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Monsoon Shifts and Migratory Responses: The Impact of Water Stress on Mobility in India

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Extended Abstract

Background: Given that global warming is now considered inevitable, there is a concern that climatic variability, through its impact on agriculture, is likely to add to the already high vulnerability of poor households (Skoufias et al., 2011). This is because most developing countries, like India, are more dependent on agriculture as the primary source of livelihood for majority of its people (52%) and agriculture is bound to be the most susceptible sector to climate change. In addition, Indian agriculture and the summer monsoon are inextricably linked since the water needs of agriculture are tightly connected to the vagaries of the monsoon in India. Millions of farmers who depend on agriculture for their livelihood, wait in anticipation at the beginning of every monsoon season in June, about what the rains will bring. Therefore, a change in timing and intensity of precipitation patterns has large implications for water availability, the sustenance of agricultural productivity and leads to adoption of various adaptation strategies, two of which are the focus of study in this paper: irrigation access and use, as well as migration.

This paper contributes to the growing literature on environmental migration. Environmental migration can occur in response to sudden natural disasters (Stern, 2007), to unintended consequences of imbalances in the ecosystem produced by development projects like building of dams (Drabo et al, 2011) or because of the slow onset of climate change that gets reflected in the shortage of environmental resources(like water)which in turn impede a secure livelihood through agriculture. We focus on the latter phenomenon.

Objective: In this study, we provide evidence on the causal relationship between climate change and adaptive measures of irrigation adoption and migration in one of the world's most water stressed countries. India uses more water for irrigation than any other country but faces increasing variability in rainfall causing pressure on water supply in wells and canals. Migration estimates remain relatively low, yet recent data from the Census suggest that the urban population, for the first time, grew faster than rural India's with most of the increase attributed to migration. We empirically test the impact of rainfall and temperature variability, on out-migration decisions through the channel of irrigation access, by linking household data to geo-referenced climate data. This paper attempts to generate discussions pertaining to climate change impacts on various adaptation measures and water resources for water intensive and developing economies, where precipitation variability is felt most acutely.

Data & Methods: Fixed- effects and instrumental variable models will be used with two nationally representative household surveys, panel data from 1971-2006 and cross-sectional data from 2007, to estimate household adaptation in response to weather and climate variability.

The Additional Rural Incomes Survey and the Rural Economic and Demographic survey is a panel household dataset that covers the agricultural years 1970/71, 1981/82, 1998/99 and 2006/7. The survey is nationally representative and covers a variety of variables like out-migration of household members, education, public works, profits as well as agricultural variables such as irrigated area, type of irrigation source(canals, wells, ponds), investment in irrigation structures, production statistics, input use(fertilizer, agricultural implements), harvest prices, soil type, among others. The panel nature of the dataset, allows the ability to control for unobserved and omitted variables that can confound the true impacts of climate variability on irrigation and migration.

The second dataset we use is the 64th Round National Sample Survey on Employment, Unemployment and Migration for the year 2007-08. This nationally representative household survey is the most recent round and covers detailed migration information for both short-term as well as permanent out-migrants. The survey contains questions on individuals' migration history, including duration of stay in the destination, and other key socio-demographic characteristics such as age, gender, caste, religion, marital status, education etc. We merge 2001 Census data on irrigation access to capture the irrigation channel in this cross-sectional analysis.

Lastly, we use unique historical weather data for the years 1951-2007 from APHRODITE (Asian Precipitation- Highly Resolved Observational Data Integration Towards Evaluation of the Water Resources) , a gauge-based daily observationally gridded precipitation and temperature dataset at a 0.25 x 0.25 degree grid resolution. Since rainfall by its very nature is an "unusual discontinuous atmospheric phenomena" with high spatial and temporal variability (Mishra et al, 2011), the quality of precipitation data to be used is not trivial. APHRODITE is the only long-term (1951 onward) continental-scale daily product that contains a dense network of daily rain-gauge data for Asia including the Himalayas, South and Southeast Asia and mountainous areas in the Middle East. Temperature data in our analysis also comes from APHRODITE and is available for the period of 1973-2007.

Multivariate logistic regressions will be used to model the impact of climate and weather variability on irrigation and migration outcomes. The models will control for confounding factors.

References:

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