	0.004	0.084	0.182	0.055	0.090	0.009	0.014	0.057	0.080
Top 3 states Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.017 (0.027)	-0.011** (0.004)	-0.066** (0.020)	0.020 (0.019)	-0.012 (0.016)	-0.004 (0.018)	0.033*** (0.009)	-0.006 (0.006)	0.007 (0.011)	0.021** (0.009)
Impact on phase 3 under full (2007/8 and 2011/12)	0.057 (0.035)	0.00 (0.004)	-0.067* (0.037)	0.000 (0.024)	-0.011 (0.021)	0.008 (0.029)	0.027 (0.019)	-0.007 (0.007)	-0.020 (0.017)	0.015 (0.016)

Notes: The dependent variable is the fraction of unit time spent in a particular activity. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Standard errors clustered at the district-year level in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 12B: Impact of MGNREGA on time shares for females in the dry season, (EUS data set)

	Agriculture			Non-agriculture			Public works	Domestic works	Unemployment	Not in labour force
	Self	Regular	Casual	Self	Regular	Casual				
All India: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.167	0.002	0.054	0.055	0.013	0.014	0.002	0.622	0.027	0.044
Phase 3 districts in 2004/5	0.222	0.003	0.051	0.039	0.019	0.014	0.001	0.585	0.029	0.038
All India Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.023** (0.011)	0.002** (0.001)	<i>-0.005</i> <i>(0.006)</i>	-0.007* (0.004)	-0.001 (0.003)	0.004 (0.002)	0.012*** (0.002)	<i>-0.033**</i> <i>(0.013)</i>	0.006 (0.004)	-0.000 (0.003)
Impact on phase 3 under full (2007/8 and 2011/12)	0.020** (0.010)	-0.001 (0.001)	<i>-0.019**</i> <i>(0.008)</i>	-0.010** (0.005)	0.005* (0.003)	0.004 (0.003)	0.007* (0.003)	<i>-0.018</i> <i>(0.014)</i>	0.009** (0.003)	0.004 (0.004)
Top 3 states: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.246	0.001	0.094	0.095	0.016	0.020	0.006	0.443	0.039	0.042
Phase 3 districts in 2004/5	0.258	0.001	0.037	0.035	0.014	0.013	0.006	0.576	0.027	0.033
Top 3 states Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.003 (0.023)	0.001 (0.002)	-0.035** (0.012)	-0.024* (0.012)	0.014 (0.010)	0.010 (0.007)	0.032*** (0.008)	-0.019 (0.029)	0.007 (0.009)	0.011 (0.009)
Impact on phase 3 under full (2007/8 and 2011/12)	0.053* (0.029)	-0.003 (0.003)	-0.036 (0.027)	0.009 (0.011)	0.007 (0.007)	0.009 (0.011)	0.017 (0.015)	-0.063 (0.041)	-0.007 (0.011)	0.011 (0.015)

Notes: The dependent variable is the fraction of unit time spent in a particular activity. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Standard errors clustered at the district-year level in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 12C: Impact of MGNREGA on time shares for males in the rainy season, (EUS data set)

	Agriculture			Non-agriculture			Public works	Domestic works	Unemployment	Not in labour force
	Self	Regular	Casual	Self	Regular	Casual				
All India: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.399	0.009	0.119	0.201	0.067	0.066	0.001	0.015	0.054	0.068
Phase 3 districts in 2004/5	0.377	0.014	0.105	0.181	0.088	0.082	0.001	0.010	0.072	0.070
All India Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.023** (0.011)	0.004** (0.002)	<i>0.013</i> <i>(0.009)</i>	0.000 (0.007)	-0.006 (0.005)	<i>0.008</i> <i>(0.005)</i>	0.003** (0.001)	0.002 (0.002)	0.014** (0.006)	<i>-0.015***</i> <i>(0.004)</i>
Impact on phase 3 under full (2007/8 and 2011/12)	-0.008 (0.013)	0.000 (0.002)	<i>-0.025**</i> <i>(0.011)</i>	0.007 (0.008)	0.018** (0.007)	<i>0.009</i> <i>(0.008)</i>	-0.005** (0.002)	0.008** (0.003)	0.012** (0.005)	<i>-0.016**</i> <i>(0.006)</i>
Top 3 states: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.431	0.008	0.113	0.180	0.074	0.079	0.001	0.006	0.043	0.065
Phase 3 districts in 2004/5	0.464	0.005	0.085	0.181	0.072	0.069	0.001	0.009	0.054	0.060
Top 3 states Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.007 (0.028)	0.006 (0.005)	-0.009 (0.021)	-0.001 (0.015)	-0.031** (0.012)	0.001 (0.015)	0.008*** (0.002)	0.004 (0.004)	0.025** (0.011)	-0.010 (0.012)
Impact on phase 3 under full (2007/8 and 2011/12)	-0.011 (0.043)	-0.005 (0.008)	-0.023 (0.049)	0.055** (0.023)	-0.015 (0.019)	-0.017 (0.027)	0.003 (0.007)	0.015 (0.013)	0.019 (0.015)	-0.019 (0.019)

Notes: The dependent variable is the fraction of unit time spent in a particular activity. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Standard errors clustered at the district-year level in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 12D: Impact of MGNREGA on time shares for females in the rainy season, (EUS data set)

	Agriculture			Non-agriculture			Public works	Domestic works	Unemployment	Not in labour force
	Self	Regular	Casual	Self	Regular	Casual				
All India: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.203	0.002	0.075	0.049	0.014	0.010	0.000	0.586	0.021	0.040
Phase 3 districts in 2004/5	0.241	0.004	0.061	0.038	0.016	0.011	0.000	0.567	0.026	0.036
All India Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	0.004 (0.010)	0.000 (0.001)	0.007 <i>(0.005)</i>	-0.002 (0.004)	-0.003 (0.002)	0.003 (0.002)	0.002*** (0.000)	-0.010 <i>(0.011)</i>	-0.001 (0.003)	0.001 (0.003)
Impact on phase 3 under full (2007/8 and 2011/12)	-0.006 (0.011)	0.002* (0.001)	0.005 <i>(0.006)</i>	-0.006 (0.004)	0.000 (0.003)	0.002 (0.003)	0.002 (0.002)	-0.012 <i>(0.014)</i>	0.004 (0.003)	0.008** (0.004)
Top 3 states: Average time shares (fraction of unit time)										
Phase 1 and 2 districts in 2004/5	0.282	0.001	0.117	0.076	0.025	0.017	0.001	0.405	0.031	0.045
Phase 3 districts in 2004/5	0.274	0.002	0.045	0.037	0.013	0.006	0.000	0.574	0.017	0.031
Top 3 states Impact estimates: Difference in change in time shares between treatment and control districts										
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.087** (0.027)	-0.001 (0.001)	-0.008 (0.013)	-0.002 (0.009)	0.001 (0.005)	-0.006 (0.008)	0.005** <i>(0.002)</i>	0.113*** (0.030)	-0.012 (0.009)	-0.002 (0.007)
Impact on phase 3 under full (2007/8 and 2011/12)	-0.007 (0.043)	-0.001 (0.001)	-0.013 (0.027)	0.015 (0.021)	0.005 (0.007)	0.001 (0.008)	0.007 <i>(0.006)</i>	-0.012 (0.047)	-0.007 (0.012)	0.013 (0.015)

Notes: The dependent variable is the fraction of unit time spent in a particular activity. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Standard errors clustered at the district-year level in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 13A: Impact of MGNREGA on real casual wages (INR per day in 2004/5 prices) in the agriculture sector: Difference (in percentage points over time) in rates of growth in real casual wage between treatment and control districts, (EUS data set)

	Male				Female			
	Dry season	No. of individuals	Rainy season	No. of individuals	Dry season	No. of individuals	Rainy season	No. of individuals
All India Impact estimates								
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	4.1* (2.2)	11682	3.0 (2.1)	13343	9.2** (2.9)	7182	1.6 (2.5)	8860
Impact on phase 3 under full (2007/8 and 2011/12)	-4.5 (2.8)	9264	1.7 (2.5)	10076	-7.2** (3.6)	5614	-0.2 (3.1)	6656
Top3 states Impact estimates								
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	1.6 (5.7)	2367	-2.5 (4.1)	2687	5.6 (6.0)	2024	1.0 (4.4)	2514
Impact on phase 3 under full (2007/8 and 2011/12)	-13.7 (10.1)	1801	-5.1 (8.0)	2103	-7.6 (8.9)	1632	-10.9 (10.4)	2002

Notes: The dependent variable is logarithm of casual wage in agriculture. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Standard errors clustered at the district-year level in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Table 13B: Impact of MGNREGA on real casual wages in non-agriculture (INR per day in 2004/5 prices) in the non-agriculture sector: Difference (in percentage points over time) in rates of growth in real casual wage between treatment and control districts, (EUS data set)

	Male				Female			
	Dry season	No. of individuals	Rainy season	No. of individuals	Dry season	No. of individuals	Rainy season	No. of individuals
All India Impact estimates								
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	10.3*** (2.4)	7898	-0.9 (3.0)	6690	21.9** (9.6)	1439	9.7 (13.8)	1067
Impact on phase 3 under full (2007/8 and 2011/12)	5.1* (3.1)	8243	-0.2 (3.6)	6713	-1.3 (8.4)	1251	13.1 (14.4)	964
Top3 states Impact estimates								
Impact on phase 1 and 2 under partial (2004/5 and 2007/8)	-0.6 (5.2)	1636	14.5*** (4.0)	1293	1.5 (32.8)	402	54.1** (27.1)	266
Impact on phase 3 under full (2007/8 and 2011/12)	-6.1 (7.8)	1667	5.9 (6.7)	1267	-18.9 (20.4)	398	-25.3 (33.7)	248

Notes: The dependent variable is logarithm of casual wage in non-agriculture. Figures in bold and italics are presented for those outcomes which have pre-programme differences across treatment and control districts. Impact on phase 1 and 2 under partial is $(100 * (\alpha_1))$ in equation 1. Impact on phase 3 under full is $(100 * (\gamma_1))$ in equation 2. Standard errors clustered at the district-year level in parentheses. *significant at 10%; ** significant at 5%; ***significant at 1%.

Appendix A

Table A1: Season wise distribution of time shares for casual labour employment in 2007/8

States	Public works		Agriculture		Non-agriculture	
	Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season
Rajasthan	0.028	0.002	0.027	0.043	0.101	0.057
Andhra Pradesh	0.034	0.010	0.200	0.247	0.061	0.046
Madhya Pradesh	0.036	0.005	0.159	0.179	0.050	0.030
Karnataka	NA	NA	0.261	0.250	0.035	0.036
Chhattisgarh	0.041	0.002	0.105	0.192	0.051	0.013
Jharkhand	0.003	0.002	0.037	0.062	0.102	0.066
Tamil Nadu	0.009	0.001	0.177	0.199	0.077	0.078
Himachal Pradesh	0.010	0.008	0.008	0.019	0.059	0.058
Assam	0.003	0.000	0.080	0.061	0.029	0.026
Uttar Pradesh	0.003	0.002	0.076	0.066	0.049	0.044
Uttaranchal	0.015	0.003	0.024	0.045	0.077	0.052
West Bengal	0.004	0.002	0.130	0.156	0.057	0.055
Gujarat	NA	NA	0.182	0.174	0.055	0.050
Kerala	0.001	0.001	0.081	0.070	0.111	0.097
Orissa	0.005	0.002	0.093	0.161	0.077	0.027
Bihar	0.002	0.003	0.167	0.175	0.026	0.023
Punjab	0.001	0.000	0.108	0.078	0.056	0.060
Haryana	0.001	0.003	0.074	0.050	0.075	0.058
Maharashtra	0.000	0.001	0.217	0.228	0.049	0.026
All India (19 states)	0.010	0.003	0.134	0.146	0.058	0.044

Source: Employment and Unemployment Survey, National Sample Survey (NSS), 2007/8

Note: 'NA' means not available. The states have been arranged according to the ranking of successful MGNREGA implementation given in Table 1.

Table A2: Individual, household and district characteristics in phase 1&2 and phase 3 districts in 2004/5

Individual characteristics						
	Male			Female		
	Phase 1&2 districts (a)	Phase 3 districts(b)	Difference (a)-(b)	Phase 1&2 districts (c)	Phase 3 districts(d)	Difference (c)-(d)
Age (in years)	35.8	35.7	0.1	35.4	35.9	-0.5***
Education categories (proportion of target population)						
Not literate	0.33	0.25	0.08***	0.60	0.50	0.10***
Below primary	0.15	0.12	0.03***	0.11	0.10	0.01
Primary	0.17	0.19	-0.02***	0.12	0.15	-0.03***
Middle	0.21	0.26	-0.05***	0.12	0.16	-0.04***
Secondary	0.14	0.17	-0.03***	0.07	0.09	-0.02***
Household characteristics						
	Phase 1&2 districts(a)		Phase 3 districts(b)		Difference(a)-(b)	
SC/ST (proportion of households)	0.29		0.21		0.80***	
District Characteristics						
	Phase 1&2 districts(a)		Phase 3 districts(b)		Difference(a)-(b)	
Annual urban casual wage (in INR per day)	58		72		-14***	
	Dry season			Rainy season		
	Phase 1&2 districts(a)	Phase 3 districts(b)	Difference (a)-(b)	Phase 1&2 districts(c)	Phase 3 districts(d)	Difference (c)-(d)
Rainfall (in mm)	331	301	30	817	619	198***

Source: Crop-wage data set (described in the text), and Employment and Unemployment Survey, 2004/5

Notes: Target population consists of individuals residing in rural areas, between 18 and 60 years of age, and with secondary education or less. * significant at 10%; ** significant at 5%; ***significant at 1%.

Table A3: Labour and water requirement of selected crops

Panel A: Labour requirement(in hours per hectare)					
Rajasthan					
Kharif crops	Bajra	Maize	Soyabean	Jowar	Moth
	290	583	357	250	NA
Rabi crops	Wheat	Mustard	Gram	Barley	
	481	280	229	483	
Andhra Pradesh					
Kharif crops	Paddy	Groundnut	Cotton	Arhar	Maize
	835	642	824	465	616
Rabi crops	Paddy	Jowar	Urad	Gram	Groundnut
	835	424	272	323	642
Madhya Pradesh					
Kharif crops	Soyabean	Paddy	Maize	Jowar	Bajra
	329	540	436	385	NA
Rabi crops	Wheat	Gram	Mustard		
	352	238	285		
Panel B: Water requirement(in INR per hectare)					
Rajasthan					
Kharif crops	Bajra	Maize	Soyabean	Jowar	Moth
	63	43	49	75	NA
Rabi crops	Wheat	Mustard	Gram	Barley	
	2936	1651	1383	2706	
Andhra Pradesh					
Kharif crops	Paddy	Groundnut	Cotton	Arhar	Maize
	611	446	168	0	45
Rabi crops	Paddy	Jowar	Urad	Gram	Groundnut
	611	106	0	1	446
Madhya Pradesh					
Kharif crops	Soyabean	Paddy	Maize	Jowar	Bajra
	7	210	0	0	NA
Rabi crops	Wheat	Gram	Mustard		
	1879	534	1206		

Source: Estimates of cost of cultivation for 2006/7, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India

Note: NA means not available

Appendix B

We describe the data sources and the construction of variables of both datasets.

B.1. Crop-wage Dataset

All variables in the crop-wage dataset are at the district level. Data has been collected for each year from 2000/01 to 2009/10 forming a panel at the district level.

Share of Gross Irrigated Area in Total Cropped Area: Annual data on gross irrigated area (in hectares) at the district level for each year has been taken from the *Land Use Statistics*, brought out by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. Gross irrigated area refers to the total area under irrigation in a given year, wherein the same plot of land may be counted multiple times depending on the number of times it had been cultivated in that year. Corresponding data on total cropped area (also in hectares) has been taken from the same source. The share of gross irrigated area in total cropped area is then created as a ratio of these two variables.

Real Agricultural Wage, disaggregated by gender and by season (in INR per day, 2004/5 prices): Monthly data at the district level on nominal agricultural wage has been compiled from the report on *Agriculture Wages in India*, published by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. Nominal agricultural wage reported here consists of two categories: 'field labour wages' and 'other agricultural labour wages'. For most states, the data on field labour wages is further separated by operation.²⁸ For these states, composite field labour wages are computed by aggregating across these operations using as weights the shares of employment in each operation. Similarly, 'field labour wages' and 'other agricultural labour wages' are aggregated using as weights the shares of employment in each of these activities to arrive at a single nominal agricultural wage.²⁹ Using this monthly series, nominal agricultural wage by season (Dry and Rainy), is calculated as the arithmetic mean of monthly figures corresponding to the Dry and Rainy seasons. This entire exercise is conducted separately for males and females, as wages are reported separately by gender. The nominal agricultural wages thus obtained are deflated to 2004/5 prices using the state level Consumer Price Index for Agricultural Labour, CPI-AL, constructed by the Labour Bureau of India.

²⁸ Operations include ploughing, sowing, weeding, transplanting, and harvesting. Of all states considered here, only Andhra Pradesh, Maharashtra and Karnataka report aggregate field labour wages instead of separate wages for each operation.

²⁹ The weights in terms of shares of employment were calculated using the Employment and Unemployment survey for 2004/05, and the same weights were applied for all the years assuming that the shares of employment across operations within agriculture did not vary much over the study period.

Cropping Pattern (crop shares in total cropped area for major crops): In order to identify changes in cropping patterns, it is important to consider a geography that is characterised by homogenous agro-climatic conditions (to be able to identify competing crops), and at the same time is large enough to have sufficiently large number of treatment and control districts (so to avoid estimation issues related to small sample size). We consider state-season (Kharif and Rabi) to be such an appropriate geography. Thus, impact on cropping patterns is studied by looking at whether crop shares in total cropped area have changed within a state-season strata. The analysis is done only for the top three states according to successful MGNREGA implementation. Since it is not possible to study all crops grown within a state-season strata, we restrict ourselves to studying the set of crops with the largest crop shares that together cover at least 90 percent of total cropped area within the state-season strata during the pre-programme years (2000/1 to 2004/5). If the set of such crops is greater than five in number, then we restrict ourselves to top five crops. For each state-season strata, crop specific acreages (in hectares) at the district level have been taken from the Area Production and Yield, APY, reports of the Ministry of Agriculture, New Delhi. Corresponding figures for total cropped area (in hectares), are calculated by summing over all reported crop acreages. Crop shares at the district level are then calculated by taking the ratio of crop specific acreage to total cropped area.

Crop Yield (in tonnes per hectare): As for cropping patterns, we study crop yields within a state-season strata, and for the same state-season strata looked at to study the impact on cropping patterns. Further, for each state-season, crop yields are studied for the same set of crops used to study cropping patterns. Within each state-season, district level data for crop yields are directly reported in the APY reports.

Note that between 2000/01 to 2009/10, about 33 districts were newly created. Out of these newly created districts, 23 were created by bifurcation from one parent district; for these we use the older (aggregated) geographical definitions. We drop the ten districts that were created from two or more parent districts.

B.2. EUS Dataset

This dataset refers to various rounds of the nationally representative Employment Unemployment Survey (EUS) of the National Sample Survey Organization (NSSO). We utilize three rounds of this survey for the main analysis. These are the 61st, 64th, and 68th rounds, and corresponding to the years, 2004/5, 2007/8 and 2011/12, respectively. We also use data from the 55th round,

corresponding to 1999/2000, to correct for pre-programme trends. All variables in the EUS dataset are at the individual level.

Our target population is all individuals residing in rural areas, between 18 and 60 years of age, and with secondary education or less. We restrict ourselves to this target population, so as to maintain comparability with other studies in this area (most notably, Imbert and Papp 2014).

We analyse impacts on two main labour market outcomes, namely employment shares (if employed, then further disaggregated by sector and by contract type), and casual wage (in agriculture and in non-agriculture). We explain these two outcomes below.

Employment Shares (fraction of time spent in each category): For each individual in a household, the EUS collects information on time spent in various activities during the week immediately preceding the date of the survey interview. We use this information to calculate the fraction of time spent in the reference week across ten mutually exclusive and exhaustive employment categories. These categories are as follows:

1. Self-employment in agriculture
2. Regular wage employment in agriculture
3. Casual wage employment in agriculture
4. Self-employment in non-agriculture
5. Regular wage employment in non-agriculture
6. Casual wage employment in non-agriculture
7. Wage employment in public works (including MGNREGA when it is offered)
8. Domestic work (free collection of goods, sewing and so on)
9. Unemployment
10. Not in labour force

Note that categories 1 through 6 if aggregated, constitute fraction of time spent in private sector employment as a whole. Also, categories 8 and 10 when combined tell us the fraction of time spent outside the labour force, defined more broadly to include domestic work.

Causal Wage, disaggregated by sector (in INR per day, 2004/5 prices): In order to calculate casual wages in each sector, we first classify casual work into that in agriculture and in non-agriculture using the National Industrial Classification 1998 (five digit) industry code reported in the survey. The five digit codes are then mapped on to two digit codes, and finally assigned either to agriculture

(codes 01, 02 and 05) or to non-agricultural (codes 10-99). Nominal wages in each sector are then calculated using information on total wage earnings earned during the week preceding the date of the survey and total days spent in wage employment in that sector during that week. Nominal wages are then expressed in 2004/5 prices using state level Consumer Price Index for Rural Labour, CPI-RL, constructed by the Labour Bureau of India.

B.2. Explanatory variables

Monthly rainfall at the district level is collected from two sources. For the period from 1999/0 to 2007/8 is taken from International Crop Research Institute for Semi-Arid Tropics, ICRISAT, Hyderabad, and for the remaining years, it is taken from Indian Meteorological Department, Government of India. This monthly series is aggregated to obtain rainfall by season or rainfall at the annual level, as required.

District level average urban casual wage for the years 1999/2000, 2004/5, 2007/8 and 2009/10 is calculated using the Employment Unemployment Surveys (EUS) for these years. Similarly, district level population shares of SC/ST and district level literacy rate is also computed using EUS surveys for the years just mentioned.