

Environmental Degradation and Migration

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Abstract

The argument that environmental degradation is an important driving force of migration has experienced a strong revival in the climate change context. While various studies predict large environmental migration flows due to climate change and other environmental stressors, the ex post empirical evidence for such migration is very patchy at best. We contribute to the emerging empirical literature in this field by focusing on the micro-level. We examine how and why different types of environmental conditions may lead to internal migration. The analysis relies on survey data for both migrants and non-migrants in 16 countries. The results suggest that both sudden-onset and long term environmental events, such as floods and droughts, have no significant effect on internal migration. In contrast, individual perceptions of negative environmental conditions can motivate people to move. We also find that people tend to respond to long-term environmental problems with adaptation, rather than migration. These findings indicate that different types of environmental problems – notably, natural hazards vs. gradual environmental degradation – can create different incentives for people to migrate or stay.

Key words: environmental degradation, migration, short vs long term environmental problems, perceptions of environmental degradation.

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Introduction

The debate on whether and how environmental degradation impairs human security and ultimately forces people to leave their homes and migrate to places more conducive to their wellbeing has experienced a strong revival in the climate change context. The Intergovernmental Panel on Climate Change (IPCC 2007), the Stern Review (2006), and many more specific studies demonstrate that climate change is taking place, that human activity has clearly contributed to the phenomenon, and that it will have far reaching repercussions for ecosystems and humans. Many academics and policy-makers also argue that climate change is likely to cause mass population dislocations (migration) due to extreme weather events, such as stronger and more frequent storms, floods¹, and droughts, as well as longer-term, gradual problems, such as desertification² and rising sea levels³. Several studies estimate that these environmental events and processes could force 200 million to 1 billion people to move permanently or temporarily within their own countries or internationally (Laczko and Aghazarm 2009; Myers 1997, 2002).

Most of the existing scientific literature on ‘environmental migration’⁴ regards the environment-migration nexus as self-evident. After all weather-related events have led to considerable internal and international migration flows in various instances. In the 1930s, an estimated 2.5 million North Americans left the Great Plains because of droughts and dust storms (Reuveny 2008). In 1960-1980, almost 10 million people migrated in the Sub-Saharan African region because of droughts (El Hinnawi 1985; Jacobson 1989). Since the 1970s approximately 600,000 people in Bangladesh and 4 million in the Philippines were forced to move because of storms, floods, droughts, and landslides (Reuveny 2008; Reuveny and Peterson 2008). Hurricane Katrina

¹ The International Disaster Database EM-DAT puts the number of people affected by floods at 99 million per year in the time-period 2000 - 2008.

² The IPCC projects that more than one billion people around the world will be affected by increased water shortages by the 2050s (IPCC, “Summary for Policymakers”, p10).

³ The IPCC (2007) lists estimates of global mean sea-level rise of between 0.18 and 0.59 meters by 2090-2099 and 0.3 to 0.8 meters by the year 2300. According to some studies 400 to 600 million people living in low elevation coastal areas, such as some islands (e.g. Tuvalu and Maldives), and in major river deltas and estuaries in East and South Asia would be affected by sea-level rise (MacGranahan et al, 2007; Antholl et al., 2006).

⁴ We use the term “environmental migration” as relating to persons who are displaced primarily for environmental reasons. We prefer the term “environmental migration” over the term “environmental refugees” because the latter term narrower and refers primarily to situations where people are facing extremely hostile environmental conditions that leave them with no choice but to leave.

resulted in 1.5 million people being displaced temporarily and 500,000 permanently in New Orleans and surrounding areas (Grier 2005).

Unfortunately, such case specific pieces of evidence do not allow for more general conclusions with respect to whether and how environmental degradation affects migration. The environment-migration relationship may well be conditional on various individual, socio-economic, and political factors. Interestingly, a direct relationship between environmental degradation and migration is proposed primarily by environmental policy specialists. Other academic fields of inquiry do not regard environmental factors as key determinants of migration. Neoclassical economists, for example, emphasize either that potential migrants calculate their expected earnings in their place of origin in comparison to various places of destination (Sjaastad 1962; Todaro 1969); or that migration decisions are taken by the household as a whole as part of its survival strategy. As to the latter approach, migration of a household member is seen as a way for the household to minimize risks and maximize its chances of survival under conditions of economic uncertainty by diversifying its sources of income (Stark 1991; Stark and Bloom 1985). Sociologists highlight migrant networks and a 'culture of migration' (Massey 1990a; Kandel and Massey 2002). Political scientists stress political instability and armed violence as driving forces of migration (Moore and Shellman 2004; Davenport et al. 2003). To the extent environmental factors are considered in these approaches, they are regarded as either 'stressors' or 'locational characteristics' that provide physical amenities or disamenities influencing the likelihood of migration (Wolpert 1966; Speare 1974; Knapp and Graves 1989).

Empirically, the existing literature on the environment-migration nexus is rather fragmentary. It relies mainly on case studies (Mortreux and Barnett 2009; Henry et al. 2004; Ezra, and Kiros 2001; Mese-Hausken 2000). These studies offer interesting insights into the complex relationship between environmental conditions and migration, suggesting that migration dynamics are context specific and thus findings are hard to generalize (Hunter 2005). Most of these studies focus on migrants (e.g., Doevenspeck 2011, van der Geest 2009; Gray 2008). This focus might result in biased results because it cannot account for decisions not to migrate. That is, these studies cannot consider the possibility that environmental degradation does not affect all people the same way, and that people do not respond to environmental degradation in a unified, singular manner.

Moreover, the existing literature does not tell us much about how different types of environmental degradation affect incentives and decisions of people to migrate or stay.

This paper contributes to the environmental migration literature by addressing the shortcomings mentioned above. We develop a theoretical argument that links different types of environmental problems – notably short- vs. long-term problems – to decisions to migrate or stay.⁵ Moreover, we use new micro-level data from 16 countries that covers both those persons who migrated and those who decided not to migrate. Hence we reduce problems of selection bias and strive for more generalizable conclusions.

The next section reviews the relevant literature. We then develop our theoretical argument. In the subsequent section we discuss the empirical approach and present the results. The final section summarizes the findings and discusses their policy implications.

What Do We Know?

Environmental problems can contribute to migration by pushing people out of affected areas. Migration may thus be driven by environmental changes that come about suddenly, such as natural hazards; or by gradual, slow-onset environmental problems. For example, extreme weather events and natural disasters – such as storms, hurricanes, or floods – can act as an immediate push factor. In contrast, gradual, long-term environmental changes – such as desertification, land degradation, or sea level rise – can lead to a decline in living standards that increases the costs of staying versus leaving. Migration can be a survival strategy for people confronting environmental disasters or problems (Hugo 1996). But it is not the only strategy. Reuveny (2007: 657), for instance, argues that “people can adapt to environmental problem in three ways: stay in place and do nothing, accepting the costs; stay in place and mitigate the changes; or leave affected areas”.

Empirical research shows that migration can in fact be a response to environmental problems. Meze-Hausken (2000), for example, reports that migration in dry land areas of Ethiopia was undertaken by families during times of drought after other options, such as reducing food

⁵ In this paper we focus on internal migration. There is a strong consensus in the scientific literature that most migration flows associated with environmental factors are internal. International migration may occur, but this is the exception rather than the rule (Raleigh et al 2008).

consumption and selling off possessions, were exhausted. However, as discussed in the remainder of this section, most existing studies are very location- and context-specific, and they do not offer insights into how different types of environmental changes could affect migration.

Most research addressing environmental migration has focused on natural disasters, such as floods, storms, cyclones, tornados, and volcanic eruptions. It assumes that the associated migration patterns were forced, not voluntary. That is, migrants had no other choice but to leave, even if they were highly reluctant to do so. Existing research also shows that such sudden environmental events lead overwhelmingly to short term, internal displacements (Myers et al. 2008; Raleigh et al. 2008). The victims of such events tend to either stay where they live, or to move only within a short distance; many then return and reconstruct their homes in the affected areas (Raleigh et al. 2008). Although it seems plausible that rapid onset environmental phenomena lead to mostly temporary displacement, it is not obvious why this should be the case. The reason is that some studies show that a high frequency of natural disasters eventually encourage people to move away from their homes permanently (Afifi and Warner 2008; Morrissey 2008).

Compared to short-term natural disasters, slow-onset environmental changes, such as droughts and desertification, could lead to a different migration pattern. Migration under such conditions should be regarded as one of several coping strategies for dealing with resource scarcity. For nomadic pastoralists and sedentary farmers in the Sahel region, for example, migration is a fundamental strategy for dealing with environmental problems. Long-term environmental changes such as land degradation may thus have bigger influence on migration behavior than episodic weather-related events (Henry et al., 2004). As a result, the distinction between forced and voluntary migration becomes blurred in the context of slow-onset, long-term environmental problems.

It is not surprising then that the empirical evidence is inconclusive primarily with respect to migration effects of slow-onset, long-term environmental problems. On the one hand, we observe various cases of mass population movements apparently caused by droughts in Africa, Asia, Latin America, and elsewhere. For instance, Ezra and Kiros (2001) examine migration flows in the drought prone regions of Ethiopia in the period 1984-1994. They find that migration rates were highest during the year of the drought (1984), which suggests a strong immediate impact of

environmental factors on out-migration. They conclude that drought, by increasing vulnerability to food shortages, led to migration.⁶ Ezra (2001) also reports that migration was used as an adaptation strategy by a considerable number of households in northern Ethiopia during the large-scale famines of the 1980s. Similar results are reported by Morrisey (2008) for migration flows due to droughts in the highlands of Ethiopia.

On the other hand, several studies conclude that droughts have had only a minor impact on migration. Findley (1994) reports that in Mali during 1983-1985 droughts produced short-term internal migration of women and children. But overall migration declined. The author interprets this finding as suggesting that the drought contributed to a lack of financial means for migration. Henry et al. (2003) note that including environmental variables (such as reduced rainfall and land degradation) alongside other potential determinants improved the prediction of internal migration in Burkina Faso. But the estimated effect of these environmental variables was weaker than the effect of socio-demographic variables. In a subsequent study Henry et al. (2004) observe that in Burkina Faso people from the drier regions were less likely than those from wetter areas to migrate. Gray (2009) investigates the effects of environmental factors on out-migration from a rural area in the southern Ecuadorian Andes. It turns out that negative environmental conditions do not necessarily increase migration.

Finally, the European research program EACH-FOR (Environmental Change and Forced Migration Scenarios), the largest research effort on the environment-migration nexus to date, has produced 23 country case studies. By and large, these case studies indicate a positive relationship between water scarcity and desertification on the one hand and migration on the other. They consider different forms of environmental degradation as well as natural disasters as reasons for environmental migration. Whereas some form of long-term environmental degradation exists in nearly every country studied by EACH-FOR, natural disasters as a driver of migration appear predominantly in the Asian, Latin American, and African country cases. Factors such as civil wars appear as the primary reason for migration in countries such as Mozambique or Tajikistan. In countries like Ecuador or Haiti, problems of environmental degradation are found to have

⁶ Meze-Hausken's (2000) shows, however, that there was no correlation between vulnerability and the time elapsed until migration: the most vulnerable left after a similar number of months as the least vulnerable.

contributed to civil unrest. The EACH-FOR project also concludes that Ghana and Sub-Saharan Africa have been and will be a prime locus of environmental migration.

This brief review of the literature⁷ shows that environmental changes *can* act as a driver of migration. It also shows, however, that existing research suffers from at least three shortcomings. First, virtually all studies we know of focus on one specific country and examine one particular environmental problem. Because the effects of environmental degradation on migration are likely to be context specific, it remains unclear whether the results of these studies are also relevant for other countries and other environmental problems. Second, by implication existing research also does not tell us much about whether and how effects on migration might differ across different types of environmental changes. Moreover, many studies use problematic indicators for environmental changes. For instance, Ezra and Kiros (2001) proxy environmental degradation with a dummy variable for whether the community in which the household is located is classified as more or less vulnerable. This classification is based on opinions voiced by the Ministry of Agriculture and local government officials in Ethiopia. Other studies (Doevenspeck 2011; Massey et al. 2010; Gray 2009) measure local environmental conditions with respondents' perception of changing agricultural productivity, the time required to collect firewood, household total land area, meager harvest, or food security. While such indicators may well capture environmental degradation in one way or the other, there is no uniform measurement of environmental degradation across case studies. Hence their results are virtually impossible to compare in a systematic fashion.

The third problem is that most studies using micro-level data, usually collected through surveys of individuals or households, concentrate on those persons who have migrated. By ignoring those who have not they are likely to suffer from selection bias because they do not allow for any conclusions with respect to persons who, despite environmental degradation, decided not to migrate.

In this paper we seek to address these three shortcomings just discussed. We focus both on short-term and long-term “actual” environmental problems as well as on individual perceptions of environmental changes and how they may affect migration. After developing a theoretical

⁷ For a much larger review of the existing literature, to which some authors of this paper have also contributed, see: <http://www.bis.gov.uk/foresight/migration>.

argument to this end in the next section we then test this argument using new data for multiple (16) countries. This data includes information both on individuals that did migrate and individuals who did not.

Theory

The existing literature on the environment-migration nexus is dominated by neo-Malthusian and push-pull⁸ theories. The prevailing argument holds that environmental changes deprive people of their livelihood and force them to migrate to better environments, usually permanently. This argument identifies a direct, unidirectional, causal relationship between environmental changes and migration. It does not take into account that people may adapt to environmental changes. Moreover, it does not account for the possibility that environmental changes may be only one of the factors determining whether or not people migrate. In other words, they blend out that migration is just one of several possible responses, and that adaptation to environmental changes is a possible alternative (Adger et al. 2007).

Several authors (e.g. Lonergan 1998; Castles 2002) have noted this problem and have argued that environmental conditions are part of a complex pattern of causality. They argue that environmental, economic, social, and political factors are interrelated and need to be examined jointly in order to understand the role environmental factors play in population movements.⁹ A recent body of literature has thus considered various economic, social, demographic, environmental, and other factors that may influence migration. However, as of now, there is no single, coherent theory of migration, but rather a fragmented set of theories, often segmented by disciplinary academic boundaries.

Theoretical issues concerning determinants of migration are commonly explored at either the macro or the micro level. In economics, neoclassical *macro*-economists focus on differentials in wages and employment conditions between locations, and on migration costs.¹⁰ According to this

⁸ A push factor is a flaw or distress that drives a person away from a given place, while a pull factor is a benefit that attracts people to a location (Lee 1966).

⁹ Suhrke (1994) classifies these two approaches as minimalist (environmental degradation as a direct cause of migration) and maximalist (environmental change as a contextual variable that can contribute to migration).

¹⁰ Although this neoclassical economics argument was developed to explain international migration it can easily apply to internal migration, such as migration from rural to rural and rural to urban areas.

approach, individuals migrate from lower-wage to the higher-wage locations to increase their current and future incomes. Consistent with this approach, neoclassical *micro*-economists regard migration as a rational decision by individuals to maximize their income (e.g. Sjaastad 1962; Todaro 1969; Borjas 1989). That is, prospective migrants will decide to migrate if they can expect a positive net return from movement (Sjaastad 1962; Massey et al. 1993).

The ‘new economics of migration’ approach views migration as a household (rather than an individual) strategy. Migration serves to minimize family income risks or to overcome capital constraints on production activities of the family (e.g. Stark 1991; Stark and Bloom 1985; Stark 1984; Stark and Levhari 1982). That is, migration decisions are taken by the family or household, not by the prospective migrant alone. The household aims at maximizing expected income collectively, minimizing economic risks, and reducing barriers associated with various market failures. By diversifying the allocation of its resources (i.e., family labor) the household seeks to control risks to its economic wellbeing. Temporary or long-term migration of members of a household is perceived as a strategy for diversifying sources of income and thus maximizing its chances of survival in an uncertain world. In the event local economic conditions do not allow the household to generate sufficient income, it can still rely on migrant remittances for support (Massey et al. 1993).¹¹

Environmental conditions have not been systematically considered in such arguments, but are easy to add in the form of push and pull factors. One option for doing so is to draw on the ‘stress-threshold’ model (Wolpert 1966). From the perspective of this model, environmental problems, such as floods, droughts, desertification, etc., can act as ‘stressors’ that bring about ‘strains’ and motivate individuals to consider migration as a response.¹² That is, when environmental ‘stressors’ put an individual’s wellbeing at risk, decrease her personal income from production, and/or lower her opportunity for future employment then she is more likely to consider migrating to places with better environmental attributes and better income opportunities.¹³ Accordingly,

¹¹ Adger et al. (2002) report that remittances from out-migrants were an important factor in maintaining the social resilience of coastal communities in Vietnam. Afolayan and Adelekan (1999) and Ezra (2001) report that similar practices have been used by communities in Western Sudan and Northern Ethiopia.

¹² Air pollution, congestion, and crime are often mentioned as important factors affecting individuals’ decision to reallocate from city centers to suburbs, and from metropolitan areas to small cities.

¹³ Barrios et al. (2006), using cross-sectional data for 78 countries over a 30-years period, report that rainfall shortages increased rural out-migration only in Sub-Saharan Africa, but not elsewhere in the developing world.

environmental stress should be more paramount in settings where people are more directly dependent on the natural environment for their livelihood. In such settings, environmental stress is more likely to directly threaten individuals' survival.

However, while the presence of environmental stressors, as measured in an objective manner, may well promote migration, we expect such stressors to be neither a necessary nor a sufficient condition for migration. The reason is that individuals are likely to first try and abate the respective environmental problem and/or adapt to it before they consider migration. In other words, individuals are unlikely to opt for migration as their first best strategy when exposed to environmental degradation. Rather, they will first try and reduce their personal exposure and vulnerability to the problem and, if the nature of the collective action problem permits, also contribute to reducing the problem as such. They will do so because migration is costly, for instance because of personal bonds individuals have developed over their lives with their home location and its people. Consequently, an individual will consider migration when environmental degradation has a major impact on her personal wellbeing and her efforts to adapt to and/or mitigate this impact are failing. That is, an individual is more likely to consider migration after she has experienced a 'threshold of dissatisfaction' with environmental degradation in her present location (Speare 1974). The empirical implication of this theoretical argument is that *an individual's relative level of (dis-)satisfaction with the prevailing environmental conditions at her current location influences her decision on whether to migrate or stay. Greater dissatisfaction increases the probability that she will decide to migrate.*

As noted in the literature review section, we should not expect migration to be the automatic response to any kind of environmental problem. Migration decisions are likely to be context-specific. This implies not only that we must consider drivers of migration other than environmental problems alongside the latter. It also implies that we should consider the specific characteristics of environmental degradation. We propose that these characteristics should not be regarded in a one-dimensional form, that is, in the sense of bigger or smaller environmental problems. We also need to pay attention to their temporal characteristics. The most interesting variation in this respect, in our view, is the difference between *sudden vs. slow-onset* and *short-term vs. long-term* problems. Sudden and rapid (short-term) environmental events, such as floods, tornadoes, and hurricanes can have severe impacts – at least in the short run – on the wellbeing of

individuals. However, because migration is usually a costly adaptation strategy, individuals are likely to see sudden, short-term environmental events as transitory – even if these events are highly destructive – and try to cope and adapt. They may consider migration in the aftermath of such natural disasters, but are likely to postpone such a decision. Individuals are usually tied to a particular location by lifestyle, bonds to other people, culture, social traditions and identity. For these reasons, they are likely to view hardship inflicted upon them by a sudden environmental event as transitory. Empirical studies have also shown that social bonds and solidarity tend to increase in times of natural disasters. Consequently, strong ties to the current location are likely to offset potential motivations to leave (migrate). The empirical implication of this theoretical argument is that *sudden and short-term environmental changes (events) have no significant effect on individuals' decisions to migrate.*¹⁴

Slow-onset and long-term environmental problems, such as droughts and desertification, are likely to have smaller impacts on the wellbeing of individuals because people can adjust their productive strategies over time when facing such environmental changes. Such responses include, for example, investments in irrigation systems, use of drought resistant plant and animal varieties, or diversification of income sources¹⁵. Hence we should expect that *slow-onset and long-term environmental problems will not increase the probability of migration* because affected individuals are more likely to have adapted to (increasingly) negative environmental conditions.¹⁶

We agree with studies noting that migration decisions may be affected more by perceptions of environmental changes rather than environmental changes as identified in some objective fashion.¹⁷ Environmental problems are likely to have asymmetric impacts across the affected population. Some individuals might be negatively affected, others might benefit.¹⁸ In addition,

¹⁴ Large-scale, intense floods and droughts can, of course, force people out of their communities. But they are likely to return once conditions improve and rebuild their lives in a 'familiar' setting.

¹⁵ To the extent migration decisions are taken by the household diversification of income sources might be accomplished by having a single-family member migrate. If so, this is likely to weaken the relationship between environmental changes and migration.

¹⁶ This argument reflects the neo-Malthusian vs Cornucopian debate in the broader literature on environmental changes, human security, and social conflict.

¹⁷ Hunter (2005) stresses that perceptions of risk act as a 'mediating factor' between environmental stress and migration.

¹⁸ A recent study based on micro-level data for a sample of African farmers shows that higher annual temperatures are associated with positive variation of net revenues for livestock owners and negative variation of net revenues from crop production (CEEPA 2008).

perspectives on environmental problems are almost by definition relative, influenced by the ability of an individual to cope with and adapt to environmental problems. The range of adaptive/copying options varies from one individual to the next, depending for example on the work skills, financial assets and other attributes of the individual such as age, sex, health and education. That is, perceptions of environmental degradation depend not only on the respective individual's exposure to a particular environmental problem, but also on her adaptive capacity. The empirical implication of this theoretical argument is that *negative perceptions of environmental conditions (degradation) motivate individuals to migrate because they affect their relative level of satisfaction with the current location.*

Empirical Analysis

To test the arguments developed above we use data collected by the European research program EACH-FOR (Environmental Change and Forced Migration Scenarios). The EACH-FOR program offers micro-level data for migrants and non-migrants. This data allows us to examine whether environmental factors affect migration choices, both of individuals who migrated and individuals who might have suffered from environmental degradation but did not migrate. Most research on the environmental migration issue to date examines migrants only and thus selects on the dependent variable. The EACH-FOR data includes information on internally displaced people as well as non-migrants in 16 countries.¹⁹ This geographic coverage improves on existing studies, most of which focus on one specific country or region. Moreover, for our main independent variable, environmental degradation, we use exogenous data on environmental shocks and degradation as well as survey information on individuals' perception of environmental degradation. This approach allows us to differentiate between 'real' environmental problems and perceived environmental degradation.

The EACH-FOR project focused on 23 case study areas in developing countries or transition economies (Figure 1). The reason is that the population of these countries is presumably more vulnerable to various facets of environmental degradation and extreme weather events. The case studies were carried out by members of the EACH-FOR project team and local researchers familiar with the respective local language and customs (Afifi and Warner 2008). Systematic

¹⁹ These are Bangladesh, China, Ecuador, Egypt, Haiti, Kazakhstan, Kyrgyz Republic, Mexico, Morocco, Mozambique, Niger, Tajikistan, Turkey, Tuvalu, Vietnam and Western Sahara.

surveys based on a uniform questionnaire were administered in each case study area.²⁰ Due to financial and time constraints, they were limited to around 30 migrants and 30 non-migrants per country (Afifi and Warner 2008).

Figure 1 about here

Our dependent variable measures a person's decision to migrate. It takes on the value 1 for those individuals who migrated and the value 0 for those who did not. The main explanatory variables capture whether there was a drought or a flood at the place of origin or the current location of the respective person. This data is taken from an external source, the EM-DAT/OFDA/CRED International Disaster Database²¹, and not the EACH-FOR survey data. That is, we use an exogenous measure of environmental shocks.

Data for all other variables is taken from the surveys of the EACH-FOR program. We include a measure of whether the environmental problem (if present) was long-term in nature, as in the case of deforestation and desertification. Two survey items were used to code this measure. First, if a migrant mentioned environmental problems playing a role in her/his decision, she/he was asked: *“Think about the time you migrated in part because of environmental problems. Tell us about the reasons that caused you to move away from the place with environmental problems (For those who were resettled by the government: think about the time of your resettlement)”*. Second, for non-migrants, the following item was used: *“How would you describe the environmental situation in your place of residence? Has the environmental quality improved or worsened during the past years?”* Non-migrants were also asked to specify the environmental situation if they indicated a change for the worse.

Using this information, we coded a variable capturing long-term environmental problems. Furthermore, we coded whether problems respondents were facing were related to environmental

²⁰ For more detailed information on the questionnaires, c.f. http://www.each-for.eu/index.php?module=project_outline

²¹ www.emdat.be

degradation and pollution²², were of an economic nature²³, were associated with droughts²⁴, or concerned the general influence of natural hazards²⁵. We also include a dummy variable that takes on the value of 1 if a person (migrant or not) responds that environmental problems were present at either her/his place of origin (migrants) or at her/his current location (non-migrants). This variable measures a respondent's perception of environmental problems.

Table 1 and 2 about here

Following recent explanatory models of migration²⁶, we also include a dummy variable capturing whether another family member migrated before and whether a person comes from a rural background. We control for gender and age. Moreover, we control for how long a respondent lived (in months) at the previous location. For non-migrants, the value of this variable is equal to their age in months. Table 1 provides an overview of variables in our analysis. Table 2 shows the descriptive statistics.

²² This variable takes on the value 1 if the respondent mentioned one or more of the following environmental problems: water salinity, poor ground water quality, poor water quality, air pollution, noise, water pollution, poor soil quality, soil eradication, environmental degradation, soil degradation, rise of sewage water level, sand creeping into river, jacinth flower in river, water erosion, river bank erosion, land overusage, land degradation, land pollution, industrial pollution, underground waters, sinking of land, decreasing land fertility, nuclear range, rangeland degradation, mine pollution, poor environmental conditions, coastal erosion, soil salinity, garbage, radiation, waste, deforestation, erosion.

²³ This variable takes on the value 1 if the respondent mentioned one or more of the following environmental problems: declining harvest, decreasing fish production, low productivity, food scarcity, declining yields, not enough crops, not enough food, food shortage, lack of service, not self sufficient, no farmland, lack of electricity, lack of electricity, lack of medical care, lack of animal fodder, shortage of land, low productivity, lack of vitamins, low crop production, poor food quality, poor sanitation, shortage of land, lack of housing, high living costs.

²⁴ This variable takes on the value 1 if the respondent mentioned one or more of the following environmental problems: water shortage, more droughts, delayed rain, declining rain, declining water level, rain shortage.

²⁵ This variable takes on the value 1 if the respondent mentioned one or more of the following environmental problems: sea level rising, more rain, coastal change, insect, insect attacks, extreme heat and cold, floodings, fear of earthquakes, climate change, wind shortage, land slides, frequent rainfall, hurricanes, more rain, natural hazards, snow disaster.

²⁶ These models emphasize that migration decisions are taken in a broader socio-economic context. Social relationships and networks play an important role in individual decisions to migrate. According to Massey et al (1993:448), "Network connections constitute a form of social capital that people can draw upon to gain access to foreign employment." These networks can help increase the likelihood of migration by reducing the costs and risks and by raising expected income. While the costs of migration are fairly high for the first migrant heading to a new destination, the potential costs for relatives and friends who follow decrease sharply once the first migrant has settled in her/his destination. Consequently, once migration networks are established, it becomes easier for others members of the household or the community of the individual migrant to migrate as well (Massey 1990a,b).

Since our dependent variable is binary we use logistic regression models to analyze how environmental variables relate to a respondent's decision to migrate. Table 3 shows the results of three logistic regression models. Model 1 is the baseline model, model 2 controls for the time the respondent has spent at her/his previous location, and model 3 disaggregates environmental problems respondents mentioned in the surveys.

Table 3 about here

In all three models, we find that “real” natural disasters in the form of floods and droughts do not have a significant effect on migration decisions. The regression coefficients on the two variables of interest do not reach standard significance levels. This result is consistent with the arguments set forth in the previous section of the paper, where we claimed that: (a) people tend to treat short-term natural disasters, such as floods, as transitory and do not migrate following such events; and (b) people are unlikely to migrate in response to longer-term threats, such as droughts. The latter claim is also supported by the negative and statistically significant effect of the variable measuring whether a person faces/faced a long-term environmental threat where she/he lives or lived. When people face a long-term environmental threat they do not seem to opt for migration to deal with this problem. Rather, they seem to stay and try to adapt.

This result appears inconsistent with the result that respondents perceiving major environmental problems where they previously lived are more likely to migrate: the effect of the ‘environmental perception’ variable on the choice to migrate is positive and significant. When we disaggregate the variable capturing long-term environmental problems we obtain some very interesting results (model 3 in Table 3). Long-term economic, pollution, and natural hazard problems are not associated with migration, suggesting that people seek to adapt instead of opting for migration. The exception is long-term drought, which appears to motivate people to migrate. This finding is very interesting. It suggests that the variable measuring “real” droughts does not seem to capture the factors that make droughts a threat to people's livelihood and lead them to migrate.

Concerning the control variables, we find that female respondents, older respondents, and respondents who come from a rural area are less likely to migrate. In contrast, if a family member

has already migrated the average survey respondent is more likely to opt for migration, too. This finding offers support for the network perspective on migration.

The findings discussed here are independent of whether we control for how long a person has lived in the past (or current) location (model 2 in Table 3). However, as one should expect, the longer a person has lived at a given place, the less likely she/he is to migrate. This result supports the argument that individuals are tied to a particular location by lifestyle, bonds to other people, culture, social traditions and identity.

Considering interaction effects allows for an additional, even more direct test of our key argument. This argument holds that long-term environmental problems are less likely to lead to migration because people are socially bonded to their home locations. This means that they will, first and foremost, try to adapt. Only when adaptation fails will they consider migration. One empirically testable implication of this argument is that the effect of long-term environmental problems should be more pronounced for individuals who have lived at their current place for a longer time. Similarly, perceived environmental problems should have a stronger migration enhancing effect on those people who have lived for a shorter time at their current location; those individuals experience weaker social bonds and should thus face less difficulties in moving somewhere else.

Table 4 about here

Table 4 reports the results for these models. Model 1 shows the results for the interaction effect between long-term environmental problems and the time a person has lived at the previous (current) location. Model 2 shows the results for the interaction effect between perceived environmental problems and the time a person has lived at the previous (current) location.

Figures 2 and 3 about here

Figures 2 and 3 show the coefficients on ‘long-term environmental problems’ and ‘perceived environmental problems’ at different levels of the variable measuring how long a respondent has lived at the previous (current) location. Figure 2 shows that ‘long-term environmental problems’ significantly increase the likelihood of someone staying at his/her current location only if this person has lived there for a long time. This result suggests that people prefer adaptation to long-term environmental problems, but only if they are socially bonded to their current location. If a person has lived at a given location only for a short time, the effect of the variable measuring ‘long-term environmental problems’ on the decision to migrate is no longer significant. This result is consistent with the argument that adaptation to long-term environmental problems is more likely when people experience stronger social bonds at their current location.

Similarly, Figure 3 shows that ‘perceived environmental problems’ significantly increase the likelihood of migration only if the respondent has lived for a short time at the current location. If she/he has lived at the current location for a long time, which presumably is associated with stronger social bonds, migration becomes less likely even when the respondent perceives environmental problems.

Pooling all observations for the analysis, as we have done, does not take into account unit heterogeneity at the country level. Because we are dealing with internal migration, we consider this strategy appropriate. Focusing on internal migration implies that all factors at the country level, such as political system characteristics, national income, economic openness, political stability, levels of armed violence, etc., are constant and cannot explain a person’s decision to migrate. However, one problem might be that individuals’ general propensity to migrate differs from country to country. To test the robustness of our results we therefore use a conditional (fixed-effects) logit regression model.

Table 5 about here

The results (Table 5) show that our main conclusions do not change when we introduce fixed country effects. Both variables measuring “real” environmental stressors, namely, floods and droughts, are not significantly associated with decisions to migrate. Perceived environmental problems significantly increase individuals’ propensity to migrate, whereas long-term environmental problems are associated with a higher likelihood of adaptation.

In summary, our results indicate that it is important to consider the specific context in which environmental stressors could, in principle, influence decision to migrate. They show that environmental problems do not necessarily force people to migrate. The prevailing option, when facing environmental stress, is adaptation. Only when people perceive environmental threats as strong and do not have close ties to their current location are they willing to accept the costs of migration.

Conclusion

Does environmental degradation cause migration? While research on the environment-migration nexus has been conducted for some time, the issue has become highly salient in the context of the climate change debate. Various scientific studies and also many statements by policy-makers suggest that one major consequence of climate change could be that environmental events and processes force millions of people to move permanently or temporarily within their own countries or internationally. Migration on such a massive scale could lead to additional adverse outcomes, such as social unrest or even armed conflict (Laczko and Aghazarm 2009; Myers 1997, 2002).

Unfortunately, both the theoretical and empirical foundations for such claims are rather thin. We contribute to addressing this problem by developing a theoretical argument that considers different types of environmental stressors and their likely effects on individuals' choices to migrate or stay. Empirically, our research improves on existing studies in at least three ways: we take into account "real" as well as perceived environmental degradation, and we consider both sudden-onset and long term environmental problems; we use survey data for persons who migrated and for those who decided to stay; and we use data for a larger set of countries than prior research on the issue.

The results show that "real" sudden-onset as well as longer-term environmental problems, such as floods and droughts, are not significantly associated with migration choices. In contrast, individual perceptions of environmental degradation play an important role. This result lines up well with the argument that environmental degradation can have very asymmetric effects on people. While some persons may have the capacity to adapt, others regard a given environmental problem as a threat to their livelihood. Our results also show that individuals tend to respond to long-term environmental problems with adaptation, rather than migration. People prefer

adaptation over migration when facing long-term environmental problems and/or when perceiving environmental problems, but only if they are socially bonded to their current location.

The policy-implications of our findings are that a more differentiated perspective on the issue of environmental migration is urgently needed. It remains possible that abrupt and extreme climatic changes could force people to migrate permanently from some areas of the world, particularly from low-lying coastal areas in some developing countries. However, if the past provides any insights into what may happen in the future, our results suggest that most people prefer adaptation over migration, except if social bonds to their current location are weak. This finding applies both to slow-onset, longer-term and to sudden-onset, shorter-term environmental problems. The main implication is, therefore, that spectacular “climate refugee” scenarios (Laczko and Aghazarm 2009; Myers 1997, 2002) are probably exaggerated, and that financial and technical support for adaptation to environmental degradation resulting from climate change or other causes is the most productive policy-option.

Table 1: Variables

<i>Variable</i>	<i>Description</i>	<i>Data Source</i>
Migrants	Did respondent migrate: yes/no	EACH-FOR
Flood	Was a flood present at the last/current location	EM-DAT
Drought	Was a drought present at the last/current location: yes/no	EM-DAT
Long-term environmental problem	Did the respondent mention long-term environmental problems, such as desertification: yes/no	EACH-FOR
Perception of environmental problem	Were environmental problems present at the last/current location: yes/no	EACH-FOR
Female	Respondent's gender	EACH-FOR
Age	Respondent's age	EACH-FOR
Family member has migrated	Has a family member already migrated to the current location: yes/no	EACH-FOR
Rural background	Is the respondent from a rural background: yes/no	EACH-FOR
Long-term: economic	Did the respondent mention long-term problems in the form of economic losses: yes/no	EACH-FOR
Long-term: natural hazard	Did the respondent mention long-term environmental problems in the form of natural hazards: yes/no	EACH-FOR
Long term: pollution	Did the respondent mention long-term environmental problems in the form of pollution: yes/no	EACH-FOR
Long-term: drought	Did the respondent mention long-term environmental problems in the form of droughts: yes/no	EACH-FOR
Time spent at current/last location in months	How much time in months has the respondent spent at last/current location	EACH-FOR

Table 2: Descriptive Statistics

<i>Variable</i>	<i>Yes</i>	<i>No</i>	<i>N</i>
Migrants	454	148	602
Flood	300	302	602
Drought	44	558	602
Long-term environmental problem	205	397	602
Perception of environmental problem	202	400	602
Female	197	362	559
Family member has migrated	367	155	522
Rural background	329	273	602
Long-term: economic	66	536	602
Long-term: natural hazard	39	563	602
Long term: pollution	107	495	602
Long-term: drought	82	529	692

<i>Variable</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>N</i>
Age	40.892	12.495	17	87	509
Time spent at current/last location in months	288.926	227.263	2	1044	420

Table 3: Baseline Logistic Models

	(1)	(2)	(3)
flood	0.35 (0.270)	-0.53 (0.558)	0.33 (0.290)
drought	-0.35 (0.432)	0.54 (0.739)	-0.52 (0.447)
long-term environmental problem	-1.12*** (0.260)	-0.99** (0.468)	
long-term: economic			-1.03*** (0.392)
long-term: natural hazard			-1.83*** (0.432)
long-term: pollution			-1.38*** (0.300)
long-term: drought			0.68* (0.391)
perception of environmental problem	1.16*** (0.271)	1.22** (0.531)	1.15*** (0.283)
female	-0.95*** (0.271)	-0.31 (0.480)	-0.93*** (0.288)
age	-0.03*** (0.010)	0.52*** (0.104)	-0.03*** (0.010)
family member has migrated	0.62** (0.277)	0.56 (0.573)	0.58** (0.292)
rural	-1.56*** (0.318)	-1.71*** (0.546)	-1.62*** (0.328)
time spent at last place		-0.05*** (0.009)	
Constant	3.39*** (0.540)	3.22*** (1.085)	3.60*** (0.570)
Observations	492	390	492
N	492	390	492
Log Likelihood	-208.5	-64.33	-194.5
Pseudo R2	0.206	0.724	0.259
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1			

Table 4: Interaction Effects

	(1)	(2)
long-term environmental problem	2.32 (1.546)	-0.99** (0.474)
time spent at last place	-0.05*** (0.009)	-0.05*** (0.009)
time*long-term	-0.01** (0.004)	
time*environmental perception		-0.01** (0.003)
flood	-0.68 (0.570)	-0.51 (0.556)
drought	0.28 (0.749)	0.94 (0.784)
perception of environmental problem	1.27** (0.540)	3.97*** (1.500)
female	-0.10 (0.493)	-0.18 (0.491)
age	0.49*** (0.097)	0.50*** (0.104)
family has migrated	0.62 (0.577)	0.54 (0.579)
rural	-2.03*** (0.593)	-1.66*** (0.536)
Constant	2.31** (1.130)	2.12* (1.170)
Observations	390	390
N	390	390
Log Likelihood	-61.69	-62.17
Pseudo R2	0.735	0.733
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

Table 5: Conditional (Fixed-Effects) Logit Models

	(1)	(2)
flood	0.62 (0.422)	0.58 (0.433)
drought	14.50 (691.043)	14.29 (644.318)
long-term environmental problem	-1.03*** (0.331)	
long-term: economic		-0.98** (0.460)
long-term: natural hazard		-1.73*** (0.552)
long-term: pollution		-1.15*** (0.397)
long-term: drought		0.13 (0.466)
perception of environmental problem	1.27*** (0.309)	1.24*** (0.321)
female	-0.70* (0.359)	-0.76** (0.372)
age	-0.01 (0.012)	-0.01 (0.012)
family member has migrated	0.43 (0.342)	0.45 (0.364)
rural	0.48 (0.483)	0.32 (0.494)
Observations	329	329
N	329	329
Log Likelihood	-135.3	-127.2
Pseudo R2	0.176	0.225
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

Figure 1: EACH-FOR Field Research Surveys

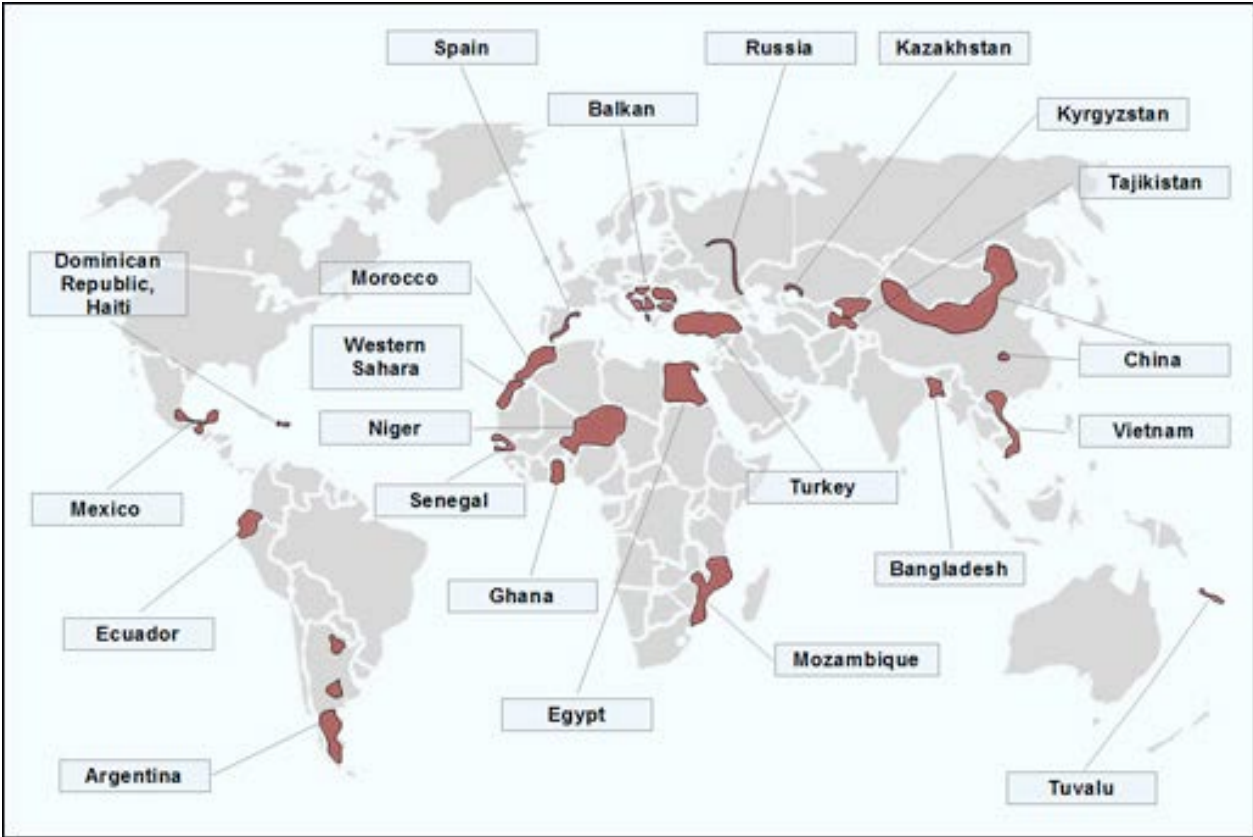


Figure 2: Interaction Effect: Long-Term Environmental Problem and Residency at Last Location

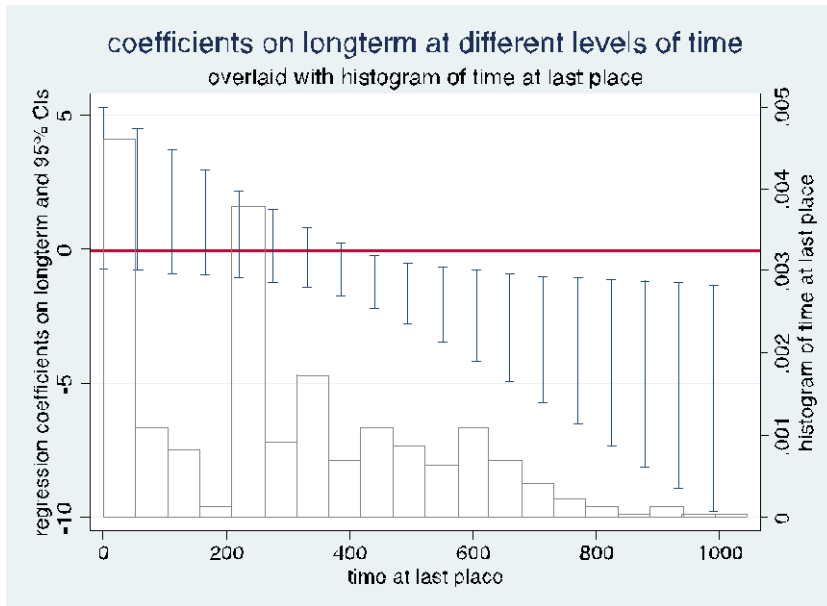
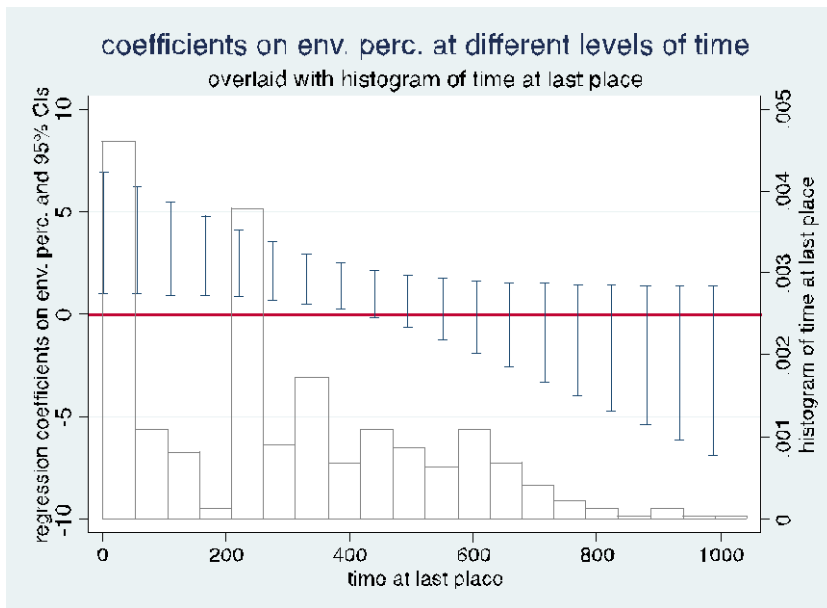


Figure 3: Interaction Effect: Perceived Environmental Problems and Residency at Last Location



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