Climatic Variability and Cause-Specific Migration across Rural and Urban India

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Introduction and background

A growing literature on the demographic impacts of climate change has shown that changes in temperature and precipitation disrupt migration patterns throughout the developing world (Fussell et al. 2014; Hunter et al. 2015). The empirical record today represents a significant improvement over what was available just a half-decade ago, but it is nonetheless characterized by limitations that preclude a coherent explanation of observed patterns. In the current study of climate-related migration in India, we aim to address at least two of these limitations by (a) analyzing the effects of climate variability on cause-specific migration; and (b) decomposing migration outcomes between rural and urban origins and destinations.

Our analysis of climate-related migration by cause will allow us to evaluate implicit but largely untested hypotheses about how climatic variability can affect migration behaviors. The conceptual model behind most previous research on climate-induced migration presumed that climatic variability affects migration through changes in agricultural production and other determinants of economic welfare. This in turn shapes migration by incentivizing risk-reduction behaviors or changing the stock of resources needed to fund migration (Gray & Bilsborrow 2013; Nawrotzki & Bakhtsiyarava 2017; McLeman & Smit 2006). As such, the implicit assumption is that most climate-related migration is in fact labor migration. With few exceptions (e.g., Gray & Mueller, 2012), this hypothesis has not been tested explicitly, leading to largely speculative explanations about why exposure to climatic variability would lead to changes in migration behavior. We aim to evaluate this question empirically by linking climate records with survey data on spatial mobility and causes of migration.

In addition to analyzing the effects of climate variability on migration by cause, we will also test for variation between rural and urban origins and destinations. Although a number of studies account for the rural (urban) status of the origin or the destination, few studies have been able to account for both (Nawrotski et al. 2017). Our findings will contribute to a literature examining the effects of climate change on urbanization more broadly (Barrios et al. 2006; Henderson et al. 2017), testing the assumption that climate-related migration is largely from rural to urban areas. We will examine differences in climate effects between moves from rural to urban areas, urban to rural areas, and between rural (urban) origins and destinations (i.e., rural-rural and urban-urban moves). Evidence about the role of climate in flows between rural and urban areas is potentially useful to understand how individuals and households cope with shocks. For example, do affected rural populations seek work in more distant rural places, where livelihoods are similar to the origin but climatic conditions are more favorable? Or do they migrate to urban areas, where social and economic opportunities are likely to vary greatly from the origin?

Beyond addressing these particular substantive issues, this study will contribute new evidence from India to the growing literature on climate and migration. There has been relatively little attention to the Indian context in the climate-migration literature (see Dallman & Millock 2017, Viswanathan & Kumar 2015 for exceptions), which represents an important gap in knowledge given the large population and potential for serious climate impacts on the subcontinent (O'Brien et al. 2004; Pailler & Tsaneva 2018; Taraz 2018).

Research objectives

With these motivations in mind, we aim to estimate and explain the effects of climatic variability on migration in India by addressing the following objectives. First, we will estimate the overall effects of precipitation and temperature anomalies on the probability of migration. Second, we will determine whether the effects of climate on migration vary between more local, intra-state moves and inter-state mobility. Third, using the preferred specification(s) from the initial analyses, we will test variation in climate effects by the cause of migration. Here, we are able to distinguish between moves for work; education; marriage; and insecurity or disaster. Fourth and finally, we examine the effects of climate on migration disaggregated by rural and urban origins and destinations. While we account for flows in all directions between rural and urban areas, we are particularly interested in testing the common assumption that migration will spur rural to urban moves.

Data, measures, and methods

We draw on demographic records from the Indian Socio-Economic Survey, which is implemented by the Government of India's National Sample Survey Organization and which we access through IPUMS-International (Minnesota Population Center 2018). We extract files from 1983, 1987, and 1999, which are the only available rounds that include full information on migration by cause and rural (urban) classification of both origin and destination. Using time-consistent state identifiers and boundary files, we then link these demographic data to monthly precipitation and temperature estimates for the years 1951-2013, which were produced by the University of East Anglia's Climate Research Unit (CRU) and we extracted using IPUMS-Terra (Minnesota Population Center 2016).

Our main outcome variable is migration, which we define as a change in residence during the past year or less. Specifically, we classify individuals as migrants if they have resided in their current place of residence for one or fewer years. We use the data on previous residence collected in the survey to characterize individuals' residence at the start of that 23-month migration interval. This approach assumes that only one move occurred during the 23-month interval. With this information, we can determine whether migrants, so defined, have crossed a state boundary, and we are able to classify the rural (urban) status of prior residence.[1] The data also include information on the reason for the most recent migration, which we use to classify the cause of the move. With this information, we construct four migration variables: (1) a binary indicator of any migration: (2) a three-category variable contrasting (i) non-migrants with (ii) intra-state and (iii) inter-state moves; (3) a three-category variable contrasting (i) non-migrants with migrants to (ii) rural and (iii) urban areas; and (4) a five-category variable contrasting (i) non-migrants with migrants who moved due to (ii) work, (iii) education, (iv) marriage, and (iv) insecurity or disaster.[2]

We estimate binary and multinomial logistic regression models of these outcomes as appropriate. In each model, migration is a function of recent climate and net of controls for age, sex, and primary school attainment and both year and state fixed effects. Note that our models of migration by rural (urban) classification of destination will account for origin type by interacting origin rural (urban) status with our measures of temperature and precipitation variability. Recent climate will be defined as the state average temperature and precipitation over the 24-months prior to the survey (i.e., overlapping with the migration interval), standardized over all other 24-month intervals over the 1951-2013 climate history. We will adjust standard errors for clustering at the state level.

Preliminary results

We present preliminary results from two models. First, we estimate a binary logistic regression of any migration as specified above. The results (Figure 1) reveal that precipitation is positively associated with the migration odds, while temperature has null effects. According to point estimates, a two-year spell of

[1] The rural (urban) status of previous and current residence is based on the administrative definitions used in the Indian Socio-Economic Survey. According to IPUMS-International documentation, "Urban areas are defined as towns (places with municipal corporation, municipal area committee, town committee, notified area committee or cantonment board); also, all places having 5,000 or more inhabitants, a density of not less than 1,000 persons per square mile or 400 per square kilometer, pronounced urban characteristics and at least three fourths of the adult male population employed in pursuits other than agriculture" (Minnesota Population Center 2018). Note that the university of rural (urban) areas may have changed over time due to reclassification.

[2] Categories may be collapsed if necessary and as appropriate given the distribution of the data.

precipitation that is two standard-deviations above the mean leads to an approximately three percentage point increase in the probability of migration. Note that in other preliminary analyses (not shown), we find no evidence of non-linearities in these precipitation effects.

Second, we estimate a multinomial model that distinguishes between moves to rural and urban destinations (Figure 2). The results indicate that the positive association between precipitation and migration is stronger on moves to urban destinations versus rural destinations. In our subsequent analyses, we will explicitly test whether such patterns are driven by rural-to-urban moves, or if this finding also reflects climate-related urban-urban migration.

Preliminary conclusions and next steps

We will extend these preliminary findings by conducting additional analyses exploring migration by cause, and disaggregating migration to rural and urban destinations by origin type. We will also test the sensitivity of these findings to alternative measurement decisions. For example, we will conduct robustness checks using a more restrictive definition of migration (moves within the past 12 months) and using lagged measures of climatic variability.

We anticipate that results from this study will offer significant contributions to the climate-related migration literature. First, by linking spatial mobility survey data with climate records, we are able to explicitly evaluate the predominance of labor as the cause for migration in the Indian context, a presumption in much of the existing research on climate-related migration. Second, we empirically test the rural-to-urban migration assumption by including both points of origin and destination. Finally, by focusing on the Indian context, we shed light on a region that has garnered little climate-migration research attention.

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Figures

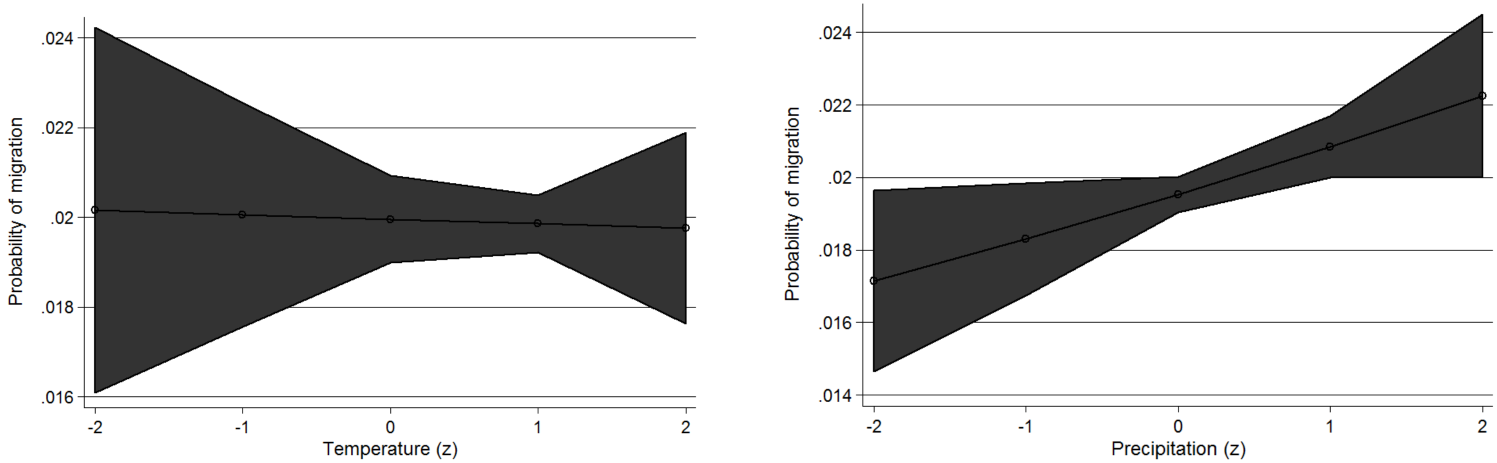

Figure 1 Predicted probability of migration by temperature (left) and precipitation (right)

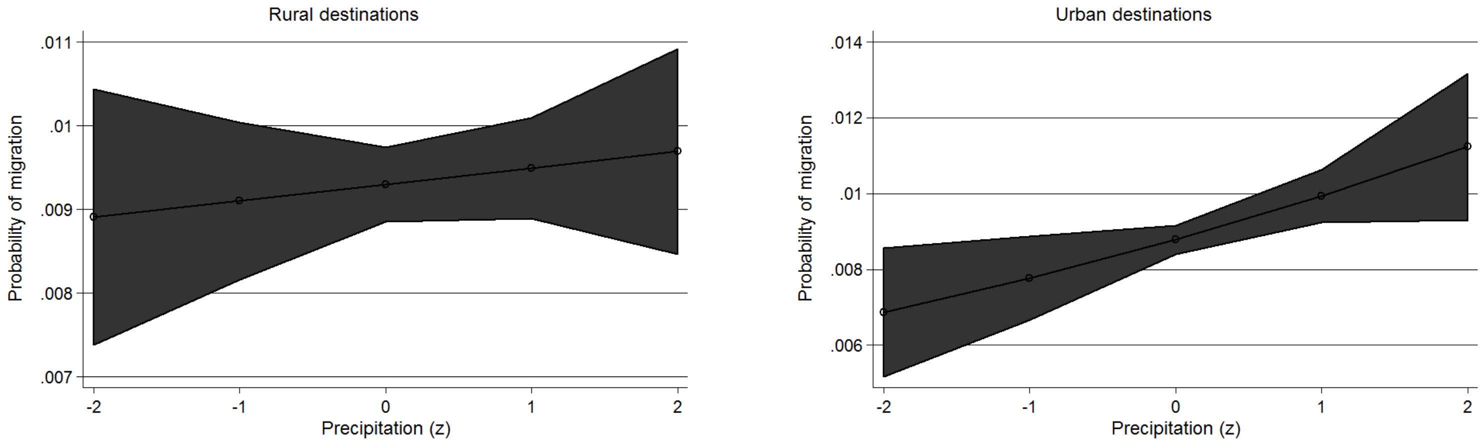

Figure 2 Predicted probability of migration to rural (left) and urban (right) areas by precipitation