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Article

Climate change, natural disasters, and migration

IZA World of Labor

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Suggested Citation: Mbaye, Linguère Mously (2017) : Climate change, natural disasters, and migration, IZA World of Labor, ISSN 2054-9571, Institute for the Study of Labor (IZA), Bonn, <https://doi.org/10.15185/izawol.346>

This Version is available at:

<https://hdl.handle.net/10419/162356>

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Climate change, natural disasters, and migration

The relationship between migration and natural events is not straightforward and presents many complexities

Keywords: climate change, natural disasters, migration, remittances, mitigation strategy

ELEVATOR PITCH

The relationship between climatic shocks, natural disasters, and migration has received increasing attention in recent years and is quite controversial. One view suggests that climate change and its associated natural disasters increase migration. An alternative view suggests that climate change may only have marginal effects on migration. Knowing whether climate change and natural disasters lead to more migration is crucial to better understand the different channels of transmission between climatic shocks and migration and to formulate evidence-based policy recommendations for the efficient management of the consequences of disasters.

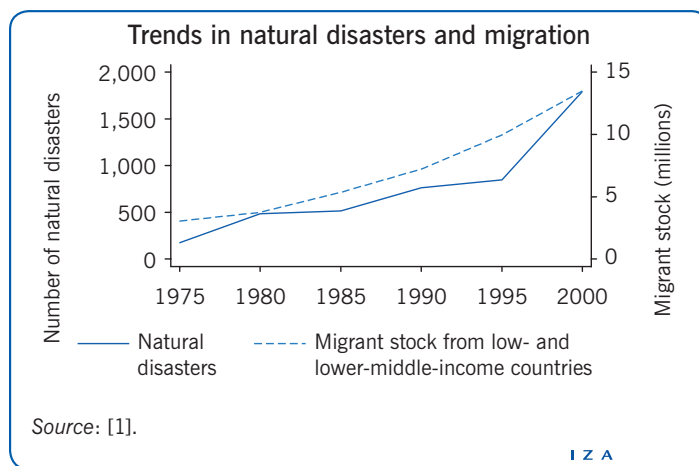
KEY FINDINGS

Pros

- ⊕ Migration can help people cope with the adverse effects of climatic shocks by providing them with new opportunities and resources.
- ⊕ Remittances from overseas migrants increase after disasters in their home countries and play an important role in mitigating the adverse effects of climatic shocks and natural disasters.
- ⊕ Climatic factors, such as natural disasters or rainfall and temperature variations, may increase international migration through their effect on internal migration.
- ⊕ Agricultural productivity represents one of the pathways that can explain the relationship between climatic shocks and migration.
- ⊕ Public intervention both before and after disasters helps build resilience and can explain why migration responses differ according to different shocks.

Cons

- ⊖ The migration response to disasters depends on the nature of the shock (slow vs rapid onset events), its severity, and the vulnerability of the affected people.
- ⊖ Due to liquidity constraints, poor people might not be able to migrate in the aftermath of climatic shocks.
- ⊖ In developing countries, international migration due to disasters may be driven by highly educated people, which may foster brain drain in a vulnerable context.



AUTHOR'S MAIN MESSAGE

Climate change and natural disasters cause people to migrate if they do not have alternative mitigation strategies, are forced to move because of the shock, and can afford migration costs. Consequently, disaster management requires a holistic approach, where migration and remittances, which are private mechanisms, should be considered along with public intervention. In addition to helping households build resilience by, for example, investing in infrastructure in vulnerable areas, providing social protection, and allocating aid rapidly and efficiently, better world governance is needed to reduce the human impact on climate change.

MOTIVATION

Climate change and natural disasters are two of the biggest challenges for current and future generations. Although the relationship between climatic factors and migration has probably always existed, the mechanisms through which the former impacts the latter are not yet fully understood. This is due to the fact that their relationship is not straightforward and shows many complexities. For policymakers, it is important to know what can motivate or prevent people from migrating in the aftermath of a disaster. It is also crucial to understand the role of the shock's intensity as well as to determine whether the relationship between climate change, natural disasters, and migration is direct or affected by other factors. Moreover, knowing if people engage in internal rather than international migration would probably not have the same implications with for the cost and affordability of relocation, policy management of migrants, or the size of future remittances. For all these reasons, empirical evidence is needed to inform policymakers about the different migration responses to climate change and natural disasters. This would help design better policies in terms of protecting the most vulnerable populations from climatic shocks and their consequences.

Definition of climatic shocks and natural disasters

The term “climatic shocks” refers to variations in rainfall and temperature over a long time period. While climatic shocks suggest a long-term dimension of climate variability, “natural disasters” are defined as short-term shocks, which happen suddenly and are mainly unexpected. The main natural disasters considered are floods, earthquakes, volcanic eruptions, landslides, droughts, tsunamis, storms or hurricanes, extreme heat, water surges, water waves, and wildfires.

Although climatic shocks and natural disasters are the most frequently studied types of shocks when examining the effect of environmental factors on migration, environmental deterioration has also been considered, but only in a few studies. Environmental deterioration is measured through deforestation, soil quality, sea level rise, air pollution, soil erosion, overfishing, crop land, arable land, and crop failure.

Source: For detailed references, see Table S1 in the supplementary information of Pratikshya, B.-M., M. Oppenheimer, and S. M. Hsiang. “Nonlinear permanent migration response to climatic variations but minimal response to disasters.” *Proceedings of the National Academy of Sciences* 111:27 (2014): 9780–9785. Online at: <http://www.pnas.org/content/111/27/9780.full.pdf?with-ds=yes>

DISCUSSIONS OF PROS AND CONS

Migration as a coping strategy for climate change and natural disasters

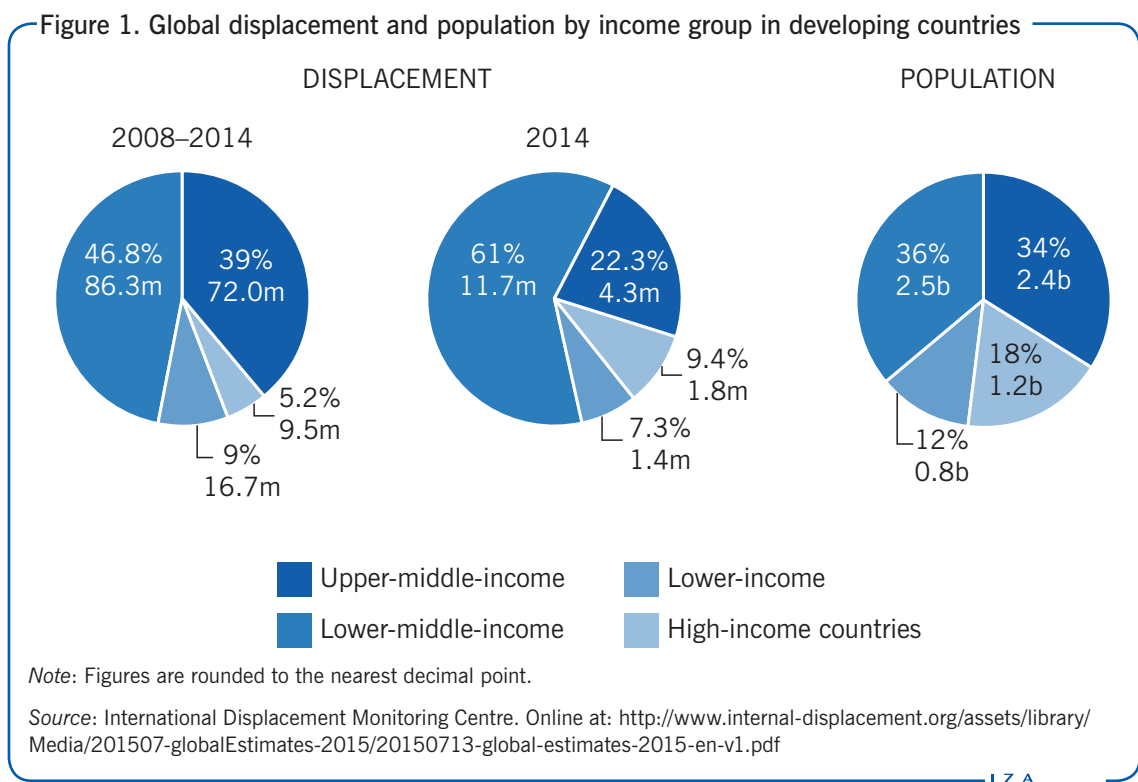
The mitigating role of migration

Population movement is a natural way to deal with climatic shocks, particularly when livelihoods are destroyed. Migration can be considered as an adaptation strategy when disasters occur because it helps mitigate the adverse effects of climatic shocks by providing new opportunities and resources to affected people. It is also employed as a coping strategy when other solutions have failed. For instance, in the case of drought, potential solutions, which are also considered survival strategies, can include changing

consumption patterns by reducing the number of daily meals, selling household assets, using food reserves, and benefiting from solidarity through gifts, loans, and aid. Having many possible coping strategies will reduce the likelihood of migration due to shocks [2].

Between 2008 and 2014, developing countries accounted for 95% of global displacement due to disasters. Moreover, most of the displacements are from middle-income countries (Figure 1). This is illustrative of the fact that people at the extremities of the income distribution do not necessarily migrate in the aftermath of disasters. Indeed, the poorest cannot afford to migrate and the richest have other mitigation strategies, such as the possibility to recover their lost assets or better access to effective infrastructure and social services, which allow them to cope with disasters without migrating. Therefore, people at the middle of the income distribution are those who do not have many alternatives at their disposal to deal with adverse climatic shocks and, at the same time, can afford migration costs.

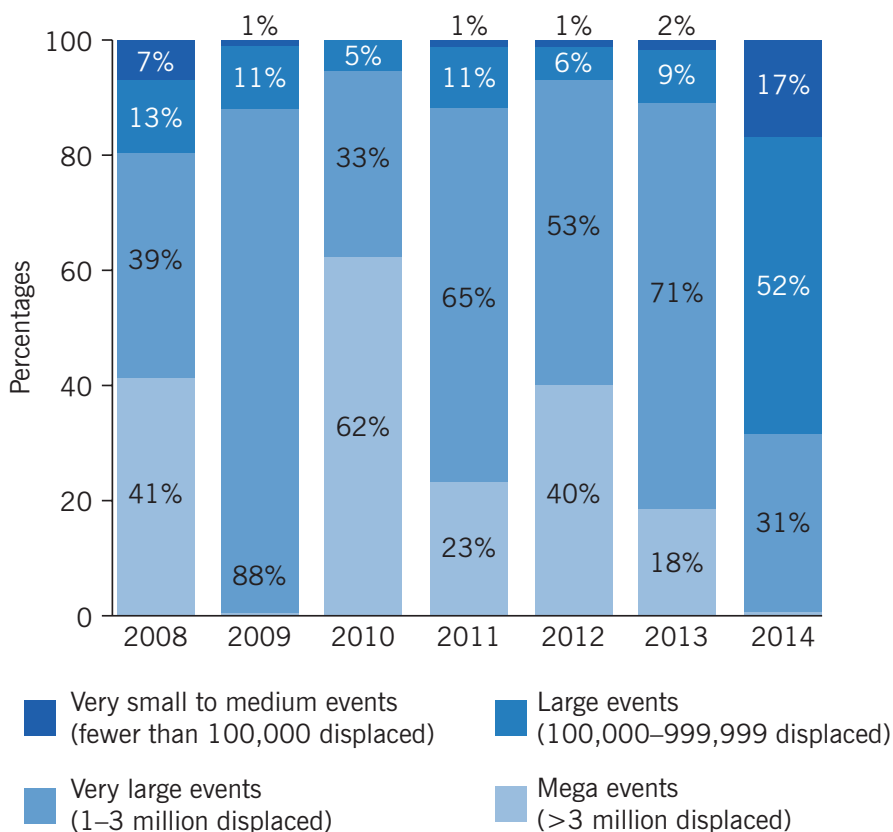
However, it is important to point out that the rather low rates of disaster-related migration from poor and high-income countries does not necessarily mean that the poorest and the richest people in a specific country do not migrate. There is some heterogeneity within developing countries, which shows that the level of vulnerability and the severity of the shock also matter when it comes to the relationship between disasters and migration. The level of vulnerability is correlated with factors such as the risk of exposure to the shock, the level of poverty, the social structure, the diversification of assets and income, and the political situation. Indeed, people living in a politically unstable environment have fewer survival strategies available to them than those living in a peaceful one. The severity of the shock is measured through the frequency, temporal spacing, and spatial distribution of the event, and the way people affected perceive the shock [2]. The frequency of shocks represents the number of events in a given period.



The temporal spacing measures the elapsed time between two events. The spatial distribution takes into account the extent of the shock in a given region; for instance, an event that is isolated to a specific area is easier to deal with than an event that affects an entire country. Finally, the way people perceive the shocks is shaped by expectations and experiences from previous events.

The role of vulnerability and severity is highlighted in the case of Bangladesh over the period 1994–2010. Moderate flooding, as compared to low levels of flooding, increased an individual’s likelihood to move locally, but decreased his or her likelihood to make a long-distance migration; this was especially true for vulnerable groups such as the poor or women. Moreover, households that were not directly affected by the flooding but lived in areas with severe crop failure were more likely to move [3]. Figure 2 provides a good illustration of how a disaster’s severity impacts population displacement. It shows that displacements due to large-scale events represented 62% of displacement in 2010. This is mainly due to the fact that large-scale disasters occurred in 2010 with, for instance, the earthquakes in Haiti and Chile and significant floods in China, Columbia, Mexico, and Brazil. In 2014, just 32 large to very large-scale events (accounting for less than 5% of all globally recognized events) were the cause of 83% of total displacements. Meanwhile, very small to medium-sized events represented 95.4% of the total number of individual disasters

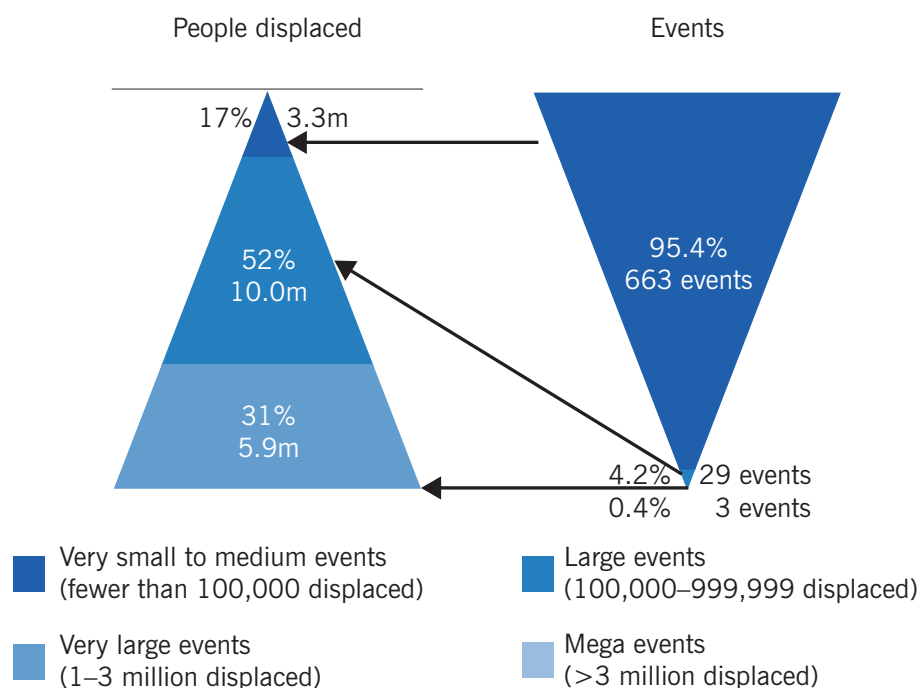
Figure 2. Proportion of total displaced each year by event size, 2008–2014



Note: All percentages are rounded.

Source: International Displacement Monitoring Centre. Online at: <http://www.internal-displacement.org/assets/library/Media/201507-globalEstimates-2015/20150713-global-estimates-2015-en-v1.pdf>

Figure 3. Displacement by event size compared with number of events at different scales, 2014



Note: All percentages are rounded.

Source: International Displacement Monitoring Centre. Online at: <http://www.internal-displacement.org/assets/library/Media/201507-globalEstimates-2015/20150713-global-estimates-2015-en-v1.pdf>

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but caused only 17% of the total number of displaced people (Figure 3). This shows that very small numbers of large-scale disasters can be responsible for a huge portion of the displacement, while most disasters, which are considered small- to medium-sized events, are responsible for far fewer displacements.

The role of remittances

Migration can also serve as a coping mechanism through the remittances sent back by emigrants to communities affected by climatic shocks and natural disasters. Remittances help increase the resilience of households toward natural disasters and reduce their vulnerability to the effects of shocks. As migrants are, by definition, not present in their home communities, their transfers provide insurance in case of shocks for their left-behind relatives. Consequently, remittances help households deal with income shocks caused by disasters.

An example from the Philippines shows that transfers of money back home from international migrants increase when natural disasters occur in their country of origin. Filipino households with overseas migrants managed to completely mitigate the income losses they suffered as a result of rainfall shocks with the receipt of remittances; this was not the case for households without overseas migrants [4]. In this context, it would thus be important to find ways to reduce the cost of sending remittances, which currently remain high, particularly in the case of international migrants' transfers.

Impact of climate change and natural disasters on migration

Internal vs international migration

Studies that look at the impact of climatic factors on internal migration use the urbanization rate, measured as a country's share of urban to total population, as a proxy for rural-urban migration due to the unavailability of comparable internal migration data across countries and over time [5], [6]. This is based on the assumption that most internal population displacement is due to rural-urban migration. However, evidence on the link between climate change, natural disasters, and internal migration is rather mixed and varies depending on the nature of the shock and across regions. On the one hand, it has been found that natural disasters, defined as short-term shocks, increase the urbanization rate in developing countries [6]. On the other hand, evidence shows that increasing temperatures, associated with long-term events, positively affect internal migration in middle-income countries but not in low-income countries, which is related to liquidity constraints, as will be discussed later in the article [5].

Evidence also shows that climatic shocks and natural disasters could lead to international migration [1], [7], [8]. For instance, natural disasters closely related to climate change such as storms, floods, wet mass movements, drought, wildfire, and extreme high temperatures, have been shown to boost migration from developing countries to the six main OECD receiving countries: Australia, Canada, France, Germany, the UK, and the US. Furthermore, this effect is primarily driven by the migration of highly educated people to these countries [1]. Education is correlated with income, which may indicate that those highly educated people can afford migration costs. This could also be interpreted to mean that disasters related to climate change lead to brain drain from developing countries, especially when the affected countries are in a vulnerable situation due to the shock.

Another body of evidence finds that climatic shocks such as weather anomalies affect international migration through their effect on internal migration, which is called an "economic geographic channel" [8]. For instance, in the case of sub-Saharan Africa, weather anomalies are positively associated with rural-urban migration because of their effects on the agricultural sector. This internal migration, in turn, leads to an increase in international migration because it raises the number of workers in cities, translating into lower wages and increasing people's willingness to move internationally in search of higher wages. Weather anomalies can also lead to high international migration through a so-called "amenity channel" by increasing the spread of disease and risk of death [8].

The role of liquidity constraints: Slow vs rapid onsets and temporary vs permanent migration

The positive relationship between climatic shocks and migration, both internal and international, has been challenged in the economics literature. There is some evidence showing that climatic shocks do not necessarily lead to more internal or international migration if the affected people are burdened by liquidity constraints or if they have to deal with slow onset events such as slowly changing temperatures [5]. Conversely, it might be argued that when faced with rapid onset events such as cyclones, storms, and floods, people could be forced to move because they lose everything all at once, which is not necessarily the case with slow onset events. Moreover, studies show that due to liquidity constraints, victims of rapid onset events are more likely than victims of slow onset events to make short-distance migrations [6] or short-term relocations, rather than to embark

on permanent or long-distance migration [3]. For instance, a large-scale analysis from Indonesia illustrates the impact of long-term climatic shocks versus short-term disasters on different types of migration. Considering internal migration (i.e. province-to-province migration) of more than 7,000 households over 15 years, this study showed that natural disasters, which can also be considered as rapid and sudden events, only have a marginal effect on permanent outmigration to another province, while climatic variations associated with slow onset events such as rainfall and temperature variations increase permanent outmigration from a certain threshold (25°C for temperature and 2.2m for rainfall), with the effect of high temperatures being more important than that of greater rainfall [9].

Indirect effects of natural disasters on migration

Some studies have found that climatic factors do not have any direct impact on migration, but an indirect one [6]. One possible transmission channel is agricultural productivity [5], [10]. This means that adverse climatic shocks initially reduce agricultural productivity, which, in turn, leads to increased migration.

Evidence from economic history provides a good example of how negative climatic shocks affect population movement through their effects in the agricultural sector. For instance, in the agriculturally dependent plains counties of the US in the 1930s, large dust storms due to prolonged severe drought conditions and intensive land use caused permanent soil erosion. This phenomenon, known as the American Dust Bowl, incurred substantial agricultural costs that were mitigated, to a degree, by a relative population decline caused by outmigration from high-erosion counties to low-erosion ones [11].

This example illustrates how disasters have affected internal migration through their effect on the agricultural sector. However, recent evidence shows that climatic shocks (i.e. long-term events) can also affect international migration through agricultural productivity. For instance, using bilateral annual migration data from 163 origin countries and 42 destination countries, which are mainly OECD countries, during the period 1980–2010, higher temperatures have been found to increase international migration flows, but only for countries that are highly dependent on agriculture [10].

The role of public intervention

Some disasters may increase migration flows, while others do not have any impact on them; this might be explained by the role of public intervention, both ex-ante and ex-post (meaning before and after the event). Public intervention is crucial to reduce a population's vulnerability to climatic shocks and to improve their resilience [12]. For instance, in the US in the 1920s and 1930s, there were outflows of migrants from areas that experienced a large number of tornadoes, while those affected by floods had net inflows of migrants. The difference in migration responses in the aftermath of tornadoes and floods can be explained primarily by the early intervention actions of public authorities. Authorities invested ex-ante in the infrastructure and protection of flood-prone areas, which made them more resilient to shocks and improved their attractiveness as living options. Such interventions did not happen in tornado-prone areas [13].

More recently, in Bangladesh, over the period 1994–2010, the occurrence of floods did not lead to high migration from affected areas, while crop failure caused a dramatic increase

in migration. Again, the different migration reactions can be attributed to authorities' responses to the disasters; assistance was provided in the aftermath of floods, while it was not the case for crop losses [3]. Coping strategies for floods have received more attention than for crop losses, both from researchers and policymakers, at least in the case of Bangladesh. However, it remains unclear why governments are generally more likely to invest in flood-prone areas than those affected by other types of shocks. One hypothesis is that floods are particularly destructive with respect to housing and assets, whereas crop losses do not incur the same type of losses. Given this tendency, it might be useful for governments to expend more resources targeting populations affected by other types of shocks such as crop failure.

LIMITATIONS AND GAPS

Although interest is increasing with respect to the relationship between climate change, natural disasters, and migration, both in the academic literature and among policymakers, it is still difficult to achieve consensus on the exact nature of the relationship. Consequently, there is, above all, a need for more evidence at the microeconomic level. Long-duration panel data sets are needed to better understand the long-term effects of disasters, though more efforts are currently underway to address this issue. Having access to more information on the socio-demographics of migrants in the aftermath of shocks as well as knowing how people displaced due to climatic shocks and natural disasters differ from conventional migrants such as labor migrants will help researchers understand the consequences of disasters for both the origin and destination areas. Additional information on the affected populations as well as on those who relocate within their origin countries following a post-disaster migration will also help shape specific policy intervention. Finally, a crucial area for further research is to investigate the impact of disaster-induced migration on the well-being of both migrants and those left behind. This is particularly important because it could, for instance, affect labor market outcomes in both origin and destination countries, as well as inform on the integration of migrants in the receiving countries.

SUMMARY AND POLICY ADVICE

Natural disasters can occur anywhere; however, developing countries are the most vulnerable to their effects. These countries are unable to build up their resilience prior to the event or to efficiently manage the post-disaster effects. Consequently, migration can play an important mitigating role in the aftermath of natural disasters. This role is reinforced by the impact of remittances, which help build households' resilience ex-ante and reduce the adverse effects of shocks on their livelihoods ex-post. Disasters can lead to internal migration and, depending on the circumstances, to international migration. People must be able to afford to migrate; this makes liquidity constraints an important element of the relationship between disasters and migration. Liquidity constraints can also explain why people do not migrate in the case of slow onset events. Moreover, even if people are forced to move, as is often the case in rapid onset events, liquidity constraints may force them to relocate only temporarily or embark on short-distance migrations. Disasters related to climate can also impact migration through their effects on agricultural productivity, typically by

degrading crop yields. Finally, the evidence shows that the type of policy interventions employed both before and after disasters can explain why different disasters induce different migration responses.

Migration and remittances, which are private mechanisms for dealing with shocks, should be considered as complementary to public intervention, and not as substitutes. If only migration and remittances are available as mitigation strategies against disasters' effects, this can lead to an increase in inequality between migrant households and non-migrant households, as well as between remittance receivers and non-receivers. Thus, disaster management requires a holistic approach, which takes into account both private and public mechanisms for protection and intervention. Governments should thus help channel migration when necessary and alleviate the cost of sending remittances. Moreover, ex-ante, public authorities can help households build disaster resilience through, for instance, better social protections, effective insurance mechanisms, and by diversifying the economy to reduce dependence on agriculture. It is also important for governments to intervene rapidly and to have strong institutions that can manage aid flows after disasters [12].

However, while it is largely accepted that climate change and natural disasters are one of the main challenges of the contemporary era, it is still difficult to achieve consensus on an appropriate course of action, particularly between developed and developing countries. Private solidarity mechanisms are at work—for example, in the form of remittances—but there is a lack of solidarity between countries. This raises equity issues because poor countries only play a small role in driving the climate change process compared to developed ones, yet their increased vulnerability exposes them more than richer nations to its adverse effects. Thus, addressing the issue of climate change requires better governance on a global scale, with more efficient aid allocated to vulnerable countries as well as better migration policies toward migrants from those countries. Migration in the aftermath of climatic shocks or natural disasters should not be perceived as a threat for many reasons. First, most migrants move internally or to neighboring countries. Second, due to the prospect of remittances, migrants can help those left behind to deal with shocks. Finally, migration remains a human right, above all in the case of disasters related to the climate. Migrants should thus be received and integrated into host societies, for the benefit of all.

Acknowledgments

The author thanks an anonymous referee and the IZA World of Labor editors for many helpful suggestions on earlier drafts. Previous work of the author contains a larger number of background references for the material presented here and has been used intensively in all major parts of this article [12]. Any opinions expressed are those of the author and do not necessarily represent the views of the African Development Bank Group or IZA.

Competing interests

The IZA World of Labor project is committed to the *IZA Guiding Principles of Research Integrity*. The author declares to have observed these principles.

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