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Can irrigation reduce climate change-related migration?

Climate change will affect global mobility patterns, both through slow onset changes (such as gradual increases in temperature and changes in precipitation patterns) and through extreme weather events (such as floods and storms). In the last assessment reports by the Intergovernmental Panel on Climate Change (IPCC), migration is seen as an adaptation strategy that could have potential benefits in reducing the share of the world population that is exposed to climate change in vulnerable regions. However, although there is high likelihood of increases in displacement because of climate change over the next century, the exact numbers are hard to assess. The most recent quantitative projections predict that between 100 and 200 million people may move *internationally* by 2100, because of increases in temperature, disasters, and sea level rise, but that only 20% of those will go to OECD countries (Burzynski et al., 2022). With regard to internal displacement, the Internal Displacement Monitoring Centre estimates that there were 23.7 million people displaced due to disasters in the year 2021 alone compared to 14.4 million displaced due to conflict and violence. Most disaster displacement is relatively short-term, and in the long run, it is climate change trends that may have more impact on migration.

The relatively low incidence of climate change on international migration so far can be partly explained by the high cost of international migration, measured not only in terms of transportation costs but also in terms of border-related costs such as visa and other entry restrictions. There are exceptions though, as some studies find evidence of increases in international mobility in already established migration corridors (such as in between the Philippines and the U.S., or Mexico and the U.S.) following extreme events such as typhoons and droughts. In contrast, a plethora of studies show an increase in climate-related *internal* migration, mostly consisting of people moving from rural areas to urban areas.

These findings are important for policymakers, since they go against two common perceptions of climate change-related migration. The first is that climate change will lead to potentially large increases in the numbers of extra-European migrants into the E.U., whereas we are more likely to expect intensification of migrant flows along well-known migration corridors and also internally on the African continent and in Asia.

The second important observation is that the countries that are the worst hit by climate change (typically countries located in the tropics, that are poor and already have high mean temperatures to start with and often low adaptive capacities) are also the ones that will carry the largest share of the social costs of migration.

Whereas rural-urban migration can be positive for the migrants themselves if it enables them to find work and improve their conditions of living, there are externalities linked to crowding in the cities of destination in terms of housing and infrastructure provision for public services, such as water and health services. The extent to which the social costs of such externalities may counterbalance the positive effects of migration through increases in labour productivity and in consumption by the migrants is a real issue for public policy evaluation that could give information on which policies to pursue. The net effect of the many social consequences of migrations is still an open issue of research. This also implies that migration policies and climate change policies should not be thought of separately and in isolation.

One consistent finding in the scientific literature is the heterogeneity in migratory responses to climate change across countries. A main factor, in particular in poor countries, is the role played by the agricultural sector in such responses. Several studies show that higher temperatures typically increase outmigration from middle-income countries, but that higher temperatures can inhibit out-migration from poor countries where individuals are likely to face liquidity constraints to finance migration. Whereas higher temperatures increase the incentives to move, they also reduce the income derived from agricultural activities and, hence, impoverish the population further, making it less likely that they can afford the costs of migration.

Therefore, particular attention should be paid to the means of adaptation in countries whose economies depend on agriculture. In particular, what are the effects of equipment that would reduce the damages from climate change in the regions of origin: less migration – or more migration - because of higher income and hence better possibilities to finance migration? If the agricultural sector is the main source of income, alternative adaptation methods that could limit the effect of higher temperatures on agricultural yields should also affect the role that temperature can be expected to play in migration.

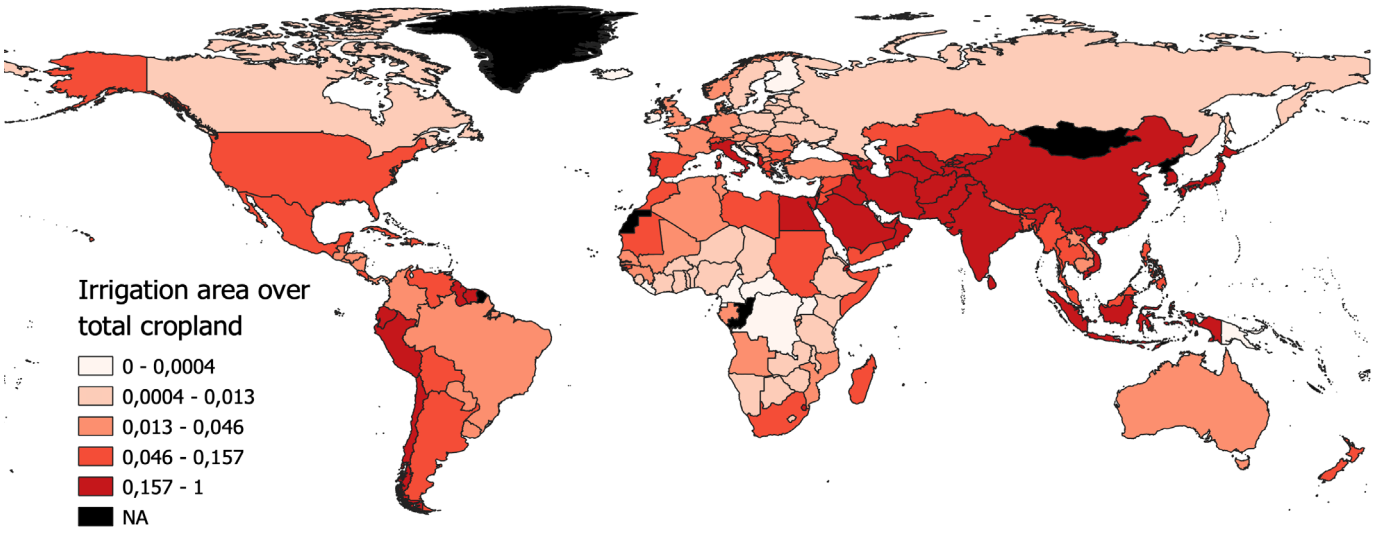
In Benonnier, Millock & Taraz (2022), we analyse how access to irrigation – as a means of agricultural adaptation – affects the relation between rising temperatures and migration. We find that higher temperatures indeed reduce long-term decadal outmigration rates in very poor countries (countries that were in the bottom quartile of the GDP per capita distribution in 1960). Internal migration, as proxied by urbanisation rates, is also significantly *reduced* by higher temperatures, implying that there are individuals who would potentially want to migrate but that cannot do so due to the reduced income induced by higher temperatures. Our analysis also controls for precipitation but it is temperature increases that are the most significant driver of both international and internal migration.

Irrigation is an important means of adaptation since it reduces heat stress for plant growth and improves agricultural yields. In the analysis we leverage the variation in area equipped for irrigation across the world, which is different from area actually irrigated. To further reduce endogeneity concerns, we interact the weather variables with the share of cropland in the country that was equipped for irrigation in 1960 (see the Figure). The analysis relies on exogenous interdecadal variation in weather (temperature and rainfall) conditional on country fixed effects, poor country times decade fixed effects and region times decade fixed effects to control for time-varying variables that may affect migration differently at those levels. We also add important time-varying controls that could determine both migration rates and irrigation equipment, such as the political institutions of the country as well as state capacity to provide either safety nets or social programs to cushion the effects of rising temperatures (proxied as government final consumption).

The results show that access to irrigation equipment offsets partially the effect of higher temperatures on urbanization. For poor countries that had the mean share of cropland equipped for irrigation in 1960, a 1°C increase in the decadal average temperature reduces the urbanization rate by 6.7 percentage points (the average urbanization rate in the poor countries in the sample is 19%). For poor countries that were one standard deviation above the mean share of cropland equipped for irrigation in 1960, there is only a 4.6 percentage point reduction in urbanization. That is, this amount of difference in the area equipped for irrigation reduces the negative effects of rising temperatures by almost a third. Although irrigation attenuates the effect of rising temperatures, the overall effect of higher temperatures on urbanisation remains negative in our sample. We do not find a similar modulating effect of irrigation on emigration, which suggests that internal migration is more affected by an agricultural income mechanism, for which access to irrigation can provide a buffer.

It is perhaps counterintuitive that investments in climate-resilient agriculture might increase internal migration in countries in which households do not have enough income to finance costly migration. At the level of the individual household exposed to climate change this is certainly a good outcome, since it enables migration to be chosen as one adaptation strategy amongst others, and lessens the possibility of trapped populations. In fact, migration may be underutilized as an adaptation strategy to climate change. In the context of climate change, though, rising temperatures will also affect available water resources for irrigation, and irrigation as such can be a form of maladaptation. The purpose of our analysis was to measure to what extent access to irrigation, in the past, has affected climate-related migration. Much current research is devoted to investigating different adaptation strategies and how they interact with migration as adaptation to climate change, which should enable policymakers to better integrate climate and migration policies.

Figure.
Area equipped for irrigation over total cropland in the world in 1960.



Source: Benonnier, Millock & Taraz (2022)

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