Natural disasters, migration and education: an empirical analysis in developing countries

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Online Appendix

Appendix A: Definitions

A.1 Intergovernmental Panel on Climate Change (IPCC, 2007)) definition

"*Climate change in IPCC usage refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods"*.

A.2 Definitions of environmental migrants/ refugees

El Hinnawi (1985): Environmental migrants are *"people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption that jeopardized their existence or seriously affected the quality of their life"*.

Bates (2002) criticizes the definition and classification of environmental migration of El-Hinnawi in the UNEP 1985 report. For Bates, this definition does not provide generic criteria distinguishing environmental refugees from other types of migrants and does not specify differences between types of environmental refugees. It makes no distinction between refugees who flee volcanic eruptions and those who gradually leave their homes as soil quality declines. For Bates, "a working definition of environmental refugees includes *people who migrate from their usual residence due to changes in their ambient non-human environment"*. This definition remains necessarily vague in order to incorporate the two most important features of environmental refugees: the transformation of the environment to one

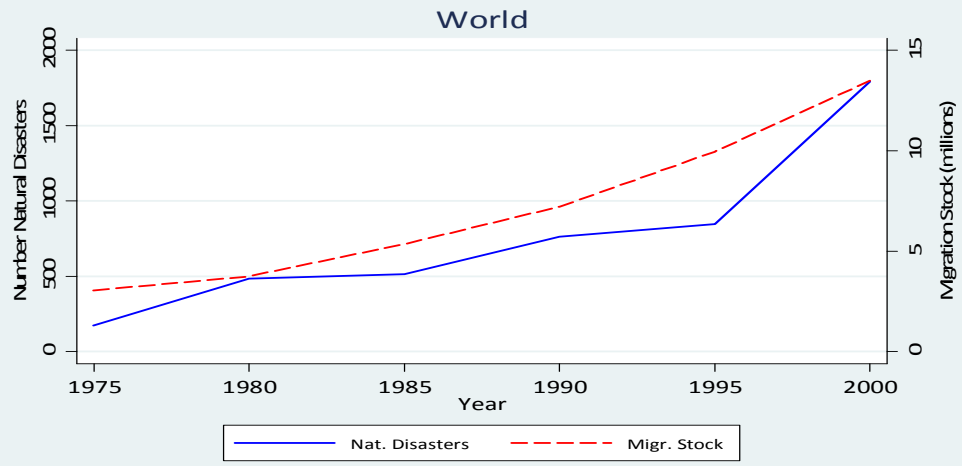
less suitable for human occupation and the acknowledgment that this causes migration. The author establishes a classification of environmental refugees according to the causes of migration. One distinguishes between three categories of human migration due to environmental change as follows. (i) Environmental refugees due to disasters caused by natural or technological events. Those people are short-term refugees in geographically limited areas. Natural disasters, which include hurricanes, floods, tornadoes, earthquakes or events that made a place inhabitable temporarily or permanently are considered, alongside technological disasters resulting from human choices, as unintentional migration. (ii) Environmental refugees due to expropriation of the environment are people who leave their habitat permanently to allow land use. The expropriation of the environment can be due on one hand to economic development such as the construction of hydroelectric dams or roads and, on the other hand, to warfare and the destruction of the environment, strategically displacing the population during war incorporating, for instance, land mines. (iii) Environmental refugees due to the deterioration of the environment: the migration of these people is caused by the anthropogenic degradation of their environment: one talks about environmental migrants. The effect of environmental degradation ripples through the local economy context to affect migration. While disasters and expropriation refugees do not possess any real means to control environmental change, environmental migrants can decide the strategies to cope with environmental change.

References

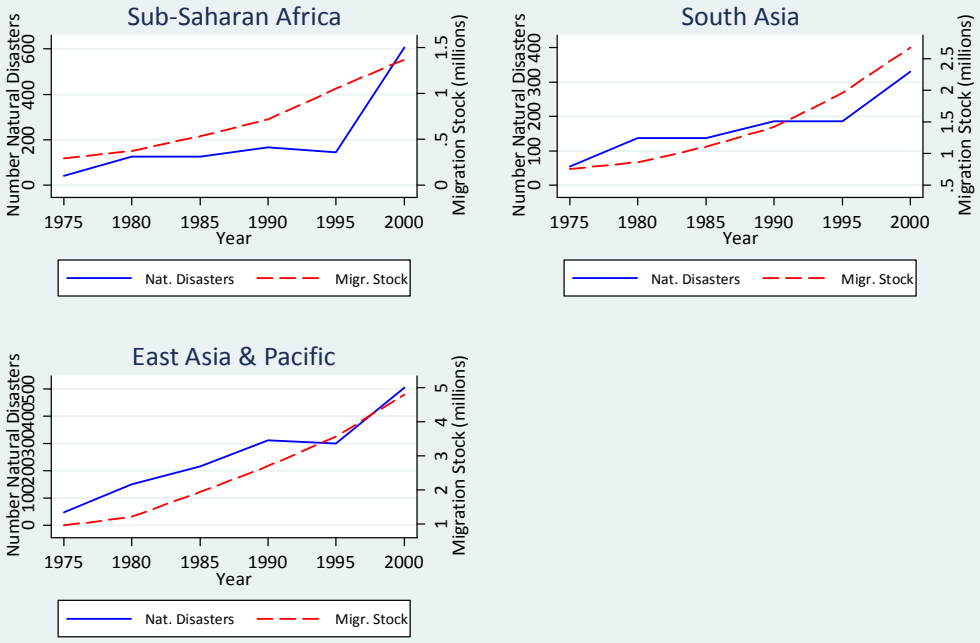
Bates, D. (2002), 'Environmental refugees? Classifying human migrations caused by environmental change', *Population and Environment* **23**(5): 465-477.

El-Hinnawi, E. (1985), 'Environmental refugees', United Nations Environment Programme, Nairobi, Kenya.

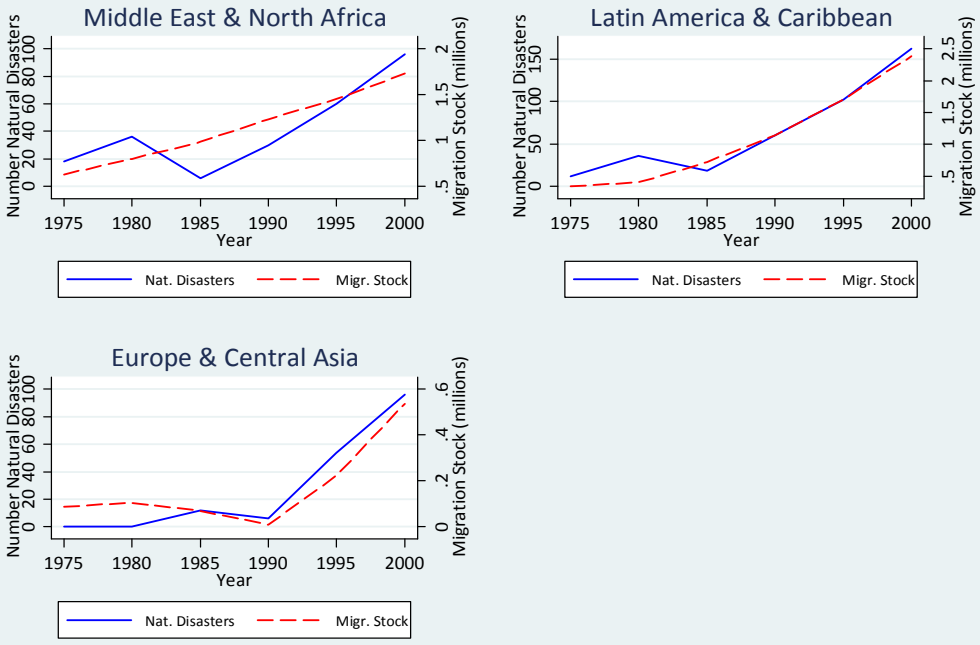
Appendix B: Trends of natural disasters and stocks of migrants of low and lower middle income countries



Source: Authors' construction based on data from CRED, and Schiff and Sjöblom (2008)



Source: Authors' construction based on data from CRED, and Schiff and Sjöblom (2008)



Source: Authors' construction based on data from CRED, and Schiff and Sjöblom (2008)

Appendix C: Variables definition and sources

Variables	Definition	Source
-Low educational migration rate -Medium educational migration rate -High educational migration rate	Stocks of migrants from sending countries to the 6 key receiving countries in the OECD (Australia, Canada, France, Germany, UK, USA) by educational level, divided by the stock of adults (+25) corresponding to the same educational level, in the country of origin + The stock of migrants of sending countries.	M. Schiff and M.C Sjoblom (World Bank Databases)
Migration rate	Total of low, medium and high educational levels	M. Schiff and M.C Sjoblom (World Bank Databases)
Migrant stock lag	Lagged migrant stocks	M. Schiff and M.C Sjoblom (World Bank Databases)
Natural disasters	Dummy variable taking the value 1 if the country experienced natural disasters in the five year period. These disasters are meteorological disasters (storms); hydrological disasters (floods and other wet mass movements; and drought, wildfire) and climatological disasters (extremely high temperatures).	CRED 2010
GDP origin	Gross Domestic Product at the origin country	Online World Bank WDI
GDP destination	Gross Domestic Product at the destination country	Online World bank WDI
Population origin	Total population in the country of origin	Online World Bank WDI
Population destination	Total population in the country of destination	Online World Bank WDI
Population density	Number of inhabitants per km²	Online World Bank WDI
Urban population	Urbanization rate in the origin country	Online World Bank WDI
Arable area percentage	Arable area as percentage of total land area	Online World Bank WDI
Institutions quality	Political Rights are measured on a one-to-seven scale, with one representing the highest degree of Freedom and seven the lowest.	Freedom House
Civil war	Dummy variable taking the value 1 for a minimum of 25 battle-related deaths per year and 0 otherwise.	UCDP/PRIO Armed Conflict Dataset
Rainfall	Average rainfall per year	Mitchell T., Carter T., Jones P., Hulme M. and New M. (2003)
Temperature	Average temperature per year	Mitchell T., Carter T., Jones P., Hulme M. and New M. (2003)

References

Freedom House dataset, [Available at] http://www.freedomhouse.org

Mitchell, T., T. Carter, P. Jones, M. Hulme, and M. New (2003), 'A comprehensive set of high-resolution grids of monthly climate for Europe and the globe: the observed record

(1901–2000) and 16 scenarios (2001–2100)', Tyndall Working Paper 55, Tyndall Centre for Climate Change Research, Norwich, UK.

UCDP/PRIO Armed Conflict Dataset, [Available at] http://www.prio.org/Data/Armed-Conflict/

World Development Indicators, Worldbank online databases, [Available at] http://data.worldbank.org/data-catalog/world-development-indicators