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Short-term Migration, Rural Workfare Programs and Urban Labor Markets: Evidence from India *

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Abstract

This paper provides some of the first evidence that rural development policies can have fundamental effects on the reallocation of labor between rural and urban areas. It studies the spillover effects of the world's largest rural workfare program, India's rural employment guarantee. We find that the workfare program has substantial consequences: it reduces short-term (or seasonal) migration to urban areas by 9% and increases wages for manual, short-term work in urban areas by 6%. The implied elasticity of unskilled wages with respect to short-term migration is high (-0.7).

Keywords: Internal Migration, Workfare Programs, Spillover Effects, India.
JEL Classification: O15 J61 R23 H53

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1 Introduction

Since rural and labor markets are linked through migration flows, rural development policies may have spillover effects on urban areas by affecting the reallocation of labor between rural and urban areas (Harris and Todaro, 1970; Fields, 2005). The existence of these spillovers is an open empirical question, which is challenging for at least two reasons. First, rural development policies may affect urban areas in different ways, e.g. through changes in migration, consumption or investment.[1] Precisely identifying migration spillovers is difficult, unless migration networks are geographically distinct from production and trade linkages. Second, rural to urban migration flows include not only long-term migrants, who leave the village to settle down in the cities, but also short-term (or seasonal) migrants, who still live in the village and spend part of the year working in the cities. Short-term migration is difficult to measure without dedicated survey data, and it has so far received little attention in economics.[2] In countries where data is available, short-term flows seem to play a major role in labor reallocation between rural and urban areas: in 2007 an estimated 8.1 million rural Indian adults undertook trips of one to six months to work in urban areas. By comparison, in the same year net rural to urban long-term migration was about 2 million, and 14 million urban adults did casual (unskilled) wage work.[3]

In this paper, we study the effect of India's National Rural Employment Guarantee Act (NREGA) on migration from rural areas to urban areas, and its consequences for urban labor markets. The NREGA is well-suited for the purpose of studying rural to urban spill-overs. It is a workfare program, which hires rural adults on public works during the agricultural off-season with the goal of increasing the income of the poor.[4] It is a large program, with close to 50 million household participants in 2013[5], which had significant impacts on rural labor markets (Imbert and Papp, 2015). In order to evaluate its effect on rural to urban migration, and urban labor markets we combine a novel dataset from a high out-migration area collected by the Research Institute for Compassionate Economics (herafter RICE Coffey et al. (2015)) with data from the nationally representative National Sample Survey (hereafter NSS). Our identification strategy relies on variation in NREGS implementation across India.

[1] Agricultural productivity has been found to have local spillover effects on the non-agricultural sector through these three channels (Marden, 2015; Colmer, 2016; Santangelo, 2016).

[2] See Banerjee and Duflo (2007); Badiani and Safir (2009); Morten (2012); Bryan et al. (2014).

[3] Authors' calculations based on the NSS Employment-Unemployment Survey (July 2007 to June 2008).

[4] Workfare programs are common antipoverty policies. Recent examples include programs in Malawi, Bangladesh, India, Philippines, Zambia, Ethiopia, Sri Lanka, Chile, Uganda, and Tanzania.

[5] Official reports available at http://nrega.nic.in.

The scheme was rolled out across Indian districts in phases, with 330 "early districts" selected to implement the scheme first, and the remaining rural districts implementing it in April 2008. It was also unevenly implemented across states, with seven "star states" providing most of the public employment.

We evaluate the impact of the NREGA on short-term migration using two empirical strategies. First, we use RICE survey data from 70 villages located in a high out-migration area and matched across two state borders and compare NREGA work and migration across states and seasons. We find that adults living in one state that provided more days of government work spend less time outside the village for work compared with the two other other states: one additional day of public employment reduces short-term migration by 0.6 days. Reassuringly, this cross-state difference in days spent outside the village for work is present only during the summer months when most of the government work is provided. Second, we use nationally representative data from NSS and compare districts selected to implement the NREGA in states which actively implemented the scheme ("early disticts" of "star states"), with other rural districts. We find no difference in public employment or migration in 1999, before the NREGA was implemented. Between 1999 and 2007, public employement increased and short-term migration decreased in districts where the program was implemented. Our estimates suggest that short-term migration flows across India decreased by up to 9%.

We next consider the impact of the NREGA on urban labor markets. A calibration exercise reveals that a 1% drop in the inflow of short-term migrants may increase wages for manual, short-term work in urban areas by as much as 0.7%. We investigate this prediction empirically using data on long and short-term migration flows and a gravity model which predicts for each urban area the inflow of migrants coming from rural areas with and without the NREGA. We find that unskilled wages increased in urban labor markets with higher migration rates from rural areas where the NREGA is implemented. The increase in wages is 6% across urban India, which is consistent with the calibration. By contrast, urban centers with higher migration rates from rural areas where the NREGA is not implemented experienced lower wage growth. Urban wage growth does not depend on the origin of rural short-term migrants before the program was implemented or after the program was rolled out in all rural districts, which suggests that our results are not driven by long run trends unrelated to the program. Finally, the urban wage effects are not concentrated in districts or states which implemented the NREGA. This finding alleviates the concern that NREGA implementation would be endogenous to urban outcomes. It also suggests that our results are driven by changes in migration, rather than local demand or investment.

This paper contributes to the literature in three ways. First, we present evidence that workfare programs can have important effects on labor markets beyond their direct impact on beneficiaries. 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, 2015; Zimmermann, 2013). Other studies have suggested that workfare programs may reduce short-term migration from rural areas (Jacob, 2008; Ashish and Bhatia, 2009; Morten, 2012; Das, ming). This study is the first to provide direct evidence that through their effect on short-term migration, rural public works have significant impacts on urban labor markets.

Second, 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 (Gollin and Rogerson, 2014; Morten and Oliveira, 2014; Munshi and Rosenzweig, 2016). Some studies have also suggested that there is scope for policies to reduce poverty and promote economic development by encouraging migration (Jalan and Ravallion, 2002; Bryan et al., 2014; Kraay and McKenzie, 2014). Angelucci (2013) finds that by relaxing credit constraints a cash-transfer increases migration from Mexico to the US. In contrast, our results suggest that workfare programs which provide public employment in rural areas may reduce migration by increasing the opportunity cost of leaving the village.

Third, we estimate the labor market effects of short-term (or seasonal) migration flows. The migration literature traditionally focuses on estimating the impact of inflows of international migrants on local labor markets (Card, 1990, 2001; Friedberg, 2001; Borjas, 2003). Recent studies have investigated the impact of changes in migration within countries following a productivity shock or an initial inflow of international migrants (Kleemans and Magruder, 2014; Badaoui et al., 2014; Monras, 2014). Closer to our study, Boustan et al. (2010) estimate the impact of the generosity of New Deal programs on migration, wages and employment in US cities during the Great Depression. Our contribution is to show that short-term, seasonal movements of labor are reactive to policy changes and may have large impacts on urban labor markets.

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. Section 4 uses nationally representative data from NSS Surveys to estimate the impact of the program on urban labor markets across India. Section 5 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.

2.1 The NREGA

India's National Rural Employment Guarantee Act (NREGA), passed in September 2005, entitles every household in rural India to 100 days of work per year at a state specific minimum wage. The act was gradually introduced throughout India starting with 200 of the poorest districts in February 2006, extending to 130 additional districts in April 2007, and to the rest of rural India in April 2008. The assignment of districts to phases was partly based on a backwardness index computed by the Planning Commission, using poverty rate, agricultural productivity, agricultural wages and the share of tribal population as poverty criteria (Planning Commission, 2003). In the analysis we will call "early districts" the districts in which the scheme was implemented by April 2007 and "late districts" the rest of rural India. Column One and Two in Table 1 present the main differences between early and late districts. Early districts are indeed poorer than late districts, they have lower wages and agricultural productivity, and a higher share of tribal population. As compared to late districts, they have reduced access to education and medical facilities, banks, post offices, paved roads and electricity.

Available evidence suggests substantial variation in the implementation of the program across states and even districts (Dreze and Khera, 2009; Dreze and Oldiges, 2009). Figure 1 shows the extent of cross-state variation in public works employment in 2004-05 (before the NREGA) and 2007-08 (when the NREGA was implemented in phase one and two districts). As in Imbert and Papp (2015) we use the term "star states" to describe seven states which are responsible for most NREGA employment provision: in Andhra Pradesh, Chhattisgarh, 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.

Columns Four and Five in Table 1 present averages of socio-economic indicators in star and non-star states.[6] According to these indicators, star states do not seem to be systematically richer nor poorer than other states. Poverty rates are slightly lower in star states,

[6] Appendix A details how we construct these indicators.

the literacy rate and the fraction of scheduled castes are the same, the proportions of scheduled tribes are 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 better access to electricity (according to 2001 census data), and spent more per capita under the national rural road program and under national watershed programmes in 2007-08, which suggests that they are more effective in implementing public infrastructure programs.

An important question is whether differences in economic conditions or quality of governance can explain differences in public employment provision under the NREGA between star and non-star states. Figure 2 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 as well as worker controls.[7] The ranking of states in terms of employment provision remains strikingly similar to Figure 1. This provides support to the idea that differences in NREGA implementation are not mainly driven by differences in economic conditions or governance quality, but by some combination of political will, existing administrative capacity, and previous experience in providing public works (Dutta et al., 2012).[8]

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 keep work-sites closed throughout the fall so they do not compete with the labor needs of farmers (Association for Indian Development, 2009). According to the National Sample Survey 2007-08, the average number of days spent on public works per adult was above one day during the first and second quarter of the year (January to June), and about a quarter of a day during the third and fourth quarter (July to December).

Work under the act is short-term, often on the order of a few weeks per adult. In our own survey described below, households with at least one member employed under the act

[7]Worker controls include dummy variables for gender, age group, religion, caste, education level and marital status.

[8]For example, in the Congress ruled Andhra Pradesh the 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 the NREGA as part of the state's long tradition of drought relief. In Maharashtra the scheme was not implemented, because it was perceived as a repetition of the state's Employment Guarantee Scheme launched in the 1970s, which (Ravallion et al., 1991).

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, 45% of Indian households wanted work under the act but only 25% of Indian households benefited from the program.[9] The rationing rule is at the discretion of local officials: a World Bank report notes that "workers tend to wait passively to be recruited rather than actively applying for work" (The World Bank, 2011).

2.2 Nationally representative data (NSS)

The main obstacle to studying migration is the scarcity of reliable data. The migration literature traditionally focuses on long-term migrants, who appear in population censuses. Studying short-term migration is more challenging, as it requires dedicated data collection efforts, which are often targeted to particular rural areas known to have high levels of seasonal migration (Bryan et al., 2014). In this study we combine two data sources, the nationally representative NSS survey and an original survey from 70 villages located in a high out-migration area.[10]

Our primary source of information 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 which collects information on employment and wages in urban and rural areas, with one specialized module whose focus changes from round to round. For the purpose of our analysis, we use the 1999-00, 2004-05, 2007-08 and 2011-12 rounds, of which only the 1999-00 and 2007-08 rounds include questions on the migration history of each household member. For the 2007-08 round, we only consider the first three quarters of the survey year (July 2007 to March 2008), before the roll-out of the program to late districts on the 1st April 2008.

Our analysis with NSS data focuses on district level outcomes.[11] 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

[9] Author's calculations based on NSS Employment-Unemployment Survey (June 2009-July 2010).

[10] 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 or living conditions at destination.

[11] 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.

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.[12]

2.2.1 Short-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, even if migration has not actually changed between the two periods. Indeed, the percentage of short-term migrants among rural prime age adult is an estimated 1.67% in 1999-00 and 2.51% in 2007-08.[13]

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 report migration rates above 5%.

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

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

[13] Authors calculation based on NSS Employment Surveys 1999-00 and 2007-08. In the RICE survey described below, we find 32% of adults were away from one to six months in the last 12 months and 23% were away for two to six months. This suggests that a statistical artifact may explain the whole difference between 1999-00 and 2007-08 short-term migration levels measured by the NSS.

each person the percentage of days in the past seven days spent in each of six mutually exclusive activities: public works, casual wage work, salaried wage work, self-employment, unemployement and out of the labor force. The NSSO makes the distinction between two types of wage 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 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 reports casual work as her principal or subsidiary occupation.

2.3 Data from a high out-migration area (RICE survey)

The NSS surveys enable us to precisely measure employment and wages across India. Unfortunately, the information they collect on short-term migration is rudimentary. In particular, NSS data only records whether household members have left the village in the last year, not when and for how long. We complement NSS with an original and detailed survey from a high out-migration area implemented by the RICE (Coffey et al., 2015). This survey provides detailed information on public employment and migration trips by season, including the number of days worked under the NREGA and the number of days spent away. This allows us to take into account the seasonality of public works and short-term migration, and to study the effect of the program on the duration of migration trips.

2.3.1 Sample Selection

Figure 3 is a map of the RICE survey area with the locations of surveyed villages. Villages were selected to be on the border of three states: Gujarat, Rajasthan, and Madhya Pradesh. The 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.[14] Each village in Rajasthan was matched with one village either in Gujarat or in Madhya Pradesh with similar characteristics. The matching was based on latitude, longitude and proximity to the border, as well as caste

[14] Besley et al. (2012) followed a similar strategy and surveyed villages at the border of multiple states.

composition of the population, culturable land, irrigated and non irrigated land per capita.

The RICE survey consists of household, adult, and village modules. The sample includes 705 households living in 70 villages. The household module was completed by the household head or another 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.[15]

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 the sample we use for our analysis. However, these migrants may be less likely to change their migration behavior in response to the NREGA: they are half as likely to have ever done NREGA work as other adults in the sample.[16]

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. The sixth column shows the short-term migration rate is 16% for the four districts chosen for the RICE survey according to NSS, which is half the mean in sample villages but well above the all-India average.

[15] See Coffey et al. (2015) for a detailed description of the RICE survey.

[16] We can include adults that were not interviewed personally in the analysis by using information collected from the household head and check that our results are not affected.

2.3.2 Measuring Migration

The survey instrument was specifically designed to measure migration, cultivation, and participation in the NREGA, which are all highly seasonal. The survey was implemented at the end of the summer 2010, i.e. when most migrants come back for the start of the agricultural peak season. Surveyors asked retrospective questions to each household member 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.[17]

Table 3 presents descriptive information about short-term migration trips. As expected, migration is concentrated during the winter and the summer and is much lower during the peak agricultural season (from July to November). Short-term migrants travel relatively long distances (300km on average during the summer), and a large majority goes to urban areas and works in the construction sector. Employer-employee relationships are often short-term: only 37% of migrants knew their employer or labor contractor before leaving the village. Living arrangements at destination are rudimentary, with 86% of migrants reporting having no formal shelter (often a bivouac on the work-site itself). Finally, most migrants travel and work with family members, only 16% have migrated alone. Column Four presents national averages from the NSS survey. Migration patterns are similar along the few dimensions measured in both surveys. The average rural short-term migrant in India as a whole is less likely to go to urban areas, and more likely to work in the manufacturing or mining sector than in the our survey sample.

3 Program effect on migration

In this section, we investigate the effect of the NREGA on migration using two different empirical strategies.

[17] 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.

3.1 Evidence from a high out-migration area: empirical strategy

In order to estimate the impact of the NREGA on short-term migration, we first use the RICE survey and compare public employment provision and migration in different seasons in villages in Rajasthan with matched villages in the two neighboring states of Gujarat and Madhya Pradesh. We exploit the cross-state variation in program implementation and compare Rajasthan, one of the most proactive state in implementing the NREGA, with Gujarat and Madhya Pradesh. We also take advantage of public works seasonality and compare the summer months, where most public employment is provided, to the rest of the year. Unlike a simple comparison across states, our double-differences strategy allows migration levels to be different between Rajasthan and the two other states in the winter, season where migration is present but no public employment is provided. The estimating equation is:

$$Y_{is} \quad = \alpha \quad + \beta_0 Raj_i + \beta_1 Sum_s + \beta_3 Raj_i * Sum_s + \gamma \mathbf{X_i} + \varepsilon_{is} \tag{1}$$

where Y_{is} is the outcome for adult i in season s, Raj_i is a dummy variable equal to one if the adult lives in Rajasthan, Sum_s is a dummy variable equal to one for the summer season (mid-March to mid-July) and X_i are controls. The vector X_i includes worker characteristics (gender, age, marital status, languages spoken and education dummies), households characteristics (number of adults, number of children, religion and caste dummies, landholding in acres, dummies for whether the household has access to a well, to electricity, owns a cell phone or a TV), village controls listed in Table 4 and village pair fixed effects.[18] Standard errors are clustered at the village level.[19]

This difference will be captured by the coefficient β_0. In order for β_3 to be an estimate of NREGA impact, villages in Rajasthan need to be comparable with their match on the other side of the border either in Gujarat or in Madhya Pradesh in all other respects than NREGA implementation. Potential threats to our identification strategy are 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 along these dimensions. Table 4 presents sample means of village characteristics for village pairs in Rajasthan and

[18] We also estimate our specification including a dummy variable for whether the adult reported being willing to work more for the NREGA in this particular season and find similar results (not reported here).

[19] We also computed standard errors using two-way clustering at the village and season level following Cameron et al. (2011) and obtained smaller standard errors.

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 size, 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 infrastructure 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 as a robustness check.

3.2 Evidence from a high out-migration area: results

We first compare public employment provision across states and seasons. We use days worked for the NREGA in each season as an outcome and estimate Equation 1. The first column of Table 5 confirms that across states, less than one day of public employment is provided outside of the summer months. During the summer, adults in Madhya Pradesh and Gujarat, work about six days for NREGA. The coefficient on the interaction of Rajasthan and summer suggests that in Rajasthan nine more days of public employment are provided. The inclusion of controls and village pair fixed effect changes the estimated coefficients very little (Column Two). Panel B in Table 5 presents the 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 twice as many days on NREGA work-sites than adults in Madhya Pradesh who work seven days and a half on average.

Columns Three of Table 5 estimate the same equation with days spent outside the village for work as the dependent variable. Estimates from Panel A suggest that the average adult in Madhya Pradesh and Gujarat villages spent 11 days away for work during the monsoon and winter 2009. Adults in Rajasthan villages spent a day less away for work, but the difference is not significant. By contrast, in the summer adults in Rajasthan villages spent five and a half 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. We estimate the same specification without the village pairs that include Gujarat villages. The magnitude of the effect increases to eight and a half days per adult (Column Three Panel B of Table 5). The estimated coefficients hardly change with the inclusion of controls and village fixed effects. Taken together, our estimates suggest that one additional day of NREGA work reduces migration by 0.6 to 1.2 days.[20]

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). Column Five and Six of Table 5 estimate Equation 1 taking as outcome a binary variable equal to one if the adult migrated during the season. In Madhya Pradesh and Gujarat villages, 20% of adults migrated at some point between July 2009 and March 2010. The probability is exactly the same in Rajasthan villages. During the summer 2009, on average 39% adults migrated in Madhya Pradesh and Gujarat villages. The proportion of migrants was seven percentage points lower in Rajasthan villages and the difference is highly significant. Panel B Column Five of Table 5 presents the estimates when we compare only villages in Madhya Pradesh and Rajasthan. We find that the probability of migrating during the summer months is 10 percentage points lower for adults in Rajasthan. The estimates are robust to the inclusion of controls and pair fixed effects.[21]

As detailed in Coffey et al. (2015), there are many important differences among adults living in Rajasthan, Madhya Pradesh and Gujarat. As a result, differences in migration could be partly due to preexisting differences among the states unrelated to the NREGA. The fact that we do not find any significant difference in winter, when the program is not implemented but migration is relatively high, gives some reassurance that migration patterns are not systematically different across-states. We also compare the number of long-term migrants across states, i.e. individuals who changed residence and left the household in the last five years, and find no significant differences (see Appendix Table A.2). Finally, our survey included retrospective questions about migration trips in previous years. Using non-missing responses, we find no significant difference in migration levels in 2004 and 2005, i.e. before NREGA was implemented.[22]

In the next section, we present our second identification strategy which uses NSS data before and after NREGA implementation and enables us to test for pre-existing differences

[20]We repeat the same analysis including adults who were not interviewed personally but about whom information was collected from the household head. The results, shown in Appendix Table A.1 are extremely similar. As discussed in Section 2.3 adults who were not interviewed personally are more likely to migrate in all seasons, and hence less likely to change their migration behavior in response to the NREGA.

[21]We find no significant differences in the number of trips made during the season between villages in Rajasthan and villages in Gujarat and Madhya Pradesh (results not shown).

[22]Less than 50% of respondents remembered whether they migrated before 2005, so we cannot exclude that migration levels were in fact different.

in migration which may be correlated with NREGA implementation.

3.3 All-India effect on migration: empirical strategy

An important question is whether our finding that public employment provision under NREGA reduces short-term migration holds across India. We investigate this question 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 March 2008, NREGA was implemented in 330 early districts, but not in the rest of rural India.[23] 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 changes in employment and migration between 1999-00 and 2007-08 in early districts of star states with other rural districts. Our outcomes of interest are the number of days spent on public works per year, the fraction of adults who have done short-term migration trips during the past year and the fraction of households which saw any member leaving during the last year to reside elsewhere.

Let Y_{iot} be the outcome for individual i in rural district of origin 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 $\mathbf{Z_o}$ denote a vector of district characteristics which do not vary with time, $\mathbf{X_{ot}}$ a vector of district characteristics which do vary with time. District controls are listed in Table 1. Let $\mathbf{H_i}$ be a vector of individual characteristics, including dummies for gender, education levels, caste, religion and age ranges. We use data from NSS 2007-08 and estimate the following equation:

$$\begin{aligned} Y_{iot} &= \beta_0 Early_o + \beta_1 Star_o + \beta_2 Early_o \times Star_o \\ &+ \delta \mathbf{Z_o} + \gamma \mathbf{X_{ot}} + \alpha \mathbf{H_i} + \eta_t + \mu_o + \varepsilon_{iot} \end{aligned} \tag{2}$$

The main identifying assumption is that absent the NREGA early districts in star states would have had similar public employment and migration levels as other early districts and late districts in non-star states. In order to test this hypothesis, we estimate Equation 2 using data from NSS 1999-00, i.e. before the program was implemented. We would expect

[23] We exclude from the analysis the last quarter of 2007-08, because the NSS survey year ends in June 2008, and NREGA was extended to all rural districts in April 2008.

no significant differences between early districts of star states and other early districts and late districts in non-star states.

Combining the two datasets, we can also implement a difference in differences strategy where we compare changes in outcomes in early districts of star states, to changes in other early districts and changes in late districts in non-star states. Let η_t and μ_o denote time and district fixed effects respectively. We use data from NSS 1999-00 and 2007-08 and estimate the following equation:

$$\begin{aligned} Y_{iot} &= \beta_0 Early_o \times \mathbf{1}\{t > 2006\} + \beta_1 Star_o \times \mathbf{1}\{t > 2006\} \\ &+ \beta_2 Early_o \times Star_o \times \mathbf{1}\{t > 2006\} + \delta \mathbf{Z_o} \times \mathbf{1}\{t > 2006\} + \gamma \mathbf{X_{ot}} + \alpha \mathbf{H_i} + \eta_t + \mu_o + \varepsilon_{iot} \end{aligned} \quad (3)$$

The main identifying assumption is now that absent NREGA early phase districts of star states would have experienced the same trends in short-term migration as the rest of rural India. Unfortunately, we face two important data limitations which make this assumption harder to assess. First, as explained in section 2.2 short-term migration is defined differently in NSS 1999-00 and 2007-08, so that even if the program had no effect, we may observe differential changes in measured migration across districts depending on the prevalence of migration trips of one to two months, which are counted in 2007-08 but not in 1999-00. Second, there is no district-level data on short-term migration for pre-1999 or post-2008 which would allow us to test for the existence of differential trends before or after NREGA roll-out.

3.4 All-India effect on migration: results

Estimates of the program's impact on public employment are presented in Panel A of Table 6. Columns One and Two present the estimates of Equation 2 using data from July 2007 to March 2008, when the NREGA was implemented only in early districts. In late districts of non-star states there is virtually no public employment provided: adults spend 0.23 days on public works per day on average. Without controls, the estimated coefficient on the early district dummy is a significant 0.45, which becomes zero after the inclusion of controls. This confirms that early districts outside of star states provided some, but very little employment under the NREGA (See Section 2.1). The coefficient on star states is small and insignificant, but the coefficient on the interaction is a highly significant 4.7, which drops only slightly after the inclusion of controls. These results suggest that public employment provision under the NREGA in 2007-08 was concentrated in early districts of star states, and that this difference cannot be explained by differences in district characteristics. As a check, Column Three presents the estimates of Equation 2 using data from NSS 1999-00. We find no significant differences in employment provision across early districts and star states, before NREGA was implemented. We also estimate Equation 3 and find no significant change in public employment outside early districts of star states. These results confirm that between 2004-05 and 2007-08, the NREGA increased employment on rural public works only in early districts of star states, which is where we expect to find an impact on migration. In order to test whether this effect persisted over time, we estimate Equation 2 using data from NSS 2011-12, three years after the program had been rolled out across India. The results in Column Five of Panel A in Table 6 suggest that by 2011-12 public employment in other districts (especially in late districts of star states) had caught up with early districts of star states.

Estimates of the program impact on short-term migration are presented in Columns One to Four of Panel B in Table 6. Column One and Two present the estimates of Equation 2 using data from July 2007 to March 2008. Short-term migration is relatively rare in late phase districts of non-star states: only 1.24 percent of adults have spent one to six months away for work in the last year. The coefficients with controls suggest that there is significantly more short-term migration in early districts of non-star states with 1.9% of short-term migrants. The magnitude of the coefficients suggests that the prevalence of short-term migration in early districts of star-states is much lower, about 1%, but the difference is not significant. We next estimate Equation 2 on 1999-00 data, and find no significant differences across these districts before NREGA was implemented (Column Three). When we implement specification 3, we find that within non-star states, the proportion of rural adults in early districts which made short-term migration trips during the last year increased by 0.8 percentage points between 1999-00 and 2007-08, as compared to rural adults in late phase districts. In late phase districts of star states, the relative increase in the proportion of short-term migrants was similar, about 0.9. The estimated coefficient on the interaction term is negative and significant, and the point estimate suggests that as compared to other rural districts short-term migration decreased by 44% in rural districts where NREGA work was provided. Finally, we estimate Equation 2 using NSS 2007-08 data at the household level to explore the impact of NREGA on long-term migration. We find that the fraction of households from which at least one member has left during the past year is 6.9% in late districts of non-star states. We find no significant differences in long-term migration across early districts and star states, and the magnitude of the coefficients is much smaller, relative to the average in late districts of non star states.

3.5 Effect on migration: discussion

Both empirical strategies independently confirm that the NREGA significantly reduced short-term migration. However, the magnitudes of the estimated impact differ: in response to a comparable increase in public employment (five days per adult) the estimated change in the short-term migration rate is 20% in the RICE survey sample and 44% in NSS. The difference between the two estimates may be simply due to some heterogeneity in the impact of NREGA in the survey sample as compared to the rest of rural India. It may also be due to the fact that the program impacts migration directly, through increased participation on public works, but also indirectly, through a rise in private sector wages in rural areas (Imbert and Papp, 2015). Since villages in the survey sample are located next to each other and belong to the same labor market, comparing migration on either side of the state borders only allows us to capture the direct effect of NREGA employment provision. By contrast, in the NSS we compare entire districts which are large enough to be distinct labor markets. Hence by comparing migration across districts, we are likely to capture the effect of rising private sector wages as well as the effect of public employment provision.

We find no evidence of an impact of NREGA on long-term migration. By providing additional income, the program may encourage long-term migration by alleviating financial constraints (Angelucci, 2013), mitigating income risk (Bianchi and Bobba, 2013) or reducing household dependence on village-based informal insurance (Munshi and Rosenzweig, 2016). It is possible that these effects only materialized after a longer period of implementation and that we are not able to capture them. In particular, our identification strategy based on NSS only estimates the effect of the program one or two years after the program roll-out. Results from our survey, however, provide suggestive evidence against these effects, as we do not find any systematic difference in long-term migration in Rajasthan villages which by the time of the survey had benefitted from higher employment provision for four years.

In 1999-00 early districts of star states were responsible for 20% of short-term migration flows: hence our estimates suggest that the NREGA may have decreased short-term migration flows across India by 9%. This estimate is relatively large, and since migrant workers from rural areas represent an important fraction of the unskilled labor force in urban areas, one would expect the NREGA to have significant effects on urban labor markets. We investigate this issue empirically in the next section. However, it is important to note that 9% is likely to be an overstimate of the effect of the program. By decreasing migration from early districts of star states the NREGA may increase urban wages, which may attract more migrants from other rural districts. Hence, the negative impact of the program we estimate in this section is the combination of a decline in migration in rural areas with NREGA employment and a rise in migration in other rural areas. Hence the net effect of the program on short-term migration flows across India is likely to be smaller than 9%. The next section estimates the effect of the NREGA on urban areas.

4 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. Throughout the analysis, we will focus on the market for casual labor, i.e. manual, short term work, which is the relevant market for short-term migrants. We first outline a simple theoretical model which suggests that small changes in rural to urban migration may have large impacts on urban labor markets. 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 markets by comparing changes in outcomes in urban districts that are more or less exposed to changes in migration due to NREGA.

4.1 Urban labor market equilibrium model

In order to calibrate the potential effects of changes in migration flows due to NREGA, we present a simple model of the urban labor market equilibrium. 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 that the urban labor market is competitive and that residents and short-term migrants are perfect substitutes, 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 α, the more the urban center relies on migrant labor to satisfy its demand for labor. Let η_D and η_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 α, η_D and η_S:

$$\frac{dw}{w} / \frac{dL_m}{L_m} = -\frac{\alpha}{\eta_S - \eta_D(1+\alpha)} \tag{4}$$

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 areas 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 α, 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 million and the number of urban adults who declare doing casual labor as a primary or secondary occupation is 15 million. This yields an estimate of α for urban India $\widehat{\alpha} = 0.53$.[24] For the sake of the calibration, let us now assume that the elasticity of labor demand of urban India is $\eta_D = -0.4$ and the elasticity of labor supply is $\eta_S = 0.1$.[25] . The implied elasticity of urban wages to migration is -0.7, i.e. a decrease in short-term migration from rural areas by 1% would increase urban wages by 0.7%. 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. The estimates presented in the previous section suggest that the NREGA may have reduced short-term migration by up to 9%, which would imply an increase in wages by 6%. Assuming higher labor demand and labor supply elasticities would yield lower estimates, but under reasonable assumptions one expects the program to have large impacts on wages wages for casual labor in urban areas. [26]

It is straightforward to extend the model to the case of two rural locations (denoted 1 and 2), of which only location 1 experiences an exogenous change in migration due to the

[24] Both the numerator and the denominator of the migration rate are likely to be underestimated. On the one hand, the NSS migration measure only captures trips from one to six months, excluding longer and shorter short-term trips. On the other, there may be more casual laborers in the cities, for example rural workers who commute to the cities.

[25] These numbers are consistent with the existing literature on rural labor markets in India (Binswanger and Rosenzweig, 1984) and the literature on unskilled migration (Borjas, 2003). In Imbert and Papp (2014) we estimate labor demand elasticity in rural India to be -0.38.

[26] Due to the much larger size of the rural workforce, the effect of changes in short-term migration on rural wages is likely to be small. Imbert and Papp (2015) study the effect of the program on rural wages.

implementation of a public works program. We denote by $\alpha_1 = \frac{L_m^1}{L_u}$ 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 η_M the elasticity of migration with respect to the urban wage. The elasticity of urban wages with respect to an exogenous change in migration from location 1 is given by:

$$\frac{dw}{w} / \frac{dL_m^1}{L_m^1} = -\frac{\alpha_1}{\eta_S + \eta_M \alpha_2 - \eta_D(1 + \alpha_1 + \alpha_2)} \quad (5)$$

Assuming that the elasticity of migration with respect to a change in urban wages is positive, a drop in migration from location 1 increases migration from location 2, 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.

4.2 Predicting short-term migration flows

We now turn to the estimation of the effect of the NREGA on urban labor markets. For this we first need to predict short-term migration flows, and estimate for each urban center the empirical counterpart of α_1 and α_2, the ratio of short term migrants from rural areas with and without the NREGA divided by the number of urban workers.

As discussed in Section 2.2, we know whether rural short-term migrants went to an urban center, but we do not know their exact destination. We only know whether they went to the same district, another district of the same state or another state. In order to allocate short-term migrants to a particular destination, we use data on the origin of long-term migrants who came from rural areas and settled in urban areas between 1991 and 2000, according to the 2001 census. For these long-term migrants, we know whether they came from the same district, another district of the same state or another state, and which state they came from. We compute for each urban district the fraction of rural long-term migrants who came from a given state. We next use this fraction to allocate rural short term migrants from each state to urban districts across India.[27] This provides us with an estimate of m_{od}, the number of short-term migrants from rural parts of district o to urban parts of district d in 2007-08. 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" (Card and

[27] The details of our method are described in Appendix A.

DiNardo, 2000; Munshi, 2003).

We next build a gravity model that predicts migration flows based on district characteristics independent of the NREGA. For this we use the distance between district o and district d (which we denote δ_{od}) and an index of language proximity between origin and destination (I_{od}).[28] We also use average real wages at origin and destination (w_o and w_d respectively), the number of casual workers at origin and destination (N_o and N_d respectively) estimated from NSS 2004-05, before the NREGA was in place. We 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 ($o = d$). The model is estimated using Poisson-quasi maximum likelihood, 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 is:

$$\begin{aligned} m_{od} &= \beta_1 log(\delta_{od}) &+\beta_2 log(w_o) + \beta_3 log(w_d) + \beta_4 log(N_o) \\ &+\beta_5 log(N_d) &+\beta_6 I_{od} + \beta_7 1\{S_o = S_d\} + \beta_8 1\{o = d\} + \varepsilon_{od} \end{aligned} \quad (6)$$

Finally, we construct for each urban center the empirical counterparts of α_1 and α_2 in the theoretical framework, i.e. the measure of exposure to changes in migration from districts where public employment is provided and from districts where no public employment is provided. $\widehat{m_{od}}$ is predicted short-term migration from rural district o to urban district d. Let L_d denote the number of casual workers living in urban district d in 2004-05 (estimated as explained in Section 2.2). In order to measure the exposure of each urban district to migration flows, we construct the two following ratios:

$$\widehat{\alpha_{1d}} = \frac{\sum_{o \in StarEarly} \widehat{m_{od}}}{L_d} \quad and \quad \widehat{\alpha_{2d}} = \frac{\sum_{o \notin StarEarly} \widehat{m_{od}}}{L_d}$$

α_{1d} and α_{2d} 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.

We first estimate equation 6 to predict migration flows between rural-urban district pairs. As Table A.3 in the appendix shows, the determinants of migration all have a significant impact on migration flows, and their coefficients have the expected signs. Distance negatively

[28] The index of language proximity 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.

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 more people have a language in common with them. Finally, rural short-term migrants are more likely to migrate to urban centers in the same state. These effects are robust to the model used, and to different definitions of the outcome variable. In the following we use predictions from the Poisson model, whose estimates are shown in Column Four of Table A.3.

We next use predicted migration flows to compute the two ratios α_1 and α_2, which measure the importance of migration flows from early districts in star states and from other rural districts respectively, as a fraction of the urban casual labor force. Table A.4 in the appendix presents the weighted average of these estimates for each state. States in which urban areas rely heavily on short-term migrants from early districts of star states are some of the star states themselves (Andhra Pradesh, Madhya Pradesh and Rajasthan). Delhi, Himachal Pradesh and Haryana receive high levels of migration both from early districts of star states and from other rural districts. Many states with high levels of rural migration do not rely on rural migrants from early phase districts of star states. We use this variation across urban labor markets to identify the effect of changes in migration induced by the NREGA.

4.3 Program effect on urban labor markets: strategy

Using our measure of exposure of each urban center to changes in short-term migration flows, we next estimate the impact of the NREGA on urban labor markets. Our identification strategy consists of comparing changes in wages in urban centers which rely more on short-term migration from rural areas where the program is implemented (high α_d^1) to outcomes in centers for which migration is less important relative to the resident casual workforce (low α_d^1). For a given level of α_d^1, we further compare urban centers which attract migrants from rural areas without the program (high α_d^2) to districts that do not. We predict a relative increase in wages in urban centers which rely more on migrants coming from rural areas where the program reduces migration, and we predict wages to remain stable or decrease in urban centers which rely more on migrants coming from rural areas where the program is not implemented.

Let Y_{idt} denote the outcome for individual i living in urban district d in quarter t. 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 η_t and μ_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:

$$\begin{aligned} Y_{dt} &= \beta_0 + \beta_1 \widehat{\alpha_{1d}} \times \mathbf{1}\{t > 2006\} + \beta_2 \widehat{\alpha_{2d}} \times \mathbf{1}\{t > 2006\} \\ &+ \delta Z_d \times \mathbf{1}\{t > 2006\} + \gamma X_{dt} + \alpha H_i + \eta_t + \mu_d + \varepsilon_{dt} \end{aligned} \tag{7}$$

For inference purposes, we need to account both for the fact that regressors $\widehat{\alpha_{1d}}$ and $\widehat{\alpha_{2d}}$ are estimated from equation 6 and that error terms in equation 7 are likely correlated for observations pertaining to the same district. We hence bootstrap standard errors by repeating the estimation of models 6 and 7 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 the 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 2004-05, before the NREGA was implemented, and between 2007-08 and 2011-12, i.e. after the NREGA was rolled out across India. 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. As a third check, we estimate equation 7 including time specific trends for early phase districts, for star states and for early phase districts in star states, in order to control for direct effects of public employment provision and for state specific policies or macro-economic shocks which may have affected urban wage growth.

4.4 Program effect on urban labor markets: results

Table 7 presents the estimated effect of the NREGA on urban wages. We find that between 2004-05 and 2007-08, urban centers with higher migration rates from early districts of star states have experienced a relative increase in wages. The estimated coefficient suggests that in the average urban district, for which the migration rate from early districts in star states is 10%, wages have increased by 7%. The magnitude of the estimate declines slightly with the inclusion of district and worker controls to 6%. A 6-7% increase in wages is consistent with the results of our calibration. We also find evidence of a mitigating impact through increased migration from rural districts that do not have the program. For a given migration rate from early districts of star states, an urban center with a 10% higher migration rate from other rural districts experienced a 1% lower wage growth. In the average urban center, for which the migration rate from other rural districts is 40%, the increase in wages (+6%) caused by a drop in migration from rural areas with the NREGA was partly compensated by an increase in migration from areas without the NREGA (-4%). This mitigating effect may have been short-lived however, since the program was later implemented across India.

As a robustness check, we estimate the same specification using data from 1999-00 and 2004-05 and from 2007-08 and 2011-12. We find no evidence that wages followed different trends in urban centers with more migration from early districts in star states either before the program was implemented, or after it was rolled out across India (Column Three and Four of Table 7). We estimate our specification using wages for salaried work as an outcome. Our results, presented in Column Five of Table 7 suggest salaried wages increased in urban centers with more migration from early districts of star states, but the coefficient is twice as small and insignificant. We also estimate our specification allowing for specific trends for early phase districts, for star states and for early phase districts of star states and find similar estimates (see Appendix Table A.5). These results provide some reassurance that our findings are not driven by economic shocks or policies correlated with NREGA implementation. They also confirm that because of the relatively long distances travelled by short-term migrants, the spillover effects of the program on urban labor markets are not limited to districts or states that implement the NREGA, but geographically widespread. This also suggest that the spillover effects are due to migration rather than local changes in rural demand for urban goods or investment of rural households in urban firms (Marden, 2015; Santangelo, 2016).

Finally, Table 8 presents the estimated impact on time allocation of urban workers with and without district controls. We find evidence of an increase in time spent doing casual labor and a decrease in time spent being self-employed among residents in urban centers exposed to a drop in migration. This finding is consistent with an increase in wage work by urban residents in response to an increase in urban wages. However, the point estimates are very sensitive to the inclusion of controls, and the magnitude of the effects is somewhat too large. The estimated coefficient with (resp. without) controls suggests that a 10% higher migration rate increases time spent doing casual labor by 0.8 (resp. 0.3) percentage points, which is equivalent to a 14% (resp. 5%) increase in casual labor. Given that the corresponding wage increase is only 6-7%, these estimates imply a labor supply elasticity which is implausibly large. We also find evidence of a decrease in casual labor and increase in self-employment in urban centers which receive more migrants from rural districts that do not have the program.[29] Overall, our results show that through its effect on short-term migration, the NREGA has had a large impact on urban labor markets.

5 Conclusion

This paper provides two new pieces of evidence. First, we show that a large rural anti-poverty program reduces short-term (or seasonal) migration to urban areas. Theoretically, a workfare program may have ambiguous effects on migration. By providing additional income, it may relax credit constraints and increase migration (Angelucci, 2013). By improving employment opportunities in rural areas, it may also increase the opportunity cost of migration (Imbert and Papp, 2014). Finally, by providing an alternative form of insurance, it may decrease the need for risk-scoping migration (Morten, 2012). We provide evidence that in the case of the NREGA, the net effect is negative.

Second, we find that changes in short-term migration induced by the program have a significant impact on the market for unskilled casual work in urban areas. To our knowledge, our study is the first to present evidence on the role of seasonal migration in the reallocation of labor across space and economic sectors in developing countries. We show that seasonal flows are highly responsive to changes to employment opportunities in rural areas and are large enough to impact the labor market equilibrium in urban areas. Taken together, these findings suggest that migration responses and potential spillover effects on urban areas should be taken into account while designing rural anti-poverty policies.

[29] These effects remain when we allow for different trends in early districts, star states, and early districts of star states (see Table A.6).

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A Appendix

A.1 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" is computed by dividing the number of literate person. Finally, we use information from the census village directory to compute "irrigated cultivable land per capita" and "non irrigated cultivable land per capita" as well as the fraction of villages accessed by paved road, the fraction of villages with bus service, with education facility, medical facility, Post and Telecom facilities, bank, and electricity connection.

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 [30]. 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 workers 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).[31] The data is then aggregated to obtain mean monthly rainfall for every cell, and

[30]Data is available at http://eands.dacnet.nic.in/.

[31]Data is available at http://trmm.gsfc.nasa.gov/. See **?** presents the data in more details.

scaled up to the district level by averaging over the cells which overlap with a district (there are on average six grid-cells per district). We compute cumulative rainfall in each district-month as the sum of rainfall since the last 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[32] and from the State Election Commissions of each states. “State Government Politically Aligned with Central Government” is a dummy variable for whether the Chief Minister of a state is member of a party which participates to the Central Government. “Log Spending on Rural Roads Program per Capita” is the log of expenditures made in a district under the Pradhan Mantri Gram Sarak Yozna (PMGSY) divided by the population of the district according to the 2001 census.[33] “Log Spending on Watershed Programs per Capita” is the log of expenditures made in a state under the Integrated Wasteland Development Program (IWDP), the Desert Development Program (DDP) and the Drought Prone Area Program (DPAP) divided by the population in the state according to the 2001 census.[34]

A.2 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

[32] http://www.eci.nic.in/ecimain1/index.aspx

[33] Financial reports for PMGSY are available online at http://pmgsy.nic.in/

[34] Financial reports for IWDP DDP and DPAP are available online at http://watershedmpr.nic.in/reports.aspx

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.3 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 re-weighting, 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 Ω_{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 ω_d is the population weight for district d.

A.4 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 the Census 2001, NREGA phases, agricultural productivity, rainfall, PMGSY and IWDP/DDP/DPAP spending data from 2001 to 2010.

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Figure 1: Cross-state variation in public employment provision

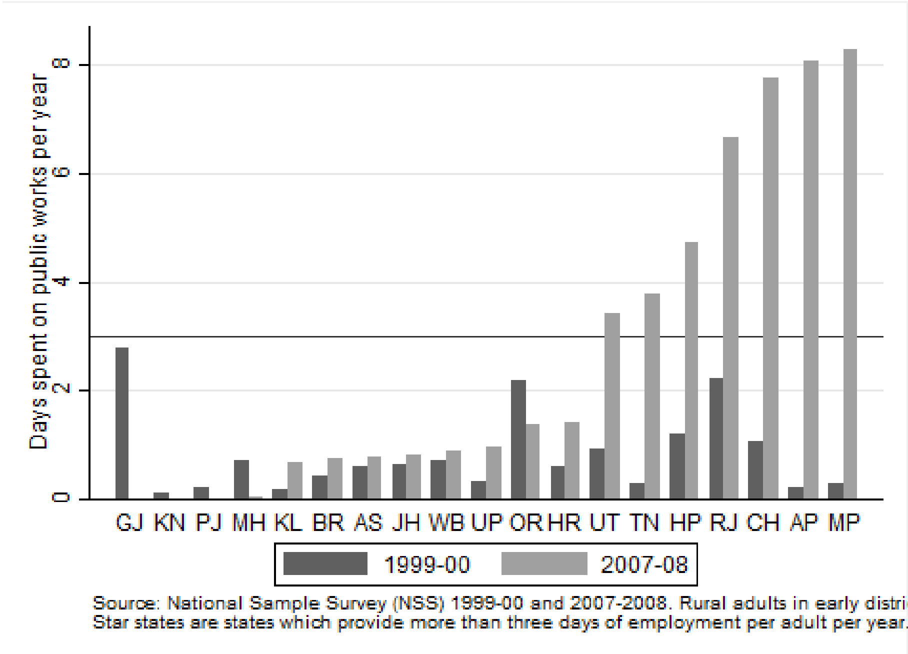

Figure 2: Unexplained cross-state variation in public employment provision

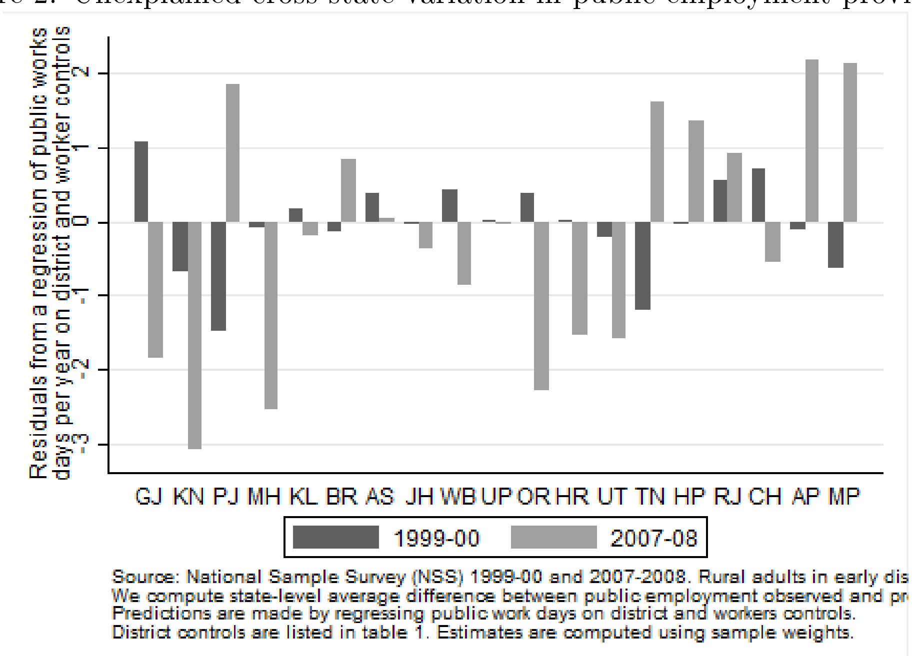

Figure 3: Map of short-term migration

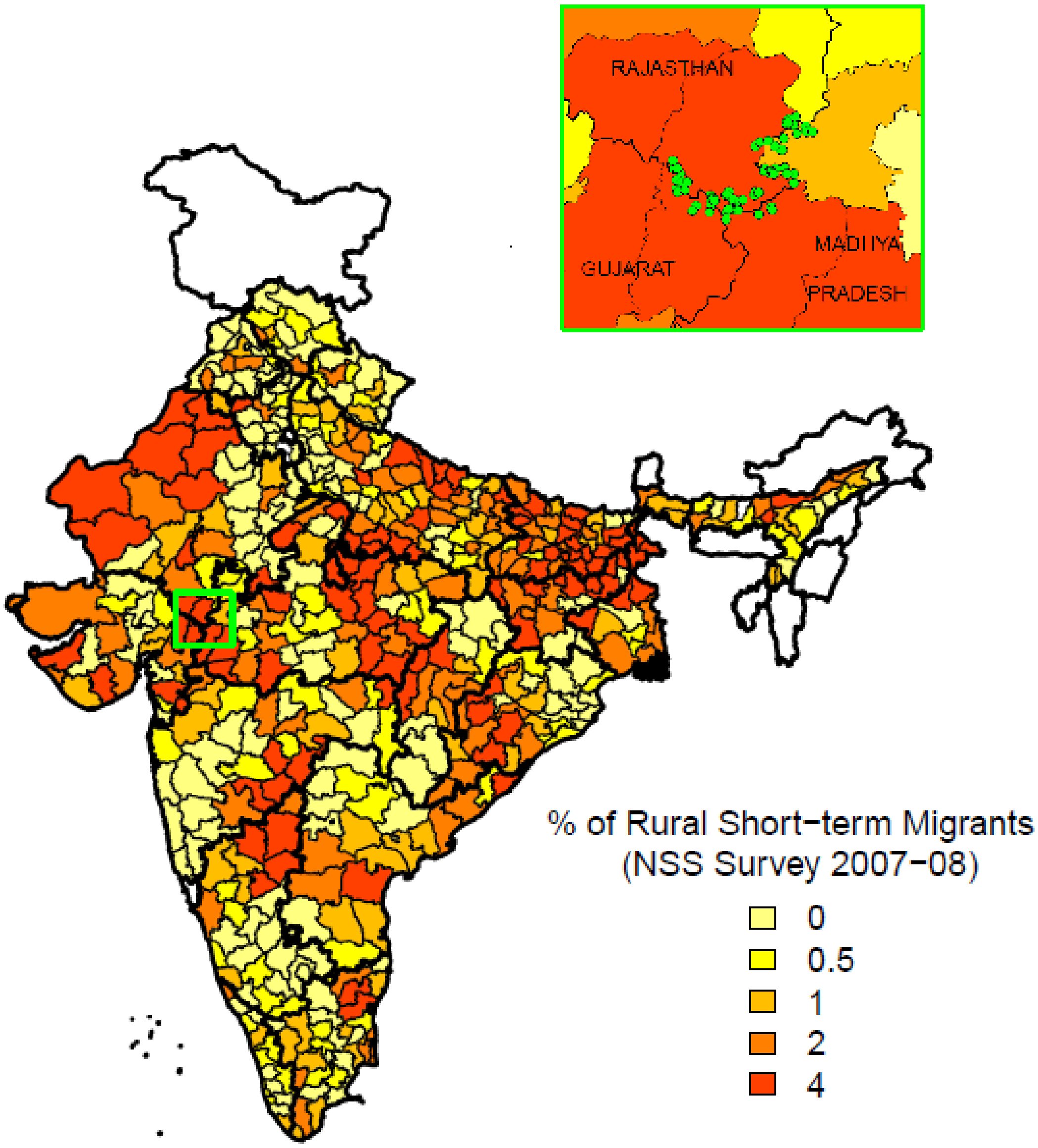

Table 1: District Controls

	Early Districts (1)	Late Districts (2)	p-value (3)	Star States (4)	Other States (5)	p-value (6)	Source (7)	Time-varying? (8)	Rural or Urban Control?
Literacy Rate	56%	65%	0.00	60%	60%	0.54	2001 Census	No	Both
Fraction Scheduled Castes (SC)	18%	18%	0.64	18%	18%	0.28	2001 Census	No	Both
Fraction Scheduled Tribes (ST)	17%	4%	0.00	16%	9%	0.00	2001 Census	No	Both
Agricultural Productivity per Capita (Normalized)	5.88	6.17	0.01	6.09	5.96	0.21	Ag. Ministry	No	Rural only
Log Daily Wage for Casual Labor	3.64	3.96	0.00	3.76	3.79	0.46	NSS 2004-05	No	Both
Log Daily Wage for Salaried Labor	4.41	4.49	0.08	4.38	4.47	0.07	NSS 2004-06	No	Both
Poverty Rate	33%	21%	0.00	26%	29%	0.08	NSS 2004-05	No	Both
Log Population Density (per sq. km)	1.18	1.18	0.89	0.77	1.39	0.00	2001 Census	No	Both
Employment Share in Agriculture	47%	38%	0.00	51%	40%	0.00	NSS 2004-05	No	Both
Employment Share in Construction	3%	3%	0.32	4%	3%	0.00	NSS 2004-05	No	Both
Employment Share in Manufacturing	4%	6%	0.00	6%	5%	0.04	NSS 2004-05	No	Both
Employment Share in Services	8%	10%	0.00	8%	9%	0.00	NSS 2004-05	No	Both
Fraction of Villages accessed by Paved Road	65%	83%	0.00	67%	76%	0.00	2001 Census	No	Rural only
Fraction of Villages with Bus Service	48%	68%	0.00	58%	56%	0.41	2001 Census	No	Rural only
Fraction of Villages with Education Facility	94%	96%	0.00	96%	94%	0.00	2001 Census	No	Rural only
Fraction of Villages with Medical Facility	53%	64%	0.00	60%	57%	0.13	2001 Census	No	Rural only
Fraction of Villages with Post and Telecom Facility	61%	78%	0.00	69%	68%	0.44	2001 Census	No	Rural only
Fraction of Villages with Bank Facility	18%	28%	0.00	21%	24%	0.04	2001 Census	No	Rural only
Fraction of Villages with Electricity	82%	96%	0.00	96%	84%	0.00	2001 Census	No	Rural only
Irrigated Cultivable Land per Capita (ha)	0.09	0.13	0.00	0.11	0.10	0.07	2001 Census	No	Rural only
Non irrigated Cultivable Land per Capita (ha)	0.20	0.15	0.01	0.23	0.15	0.00	2001 Census	No	Rural only
Cumulative Rainfall (normalized) in 2007-08	0.48	0.31	0.05	0.10	0.57	0.00	TRMM	Yes	Rural only
Election Year in 2007-08	13%	4%	0.00	16%	6%	0.00	Gov Website	Yes	Rural only
State Government Politically Aligned with Central Government in 2007-08	46%	55%	0.06	41%	55%	0.00	Gov Website	Yes	Rural only
Log Spending on Rural Roads Program (PMGSY) per Capita in 2007-08	1.61	1.56	0.78	2.26	1.24	0.00	Gov Website	Yes	Rural only
Log Spending on Watershed Programs (IWDP/DDP/DPAP) per Capita in 2007-08	2.42	2.92	0.00	3.63	2.13	0.00	Gov Website	Yes	Rural only
Number of District Observations	288	210		169	329				
Number of Individual Observations (rural areas)	133666	79182		64702	148146				

This table presents means of the controls used in the paper for different samples. Only rural areas are used. 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: RICE survey Sample

	Own Survey				NSS Survey 2007-08	
	All Adults	Full Adult Survey Completed	Adult Survey not Completed	Difference (3) - (2)	All Adults (India)	All Adults (Sample Districts)
	(1)	(2)	(3)	(4)	(5)	(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	0.433	0.422	0.482	0.060	--	--
	(0.0179)	(0.0394)	(0.0187)	(0.0412)		
Migrated for Work all Three Seasons	0.119	0.080	0.295	0.215	--	--
	(0.011)	(0.0318)	(0.0101)	(0.0324)		
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	0.301	0.312	0.251	-0.061	0.025	0.160
	(0.0159)	(0.0351)	(0.0166)	(0.0362)	(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: Migration patterns

	Migration Survey			NSS
	Summer 2009	Monsoon 2009	Winter 2009-10	Year 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%	24%
Worked in manufacturing and mining	9%	5%	6%	18%
Worked in construction	70%	70%	56%	42%
Worked in other sector (including services)	8%	4%	4%	16%
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 4: Village Balance

	MP-RJ Pairs			GJ-RJ Pairs		
	RJ Mean	MP Mean	Difference	RJ Mean	GJ Mean	Difference
Matching variables						
Frac Population SC	0%	1%	0.74	1%	0%	0.24
Frac Population ST	96%	96%	0.99	98%	99%	0.35
Total culturable land	160.5	161.0	0.99	250.3	235.0	0.85
Frac culturable land irrigated	25%	25%	0.97	31%	27%	0.67
Frac culturable land non irrigated	59%	59%	0.93	57%	50%	0.51
Population per ha of culturable land	3.5	3.5	1.00	5.7	5.6	0.98
Village and household controls						
Total Population	570	576	0.95	1324	1276	0.90
Frac Population Literate	24%	26%	0.49	29%	34%	0.19
Bus Service?	16%	16%	1.00	40%	90%	0.02
Distance to Paved Road (km)	0.3	0.9	0.08	0.5	0.3	0.71
Distance to Railway (km)	50.2	44.7	0.32	73.9	47.2	0.05
Distance to Town (km)	10.5	11.2	0.78	6.1	10.0	0.06
Farm is HH Main Income Source	57%	55%	0.75	42%	42%	1.00
HH Land owned (Acres)	3.0	2.8	0.60	2.4	2.4	0.91
% HH with electricity	23%	33%	0.18	22%	57%	0.02
% HH with cellphone	35%	33%	0.76	33%	55%	0.02
% HH with access to a well	47%	52%	0.50	38%	58%	0.12
% HH which uses irrigation	50%	54%	0.68	60%	52%	0.59
Number of villages	25	25		10	10	

Village characteristics are from the Census 2001 and household characteristics from our own survey. The following acronyms are used for state names: RJ for Rajasthan, MP for Madhya Pradesh and GJ for Gujarat. Differences are normalized, i.e. divided by the standard deviation of the covariate in the sample. A difference of more than 0.25 standard deviations is considered as substantial (Imbens and Wooldridge 2009). All village and household characteristics listed in this table are included as control in our main specification.

Table 5: Impact of the NREGA on public employment and migration (Survey Sample)

	NREGA Days		Days away		Any migration trip	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All village pairs						
Rajasthan	-0.117	-0.955**	-1.177	-1.119	-0.0114	-0.0124
	(0.183)	(0.474)	(1.671)	(1.700)	(0.0232)	(0.0209)
Summer (March-July)	5.982***	5.982***	13.30***	13.30***	0.187***	0.187***
	(0.802)	(0.807)	(1.746)	(1.755)	(0.0209)	(0.0211)
Rajasthan x Summer	8.990***	8.990***	-5.503**	-5.503**	-0.0703**	-0.0703**
	(1.128)	(1.134)	(2.203)	(2.216)	(0.0268)	(0.0269)
Observations	6,588	6,588	6,588	6,588	6,588	6,588
Mean in MP and GJ from July to March	.67	.67	10.69	10.69	.2	.2
Worker Controls	No	Yes	No	Yes	No	Yes
Village Pair Fixed Effect	No	Yes	No	Yes	No	Yes
Panel B: Excluding GJ-RJ Pairs						
Rajasthan	-0.231	-0.335	-0.381	-1.271	-0.000557	-0.0221
	(0.220)	(0.468)	(1.827)	(1.652)	(0.0256)	(0.0220)
Summer (March-July)	7.606***	7.606***	17.24***	17.24***	0.233***	0.233***
	(0.895)	(0.901)	(1.918)	(1.931)	(0.0226)	(0.0228)
Rajasthan x Summer	7.408***	7.408***	-8.640***	-8.640***	-0.107***	-0.107***
	(1.281)	(1.290)	(2.570)	(2.587)	(0.0301)	(0.0303)
Observations	4,677	4,677	4,677	4,677	4,677	4,677
Mean in MP from July to March	.85	.85	8.77	8.77	.18	.18
Worker Controls	No	Yes	No	Yes	No	Yes
Village Pair Fixed Effect	No	Yes	No	Yes	No	Yes

The unit of observation is an adult in a given season. Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. Column One and Two presents results from a regression of days spent working on the NREGA during a particular season on a set of explanatory variables. In Column Three and Four the outcome is the number of days spent away for work. In Column Five and Six the outcome is a binary variable equal to one if the adult spent some time away for work during a particular season. Rajasthan is a dummy for whether the adult lives within a village in Rajasthan. Summer is a dummy for the summer months (mid-March to mid-July) 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 6: Impact of the NREGA on public employment and migration (NSS Sample)

Panel A: Public Employment	Days spent on public works per adult per year				
	2007-08	2007-08	1999-00	1999-00 2007-08	2011-12
	(1)	(2)	(3)	(4)	(5)
Early District	0.447***	-0.178	0.270	-0.290	0.638
	(0.154)	(0.284)	(0.288)	(0.385)	(0.563)
Star State	0.251	-0.355	-0.0744	-0.0493	3.811***
	(0.208)	(0.417)	(0.314)	(0.496)	(0.906)
Early X Star	4.651***	4.579***	-0.379	4.959***	-0.283
	(1.017)	(0.971)	(0.449)	(1.097)	(1.200)
Mean in Other Districts	0.23	0.23	0.28	.	0.95
Observations	159,849	159,849	251,847	411,696	321,673
Workers Controls	No	Yes	No	Yes	Yes
District Controls	No	Yes	No	Yes	Yes
District fixed effect	No	No	No	Yes	No

Panel B: Migration	Short-term Migration				Long-term Migration
	2007-08	2007-08	1999-00	1999-00 2007-08	2007-08
	(1)	(2)	(3)	(4)	(5)
Early District	2.111***	0.678*	-0.173	0.842*	0.903
	(0.355)	(0.406)	(0.329)	(0.462)	(0.691)
Star State	0.675**	0.292	-0.530*	0.955**	1.045
	(0.290)	(0.393)	(0.310)	(0.428)	(0.991)
Early X Star	-1.507***	-0.914	0.501	-1.427*	-0.906
	(0.539)	(0.736)	(0.528)	(0.733)	(1.007)
Mean in Other Districts	1.24	1.24	1.45	.	6.92
Observations	159,849	159,849	248,074	407,923	159,849
Workers Controls	No	Yes	Yes	Yes	Yes
District Controls	No	Yes	Yes	Yes	Yes
District Fixed Effect	No	No	No	Yes	No

In Panel A and Panel B Column 1 to 4 the unit of observation is a rural adult. In Column 5 of panel B the unit of observation is a rural household. Each column presents results from a separate regression. In Panel A the outcome is the estimated number of days spent on public works per adult per year. In Panel B Columns 1 to 4 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. In Panel B Column 5 the unit of observation is a household and the outcome is a binary variable equal to 100 if any household member has moved out of the household in the last 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 7: Program effect on urban casual wages

	Log Casual Wages				Log Salaried Wage
	2004-05 2007-08		1999-00 2004-05	2007-08 2011-12	2004-05 2007-08
	(1)	(2)		(3)	(4)
Migration rate from early districts of star states (α_1)	0.695***	0.608***	-0.346	0	0.345
	(0.262)	(0.25)	(0.221)	(0.213)	(0.24)
Migration rate from other rural districts (α_2)	-0.146*	-0.108*	0.0598	-0.084	-0.081
	(0.088)	(0.065)	(0.074)	(0.066)	(0.064)
Observations	14,815	14,815	20,388	12,654	34,097
District Controls	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes

(α_1) is the ratio of the predicted number of rural migrants from early districts of star states on the number of urban residents who do casual work. (α_2) is the ratio of the predicted number of migrants from other rural districts on the number of residents who do casual work. In column 1, 2 and 4 the sample is composed of urban adults surveyed in NSS from July 2004 to June 2005 and July 2007 to March 2008. In column 3 the sample is composed of urban adults surveyed in NSS from July 2007 to March 2008 and July 2011 to June 2012. 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. District Controls are presented in Table 1. Worker controls include dummies for gender, education level, caste, age group and religion. Standard errors are bootstrapped and clustered at the district level. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

Table 8: Program effect on time allocation of urban workers

WHOLE DATA	Log Total Assets Declared by District-Level Functionaries							
	All 2012-13		DDC only 2011-12		DDC only 2012-13		DDC only 2013-14	
Sample	-0.399*	-0.326*	-0.0343	0.0218	-0.222	-0.119	0.287	0.213
	(0.226)	(0.193)	(0.215)	(0.231)	(0.351)	(0.332)	(0.345)	(0.305)
		0	0	0	0	0	0	0
Observations	278	278	36	36	33	33	28	28
Functionary Controls	No	Yes	No	Yes	No	Yes	No	Yes
District Controls	No	Yes	No	Yes	No	Yes	No	Yes
TRIMMED 5%	Log Total Assets Declared by District-Level Functionaries							
	All 2012-13		DDC only 2011-12		DDC only 2012-13		DDC only 2013-14	
Sample	-0.434*	-0.362*	0.0658	0.00587	-0.471*	-0.428	-0.0891	-0.750*
	(0.214)	(0.193)	(0.193)	(0.216)	(0.268)	(0.304)	(0.263)	(0.380)
Observations	269	269	32	32	27	27	25	25
Functionary Controls	No	Yes	No	Yes	No	Yes	No	Yes
District Controls	No	Yes	No	Yes	No	Yes	No	Yes

Declarations 2011-12 were made from January 2011 to June 2012, declarations 2012-13 from August 2012 to June 2013 and declarations 2013-14 from July 2013 to September 2014. The intervention period was September 2012 to April 2013. "District Development Committee" or DDC are in charge of rural development programs, including MGNREGS, in each district. Functionary Controls include the age, the square of age, and dummies for gender and designation of the functionaries as well as a dummy for whether the functionary is posted in the district she was born in. District Controls include the log of spending on labor costs, the log of spending material under the MGNREGS in the financial year 2011-12 (according to the official website nrega.nic.in), as well as the log of the rural population (according to the 2011 census).

Table A.1: Cross-state comparison of NREGA work and migration (RICE Survey, all adults)

	NREGA Days		Days away		Any migration trip	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All village pairs						
Rajasthan	-0.133	-0.961**	-1.445	-1.111	-0.0160	-0.0115
	(0.182)	(0.473)	(1.784)	(1.707)	(0.0241)	(0.0210)
Summer (March-July)	6.399***	5.951***	12.93***	13.36***	0.181***	0.188***
	(0.872)	(0.807)	(1.742)	(1.762)	(0.0206)	(0.0212)
Rajasthan x Summer	8.618***	9.021***	-5.590**	-5.566**	-0.0700**	-0.0718***
	(1.163)	(1.135)	(2.212)	(2.221)	(0.0268)	(0.0271)
Observations	6,957	6,579	6,957	6,579	6,957	6,579
Mean in MP and GJ from July to March	0.69	0.69	11.67	11.67	0.21	0.21
Worker Controls	No	Yes	No	Yes	No	Yes
Village Pair Fixed Effect	No	Yes	No	Yes	No	Yes
Panel B: Excluding GJ-RJ Pairs						
Rajasthan	-0.242	-0.342	-1.070	-1.253	-0.00860	-0.0210
	(0.219)	(0.468)	(1.825)	(1.656)	(0.0260)	(0.0221)
Summer (March-July)	7.958***	7.568***	16.83***	17.35***	0.226***	0.235***
	(1.002)	(0.906)	(1.890)	(1.928)	(0.0220)	(0.0228)
Rajasthan x Summer	7.189***	7.446***	-8.301***	-8.748***	-0.101***	-0.110***
	(1.363)	(1.293)	(2.538)	(2.586)	(0.0295)	(0.0303)
Observations	4,938	4,668	4,938	4,668	4,938	4,668
Mean in MP from July to March	.86	.86	9.49	9.49	.18	.18
Worker Controls	No	Yes	No	Yes	No	Yes
Village Pair Fixed Effect	No	Yes	No	Yes	No	Yes

The unit of observation is an adult in a given season. The sample includes adults which were not interviewed personally but for whom NREGA work and migration days have been reported by the household head. Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. Column One and Two presents results from a regression of days spent working on the NREGA during a particular season on a set of explanatory variables. In Column Three and Four the outcome is the number of days spent away for work. In Column Five and Six the outcome is a binary variable equal to one if the adult spent some time away for work during a particular season. Rajasthan is a dummy for whether the adult lives within a village in Rajasthan. Summer is a dummy for the summer months (mid-March to mid-July) 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.2: Cross-state comparison of permanent migration in the last five years (RICE Survey)

	Any Permanent Migrant		Number of Migrants	
	(1)	(2)	(3)	(4)
PANEL A: All village pairs				
Rajasthan	0.0447	0.0432	-0.0288	-0.197
	(0.0388)	(0.0327)	(0.185)	(0.173)
Observations	702	702	702	702
Mean in MP	.39	.39	1.23	1.23
Worker Controls	Yes	Yes	Yes	Yes
Village Pair Fixed Effect	No	Yes	No	Yes
PANEL B: Excluding GJ-RJ Pairs				
Rajasthan	0.0501	0.0414	0.112	-0.00927
	(0.0472)	(0.0371)	(0.215)	(0.186)
Observations	503	503	503	503
Mean in MP	.4	.4	1.24	1.24
Worker Controls	Yes	Yes	Yes	Yes
Village Pair Fixed Effect	No	Yes	No	Yes

The unit of observation is a household Results in Panel B are based on pairs of villages in Madhya Pradesh and Rajasthan only. In Column One and Two the dependent variable a a dummy which equals one if any member of the household left within the past five years. In Column Three and Four the Rajasthan it is the number of household members who left within the past five years. 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.3: Predictions of rural to urban short-term Migration flows

	Migrants OLS (1)	Any Migrant Probit (2)	Log Migrants OLS (3)	Migrants Poisson (4)
Log Distance	-10.36*	-0.127**	-1.230***	-0.469***
	(5.863)	(0.0540)	(0.135)	(0.135)
Log Destination Casual Deflated Wage	15.52***	0.0389	0.568***	0.315**
	(4.914)	(0.0512)	(0.121)	(0.150)
Log Origination Casual Deflated Wage	-14.05**	-0.0212	-1.046***	-1.063***
	(5.871)	(0.0685)	(0.178)	(0.261)
No Casual Worker at Destination	93.54***	0.0555	2.855***	1.656**
	(25.12)	(0.205)	(0.492)	(0.668)
Log Destination Population	36.25***	0.103***	0.874***	1.055***
	(7.157)	(0.0171)	(0.0442)	(0.0943)
Log Origin Population	29.31***	0.438***	1.295***	0.939***
	(6.371)	(0.0327)	(0.0748)	(0.120)
Language Proximity	46.47**	0.652***	1.715***	1.788***
	(18.65)	(0.147)	(0.306)	(0.467)
Same State	104.6**	-0.0325	1.593***	0.656*
	(41.93)	(0.136)	(0.313)	(0.359)
Same District	1,840***	-1.026***	-2.957***	0.0459
	(208.2)	(0.305)	(0.801)	(0.733)
Observations	247,506	247,506	147,794	247,506
R-Squared	0.046		0.442	

Each col+B8:F40umn 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 4 is the number of migrants going from rural to urban districts. The outcome in Column 2 is a binary variable for whether there is any migrant. The outcomes in Column 3 is the log of 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 A.4: Predicted short-term migration inflows from rural areas as share of urban casual labor force

STATE	Predicted Migration rate from early districts of star states α_1	Predicted Migration rate from other rural districts α_2	Star State?
	(1)	(2)	(4)
Andhra Pradesh	22%	15%	Yes
Assam	4%	28%	No
Bihar	8%	54%	No
Chhattisgarh	17%	28%	Yes
Delhi	50%	221%	No
Gujarat	6%	40%	No
Haryana	16%	73%	No
Himachal Pradesh	4%	14%	Yes
Jharkhand	7%	36%	No
Karnataka	4%	26%	No
Kerala	2%	14%	No
Madhya Pradesh	16%	33%	Yes
Maharashtra	7%	46%	No
Orissa	3%	27%	No
Punjab	12%	67%	No
Rajasthan	15%	53%	Yes
Tamil Nadu	10%	22%	Yes
Uttar Pradesh	13%	80%	No
Uttaranchal	25%	90%	Yes
West Bengal	3%	49%	No
All 20 states	10%	41%	

Column One present the ratio between the number of rural migrants from early districts of 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 other rural districts 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 subsidiary status of urban prime age adults in NSS 2004-05. Rural to urban migration flows are predicted using the gravity model presented in Table A3.

Table A.5: Program effect on urban casual wages controlling for time trends specific to states and districts with high NREGA employment

	Log Casual Wages				Log Salaried Wage
	2004-05 2007-08		1999-00 2004-05	2007-08 2011-12	2004-05 2007-08
	(1)	(2)	(3)		(4)
Migration rate from early districts of star states(α_1)	0.783***	0.565**	-0.177	0.0419	0.126
	(0.230)	(0.251)	(0.298)	(0.243)	(0.294)
Migration rate from other districts (α_2)	-0.155**	-0.106*	0.0218	-0.0868	-0.0422
	(0.0641)	(0.0566)	(0.0754)	(0.0660)	(0.0604)
Early District	0.126*	0.0389	-0.0737	-0.0844*	0.0720*
	(0.0672)	(0.0439)	(0.0468)	(0.0460)	(0.0405)
Star State	0.100	0.101*	-0.0799	-0.0540	0.0747
	(0.0690)	(0.0539)	(0.0485)	(0.0599)	(0.0554)
Early X Star State	-0.250**	-0.185***	0.0941	0.106	-0.0558
	(0.0972)	(0.0675)	(0.0752)	(0.0840)	(0.0795)
Observations	14,815	14,815	20,388	12,654	12,654
District Controls	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	Yes	Yes	Yes

(α_1) is the ratio of the predicted number of rural migrants from early districts of star states on the number of urban residents who do casual work. (α_2) is the ratio of the predicted number of migrants from other rural districts on the number of residents who do casual work. In column 1, 2 and 4 the sample is composed of urban adults surveyed in NSS from July 2004 to June 2005 and July 2007 to March 2008. In column 3 the sample is composed of urban adults surveyed in NSS from July 2007 to March 2008 and July 2011 to June 2012. 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 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. 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.

Table A.6: Program effect on urban employment controlling for time trends specific to states and districts with high NREGA employment

	Casual Labor	Salaried Work	Self-Employment	Unemployed	Not in Labor Force
	(1)	(2)	(3)	(4)	(5)
Migration rate from early districts of star states (α_1)	-3.183	11.45	-10.86*	-2.476	4.887
	(4.256)	(9.737)	(6.543)	(2.741)	(6.820)
Migration rate from other districts (α_2)	1.447	-4.134*	3.568**	0.441	-1.453
	(0.982)	(2.138)	(1.430)	(0.666)	(1.568)
Early District	-1.117*	1.567*	-1.388	0.430	0.564
	(0.652)	(0.890)	(0.876)	(0.503)	(0.863)
Star State	1.417	-2.490*	-0.421	1.189*	0.312
	(1.100)	(1.306)	(1.439)	(0.609)	(1.517)
Early X Star State	0.770	-2.070	2.277	-0.203	-0.958
	(1.266)	(1.980)	(1.821)	(0.859)	(1.849)
Observations	193,578	193,578	193,578	193,578	193,578
District Controls	No	No	No	No	No
Worker Controls	No	No	No	No	No
	Casual Labor	Salaried Work	Self-Employment	Unemployed	Not in Labor Force
	(6)	(7)	(8)	(9)	(10)
Migration rate from early districts of star states (α_1)	6.761*	8.706	-27.08***	-5.372	17.57***
	(3.927)	(6.068)	(7.066)	(3.317)	(6.080)
Migration rate from other districts (α_2)	-0.955	-1.302	3.319*	0.727	-2.002
	(0.925)	(1.551)	(1.752)	(0.745)	(1.576)
Early District	-0.645	1.981*	-2.563**	0.178	1.780*
	(0.668)	(1.012)	(1.172)	(0.603)	(1.045)
Star State	0.860	-2.468*	1.988	1.116*	-1.564
	(0.938)	(1.285)	(1.341)	(0.652)	(1.429)
Early X Star State	-0.564	-1.165	4.547**	0.179	-3.753**
	(1.189)	(1.660)	(1.779)	(0.916)	(1.647)
Observations	193,578	193,578	193,578	193,578	193,578
District Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes	Yes

(α_1) is the ratio of the predicted number of rural migrants from early districts of star states on the number of urban residents who do casual work. (α_2) is the ratio of the predicted number of migrants from other rural districts on the number of residents who do casual work. The sample is composed of urban adults surveyed in NSS from July 2004 to June 2005 and July 2007 to March 2008. Each column presents results from a separate regression. The outcome is the fraction of total time spent in each activity. 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.