Review of: "Weathering changes – livelihood adaptation to weather shocks in rural India by disadvantaged social groups"

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Potential competing interests: No potential competing interests to declare.

This paper studies the relationship between a constructed multiscale drought index (which the authors call climate-related shocks) and migration in India. To do this the authors use monthly gridded precipitation and potential evapotranspiration data for 60 months (prior to survey) from the Climate Research Unit, and individual level data from the India Human Development Surveys (2004/05 and 2011/12). The climate and IHDS datasets are matched at the district level (assumption). Using the matched data, the authors attempt to answer some important questions related to migration.

Overall, I appreciate the work that the authors have done. The research question, linking climate change and migration, is quite interesting. I think the work has potential, but I also believe that paper has multiple areas that need to be addressed. Below I elaborate each of these areas. I hope these opinions will assist in improving the work. The authors can address these concerns in the paper, as they deem fit:

- Slow-onset climate change. The authors should add a discussion on this term. In the empirical strategy, they use binary indicators of dryness and wetness as the primary explanatory variables. A discussion on how wetness and dryness relate to slow-onset climate change would be helpful for readers.
- In the data section, the authors do not mention how many districts they are able to match. By looking at the white spaces in figures 3 – 5, it appears that they are unable to match a large number of districts. Is it because these districts are missing from the IHDS data or from the CRU data? This point needs to be discussed in the writing.
- For disadvantaged groups, the authors use three categories — Other Backward Class (OBC), Scheduled groups (including Scheduled Tribes/Scheduled Castes), and others. It is not clear if the authors are including General caste categories into “others.” Are people from General caste groups overall excluded from the sample?
- A related concern is that it is not clear if the authors are focusing only on households with a migrant. If yes, it should be changed, and the study should include both migrant and non-migrant households (see Bucheli et al., 2019; Bucheli and Fontenla, 2022). Both these concerns lead to the issue of selection bias, and therefore, the omitted groups should be included.
- The outcome variable in the study is – whether the household shows an increase in the number of migrants over the two survey years. In addition to this, the authors should use a binary indicator that takes a value of 1 if any household member has migrated, as the dependent variable. This would allow using two different outcome variables in the study. Number of migrating members (at the intensive margin) and having a migrant member (at the extensive margin).

- The authors mention that they restrict the sample to households residing in rural areas in wave I of the IHDS. Does this mean that they are only using IHDS 2004/05 in the study? This needs to be discussed in the paper. Instead of just restricting to households in IHDS 2004/05, the authors can treat the two IHDS rounds as a repeated cross section survey (Karmakar et al., 2022) and include the full sample households in the study.
- IHDS provides information on when the member migrated (month and year), using this data the authors should construct their explanatory variable for the last 60 months prior to each migrating member, instead of the last 60 months prior to the entire survey. By doing this, the authors can have a larger difference/variation in the climate data, instead of a district-level coverage.
- The authors state that the empirical strategy presents a causal relationship between a constructed multiscale drought index and migration in India. To my understanding, to establish causality, the authors need to check for mechanisms through which climate shocks can affect migration. IHDS consists of a large number of questions, which can be used to test for the causal pathway. For example, changes in factors like members losing their occupational activity, decline in agricultural output, conflict with neighbors, decline in confidence in institutions, decline in community participation, increase in incidence of diseases, due to climate shocks can be tested as potential mechanisms?
- The authors can do a number of robustness checks. These robustness checks would strengthen their findings, and also allow readers to understand why the migration is solely driven by climate shocks and not by other factors. These are described below:
- They can restrict the sample to those households who do not have a migrating member in the last 60 months. This is because migration within household members can be correlated, and instead of climate change the results could be driven by pre-existing migration in the household.
- They can check if members migrate within a district or within a state (one district to another). Since the authors use district-level climate data, within a district migration may simply not be capturing the effect of an adverse climate shock. As the migrating member can move to a different place in the same district and experience the same climate.
- Another robustness check is to test for the occupation that the migrant is undertaking at the destination. For example, if members are moving to a new place due to a permanent job, then the migration is unlikely to be driven by a climate shock. People can simply move if they have a job at a new region even in absence of an adverse climate shock.

Minor comments:

- The authors should have one table showing the summary statistics of all the variables that they are using. This would allow readers to get a clear idea of the sample. In the regression tables, they should use the variable names they have in the empirical equations. Having #, and variable labels in the results tables is somewhat confusing to follow.
- In addition to climate shocks at the district-level, there could be other factors that vary across districts (e.g., population, employment, poverty) which could be driving the migration. To address these differences, the authors should include district-level dummies (District fixed effects) in the regressions. They should also cluster standard errors that the district level.
- In the Intro, the authors should have a paragraph that succinctly talks about the objective of research, the data, the empirical strategy, and the main results. This would allow readers to get an idea of the paper before moving into the

details.

Bucheli, J. R., & Fontenla, M. (2022). The Impact of Return Migration on Economic Development.*Review of Economics and Statistics*, 1-45.

Bucheli, J. R., Fontenla, M., & Waddell, B. J. (2019). Return migration and violence.*World Development*, *116*, 113-124.

Karmakar, A., Ganvir, N., & Berrens, R. P. (2020). The Impact of Institutional Arrangements on Farmland Rents in India: A Ricardian Analysis. *Journal of Agriculture and Environment for International Development (JAEID)*, *116*(2), 29-58.