# Short-term Migration and Rural Workfare Programs: Evidence from India *

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**Abstract**

We study the effect of a large rural public works program on short-term migration from rural to urban areas in India. Using cross-state variation in public employment provision for identification, we find that participation to the program significantly reduces short-term migration. This has two important implications. First, households who choose to participate in local public works rather than migrating forgo much higher earnings outside of the village. We estimate a structural model of migration decisions which suggests the utility cost of migration may be as high as 60 % of migration earnings. Second, via its effect on migration, the program has a significant impact on urban labor markets. We use a gravity model to predict migration flows from rural to urban areas and find evidence that urban centers which are more exposed to a reduction of short term migration inflows experience significantly higher wage growth and a slight decline in employment for urban workers.

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# 1 Introduction

Conventional models of migration within developing countries consider migration as a long term decision (Harris and Todaro, 1970). Yet considerable evidence outside of economics (Haberfeld et al., 1999; Mosse et al., 2002; Smita, 2008; Deshingkar, 2006) and an increasing number of studies within economics (Banerjee and Duflo, 2007; Badiani and Safir, 2009; Morten, 2012) suggest a significant fraction of within developing countries migration is short-term. According to nationally representative data from National Sample Survey, in 2007-08 4.5 million Indian adults changed residence from rural to urban areas, 2.5 million adults changed residence from urban to rural areas and 8.5 million rural adults did short term migration trips (one to six months) for work in urban areas (see Figure 1). Short term and long term migration decisions are qualitatively different. Short-term migrants do not have to lose their land, or the support of informal insurance networks, and hence do not have to pay the same large fixed cost as long term migrants Munshi and Rosenzweig (2009). Short term migration is often seasonal, driven by the lack of earnings opportunities in rural areas during the agricultural off-season. As Figure 2 shows, long term migration is more common among rich households, and short-term migration more prevalent among poor households. Some authors have recommended government policies encouraging short-term migration as an effective way to reduce rural poverty (Bryan et al., 2011; Khandker, 2012).

In this paper, we study the effect a large rural workfare program, India's National Rural Employment Guarantee Act (NREGA) on short-term migration. Workfare programs, which hires rural workers during the off-season of agriculture with the goal of increasing the income of the poor are common antipoverty policies.[1] On the one hand they relax cash constraints and mitigating income risk, which may encourage migration (Angelucci, 2013). On the other, they improve local employment opportunities, which increases the opportunity cost of migration. Using cross state variation in public employment provision act for identification, we find evidence that NREGA significantly reduced short-term migration flows. Based on newly collected data from a high out-migration area, we show that many migrants declare wanting more public employment, despite the fact that earnings outside of the village are much higher. This suggests that utility costs of migration are large, and that the net income effects of the program may be low or even negative, though this does not rule out substantial welfare gains for participants. By reducing short term migration, the program may also have a large impact on urban labor markets. We use a gravity model of short term migration flows

[1] Recent examples include programs in Malawi, Bangladesh, India, Philippines, Zambia, Ethiopia, Sri Lanka, Chile, Uganda, and Tanzania.

from rural to urban areas and show that urban labor markets with higher predicted inflows from areas with more public employment experience higher wage growth and a relative decline in employment.

We present three pieces of evidence suggesting that participation to the workfare program reduces migration. First, using detailed survey data from a matched sample of villages spread across three states in a high out migration area, we find eight percent of surveyed adults report that had they not received work under the program, they would have migrated for work. In addition, about twelve percent of surveyed adults report both migrating and participating in the workfare program in the same season, and 88% of them declare they would do more work under the program if it were available. Second, we find that adults living in a state that provides more days of government work, even conditional on demand for government work, spend less time outside the village for work compared with other states. This cross-state difference in days spent outside the village for work is statistically significant only during the summer season during which most of the government work is provided. Third, using nationally representative data from NSS 2007-08, we find lower incidence of short term migration in "early" districts selected to implement NREGA first in "star" states which provide most of public employment as compared to districts in star states which received NREGA later and to early districts in states where little NREGA employment was provided. These differences are absent in 1999-00, before the program was implemented.

It is perhaps surprising that migration appears to be so strongly affected by the workfare program, given that earnings outside of the village are nearly twice the level of workfare daily earnings. The gap in earnings could simply reflect differential productivity between migrants and participants in the government program, but the wage differential persists even for adults who report both working for the government program and migrating. The large wage differentials combined with high demand for work under the workfare program suggest substantial migration costs. We investigate migration costs formally by modeling short-term migration using a framework similar to Benjamin (1992). Short-term migration provides a higher monetary return than local work but requires a fixed cost. Workers also incur a flow cost for each day spent away. Using this framework and the survey data, we are able to draw some conclusions about the flow costs of migration. Specifically, we compare the daily earnings of migrants who report wanting to work more for the workfare program with the government wage provided by the program. Since these individuals have already paid the fixed costs of migration, this difference is informative of the minimum marginal costs migrants incur along the intensive margin. We find that for the average migrant, the flow

costs of migration are 60% of daily earnings in the city.

We also consider the impact of the program on the labor market equilibrium in urban areas. A simple theoretical framework suggest that under reasonable assumptions, a small decline in rural to urban short term migration caused by NREGA may have large effects on urban wages. We combine NSS data on short term migration and census information on long term migration to build a matrix of migration flows from each rural to each urban district. We then estimate a gravity model of short term migration based on baseline characteristics, which allows us to predict migration flows independently from the effect of the program. Finally, we compare changes in labor market outcomes in urban centers which rely more or less heavily on migration from early districts in star states, where most NREGA employment is provided, and find evidence of higher wage growth for casual labor and a slight decline in employment between 2004-05 and 2007-08 in urban centers which were more exposed to a decline in short term migration. By contrast, we find no significant effect on wages for salaried workers, who are not on the same labor market as rural migrants, and no significant change in casual wages between 1999-00 and 2004-05, before NREGA was implemented, which suggest that our results are not driven by pre-existing trends, or macro-economic shocks unrelated to the program.

This paper contributes to the literature in three ways. First, we present evidence that even workfare programs operating during the agricultural off-season may have a significant impact on private sector employment, and that for many workers the opportunity cost of time is considerably greater than zero. The literature on labor market impacts of workfare programs is mostly theoretical (Ravallion, 1987; Basu et al., 2009). Recent empirical studies focus on the impact of workfare programs on rural labor markets (Azam, 2012; Berg et al., 2013; Imbert and Papp, 2014; Zimmermann, 2013). Other studies and papers have suggested that the NREGA may be impacting migration (Jacob, 2008; Ashish and Bhatia, 2009; Morten, 2012). To our knowledge, our paper is the first to estimate the impact of a public works program on rural to urban short-term migration.

Second, we use demand for employment on public works among migrants to shed light on the determinants of migration decisions. The literature highlights the importance of opportunity costs (i.e. local employment opportunities) and financial constraints in migration decisions (Angelucci, 2013; Bazzi, 2014). Bryan et al. (2011) find a transport cost subsidy in rural Bangladesh has long term positive effects on seasonal migration to urban areas, and explain their results by uninsured risk of failed migration and lack of information on returns to migration. In the context we study households are well informed about potential mi-

gration earnings and reduce migration when workfare benefits are available, which suggests short-term migration decisions are mostly driven by opportunity costs, rather than financial constraints or risk aversion.

Third, we present evidence that a commonly used anti-poverty policy significantly affects the extent of labor reallocation towards the urban non agricultural sector. The recent literature on structural transformation identifies the lack of labor mobility as an important obstacle to development, which may be due to multiple factors, such as subsistence constraints, transportation costs and village based informal insurance (Gollin and Rogerson, 2014; Morten and Oliveira, 2014; Munshi and Rosenzweig, 2013). It also suggests policies could reduce poverty and promote economic development by encouraging migration (Jalan and Ravallion, 2002; Kraay and McKenzie, 2014). We show that by reducing short-term migration, anti-poverty programs which generate employment in rural areas may bring significant welfare gains to rural workers, but at the same time it may also reduce their income, and impose large losses on urban employers.

The following section describes the workfare program and presents the data set used throughout the paper. Section 3 uses cross-state variation in public employment provision to estimate the impact of the program on short-term migration. 4 uses detailed information on migration and program participation decisions from the migration survey to provide structural estimates of migration costs. Section 5 uses nationally representative data from NSS Surveys to estimate the impact of the program on urban labor markets across India. Section 6 concludes.

# 2 Context and data

In this section we describe employment provision under the National Rural Employment Guarantee Act. We next present the two data sources we use in the empirical analysis. We use two rounds of the National Sample Survey (1999-00 and 2007-08), which provide nationally representative data on short-term migration flows and labor market outcomes in rural and urban areas. Our analysis also draws from an original household survey in a high out-migration area at the border of three states (Gujarat, Rajasthan and Madhya Pradesh), which collected detailed information on short-term trips outside of the village.

## 2.1 NREGA

The rural workfare program studied in this paper is India's National Rural Employment Guarantee Act (NREGA). The act, passed in September 2005, entitles every household in rural India to 100 days of work per year at a state-level minimum wage. The act was gradually introduced throughout India starting with 200 of the poorest districts in February 2006, extending to 130 districts in April 2007, and to the rest of rural India in April 2008. In the analysis we will call "early districts" the districts in which the scheme was implemented by April 2007 and late phase districts the rest of rural India. Column One and Two in Table 1 present the main differences between early and late phase districts. early districts were chosen to be poorer than late phase districts. Poverty rate is higher, literacy rate, agricultural productivity and wage for casual labor are lower in early than in late phase districts.

Available evidence suggests substantial state and even district variation in the implementation of the program (Dreze and Khera, 2009; Dreze and Oldiges, 2009). Figure 5 shows the extent of cross-state variation in public works employment in 2004-05 (before NREGA) and 2007-08 (when NREGA was implemented in phase one and two districts). As in Imbert and Papp (2014) we call "star states" seven states which are responsible for most NREGA employment provision: in Andhra Pradesh, Chattisgarh, Himachal Pradesh, Madhya Pradesh, Rajasthan, Uttarkhand and Tamil Nadu. (Dutta et al., 2012) argue that cross-states differences in NREGA implementation did not reflect underlying demand for NREGA work. States such as Bihar or Uttar Pradesh, which have a large population of rural poor have provided little NREGA employment.

Column Four and Five in Table 1 presents averages of socio-economic indicators in star and non-star states.[2] Star states do not seem systematically poorer than the other states: the poverty rate is lower, the literacy rate and the fraction of scheduled castes is the same, the proportion of scheduled tribes is higher. Star states have a larger fraction of the labor force in agriculture, but the agricultural productivity per worker and the wage for casual labor in agriculture are the same. They have lower population density, which translates into larger amounts of cultivable land per capita, both irrigated and non irrigated. Finally, they have built more roads under the national program PMGSY in 2007-08, and have better access to electricity (according to 2001 census data), which suggests that they may be more effective in implementing public infrastructures programs. However, there does not seem to be any systematic difference between star and other states in access to education, health,

[2]Appendix A.1 details how we construct these indicators.

telecommunication, transport or banking services.

An important question is whether differences in economic conditions can explain differences in public employment provision under NREGA between star and non star states. Figure 6 plots for each state the average residual from a regression of the fraction of time spent on public works by each prime age adults on the whole list of district characteristics presented in Table 1. The ranking of states in terms of employment provision remains stringly similar to Figure 5. This suggests that differences in NREGA implementation are not explained by differences in economic conditions, but by some combination of political will, existing administrative capacity, and previous experience in providing public works.[3]

Public employment provision is also highly seasonal. Local governments start and stop works throughout the year, with most works concentrated during the first two quarters of the year prior to the monsoon. The monsoon rains make construction projects difficult to undertake, which is likely part of the justification. Field reports, however, document government attempts to stop works during the rainy season so they do not compete with the labor needs of farmers (Association for Indian Development, 2009). Figure 7 shows variation in time spent on public works across quarters of the year. Public employment drops from 1.2% to 0.2% between the second and third quarter, and stays low in the fourth quarter.

Work under the act is short-term, often on the order of a few weeks per adult. Households with at least one member employed under the act during agricultural year 2009-10 report a mean of only 38 days of work and a median of 30 days for *all* members of the household during that year, which is well below the guaranteed 100 days. Within the study area as well as throughout India, work under the program is rationed. During agricultural year 2009-10, an estimated 19% of households reported attempting to get work under the act without success.[4] The rationing rule that local officials use varies from village to village and is unfortunately unknown to us. Conversations with survey respondents suggested that in some cases local officials provided work preferentially to certain households, while in other cases a certain number of household members from each household were allowed to work for the act. In all cases, work was primarily available during the summer, and most respondents were actively recruited for work by village officials rather than applying for work(The World Bank, 2011).

[3]For example, in the Congress ruled Andhra Pradesh NREGA was well implemented while in Gujarat the BJP government refused to implement what it viewed as a Congress policy. In Rajasthan the BJP government adopted NREGA as part of the state's long tradition of drought relief while in Maharashtra the scheme was impopular, because it was perceived as a repetition of the State Employment Guarantee started in the 1970s, which had failed to generate durable employment opportunities.

[4]Author's calculations based on NSS Round 66 Employment and Unemployment Survey.

## 2.2 NSS Employment Surveys

The main obstacle to studying migration is the scarcity of reliable data. In this study we use two data sources, a nationally representative survey with few questions on migration and a very detailed survey from a high out-migration area.[5]

The primary source of information on short-term migration in India is the Employment and Unemployment Survey carried out by the National Sample Survey Organisation (here on, "NSS Employment Survey"). The NSS Employment Survey is a nationally representative household survey conducted at irregular intervals with one specialized module whose focus changes from round to round. For the purpose of our analysis, we use the 1999-00 and 2007-08 rounds, which contain questions on migration history of each household member.

Our analysis with NSS data focuses on district level migration flows.[6] The NSS Employment survey sample is stratified by urban and rural areas of each district. Our sample includes districts within the twenty largest states of India, excluding Jammu and Kashmir. We exclude Jammu and Kashmir since survey data is missing for some quarters due to conflicts in the area. The remaining 497 districts represent 97.4% of the population of India. The NSSO over-samples some types of households and therefore provides sampling weights (see National Sample Survey Organisation (2008) for more details). All statistics and estimates computed using the NSS data are adjusted using these sampling weights.[7]

### 2.2.1 Short-term and long-term migration

In order to measure short-term migration, we use NSS Employment surveys 1999-00 and 2007-08, which are the only two recent rounds that include a migration module. NSS 1999-00 asks whether each household member has spent between two and six months away from the village for work within the past year. NSS 2007-08 asks a slightly different question, whether each household member has spent between *one* and six months away from the village for work within the past year. For this reason, one would expect 2007-08 data to report higher levels of short term migration than 1999-2000. Indeed, the percentage of short term migrants among rural prime age adult is an estimated 1.67% in 1999-00 and 2.51% in

[5]To our knowledge, no comparable data exists for India as a whole. ARIS REDS data for the year 2006 does contain information on seasonal migration, but no information on job search, work found and living conditions at destination.

[6]Districts are administrative units within states. The median district in our sample had a rural population of 1.37 million in 2008 and an area of 1600 square miles.

[7]See Appendix A.1 for details on the construction of sample weights.

2007-08.[8]

For those who were away, NSS 2007-08 further records the number of trips, the destination during the longest spell, and the industry in which they worked. The destination is coded in seven categories: same district (rural or urban), other district in the same state (rural or urban), another state (rural or urban), and another country. Figure 3 draws the map of short term migration across rural Indian districts. Short term migration is not widespread, with most districts having migration rates lower than 1%. It is highly concentrated in poorer districts of the North-East (Bihar, Uttar Pradesh) and the West (Gujarat and Rajasthan), which often report migration rates above 5%.

Since we are interested in migration flows between rural and urban areas, we need to construct the number of workers migrating from the rural part of each district to the urban part of each district. For this, we combine information on destination in NSS 2007-08 with data on the state of last residence of migrants who came from rural to urban areas between 1991 and 2000, according to the 2001 census. Specifically, we use information on the district of residence and the state of origin of long term migrants who live in urban areas and come from rural areas to predict the district of destination of short term migrants living in rural areas who go to urban areas. The underlying assumption is that short and long term migration follow the same geographical patterns. This assumption can be justified by the role of family, village and sub-caste networks in migration decisions, which give rise to "chain migration". The details of our method are described in Appendix A.1.

### 2.2.2 Employment and wages

We further use NSS Employment Surveys to construct measures of employment and wages at origin and destination. The NSS Employment Survey includes detailed questions about the daily activities for all persons over the age of four in surveyed households for the most recent seven days. We restrict the sample to persons aged 15 to 69. We then compute for each person the percentage of days in the past seven days spent in each of five mutually exclusive activities: public works, private sector work, domestic work not in the labor force, and unemployed. Private sector includes both waged work and self-employment. The NSSO makes the distinction between two types of waged work depending on the duration and formality of the relationship with the employer: salaried work is long term and often involves a formal contract, and casual work is temporary and informal. In our analysis, we will focus

[8] Authors calculation based on NSS Employment Surveys 1999-00 and 2007-08. In the migration survey described below, the proportions of short term migrants away from two to six months and one to six months are 23% and 32% respectively.

on casual work, which is the dominant form of employment for short term migrants from rural areas. We compute the average earnings per day worked in casual labor (the "casual wage") and in salaried work (the "salaried wage"). Finally, in order to estimate the total number of workers engaged in casual work in each district we use the NSSO question on the occupation of each household member in the last year and categorize as "casual worker" every household member who report casual work as her principal or subsidiary occupation.

## 2.3 Migration Survey

### 2.3.1 Sample Selection

Figure 3 shows the location of villages selected for the migration survey, and Figure 4 provides a map of the survey area. Migration survey villages were selected to be on the border of three states: Gujarat, Rajasthan, and Madhya Pradesh. The survey location was selected because previous studies in the area reported high rates of out-migration and poverty (Mosse et al., 2002), and because surveying along the border of the three states provided variation in state-level policies.

The migration survey consists of household adult and village modules. The sample includes 705 households living in 70 villages in the states Gujarat, Rajasthan and Madhya Pradesh. The household module was completed by the household head or other knowledgeable member. One-on-one interviews were attempted with each adult aged 14 to 69 in each household. In 69 of the 70 villages, a local village official answered questions about village-level services, amenities and labor market conditions.

The analysis in this paper focuses entirely on those adults who completed the full one-on-one interviews. Table 2 presents means of key variables for the subset of adults who answered the one-on-one interviews as well as all adults in surveyed households. Out of 2,722 adults aged 14-69, we were able to complete interviews with 2,224 (81.7%). The fourth column of the table presents the difference in means between adults who completed the one-on-one interview and those who did not. The 498 adults that we were unable to survey are different from adults that were interviewed along a number of characteristics. Perhaps most strikingly, 40% of the adults that we were unable to survey were away from the village for work during all three seasons of the year compared with eight percent for the adults that we did interview. It should therefore be kept in mind when interpreting the results that migrants that spend most of the year away from the village are underrepresented in our sample.

To assess how the adults in our sample compare with the rural population in India, the

fifth column of Table 2 presents means from the rural sample of the nationally representative NSS Employment and Unemployment Survey. Literacy rates are substantially lower in the study sample compared with India as a whole, reflecting the fact that the study area is a particularly poor area of rural India. The NSS asks only one question about short-term migration, which is whether an individual spent between 30 and 180 days away from the village for work within the past year. Based on this measure, adults in our sample are 28 percentage points more likely to migrate short-term than adults in India as a whole. Part of this difference may be due to the fact that our survey instrument was specifically designed to pick up short-term migration, though most of the difference is more likely due to the fact that the sample is drawn from a high out-migration area. The sixth column presents the mean from NSS survey for the four districts chosen for the migration survey. The short-term migration rate is 16%, which is still only half of the mean in the migration survey, but 14 percentage points higher than the all-India average.

### 2.3.2 Migration patterns

Table 3 presents means of variables for different subgroups. Adults who reported migrating within the past year (Column One) are much younger, less educated, and more likely to be male than respondents on average. NREGA participants (Column Two) are slightly older, much less educated and more likely to be female than the average respondent. NREGA participants who report not wanting to work for the NREGA (Column Three) are more educated and slightly more likely to be female than the average respondent. The measures of household wealth such as land holdings, whether the household owns a cell phone, and whether the household has an electricity connection do not differ substantially across groups.

The lives of the people in the study area are closely linked to the agricultural cycle. As a result, it was crucial that the survey instrument collect data for each individual over the course of at least one full agricultural year. Since migration, cultivation, and participation in the NREGA are all highly seasonal, the survey instrument included questions about each activity separately for summer 2010, winter 2009-10, monsoon 2009, and summer 2009. Most respondents were surveyed between mid summer 2010 and early monsoon 2010, so that in many cases, summer 2010 was not yet complete at the survey date. As a result, when we refer to a variable computed over the past year, it corresponds to summer 2009, monsoon 2009, and winter 2009-10. Respondents were much more familiar with seasons than calendar months, and there is not an exact mapping from months to seasons. Summer is roughly mid-March through mid-July. The monsoon season is mid-July through mid-November, and

winter is mid-November through mid-March.

Columns One to Three of Table 4 provide some information about migration trips from the migration survey. First, as found in other studies, migration is concentrated during the winter and the summer and much lower during the peak agricultural season (from July to November). Second, migrants cover relatively long distances (300km on average during the summer), and most of them go to urban areas (84%). A majority works in the construction sector (70%), with short-term employer-employee relationships (only 37% of them knew their employer or the contractor before leaving the village). Living conditions at destination are very informal, with 86% of migrants reporting having no formal shelter (often a bivouac on the work-site itself). Finally, only a minority (16%) migrates alone; in the sample most migrants travel and work with family members. Column Four presents national averages from NSS survey. Along the dimensions measured in both surveys, migration patterns are slightly different in India as a whole and in the migration survey sample. In particular, the average rural short-migrant is more likely to stay in the same state (50%), less likely to go to urban areas (68%), and more likely to work in the manufacturing or mining sector (18%).

### 2.3.3 Measuring Demand for NREGA Work

An important variable for the following analysis is whether an individual wanted to work more for the NREGA during a particular season. Specifically, the question is, "if more NREGA work were available during [season] would you work more?" for individuals who had worked for the NREGA. For individuals who did not work for the NREGA, we asked "did you want to work for the NREGA during [season]?" One should be skeptical that the answer to these questions truly indicates a person's willingness to work. Table A.2 shows that the correlations between the response to the resulting measure of demand and respondent characteristics are sensible. We also check the reasons given by respondent*s* for why they did not work if they wanted to work and why they did not want to work if they reported not wanting to work. A.3 shows that the closure of worksites and the inaction of village officials are the main reasons given by respondents who wanted more NREGA work while other work opportunities, studies, and sickness are the the main reasons given by respondents who did not want more NREGA work.

### 2.3.4 Measuring Earnings

In order to assess the costs of migration, we require reliable measures of the wage that NREGA participants and migrants earn. Given the short-term nature of most migrant jobs,

the same migrant might work for multiple employers for different wages within the same season. For this reason, the survey instrument included questions about earnings, wages, and jobs for each trip within the past four seasons up to a maximum of four trips. Some migrants still might hold multiple jobs and therefore earn different wages within the same trip, but daily earnings and wages are more likely to be constant within the same migration trip than within the same season. In total, this yields wage observations for 2,749 trips taken by 1,125 adults. So that we do not overweight migrants who took more frequent, shorter trips relative to migrants who took less frequent, longer trips, we calculate the average wage for each migrant for each season that the migrant was away. Appendix A.1 describes the construction of the earnings measures in detail.

# 3 Program effect on migration

In this section, we use the migration survey to investigate the effect of NREGA on short term migration and estimate migration costs. We first present descriptive statistics on program participation, demand for NREGA work and migration. We next estimate the program effect by comparing public employment provision and migration in Rajasthan villages with matched villages in Gujarat and Madhya Pradesh.

## 3.1 Migration and NREGA work

We first investigate the correlation between demand for NREGA work, program participation and short-term migration in the migration survey sample. We follow our conceptual framework and divide the population of adults in our sample into six groups. In the first are individuals who do not migrate, and who neither worked for the NREGA nor want to work for the NREGA (Type 1). In the second are individuals who do not migrate but either worked for the NREGA or report wanting to work for NREGA (Type 2). In the third group are individuals who migrate and work for the NREGA, but report they would not migrate if no NREGA work was available (Type 3). In the fourth group are adults who report they would have migrated had they not received NREGA work (Type 4). In the fifth group are individuals who both migrated and worked for the NREGA or want work (Type 5). In the last group are migrants who neither worked for the NREGA nor want to work for the NREGA (Type 6).

In the fourth column of Table 5 we see that across all states, only 14% of surveyed adults report not migrating and not wanting NREGA work (first row). The largest group (43%)

is composed of adults who do not migrate and participate or would like to participate in NREGA (second row). Demand for NREGA work is proportionnally even higher among migrants: among the 35% of adults who migrated, only one out of seven report not wanting to work for NREGA (4%). Thirty percent of the sample migrate and participate in NREGA or want to work for NREGA (fifth). Based on the model, we would expect that these individuals are ready to substitute away from migration towards NREGA work. However, this is only a lower bound on the impact of the NREGA on migration. An additional 8% of adults report that they would have migrated had they not worked for the NREGA (fourth row). Only 1% of adults are migrants and would not have migrated without NREGA work (third row).

These results suggest that NREGA work reduced or could potentially reduce migration for 38% of adults or 80% of migrants. Comparing the first, second and third columns of Table 5 also reveals important differences across states in the sample. In particular, the proportion of adults who declare they stopped migrating because of NREGA increases from 3% in Gujarat to 8% in Madhya Pradesh and 10% in Rajasthan (fourth row). In the following section, we use cross-state variation in the quality of NREGA implementation to estimate the impact of the program on short-term migration.

## 3.2 Border effect on migration: strategy

As explained in section 2, the migration survey villages were selected in part because they were located at the intersection of the three states of Rajasthan, Madhya Pradesh, and Gujarat. The objective was to exploit differences in implementation of the NREGA across the border to estimate it impact on migration. Table 6 shows that the fraction of adults who worked for NREGA during the summer 2009 is 50% in Rajasthan, 39% in Madhya Pradesh, and 10% only in Gujarat. Conditional on participation, NREGA workers receive 31 days in Rajasthan on average, 22 days in Madhya Pradesh and 25 days in Gujarat. Interestingly, the number of days of NREGA work adults would want to work is the same in all borders, which confirms that variation in NREGA employment provision are due to differences in political will and administrative capacity in implementing the scheme.
In order to estimate the impact of the program on days worked on the NREGA and days spent outside the village we compare Rajasthan with the other two states Gujarat and Madhya Pradesh. The estimating equation is:

$$Y_i = Raj_i + X_i + \epsilon i \tag{1}$$

where $Y_i$ is an outcome for adult $i$, $Raj_i$ is a dummy variable equal to one if the adult lives in Rajasthan and $X_i$ are controls. The vector $X_i$ includes worker and households characteristics presented in table 3, a dummy variable for whether the adult reported being willing to work more for the NREGA, village controls listed in table 7 and village pair fixed effects. Standard errors are clustered at the village level.

The underlying identification assumption is that villages in Rajasthan are comparable with their match on the other side of the border either in Gujarat or in Madhya Pradesh. A potential threat to our identification strategy is that villagers across the border live in different socio-economic conditions, have different access to infrastructures, or have benefited from different state policies (in education, health etc.). For this reason it is important to test whether the villages are indeed comparable in these respects. Table 7 presents sample mean of village characteristics for village pairs in Rajasthan and Madhya Pradesh and village pairs in Rajasthan and Gujarat. Across all states, villages have similar demographic and socio-economic characteristics. They have the same population, proportion of scheduled tribes, literacy rate, fraction of households who depend on agriculture as their main source of income, same average land holding and access to irrigation. There are however significant differences in infrastructures across states. Villages in Madhya Pradesh are significantly further away from the next paved road than matched villages in Rajasthan, but the difference is relatively small (600 meters). Villages in Gujarat are closer to railways, to towns, have greater access to electricity and mobile phone networks. For robustness, we include all these characteristics in our analysis as controls. Since villages in Gujarat seem systematically different from matched villages in Rajasthan along some important dimensions, we also implement our estimation excluding pairs with Gujarat villages.

## 3.3 Border effect on migration: results

We first estimate the border effect on days worked for the NREGA as the outcome and consider each season separately. The first column of Table 8 presents the estimates from regressing days worked for the NREGA during summer 2009 on a dummy variable for whether the adult lives in Rajasthan and controls. The coefficient on the Rajasthan dummy suggests that on average, adults in Rajasthan worked twice as many days than the average adult in the MP and Gujarat villages who worked six days (Column One). With the inclusion of expressed demand for NREGA work the estimated coefficient remains the same (Column Two). Columns Three through Six repeat the same analysis using NREGA days worked during winter and monsoon. We see little difference across states in days worked during these

seasons mainly because days worked is close to zero everywhere. Panel B in Table 8 presents estimates obtained without villages on the border of Gujarat and Rajasthan. Comparing villages on either side of the border between Rajasthan and Madhya Pradesh, adults in Rajasthan work six days more on average on NREGA worksites than adults in Madhya Pradesh (who work eight days on average).

Table 9 repeats the same analysis with days spent outside the village for work as the dependent variable. Estimates from the first two columns suggest that during summer 2009, adults in the Rajasthan villages spent almost seven fewer days on average working outside the village than their counterpart on the other side of the border, who are away for 24 days on average. Assuming villages in Gujarat and Madhya Pradesh provide a valid counterfactual for the village in Rajasthan, these estimates suggest that one day of additional NREGA work reduces migration by approximately 1.16 days. This effect is the combination of a reduction in the probability of migrating (extensive margin) and the length of migration trips conditional on migrating (intensive margin). Appendix Tables A.4 and A.5 show in Rajasthan villages the probability of migrating in the summer is nine percentage point lower than the average of 39% in Madhya Pradesh and Gujarat and the number of days spent away from the village by migrants during the summer is lower by five days (insignificant) in Rajasthan from an average of 62 days in Madhya Pradesh and Gujarat.

As detailed in Coffey et al. (2011), however, there are many important differences among adults living in Rajasthan, Madhya Pradesh and Gujarat. As a result, these differences in migration could be partly due to preexisting differences among the states unrelated to the NREGA.[9] As a test, Columns Three through Four of Table 9 present the results using days worked outside the village during monsoon and winter as the dependent variable. To the extent that the difference in migration during summer 2009 is driven by differences in migration unrelated to the NREGA, we might expect that these differences would also appear during the monsoon and winter when there is no differential in NREGA work across the states. In fact, the estimates in Columns Three through Six show that the differences across states during these seasons are much smaller and statistically insignificant. As a final robustness check, we estimate the same specification without the village pairs that include Gujarat villages. The magnitude of the border effect increases to 7.8 days per adult. (Panel B of Table 9).

[9]The migration survey included retrospective questions about past migration trips. Using non missing responses, we find no significant difference in migration levels in 2004 and 2005, i.e. before NREGA was implemented. Unfortunately, less than 50% of respondents remembered whether they migrated before 2005, so we cannot exclude that migration levels were in fact different.

### 3.4 All-India effect on migration: empirical strategy

A natural question is whether our finding that higher public employment provision implies lower short term migration is limited to the migration survey villages or whether it holds across India. We investigate this using nationally representative data from NSS 1999-00 and 2007-08. In order to estimate the impact of the program on migration and labor markets, we use variation in NREGA implementation documented in section 2. When the second NSS survey was carried out between July 2007 and June 2008, NREGA was implemented in 330 early districts, but not in the rest of rural India. As discussed in section 2, the quality of NREGA implementation varied across states, with seven "star states" providing most of NREGA employment. Our empirical strategy builds on these observations and estimates the impact of the program by comparing early districts of star states with other rural districts. We first use cross-sectional variation and compare public employment and migration levels in 2007-08, when the program was active in early districts and in 1999-00, in order to test whether outcomes were different before NREGA was implemented. Let $Y_{iot}$ be the outcome for individual $i$ in rural district $o$ in year $t$. Let $Early_o$ be a binary variable equal to one for early districts, and $Star_o$ a binary variable equal to one for star states. Let $Z_o$ denote a vector of district characteristics which do not vary with time, $X_{ot}$ a vector of district characteristics which do vary with time and $H_i$ a vector of individual characteristics. We estimate the following specification on 1999-00 and 2007-08 data successively:

$$\begin{aligned} Y_{io} &= \beta_0 Early_o + \beta_1 Star_o + \beta_2 Early_o \times Star_o \\ &+ \delta Z_o + \gamma X_o + \lambda X_o \times Early_o + \alpha H_i + \varepsilon_{io} \end{aligned}$$

We next estimate the effect of the program using a difference in difference strategy, i.e. comparing changes in public employment and changes in migration in early districts of star states and in other districts. Let $NREGA_{ot}$ be a binary variable equal to one for early districts in 2007-08. Les $\eta_t$ and $\mu_o$ denote time and district fixed effects respectively. We use data from NSS 1999-00 and 2007-08 and estimate the following equation:

$$\begin{aligned} Y_{iot} &= \beta_0 NREGA_{ot} + \beta_1 Star_o \times \mathbf{1}\{t > 2006\} + \beta_2 NREGA_{ot} \times Star_o \\ &+ \delta Z_o \times \mathbf{1}\{t > 2006\} + \gamma X_{ot} + \lambda X_{ot} \times Early_o + \alpha H_i + \eta_t + \mu_o + \varepsilon_{iot} \end{aligned}$$

### 3.5 All-India effect on migration: results

Estimates of the program impact on public employment are presented in Table 12. In 2007-08, public employment in late phase districts of non-star states is quasi absent: rural adults in these districts spend 0.05% of time on public works. Early districts in non star states and late phase districts star states have slightly higher levels of public employment (.2% and .45% respectively), but the difference becomes insignificant once controls are included (Column Two). By contrast, public employment in early districts of star states is considerably higher, with rural adults spending about 2% of total time on public works. The difference remains significant after controls are included. As Column Three shows, this large cross-sectional variation in public employment does not exist in 1999-00, before NREGA was implemented. Results from the difference in difference specification presented in Column Four confirm these findings: the share of total time spent on public works increased in early districts of star states by 1.7 percentage point between 1999-00 and 2007-08 while there is no change in public employment in early districts of non star states. One would hence expect migration to decrease in early districts of star states as compared to early districts of other states.

Estimates of the program impact on short term migration from rural districts are presented in Table 13. In late districts of non star states, 1.2% of rural prime age adults have made a short term migration trip in 2007-08. According to the estimates with controls (in Column Two) migration is 1 percentage point higher in early districts of non star states, and the same in early districts of star states. Interestingly, in 1999-00 there is no significant difference between late and early districts either in star or non star states (Column 4). The estimates from the difference in difference specification in Column 5 suggest that as compared to changes in late phase districts of non star states migration rose in early districts of non star states, rose in late districts of star states, but stayed the same in early districts of star states. Since NSS 2007-08 counts trips from one to six months whereas NSS 1999-00 counts trips from two to six months, the relative increase of short term migration in early districts may be due to higher prevalence of trips from one to two months. Nevertheless, these results suggest that rural districts where more NREGA work is provided have lower short term migration than districts in the same states or districts with similarly low level of development in other states.

These results, taken together with the results based on the migration survey sample, suggest that government work is an attractive alternative to migration for the adults in our sample and that the NREGA has had a significant impact on short term migration. This has two important implications. First, given that the wage per day of work outside the village is

roughly twice that for NREGA workers, then for workers to prefer NREGA employment to migration the cost of migration need to be high. Second, since migrant workers from rural areas represent an important fraction of the unskilled labor force in urban areas, rural public works program such as NREGA may have significant effects on urban labor markets. We investigate these issues formally in the next two sections.

# 4 Migration Costs

In this section, we briefly outline a theoretical model to understand the impact of the program on migration decisions by rural workers, and use it to structurally estimate the flow cost of migration.

## 4.1 Model of migration and participation decisions

Consider an individual $i$ living in a rural area. She splits total time $T$ between work in of the village $r$ and work outside the village $T - L_m$. In-village earnings take the form $f(L_i^r)$ with $f(\cdot)$ increasing and concave and $f'(0) >> 0$. Leaving the village requires a fixed cost $c_f$ and a variable cost $c_v$ per unit of time spent outside the village. While outside the village, migrants earn $w_u$ per day away. Time spent in the village $L_r$ solves:

$$\max_{L_r} f(L_r) + (w_u - c_v)L_r - c_f \mathbb{1}\{L_r < T\}$$
$$\text{such that } L_r \in [0, T]$$

For any interior solution $L_r < T$, the optimal period of time spent in the village is $L_r^*$ such that $f'(L_r^*) = w_u - c_v$. Let $M_0$ be a dummy variable which is equal to one when the invidual migrate. Leaving the village for work is optimal if and only if:

$$M_0 = 1 \quad \Leftrightarrow \quad (w_u - c_v)(T - L_r^*) - c_f - [f(T) - f(L_r^*)] > 0 \tag{2}$$

The model assumes the utility function is linear in earnings and that there is no leisure choice. More generally, one could think of $f(L_r)$ as capturing utility from time spent in the village after the individual has optimally chosen work outside of the village $T - L_r$ and leisure given a time constraint of $T$, and one could interpret $(w_u - c_v)L_r - c_f \mathbb{1}\{L_r < T\}$ as capturing utility from time spent outside the village. The variable cost $c_v$ would then include the value of leisure outside the village.

Next, we consider what happens when $L_g$ days of government work (NREGA work) are offered within the village at wage $w_g$. We assume $L_g$ is small relative to the usual duration of migration trips ($L_g < T - L_r^*$) and fixed, i.e. workers choose whether or not participate to the program, but not the number of days they work. Let $c_p$ denote the cost of participation to the program.[10] Let $M_1$ be a dummy variable which is equal to one when the individual migrate and $P$ a dummy variable which equals to one if the individual participates to the program. Participation and migration decisions are made jointly: individuals choose among four options, with the following pay-offs:

| | $P=0$ | $P=1$ |
|---|---|---|
| $M_1=0$ | $U_1 = f(T)$ | $U_2 = f(T-L_g)+w_gL_g - c_p$ |
| $M_1=1$ | $U_3 = f(L_r^*) + (w_u - c_v)(T - L_r^*) - c_f$ | $U_4 = f(L_r^*) + (w_u - c_v)(T - L_r^* - L_g) - c_f + w_gL_g - c_p$ |

Let us first consider options 1 and 2. Conditional on not migrating, individuals participate to the program if and only if $U_2 > U_1$, i.e. if:

$$w_gL_g - c_p > f(T) - f(T - L_g) \tag{3}$$

Assuming zero cost of participation and letting $L_i^g$ tend towards zero, this condition becomes $f'(T) < w_g$, i.e. individuals who do not migrate participate to the program if the marginal productivity of their time in the village is lower than the NREGA wage.

Let us next consider options 3 and 4. Conditional on migrating, individuals participate to the program if and only if $U_4 > U_3$, i.e. if:

$$w_gL_g - c_p > (w_u - c_v)L_g \tag{4}$$

Assuming zero cost of participation, this condition becomes $w_g > w_u - c_v$. Migrants participate to the program if and only if the NREGA wage is higher than the earnings from one day away minus the flow cost of migration.

Finally, let us consider the migration decision. If the worker does not participate, the decision rule is the same as if the program did not exist, i.e. she migrates if and only if 2 is

[10] These assumptions are consistent with the evidence discussed in Section 2.1 that demand for NREGA work is heavily rationed, and with the empirical distribution of migration trips and NREGA workspells in our sample: during the summer 2009 less than 15% of adults who worked for NREGA received more than 32 days, but more than 85% of adults who migrated were away for more than 32 days.

satisfied. Conditional on participation in NREGA, leaving the village for work is optimal if and only if:

$$M_1|_{P=1} = 1 \quad \Leftrightarrow \quad f(T - L_g) < f(L_r^*) + (w_u - c_v)(T - L_r^* - L_g) - c_f \tag{5}$$

Comparing individual decisions with and without the government program, there are six types of individuals to consider:

- Type 1: Never migrate and do not participate to the program. (2) and (3) do not hold.
- Type 2: Never migrate and participate. (3) holds, (2) and (5) do not.
- Type 3: Start migrating with the program. (5) and (4) hold, (2) does not.
- Type 4: Stop migrating with the program. (2) and (3) hold, (5) does not.
- Type 5: Keep migrating and participate. (2), (4) and (5) hold.
- Type 6: Keep migrating and do not participate. (2) holds, (4) does not.

Let $L_m$ denote total migration from rural areas and $L_m^i$ individual migration. Without the program, Type Four, Five and Six individuals migrate:

$$L_m = \sum_{i \in T_4, T_5, T_6} (T^i - L_r^{i*})$$

Let us now consider the case where the government offers a small amount of government work: $L_g$ to each individual. Types Three, Five and Six individuals migrate:

$$L_m = \sum_{i \in T_6} (T^i - L_r^{i*}) + \sum_{i \in T_3, T_5} (T^i - L_r^{i*} - L_g^i)$$

The change in migration due to the implementation of the program is the sum of three effects. On the intensive margin, Type Five individuals $w_g > w_u - c_v$ reduce migration days one-for-one with government work. On the extensive margin, Type Three individuals start migrating and Type Four individuals stop migrating:

$$\Delta L_m = -\sum_{i \in T_5} L_g^i + \sum_{i \in T_3} [T^i - L_r^{i*} - L_i^g] - \sum_{i \in T_4} L_r^{i*}$$

The net effect of the program on total migration depends on the size of Types Three, Four and Five. One of the contributions of the paper is to use survey data to measure the

size of these groups and to estimate structurally the distribution of migration costs. We focus on the participation decision of current migrants (Types Three, Five and Six).

## 4.2 Estimating Migration Costs

We now build on our theoretical framework to provite structural estimates of migration costs. From Equation 5 and assuming away the cost of participation, current migrants participate to the program if and only if $c_v > w_u - w_g$, i.e. the flow cost of migration is higher than the difference between migration daily earnings and the NREGA wage. Suppose for each individual $i$, we observe potential earnings per day outside the village ($w_u^i$), earnings per day of government work ($w_g^i$) and a dummy variable for whether the individual would work more for the government program if provided work ($WANT_i$). We interpret $WANT_i$ as the participation decision in a hypothetical situation were migrants would not have to pay the cost of participation ($c_p = 0$).[11] Since we focus on current migrants, we can put a higher bound on migration costs by assuming that on average the flow cost of migration is lower than daily earnings from migration ($c_v < w_u$). Suppose that variable migration costs within the population of current migrants are distributed according to $N(\mu_c, \sigma_c)$. Then the likelihood of $\mu_c$, $\sigma_c$ conditional on $w_u$, $w_g$ and $WANT_i$ is:

$$L(\mu_c, \sigma_c|_{w_g^i, w_u^i, WANT_i}) = \sum_{WANT_i=1} \log\left(\Phi(\frac{w_u^i - w_g^i - \mu_c}{\sigma_c})\right) + \sum_{WANT_i=0} \log\left(\Phi(\frac{w_u^i - \mu_c}{\sigma_c}) - \Phi(\frac{w_u^i - w_g^i - \mu_c}{\sigma_c})\right) \quad (6)$$

Table 10 presents the earnings per day of work outside the village and per day spent outside the village for migrants as well as earnings per day worked for the NREGA. The construction of these variables is described in detail in Section 2.3. The first column restricts the sample to individuals who worked for the NREGA and migrated during summer 2009. The second column extends the sample to all adults who left the village during summer 2009. The third column and fourth column split the sample of migrants into those who report wanting more NREGA work and those who report not wanting more NREGA work. The differential between daily earnings outside the village and NREGA earnings is over 40% higher for migrants who do not want NREGA work.

[11] As a robustness check, we repeat the same analysis with only migrants who are currently participating in NREGA, i.e. those who have already paid the cost $c_p$, and find very similar results.

Next, we estimate the distribution of variable migration costs using the framework set out in the previous section. Table 11 presents the results. The mean migration cost per day away is 60.5 rupees which is 59% of the average daily earnings per day away from the village. The standard deviation of migration costs is 30 rupees, though this should be interpreted with caution since any measurement error in NREGA earnings or earnings per day away from the village will increase this estimated standard deviation. Hence, these structural estimates suggest the flow cost of migration needs to be very high to explain that many migrants are ready to forgo higher wages at destination and do NREGA work in the village.

## 4.3 Interpretation of Migration Costs

We next try to assess the relative importance of three possible sources of migration costs: higher costs of living at destination, uncertainty about earnings from migration and disutility cost from leaving dependants behind.

First, there are monetary costs to being away. Living in urban areas is more expensive than living in the village, and migrants may need to pay for goods they would get for free or for cheap at home. Since our estimation relies on nominal comparisons, any difference in living costs will enter the flow cost of migration. Existing evidence on urban-rural wage gaps in India suggests adjusting for living costs may be important. Using NSS 2009-10 Employment Unemployment surveys and state poverty lines as deflators, Hnatkovska and Lahiri (2013) show urban-rural real wage gaps are zero, or even negative at the bottom of the distribution of wages. However, deflators used for urban residents may not be appropriate for short-term migrants if their respective consumption baskets are very different. As we saw from Table 4, 86% of migrants in the summer 2009 had no formal shelter and were bivouacking on worksites, and most of the remaining 14% stayed with friends and family. Hence, very few migrants paid the cost of lodging in urban areas, which is an important part of living costs for residents. Similarly, expenditures on health and education, on durable goods are likely made at home and not at destination. Food is perhaps the only type of expenditures short-term migrants need to make in urban areas and even then migrants often bring large quantities of food from the village.

In order to evaluate what fraction of the estimated flow cost of migration can be explained by differences in living costs, we consider two deflators for migration earnings. We first follow Hnatkovska and Lahiri (2013) and consider the ratio of the urban poverty line to the rural poverty line in 2009, which is equal to $578/446 = 1.30$ (Planning Commission, 2009). Assuming that when they are at destination, migrants spend their income as urban

residents do, higher costs of living amount to 30% of migration earnings, i.e. half of estimated migration costs. However, if migrants expenditures at destination only include food items, a more appropriate deflator applies urban prices only to food expenditures, and rural prices to the rest. We use NSS Employment Unemployment Survey to estimate food shares in urban and rural areas for households whose per capita expenditures are within 5% of the poverty line. Let $P_r$ and $S_r$ (resp $P_u$ and $S_u$) denote the poverty line and the share of food expenditures for households at the poverty line in rural (resp. urban) areas. The new deflator is: $\frac{P_u * S_u + P_r * (1-S_r)}{P_r} \approx 1.13$. In the absence of detailed consumption data at origin and destination for migrants, these figures provide suggestive evidence that differences in living costs between destination and origin may amount to 13% of migration earnings, or 22% of the estimated flow cost of migration.[12]

Second, migration is risky. Migrants may not find work at destination or may have to work for lower wages than expected. Bryan et al. (2011) argue the risk of failed migration is an important barrier to seasonal migration during the hunger season in Bangladesh. They also find evidence of individual learning on migration risk, but little evidence of peer effects, which suggests the risk is idiosynchratic. In contrast with Bryan et al. (2011) experiment, individual learning has already taken place in the context we study: 71% of short term migrants in the Summer 2010 report having migrated in the Summer 2009, and only 8.6% have never migrated before. We can use information on migration earnings from repeated trips to estimate the idiosynchratic risk migrants are exposed to. Earnings are defined as earnings per day away, which allows us to account for both employment and wage risk. We restrict the analysis to 435 migrants for which we have earnings per day away for both summers 2009 and 2010. Their average daily earnings in the Summer 2009 are 100 Rs. We then run a regression of earnings per season on season and migrant fixed effects and estimate the standard deviation of the residuals, which is a reasonable approximation of the amount of idiosynchratic risk migrants are exposed to. The estimated standard deviation is 25Rs.[13]

We next use the estimated mean and variance of migration earnings to compute the relative risk premium, i.e. the amount one would need to guarantee to migrants at home to make them indifferent between migrating and not migrating, expressed as a fraction of

[12]Instead of using all India indices, we can compute poverty lines and food shares for the three states of the migration survey sample only (Gujarat, Madhya Pradesh and Rajasthan) and obtain similar results: the ratio of poverty lines and the ratio of food poverty lines are 1.30 and 1.06 respectively.

[13]Alternatively, one can use only cross-sectional variation and estimate idiosynchratic risk as the standard deviation of the residuals of a regression of daily migration earnings in the Summer 2009 on workers characteristics, migration history and village fixed effects. The estimated standard deviation is 29Rs, close to, but higher than our preferred estimate.

daily migration earnings. If we assume migrants utility has constant relative risk aversion $\rho$ then the relative risk premium can be approximated as a simple function of the mean $\widehat{\mu}$ and standard deviation $\widehat{\sigma}$ of daily migration earnings: $RPP \approx \frac{\rho\widehat{\sigma}^2}{2\widehat{\mu}^2} \approx \frac{\rho}{32}$ . This implies that even assuming a very high level of relative risk aversion $\rho = 10$ the relative risk premium is only .31, i.e. half of the estimated flow cost of migration. For more moderate levels of risk aversion $\rho \approx 1.5$, which Bryan et al. (2011) find match the evidence on migration decisions relatively well, the relative risk premium is slightly below .05, or 8% of our estimate of the flow cost of migration. As an alternative calibration, we use Binswanger (1980) results on risk aversion of farmers in rural India. Binswanger (1980) uses lotteries to elicit the increase in expected returns needed to compensate for an increase in the standard deviation of gains ($Z$), and finds the majority of farmers falls within a 0.33 to 0.66 range. The implied relative risk premium ($RPP = Z\frac{\sigma}{\mu}$) is between .08 and .16, i.e. between 13 and 27% of our estimated migration cost.

Taken together, these results suggest that under reasonable assumptions differences in living costs and migration risk may account for a half of the estimated utility cost of migration, but are unlikely to explain it all. The disutility cost of bivouacking for months in the city, leaving family behind is presumably also important, but harder to quantify. In order to provide evidence on these issues, we explore the heterogeneity in migration costs by specifying the flow cost of migration as a linear function of a vector of migrant characteristics $X_i$: gender, age (dummy for being less than 30 years old), marital status, a dummy for having children less than six years old and education (dummy for having more than primary education). We assume $c_v^i = \beta_v X_i + \varepsilon_v^i$ with $\varepsilon \sim N(\mu_v, \sigma_v)$. We can then estimate $\beta_v$, $\mu_v$ and $\sigma_v$ using a probit model

The results of the estimation are presented in Appendix Table A.6. The bootstrapped standard errors of the estimates are large, which is due to the low sample size. The estimated standard deviation of the residual is only slightly lower than estimated standard deviation of the costs of migration presented in Table 11. This suggest migrants observable characteristics only capture a small part of individual heterogeneity in migration costs. We find male migrants have higher migration costs, which may be due to more difficult work conditions when migrating as compared to NREGA work relative to female workers. We find older migrants, and migrants with young children have higher disutility of migration. Our analysis does not allow us to disentangle between the effect of differents tastes with respect to migration and different migration conditions which may also be correlated with migrants characteristics. However, these results provide indirect evidence that non monetary

factors such as the disutility of migration work and migration trips plays a significant role in short-term migration decisions.

# 5 Equilibrium effect of the program

In this final section, we explore the impact of NREGA on urban labor markets via a change in migration flows from rural areas. We first use the NSS data and estimate the effect of NREGA by comparing changes in public employment and migration in districts with high NREGA employment with the rest of India. We next estimate a gravity model to predict migration flows from rural to urban districts and construct a measure of reliance of each urban center on rural migration from districts with high NREGA employment and from other rural districts. Finally, we estimate the effect of the program on urban labor market by comparing changes in outcomes in urban districts which are more or less exposed to changes in migration due to NREGA.

## 5.1 Urban labor market equilibrium

We first outline a simple model of the labor market equilibrium in urban areas. Let $D_u$ denote labor demand in urban areas, $L_u$ labor supply of urban workers and $L_m$ short term migration flows between rural and urban areas. Assuming the urban labor market is competitive, the urban wage $w_u$ clears the market: $D_u = L_u + L_m$. Let us consider the effect of an exogenous change in migration inflow $dL_m$ due to the implementation of a public works program in the rural area. Let $\alpha = \frac{L_m}{L_u}$ denote the ratio of labor supply from rural migrants divided by the labor supply of urban workers. The higher $\alpha$, the more the urban center relies on migrant labor to satisfy its demand for labor. Let $\eta_D$ and $\eta_S$ denote labor demand and labor supply elasticities, respectively. One can express the elasticity of the urban wage with respect to migration as a function of $\alpha$, $\eta_D$ and $\eta_S$:

$$\frac{dw}{w} / \frac{dL_m}{L_m} = -\frac{\alpha}{\eta_S - \eta_D(1+\alpha)} \tag{7}$$

Unless the elasticity of labor supply is negative and large, the elasticity of the urban wage with respect to migration is negative, i.e. a decrease in migration caused by the introduction of a public works program in rural area will increase urban wages. As long as the elasticity of labor demand is lower than one, the elasticity of urban wages with respect to migration is increasing in $\alpha$, i.e. the more an urban area relies on migrant labor, the more sensitive the

wage to changes in migration inflows.

A simple calibration may provide a better idea of the potential magnitude of the effect of a change in rural short-term migration on urban labor markets. From NSS 2007-08 data, the estimated number of rural short term migrants is 8.1 millions and the number of urban adults who declare doing casual labor as primary or secondary occupation is 15 millions. This yields an estimate of $\alpha$ for urban India $\widehat{\alpha} = 0.53$. For the sake of the calibration, let us now assume that the elasticity of labor demand in urban India is $\eta_D = -0.3$ and the elasticity of labor supply is $\eta_S = 0.1$. The implied elasticity of urban wages to migration is $-0.95$, i.e. a decrease of short term migration from rural areas by 1% would increase urban wages by .95%. Given the size of the rural population (476 million adults, according to NSS 2007-08), a 1% decline in migration would require that only a very small fraction of rural adults (0.02% or 80 thousands workers) stopped migrating. Assuming higher labor demand and labor supply elasticities would yield lower estimates, but under reasonable assumptions one expects modest changes in rural short term migration to have large impacts on urban wages.

It is straightforward to extend the model to the case of two rural locations (denoted 1 and 2), of which only location 2 experiences an exogenous change in migration due to the implementation of a public works program. With obvious notations we denote $\alpha_1 = \frac{L_m^1}{L_u}$ and $\alpha_2 = \frac{L_m^2}{L_u}$ the ratio of labor supply of migrants from rural area 1 and 2 respectively, divided by the labor supply of urban workers. Let us denote by $\eta_M$ the elasticity of migration with respect to the wage. The elasticity of urban wages with respect to an exogenous change in migration from location 2 is given by

$$\frac{dw}{w} / \frac{dL_m^2}{L_m^2} = -\frac{\alpha_2}{\eta_S + \eta_M \alpha_1 - \eta_D(1 + \alpha_1 + \alpha_2)} \tag{8}$$

Assuming that the elasticity of migration with respect to a change in urban wages is positive, a drop in migration from location 2 increases migration from location 1, which in turn mitigates the effect of the program on urban wages. For a given level of migration from rural areas with the program, one would hence expect urban centers which receive more migration from rural areas without the program to experience lower increases in wages.

The model outlined above does not consider the effect of the program on rural labor markets. Imbert and Papp (2014) investigate this issue formally with a theoretical framework without migration, and show that the public works program increases rural wages and crowd out private sector work. However, the model presented here can easily be transposed to

consider the effect of an (exogenous) decrease in out-migration from rural areas on rural labor markets. The elasticity of rural wages to rural to urban migration is simply $\frac{\alpha^R}{\eta_S^R - \eta_D^R(1+\alpha^R)}$, where $\alpha^R$, $\eta_D^R$ and $\eta_S^R$ denote the ratio of migrants to rural labor supply, the rural labor demand and supply elasticities respectively. The decline in out-migration should mitigate the increase in rural wages due to the public works program. However, a simple calibration exercise makes clear that the impact of short-term migration on rural labor markets is negligible. In keeping with the previous calibration, let us assume that rural labor demand and supply elasticities are $\eta_D^R = -0.3$ and $\eta_S^R = 0.1$ respectively. According to NSS 2007-08 the number of rural adults who declare doing casual labor as primary or secondary occupation is 124 millions, which yields $\alpha^R = 0.06$. The rural wage elasticity with respect to migration is only $-0.07$.

## 5.2 Program effect on urban labor markets: strategy

In order to estimate the effect of NREGA on urban labor markets, we first need to predict short-term migration flows from rural to urban areas. Recall from Section 2.2 that $m_{od}$ is the number of short term migrants from rural parts of district $o$ to urban parts of district $d$. The objective is to predict $m_{od}$, using $\delta_{od}$, the distance between district $o$ and district $d$, $w_o$ and $w_d$ which denote average real wages at origin and destination respectively, $N_o$ and $N_d$ which denote the estimated number of casual workers at origin and destination, and an index of language proximity betwen origin and destination $I_{od}$[14]. We also include a dummy which equals to one when origin and destination belong to the same state ($S_o = S_d$) and a dummy which equals to one when origin and destination are in the same district ($o = d$). We use the Poisson-quasi maximum likelihood method, which has the advantage of taking into account pairs of districts with no migrants, and has been shown to perform well in trade gravity models (Silva and Tenreyro, 2006). The estimating equation writes:

$$\begin{aligned} m_{od} &= \alpha_1 log(\delta_{od}) + \alpha_2 log(w_o) + \alpha_3 log(w_d) + \alpha_4 log(N_o) \\ &+ \alpha_5 log(N_d) + \alpha_6 I_{od} + \alpha_7 1\{S_o = S_d\} + \alpha_8 1\{o = d\} + \varepsilon_{od} \end{aligned} \tag{9}$$

We next use predicted migration flows to estimate the effect of the program on urban labor markets. Let $Y_{idt}$ denote the outcome for individual $i$ living in urban district $d$ in quarter $t$. Let $L_d$ denote the number of casual workers living in urban district $d$ (constructed as

[14]The index is the probability that two individuals picked at random from origin and from destination share a common language. Details of the construction of the index can be found in appendix.

explained in Section 2.2. In order to measure the exposure of each urban district to migration flows, we construct the two following ratios:

$$\widehat{\alpha_d^1} = \frac{\sum_{o \notin StarEarly} \widehat{m_{od}}}{L_d} \; and \; \widehat{\alpha_d^2} = \frac{\sum_{o \in StarEarly} \widehat{m_{od}}}{L_d}$$

$\alpha_d^2$ and $\alpha_d^1$ are the ratio of the number of predicted short-term migrants to district $d$ coming from early districts of star states and from other rural districts respectively, divided by the estimated number of casual workers living in $d$. Let $Z_d$ and $X_{dt}$ denote a vector of time-invariant and time varying characteristics of district $d$. Let $H_i$ denote a vector of individual characteristics. Finally let $\eta_t$ and $\mu_d$ denote time and district fixed effects. In order to estimate the impact of the program on urban labor market outcomes, we use data from 2004-05 and 2007-08 and compare changes in outcomes in urban centers for which migration from early districts of star states is more or less important. Our outcomes are log deflated casual earnings, and salaried earnings, time spent on casual wage work, salaried wage work, self employment, domestic work, unemployment and out of the labor force. We estimate the following equation by ordinary least squares:

$$\begin{aligned} Y_{dt} &= \beta_0 + \beta_1 \widehat{\alpha_d^1} \times \mathbf{1}\{t > 2006\} + \beta_2 \widehat{\alpha_d^2} \times \mathbf{1}\{t > 2006\} + \delta Z_d \times \mathbf{1}\{t > 2006\} \\ &+ \gamma X_{dt} + \alpha H_i + \eta_t + \mu_d + \varepsilon_{dt} \end{aligned} \tag{10}$$

For inference purposes, we need to account both for the fact that regressors $\widehat{\alpha_d}$ are estimated from equation 9 and error terms in equation 10 are likely correlated for observations pertaining to the same district. We hence bootstrap standard errors through repeated estimations of models 9 and 10 on random district draws.

A potential threat to our identification strategy is that urban centers which hire more migrants from early districts of star states may be on different economic trends, and hence would exhibit differential changes in labor market outcomes even without NREGA.

As a first robustness check, we use a placebo strategy and compare trends in labor market outcomes in urban districts which have more or less exposure to migration from early districts of star states between 1999-00 and 2007-08, i.e. before NREGA was implemented. The estimating equation is:

$$\begin{aligned} Y_{dt} &= \beta_0 + \beta_1 \widehat{\alpha_d^1} \times \mathbf{1}\{t > 2000\} + \beta_2 \widehat{\alpha_d^2} \times \mathbf{1}\{t > 2000\} + \delta Z_d \times \mathbf{1}\{t > 2000\} \\ &+ \gamma X_{dt} + \alpha H_i + \eta_t + \mu_d + \varepsilon_{dt} \end{aligned}$$

As a second robustness check, we estimate the same equation using salaried wages as a dependent variables. Salaried workers are skilled workers hired on long term contracts, and hence do not belong to the same labor market as unskilled short-term migrants. Depending on the level of complementarity between skilled and unskilled workers, a change in unskilled wages could affect wages for skilled workers. However, the effect on skilled wages is likely to be small, as compared to the effect on unskilled wages. Hence if we find that salaried earnings exhibit very different trends in labor markets which hire more or less migrants from early districts of star states, it would suggest they may be on different economic trajectories unrelated to the program.

## 5.3 Program effect on urban labor markets: results

We first estimate equation 9 to predict migration flows between rural-urban district pairs. As Table 14 shows, the determinants of migration all have a significant impact on migration flows, and their effect has the expected sign: distance negatively affects the number of migrants. Wages at destination and origin have a positive and negative impact on migration, respectively. We predict more migration between districts with a larger number of casual workers. Migrants are more likely to go to districts where the probability of finding somebody who speaks the same language is higher. Finally, rural short term migrants are more likely to migrate to urban centers in the same district, and in the same state. We next use predicted migration flows to compute the two ratios $\alpha^1$ and $\alpha^2$, which measure the importance of migration flows from late phase districts and non star states, and from early districts in star states respectively as a fraction of the urban casual labor force. Table A.7 in Appendix presents the weighted average of these estimates for each state. Urban centers in Assam, Bihar, Jharkhand, Karnataka, Orissa and Uttar Pradesh have high levels of predicted in migration from both early districts of star states and from other districts. Urban centers with high predicted migration from early districts of star states are the star states themselves. Urban centers in Kerala, Maharashtra and West Bengal rely very little on migration from early districts of star states.

Table 15 presents the estimated effect of changes in migration due to NREGA on urban wages. We find that between 2004-05 and 2007-08, urban centers with higher dependence on short-term migrants from early districts in star states have experienced a relative increase in wages. The magnitude of the coefficient suggests that as compared to a district with no predicted migration from early districts in star states, a district with as many migrants from early districts in star states as "native" urban casual laborers would have experience

24 percentage points higher wage growth. As expected, for a given level of migration from early districts of star states, urban centers with higher predicted levels of migration from other districts experienced significantly lower wage growth. When we estimate the same specification using data from 1999-00 and 2004-05, i.e. before the program was implemented, we find no significant difference in wage trends between urban centers with more migration from early districts in star states and the others. The estimated impact on salaried wages is positive but much smaller and insignificant, which suggests that our results are not driven by differences in economic trends unrelated to the program. Table A.8 in Appendix presents the estimated impact on time allocation of urban workers. We find that private sector work (wage work and self employment) declines in urban labor markets with more migration from early district of star states.

# 6 Conclusion

The previous analysis suggests that a substantial fraction of adults either chose NREGA work over short-term migration or would have done so if more NREGA work were available. Because short-term migrants are not firmly attached to urban labor markets, their decision to migrate is easily influenced by rural (or urban) anti-poverty programs. In the case of a rural workfare program, which provides only a short period of relatively high wage work, short-term migrants can easily stay back in the village for a few more days and migrate later.

Even in an area with severe seasonality in locally available work, a seasonal workfare program still has a significant impact on private sector work. In pure income terms, it appears that workers may actually be sacrificing income to work for the program. Given the large estimated migration costs, this is not necessarily an undesirable outcome. If reducing migration is not a policy goal, however, cash transfers or credit subsidies might be preferable anti-poverty policies to workfare programs.

Our results also suggest that the program had a significant impact on urban areas. Large urban-rural wage gaps and significant barriers to permanent migration explain that short-term migration flows play an important role in labor reallocation across space and across economic sectors in developing countries. The relative sizes of the rural and urban labor force are such that even a small change in rural migration can have large impacts on urban labor markets.

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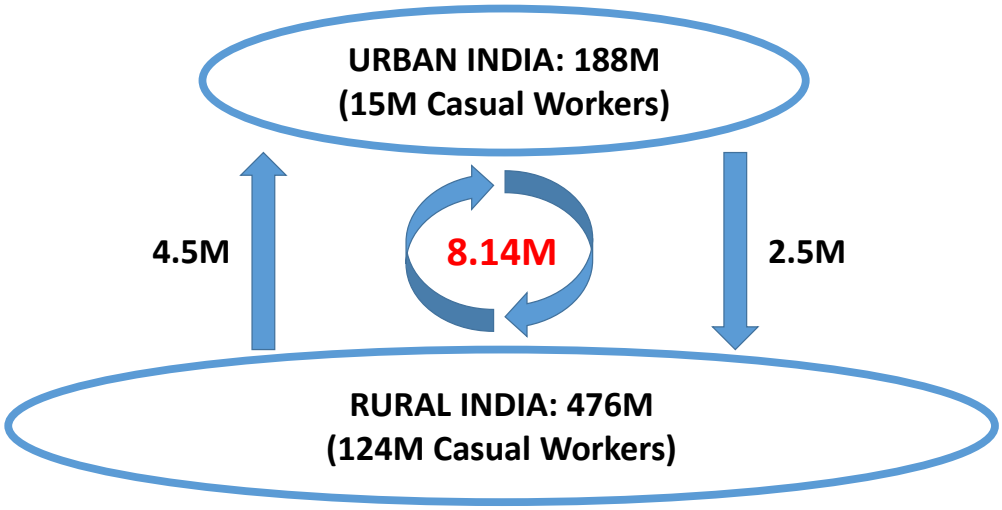
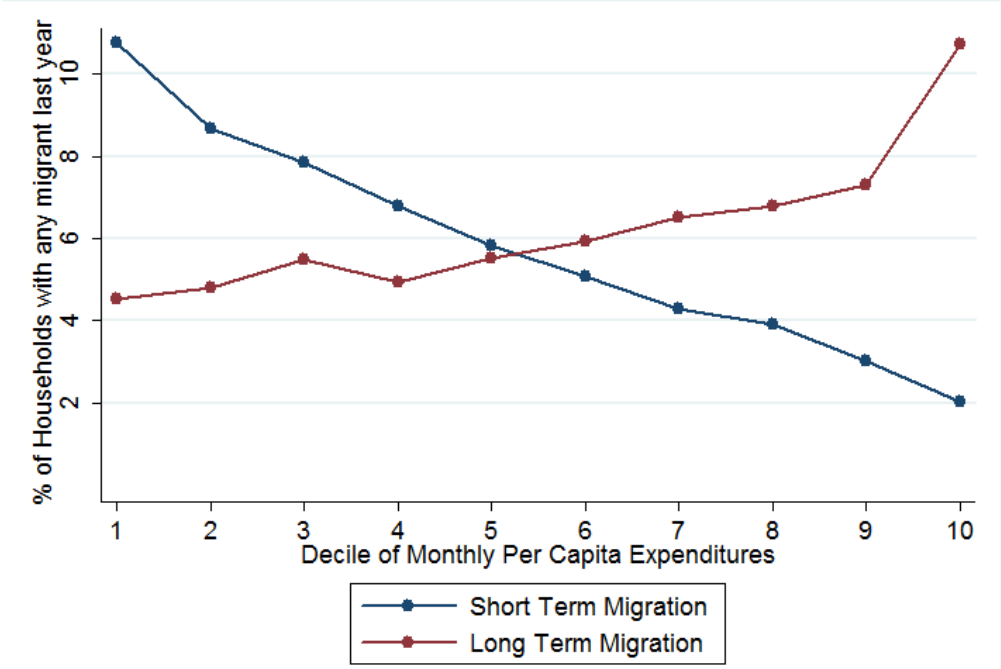
Figure 1: Migration flows in India 2007-08




Source: NSS Employment-Unemployment Survey 2007-08. Straight arrows denote long term migration, i.e. adults who changed residence in the last year. Circular arrows denote short-term migration, i.e. rural adults who left the village from two to six months for work in urban areas in the last year. Casual workers are adults who report having done casual work as their principal or secondary occupation in the the last year.

Figure 2: Long term and short term migration across consumption deciles (2007-08)




Source: NSS Employment Unemployment Survey 2007-08. Rural households only.

Figure 3: Map of short term migration

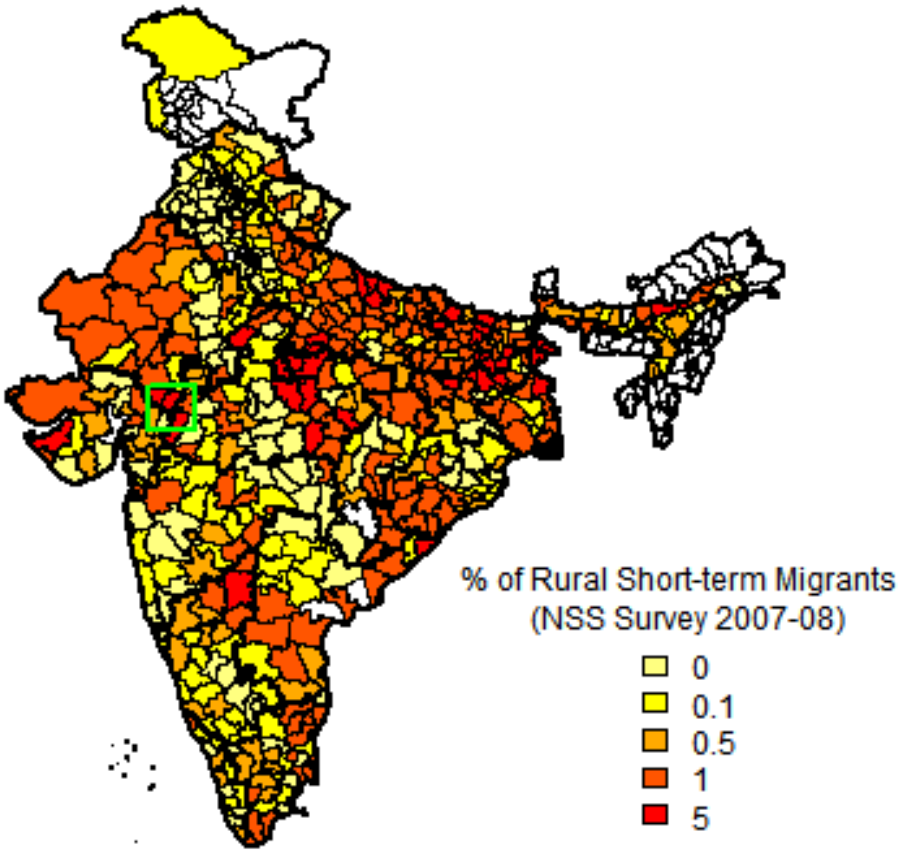


Figure 4: Map of Survey Villages

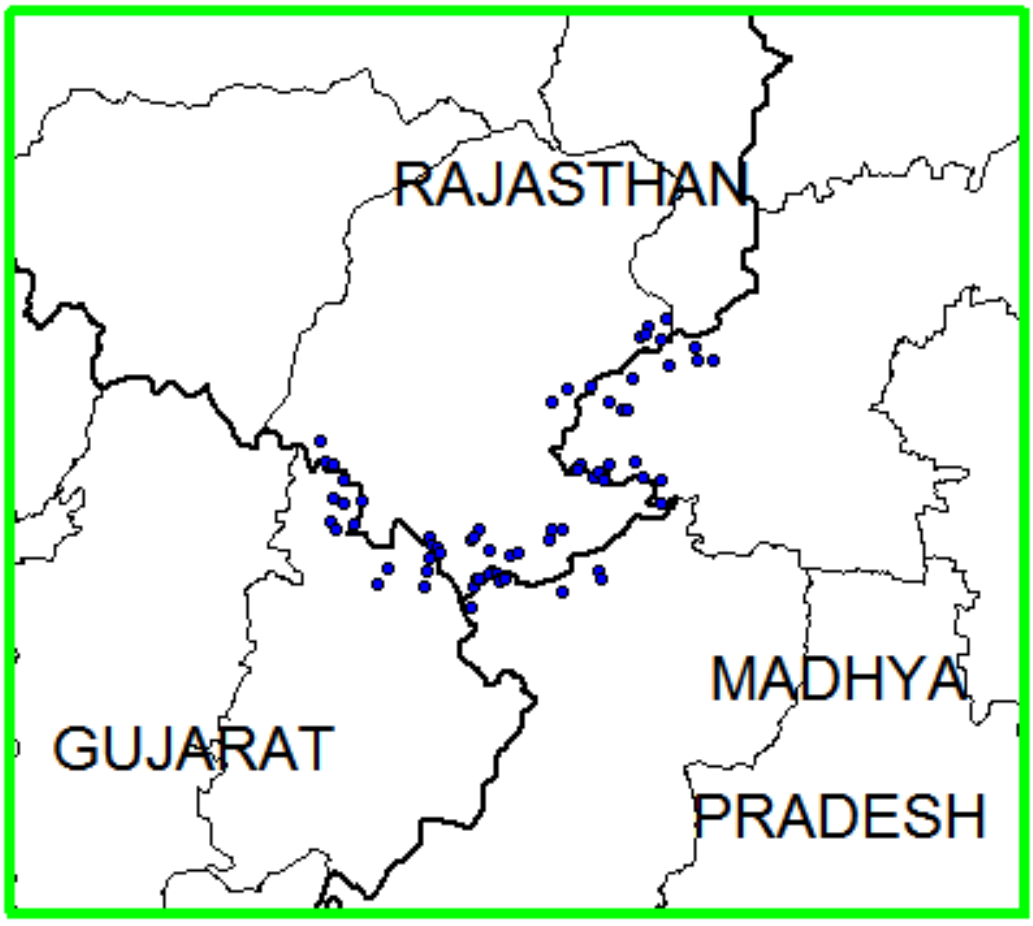
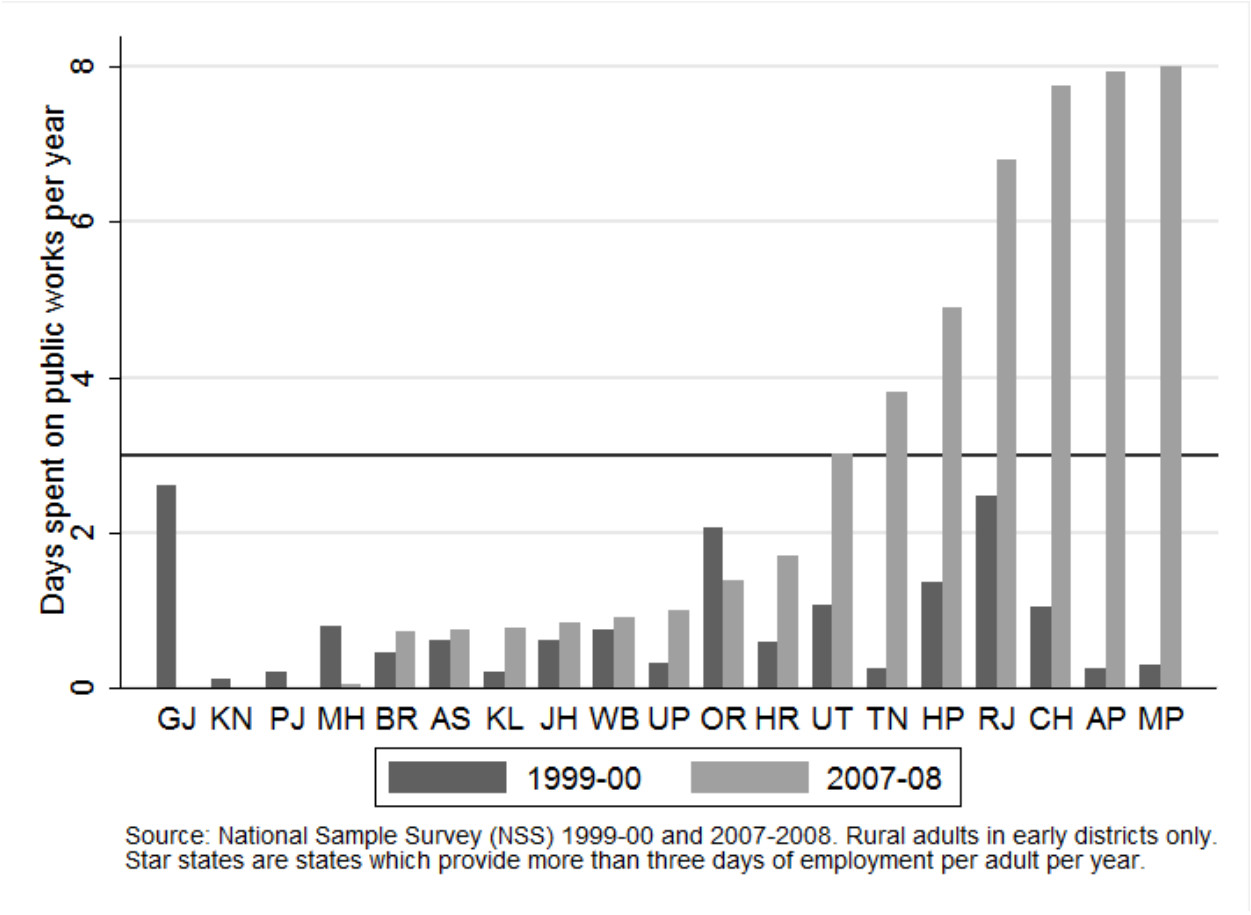
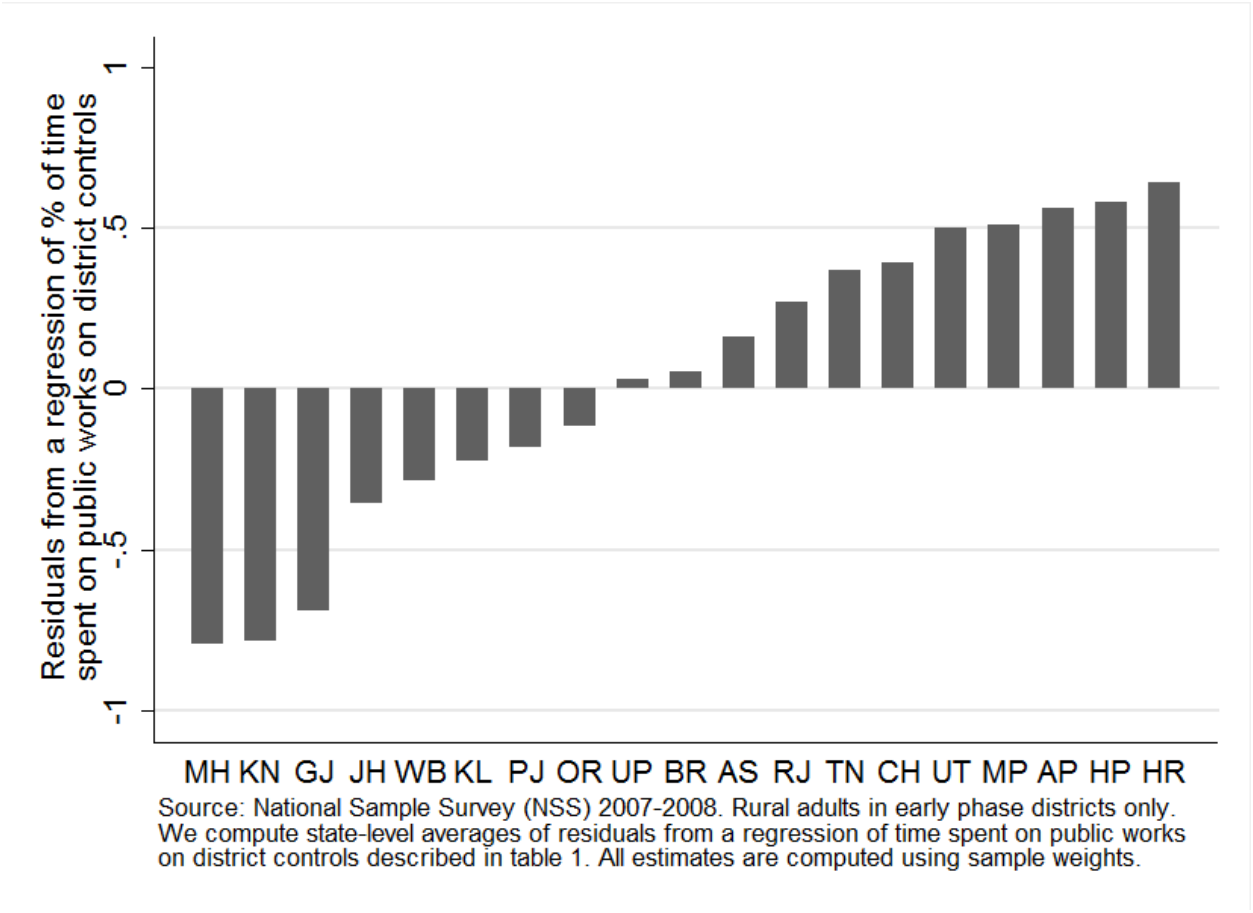


Figure 5: Cross-state variation in public employment provision



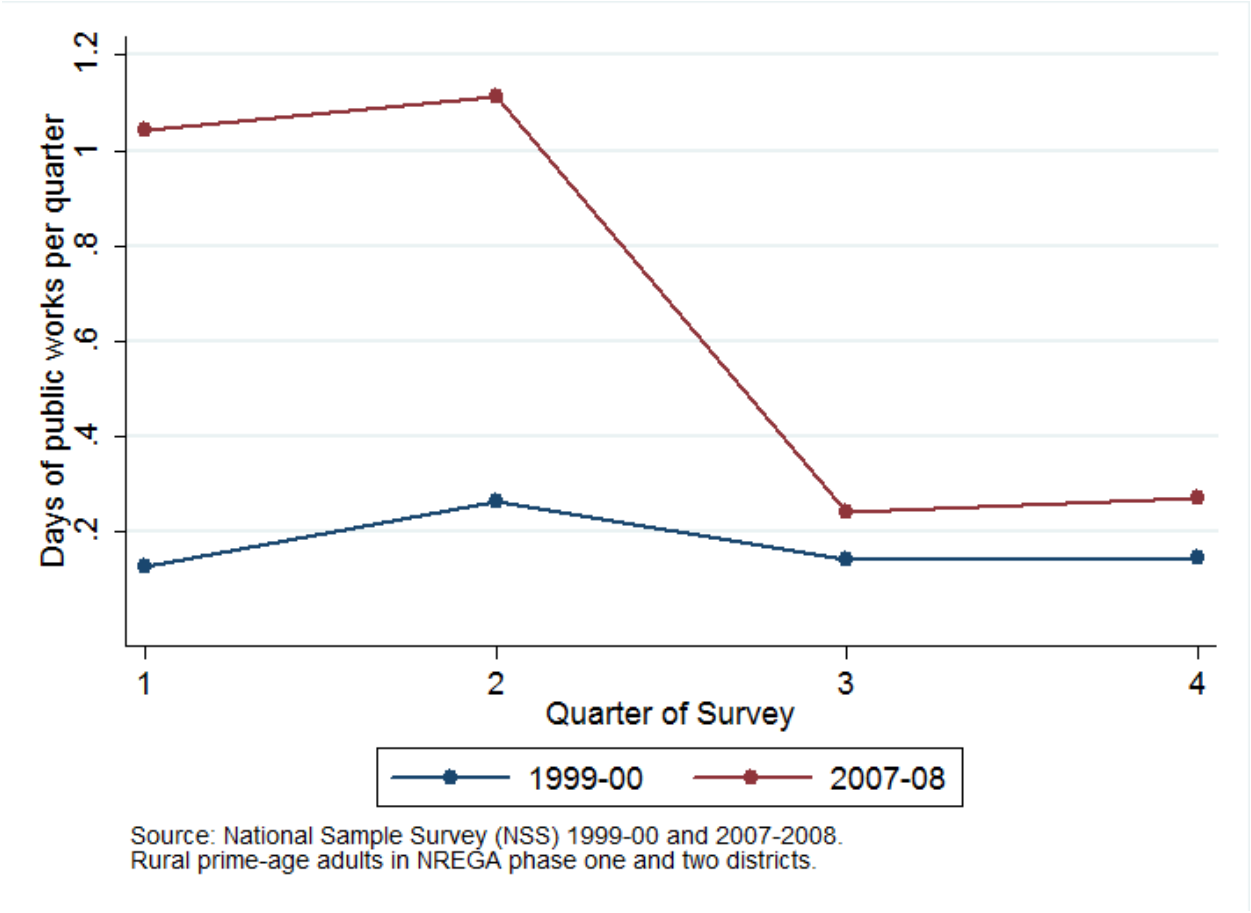

Source: National Sample Survey (NSS) 1999-00 and 2007-2008. Rural adults in early districts only.
Star states are states which provide more than three days of employment per adult per year.

Figure 6: Unexplained variation in public employment provision




Source: National Sample Survey (NSS) 2007-2008. Rural adults in early phase districts only. We compute state-level averages of residuals from a regression of time spent on public works on district controls described in table 1. All estimates are computed using sample weights.

Figure 7: Seasonality of public employment provision




Source: National Sample Survey (NSS) 1999-00 and 2007-2008.
Rural prime-age adults in NREGA phase one and two districts.

# Table 1: District Controls

| | Early Phase Districts (1) | Late Phase Districts (2) | p-value (3) | Star States (4) | Other States (5) | p-value (6) | Source (7) | Time-varying? (8) |
|---|---|---|---|---|---|---|---|---|
| Fraction Scheduled Castes (SC) | 0.17 | 0.18 | 0.35 | 0.18 | 0.17 | 0.14 | 2001 Census | No |
| Fraction Scheduled Tribes (ST) | 0.17 | 0.06 | 0.00 | 0.17 | 0.10 | 0.00 | 2001 Census | No |
| Agricultural Productivity Per Worker (normalized) | -0.10 | 0.25 | 0.00 | -0.06 | 0.11 | 0.04 | Min of Ag | No |
| Log Daily Wage for Casual Labor | 3.35 | 3.63 | 0.00 | 3.48 | 3.47 | 0.83 | NSS 1999 | No |
| Poverty Rate | 0.35 | 0.20 | 0.00 | 0.27 | 0.29 | 0.28 | NSS 1999 | No |
| Population Density (per sq. km) | 413 | 341 | 0.00 | 223 | 446 | 0.00 | 2001 Census | No |
| Literacy Rate | 0.55 | 0.64 | 0.00 | 0.60 | 0.59 | 0.68 | 2001 Census | No |
| Female Labor Force Participation Ratio | 0.40 | 0.39 | 0.54 | 0.50 | 0.35 | 0.00 | 2001 Census | No |
| Male Labor Force Participation Ratio | 0.63 | 0.63 | 0.82 | 0.65 | 0.62 | 0.00 | 2001 Census | No |
| Fraction Ag Casual Laborers | 0.23 | 0.17 | 0.00 | 0.21 | 0.20 | 0.53 | NSS 1999 | No |
| Fraction Non-Ag Casual Labor | 0.04 | 0.05 | 0.04 | 0.05 | 0.04 | 0.48 | NSS 1999 | No |
| Fraction Cultivators | 0.27 | 0.26 | 0.26 | 0.33 | 0.24 | 0.00 | NSS 1999 | No |
| Fraction Non-Ag Business | 0.07 | 0.08 | 0.03 | 0.07 | 0.07 | 0.40 | NSS 1999 | No |
| Fraction Salaried Work | 0.04 | 0.07 | 0.00 | 0.05 | 0.05 | 0.97 | NSS 1999 | No |
| Fraction of Villages accessed by Paved Road | 0.64 | 0.81 | 0.00 | 0.65 | 0.75 | 0.00 | 2001 Census | No |
| Fraction of Villages with Bus Service | 0.46 | 0.70 | 0.00 | 0.57 | 0.57 | 0.86 | 2001 Census | No |
| Distance to the nearest town (Km) | 23.29 | 17.58 | 0.00 | 25.37 | 18.71 | 0.00 | 2001 Census | No |
| Fraction of Villages with Education Facility | 0.93 | 0.95 | 0.01 | 0.96 | 0.93 | 0.01 | 2001 Census | No |
| Fraction of Villages with Medical Facility | 0.49 | 0.62 | 0.00 | 0.57 | 0.54 | 0.13 | 2001 Census | No |
| Fraction of Villages with Post and Telecom Facility | 0.58 | 0.78 | 0.00 | 0.69 | 0.66 | 0.33 | 2001 Census | No |
| Fraction of Villages with Bank Facility | 0.18 | 0.27 | 0.00 | 0.20 | 0.23 | 0.04 | 2001 Census | No |
| Fraction of Villages with Electricity | 0.45 | 0.74 | 0.00 | 0.65 | 0.55 | 0.00 | 2001 Census | No |
| Irrigated Cultivable Land per Capita (ha) | 0.08 | 0.12 | 0.00 | 0.12 | 0.09 | 0.01 | 2001 Census | No |
| Non irrigated Cultivable Land per Capita (ha) | 0.23 | 0.18 | 0.01 | 0.26 | 0.18 | 0.00 | 2001 Census | No |
| Cumulative Rainfall (normalized) in 2007-08 | 0.59 | 0.41 | 0.03 | 0.20 | 0.64 | 0.00 | TRMM | Yes |
| Election Year in 2007-08 | 0.13 | 0.04 | 0.00 | 0.19 | 0.04 | 0.00 | Gov Website | Yes |
| PMGSY Road Construction (km per year) in 2007-08 | 17.76 | 14.34 | 0.08 | 27.88 | 11.28 | 0.00 | Gov Website | Yes |
| Number of Districts | 288 | 210 | | 169 | 329 | | | |
| Number of Individual Observations | 133666 | 79182 | | 64702 | 148146 | | | |

This table presents means of the controls used in the paper for different samples. Column (1) is restricted to districts that received the workfare program prior to April 2008. Column (2) includes only districts that received the program after April 2008. Column (3) presents the p-values of the Student's t-test of equality of means in Column (1) and (2). Column (4) restricts the sample to star states. Star states include Andhra Pradesh, Chhatisgarh, Himachal Pradesh, Madhya Pradesh, Tamil Nadu, Rajasthan, and Uttarkhand. Column (5) includes districts in non-star states. Column (6) presents the p-values of the Student's t-test of equality of means in Column (4) and (5). The details of the construction of each control are given in appendix For the Student's t-test in column (3) and (6) standard errors are computed assuming correlation of individual observations over time within each district.

# Table 2: Selection of Adult Sample

| | Own Survey | | | | NSS Survey 2007-08 | |
|---|---|---|---|---|---|---|
| | All Adults (1) | Full Adult Survey Completed (2) | Adult Survey not Completed (3) | Difference (3) - (2) (4) | All Adults (India) (5) | All Adults (Sample Districts) (5) |
| Female | 0.511 | 0.525 | 0.448 | -0.077 | 0.497 | 0.494 |
| | (0.0056) | (0.0166) | (0.0067) | (0.019) | (0.001) | (0.0072) |
| Married | 0.704 | 0.729 | 0.594 | -0.134 | 0.693 | 0.720 |
| | (0.0091) | (0.021) | (0.0105) | (0.0233) | (0.0018) | (0.0177) |
| Illiterate | 0.666 | 0.683 | 0.590 | -0.093 | 0.388 | 0.498 |
| | (0.0185) | (0.0325) | (0.0189) | (0.0302) | (0.0029) | (0.0298) |
| Scheduled Tribe | 0.897 | 0.894 | 0.910 | 0.016 | 0.104 | 0.655 |
| | (0.0272) | (0.0278) | (0.0287) | (0.0225) | (0.0032) | (0.0592) |
| Age | 32.8 | 34.1 | 27.0 | -7.11 | 34.4 | 32.8 |
| | (0.248) | (0.484) | (0.301) | (0.592) | (0.0463) | (0.4684) |
| Spent 2-330 days away for work | 0.464 | 0.422 | 0.649 | 0.226 | -- | -- |
| | (0.0194) | (0.0383) | (0.0187) | (0.0385) | | |
| Migrated for Work all Three Seasons | 0.139 | 0.080 | 0.402 | 0.322 | -- | -- |
| | (0.0135) | (0.0437) | (0.0101) | (0.0447) | | |
| Ever Worked for NREGA | 0.528 | 0.581 | 0.291 | -0.290 | -- | -- |
| | (0.0253) | (0.0354) | (0.0259) | (0.0332) | | |
| Spent 30-180 days away for work | 0.313 | 0.311 | 0.321 | 0.010 | 0.025 | 0.160 |
| | (0.0158) | (0.0331) | (0.0165) | (0.034) | (0.0008) | (0.0344) |
| Adults | 2,722 | 2,224 | 498 | | 212,848 | 2,144 |

The unit of observation is an adult. Standard errors computed assuming correlation of errors at the village level in parentheses. The first four columns present means based on subsets of the adults aged 14 to 69 from the main data set discussed in the paper. The first column includes the full sample of persons aged 14 to 69 for whom the adult survey was attempted. The second column includes all persons aged 14 to 69 for which the full adult survey was completed. The third column includes all persons aged 14 to 69 for which the full adult survey was not completed. The fourth column presents the difference between the third and second columns. The fifth and sixth columns present means computed using all adults aged 14 to 69 in the rural sample of the NSS Employment and Unemployment survey Round 64 conducted between July 2007 and June 2008 for all of India and for the six sample districts respectively. Means from the NSS survey are constructed using sampling weights. "--" denotes not available.

Table 3: Summary Statistics by Subgroup

| | Migrants | NREGA Participants | Did Not Want NREGA Work | Full Sample |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Adult-level Variables | | | | |
| Female | 0.436 | 0.560 | 0.540 | 0.525 |
| Married | 0.732 | 0.788 | 0.649 | 0.729 |
| Age | 28.6 | 36.2 | 38.4 | 34.1 |
| Illiterate | 0.660 | 0.758 | 0.582 | 0.683 |
| Primary School or Less | 0.152 | 0.111 | 0.133 | 0.127 |
| Above Primary School | 0.178 | 0.122 | 0.275 | 0.180 |
| Speaks Gujarati | 0.232 | 0.092 | 0.329 | 0.211 |
| Speaks Hindi | 0.356 | 0.335 | 0.398 | 0.346 |
| Household-level Variables | | | | |
| Owns Cultivable Land | 0.998 | 0.996 | 0.998 | 0.998 |
| Cultivable Land (Acres) | 2.91 | 3.05 | 3.07 | 3.03 |
| Has Irrigated Land | 0.489 | 0.575 | 0.544 | 0.538 |
| Has Well for Irrigation or Drinking | 0.462 | 0.524 | 0.515 | 0.495 |
| Has Cell-phone | 0.387 | 0.358 | 0.404 | 0.385 |
| Has Electricity | 0.290 | 0.298 | 0.394 | 0.318 |
| Has Television | 0.005 | 0.014 | 0.038 | 0.018 |
| Dirt Floor | 0.919 | 0.911 | 0.867 | 0.900 |
| Household Head is Hindu | 0.841 | 0.880 | 0.817 | 0.849 |
| Household Head is Adivasi | 0.093 | 0.065 | 0.125 | 0.089 |
| Number of Adults | 5.04 | 4.79 | 5.02 | 4.96 |
| Number of Children | 3.13 | 2.94 | 2.72 | 2.95 |
| Adults | 1,125 | 1,133 | 498 | 2,224 |

The unit of observation is an adult. Each cell is a sample average. The first column is restricted to adults who left the village for work during the past year (summer 2009, monsoon 2009 or winter 2009-10). The second column is restricted to adults who participated in NREGA during the past year. The third column is restricted to adults who reported not wanting NREGA work during the entire past year. The fourth column includes all adults who completed the full adult survey.

Table 4: Migration patterns (Migration survey)

| | Migration Survey | | | NSS |
|---|---|---|---|---|
| | Summer | Monsoon | Winter | Year |
| | 2009 | 2009 | 2009-10 | 2007-08 |
| Migrated? | 35% | 10% | 29% | 2.5% |
| Migrant is female | 40% | 33% | 43% | 14% |
| Migrated with Household Member | 71% | 63% | 74% | 43% |
| Distance (km) | 300 | 445 | 286 | - |
| Transportation Cost (Rs) | 116 | 144 | 107 | - |
| Duration (days) | 54 | 52 | 49 | - |
| Destination is in same state | 15% | 24% | 23% | 53% |
| Destination is urban | 84% | 88% | 73% | 68% |
| Worked in agriculture | 14% | 21% | 35% | 23% |
| Worked in manufacturing and minir | 9% | 5% | 6% | 18% |
| Worked in construction | 70% | 70% | 56% | 42% |
| Found employer after leaving | 63% | 64% | 54% | - |
| No formal shelter in destination | 86% | 85% | 83% | - |
| Observations (All) | 2224 | 2224 | 2224 | 212848 |
| Observations (Migrants only) | 768 | 218 | 646 | 13682 |

Source: Retrospective questions from the migration survey implemented in summer 2010. The unit of observation is an adult. Each column restricts the sample to responses for a particular season. Seasons are defined as follows: summer from April to June, monsoon from July to September, winter from December to March.

Table 5: Migration and NREGA Work

| | Summer 2009 (1) | Monsoon 2009 (2) | Winter 2009-10 (3) | Summer 2010 (4) |
|---|---|---|---|---|
| **Panel A: Full Sample** | | | | |
| (1) Worked for NREGA | 40% | 0% | 6% | 37% |
| (2) Migrated | 35% | 10% | 29% | 42% |
| (3) Worked for NREGA and Migrated | 12% | 0% | 2% | 12% |
| (4) Would Have Migrated If No NREGA Work | 8% | 0% | 2% | 7% |
| (5) Migrated and Would Work More for NREGA | 30% | 7% | 25% | 36% |
| (6) Days Outside Village for Work | 20.5 | 4.86 | 15.2 | 24.7 |
| (7) Adults | 2,224 | 2,224 | 2,224 | 2,224 |
| **Panel B: Subsample of Adults Who Migrated** | | | | |
| (8) Worked for NREGA | 0.348 | 0.000 | 0.057 | 0.276 |
| (9) Would work more for NREGA | 0.875 | 0.725 | 0.873 | 0.860 |
| (10) Days worked on NREGA | 7.962 | 0.000 | 1.053 | 5.867 |
| (11) Adults | 768 | 218 | 646 | 927 |
| **Panel C: Subsample of Adults Who Migrated or Would Have Migrated** | | | | |
| (12) Worked for NREGA | 0.475 | 0.022 | 0.108 | 0.374 |
| (13) Would work more for NREGA | 0.897 | 0.731 | 0.880 | 0.875 |
| (14) Days worked on NREGA | 12.6 | 0.498 | 2.05 | 9.13 |
| (15) Adults | 955 | 223 | 683 | 1,072 |
| **Panel D: Subsample of Adults Who Worked for the NREGA** | | | | |
| (16) Would Have Migrated if No NREGA Work | 0.209 | 0.556 | 0.259 | 0.177 |
| (17) Migrated | 0.298 | 0.000 | 0.259 | 0.313 |
| (18) Days Outside Village for Work | 15.3 | 0.000 | 9.97 | 16.0 |
| (19) Adults | 895 | 9 | 143 | 817 |

The unit of observation is an adult. Each column restricts the sample to a particular season. Panel B restricts the sample to adults who left the village for work during the season specificed in the column heading. Panel C restricts the sample to adults who left the village for work or report that they would have left the village for work if that had not worked for the NREGA during the season specified in the column heading. Panel D restricts the sample to adults who worked for the NREGA during the season specificed in the column heading.

Table 6: Cross-States differences in NREGA work provision

| | Gujarat | Madhya Pradesh | Rajasthan |
|---|---|---|---|
| | (1) | (2) | (3) |
| Worked for NREGA | 10% | 39% | 50% |
| NREGA Days Worked | 2.5 | 8.4 | 15.5 |
| NREGA Days Worked if Worked | 25.3 | 21.7 | 31.7 |
| Would have done more NREGA Work | 78% | 79% | 81% |
| Total Days of NREGA Work Desired | 48.7 | 41.4 | 44.3 |
| Adults | 330 | 749 | 1,145 |

Source: Retrospective questions from the migration survey implemented in summer 2010. The unit of observation is an adult. Each column restricts the sample to responses for a particular state.

Table 7: Village Balance

| Village characteristic | MP-RJ Pairs RJ Mean | MP Mean | pvalue | GJ-RJ Pairs RJ Mean | GJ Mean | pvalue | Source | Included as control? |
|---|---|---|---|---|---|---|---|---|
| Total Population | 570 | 602 | 0.76 | 1375 | 1241 | 0.71 | Census 2001 | No |
| Frac Population Literate | 24% | 26% | 0.64 | 29% | 34% | 0.22 | Census 2001 | No |
| Frac Population ST | 95% | 95% | 0.98 | 97% | 99% | 0.31 | Census 2001 | No |
| Bus Service? | 15% | 15% | 0.98 | 45% | 90% | 0.02 | Census 2001 | Yes |
| Distance to Paved Road (km) | 0.3 | 0.9 | 0.08 | 0.5 | 0.3 | 0.70 | Census 2001 | Yes |
| Distance to Railway (km) | 49.4 | 43.3 | 0.28 | 75.0 | 45.9 | 0.03 | Census 2001 | Yes |
| Distance to Town (km) | 10.1 | 11.2 | 0.64 | 6.1 | 10.2 | 0.04 | Census 2001 | Yes |
| Distance to Post Office (km) | 5.9 | 4.1 | 0.11 | 2.6 | 3.4 | 0.43 | Census 2001 | No |
| Distance to Hospital (km) | 6.3 | 7.7 | 0.35 | 5.4 | 7.8 | 0.19 | Census 2001 | No |
| Distance to Bank Branch (km) | 15.9 | 13.1 | 0.41 | 10.9 | 10.2 | 0.83 | Census 2001 | No |
| Farm is HH Main Income Source | 57% | 54% | 0.55 | 41% | 42% | 0.97 | Migration Survey | No |
| HH Land owned (Acres) | 3.1 | 2.8 | 0.32 | 2.5 | 2.4 | 0.98 | Migration Survey | No |
| % HH with electricity | 24% | 33% | 0.29 | 23% | 56% | 0.02 | Migration Survey | Yes |
| % HH with cellphone | 36% | 35% | 0.89 | 33% | 56% | 0.01 | Migration Survey | Yes |
| % HH with access to a well | 47% | 53% | 0.34 | 39% | 57% | 0.13 | Migration Survey | No |
| % HH which uses irrigation | 50% | 55% | 0.61 | 61% | 53% | 0.61 | Migration Survey | No |
| Number of villages | 25 | 25 | | 10 | 10 | | | |

The following acronyms are used for state names: RJ for Rajasthan, MP for Madhya Pradesh and GJ for Gujarat. Village characteristics which are significantly different at the 5% level between either RJ and MP villages or RJ and GJ villages are included as control in the regression analysis.

Table 8: Cross-state Comparison Days Spent Working for NREGA

| **PANEL A: All village pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | 6.334*** | 5.998*** | 0.250 | 0.102 | -0.426 | -0.364 |
| | (1.203) | (0.939) | (0.195) | (0.0740) | (0.380) | (0.392) |
| Want More NREGA Work | | 10.54*** | | 0.0919 | | 1.054*** |
| | | (0.967) | | (0.0976) | | (0.224) |
| Observations | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 |
| Mean in MP and GJ | 6.65 | 6.65 | .03 | .03 | 1.32 | 1.32 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| **PANEL B: Excluding GJ-MP Pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | 6.712*** | 6.152*** | 0.355 | 0.127 | -0.360 | -0.489 |
| | (1.322) | (0.981) | (0.264) | (0.0911) | (0.372) | (0.404) |
| Want More NREGA Work | | 11.72*** | | 0.102 | | 1.403*** |
| | | (0.965) | | (0.136) | | (0.292) |
| Observations | 1,559 | 1,559 | 1,559 | 1,559 | 1,559 | 1,559 |
| Mean in MP | 8.46 | 8.46 | .04 | .04 | 1.67 | 1.67 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |

The unit of observation is an adult. Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. Each column presents results from a regression of days spent working on the NREGA during a particular season on a set of explanatory variables. Rajasthan is a dummy for whether the adult lives within a village in Rajasthan. Standard errors are computed assuming correlation of errors within villages. All regressions include a constant. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table 9: Cross-state Comparison Days Spent Working Outside the Village

| **PANEL A: All village pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | -7.084** | -7.673*** | 0.961 | 0.697 | 0.536 | -0.586 |
| | (3.335) | (2.849) | (1.158) | (1.174) | (2.208) | (2.111) |
| Want More NREGA Work | | 1.547 | | -2.159 | | 1.019 |
| | | (2.254) | | (1.891) | | (2.231) |
| Observations | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 |
| Mean in MP and GJ | 23.99 | 23.99 | 5.11 | 5.11 | 16.28 | 16.28 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| **PANEL B: Excluding GJ-MP pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | -7.801** | -9.123*** | 0.109 | -1.045 | -0.893 | -2.190 |
| | (3.535) | (3.009) | (1.164) | (1.190) | (1.952) | (2.072) |
| Want More NREGA Work | | 4.819* | | -1.872 | | 1.151 |
| | | (2.606) | | (2.444) | | (2.770) |
| Observations | 1,559 | 1,559 | 1,559 | 1,559 | 1,559 | 1,559 |
| Mean in MP | 26.01 | 26.01 | 3.18 | 3.18 | 14.37 | 14.37 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |

The unit of observation is an adult. Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. Each column presents results from a regression of days spent outside of the village during a particular season on a set of explanatory variables. Rajasthan is a dummy for whether the adult lives within a village in Rajasthan. Standard errors are computed assuming correlation of errors within villages. All regressions include a constant. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table 10: Wage Differentials (Summer 2009)

| | Migrated and Worked for NREGA | Migrated | Migrated and Want More NREGA Work | Migrated and Do not Want More NREGA Work |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| (1) Earnings per Day Outside Village | 99.3 | 101.3 | 99.4 | 114.9 |
| | (3.12) | (2.29) | (2.11) | (7.51) |
| (2) Earnings per Day of NREGA Work | 64.2 | 62.6 | 62.6 | 62.5 |
| | (1.92) | (0.73) | (0.76) | (1.31) |
| (3) Difference (1) - (2) | 35.1 | 38.7 | 36.7 | 52.4 |
| | (3.32) | (2.15) | (2) | (7.16) |
| Observations | 267 | 768 | 672 | 96 |

The unit of observation is an adult. The first row presents the mean earnings per day outside the village during summer 2009 for different subsets of all migrants. For adults with missing earnings, earnings from migration trips taken during summer 2010 are used to predict earnings in summer 2009. The second row presents the mean of earnings per day worked for NREGA during summer 2009. For adults who did not work for NREGA or have missing earnings, earnings are predicted using summer 2010 NREGA earnings and a set of person-level characteristics. Standard errors computed assuming correlation of errors within villages in parentheses.

Table 11: Migration Cost Estimates

| | Parameter Estimate |
|---|---|
| (1) Mean Migration Cost | 60.5 |
| | [57.7,63.4] |
| (2) Standard Deviation of Migration Costs | 30.1 |
| | [28.1,32] |
| (3) Mean Earnings per Day Outside Village | 102.5 |
| (4) Migration Costs as % of Earnings | 59.0% |
| (5) Observations | 768 |

The unit of observation is an adult. The first and second rows present estimates of the mean and standard deviation of the distribution of migration costs per day spent outside the village for the sample of adults who left the village during summer 2009. Confidence intervals are computed by bootstrapping assuming errors are correlated within villages.

Table 12: All India impact of NREGA on public works days

| | 2007-08 | | 1999-00 | Diff in Diff |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Early | 0.535*** | -0.364 | 0.302 | -0.541 |
| | (0.143) | (0.346) | (0.272) | (0.466) |
| Star State | 1.485*** | 0.697 | 0.129 | 0.800 |
| | (0.430) | (0.702) | (0.284) | (0.722) |
| Early X Star State | 5.046*** | 6.038*** | -0.411 | 6.480*** |
| | (1.404) | (1.628) | (0.438) | (1.666) |
| Mean Other Districts | 0.0580 | 0.0580 | 0.0753 | |
| Observations | 212,848 | 212,197 | 246,051 | 464,560 |
| Workers Controls | No | Yes | Yes | Yes |
| District Controls | No | Yes | Yes | Yes |
| District FE | No | No | No | Yes |

The unit of observation is a rural adult. Each column presents results from a separate regression. The outcome is the estimated number of days spent on public works per adult per year. Early District is a dummy variable equal to one for districts in which NREGA is implemented in 2007-08. Star state is a dummy variable equal to one for Andhra Pradesh, Himachal Pradesh, Chhattisgarh, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttarkhand. District Controls are presented in Table 1. For the specification presented in column Four the dummies Early District and Star State, as well as time invariant controls are interacted with a time dummy equal to one for the period 2007-08. Standard errors are clustered at the district level. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table 13: All India impact of NREGA on probability of short-term migration

| | 2007-08 | | 1999-00 | Diff in Diff |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Early | 2.256*** | 0.905** | -0.125 | 0.908* |
| | (0.372) | (0.422) | (0.323) | (0.465) |
| Star State | 0.633** | 0.366 | -0.528* | 0.951** |
| | (0.289) | (0.420) | (0.318) | (0.483) |
| Early X Star State | -1.474*** | -1.446 | 0.569 | -1.952** |
| | (0.551) | (1.020) | (0.551) | (0.970) |
| Mean Other Districts | 1.22 | 1.22 | 1.44 | |
| Observations | 212,848 | 212,332 | 242,305 | 460,922 |
| Workers Controls | No | Yes | Yes | Yes |
| District Controls | No | Yes | Yes | Yes |
| District FE | No | No | No | Yes |

The unit of observation is a rural adult. Each column presents results from a separate regression. The outcome is a binary variable which is equal to 100 if workers have spent one to six months away from work during the last year and zero otherwise. Early District is a dummy variable equal to one for districts in which NREGA is implemented in 2007-08. Star state is a dummy variable equal to one for Andhra Pradesh, Himachal Pradesh, Chhattisgarh, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttarkhand. District Controls are presented in Table 1. For the specification presented in column Four, the dummies Early District and Star State, as well as time invariant controls are interacted with a time dummy equal to one for the period 2007-08. Standard errors are clustered at the district level. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table 14: Predictions of rural to urban short term Migration flows

| | Migrants OLS (1) | Log (1+Migrants) OLS (4) | Migrants Poisson (5) |
|---|---|---|---|
| Log Distance | -10.17 | -0.332*** | -0.418*** |
| | (6.338) | (0.0648) | (0.136) |
| Log Destination Casual Deflated Wage | 23.27*** | 0.228*** | 0.648*** |
| | (6.597) | (0.0493) | (0.234) |
| Log Origination Casual Deflated Wage | -18.92*** | -0.371*** | -0.478** |
| | (5.967) | (0.0696) | (0.224) |
| Missing Destination Casual Deflated Wa | 133.3*** | 1.100*** | 3.568*** |
| | (32.94) | (0.192) | (1.048) |
| Missing Origin Casual Deflated Wage | -35.63 | -1.080*** | -3.279*** |
| | (28.29) | (0.282) | (1.099) |
| Log Destination Population | 38.03*** | 0.269*** | 1.004*** |
| | (7.607) | (0.0244) | (0.100) |
| Log Origin Population | 32.94*** | 0.485*** | 0.852*** |
| | (7.299) | (0.0402) | (0.141) |
| Language Proximity | 52.97** | 0.770*** | 1.684*** |
| | (20.67) | (0.141) | (0.475) |
| Same State | 111.6*** | 1.271*** | 0.763** |
| | (42.45) | (0.148) | (0.333) |
| Same District | 1,898*** | -0.0399 | 0.0398 |
| | (221.6) | (0.374) | (0.751) |
| Observations | 229,738 | 229,738 | 229,738 |
| R-Squared | 0.046 | 0.296 | |

Each column presents the results of a separate regression. The unit of observation is a pair of one rural and one urban district. The outcome in Column 1 and 3 is the number of migrants going from rural to urban districts. The outcome in Column 2 is the log of one plus the number of migrants. All estimates are computed without sampling weights. Standard errors in parentheses are adjusted for correlation of the errors between state pairs. ***, **, and * indicate significance at the 1, 5, and 10% levels.

Table 15: Program effect on urban casual wages

| Ratio of rural migrants to resident casual workers for migrants coming from: | Log Casual Wages | | | Log Salaried Wages |
|---|---|---|---|---|
| | Program | | Placebo | Program |
| | (1) | (2) | (3) | (4) |
| Late Districts Other States | -0.00489 | -0.0601* | 0.0339 | -0.0309 |
| | (0.0321) | (0.0362) | (0.0269) | (0.0197) |
| Early Districts Other States | -0.0782** | -0.0378 | 0.00383 | -0.0170 |
| | (0.0350) | (0.0316) | (0.0246) | (0.0120) |
| Late Districts Star States | -0.179 | -0.157 | 0.230 | -0.138 |
| | (0.169) | (0.180) | (0.161) | (0.0986) |
| Early Districts Star States | 0.388** | 0.366* | -0.266 | 0.216* |
| | (0.178) | (0.202) | (0.185) | (0.130) |
| Observations | 16,988 | 16,988 | 20,884 | 41,256 |
| District Controls | No | Yes | Yes | Yes |
| Worker Controls | No | Yes | Yes | Yes |

In column 1, 2 and 4 the sample is composed of urban adults surveyed in NSS 2004-05 and 2007-08. In column 3 the sample is composed of urban adults surveyed in NSS 1999-00 and 2004-05. Each column presents results from a separate regression. In columns 1 to 3, the outcome is log deflated casual earnings. In column 4 the outcome is log deflated salaried earnings. Early districts are those selected for the first and second phase of NREGA implementation. Star states are Andhra Pradesh, Himachal Pradesh, Chhattisgarh, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttarkhand. District Controls are presented in Table 1. Worker controls include dummies for gender, education level, caste, age group and religion. Standard errors are clustered at the district level. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

# FOR ONLINE PUBLICATION ONLY

# A Appendix

## A.1 Construction of Key Variables

**Earnings per Day Worked for Migrants** The survey instrument included questions about the frequency of payment and the typical amount per pay period. In most cases (74%), respondents were paid daily and in these cases we used the typical daily payment as earnings per day worked. We also asked respondents how many days per week they typically worked. Respondents worked on average six days per week and the median respondent worked six days. For respondents who were paid weekly, fortnightly, or monthly, we used the reported payment adjusted by the typical number of days per week worked. For example, a migrant paid 800 rupees weekly and working six days per week earns $800/6 = 133$ rupees per day worked. For migrants that were paid irregularly or in one lump sum at the end of work, we used the total earnings from the trip divided by the number of days worked. For migrants with missing values of days worked per week, we assumed they worked six days.

Surveyors were instructed to check whether daily earnings, total earnings, trip length, and days worked per week made sense together. If they did not, they were instructed to ask the respondent for an explanation and write it down. For example, in one case, total earnings from a trip was abnormally high because the respondent was paid for work performed on a different trip. In cases in which the surveyor comments indicated that the reported variables did not accurately measure the earnings per day worked of the respondent, we either adjusted the daily earnings or set the daily earnings to missing.

Finally, five percent of respondents received payment in-kind for their work, being paid in wheat for example. We leave these daily earnings observations as missing.

**Earnings per Day Away for Migrants** For respondents with non-missing total earnings (62%), earnings per day away was computed using total earnings divided by days away. For respondents with missing total earnings, we used earnings per day worked adjusted downwards using days worked per week away. Table A.1 presents summary statistics. The table reveals that during summer 2009, out of 768 migrants, we have non-missing earnings for only 593 (77%). This is because for some adults who took more than four trips, we did not record information for any of the trips taken during summer 2009. For these adults and all adults with non-missing summer 2010 earnings, we construct predicted earnings for

summer 2009 by projecting summer 2009 earnings onto summer 2010 earnings and dummies for whether the person was engaged in migrant agricultural labor during summer 2009 and summer 2010. The mean for the resulting earnings per day away is provided in Row 6 of Table A.1.

**Earnings per Day Away of NREGA work** The second half of Table A.1 presents the measures of daily earnings for NREGA work. Importantly, some respondents report never having been paid. Out of the 895 adults who worked for the NREGA during summer 2009, 32 (3.6%) report not having been paid in full at the time of the survey. Assuming a wage of zero for those who were not paid yields a wage of 64.4 rupees per day compared with 67 for only those who were paid. For the following analysis, we will need a measure of daily earnings on NREGA that non-NREGA participants would expect to receive. We predict NREGA earnings during summer 2009 for non-participants with a linear regression using summer 2010 NREGA daily earnings, a gender dummy, age, age squared, and dummies for highest education achieved, and state. Interestingly, none of the predictors except summer 2010 NREGA daily earnings are statistically significant, suggesting that the NREGA wage does not vary with productivity. In contrast, gender and age are good predictors of migration earnings.

## A.2 District Controls

**Census** A number of the district controls are computed from the primary census abstract of 2001. In all cases, we use information for rural areas only, which we then aggregate to the district level. We compute "fraction of scheduled tribes" and "fraction of scheduled castes" by dividing by total population. "Population density" is obtained by dividing total population by total area. "Literacy rate," "male labor force participation ratio" and "female labor force participation ratio" are respectively computed by dividing the number of literate persons, of male workers and of female workers respectively by total population aged six and over. "Fraction of labor force in agriculture" is obtained by dividing the number of rural individuals who report working as cultivators or agricultural laborers as their main or secondary occupation by the total number of workers. Finally, we use information from the census village directory to compute "irrigated cultivable land per capita" and "non irrigated cultivable land per capita."

**Agricultural Productivity:** We compute agricultural productivity per worker for each

agricultural year in each district using two sources of data. First, the Ministry of Agriculture publishes yearly data on output and harvest prices of 36 grain and cash crops in every district [15]. This allows us to compute the value of agricultural production for every district-year. Second, we use National Sample Survey data to estimate the number of (self employed and wage) workers active in agriculture for every district-year. NSS survey years match exactly the Ministry of Agriculture definition of agricultural years (July-June). Hence, dividing output value by the number of agricultural works yields agricultural productivity per worker for each NSS survey year.

**Rainfall** To control for monthly rainfall at the district level over the period 1999-2010, we use data from the Tropical Rainfall Measuring Mission (TRMM), which is a joint mission between NASA and the Japan Aerospace Exploration Agency (JAXA). The TRMM Multi-Satellite Precipitation Analysis provides rainfall data for every three hours at a resolution of 0.25 by 0.25 degree grid-cell size. Rainfall measurement are made by satellite and calibrated using monthly rain gauge analysis data from the Global Precipitation Climatology Project (GPCP).[16] The data is then scaled up to obtain mean monthly rainfall for every cell. On average there are 6 grid-cells per district. We compute cumulative rainfall in each district-month as the sum of rainfall since July 1st, and express it as percentage deviation from the 1998-2011 mean for this district-month.

**Other district controls** "Pre-election year" is a dummy for whether state assembly or Panchayati Raj (local) elections are to be held in the following year. To construct this control, we used online reports from the Electoral Commission of India[17] and from the State Election Commissions of each states. "PMGSY Road Construction" is an estimate of the number of km of road built under the national rural roads construction program Pradhan Mantri Gram Sadak Yozna. We use online reports on each road built under the scheme to compute for each district quarter the average number of km completed per quarter over the last five quarters.[18]

[15] Data is available at `http://eands.dacnet.nic.in/`.
[16] Data is available at `http://trmm.gsfc.nasa.gov/`. See Fetzer (2013) presents the data in more details.
[17] `http://www.eci.nic.in/ecimain1/index.aspx`
[18] `http://pmgsy.nic.in/`

## A.3 Rural-Urban Short-term Migration Matrix

In this section we describe in details how we assign rural short term migrants observed in NSS Employment Survey 2007-08 to a particular district of destination. NSS Employment Survey reports destination into seven categories: same district (rural or urban), other district in the same state (rural or urban), another state (rural or urban), and another country. The issue is hence to predict the district of destination for migrants who went to urban areas of the same state or went to urban areas of another state. For this purpose, we use Census 2001 information on permanent migrants, i.e. prime age adults living in urban areas who changed residence in the last 10 years and came from rural areas, for which the census records the state of previous residence.

Let $M_{od}$ and $m_{od}$ denote respectively long and short term migration flows from the rural part of district $o$ to the urban part of district $d$. Let $S_o$ be the state of origin and $S_d$ the state of destination. From the NSS Employment survey, we observe short-term migration within the same district ($m_{oo}$), to another district from the same state ($\sum_{d,o\in S_d,o\neq d} m_{od}$)) and to another state ($\sum_{d,S_o\neq S_d} m_{od}$). From Census 2001 data, for each urban destination $d$, we observe long term migration from the same district ($M_{dd}$), long term migration from other districts of the same state ($\sum_{i\in S_d,i\neq d} M_{id}$), and long term migration from each state ($\sum_{i\in S_o,S_o\neq S_d} M_{id}$). We combine these pieces of information to predict short term migration flows $m_{od}$.

Our method relies on two assumptions. First, we need to assume that the proportion of short term migrants who go from district $o$ to another district $d$ of the same state is the same as the proportion of long term migrants in district $d$ who come from another district of the same state. Second, we need to assume that the proportion of short term migrants who go from district $o$ in state $S_o$ to district $d$ in another state is the same as the proportion of long term migrants in district $d$ who come from state $S_o$. Formally, we use the following algorithm to predict short term rural to urban migration flows:

$$\widehat{m_{od}} = \begin{cases} m_{od} & \text{if } o{=}d \\ \frac{\sum_{i\in S_d,i\neq d} M_{id}}{\sum_{j\in S_d}\sum_{i\in S_d,i\neq d} M_{ij}} \sum_{j,S_j=S_o,j\neq o} m_{oj} & \text{if } o\neq d \text{and } S_o=S_d \\ \frac{\sum_{i\in S_o} M_{id}}{\sum_{j\in S_d}\sum_{i\in S_o} M_{ij}} \sum_{j,S_j\neq S_o} m_{oj} & \text{if } o\neq d \text{and } S_o\neq S_d \end{cases}$$

## A.4 Weighting

The NSSO provides sample weights which ensure that the weighted mean of each outcome is an unbiased estimate of the average of the outcome for the population National Sample Survey Office (2010). For the purpose of our analysis, we re-weight observations so that the sum of all weights within each district is constant over time and proportional to the rural population of the district as estimated from the NSS Employment Surveys. When we use NSSO survey weights without reweighting, the results are almost identical to our main results (results not shown). As compared to using ordinary least squares without any weighting, our approach allows us to make sure that our results are not driven by smaller districts with few observations for casual wages. More concretely, let $w_i$ be the weight for person $i$, and let $\Omega_{dt}$ be the set of all persons surveyed in district $d$ at time $t$. Then the new weight for person $i$ is $w_i \times \frac{\omega_d}{\sum_{i \in \Omega_{dt}} w_i}$ where $\omega_d$ is the population weight for district $d$.

## A.5 Construction of District Panel

During the period covered by the analysis, some districts split while other districts merged together. Constructing the district panel requires matching districts both over time as well as across data sets. Fortunately, the NSS district definitions for surveying stayed constant from 2004 to 2008, despite splits and merges. We therefore use the NSS district definitions from this period and match other data sets to these. We first match the NSS 1999-2000 to 2004-05 and 2007-08 data. All districts could be matched between the two surveys but for five districts missing in 1999-00. However about fifty of them had split between 1999-00 and 2005-05. We adopt the following procedure If a given district has split in x districts (x is most of the time equal to two, sometimes three), we duplicate observations from that district x times so that one set of observation can be matched with one of the newly created district. In order to keep the total weight of that district constant, we divide each weight in the 1999-00 data-set by x. We further match NSS data with Census 2001 survey, NREGA phases 2005, ARIS-REDS 1999-00 survey, PMGSY road construction data from 2001 to 2010

Table A.1: Wage Summary Statistics

| | Summer 2009 (1) | Monsoon 2009 (2) | Winter 2009-10 (3) | Summer 2010 (4) |
|---|---|---|---|---|
| (1) Adults Who Migrated | 768 | 197 | 481 | 654 |
| (2) Adults with Non-missing Earnings | 568 | 159 | 408 | 503 |
| (3) Mean Earnings per Day Worked | 118.1 | 128.4 | 126.0 | 123.9 |
| (4) Mean Earnings per Day Away | 100.9 | 107.9 | 109.8 | 109.8 |
| (5) Adults with Predicted Earnings | 768 | | | |
| (6) Mean Predicted Earnings per Day Away | 101.3 | | | |
| (7) Adults Who Worked for NREGA | 267 | | | |
| (8) Adults with Non-missing Earnings | 259 | | | |
| (9) Mean Earnings per Day of *Paid* Worked | 64.7 | | | |
| (10) Adults with Predicted NREGA Earnings | 768 | | | |
| (11) Mean Predicted NREGA Earnings | 62.6 | | | |

The unit of observation is an adult. See the text and appendix for details on construction of the earnings measures. Each column restricts the sample to responses for a particular season.

Table A.2: Correlates of Demand for NREGA work

| | Want more NREGA Work | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Female | -0.0275* | 0.0000369 | 0.00216 |
| | (0.0161) | (0.0165) | (0.0165) |
| Primary School or Literate | -0.0335 | -0.0237 | -0.0237 |
| | (0.0215) | (0.0212) | (0.0212) |
| Secondary or Above | -0.171*** | -0.154*** | -0.151*** |
| | (0.0295) | (0.0285) | (0.0283) |
| Monsoon 2009 | -0.263*** | -0.263*** | -0.250*** |
| | (0.0183) | (0.0183) | (0.0169) |
| Winter 2009-10 | -0.0477*** | -0.0477*** | -0.0447*** |
| | (0.00703) | (0.00703) | (0.00668) |
| Age | 0.0350*** | 0.0347*** | 0.0343*** |
| | (0.00348) | (0.00330) | (0.00330) |
| Age Squared | -0.000481*** | -0.000452*** | -0.000448*** |
| | (0.0000446) | (0.0000425) | (0.0000425) |
| Salaried Job | -0.330*** | -0.297*** | -0.296*** |
| | (0.0653) | (0.0640) | (0.0639) |
| Migrant (Any Season) | | 0.121*** | 0.0961*** |
| | | (0.0193) | (0.0216) |
| Migrated (Current Season) | | | 0.0542** |
| | | | (0.0234) |
| Constant | 0.326*** | 0.217*** | 0.214*** |
| | (0.0674) | (0.0653) | (0.0651) |
| Observations | 6,669 | 6,669 | 6,669 |

The unit of observation is an adult by season. Standard errors computed assuming correlation of errors within villages. The dependent variable is a dummy variable for whether the individual reports willingness to work more days for the NREGA during a given season if work were available. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table A.3: Reasons of Demand for NREGA work

| | Summer 2009 (1) | Monsoon 2009 (2) | Winter 2009-10 (3) |
|---|---|---|---|
| **Panel A: Full Sample** | | | |
| Worked for NREGA | 0.402 | 0.004 | 0.064 |
| NREGA Days Worked | 11.2 | 0.106 | 1.13 |
| NREGA Days Worked Conditional on Working | 28.1 | 26.1 | 18.0 |
| Want More NREGA Work | 0.800 | 0.537 | 0.752 |
| Total Days of NREGA Work Desired | 43.9 | 21.5 | 42.7 |
| Adults | 2,224 | 2,224 | 2,224 |
| **Panel B: Subsample of Adults Who Want More Work** | | | |
| Why Did You Not Work More? | | | |
| Family Worked Maximum 100 days | 0.036 | 0.003 | 0.007 |
| Works Finished/No Work Available | 0.556 | 0.817 | 0.745 |
| No Program ID Card/Name Not on ID Card | 0.035 | 0.044 | 0.036 |
| Officials Would not Provide More Work | 0.058 | 0.009 | 0.033 |
| Other | 0.306 | 0.203 | 0.226 |
| Adults | 1,779 | 1,194 | 1,673 |
| **Panel C: Subsample of Adults Who Do Not Want More Work** | | | |
| Why Did You Not Want to Work More? | | | |
| Working Outside the Village | 0.171 | 0.047 | 0.123 |
| Other Work in Village | 0.126 | 0.669 | 0.245 |
| Sick/injured/unable to work | 0.101 | 0.045 | 0.087 |
| Studying | 0.236 | 0.169 | 0.307 |
| NREGA Does Not Pay Enough | 0.043 | 0.014 | 0.038 |
| No Need for Work/Do Not Want to Do Manual Work | 0.036 | 0.015 | 0.022 |
| Other | 0.436 | 0.152 | 0.334 |
| Adults | 445 | 1,030 | 551 |

The unit of observation is an adult. Each column restricts the sample to responses for a particular season. Panel A includes all adults who completed the adult survey. Panel B restricts the sample to adults who report wanting to work more for the NREGA during the season specified in the column heading. Panel C restricts the same to adults who report not wanting to work more for the NREGA during the season specified in the column heading.

Table A.4: Cross-state Comparison of the probability of migrating

| **PANEL A: All village pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | -5.215 | -8.104** | -0.948 | -3.537 | -2.161 | -1.333 |
| | (4.390) | (3.822) | (7.542) | (9.382) | (5.239) | (4.525) |
| Want More NREGA Work | | -9.229* | | -19.84** | | -11.99** |
| | | (5.292) | | (8.366) | | (5.120) |
| Observations | 757 | 757 | 214 | 214 | 638 | 638 |
| Mean in MP | 62.07 | 62.07 | 50.68 | 50.68 | 54.48 | 54.48 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| **PANEL B: Excluding GJ-MP Pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | -5.841 | -9.326** | 7.006 | 13.27 | -2.486 | -1.032 |
| | (4.859) | (4.152) | (10.55) | (20.50) | (5.248) | (5.309) |
| Want More NREGA Work | | -1.657 | | -31.76** | | -6.328 |
| | | (5.333) | | (13.94) | | (6.527) |
| Observations | 549 | 549 | 115 | 115 | 431 | 431 |
| Mean in MP | 63.66 | 63.66 | 44.58 | 44.58 | 51.40 | 51.40 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |

The unit of observation is an adult. Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. Each column presents results from a regression of days spent outside of the village during a particular season if the individual migrated on a set of explanatory variables. Rajasthan is a dummy for whether the adult lives within a village in Rajasthan. Standard errors are computed assuming correlation of errors within villages. All regressions include a constant. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table A.5: Cross-state Comparison of Days Spent Working Outside the Village for Migrants

| **PANEL A: All village pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | -5.215 | -8.104** | -0.948 | -3.537 | -2.161 | -1.333 |
| | (4.390) | (3.822) | (7.542) | (9.382) | (5.239) | (4.525) |
| Want More NREGA Work | | -9.229* | | -19.84** | | -11.99** |
| | | (5.292) | | (8.366) | | (5.120) |
| Observations | 757 | 757 | 214 | 214 | 638 | 638 |
| Mean in MP | 62.07 | 62.07 | 50.68 | 50.68 | 54.48 | 54.48 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| **PANEL B: Excluding GJ-MP Pairs** | Summer 2009 | | Monsoon 2009 | | Winter 2009-10 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rajasthan | -5.841 | -9.326** | 7.006 | 13.27 | -2.486 | -1.032 |
| | (4.859) | (4.152) | (10.55) | (20.50) | (5.248) | (5.309) |
| Want More NREGA Work | | -1.657 | | -31.76** | | -6.328 |
| | | (5.333) | | (13.94) | | (6.527) |
| Observations | 549 | 549 | 115 | 115 | 431 | 431 |
| Mean in MP | 63.66 | 63.66 | 44.58 | 44.58 | 51.40 | 51.40 |
| Worker Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Village Pair Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |

The unit of observation is an adult. Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. Each column presents results from a regression of days spent outside of the village during a particular season if the individual migrated on a set of explanatory variables. Rajasthan is a dummy for whether the adult lives within a village in Rajasthan. Standard errors are computed assuming correlation of errors within villages. All regressions include a constant. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table A.6: Heterogeneity in migration costs

| | Casual Labor | Salaried Work | Self-Employment | Domestic work | Unemployed |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Migrants from Late Districts or Other | -0.0866 | -0.231 | 0.586*** | -0.199 | -0.0161 |
| | (0.126) | (0.196) | (0.199) | (0.207) | (0.0738) |
| Migrants from Early Districts Star States | 0.246 | 1.457 | -3.496*** | 1.144 | 0.0610 |
| | (0.785) | (1.073) | (1.116) | (1.118) | (0.406) |
| Observations | 234,570 | 234,570 | 234,570 | 234,570 | 234,570 |
| Worker Controls | No | No | No | No | No |
| District Controls | Yes | Yes | Yes | Yes | Yes |

The sample is composed of urban adults surveyed in NSS 2004-05 and 2007-08. Each column presents results fro regression. The outcome isthe fraction of total time spent in each activity. Early districts are those selected for the second phase of NREGA implementation. Star states are Andhra Pradesh, Himachal Pradesh, Chhattisgarh, Madhy Rajasthan, Tamil Nadu and Uttarkhand. District Controls are presented in Table 1. Worker controls include dummi gender, education level, caste, age group and religion. Standard errors are clustered at the district level. ***, ** indicate significance at the 1, 5 and 10 percent level.

Table A.7: Predicted short term migration inflows from rural areas as share of urban casual labor force

| | $\alpha_1$ | $\alpha_2$ | Star State? |
|---|---|---|---|
| STATE | (1) | (2) | (4) |
| Andhra Pradesh | 16% | 20% | Yes |
| Assam | 78% | 10% | No |
| Bihar | 91% | 12% | No |
| Chhattisgarh | 19% | 9% | Yes |
| Delhi | 269% | 34% | No |
| Gujarat | 32% | 4% | No |
| Haryana | 110% | 20% | No |
| Himachal Pradesh | 67% | 17% | Yes |
| Jharkhand | 34% | 6% | No |
| Karnataka | 22% | 3% | No |
| Kerala | 22% | 3% | No |
| Madhya Pradesh | 41% | 18% | Yes |
| Maharashtra | 45% | 6% | No |
| Orissa | 39% | 5% | No |
| Punjab | 59% | 9% | No |
| Rajasthan | 54% | 15% | Yes |
| Tamil Nadu | 14% | 6% | Yes |
| Uttar Pradesh | 86% | 11% | No |
| Uttaranchal | 40% | 8% | Yes |
| West Bengal | 44% | 3% | No |
| Total | 40% | 9% | |

Column One present the ratio between the number of rural migrants from late phase districts and from non star states doing short-term trips to urban parts of a given state and the number of casual workers living in urban areas of that state. Column Two presents the ratio between the number of rural migrants from early phase districts of star states doing short-term trips to urban parts of a given state and the estimated number of casual workers living in urban areas of that state. The number of casual workers is estimated using usual principal and subisdiary status of urban prime age adults in NSS 2007-08. Rural to urban migration flows are predicted using the gravity model presented in Table 14.

Table A.8: Program effect on time allocation of urban workers

| | Casual Labor | Salaried Work | Self-Employment | Domestic work | Unemployed |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Migrants from Late Districts or Other | -0.0866 | -0.231 | 0.586*** | -0.199 | -0.0161 |
| | (0.126) | (0.196) | (0.199) | (0.207) | (0.0738) |
| Migrants from Early Districts Star States | 0.246 | 1.457 | -3.496*** | 1.144 | 0.0610 |
| | (0.785) | (1.073) | (1.116) | (1.118) | (0.406) |
| Observations | 234,570 | 234,570 | 234,570 | 234,570 | 234,570 |
| Worker Controls | No | No | No | No | No |
| District Controls | Yes | Yes | Yes | Yes | Yes |

The sample is composed of urban adults surveyed in NSS 2004-05 and 2007-08. Each column presents results fro regression. The outcome isthe fraction of total time spent in each activity. Early districts are those selected for the second phase of NREGA implementation. Star states are Andhra Pradesh, Himachal Pradesh, Chhattisgarh, Madhy Rajasthan, Tamil Nadu and Uttarkhand. District Controls are presented in Table 1. Worker controls include dummi gender, education level, caste, age group and religion. Standard errors are clustered at the district level. ***, ** indicate significance at the 1, 5 and 10 percent level.