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Remittances and Natural Disasters

Ex-post Response and Contribution to Ex-ante Preparedness

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Abstract

Macro- and micro-economic evidence suggests a positive role of remittances in preparing households against natural disasters and in coping with the loss afterwards. Analysis of cross-country macroeconomic data shows that remittances increase in the aftermath of natural disasters in countries that have a larger number of migrants abroad. Analysis of household survey data in Bangladesh shows that per capita consumption was higher in remittance-receiving households than in others after the 1998 flood. Ethiopian remittance-dependent households seem to use cash reserves rather than sell livestock to cope with drought. In Burkina Faso and Ghana, international remittance-receiving households, especially those receiving remittances from high-income developed countries, tend to have housing built of concrete rather than mud and greater access to communication equipment, suggesting that they are better prepared against natural disasters.

This paper—a joint product of the Global Facility for Disaster Reduction and Recovery (GFDRR) Unit, Sustainable Development Network Vice Presidency, and the Migration and Remittances Team of the Development Prospects Group, Development Economics Vice Presidency—is part of a larger effort of the GFDRR unit to disseminate the emerging findings of the forthcoming joint World Bank-UN Assessment of the Economics of Disaster Risk Reduction. Thanks to Antonio C. David for his contribution to the macroeconomic analysis when he was at the Development Prospects Group in early 2008. We are grateful to the reviewer, Dean Yang, for his advice and suggestions, and to Saroj Kumar Jha, Mirafe Marcos , S. Ramachandran, Apurva Sanghi and participants at a workshop at the World Bank for their constructive comments. Ani Rudra Silwal provided excellent research assistance. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The GFDRR team leader Apurva Sanghi can be contacted at asanghi@worldbank.org. Correspondence regarding the paper should be addressed to Sanket Mohapatra at smohapatra2@worldbank.org.

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Keywords: Natural disasters, migration, remittances, poverty, coping strategies, insurance, development finance

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Remittances and Natural Disasters: Ex-post Response and Contribution to Ex-ante Preparedness

1. Introduction

The literature suggests that migrant remittance flows increase in the aftermath of natural disasters, macroeconomic or financial crises, and act as a safety net for households that have migrants abroad (World Bank 2006).[1] While there is anecdotal evidence and a number of case studies on this phenomenon, there is little empirical evaluation of the relationship between remittances and natural disasters (see next section for literature survey). In this paper we examine three inter-related questions:

(1) How do remittances respond *ex-post* to natural disasters?

(2) Do remittances help recipient households to maintain consumption expenditure in the aftermath of disasters?

(3) Are remittance-receiving households *ex-ante* better prepared for rapid-onset disasters such as earthquakes and floods?

We use cross-country macroeconomic data to examine the ex-post response of migrant remittances to natural disasters for a large sample of developing countries, income groups and geographical regions to examine the hypothesis that remittances respond in a countercyclical (compensatory) manner to natural disasters in the recipient economies.

This paper also relies on micro-level household survey data for several developing countries (Bangladesh, Burkina Faso, Ethiopia and Ghana) to understand how remittances sent by migrants residing in high-income and developing countries contribute to *ex-post* disaster relief for the affected households, and to *ex-ante* preparedness against future natural disasters.

To briefly summarize the results, we find that:

- Remittances increase in response to natural disasters in countries that have a larger emigrant stock as a share of the home country population.

[1] There are about 200 million international migrants. A large share of these international migrants or about 156 million people are from developing countries (Ratha and Shaw 2007). Migrants from developing countries sent home an estimated $305 billion in officially recorded remittances in 2008, with these flows larger than official aid and foreign direct investment in many developing countries.

- In the period after a flood in Bangladesh in 1998, per capita household consumption was higher for households that receive remittances, even after controlling for the possibility that these households may be self-selected.
- International remittance-receiving households in Burkina Faso and Ghana, especially those that receive remittances from high-income OECD countries, have housing built of concrete rather than mud and have greater access to communications, which can help in coping during natural disasters.
- Ethiopian remittance-receiving households tend to rely on cash reserves during shocks to food security, rather than sell productive assets such as livestock.

The rest of the paper is organized as follows. The next section reviews the literature on natural disasters, migration and remittances. Section 3 presents cross-country analysis on the *ex-post* response of remittances to natural disasters. In section 4, we explore using household survey data to analyze ex-post responses and ex-ante preparedness. Section 4.1 considers how remittances to Bangladesh helped households in maintaining consumption after a severe flood (a rapid-onset but predictable disaster) in 1998. Section 4.2 considers for Burkina Faso and Ghana whether remittance-receiving households are ex-ante better prepared for rapid-onset disasters such as earthquakes and landslides. This section provides an analysis of how recipient households often use remittances for investment in stronger housing and improving access to communication, which can help in reducing vulnerability to natural disasters.[2] Section 4.3 explores the coping strategies used by remittance-recipient and non-recipient households in Burkina Faso with predictable and recurrent droughts. Section 5 concludes.

2. Natural disasters, migration and remittances: Review of the literature

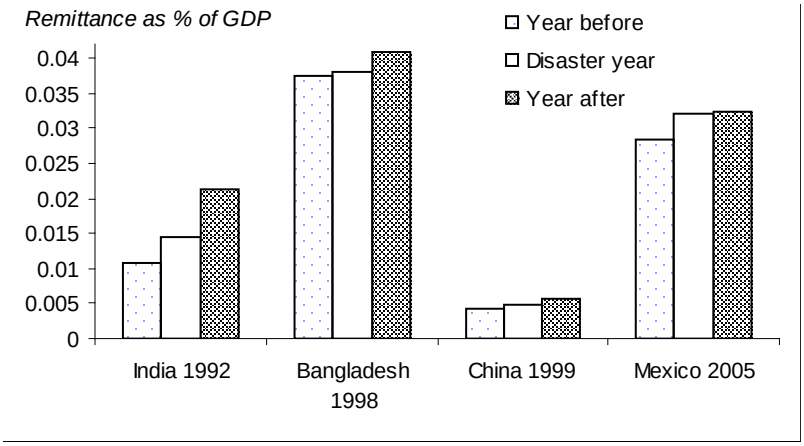
This section provides a review of the response of remittances to natural disasters drawing on the macro economic literature and household level studies. Anecdotal and case study evidence seem to suggest that contrary to private international capital flows (which are usually procyclical), remittance flows increase or remain stable after the onset of large shocks such as natural disasters, macroeconomic or financial crises and armed conflicts (Clarke and Wallsten, 2004, World Bank, 2005 and Weiss Fagen and Bump, 2005). Yang (2007) provides cross-country evidence on the response of international flows to

[2] Such income shocks may be factored in the inter-temporal consumption and remitting decisions.

hurricanes, and concludes that for poorer countries, increased hurricane exposure is associated with greater remittance flows. In addition, it is estimated that in the Caribbean, a 1 percent decrease in real gross domestic product (GDP) is associated with a 3 percent increase in migrant remittances with a two-year lag (Mishra 2005). Figure 1 and Figure 2 provide certain instances of the response of remittances to large natural disaster in selected countries.

Furthermore, there is an emerging consensus in the literature that migration and remittances are part of an overall livelihood strategy by which households try to insure against shocks in disaster prone regions. Migration flows increased in the aftermath of disasters as in Jamaica in 1989 after hurricane Gilbert and in Central America in 1998 after hurricane Mitch (Wisner, 2003). In El Salvador, an agricultural shock increases the probability of migration of a household member to the United States by 24.3 percent (Haliday 2006).[3] Increased migration can lead to an increase in remittance transfers to the households after disaster events, but with a lag (Attzs, 2008).[4]

Figure 1: Increase in remittances after large natural disasters (disaster costs in constant 2000 US dollars)

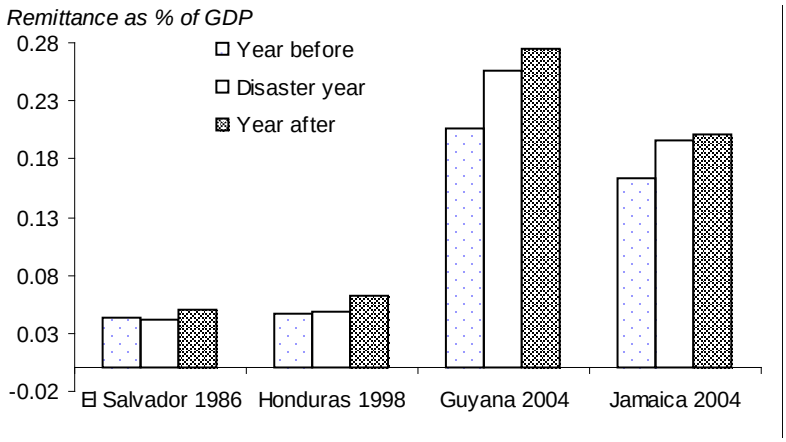


* These represent the years in which developing countries experienced the highest damages from natural disasters in constant 2000 US$. Estimated damages due to natural disasters were $9.4 billion in India in 1992, $4.5 billion in Bangladesh in 1998, $10.4 billion in China in 1999, $6.9 billion in Mexico in 2005. Damages are in constant 2000 US dollars.

[3] However, Yang (2007) shows for El Salvador that idiosyncratic shocks to the household such as death of a household member increase the likelihood of emigration, while covariate shocks such as earthquakes, where the entire population is affected, can even reduce emigration.

[4] Furthermore, if migration and remittance decisions are undertaken as a part of the overall coping strategy by households in disaster prone regions, we may not necessarily observe a marked increase in remittances in the wake of slow onset disaster event such as drought since remittances are factored into the inter-temporal consumption decisions and will not change much unless there is an idiosyncratic shock.

Figure 2: Increase in remittances after large natural disasters (disaster costs as share of GDP)



* These represent the years in which developing countries experienced the high damages as a share of GDP from natural disasters. Damages due to natural disasters were 0.04 percent of GDP in El Salvador in 1986, 0.08 percent of GDP in Honduras in 1998, 0.01 percent of GDP in Guyana in 2004 and 0.01 percent of GDP in Jamaica in 2004

Migrant remittances have an important consumption-smoothing effect and can contribute to financing household investment in concrete housing and communication equipment to increase ex-ante preparedness and to mitigate the impact of disasters in disaster prone areas. Several country studies using household survey data confirm the consumption smoothing role played by remittances in recipient households (see Quartey and Blankson 2004). Yang and Choi (2006) show for the Philippines that remittances help to compensate for nearly 65 percent of the loss in income due to rainfall shocks.

Evidence from small-scale surveys conducted after disasters suggest that migrant remittances may have helped recipient households. A survey of households in four villages in Pakistan after a devastating earthquake in 2005 reveals that migrant remittances were important factors in disaster recovery and reconstruction (Suleri and Savage, 2006). The authors suggest quickly restoring banking and financial services to facilitate remittance flows. Remittance-receiving households in the Aceh region of Indonesia were found to have recovered faster from the 2004 Tsunami though because of immediate relief provided by migrant remittances, although remittance transfers were adversely affected due to the disruption of financial services and informal remittance transfer channels (Wu 2006).

In Gonavies, the largest city in Haiti, in-kind transfers from friends and relatives abroad, especially in the United States, after the cyclone Jeane in 2004 played an important role in relieving the immediate distress from the devastation caused by the cyclone (Fagan 2006). There was a 15 percent increase in remittances to Granada after

hurricane Ivan in 2005, which helped the households to recover from the disaster (Harvey and Savage 2007). Increased remittances helped to smooth household consumption and compensate for the loss of assets after an earthquake in El Salvador in 2001 (Haliday 2006).

There is increasing emphasis in the policy debates on measures that can reduce the *ex-ante* vulnerability to natural disasters.[5] In disaster prone regions or countries, ex-ante actions taken by households with migrants (community and the government) in preparation for a possible disaster can substantially reduce the loss of human life and vulnerability in the aftermath of the disaster. For example, programs to reduce the impact on livelihoods have been introduced in countries such as Jamaica that face recurrent devastating cyclones.[6]

However, although there is substantial evidence of how remittances sent by migrants abroad contribute to ex-post responses, there is little evidence of how remittances can facilitate *e*x-*ante* preparedness that reduces the extent of damages in the event of a natural disaster.[7] For example, remittances can contribute to disaster preparedness by households by making resources available for investments in home improvements so as to increase their disaster resilience. Collective remittance incomes and diaspora contributions can be channelized to augment the efforts of the government and international organizations by providing disaster resistant houses.

3. Macroeconomic evidence of the response of remittances to natural disasters

In this section, we empirically investigate the following question for a large sample of developing countries and across income groups and geographical regions: Do remittances respond in a countercyclical or compensatory manner to natural disasters in the recipient economies?

[5] The Hyogo framework (www.unisdr.org/eng/hfa/hfa.htm) recognizes the importance of integrating disaster concerns in the larger context of development and vulnerability reduction**.**

[6] For example, these include green houses for horticulture that can be easily disassembled and reassembled before and after hurricanes (UN News Center "To Succeed, Disaster Management Strategies Must Target, Reduce Inequalities, Vulnerabilities Faced By Poor, UN Economic and Social Council told." 16 July, 2008 (http://www.un.org/News/Press/docs/2008/ecosoc6363.doc.htm)).

[7] There is some evidence from a related literature on household coping strategies that receiving additional income may reduce ex-ante vulnerability. Udry (1994) finds for a sample of rural households in northern Nigeria that households facing increased weather variability deplete grain inventories at a slower rate to cope with the possibility of income shocks due to weather fluctuations. In a similar work, Paxson (1992) finds for a sample of rural farmers in Thailand that farm households experiencing rainfall shocks save a significantly larger portion of transitory agricultural income in order smooth consumption from income fluctuations. In another study, Rosenzweig and Wolpin (1993) show that farmers in India are more apt to sell bullocks when they experience income shocks.

The empirical exercise is undertaken primarily to understand whether remittances respond to natural disaster events in home countries.

3.1 Data

The outcome variables of interest are migrant remittances to a country *i* in a year *t*. The econometric analysis is based on estimates of remittance flows to developing countries from the World Bank's World Development Indicators (WDI). Data on GDP per capita and population comes primarily from the same source. Summary statistics of the different flows and other variables of interest are presented in table 1.

Natural disaster data on the occurrence and effects of natural disasters are from Center for Research on the Epidemiology of Diseases (CRED), International Emergency Disasters Database (EM-DAT).[8] CRED defines a disaster as a natural situation or event which overwhelms local capacity, necessitating a request for external assistance (Noy, 2008, EM-DAT Glossary of terms). These disasters can be grouped into several categories, of which meteorological disasters (floods, wave surges, storms, droughts, land slides and avalanches), climatological disasters (disasters caused due to long run or seasonal climatic variability such as drought, extreme temperatures and wild fire) and geophysical disasters (earthquakes, tsunamis and volcanic eruptions).

Each of these categories mentioned above are not mutually exclusive and should be considered more as a typological classification. In our analysis, we focus primarily on all disaster events taken together within a country in a year rather than each of them examined separately. A reason for the focus on the total impact of all disasters in this paper is the possibility that different regions in a country can be affected by different types of disasters in a given year and since remittances data is available only at annual frequency at the country level, we would not be able to separate the response of remittances for a specific disaster.

[8] The Center for Research on the Epidemiology of Diseases (CRED) has collected and made publically available data on the occurrence and effects of natural disasters from 1900 to the present with a worldwide coverage. The database is compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutions and press agencies. The EM-DAT data is publicly available on CRED's web site at: www.cred.be.

Table 1: Summary statistics for developing countries

Variable	Obs.	Mean	Standard deviation
Remittance as a share of GDP	3,974	3.4%	7.9%
Private debt as a share of GDP	3,976	0.7%	2.6%
Portfolio equity as a share of GDP	3,661	0.1%	0.5%
Emigrants as a share of origin country population	4,995	9.2%	12.1%
Per capita GDP (constant 2000 US$)	4,035	1,469	1,530
Number of people killed per 100,000 population	2,068	6.47	72.5
Number of people affected per 100,000 population	2,142	4,148	12,295
Disaster damage as a percentage of GDP	898	0.004%	0.02%

We utilize reported measures of the total amount of direct damage (DDAMAGE), the total number of people killed (DKILLED) and the total number of people affected (DAFFECTED) for the years 1970- 2006 for all countries on which data is reported in EM-DAT. The literature on the macroeconomic impact of natural disasters has used similarly aggregated variables (see Noy 2008).

3.2 Empirical strategy and estimation

This section will attempt to provide more systematic cross-country evidence using data on all available countries on the possible existence of this "countercyclical" or compensatory effect of remittance flows in the context of natural disasters at the aggregate level.

The cross-country regression is estimated for the following specification:

$$\begin{aligned} Y_{i,t} = \; & \alpha + \beta * Y_{i,t-1} + \gamma 1 * \text{Disaster variable}_{i,t-1} + \gamma 2 * \text{Disaster variable}_{i,t-1} \\ & + \delta 1 * \text{Disaster variable}_{i,t-1} * \text{Emigrantstock}_i \\ & + \delta 2 * \text{Disaster variable}_{i,t-1} * \text{Emigrantstock}_i \\ & + \text{Region dummies}_i + \text{Time trend} + \text{error}_{i,t} \end{aligned}$$

where Y_{it} is the remittances as a share of GDP. The disaster variable is disaster cost as share of GDP in the previous year, or people affected or killed as share of population in the previous year. We include an interaction term for the stock of emigrants and the disaster variable in a country in a given year. Other controls include per capita GDP, region fixed effects and time trend. We introduce lagged remittances as an additional explanatory variable to account for the observed persistence of remittance flows over time.

As in several previous studies (Yang 2007), we use cross-country (panel) fixed effects regression. The fixed effects control for unobserved country specific

heterogeneity. Our analysis differs from the previous works in that we have used a large subsample of developing countries (129 countries) for which the data is available. Also this is one of the first studies on the determinants of the remittance flows to explicitly introduce emigrant stocks as a share of the home country population.

3.3 Results

The cross-country results show that remittances increase in response to disasters, especially for countries that have larger stocks of migrants abroad. For every $1 disaster cost, remittances would increase by $0.5 (-2.0 + 24.6*0.10) for a country where the emigrant stock is about 10 percent of the origin country population (see table 2). In the subsequent year, the increase would be an additional $1 (-1.97 +29.7*.10). Over a period of two years, remittances for such a country would increase by $1.5.

Table 2: Remittances increase in response to disasters

Dependent variable: Remittances as share of GDP	Disaster variable: Disaster cost/GDP	Disaster variable: People affected/ population	Disaster variable: People killed/ population
Disaster variable	-2.00	-0.01*	-0.79
Disaster variable lagged	-1.97	-0.01**	-0.45
Disaster variable x Emigrant stock/origin country population	24.6	0.06***	24.5
Disaster variable (t-1)x Emigrant stock/origin country population	29.7*	0.06	15.1
Lagged Remittances/GDP	0.81***	0.80***	0.81***
Observations	3,682	3,682	3,682
R-squared	0.87	0.88	0.88

* significant at 10%; ** significant at 5%; *** significant at 1%

Second, for a country with 10 percent emigrant stock as a share of population, for each 0.01 percent of population affected by a disaster, remittances would increase by 0.5 percent of GDP contemporaneously and by another 0.5 percent in the next year. Over a period of two years, remittances to that country would increase by 1 percent of GDP. The results are not significant for people killed.

4. Analysis of the role of remittances in ex-post responses and ex-ante preparedness using household surveys

Remittances may have a positive impact on consumption, housing and human capital accumulation in remittance-receiving households when compared to households that do not receive remittances. We also analyze whether receiving remittances enable households to be better prepared for unforeseen shocks. We test the following hypotheses using household survey data: (1) remittances are positively associated with absolute levels of household per capita consumption; and (2) remittance-receiving households have concrete houses and better access to communication that can reduce vulnerability to natural disasters such as earthquakes and floods.

4.1 Data and methodology

We use household survey data for Burkina Faso (2003), Ghana (2005) and Bangladesh (1998-99). In particular for Bangladesh, we have three rounds of data collected on households after the devastating flood of July-September 1998. The first round was conducted in November- December 1998, the second round in April- May 1999 and the third round was in November- December 1999.

To assess the long-term effects of remittances on current consumption, we first have to deal with the issue of self-selection: many of the factors that determine remittance-recipient status could determine the level of per capita household consumption. We use propensity matching techniques to compare the current consumption outcome between two groups: those households which receive remittances, with their "control" group constructed by matching each observation in the remittance-recipient group with their best match according to a series of factors prior to receiving remittances (Heckman, Ichimura, and Todd, 1997, 1998). This procedure helps us to control for the endogeneity of remittance-receiving status to a large extent on the basis of observable characteristics of the households.

In the regression analysis, we include factors that determine remittance-receiving status as follows: (1) age of the household head; (2) educational attainment as shown by the number of household members with primary, secondary and tertiary education; (3) physical capital such as land and other assets, (4) household's maximum education attainment or head' level of education, (5) current area of residence (urban or rural), (6) number of children below the age of 5, (7) number of adult male members, and (8) regional dummies. In some specifications, we include additional factors that determine per capita consumption such as whether the household receive public assistance and more detailed asset variables.

4.2 Role of remittances in maintaining consumption after 1998 flood in Bangladesh

Three waves of representative household surveys were conducted after a flood in 1998 in Bangladesh within four to sixteen months after the flood by the International Food Policy Research Institute (IFPRI) to understand how households cope with the flood. These surveys also provide information on the pre-flood asset holding and the migration and remittance histories of households (see annex table 1). The first round of the survey contains information on various measures of the severity of flood at the village level, such as the depth of water in the house, number of days water remained in the house, number of days evacuated, cost of repair and a flood index developed by IFPRI using the above flood measures.

Table 3. Bangladesh: Impact of receiving remittances on per capita household consumption one year after the flood after controlling for the endogeneity of remittances for flood affected-areas

Dependent variable: Per capita monthly household consumption (takas)

	(1)	(2)
Average monthly remittances received by household in the last six months (thousands of takas)	24.4*	24.6*
	(13.7)	(13.6)
Average monthly public assistance received by household in the last six months (thousands of takas)	-269.9	
	(509.4)	
Log of pre-flood assets-consumer durables	30.9***	31.2***
	(8.2)	(8.2)
Log of pre-flood assets-food stock	-5.0	-4.9
	(7.0)	(7.0)
Log of pre-flood assets-livestock	0.7	1.0
	(4.5)	(4.5)
Household has electricity	183.1***	183.7***
	(59.1)	(59.1)
Per capita land of household	6.5***	6.6***
	(1.3)	(1.3)
Maximum years of education in household	11.2*	11.5*
	(6.6)	(6.6)
Number of primary educated in household	-25.8**	-26.4**
	(11.8)	(11.8)
Number of secondary educated in household	18.6	17.9
	(20.5)	(20.5)
Number of tertiary educated in household	1.7	0.8
	(76.1)	(76.0)
Number of children below age 5 in household	-69.0***	-69.2***
	(15.7)	(15.7)
Number of males above age 15 in household	73.2***	73.5***
	(18.8)	(18.7)
Number of pre-flood migrants from household	-6.0	-6.1
	(15.9)	(15.9)
Constant	180.8	174.1
	(219.7)	(219.2)
Observations	469	469
R-squared	0.41	0.41

Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Of the 734 households which are available in all the three surveys, 493 were affected by the 1998 flood. Using propensity matching technique, we identified 469 households which are comparable in terms of household characteristics and other determinants of remittance-receiving status. Among these 469 households, around 118 or 25 percent of households receive remittances.

In table 3, we examine the impact of remittances on per capita monthly household consumption sixteen months after the flood for households in the flood affected areas. The analysis is performed on all households comparable to remittance-receiving households in terms of observable characteristics. We find that remittances have a positive and significant effect on per capita monthly household consumption. Since the average household size is 6.4, a thousand taka increase in remittances to the remittance-recipient households leads to about a 156 taka (=6.4 x 24.37) increase in monthly household consumption expenditure of the average household (including those do not receive remittances).[9]

4.3 Ex-ante preparedness of remittance-receiving households for rapid-onset disasters in Ghana and Burkina Faso

We use the latest available Ghana Living Standard Measurement Survey (GLSS V) 2005, to estimate the impact of remittances on ex ante preparedness of households. Of the 8687 households in the sample, 2181 households (25 percent) receive domestic remittances, while 541 (6.5 percent) receive remittances from OECD countries and 122 (1.5 percent) receive remittances from African countries (see annex table 2). Since we can identify the source of remittances, we can distinguish the differential impact of remittances from relatively richer OECD countries and poorer African countries on the receiving households. However endogeneity of remittance-receiving status needs to be controlled for in our analysis. As in the previous section, we used propensity score matching to construct comparable households on the basis of observable household characteristics.

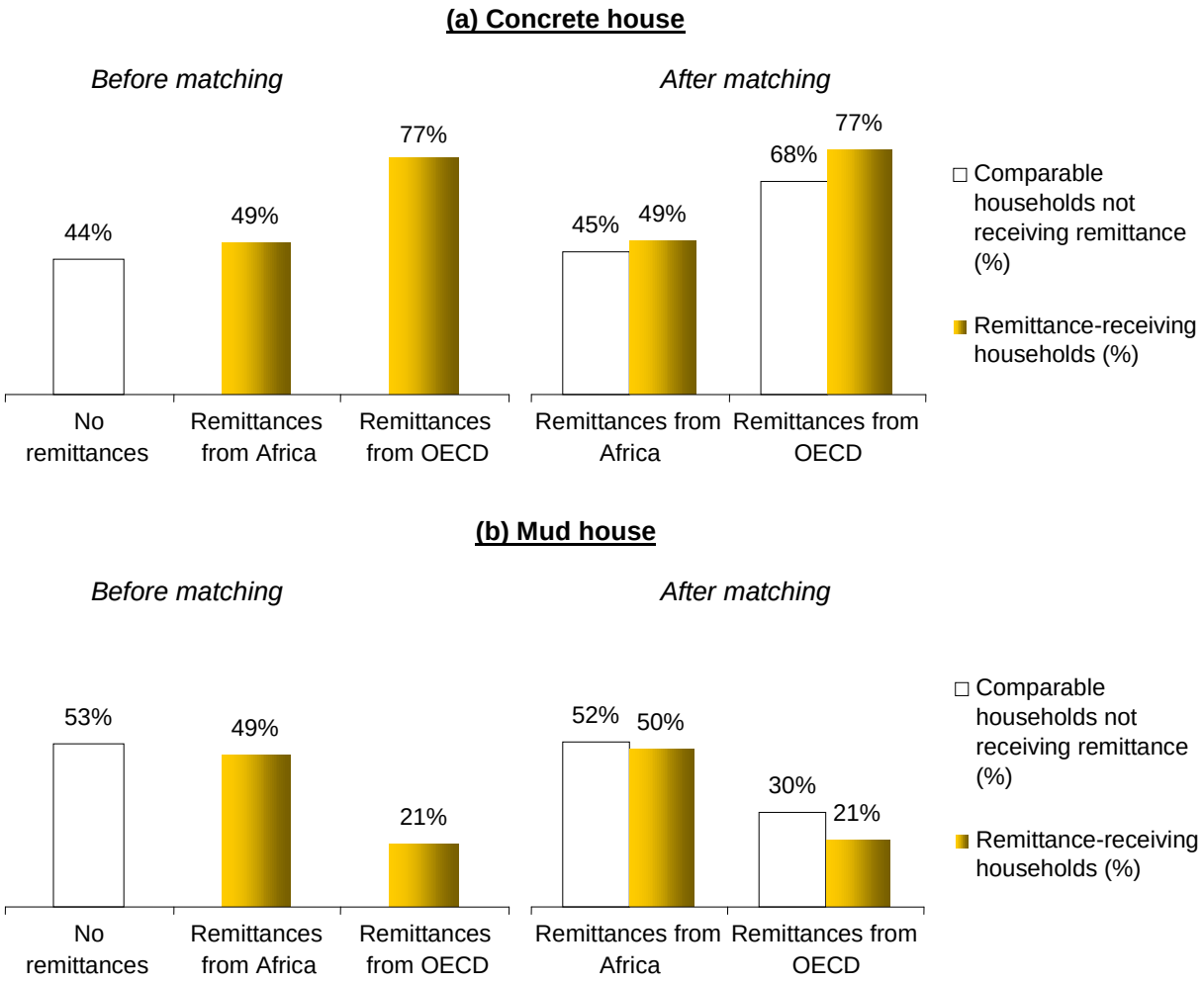
Materials used for the construction of the house potentially reveal how prepared households are in the event of rapid-onset disasters such as flood, cyclones and landslides. Concrete houses are usually more disaster resilient, while houses made of mud and bricks are more susceptible to destruction in the event of a disaster. Ghanaian households that receive international remittances tend to have a concrete house. Without

[9] That would imply a marginal propensity of consumption of 62% out of additional remittances (since the estimated increase in consumption above is the average increase for the matched sample which includes households that don't receive any remittances). This appears to be lower than the average propensity to consume likely because of the use of remittances for reconstruction after the flood.

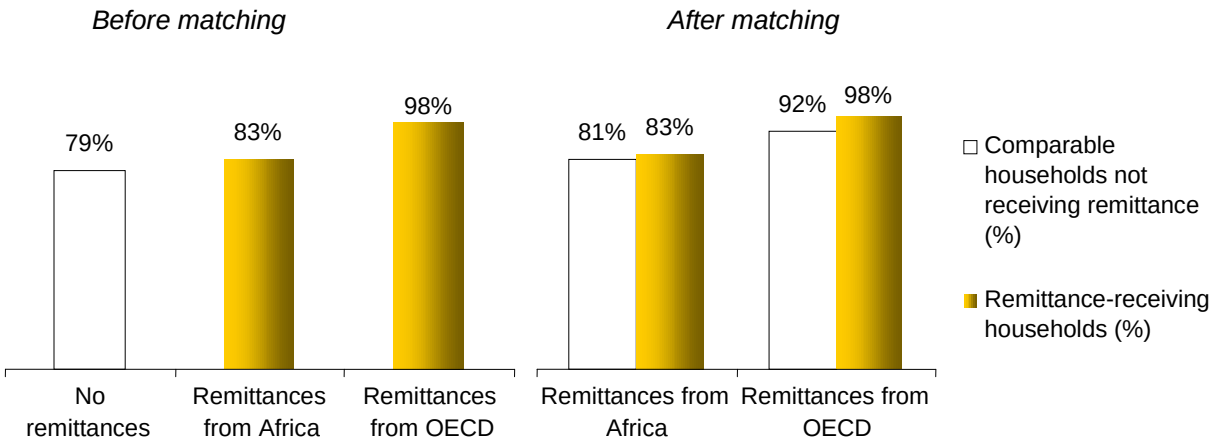
controlling for endogeneity of the remittance-receiving decision, 44 percent of Ghanaian households that do not receive remittances have a concrete house. 49 percent of households that receive remittances from other African countries have a concrete house and 77 percent of households that receive remittances from OECD countries have a concrete house.

After controlling for endogeneity of remittance-receiving status, 77 percent of Ghanaian households that receive remittances from OECD countries have a concrete house versus 68 percent of comparable households that do not receive remittances (see figure 3 and annex table 3). Of households that receive remittances from other African countries, 49 percent have a concrete house, versus 45.3 percent of comparable households that do not receive remittances.

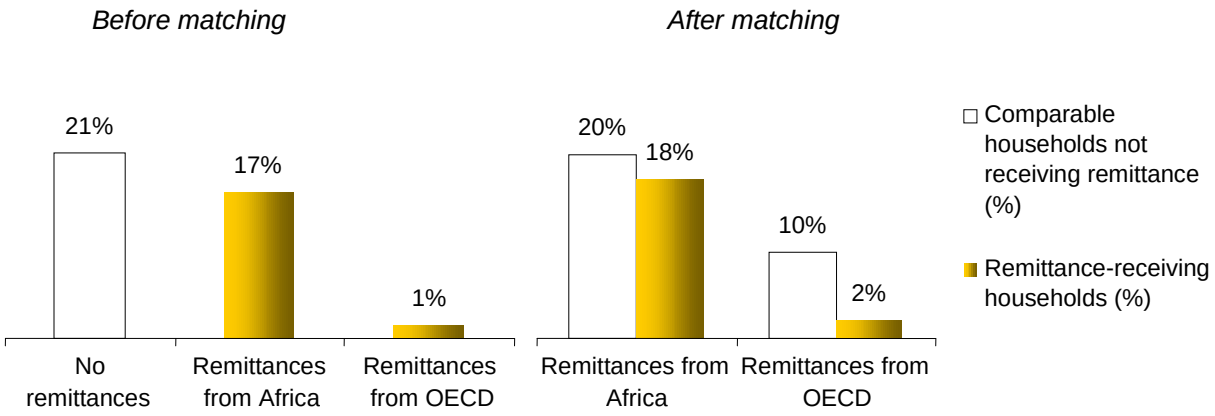
Figure 3. Ghana: Household amenities of remittance-receiving and other households



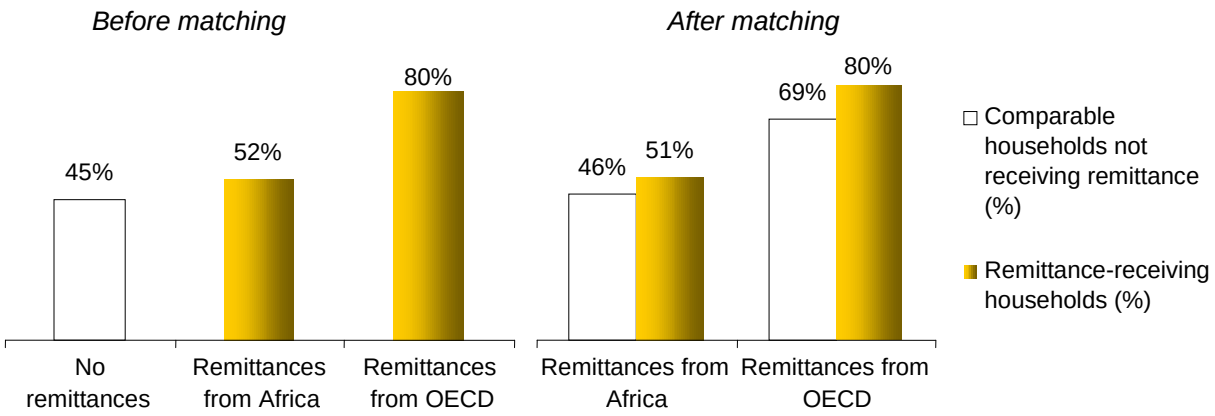
(c) Concrete roof



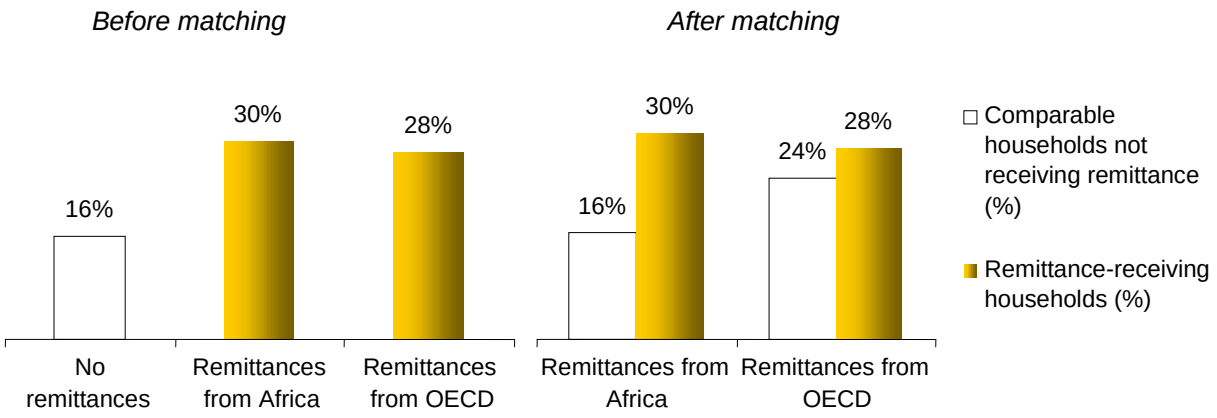
(d) Leaf roof



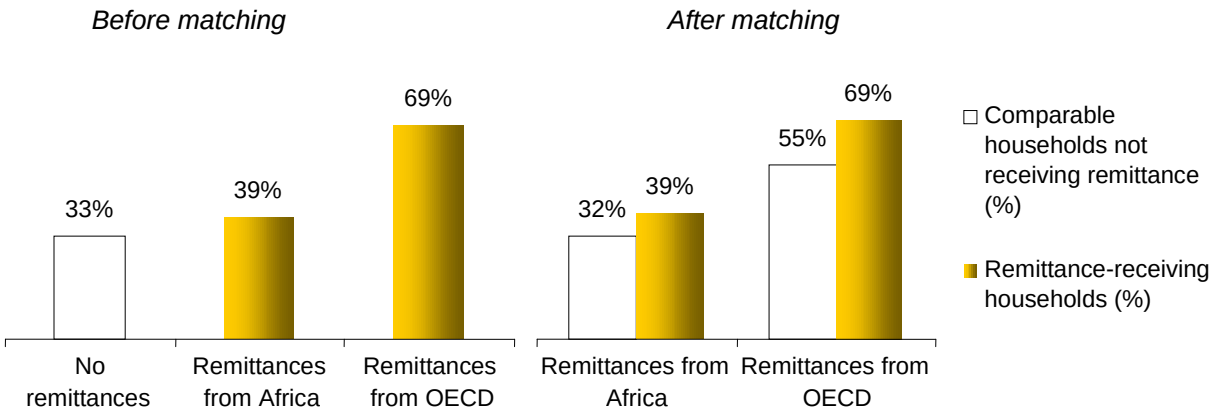
(e) Electricity



(f) Telephone - fixed



(g) Telephone - mobile



As shown in figure 3, even after correcting for endogeneity of remittance-receiving status, households that receive remittances from OECD countries and those that receive remittances from other African countries have fewer mud houses. Similarly, remittance-receiving households have roof made of corrugated iron sheets, cement, concrete, asbestos, slate and roofing tiles rather than roofing material made of leaves.

Access to electricity and communication facilities such as fixed and mobile phones can significantly improve information on possible disasters and anticipatory precautionary measures. Ghanaian households that receive international remittances tend to have electricity. Without controlling for endogeneity of the remittance-receiving decision, 45 percent of households that do not receive remittances have electricity. 52 percent of households that receive remittances from other African countries have electricity and 80 percent of households that receive remittances from OECD countries have electricity. After controlling for endogeneity of remittance-receiving status, 80

percent of households that receive remittances from OECD countries have electricity, versus 69 percent of comparable households that do not receive remittances. Of households that receive remittances from other African countries, 51 percent have electricity, versus 46 percent of comparable households that do not receive remittances.

Similarly, after controlling for endogeneity of remittance-receiving status, 28 percent of Ghanaian households that receive remittances from OECD countries have a fixed telephone, versus 24 percent of comparable households that do not receive remittances. Of households that receive remittances from other African countries, 30 percent have a fixed telephone, versus 16 percent of comparable households that do not receive remittances. In the case of mobile phones, after controlling for endogeneity of remittance-receiving status, 69 percent of households that receive remittances from OECD countries have a mobile telephone, versus 55 percent of comparable households that do not receive remittances. Of households that receive remittances from other African countries, 39 percent have a mobile telephone, versus 32 percent of comparable households that do not receive remittances.

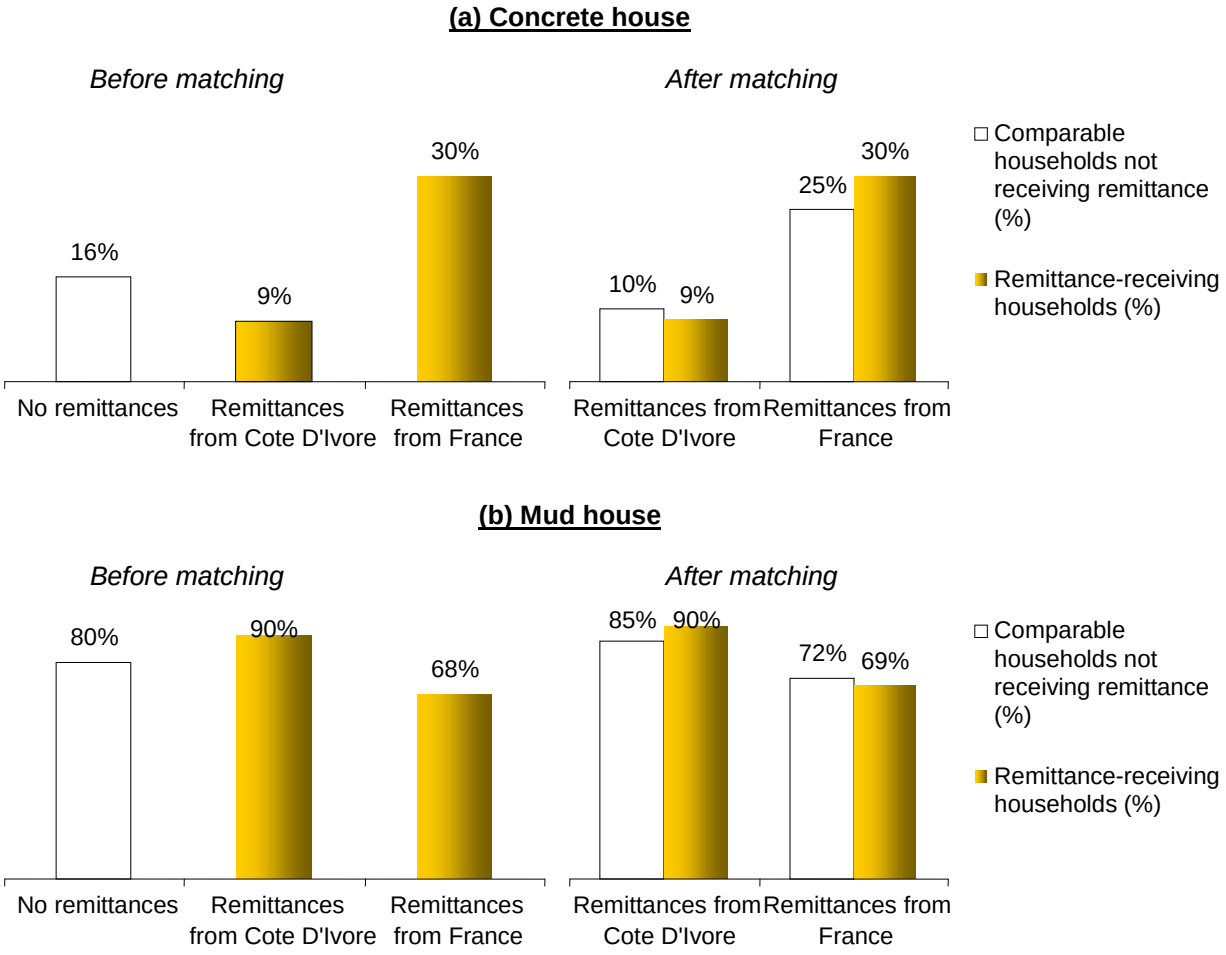
As shown in annex table 4a, regression estimates on the matched Ghanaian households further reveal that receiving remittances from OECD countries have a statistically significant and positive impact on the ownership of better houses and communication amenities. Similarly annex table 4b shows that remittances from OECD have a negative and significant impact on having low quality houses and communication amenities. Remittances from Africa enable households to have amenities such as electricity and fixed and mobile phones as evident from the statistically significant coefficients of these variables in annex table 5a. A smaller amount of remittances received by households from migrants in Africa partly explains why these households may not be able to make long term investments in housing (see annex tables 5a and 5b).

We use a nationally-representative household survey for Burkina Faso for 2003 to examine the resilience of houses to future disasters. This survey provides information on the sources of migrant remittances. Of the 8500 households in the sample, 13 percent receive domestic remittances while 1.7 percent of households receive remittances from France, which is the most important destination of migrants outside Africa (see annex table 6). Within Africa, Cote D'Ivoire is the major migrant destination and 13 percent of all households receive remittances from Cote d'Ivoire. We used propensity matching methods to construct comparable households as in the case of Ghana.

We find that after controlling for endogeneity, 30 percent of Burkinabe households receiving remittances from France have concrete houses while 25 percent of comparable households that do not receiving remittances have concrete houses (see figure 4 and annex tables 7 and 8). Similarly, we find that remittance-receiving

households have fewer houses made of low quality materials such as mud. Households receiving remittance from Cote D'Ivoire are significantly worse off than households receiving remittances from France, and are similar to Burkinabe households that do not receive any remittances.

Figure 4. Burkina Faso: Household amenities of remittance-receiving and other households



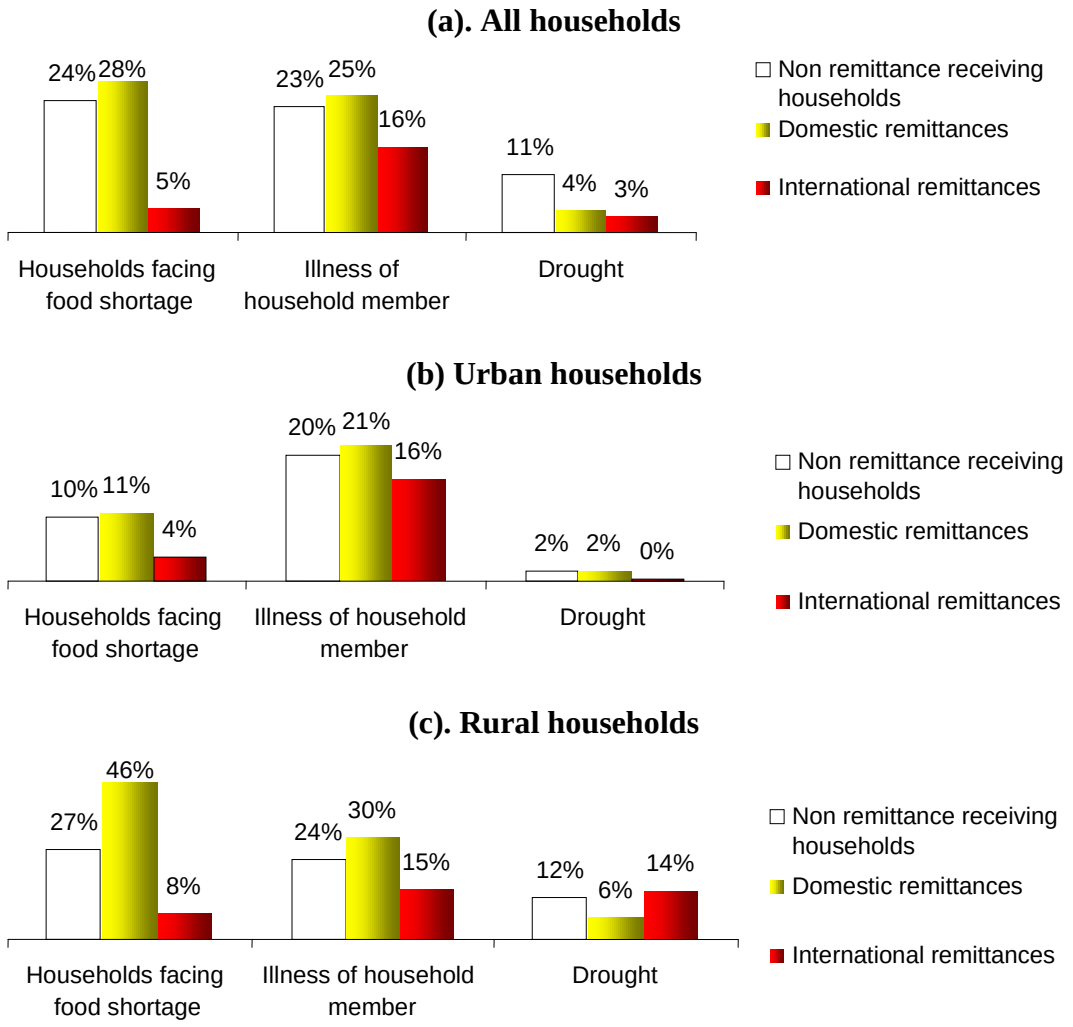
4.4. Coping strategies of remittance-receiving households versus other households in Ethiopia

Ethiopia suffers form extreme poverty and frequent shocks to food security due to recurrent droughts, floods and other natural disasters. We use the nationally-representative 2004 Welfare Monitoring Survey to examine how remittance-dependent households manage shocks to food security. Migration and remittances are generally understood as a part of coping mechanisms adopted by households facing shocks to

incomes and livelihoods (Block and Webb, 2001). Of the 33,302 households in the survey, the majority of households (67 percent) are located in rural areas.

A vast majority (93 percent) of Ethiopian households who report international remittances as their main source of income reside in urban areas. In contrast, only 14 percent of rural households report international remittances as their main source of income.[10] We examine whether households that depend on remittances face fewer shocks and whether these households behave differently from other households in coping with shocks.

Figure 5. Shocks faced by Ethiopian households



[10] However, among the "urban" households that receive remittances, 16 percent report being engaged in agricultural or related activities.

In Ethiopia, we find that households that depend on international remittances report facing fewer shocks from food shortages and drought (which often occur together) compared to other households. The illness of household members is another major shock reported by Ethiopian households. While remittance-dependent households report facing fewer shocks in terms of illness of household members—perhaps since better nutrition is usually associated with better health—the difference with the other households is smaller compared to the direct shocks to food security.

Table 4. Remittance recipient households do not sell productive assets and use own cash to cope with food shortage shocks

All households

	Households not receiving remittances	Domestic remittances	International remittances
Food Aid	42.3	55.9	0
Sale of livestock and livestock products	40.5	3.9	0
Sale of other agricultural products	18.2	3.7	0
Sale of household assets	4.1	4.6	11.5
From own cash	10.3	5.3	31.3
Others	15.6	33	48.9

Urban households

	Households not receiving remittances	Domestic remittances	International remittances
Food Aid	23.0	25.7	0
Sale of livestock and livestock products	11.05	2.23	0
Sale of other agricultural products	5.01	3.83	0
Sale of household assets	18.5	15.9	18.1
From own cash	19.6	19.0	49.5
Others	27.7	40.0	19.3

Rural households

	Households not receiving remittances	Domestic remittances	International remittances
Food Aid	43.5	63.1	0
Sale of livestock and livestock products	42.4	4.27	0
Sale of other agricultural products	19.0	3.67	0
Sale of household assets	3.12	1.82	0
From own cash	9.73	1.94	0
Others	14.8	31.4	100

In both urban and rural areas, households that receive international remittances typically do not sell their productive assets such as livestock to cope with shocks related to food shortages (table 4). These households typically rely on own cash and other means, presumably from remittances, for coping with shocks.

5. Conclusion

This paper has presented an analysis of how migrant remittances respond in the aftermath of natural disasters, and whether these flows contribute to preparedness for rapid-onset natural disasters such as earthquakes and floods.

The main findings of this paper can be summarized as follows:

- Remittances increase in response to natural disasters in countries that have a larger emigrant stock as a share of the home country population.
- In the period after a flood in Bangladesh in 1998, per capita household consumption was higher for households that receive remittances, even after controlling for the possibility that these households may be self-selected.
- International remittance-receiving households in Burkina Faso and Ghana, especially those that receive remittances from high-income OECD countries, have housing built of concrete rather than mud and have greater access to communications, which can help in coping during natural disasters.
- Ethiopian remittance-receiving households tend to rely on cash reserves during shocks to food security, rather than sell productive assets such as livestock.

The macro and micro-evidence indicate a positive role of remittances in preparing for and in coping with the consequences of natural disasters. It also provides a role for policy. Disaster response measures could include leveraging official assistance for tapping into the diaspora after natural disasters, providing resources and assistance to embassies and migrant associations to channel contributions after disasters, and quicker restoration of financial infrastructure and money transfer facilities that may have been disrupted so as to facilitate uninterrupted flow of remittances by family and friends abroad to the affected population.

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Annex table 1. Bangladesh: Summary statistics of households affected by flood in 1998

	Households receiving remittances	Households not receiving remittances
Flood Measures		
Flood measure -depth of water in the house	2.66	2.56
Flood measure-number of days of flooding	37.77	37.9
Flood measure - cost of repair	771.9	856.7
Flood measure -number of days of evacuation	9.13	10.3
Flood measure - village level food index	2.15	2.04
Household Characteristics		
Log of assets -consumer durables	7.37	7.27
Log of assets -food stock	0.71	1.17
Log of assets -livestock	5.81	5.93
Has electricity	0.10	0.06
Per capita land of households	11.3	8.37
Maximum years of education in households	6.92	4.78
Number of primary educated	1.82	1.65
Number of secondary educated	1.53	0.73
Number of tertiary educated	0.08	0.03
Number of children below age 5	0.81	0.97
Number of males above age 15	1.57	1.37
Number of pre flood migrants	0.75	0.44
Received public assistance in the last six months	0.09	0.13
Amount of remittances received in the last six months	8,730	0.00
Amount of public assistance received in the last six months	40.03	59.7
Number of households	88	405

Annex table 2. Ghana: Summary statistics of households

	Households not receiving remittances	Households receiving remittances from OECD countries	Households receiving remittances from African countries	Households receiving domestic remittances
Housing amenities				
Concrete house (%)	44.1	77.4	49.2	36.7
Mud house (%)	53.3	20.6	49.2	62.0
House – other materials (%)	2.62	2.00	1.59	1.31
Roof – concrete, iron, tiles (%)	79.2	98.0	83.3	80.6
Roof – leaves (%)	22.1	2.4	17.5	19.7
Electricity (%)	45.2	80.0	51.6	40.1
Telephone – fixed (%)	15.7	28.4	30.2	16.1
Telephone – mobile (%)	33.4	68.7	38.9	28.3
Household characteristics				
Urban (%)	41.9	76.0	36.5	33.3
Years of education of the household head	4.42	7.84	5.39	4.50
Household size	4.32	3.56	3.96	4.05
Age of the household head	43.5	47.4	50.4	49.7
Number of children below age 5	0.71	0.41	0.52	0.63
Number of males above age 15	0.98	0.66	0.87	0.90
Number of primary educated	0.46	0.42	0.62	0.43
Number of secondary educated	0.85	1.23	0.67	0.68
Number of tertiary educated	0.08	0.22	0.06	0.05
Number of technical educated	0.12	0.26	0.08	0.07
Log of consumption expenditure	16.5	17.0	17.5	16.0
Number of observations	5,835	549	126	2,284

Annex table 3. Ghana: Propensity score estimates of the remittance-receiving status on the probability of having assets – comparisons between pairs of groups

	Remittance receiving households	Comparable households not receiving remittances	t-statistics
Households receiving remittances from OECD countries			
Concrete house (%)	77	68	4.55
Mud house (%)	21	30	-4.31
House – other materials (%)	2	3	-1.02
Roof – concrete, iron, tiles (%)	98	92	5.31
Roof – leaves (%)	2	10	-6.40
Electricity (%)	80	69	5.11
Telephone – fixed (%)	28	24	2.16
Telephone – mobile (%)	69	55	6.26
Households receiving remittances from African countries			
Concrete house (%)	49	45	0.76
Mud house (%)	50	52	-0.51
House – other materials (%)	2	3	-0.97
Roof – concrete, iron, tiles (%)	83	81	0.54
Roof – leaves (%)	18	20	-0.74
Electricity (%)	51	46	1.16
Telephone – fixed (%)	30	16	3.53
Telephone – mobile (%)	39	32	1.61

Annex table 4a. Impact of receiving remittances on housing amenities of households receiving remittances from OECD countries: Probit regression for Ghana

Dependent variable	Concrete house	Roof-concrete, iron, tiles	Electricity	Telephone - fixed	Telephone - mobile
Remittance-receiving status	0.20**	0.52***	0.29***	0.12*	0.43***
	(0.08)	(0.16)	(0.08)	(0.07)	(0.07)
Urban	0.52***	0.66***	1.22***	1.33***	0.75***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Years of education of the household head	0.02	0.03	0.04***	-0.01	0.02
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Years of education of the head, squared	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Household size	-0.14***	-0.10***	-0.20***	-0.05**	-0.11***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age of the household head	0.01	-0.01	-0.02***	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age of the household head, squared	0.00	0.00	0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of children below age 5	0.06*	-0.09**	0.11***	-0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Number of males above age 15	0.04*	0.11***	0.10***	0.00	0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Number of primary educated	0.08**	0.16***	0.16***	0.07**	0.12***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Number of secondary educated	0.22***	0.30***	0.30***	0.06**	0.23***
	(0.02)	(0.04)	(0.03)	(0.02)	(0.02)
Number of tertiary educated	0.47***	0.49**	0.53***	0.30***	0.72***
	(0.08)	(0.20)	(0.08)	(0.05)	(0.07)
Number of technical educated	0.17***	0.24*	0.27***	0.11**	0.31***
	(0.06)	(0.13)	(0.06)	(0.05)	(0.05)
Log of consumption expenditure	0.32***	0.15***	0.50***	0.13***	0.42***
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Constant	-6.28***	-2.10***	-8.31***	-3.52***	-7.68***
	(0.57)	(0.67)	(0.59)	(0.58)	(0.58)
Observations	5,946	5,946	5,946	5,946	5,946

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Annex table 4b. Impact of receiving remittances on housing amenities of households receiving remittances from OECD countries: Probit regression for Ghana

Dependent variable	**Mud house**	**House - other materials**	**Leaf roof**
Remittance-receiving status	-0.20**	-0.11	-0.59***
	(0.09)	(0.14)	(0.14)
Urban	-0.50***	-0.28	-0.65***
	(0.09)	(0.35)	(0.09)
Years of education of the household head	-0.02	0.01	-0.03*
	(0.01)	(0.02)	(0.02)
Years of education of the head, squared	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Household size	0.15***	-0.01	0.10***
	(0.02)	(0.03)	(0.02)
Age of the household head	0.00	-0.02*	0.00
	(0.01)	(0.01)	(0.01)
Age of the household head, squared	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Number of children below age 5	-0.03	-0.16**	0.03
	(0.03)	(0.06)	(0.03)
Number of males above age 15	-0.07**	0.12**	-0.09***
	(0.03)	(0.06)	(0.03)
Number of primary educated	-0.09***	0.07	-0.18***
	(0.03)	(0.06)	(0.04)
Number of secondary educated	-0.22***	-0.06	-0.31***
	(0.03)	(0.05)	(0.03)
Number of tertiary educated	-0.44***	-0.26	-0.62***
	(0.09)	(0.18)	(0.19)
Number of technical educated	-0.13*	-0.23**	-0.39***
	(0.07)	(0.11)	(0.10)
Log of consumption expenditure	-0.31***	-0.15**	-0.14***
	(0.04)	(0.06)	(0.04)
Constant	5.82***	0.69	2.18***
	(0.59)	(0.97)	(0.62)
Observations	5,946	5,946	5,946

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Annex table 5a. Impact of receiving remittances on housing amenities for households receiving remittances from African countries: Probit regression for Ghana

Dependent variable	**Roof-concrete, iron, tiles**	**Electricity**	**Telephone - fixed**	**Telephone - mobile**
Remittance-receiving status	0.05	0.31**	0.59***	0.34**
	(0.16)	(0.14)	(0.13)	(0.14)
Urban	0.68***	1.04***	0.97***	0.84***
	(0.09)	(0.09)	(0.10)	(0.09)
Years of education of the household head	0.01	0.04***	-0.01	0.01
	(0.02)	(0.01)	(0.01)	(0.01)
Years of education of the head, squared	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Household size	-0.06***	-0.15***	-0.04**	-0.09***
	(0.01)	(0.02)	(0.02)	(0.02)
Age of the household head	-0.01	-0.02***	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Age of the household head, squared	0.00	0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Number of children below age 5	-0.10***	0.09***	-0.05	0.00
	(0.03)	(0.03)	(0.04)	(0.03)
Number of males above age 15	0.11***	0.07**	0.01	0.02
	(0.03)	(0.03)	(0.03)	(0.03)
Number of primary educated	0.14***	0.16***	0.07**	0.13***
	(0.03)	(0.03)	(0.03)	(0.03)
Number of secondary educated	0.30***	0.29***	0.06**	0.23***
	(0.03)	(0.03)	(0.03)	(0.03)
Number of tertiary educated	0.52**	0.61***	0.33***	0.76***
	(0.24)	(0.10)	(0.07)	(0.08)
Number of technical educated	0.29**	0.28***	0.15***	0.30***
	(0.14)	(0.07)	(0.06)	(0.06)
Log of consumption expenditure	0.08**	0.44***	0.13***	0.39***
	(0.04)	(0.04)	(0.04)	(0.04)
Constant	-1.18**	-7.45***	-3.59***	-7.27***
	(0.59)	(0.59)	(0.58)	(0.57)
Observations	5,783	5,783	5,783	5,783

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Annex table 5b. Impact of receiving remittances on housing amenities for households receiving remittances from African countries: Probit regression for Ghana

Dependent variable	**Mud House**	**House-other materials**	**Roof-leaves**
Remittance-receiving status	-0.13	-0.16	-0.05
	(0.13)	(0.30)	(0.15)
Urban	-1.66***	0.57***	-1.02***
	(0.10)	(0.21)	(0.12)
Years of education of the household head	-0.02	0	-0.02
	(0.01)	(0.02)	(0.02)
Years of education of the head, squared	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Household size	0.13***	-0.01	0.06***
	(0.02)	(0.03)	(0.01)
Age of the household head	0.00	-0.02	0.00
	(0.01)	(0.01)	(0.01)
Age of the household head, squared	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Number of children below age 5	-0.01	-0.15**	0.07**
	(0.03)	(0.06)	(0.03)
Number of males above age 15	-0.05*	0.11**	-0.10***
	(0.03)	(0.05)	(0.03)
Number of primary educated	-0.10***	0.08	-0.15***
	(0.03)	(0.06)	(0.03)
Number of secondary educated	-0.24***	-0.05	-0.28***
	(0.03)	(0.05)	(0.03)
Number of tertiary educated	-0.61***	-0.40**	-0.60***
	(0.11)	(0.19)	(0.20)
Number of technical educated	-0.21***	-0.16	-0.34***
	(0.08)	(0.11)	(0.10)
Log of consumption expenditure	-0.30***	-0.12**	-0.09**
	(0.04)	(0.06)	(0.03)
Constant	5.60***	0.27	1.35**
	(0.58)	(0.92)	(0.56)
Observations	5,783	5,783	5,783

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Annex table 6. Burkina Faso: Summary statistics

	Households receiving remittances from France	Households not receiving remittances	Households receiving remittances from Cote D'ivoire
Housing variables			
Concrete house (%)	30.4	15.6	8.9
Mud, mud, brick house (%)	68.3	80.2	90.1
Has phone (%)	11.2	14.1	16.4
Household characteristics			
Urban (%)	43.5	30.8	13.8
age of household head	44.4	43.2	48.2
years of education of household head	3.66	2.34	1.05
Asset index of the households	1.88	1.36	1.18
Number of males above the age of 15	1.66	1.65	1.72
Number of children below the age of 5	0.93	1.24	1.36
Number of primary educated in the households	1.12	0.94	0.85
Number of secondary educated in the households	0.64	0.41	0.20
Number of tertiary educated in the households	0.16	0.05	0.02
Number of households	161	6,169	1,009

Annex table 7. Burkina Faso: Propensity score estimates of remittance-receiving status on the likelihood of having household amenities – comparisons between pairs of groups

	Remittance receiving households	Comparable households not receiving remittances	t-statistics
Households receiving remittances from France countries			
Wall of the house-concrete (%)	30	25	1.4
Wall of the house-mud or mud bricks (%)	69	72	-0.8
Households receiving remittances from African countries			
Wall of the house-concrete (%)	9	10	-1.4
Wall of the house-mud or mud bricks (%)	90	85	4.6
Households receiving domestic remittances			
Wall of the house-concrete (%)	18	17	0.4
Wall of the house-mud or mud bricks (%)	80	79	0.5

Annex table 8. Impact of receiving remittance on ownership of houses with concrete walls: Probit regression for Burkinabe households receiving remittances from African countries

	Concrete House
Household receives remittances (dummy)	0.45***
	(0.10)
Urban	2.00***
	(0.09)
Age of household head	-0.01*
	(0.00)
Years of education of household head	-0.01*
	(0.01)
Asset index of the households	1.26***
	(0.05)
Number of males above the age of 15	-0.02
	(0.03)
Number of children below the age of 5	0
	(0.03)
Number of primary educated in the households	0.01
	(0.02)
Number of secondary educated in the households	-0.01
	(0.03)
Number of tertiary educated in the households	-0.17*
	(0.10)
Constant	-4.64***
	(0.19)
Observations	7,169

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%