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Working Paper

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WIDER Research Paper, No. 2008/85

Provided in Cooperation with:
United Nations University (UNU), World Institute for Development Economics Research (WIDER)

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World Institute for Development Economics Research

Research Paper No. 2008/85

Conflict, Disasters, and No Jobs

Reasons for International Migration from Sub-Saharan Africa

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October 2008

Abstract

Sub-Saharan Africa (SSA) has the highest growth rate in net international migration in the world. The reasons for this migration are investigated in this paper. First, a survey of the literature on the profile and determinants of international migration in SSA is given. Second, panel data on 45 countries spanning the period 1965 to 2005 are used to determine that the main reasons for international migration from SSA are armed conflict and lack of job opportunities. An additional year of conflict will raise net out-migration by 1.35 per 1,000 inhabitants and an additional 1 per cent growth will reduce net out-migration by 1.31 per 1,000. Demographic and environmental pressures have a less important direct impact, but a more pronounced indirect impact on migration through conflict and job opportunities. In particular, the frequency of natural disasters has a positive and significant effect on the probability that a country will experience an outbreak of armed conflict. Furthermore, there is no evidence of a 'migration hump' or of persistence in net migration rates in SSA, and no evidence that immigration is causing conflict in host countries.

Keywords: international migration, conflict, natural disasters, environmental degradation, environmentally forced migration, Africa

JEL classification: F22, J61, O15, R23, Q34, Q54

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This study has been prepared within the UNU-WIDER project on New Directions in Development Economics directed by Augustin Fosu.

UNU-WIDER acknowledges the financial contributions to the research programme by the governments of Denmark (Royal Ministry of Foreign Affairs), Finland (Ministry for Foreign Affairs), Norway (Royal Ministry of Foreign Affairs), Sweden (Swedish International Development Cooperation Agency—Sida) and the United Kingdom (Department for International Development).

ISSN 1810-2611 ISBN 978-92-9230-139-2

Acronyms

EVI	environmental vulnerability index (EVI)
IDPs	internally displaced persons
GMM	generalized method of moments
IPCC	International Panel on Climate Change
SOPAC	South Pacific Applied Geoscience Commission
SSA	Sub-Saharan Africa
UNEP	United Nations Environment Programme

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Typescript prepared by Liisa Roponen at UNU-WIDER

1 Introduction

Roughly a billion people live in absolute poverty, with a significant proportion of these in Sub-Saharan Africa (SSA). Over the last five decades economic development has stagnated in most of the continent. Africa is also the continent with the highest number of civil conflicts. It is already suffering from land degradation and freshwater scarcity, and climate change is expected to intensify these problems, causing more extreme weather conditions such as droughts and floods.[1] Therefore international migration from SSA countries can be expected to increase. Indeed, current rates of international migration from SSA are already high, and have increased dramatically in recent years. Africa is the region with the second largest population of international migrants, and the region with the highest growth rate in net migration, exceeding 275 per cent between 2000 and 2005. Concerns have been voiced about the loss of skilled labour (the 'braindrain') from the already poor countries (Adepoju 2006; Clemens and Pettersson 2008) and the potential that large-scale migration results in conflict (Smith 2007; Reuveny 2007).

Despite this pessimistic outlook, the reasons for international migration from SSA are not fully understood. According to a recent review, 'there is a relative lack of studies on international migration in SSA' (Lucas 2006: 337). More specifically, there is a lack of empirical studies into the determinants of international migration in SSA (Konseiga 2007; Lalonde and Topel 1997). Although an obvious determinant of international migration is conflict—and SSA has the largest number of refugees and internally displaced persons[2]—not much empirical work has been done to quantify the impact of conflict on international migration. As Lucas (2006: 365) points out, existing studies only proxy the effects of conflict, and have not considered 'direct indicators of the nature, duration, and intensity' of conflict. A third omission in the literature is the environmental factors and their relative importance as determinants of migration, in particular the impact of natural disasters. There is much anecdotal evidence on the extent and future potential of 'environmentally forced migration'; however, little empirical evidence has been forthcoming on the significance and extent of 'environmental migration'.

The contribution of this paper is to address these shortcomings by empirically investigating the determinants of international migration in SSA. The remainder of the paper will proceed as follows. A profile of international migration from SSA is provided in section 2. Section 3 discusses the determinants of international migration, with particular attention to economic, conflict and environmental determinants (including natural disasters). Section 4, using panel data from 1960 to 2005 on 46 countries, contains an empirical investigation into the determinants of international migration in SSA. Section 5 concludes.

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1 Reuveny (2007) discusses 38 cases of environmental migration events in recent years. Of these 15 occurred in Africa, involving more than 20 million people.

2 It is estimated that Africa accounts for one out of three refugees worldwide and around 13 million internally displaced persons (Black 2004).

2 Profile of international migration from SSA

2.1 The concept and role of international migration

Migration has been defined as 'the relocation of people within space that involves their permanent or temporary change of residence' (Mafukidze 2006: 103). When an international border is crossed, it constitutes international migration, which can be either voluntary or forced. Voluntary migration is most often associated with entrepreneurs taking advantage of opportunities abroad, or with highly skilled and talented individuals moving to better remunerated employment opportunities elsewhere (e.g., Solimano 2007). As such, voluntary migration can be said to reflect the operation of labour markets on a global level. In contrast, forced migration is seen as the international movement of people due to desperation. When such movement is for economic reasons, as when a particular economy is in crisis, the term 'economic refugee' is sometimes used. More properly, however, the term 'refugee' refers to people migrating internationally in order to flee political violence, war, civil conflicts, and persecution based on race, religion, nationality, or political opinions.[3] When people flee violence, war, and persecution but do not cross international borders, they are internally displaced persons (IDPs). As is showed below, one of the features of migration in SSA is the high level of both refugees and IDPs.

International migration, voluntary or forced, is widely recognized to be a fundamental adjustment mechanism in global labour markets and in household survival and welfare (Hatton and Williamson 2002; Adepoju 2006; Konsiega 2007; Solimano 2007). Views differ as to the impact of migration, with some considering it to have a negative influence on the development of poor countries, reinforcing the core-periphery patterns of international development (Mafukidze 2006: 105). Other researchers consider it to be positive in general for development (Stark 2004), while still others are more cautious and believe that the impact of international migration depends on how it is managed and whether or not it is mainly skill selective (Fratesi and Riggi 2007). What is important here is to recognize that international migration may affect a country's GDP and growth, its population demographics and may have an effect on conflict (in both the sender and receiving countries) and on the pressure on natural environment.

2.2 The extent of migration from SSA

Data limitations hamper an accurate assessment of migration in SSA. Existing data may underestimate its real extent (Akokpari 2000; Black 2004). Data on international migration are hampered by the fact that borders in SSA are porous, and that official statistics fail to capture informal/illegal migration (Akokpari 2000).

Available cross-country data collected by the UN Population Division, however, suggest that by 2005 in terms of the numbers of international migrants, Africa lagged behind only Europe and Central Asia. Of the estimated 190 million international migrants worldwide in 2005, 15.7 million were in SSA, the second largest number after Europe and Central Asia which account for 31.1 million. Despite having the second

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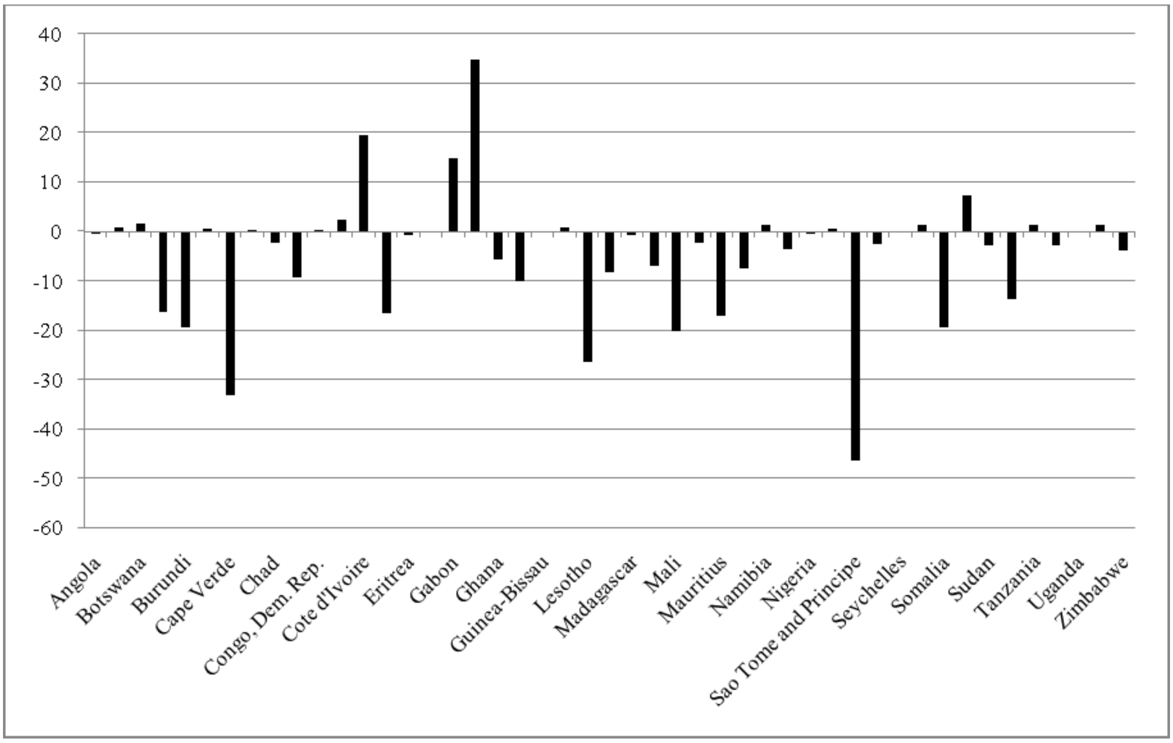
[3] See the 1951 United Nations Convention Relating to the Status of Refugees. Available at: www.unhcr.org/1951convention/.

largest migrant population, its rate of increase in net migration (275 per cent) is the highest of any region.

Figure 1 depicts international migration (by the number of migrants per 1,000 inhabitants) from SSA countries over the period 1960 to 2005. As Figure 1 shows, the relative extent of migration from SSA is the most substantial from the perspective of the small island states. Hence the largest net out-migration per 1,000 takes place in Cape Verde, Comoros, Equatorial Guinea, Mauritius, and Sao Tomé and Principe (as well as Lesotho which, although not an island, is a small country). These small island states have generally not experienced armed conflict to the extent of some others (e.g., Mozambique and Angola), but are reckoned to be environmentally vulnerable or at risk. According to the environmental vulnerability index (EVI) of the South Pacific Applied Geoscience Commission (SOPAC) and the United Nations Environment Programme (UNEP),[4] Mauritius is classified as 'highly vulnerable', Cape Verde, Comoros and Lesotho as 'vulnerable', and Equatorial Guinea and Sao Tomé and Principe as 'at risk'. Pelling and Uitto (2001) document the vulnerability of these small island states to natural disasters, identifying 65 natural disaster events that have impacted on Cape Verde, Comoros, Mauritius, and Sao Tomé and Principe between 1900 and 1997.

Figure 1 also shows that once size is controlled for, the extent of in-migration to South Africa is not as large as is commonly believed, and that The Gambia and Gabon experience far greater immigration per 1,000 inhabitants. These are relatively stable coastal countries, unaffected by water scarcity to the same extent as some of the countries in the region.

Figure 1
Net migration per 1,000 inhabitants in SSA, annual average over 1960-2005



Source of data: WDI online

4 See www.vulnerabilityindex.net/ .

2.3 Features of international migration from SSA

International migration from SSA countries is characterized by (i) migration flows that are very volatile, and (ii) most international migration from SSA nations is destined for other SSA countries (intra-SSA). These features are due to the impact of conflicts, seasonal weather patterns (environmental pressure) and artificial borders.

Consider the volatility of international migration from SSA. This can be seen in the fact that countries can alternate between net emigration to net immigration in the span of only a few years (Lucas 2006). In addition to the effects of natural disasters such as drought on the volatility of net migration, armed conflict also plays a significant role. SSA is the region with the highest number of refugees—more than 3.7 million in 2000. It is also reflected in the number of IDPs which at the end of 2006 stood at over 11 million (IDMC 2007). It is noted that once hostilities cease (as also when droughts end), refugees are quite quick to return to their countries. A further reason for the instability in migration patterns is the seasonal nature of international migration, particularly in the Sahel (Konsiega 2007).

Migration is also characterized in the SSA countries by the fact that most migration is confined to the continent (ECA 2006; Mafukidze 2006). One explanation is that a large proportion of the movement may be forced or seasonal migration, i.e., it is the intention of the migrants to return as soon as possible to their countries of origin. A second explanation may be the highly fragmented nature of nation-states in SSA, which has the highest number of countries per square kilometre in the world (Ndulu et al. 2007a: 102). Most of these states and their borders are highly artificial. The borders of SSA have been described as 'imposed arbitrarily, defended illogically and blamed incessantly' (Anon 1997: 17). As a result, these artificial borders may make international migration in the region seem much higher, as people do not need to travel great distances in order to be able to migrate internationally (Adepoju 2007).

3 Literature review

In this section the literature overview of the determinants of international migration is discussed under four headings: economic determinants, demographic determinants, conflict and environmental determinants.

3.1 Economic determinants

In the influential model of migration by Harris and Todaro (1970), the expected net economic returns from migration drive the decision whether or not to relocate. Thus potential migrants would consider differences in wages, as well as the probability of finding employment in a possible destination. In an extension to this literature, migration is seen as strategy at the household level, as opposed to the individual level, with both push and pull factors being taken into consideration (Akokpari 2000). Push factors would typically include declines in incomes and wages, rising unemployment and poverty, and a lack of basic amenities. Pull factors generally include better access to jobs, amenities, social services and education opportunities. Economic push and pull factors are widely considered as significant determinants in SSA, due to the fact that there has been overall economic stagnation in most of the continent since the 1980s, albeit with intra-SSA differences (Mafukidze 2006; Ndulu et al. 2007b).

The extent to which these economic push and pull factors eventually lead to international migration may depend on supra-national influences, including immigration laws in potential destination countries (Akokpari 2000; Myburgh 2004). These influences include the characteristics of the country, its degree of regional integration and content of its trade agreements, as well as the influence of globalization/openness.

3.2 Demographic determinants

Demographic determinants include the size, growth, density, and structure of a country or region's population. Population size, growth, and density are most often associated with the pressures these exert on natural resources. These may be the impetus to conflict and competition over scarce and/or valuable resources (Hatton and Williamson 2001; 2002). As such, this strand of the literature also emphasizes environmental factors—such as environmental degradation and natural hazards—as causes of international migration (Oliver-Smith 2006). These are discussed in more detail in section 3.4.

For the present, however, it can be noted that the structure of the population of a country may also be an important influence on migration. In this regard, as Hatton and Williamson (2002; also Lucas 2006; Adepoju 2007) point out, it is the younger people in particular who migrate more easily for economic reasons, as they have relatively more to gain in view of their longer expected lifespan. Hatton and Williamson (2002) include in their regression analysis a measure of the number of young people in a country's demographic make-up as a determinant of international migration, and find it to be statistically very significant.

A further aspect of the demographics is the social networks of the population. These can facilitate international migration by providing information, reducing travel costs, and helping assimilation (Smith 2007: 621). Once international migration has started, it may build up momentum on its own. Hatton and Williamson (2002: 559) describe the persistence in migration over time as the 'friends and relatives' effect: friends and relatives create a network that facilitates migration.

3.3 Conflict

It is generally accepted that political instability and armed conflict are among the most important determinants of international migration in SSA (Crisp 2006; ECA 2006; Mafukidze 2006; Adepoju 2007). Despite this recognition, very few studies so far have empirically analysed the impact of these factors on migration from SSA. In particular, none have used direct measures of political instability and conflict in relation to net migration. Using the stock of refugees in a country at the end of a particular year as dependent variable and various dummies for different types of conflict as explanatory variables, Hatton and Williamson (2001) investigate the effect of armed conflict on refugees. The authors capture the incidence of coups, guerrilla warfare, and civil wars, finding that these generate respectively 45, 30, and 64 refugees per 1,000 inhabitants.

Traditionally there has been less emphasis in the literature on how the consequences of international migration in SSA contribute to conflict. Recently, however, a number of authors point to the possible role of migration as a cause of conflict in destination countries (Reuveny 2007; Smith 2007). According to Reuveny (2007: 660) it is possible that environmentally forced migration is more likely to result in conflict between migrants and citizens in the destination country, because the ‘scope and speed’ at which it can occur (as for instance, after a natural disaster) does not allow the migrants to be ‘absorbed more slowly’. Smith (2007: 629) discusses how migrants are often seen as a burden, competing for jobs, resources, or even constituting a political threat. Salehyan and Gleditsch (2006) consider the possibility that migrants may ‘spread civil war’, and find that the probability of violent conflict is more than three times higher in migrant-receiving countries. In section 4 a panel data model is used to determine the extent to which conflict contributes to net migration from SSA, and to investigate whether or not migration contributes to violent conflict.

3.4 The natural environment and migration

Natural environment is an important, and perhaps the oldest, determinant of migration and displacement of people. It affects migration through three channels, namely through (i) scarcity of water and land, (ii) conflicts over natural resources, and (iii) natural hazards and natural disasters. Climate change is expected to intensify these three factors.

There are at least ten countries in SSA where more than 50 per cent of the population is severely disadvantaged with regard to water: Burkina Faso, Eritrea, Lesotho, Namibia, Niger, Senegal, Somalia, South Africa, Sudan, and Swaziland. In another nine, almost a third of the population is subject to water scarcity (Le Blanc and Perez 2007). Furthermore, water scarcity has a seasonal profile with up to 25 per cent of the SSA population experiencing water stress for 10 months or more a year (Vörösmarty et al. 2004: 13). Rainfall is unpredictable/irregular in many regions of Africa and may also be on the decline[5] (Barrios, Bertinelli and Strobl 2003).[6] In addition to water scarcity, most SSA countries are faced with land degradation (Semazzi and Song 2001; Bojö 1996).

How quick the migration response is to these environmental changes is uncertain. Environmental degradation often takes place slowly, leading to gradual migration. Moreover, as Reuveny (2007) points out, migration is not the only or the first response of the population to environmental degradation. People can also choose not to migrate by accepting lower living standards, or they can adjust to the environmental changes. The migration decision may depend on the ability and resources of a community to

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5 Declining rainfall is predicted to have serious negative effects on development. According to Barrios, Bertinelli and Strobl (2003), using cross-country panel regression methods, declining rainfall across SSA has had a significantly negative impact on economic growth rates: they estimate that it could explain up to 36 per cent of the gap in average per capita GDP between SSA countries and other developing countries.

6 There are still differences among the predictions of whether and to what extent average rainfall across Africa will change due to global climate change. There is, however, more agreement, as reflected in the International Panel on Climate Change’s predictions, that the continent will get warmer, and that it will experience more extreme weather conditions.

innovate and adapt (resilience), as well as the frequency and intensity of natural disasters.

With respect to the resilience of a community, Raleigh and Urdal (2007) find empirical evidence that water scarcity and land degradation may increase the risk of conflict, but note that these effects are ‘weak’ and that economic and political factors play a much more substantial role in the risk of conflict.[7] The difficultly with these findings is that conflict caused by resource scarcity may be due to inadequate institutions to mediate conflict and land degradation, so that the deep cause may not be environmental *per se*, but institutional (Tamas 2003). Poor SSA countries would be less able to manage potential conflict over resources than richer countries, and conflict is exacerbated in these countries by higher population growth and higher degrees of unequal access to resources (Homer-Dixon 1999; Fearon and Laitin 2003; Raleigh and Urdal 2007).

It can be noted that after Asia, SSA in terms of natural disasters has had the largest number of victims from natural disasters between 1974 and 2003, with more than 350 million affected (CRED 2004). Often these are due, or exacerbated by, environmental degradation, including changes in land cover due to human population/activity. Over the period 1974 to 2003, the annual number of natural disasters recorded in SSA increased more than 300 per cent. During this period, the countries most frequently hit by natural disasters included South Africa (56 occurrences), Ethiopia (54), Mozambique (46), Tanzania (38), Madagascar (35), Sudan (32), Nigeria (28) and Kenya (28).

One of the major natural hazards faced by SSA countries is the highly variable and unpredictable climate patterns (Washington, Harrison and Conway 2004). Droughts are a major natural hazard: SSA had the largest concentration of droughts in the world between 1974 and 2003 (CRED 2004: 122), affecting more than 200 million people (Reuveny 2007). The link between natural disasters and migration is stronger than the link between resource degradation and migration because often the unexpected disasters allow less time for adaptation, thus increasing the likelihood that people will migrate. Natural disaster, such as a sudden drought, can also ‘trigger’ armed conflict in the battle for the control of natural resources (Hendrix and Glaser 2007). In section 4 empirical evidence to support this idea is given, suggesting that natural disasters can have a significant indirect effect on migration through its influence as a trigger for armed conflict.

4 Empirical study

Having identified and discussed the most important determinants of international migration in SSA in the previous section, next I provide empirical estimates to quantify the relative impacts of these determinants on the decision to migrate.

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[7] Miguel, Satyanath and Sergenti (2004) find empirical evidence of a causal relationship from GDP growth to civil conflict.

4.1 Model

The economic approach to migration is based on the optimization behaviour of rational economic agents. The decision, influenced by push and pull factors, depends fundamentally on the net economic benefits from migration. The economic approach is useful when one deals with voluntary migration, but less useful when dealing with forced migration (Reuveny 2007: 658). During conflict or natural disasters, the 'traditional cost-benefit analysis of routine migration is superseded by the need for survival and/or protection of assets' (Ibánez and Vélez 2008: 659). Also, the incentive (option value) to wait, as in voluntary migration, may disappear.

Therefore, in order to derive a function to estimate the determinants of international migration from SSA that would allow consideration of both voluntary and forced migration, this paper follows Ibánez and Vélez (2008) who in a recent study propose a random utility model for displacement migration. They derive and test this model for internal displacement in Colombia due to violence. This model is extended here in two ways: (i) by including rapid natural environmental degradation and disaster as causes of forced migration (Ibánez and Vélez include conflict/security concerns only) and (ii) by considering international migration (they focus on internal migration only). In this regard the model derived here assumes a two-country setting: country *s* and country *m*, with households/individuals migrating both from *s* to *m*, and from *m* to *s*.

Basically the model states that any person or household, denoted by *i*, will migrate internationally if the utility from such a move exceeds the utility from remaining within a country; assume that households in country *s* will migrate if:

$$U_{im} > U_{is} \tag{1}$$

with U_{im} the indirect utility from migrating to country *m*, U_{is} the indirect utility from not migrating and remaining in country *s*.

In random utility models, indirect utility has a deterministic as well as random component (Ibánez and Vélez 2008). Thus the indirect utilities in (1) can be written as:

$$U_{im} = \mu_{im} + \varepsilon_{im} \tag{2}$$

and

$$U_{is} = \mu_{is} + \varepsilon_{is} \tag{3}$$

where $\varepsilon_{im}, \varepsilon_{is}$ are the random components and μ_{im}, μ_{is} are the deterministic components to utility.

The deterministic components reflect the main factors that individuals or households take into account when evaluating whether or not to migrate. Following the discussion in section 3, these will include relative wages or income opportunities (W_{im} vs W_{is}), the costs of migration (C_{im}), and the household's risk aversion (R_i). When considering international migration, these costs will be affected by the fact that borders (B_{im}) need to be crossed. Social networks may mitigate these costs/risk aversion, which may be a function of lagged international migration (L_{im}). Furthermore, individuals or households will take into account political instability and violent conflict (P_{im} vs P_{is}) and natural hazards (H_{im} vs H_{is}). It is assumed here, based on the discussion in section 3, that long-term, gradual environment degradation and population pressure affect income opportunities, so that $W_{is} = W_{is}(N_s, P_s)$ with N_s = environmental scarcity and D_s = population size and growth. Together (N_s,D_s) reflect demographic and environmental stress in a country.

Following Ibánez and Vélez (2008) the deterministic utility function of the individual/household i in country j ($j = s, m$) can be written as:

$$\mu_{ij} = \alpha W_{ij} + \beta C_{ij} + \delta P_{ij} + \gamma H_{ij} + \sigma R_{ij} + \theta B_{ij} + \emptyset L_{ij} \tag{4}$$

The probability of a household migration from country s is:

$$prob_{is}(migrate) = prob_i(\alpha W_{im} + \beta C_{im} + \delta P_{im} + \gamma H_{im} + \sigma R_i + \theta B_{im} + \emptyset L_{im} + \varepsilon_{im} > \alpha W_{is} + \delta P_{is} + \gamma H_{is} + \varepsilon_{is}) \tag{5}$$

Summing across all N-individuals/households i in country s at any given time results in total expected emigration from the country s to country m to be:

$$M_s^m = \sum_{i=1}^{N} prob_{is}(migrate) \tag{6}$$

With similar reasoning the expected emigration from country m to country s is:

$$M_m^s = \sum_{i=1}^{N} prob_{im}(migrate) \tag{7}$$

In any country j ($j = s, m$) the expected net rate of migration will be:

$$M_j^n = M_s^m - M_m^s = M^n(W, C, P, H, R, B) \tag{8}$$

If $M_j^n > 0$ the country j will experience net immigration (immigration exceeds emigration) and if $M_j^n < 0$, the country will experience net emigration (emigration exceeds immigration). In this paper the interest is in identifying the variables in (8) for which $M_j^n < 0$.

Equation (8) provides the basic framework for the empirical estimation in the remainder of the paper. It suggests that there are three 'groups' of time-varying determinants of net migration, namely economic opportunities and costs which include demographic and environmental stress (W, C, N, D), conflict and political variables (P) and natural environmental hazards (H). There are also time invariant determinants such as household/country fixed effects and borders (and other fixed geographical/institutional features). In the discussion on data below, the various possibilities in measuring these variables are explained.

4.2 Data and estimators

Data

The variables, the data, and data sources are summarized in Table 1. The dependent variable in subsequent regressions is net migration, corresponding to Equation (8). Using gross migration data would have been useful, but are unavailable (Hatton and Williamson 2001). As shown in Table 1, net migration is the net total of migrants during the period, i.e., the difference between the total number of immigrants and emigrants. These data, made available by the UN Population Division, have been taken for 45 SSA countries,[8] and are expressed as an annual average for the ten 5-year periods ending in 1960, 1965, 1970, 1980, 1985, 1985, 1990, 1995, 2000, and 2005.

A shortcoming in this paper that needs to be acknowledged is the quality and quantity of data, particularly on net migration. Already noted is the lack of gross migration data on the country level. The second aspect is, of course, the use of country-level data itself. The aggregated nature of migration data on a country level, and the fact that countries experience both inflow and outflows of migrants in any given year, reflecting the simultaneous push and pull factors, suggest that lower-level data, say on the household level, would be more appropriate. Third, as mentioned, there are difficulties in the accurate measurement of migration, so that the data used may not reflect the full extent of international migration. Fourth, existing data do not capture differences between short-term, temporary, or permanent migration, destination countries, nor of the composition of migrants (Lucas 2006).

Data on the various independent variables are grouped in Table 1 according to the major types of determinants identified earlier: economic opportunities, environmental degradation and demographic pressures, political instability and conflict, natural hazards and others.

As can be seen from Table 1, GDP per capita and GDP growth are used as indicators of the economic push and pull factors. GDP growth is generally used in the literature as a proxy for employment opportunities (e.g., Hatton and Williamson 2001; Lucas 2006). Furthermore, GDP per capita is postulated to be associated with a ‘migration hump’; that is to say, a nonlinear relationship is assumed between the level of GDP per capita in a country and the extent of international emigration. As Lucas (2006) explains, at low levels of per capita income, there are fewer people who can afford to overcome the fixed costs required for international migration. However, as the development level increases, people’s ‘expectations, desire and ability’ to migrate starts to increase (Adepoju 2007: 14). Thus a positive relationship can be expected between GDP per capita and net migration. At higher levels of per capita income, there are sufficient local opportunities for people to refrain from migrating. By including per capita GDP, we are able to test whether such a ‘migration hump’ exists in SSA; such evidence is currently lacking (according to Lucas 2006).

8 The countries included are Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, DR Congo, Rep. Congo, Côte d’Ivoire, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tomé and Principe, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. Due to data limitations Equatorial Guinea, Mayotte, and Seychelles are excluded.

Environmental degradation and demographic pressures are measured here by the degree of water scarcity and the proportion of the country's young population (between 15 and 24 years of age), following Hatton and Williamson (2001) in the latter. In this paper the percentage of land under irrigation is (an imperfect) proxy for water scarcity. In countries with less irrigation, there are perhaps less water resources available, and thus also a greater dependency on rainfall. Other possible indicators, such as the water stress index (see Ohlsson 1999) or the EVI (of SOPAC) were also considered, but these

Table 1
Summary of variables and data sources

Measures	Description	Sources of data
Variable: Migration		
Net migration per 1,000 inhabitants	Difference between emigration and immigration per 1,000 of a population. Provided as annual average over 5-year periods 1960-65, 1965-70, 1970-75, 1975-80, 1980-85, 1985-90, 1990-95, 1995-2000, 2000-05	UN Population Division; Available at: www://esa.un.org/unpp
Variable: Economic opportunities and costs of migration		
GDP per capita	Obtained as average GDP in constant 2000 international $ divided by total population per year over five-year intervals, 1960 to 2005. Time varying.	WB *World Development Indicators* online
GDP growth	Average annual growth in real GDP over five year intervals 1960 to 2005. Time varying.	WB *World Development Indicators* online
Variable: Demographic pressures and environmental degradation		
Young population	Proportion of population aged 15 to 24. Time varying.	UN Population Division Available at: www://esa.un.org/unpp
Land under irrigation	Measure the water scarcity in a country, taken as the hectares of arable land under irrigation. With less land under irrigation a country may have less water resources and may be more dependent on rainfall/susceptible to drought. Time varying.	WB *World Development Indicators* online
Variable: Political instability and conflict		
Armed conflict	The number of years during a 5-year period when there was civil war in a country, defined as at least 25 battle-deaths. Time varying.	UCDP PRIO Armed Conflict dataset: Available at: www.prio.no/CSCW/Datasets/Armed-Conflict/UCDP-PRIO/
Variable: Natural hazards		
Disasters	The total number of natural disasters in a country in a 5-year period between 1974 and 2003. Time varying.	CRED (2004).
Variable: Others		
Landlocked	A dummy variable = 1 if a country is landlocked and = 0 if not. Can be interpreted as an indicator of environmental stress, of ruggedness, as well as of openness to the world economy. Time invariant.	Africa Research Programme at Harvard University: Available at: www//africa.gov.harvard.edu/

indicators are only available for a single year—and were not found to induce any improvement in the results.

Population density is a potentially important determinant that not only affects economic opportunities but results in environmental stress. Following from the discussion in section 3, population density can therefore be seen as a proxy for land scarcity (Raleigh and Urdal 2007) and real wage pressure (higher population density can reduce wages) (Hatton and Williamson 2001). Potential problems exist in using population variables in a regression model on net migration: first, population variables are not likely to be endogenous. In other words, migration is likely to affect population variables, so that there is likely to be strong bi-directional causality between the variables. This consideration, as well as the fact that the UN Population division makes use of population growth patters in estimating net migration rates,[9] has influenced the decision not to use population growth rates in this paper as an independent variable in the regression analysis.

As far as political instability and conflict determinants are concerned, Table 1 shows that these are measured directly by the number of years during the 5-year period that were characterized by armed conflict (as measured by more than 25 battle-related deaths). It is generally accepted that armed conflict is an important determinant of out-migration, and one would expect to find a significantly negative relationship between violent conflict and net migration in the sample.

The effects of being subjected to natural hazards are measured here by the number of natural disasters that have taken place in a country during the period, but bearing in mind that not all natural hazards inevitably result in natural disasters. The data are taken from the Centre for Research on the Epidemiology of Disasters (CRED). It does not measure the intensity of the disaster in terms of either physical or monetary damages caused, or in terms of casualties. Whilst these are important, the frequency of disasters may be more important from the point of permanent emigration rather than once-off large disasters.

Finally, Table 1 indicates that a category of ‘other’ variables is also applied in the regression analysis, which includes whether or not a country is landlocked. People in landlocked countries may have greater difficulties in migrating internationally, if the aim is to migrate out of Africa. Also, to the extent that landlocked SSA countries may be experiencing more economic and environmental difficulties, migration from landlocked to coastal countries may be significant.

Estimating equation and estimators

Given that panel data methods are to be used, the implicit Equation (8) can be written in the following more explicit form:

$$m_{it} = x_{it}\beta + c_i + u_{it} \tag{9}$$

9 There is a very strong positive linear relationship between population growth rates and net migration rates in the sample. The correlation coefficient between these is 0.81.

For $i = 1,\ldots N$ and $t = 2,\ldots T$ and where m_{it} = net migration from country i over period t; x_{it} = a $1 \times K$ vector of explanatory variables which includes the variables set out in Table 1. As indicated in that table, some of these vary over t; c_i = unobserved country characteristics that are constant over the time period, and influence m_{it}; and u_{it} = a random error term with the usual properties.

The preferred estimator in this case is a dynamic panel data estimator, specifically the 'system GMM' estimator. This is because such an estimator allows one to deal with three issues which complicate the analysis with typical linear estimators such as OLS and 2SLS in the present case. First, one can expect important country-specific effects (c_i) to operate, which may cause omitted variable bias. Second, as was clear from the discussion in sections 2 and 3, the relationship between net migration and some of its expected determinants is complex, with the possibility of reverse causality. For instance, while population pressure can lead to out-migration, its very occurrence may act as a valve to relieve population pressure in a subsequent period. Similarly, net migration may affect economic opportunities by influencing GDP growth through changes in skilled labour. Third, migration is a dynamic process. In the case of SSA, it was noted that past levels of migration may influence current levels because of either persistence effects (networks, or 'family and friends') or instability (returning migrants). To allow for these factors, it is necessary to include lagged values of net migration in the estimation equation.

To show how the system GMM (generalized method of moments) estimator can be used, Equation (9) can be re-written in dynamic format as the following AR(1) model:

$$m_{it} - m_{it-1} = \Delta m_{it} = \gamma_t + \alpha m_{it-1} + x'_{it}\beta + c_i + u_{it} \tag{10}$$

This can be written more conveniently as:

$$m_{it} = \gamma_t + (\alpha + 1)m_{it-1} + x'_{it}\beta + c_i + u_{it} \tag{11}$$

where Δm_{it} = the difference in net migration over the period and γ_t = period-specific intercept terms, and u_{it} as defined earlier.

Taking first-differences of (11) gets rid of the time-invariant components, c_i which addresses the problem of omitted variable bias:

$$\Delta m_{it} = \gamma_t + (\alpha + 1)\Delta m_{it-1} + \Delta x'_{it}\beta + \Delta u_{it} \tag{12}$$

However, first differencing (11) introduces a further problem as it will result in the regressors becoming correlated with the error term (for instance Δm_{it-1} depends on u_{it-1}). To avoid this, instrumental variables need to be used for the endogenous regressors. Arellano and Bond (1991) propose using the lagged levels of the regressors (e.g., m_{it-j}) as instruments to avoid endogeneity—and derive a 'difference' GMM-estimator. Subsequently it has been shown that when the number of time periods used is relatively small, the lagged levels of the regressors might not be good instruments for differenced variables, especially if the latter follows a random walk (e.g., Bond, Hoeffler and Temple 2001). Following contributions from Arellano and Bover (1995) and Blundell and Bond (1998), it has now become standard to use a 'systems' GMM estimator which adds to the difference equation in (12) a further equation in levels, with the instruments in first differences. The system-GMM estimator therefore consists of estimating both (11) (which is in levels), using lagged differences (e.g., Δm_{it-j}) as instruments, and (12) (which is in first-differences), using lagged levels (e.g., m_{it-j}) as instruments (see Arellano and Bover 1995; Blundell and Bond 1998). A benefit of this systems-equation approach as opposed to the 'difference GMM' estimator is that one can now include time-invariant regressors which would otherwise by differenced out (Roodman 2006).

4.3 Regression results

Table 2 contains the 'system GMM' regression results. It can be seen from the diagnostics that the overall specification seems to be sound. The number of instruments does not exceed the number of groups, the Sargan test for over-identifying restrictions on the instruments cannot reject the null that these restrictions are valid, and the Arellano-Bond test cannot reject the null of no second-order autocorrelation. Furthermore, Table 2 reports both the normal *z*-values (column 2), the *z*-values obtained from estimating robust standard errors (column 3) and the coefficients from the two-step system-GMM estimator (column 4).

Table 2
System GMM estimates of the determinants of net migration in SSA
(dependent variable net migration), 1965-2005

(1) Variable	(2) Coefficients (one-step)		(3) Coefficients (robust one-step, SE)		(4) Coefficients (two-step)	
Intercept	-13.91	(-0.66)	-13.91	(-0.59)	-13.40	(-0.95)
Net migration (lag)	-0.24	(-2.43)**	-0.24	(-2.24)**	-0.21	(-2.46)**
GDP per capita	0.003	(1.13)	0.003	(1.05)	0.003	(1.17)
GDP growth	0.82	(6.82)**	0.82	(3.26)**	0.59	(3.25)**
GDP growth (lag)	0.49	(2.33)**	0.49	(2.86)**	0.30	(2.36)**
Population density (lag)	-0.13	(-1.70)*	-0.13	(-1.29)	0.006	(0.14)
Population 15-25 yrs (lag)	0.93	(0.84)	0.93	(0.81)	0.72	(0.98)
Land under irrigation	-0.03	(-0.06)	-0.03	(-0.08)	-0.30	(-1.53)
Natural disasters	-0.73	(-1.63)	-0.73	(-1.57)	-0.64	(-1.65)*
Incidence of armed conflict	-1.35	(-2.19)**	-1.35	(-2.39)**	-1.54	(-5.22)**
Landlocked	-4.30	(-1.08)	-4.30	(-0.82)	-3.26	(-0.73)
Diagnostics						
No. of observations	174		147		147	
No. of groups	41		41		41	
No. of instruments	19		19		19	
	Sargan test of over-identifying restrictions: χ^2 (8) = 10.73 p =0.22 (accept null that over-identifying restrictions are valid)		Arellano-Bond test for second-order autocorrelation prob > Z = 0.85 (accept null of no autocorrelation)		Sargan test of over-identifying restrictions: χ^2 (12) = 8.33, p =0.40 (accept null that over-identifying restrictions are valid)	

Note: z-ratios in parentheses. * and ** indicate statistical significance at the 10% and 5% level, respectively.

Source: Author's calculations

The results in Table 2 show that the variables which are consistently significant across columns 2 to 4 are the past levels of net migration, GDP growth, and armed conflict. Population density is significant when the one-step (non-robust) estimator is used, and so is natural disasters when the two-step estimator is used. The signs on the coefficients are as expected.

The results in Table 2 suggest that in forced migration, conflict and the quest for job opportunities are the most significant determinants of international migration in SSA. Armed conflict and GDP growth have the greatest impact on international migration, with the sizes of their respective impacts roughly similar. An additional year of conflict will raise net out-migration by 1.35 per 1,000 inhabitants while an additional 1 per cent growth will reduce net out-migration by 1.31 per 1,000. The latter results show the importance of taking lags into consideration: without lagged GDP growth, the impact of an additional 1 per cent growth on migration is only around 0.8 per 1,000, which is closer to other estimates in the literature (e.g., Hatton and Williamson 2001) where static estimation methods are used.

Past levels of migration have a significant influence on current levels. The fact that the sign on lagged migration is negative suggests a situation where there is cyclical or return migration rather than persistence in international migration flows. This confirms the patterns of volatility of international migration in SSA. It is also consistent with migration that is mainly forced. It can also be noted that GDP per capita is insignificant and enters with a positive sign, implying the absence of a ‘migration hump’ in SSA.

Population density is only significant in column 2 and has a negative (but relatively small) impact on net migration. Given the discussion in section 3, this is as expected. The reason for the negative coefficient on population density could reflect either lower relative wages, and/or population pressure on resources. Both reasons would result in a negative coefficient.

Overall, the results in Table 2 support the widely shared view that international migration from SSA is largely forced in nature, due in particular to armed conflict and political instability. It also supports the notion that economic and demographic factors lead to high rates of mainly voluntary migration. The role of natural hazards and more gradual environmental degradation and pressure on natural resources are more difficult to discern. Natural disasters enter with the right sign, but the coefficient just misses being statistically significant at the 10 per cent level when using the one-step estimator. Under the two-step estimator, the impact of natural disasters, however, is significant. Proxies for water scarcity (land under irrigation) and for being landlocked are consistently negative. Using direct measures such as the water stress index or the EVI also turns out to be insignificant. To the extent that population density is found to be negatively associated with net migration, it may be an indication that resource scarcity can matter. However, the coefficient on population density is small, so that one may conclude that unless natural disasters, environmental degradation, and resource scarcity substantially affect either conflict or job opportunities, their impact on emigration from SSA countries is not likely to be substantial.

Finally, some further remarks on the relationship between natural disasters, environmental degradation and resource scarcity and international migration are in order. As was mentioned, there is only slight indication from Table 2 that natural disasters may have an influence on migration in SSA. It is statistically significant in the two-step estimator, with a coefficient size that suggests that one additional natural disaster per year could lead to an increase in net out-migration of 0.6 per 1,000. Apart from population density, which can be seen as reflecting pressure on resources, other determinants related to environmental degradation and resource scarcity, such as irrigation, and water stress/environmental vulnerability index (not reported) are not found to be significant. However, these variables may affect conflict and job opportunities (GDP growth) and, as such, have an indirect impact on migration. In the Appendix further regression results are reported to investigate these potential channels, which confirm that natural disasters act as a trigger for conflict in SSA, and that natural disasters and reduced arable land may depress economic growth.

The Appendix includes two tables: Appendix Table A1 presents the results of a probit regression for the determinants of whether or not a country will experience conflict in a given year. The dependent variable is constructed as a dummy variable which is equal to 1 if a country experienced armed conflict in a particular year, and 0 if otherwise. Appendix Table A2 contains the system GMM results of the determinants of the number of years of conflict (intensity) in SSA. The independent variables in these regressions are based on the conflict in SSA literature (e.g., Collier and Hoeffler 1998; Welsch 2008). Thus in addition to natural disasters, these regressions include variables such as GDP, GDP growth, ethnic fractionalization (using the index in Alesina et al. 2003) and in the case of the probit regression, the EVI of a country (the proportion of land under irrigation is also used alternatively, but this turned out to be insignificant as in the system GMM estimation). Moreover, the variables applied in the regression results reported in the Appendix include the rate of net migration to test for the possibility that migration may influence conflict in a country.

The results in the Appendix show that in the outbreak of armed conflict, a probit regression finds that GDP per capita, ethnic fractionalization and the number of natural disasters are the most significant explanatory variables. Countries with a higher GDP per capita will have less probability of civil war; conversely countries with higher degree of ethnic fractionalization have a higher probability. These results are consistent with the extensive literature on civil conflict in SSA. What is novel in the case of the present results is the significant influence of natural disasters. Thus, as shown in Appendix Table A1, the number of natural disasters in a country raises its probability of being in civil war. This may be consistent with the hypothesis discussed in section 3 that natural disasters can act as a 'trigger' for conflict over scarce resources. From Appendix Table A1 the elasticity can be calculated: this indicates that an additional one disaster per annum (the average in the sample is 3.6) raises the probability that the country can fall into civil conflict by 1.75 per cent.

Appendix Table A2 shows that as far as the intensity of civil conflict is concerned (measured by the number of years of conflict), GDP growth reduces the intensity of conflict, and conflict in the previous year (lagged conflict) prolongs it (i.e., there is some persistence). Being landlocked also raises the duration of a country's conflict. One explanation for the significance of the landlocked variable is that it may reflect the fact that if institutions are lacking and conflict over natural resources do take place, it has a particularly detrimental impact on countries with a 'low degree of openness', such as Africa's landlocked nations (Arezki and Van der Ploeg 2007). Furthermore, Appendix Table A2 indicates that the number of disasters does not affect the duration/intensity of conflict, supporting the notion of natural disasters as the 'trigger' for conflict. Also, as shown in Table A1, the net migration rate (lagged here to avoid problems of reverse causality) has no significant affect on conflict.

Finally, the effects of natural disasters, environmental degradation and resource scarcity on GDP growth (which is generally seen as a proxy for job opportunities) in SSA are estimated. The detailed results (not reported here for the sake of brevity) find that the effect of the environmental variables on GDP growth is generally insignificant. Only the number of natural disasters is noted to be statistically significant with a one-period lag. Once institutions, geography and conflict are controlled for, the only environmental variable noted to be significant is the amount of arable land. This means that decreases in arable land, for instance through soil degradation, will lead to a decline in GDP growth. It is also observed that armed conflict has a statistically significant negative contemporaneous association with GDP growth, consistent with bi-directional causality between conflict and GDP growth. Finally, no evidence is found to suggest that migration has a statistically significant impact on GDP growth in SSA.

5 Concluding remarks

SSA already has the world's highest population of refugees, the second highest population of migrants, and the highest rate of growth in international migration. In this paper empirical evidence is presented to suggest that conflict and the quest for job opportunities are the most significant determinants of international migration in SSA. Specifically, armed conflict and GDP growth have the largest impacts on international migration. The sizes of their respective impacts are comparable: an additional year of conflict will raise net out-migration by 1.35 per 1,000 inhabitants and an additional 1 per cent growth will reduce net out-migration by 1.31 per 1,000. The size of the latter effect is significantly higher than the effect found earlier, for instance, by Hatton and Williamson (2001). Environmental factors are also important. It is noted that one additional natural disaster per year can lead to an increase in net out-migration of 0.6 per 1,000. Apart from population density, which can be perceived to reflect the pressure on resources, other determinants related to environmental degradation and resource scarcity, such as irrigation, and water stress/environmental vulnerability index are not found to be significant.

It has to be emphasized that disentangling the separate effects of these reasons for international migration is difficult. They interact in complex ways. Thus it is established that environmental variables affect conflict and job opportunities (GDP growth), and that conflict affects GDP growth. Specifically, the number of natural disasters in a country raises its probability of civil war. This is consistent with the view that natural disasters can act as a 'trigger' in the conflict over scarce resources. Also, in the absence of controlling variables, natural disasters are noted to have a negative impact on GDP growth, but with a period lag. Reductions in arable land, as would occur due to soil degradation, are also noted to depress GDP growth. The main impact of environment factors on migration from SSA countries can thus be said to occur through their impact on conflict and economic growth.

Finally, what policy implications emanate from these findings?

First, it has to be acknowledged by policymakers that international migration in SSA is both an adapting and mitigating strategy in the face of conflicts, natural disasters, and economic stagnation. Governments in recipient SSA countries should formulate strategies to better accommodate the inflows so as not to worsen the plight of people who have been largely forced to migrate.

Second, if confrontation can be limited further and if the continent can reverse its economic stagnation, the rate of out-migration from SSA countries will be reduced or perhaps even turned around—without significant efforts by governments to entice migrants back.

Third, SSA's growing (and predominantly young) population is putting pressure on the natural environment. Furthermore, global climate change is likely to lead to an increase in the frequency of natural hazards. It is noted here that both of these factors can fuel conflict, depress economic growth, and subsequently raise emigration. One policy response, also advocated by Le Blanc and Perez (2007), would be to attempt to reduce population growth. A further option is to reduce and reverse the extent of land degradation. More generally, however, policymakers, donors and the international development agencies should take care to strengthen state capacity and invest in building community resilience in SSA that could contribute towards reducing the likelihood of natural hazards developing into natural disasters.

Appendix

Appendix Table A1
Probit regression results for the likelihood of armed conflict in SSA and the impact of natural disasters, environmental degradation and migration on the likelihood of conflict

(1) Variable	(2) Coefficient	
Net migration	-0.020	(-1.03)
Natural disasters	0.05	(1.86)*
GDP per capita	-0.0003	(-1.83)*
GDP growth	0.01	(0.35)
Ethnic fractionalization	0.91	(1.78)*
Environmental vulnerability index	0.002	(0.82)
Pseudo R^2	0.06	

Note: z-ratios in parentheses. * and ** indicate statistical significance at the 10% and 5% level, respectively.

Source: Author's calculations

Appendix Table A2
System GMM regression results for the determinants of the intensity of armed conflict in SSA (dependent variable = number of years of civil conflict)

(1) Variable	(2) Coefficient (Robust SE)	
Intercept	-7.7	(-1.57)
Incidence of armed conflict (lag)	0.75	(3.30)**
Natural disasters	0.02	(0.31)
GDP per capita	-0.0005	(-0.82)
GDP growth	-0.08	(-4.08)**
Ethnic fractionalization	9.04	(1.45)
Net migration rate (lag)	0.006	(-0.22)
Land under irrigation	.12	(1.21)
Landlocked	4.55	(2.31)*
Diagnostics		
No. of observations	154	
No. of groups	41	
No. of instruments	17	
	Arellano-Bond test for second-order autocorrelation prob > Z = 0.85 (accept null of no autocorrelation)	

Note: z-ratios in parentheses. * and ** indicate statistical significance at the 10% and 5% level, respectively.

Source: Author's calculations

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