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I won't let you "behind"

The impact of migration on sending households

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Abstract

A boost in the scale and complexity of international migration flows have occurred in the last decades. Movements of large numbers of people may produce welfare gains to families and communities left behind. This thesis analyses the implications of migration on well-being of sending societies, adopting a household-level perspective and addressing two specific issues: the impact of remittances on health consumption decisions of relatives left behind, and the role of migration as risk management strategy in response to natural shock exposure. The effect of international remittances on household healthcare consumption is tested using data from the "Peruvian National Survey of Households". Remittances positively impact on healthcare consumption shares and this propensity is independent of the occurrence of a health shock, confirming the importance of migrant transfers for human capital accumulation. In the second part, I identify whether and under which circumstances migration represents a coping strategy to deal with sudden-onset climatic shocks, examining the case of Hurricane Mitch in Nicaragua. The findings obtained show that shock severity does not act as push factor for international migration as a whole. Only individuals belonging to agricultural households experiencing high exposure to the natural disaster increase their later likelihood to move abroad. Remittances turn out to be an efficient insurance tool to recover after natural shocks. Income flows from international migrants support household welfare preservation over the two years following the disaster, reducing the risk of being trapped into poverty.

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Introduction

In the last three decades we have witnessed an upsurge in the scale and complexity of international migration flows. More than 247 million people, or 3.4 percent of the world population, live outside their countries of birth. Search for employment opportunities, labour force shortages resulting from demographic dynamics, internal conflict and war, natural disasters, climate change, and improved and widespread access to information and technologies are all factors suggesting that migration flows would continue to rise in the next future (Ratha et al., 2016).

Movement of large numbers of people may produce welfare gains not only to migrants, but also to families and communities left behind, and hosting countries. A great extent of the benefits from international migration consists in the improvement of socio-economic status of migrants themselves. Moving to developed countries, migrants from the poorest countries experienced a 15-fold increase in income, a doubling of school enrolment rates, and significant improvements in other well-being indicators, such as child mortality. Empowerment and escape from abusive social practices are other collateral advantages of human mobility (Schiff et al., 2005; Ratha et al., 2016). As regards countries of origin, migration lowers unemployment, facilitating the access to more-productive and higher paid jobs for those staying. Remittances constitute a reliable source of income, that can either be spent for consumption or provide funds for education, health, and business starting (Calero et al., 2009; Adams and Cuecuecha, 2013; Kunwar, 2015). Under certain circumstances, remittances may encourage investments and consequently economic growth (Adams and Page, 2005). Furthermore, movements of people across national boundaries facilitate transfers of goods, ideas and capital, by lowering transaction costs, informational asymmetries and legal barriers (Kugler and Rapoport, 2007). Regarding destination countries, labour immigration can benefit the pension systems and the pro-

vision of cleaning and caring services for children and elderly people at lower prices for consumers.

At the same time, migration entails economic, social, cultural, political and emotional costs for all the actors involved. For the origin countries, these costs consist in the loss of the contribution of skilled migrants to development processes and resources invested in their education (Gibson and McKenzie, 2011). In addition, migrants and their relatives left behind may suffer from separation and lack of effective legal protection, and experience culture adaptation difficulties. As regards destination countries, migration can entail a perceived threat to cultural identity and generate some drawbacks in terms of unemployment and wages, due to migrants' competition for the same jobs as natives (Borjas, 2008; Ottaviano and Peri, 2012; Docquier et al., 2014).

The net effect of migration on development processes depends on the characteristics of migrants (high-skilled or low-skilled), migratory phenomenon (permanent or temporary, forced or intentional, etc.), sending communities (underlying demographic and labour market dynamics, stage of development process, etc.). Anyway, the role played by international labour force mobility as a vehicle for the integration of the world economy has led to a burgeoning interest for the implications of migration on sending communities. An increasing number of empirical studies and sound policy analysis have been conducted to examine the role of migration as development driver for countries of origin (Adams and Page, 2005; Acosta et al., 2007; Kunwar, 2015).

This thesis contributes to this field of research analysing the implications of migration on the well-being of sending societies, adopting a household level perspective. In particular, two so far understudied issues are considered in order to fill some existing gaps in this branch of literature: the contribution of migration to human capital investment decisions of relatives left behind, with a particular focus on the health dimension, and the role of migration as risk management strategy in response to natural shock exposure. The first topic is of particular interest as the majority of studies on this argument focus on the effect of remittances on the education investment for children left behind, leaving room for further investigations concerning the health dimension. As natural disasters and climate-related events are nowadays considered one of the main sources of negative shocks affecting developing countries, the relationship between climatic shocks and human mobility is the object of increasing attention from both policy-makers and researchers. Thus, in order to explore these topics, three distinct research questions have

been designed and developed in as many empirical works.

Firstly, the impact of receiving remittances on healthcare consumption decisions of Peruvian households is analysed in Chapter 2. In particular, I assess whether the observed positive shift in household preferences towards healthcare consumption reflects a choice of investing in human capital or a response to health shocks. Indeed, the increased deployment of resources to healthcare may be triggered by several interrelated factors linked to migration, which modify the household decision-making process and consequently the resource allocation outcomes: changes in income composition due to remittance inflows, migrants' influence on income allocation decisions, existence of a commitment to address remittances towards specific consumption items, transmission of knowledge and good practices by migrants to sending families. On the other hand, an increase in health spending can be caused by the occurrence of health shocks affecting members left behind. As the outcome is robust to a potential reverse causality bias due to the occurrence of a health shock, the role of international remittances in fostering human capital investment is confirmed.

Secondly, the impact of climatic shocks on out-migration episodes is investigated in Chapter 3, examining the case of Hurricane Mitch hitting Nicaragua in 1998. The objective of the study is to identify whether and under which circumstances migration is adopted as an *ex post* coping strategy to deal with the income volatility induced by sudden-onset climatic shocks. The findings obtained show that the severity of the shock does not act as push factor as a whole. Only individuals belonging to agricultural households experiencing high exposure to the natural disaster increase their likelihood to move abroad in the aftermath of the Hurricane. As agricultural households are usually the most affected by natural shocks, this might suggest that severe unexpected natural disasters provide incentives for migration within the most vulnerable groups. However, the choice of migration as coping strategy is driven by household asset endowments and income composition.

Finally, the effectiveness of remittances as an insurance tool to recover from the damages provoked by natural shocks is studied in Chapter 4. Referring again to the Hurricane Mitch case study, I show that income flows from migrants support household assets preservation in the two years after the disaster, reducing the risk of being trapped into poverty. In order to identify how these empirical works contribute to this field of research, a first introductory section is included. In Chapter 1 the reference theoretical

framework within which the research questions are formulated is presented. Moreover, the contribution of each empirical analysis to the current literature on the specific topics is illustrated.

Chapter 1

Migration and development: A theoretical introduction

This introductory chapter delineates the theoretical framework to which the empirical works conducted in the next chapters refer and underline how each analysis contributes to the academic debate on the migration and development nexus. The next sections are organized as follows. Section 1 presents the theoretical framework adopted to analyse the contribution of human mobility to the development of communities of origin. Section 2 and 3 provide a broad overview of previous literature contributions motivating the research questions, stressing the original contribution of each empirical work. Finally, Section 4 summarizes some elements of welfare theory inspiring the choice of the measurement instruments adopted all along the thesis to measure the welfare gains accrued by migration.

1.1 Migration and development: main theoretical frameworks

The nexus between migration and development has been widely debated by social science scholars since the 1950s, alternating optimistic and pessimistic interpretations of the impact of human mobility on the economic development of migrant-sending societies, with

a renewed hope in the potentialities of transnational migration prevailing in recent years (De Haas, 2010). However, migration and development researchers have traditionally treated the identification of the determinants of mobility decisions and the analysis of the consequences of migration on development process as independent study objects. They have disregarded the fact that developmental factors influence migration decisions which in turn alter the development outcomes of sending communities. More recent analyses have tried to adopt a more comprehensive theoretical framework, identifying the migratory phenomenon as a part of a broader development process and facilitating the interaction between migration theorists from different disciplines and paradigmatic backgrounds. (Taylor, 1999).

An *optimistic interpretation* of the role of migration for development is provided by the neo-classical "factor price equalization" theory, which explains migration by geographical differences in supply and demand for labour. Wage differentials induce mobility from low-wage, labour-surplus regions to high-wage, labour-scarce regions, as a stage of a "developmentalist" modernization process. Thus, migration would constitute a way to optimally allocate production factors with mutual benefits for both sending and receiving areas. Migrants as rational fully-informed individuals decide to move whenever migration benefits overcome costs. This neo-classical interpretation is at the base of the well-known Harris-Todaro model, according to which the expected income differential between rural and urban sectors depends on both wage differences and the probability of finding an urban job (Harris and Todaro, 1970). Subsequently, this analytic framework has been integrated including other factors determining migration decisions (both micro and macro) and adapted to the international migration context (Borjas, 1989). Distance between source and destination countries and social networks within migrant communities have been identified as major determinants of mobility costs (Massey et al., 1993).

According to this framework, significant potential economic gains may derive from migration. Allowing workers to move to labour markets where they are more productive and well-paid, migration leads to an increase in global output and income, with positive implications in terms of poverty reduction in the source countries (Schiff et al., 2005). The combination of these elements with the human capital theory provides a theoretical explanation of migration selectivity. Indeed, individuals deciding to move are typically not representative of the communities they come from. Heterogeneity in terms of demographics, personal skills, knowledge and physical abilities, determines different expected returns of migration, which translate into miscellaneous individual propensities

to migrate leading to selection into migration. (De Haas, 2010).

However, the utility maximization criteria adopted to interpret mobility decisions is based on the idea that migrants are perfectly informed on costs and benefits of moving. This is often not the case. Factor price equalization assumes that economic forces tend towards an equilibrium, ignoring the existence of market imperfections and other structural constraints on development. Therefore, actual migration patterns are hard to explain within a neo-classical framework, that mainly focuses on expected income (Skeldon, 1997), as imperfections in capital and insurance markets make the access to financial services and capital difficult or even impossible in most developing countries. Moreover, neo-classical migration theory does not consider the positive implications of human mobility due to migrants' belonging to social groups such as households, extended families and communities. As migrants are considered atomistic, utility maximizing individuals, they would have no reason to send money back. Thus, the developmental role of migration would be entirely realized through factor price equalization. However, it has been clearly acknowledged that remittances contribute to reduce liquidity constraints of sending families and can be invested in human and physical capital accumulation (Adams, 2011). In addition, both the information exchange between migrants and relatives left behind and return migration influence the development process of source communities, which benefit from the human, physical, and social capital acquired during migrants' stay in destination countries (Chauvet and Mercier, 2014; Levitt and Lamba-Nieves, 2011). All these aspects are disregarded by migration and development models inspired to the neo-classical paradigm.

Pessimistic interpretations of the migration and development nexus have been elaborated since the 1960s, inspired by the historical-structural paradigm. In line with the dependency theory, structuralists interpret migration as a natural negative consequence of increasingly unequal terms of trade between developed and underdeveloped countries. According to this framework, migration can be read as a cause of underdevelopment, rather than a key element of the development process. Voided of the agency-based component, human mobility is seen as an inevitable reaction to the increasing impoverishment experienced by rural and marginal populations and would further exacerbate the existing economic disparities among areas through the brain or brawn [1] drain due to selection

[1] "Brain drain" is the emigration of highly skilled or well-educated individuals, while "brawn drain" refers to the massive departure of young men and women from rural areas. This lost in labour supply is supposed to have a negative effect on local production.

into migration (Massey et al., 1999).

Structuralists tend to exclude from their analyses the possibility that migration may facilitate development through monetary and social remittances or return migration. In their view, as the better-off are more likely to migrate, remittances would tend to intensify inequalities within communities, since the benefits of migration would be disproportionally directed to the better-off. Therefore, the contribution of migration to poverty reduction would be marginal (Lipton, 1980). Moreover, caution about the use of migrant remittances for productive long-term investments in terms of physical and human capital has been frequently expressed. Economic, social and cultural costs of migration for communities of origin are also stressed: changes in consumption tastes, with consequent increase of general costs of living due to the substitution of locally produced- with imported goods, loss of community solidarity and sociocultural integrity are all elements associated with migration. This branch of literature has been criticized for being too rigid in interpreting individuals' migration decision exclusively as passive adaptation to deterministic macroforces. The cases of southern European countries and the "Asian Tigers" have confirmed that the high labour migration flows linked to the incorporation into global economy have ultimately benefited the development of origin countries (De Haas, 2009).

Both theoretical frameworks do not provide fully realistic insights to interpret the complexity of current migration flows. Findings emerged from empirical analyses are often contradictory and should be situated somewhere in between the two paradigms. The effects of migration on sending communities seem to vary according to the characteristics of the migratory phenomenon, the region of origin and the development outcome considered. Therefore, an improved theoretical perspective taking into account both the structural elements in which migration takes place and the individual agency to overcome constraints and potentially reshape the structural context is desirable.

The *New Economics of Labour Migration* (NELM) theory gained growing acknowledge during the 1990s and seems to respond to such requirements. This approach overcomes the neo-classical individual utility maximization perspective and consider the household as the central unit of analysis (Stark and Bloom, 1985). Thus, migration is modelled as a family strategy to differentiate risk and minimize income volatility. Adopting a household-level perspective helps to reveal the interactions going on between migration and the broader development processes. However, the NELM recognizes a fundamental contribution of human agency in picking migration as a deliberate strategy to diversify,

secure, and potentially improve household livelihoods.

Remittance behaviour can be analysed as the outcome of informal social arrangements between migrants and the relatives left behind (Rapoport and Docquier, 2006). In this view, the decision to remit and the size and timing of the transfers depend on the nature of the informal agreement established within the extended family unit. Altruism, i.e. migrant care for household members left behind, is widely recognised as an obvious motive to send income back home. Income transfers increase with migrant income and degree of altruism, while they decrease with recipient household income (Funkhouser, 1995; Agarwal and Horowitz, 2002). Remittances can be also driven by self-interest: they can be used to pay for services as maintenance of assets and relatives in the home area. In this case, the amount of money sent back home rises with the quantity of services provided. The perspective of returning home and the aspiration to inherit can foster transfers for investment in private and social assets in sending communities (Stark and Bloom, 1985). Monetary transfers between migrants and families left behind may provide insurance against unexpected income shocks. The risk-spreading argument explains the occurrence of migration even in the absence of expected wage differentials (Lucas and Stark, 1985; Katz and Stark, 1986). Coherently with this purpose, migrant transfers should support families left behind in case of drops in family income, while households ensure resources to migrants in case of unemployment or income shocks. Remittances should be sent irregularly and in correspondence to income fluctuations and they should be more frequent where income volatility is more intense (Hoddinott, 1994; Lianos and Pseiridis, 2014). Remittances can be an alternative liquidity source to overcome credit market constraints, enabling households to invest in productive activities and improving their long term livelihoods (Rosenzweig and Wolpin, 1993). Intuitively, a peculiar remittance behaviour in terms of size and timing of flows may be observed in case migration is part of a long-term investment strategy, as child education funding. The last two theoretical interpretations are particularly suited to analyse household behaviour in developing contexts in which the access to credit and insurance markets is imperfect. Finally, monetary transfers can be a repayment for previous intra-household loans used to finance migrant investment in human capital or migration costs (Cox et al., 1998; Ilahi and Jafarey, 1999). However, several motivations to remit may coexist. Risk diversification, insurance and long-term investments can contemporaneously be the incentives for the informal inter-temporal agreement.

This pluralist theoretical perspective provides more adequate instruments to understand

the complexity of the interconnections between transnational migration and development. Moreover, it can help to identify how ever-frequent phenomena as temporary and return migration may arise in specific contexts and interplay with local development processes. The next sections present how the empirical contributions in the following chapters place themselves inside the branch of literature inspired by this theoretical framework.

1.2 Impact of remittances on household welfare

Remittances [2] have become a fundamental source of external funds for developing countries nowadays. In 2015, worldwide remittance flows are estimated to have exceeded $601 billion. Of that amount, developing countries are estimated to receive about $441 billion, nearly three times the amount of official development assistance. The true size of remittances, including unrecorded flows through informal channels, is believed to be significantly larger (Ratha et al., 2016). The nature and the magnitude of such flows have persuaded practitioners of the important role they play in supporting the development efforts of recipient countries.

1.2.1 Impact of migration on poverty reduction and human capital investment

Remittances could contribute to poverty reduction, relaxing the liquidity constraints of the neediest population groups. However, in order to confirm this idea, it is necessary to assume that the amount of income provided by migrant transfers is greater than the labour income the same individual would have had in case of no migration. This assumption is really complex to test as it requires the estimation of labour income in a counterfactual scenario without migration. The findings obtained significantly vary

[2] The term "remittances" indicates the money and goods that are transmitted to households by migrants working outside of their origin communities, either in urban areas or abroad (Adams, 2011). Remittances can be sent through either formal or informal channels. Formal channels include money transfer services offered by banks, post office banks, non-bank financial institutions, foreign exchange bureaus, and money transfer operators (MTOs), e.g. Western Union and MoneyGram. Informal remittances are defined as money transfers that do not involve formal contracts and thus, are unlikely to be recorded in national accounts. Cash transfers occurring through personal relationships, or carried out by unofficial courier companies, friends or relatives are the most common forms of informal remittances (Freund and Spatafora, 2008)

according to the estimation technique employed (Adams, 2006). However, the liquidity constraint reduction hypothesis has been confirmed by several empirical contributions. Adams and Page (2005) analysing data from 71 developing countries estimate that on average an increase in international remittances of 10 per cent corresponds to a reduction of the share of people living in poverty of 3.5 per cent. Acosta et al. (2007) explore the impact of remittances on headcount poverty ratios in 11 Latin American countries, observing that extreme and moderate poverty would fall by respectively 0.37 and 0.4 percentage points for every 1 percentage point increase in the remittances to GDP ratio, with a significant country heterogeneity in the results obtained. At micro level, Adams and Cuecuecha (2013) find that receiving internal remittances reduces the probability of being poor by 16.9 per cent.

Furthermore, in contexts of imperfect financial markets, remittances can provide insurance against income volatility, encouraging more risky asset accumulation strategies and fostering more productive investments. Taylor and López-Feldman (2010) show that transfers from Mexican migrants in US alleviate liquidity constraints and exposure to risk, enhancing land productivity of recipient families. Quisumbing and McNiven (2010) report a positive effect of remittances on housing, consumer durables and non-land assets confirming their contribution in fostering physical capital accumulation.

On the other hand, these potential benefits may be counterbalanced by some challenging effects. Migration indirectly impacts on productive process, reducing household labour supply through two pathways. Firstly, the absenteeism of a member diminishes household labour endowment with negative consequences on household production. However, as previously stressed, if remittance flows are significant and constant over time, they contribute to counteract household income losses determined by the absence of a wage earner. Secondly, remittances generate an income effect which can induce moral hazard. Indeed, migrant transfers can impact on labour supply decisions of remaining members who could decide to re-address human resources devolved to production towards leisure or other types of activities (Davis et al., 2010; Jadotte and Ramos, 2016).

A major part of the literature focuses on the impact of remittances on human capital accumulation. Remittances are often associated with higher education expenditure, higher enrolment rates and educational attainments. The presumed additional liquidity from migrant transfers increases the level of available resources to allocate to education investment, helping credit-constrained households enrolling their children in school, pre-

venting dropouts and improving the quality of the education investment (Calero et al., 2009; Salas, 2014). Acosta et al. (2007) analyse the long term effect of remittances on human capital formation at the national level in 11 Latin American countries, finding that migrant transfers are positively and significantly associated to children educational attainments in most of the countries, although the dimension of the impact varies by gender, across rural and urban areas and with the magnitude of the transfer received. Lu and Treiman (2007) observe that South African Black remittance households spend significantly more on children education than their counterparts and report lower odds of child labour. Such positive effects should counteract some negative drawbacks due to the migratory process. Absence of parents leave children unprotected increasing dropouts, and the reduction of adult labour supply for domestic and non-domestic activities fosters child labour employment (Cox Edwards and Ureta, 2003; Hanson and Woodruff, 2003; Hildebrandt et al., 2005).

1.2.2 Migration and health of sending households

The study of the impact of migration and remittances on the health status of family members left behind has received less attention. Anyway, similar impact channels to those identified for education have been hypothesized. The reduction of liquidity constraints can incentive remittance receiving households (RRHs) to allocate more resources to health expenditure, fostering the access to healthcare and increasing the quality of healthcare accessed. The mechanisms through which potential improved economic conditions due to migrant transfers may enhance health outcomes are various (Deaton and Paxson, 1998; Case et al., 2002; Fletcher and Wolfe, 2014). Individuals in better socio-economic conditions experience lower exposure to communicable diseases, risky behaviours and sedentary lifestyles. Heterogeneity in the access to healthcare, knowledge about good health practices, and intergenerational transmissions of healthy behaviours are other commonly used arguments to explain reported differences in health status across income groups (Smith, 1999). However, a controversial debate persists about the direction of causality between wealth and reported health status. The Grossman 's model provides a suitable instrument to interpret the relationship between economic resources and individual health performance. According to the prediction of the model, wage rates are positively associated with consumer's demand for health and medical care, since the higher a person's wage rate, the greater the value to him of an increase in healthy time.

In addition, education increases the efficiency of the gross investments in health. Therefore, higher economic conditions lead to higher health investments which translates into better health outcomes (Grossman, 1972).

A further channel through which migration may affect health of sending households is the transfer of health knowledge. The awareness about healthcare practices and lifestyle behaviours accumulated by migrants guides relative decisions in terms of both preventive and curative medical care consumption, and improves the effectiveness of the healthcare provided (Hildebrandt et al., 2005). The impact of knowledge flows generate spillover effects also on non-migrant households, underlining the additional contribution of "social remittances" to the improvement of health status (Lindstrom and Muñoz-Franco, 2005). On the other side, the absenteeism of a family member may worsen the health status of members left behind, especially children, as it weakens caregiver attention. Such drawbacks may shrink over time as migrants accumulate experience and households adapt to the absences (Kanaiaupuni and Donato, 1999).

The large majority of empirical contributions investigate the influence of migration on child health outcomes. Kanaiaupuni and Donato (1999), Frank and Hummer (2002) and Hildebrandt et al. (2005) examine the impact of U.S. migration experience on child health in Mexico, measured in terms of infant mortality, birth weight, undernutrition and anthropometric outcomes, finding that receiving remittances is always significantly and negatively associated with the odds of low weight birth. The negative effects of migration due to family members separation unfold over time. At the initial stages, the disruptive effect of migration on households and communities seems to prevail, as it is displayed by the increase of infant mortality rates. However, income transfers from migrants and the gradual institutionalization of migration mitigate such drawbacks and entail a fall of infant mortality rates over time. Infants living in communities with 20 years of exposure to at least median migration intensity rates are nearly half as likely to die. Besides, infant survival net of other effects increase with the amount of monetary transfers received (Kanaiaupuni and Donato, 1999). However, even among those infants born into non-remittance migrant households, there exists a significantly lower risk of low birth weight, suggesting the role of health knowledge transmission for health conditions improvement (Frank and Hummer, 2002).

Only a few studies have analysed the effects of remittances on health inputs, i.e. expenditures for health services provision (preventive and curative), family planning activities,

drugs, etc. Nguyen and Nguyen (2015) find that receiving international remittances increase the number of both inpatient and outpatient health care contacts in Vietnam. Other contributions examine the effect of migrant transfers on health expenditures, examining the differences in consumption patterns between RRHs and non RRHs. Amuedo-Dorantes and Pozo (2011) show that healthcare expenditures of Mexican households rise along with migrant transfers from abroad and their responsiveness to increases in remittance income is greater than its responsiveness to other sources of household income. Adams and Cuecuecha (2010a) observe a slight increase in health marginal budget share both for internal and international RRHs in Guatemala. Adopting the same empirical strategy with data from Ghanaian households, the authors find similar results. At the mean, internal or international RRHs spend respectively 0.8% or 3% more , on health than what they would have without remittances (Adams and Cuecuecha, 2013). Differently, Mora and Taylor (2006) observe larger marginal health budget shares for Mexican rural households receiving domestic transfers, while no significant difference is noticed for families receiving international remittances.

The empirical analysis conducted in Chapter 2 contributes to this field of study. The paper investigates the impact of remittances from transnational migrants on the consumption of healthcare services of Peruvian households. Some methodological limitations of the previously mentioned contributions related to the functional form adopted to model consumption behaviour are analysed and overcome adopting a non linear demand system. In line with the predictions of the NELM theory presented in the previous section, remittances can be either the outcome of a long term decision of investing in human capital or a strategy to reduce vulnerability to negative shocks through the diversification of income sources. Therefore, the analysis tests whether the re-allocation of resources from remittances to healthcare consumption reflects a shift in RRHs' preferences towards human capital investment or it is a response to health shocks that create demand for alternative financial sources by liquidity-constrained households.

1.3 Migration and climate change

1.3.1 Environmental shocks and migration decisions

According to the projections of the Intergovernmental Panel on Climate Change (IPCC, 2014) a substantial increase in the number of environmental displaced people will occur over the course of this century. 19.2 million people were displaced by rapid-onset natural disaster such as earthquakes and floods only in 2015 (International Displacement Monitoring Centre). More difficult to compute is the number of migrants who decide to abandon their areas of origin as a result of an adaptation strategy to slower-onset events such as droughts and erosions. People choosing to move for environmental reasons fall into many different categories, and not all migration episodes linked to climatic change can be defined as forced displacements (Piguet and Laczko, 2013). However, as reported by the UNHCR (2009), the majority of people exposed to the climatic shocks and environmental degradation are concentrated in the most vulnerable areas of the world. Thus, natural disasters and environmental degradation are nowadays considered one of the main factors of risk-exposure for developing countries. They turn out to be extremely vulnerable because of low levels of initial welfare and lack of institutional support to mitigate the experienced damages (De Haen and Hemrich, 2007). Therefore, the long-term implications of these events may conduct to poverty traps, jeopardizing the opportunities for future development (Carter et al., 2007). Moreover, the effectiveness of usual risk-management strategies is limited by the fact that weather shocks are spatially covariant. Therefore, the mechanisms that usually work in case of idiosyncratic risk may not be effective when all the households in a geographical area are exposed to the same stress (Kubik and Maurel, 2016).

Agricultural and natural resource-dependent households are the most affected by environmental stress. In this case, climatic change influences migration decisions mainly through its indirect effects on agricultural productivity and rural livelihoods. Dwindling crops and livestock assets, environmental degradation reduces household income (Black et al., 2011), diminishing both the opportunity costs of migrating and the available resources to fund migration costs (Lilleør and Van den Broeck, 2011; Halliday, 2006). In line with the NELM framework, given that wages and shocks at home and destination are expected to be not positively correlated, the decision to migrate in the aftermath of a natural shock may respond to an income diversification necessity to reduce household

liquidity constraints.

The choice of migration as a response to climate changes has been empirically tested, trying to determine if climate anomalies and natural disasters act as direct push factors for out-migration flows. Divergent conclusions have been reached according to the characteristics of the environmental event observed (Halliday, 2006). Lewin et al. (2012) report a negative association between rainfall shocks and rural out-migration in Malawi. A reduction in the likelihood of moving out after the occurrence of earthquakes, volcanic eruptions and floods has been reported also in Indonesia (Tse, 2011). Koubi et al. (2016) observe that individual perceptions of long-term environmental events significantly reduce migration while perceptions of sudden-onset environmental events, such as floods, significantly increase the likelihood of migration. At the macro level,Reuveny and Moore (2009) suggest that shock intensity, is positively related to international out-migration. Epidemics and miscellaneous climatic events indirectly spur international migration, as natural disasters hitting especially rural areas raise the flows of migrants to urban environs (Beine and Parsons, 2015).

Anyway, except in case of displacement after major disasters, the decision to move arises by the interaction among environmental, political, economic, social and cultural elements (Piguet et al., 2011). Indeed, climatic factors do not hit all actors homogeneously, and the threat of climate change is perceived differently according to their characteristics (Black et al., 2011). In case of exposure to severe environmental risks, individual and households may show different resilience abilities and choose diverse adaptation strategies, including migration. In order to better understand the potentialities offered by human mobility to development, it is fundamental to identify whether and under which circumstances migration can be a strategy to cope with risk exposure due to climatic factors.

Thus, the relationship between climate change and out-migration varies along with the characteristics of migration episodes (Gray and Bilsborrow, 2013) and individuals observed (Gray and Mueller, 2012). For what concerns long-term environmental deterioration, declines in land productivity and increasing time required to gather firewood are strongly related to short-distance mobility in Nepal, although the size of the effect varies significantly across gender and ethnic groups (Massey et al., 2010). However, as migration decisions remain conditioned on mobility costs affordability, adverse conditions due to environmental deterioration can eventually reduce migration because of exacerbated liquidity constraints, as observed in rural Ecuador (Gray and Bilsborrow, 2013).

Analogously, internal mobility decisions are strongly influenced by initial endowments in rural Tanzania, where only households in the middle of the wealth distribution respond to adverse temperature and rainfall conditions migrating (Kubik and Maurel, 2016).

In order to shed further light on how this elements combine in determining mobility decisions, the empirical analysis in Chapter 3 tests the effects of an unexpected sudden-onset climatic shock on out-migration flows, examining the case of Hurricane Mitch hitting Nicaragua and other Central American countries on October, 1998. In particular, it tries to identify the ways in which the degree of shock exposure interacts with pre-shock individual and household characteristics driving the decision to move. Although the household asset level before the shock has been widely recognised as determinant of migration decisions (Carvajal and Medalho Pereira, 2009), to the best of my knowledge no contribution has investigated the role of household income composition in selecting the *ex-post* optimal coping strategy to adopt.

1.3.2 Is Migration an effective coping strategy for environmental shock recovery?

Environmental shocks may have a dramatic impact on family livelihoods both in the short and long term (Skoufias, 2003). Instantaneous increases in poverty and deprivation due to a drop in consumption levels are frequently reported in correspondence to shock exposure (IADB,2000). However, the long term implications of such drawbacks depend on whether the event affects household assets. Natural disasters damage the productive capital of firms and self-employed workers, eventually forcing physical capital liquidation to fund reconstruction or reacquisition of non-productive assets such as houses (Carter and Barrett, 2006; Zimmerman and Carter, 2003). Therefore, receiving an external source of liquidity from migrants may prevent assets liquidation, limiting long-term consequences for welfare and helping households to escape from poverty traps.

Climate-related events can also negatively affect public productive infrastructures and disrupt marketing chains, with major consequences also on people not directly hit by the shock (Gignoux and Menéndez, 2016). Natural disasters damaging whole villages or even regions invalidate the capacity of risk sharing networks and informal local group-based credit institutions that activates in normal circumstances to provide any form of

insurance (De Weerdt and Dercon, 2006; Fafchamps and Lund, 2003). Severe climatic shocks may also upset market-based coping mechanisms such as borrowing from formal financial institutions (Carter et al., 2007). Thus, relying on money transfers from relatives not hit by the shock allows to maintain household living standards during periods of general economic difficulties following disaster occurrences. On the other side, several claims have been made regarding the creative destruction component of natural disasters (Hallegatte and Dumas, 2009). Damages provoked by natural shocks would force a renewal of productive assets and stimulate the adoption of more up-to-date production technologies Gignoux and Menéndez (2016). However, the mechanisms inducing such boost can be activated by the mobilization of savings and other household resources, as of course migrant remittances.

In line with the idea of migration as a household level risk management strategy, remittances should work as intra-household mutual insurance in case of shock affecting any family member. Several empirical contributions have assessed whether this mechanism activates in case of negative income shocks. De la Briere et al. (2002) observe that the amount of money sent home by Dominican female migrants in US increases in response to unanticipated home family income shocks. Crop income shortages experienced by those who stay behind are shown to significantly raise remittances to Western Mali (Gubert, 2002). Yang and Choi (2007) observe that changes in income are negatively related to changes in remittances from overseas to the Philippines. Molina Millán (2014) provides further evidence about this co-insurance mechanisms assessing that not only internal and regional migrants provide insurance to their origin households in rural Nicaragua, but also the other way round. At the macro level, remittance flows raise strongly in response to different kinds of adverse exogenous shocks in sending countries (Bettin et al., 2015).

Similar mechanisms seem to activate even in case of climate-related shocks. Natural disasters lead to a substantial increase of migrant transfer flows towards poorer countries (Yang, 2008) and countries with a larger number of migrants abroad (Mohapatra et al., 2012). Remittances have been proved to increase in the aftermath of a disaster contributing to the reconstruction process and subsidizing risk preparedness for those countries that experienced more disruptive events in the past (Bettin and Zazzaro, 2016). Vietnamese households with internal migrants settled before the Typhoon Ketsana started to receive a larger amount of money in the aftermath of the shock (Gröger and Zylberberg, 2016). Remittances partially covered the damages of the Hurricane Gilbert in Jamaica (Clarke and Wallsten, 2004).

All these studies focus on verifying whether this intra-household insurance mechanism activates in case of shock occurrence. However, determining the efficacy of these money transfers in driving household *ex post* recovery remains an under-explored issue. Indeed, very few contributions consider whether RRHs are better able to recover from the drawbacks of a natural disaster than their counterparts. Mohapatra et al. (2012) show that RRHs perform better in terms of per capita consumption immediately after a flood in Bangladesh. Anyway, no details are provided about the efficacy of remittances in stimulating long run recovery patterns. The empirical analysis conducted in Chapter 4 aims to shed light on this issue, testing whether international RRHs recovered more easily than NRRHs from the damages caused by the Hurricane Mitch in Nicaragua. Focusing on long run processes, I test whether two years and half after the disaster RRHs were better able to recoup their previous standards of living. A better understanding of the effectiveness and limitations of migration as a strategy to restore pre-shock livelihoods may inform about conditions determining households' ability to adapt to weather-related risk. In a context of increasing occurrence and intensity of climatic stress, this potentially provide advise for effective recovering policies in developing countries.

1.4 Measuring household welfare

This section discusses the choice of the wealth indicators adopted in the next empirical chapters to measure and compare household living standards. A theoretical foundation directly referring to social welfare functions explains the selection of consumption as a proxy for household welfare. This introduction clarifies the theoretical background for the household consumption analysis conducted in Chapter 2, and motivates the selection of recovery indicators used in Chapter 4.

Several ways to measure household well-being have been proposed. The most common takes its cue from the "welfarist approach", which debates over the most appropriate measure of individual (or household) utility to be included as input of a social welfare function W (Sen, 1979).

$$W = V(y_1, y_2, ...y_N), \tag{1.1}$$

where N is the population size and y is an individual suitable measure of living standards. The ultimate scope of Equation (1.1) is to attribute a summary welfare indicator to

the distribution of the y_s, taking into account both the mean of the distribution and its dispersion. Differently, other more paternalistic approaches (non-welfarist) focus on whether households have attained certain minimal levels of well-being, adopting other indicators of welfare such as infant mortality rates in the region, life expectancy, the proportion of spending devoted to food, housing conditions, or child schooling. Several of these measures coexist in multidimensional assessments of poverty (Haughton and Khandker, 2009). Anyway, the choice of the dimensions to be included, and aggregation or comparability issues make the adoption of multidimensional indicators controversial. Therefore, welfare indicators based on consumption (income) are adopted in the next empirical chapters.

The shape of the social function allows to give more or less weight to the welfare or the poor. Establishing V increasing in each of its arguments, social welfare augments whenever any individual (or household) is better-off and no one is worse-off with respect to the utility measure picked. In this way, Pareto improvements always correspond to improvements in social welfare. Social welfare depends only on the list of individual utilities, and not on who hold them. Finally, social welfare functions are usually assumed to prefer more equal distributions to less equal ones.

In order to guarantee that all these assumption are verified, welfare levels should be appropriately measured and comparable. Indeed, two identical monetary incomes do not necessarily translate into the same living standard at different price levels, or for different household compositions (Deaton, 1997). This issue will be widely discussed in the next paragraphs. However, given a certain level of livings, the household is assumed to know how to best deploy these resources to maximize its utility. The analysis of consumption choices sheds light on this utility maximization process. Therefore, in order to measure, compare and aggregate individual (or household) utilities, we need to find a survey based measure that summarizes as closely as possible the requirements prescribed by economic theory for welfare measures.

The concept of money metric utility provides a valuable theoretical solution to solve this issue. The indifference curves defining preference orderings can be identified by the amount of money needed to reach a certain utility level at some fixed set of prices. The minimum cost of reaching an utility level is commonly expressed in terms of real consumption or income (Deaton and Muellbauer, 1980b). Therefore, a function showing the minimum consumption (income) required to meet a given level of utility u at prices

p, can be formalized. Defining y_i this consumption (income) measure for household i, we have that:

$$y_i = p.q = e(p, z, u), \tag{1.2}$$

where p is a vector of prices of goods and services, q is a vector of quantities of goods and services consumed, $e(.)$ is an expenditure function, z is a vector of household characteristics, and u is the level of utility achieved by the household. Given the price vector p, and the demographic characteristics z, y_i corresponds to the consumption (income) needed to reach the utility level u (Haughton and Khandker, 2009).

In the context of developing countries, there is a very strong case in favour of measuring money metric utilities through consumption rather than income. The permanent income hypothesis under which transitory income is saved while long-term income is largely consumed provides the theoretical argument in support of that choice. It claims that income rises and falls in the course of lifetime, fluctuating somewhat from year to year, whereas consumption remains relatively stable (Alderman and Paxson, 1994; Donaldson, 1992). However, the marked preference for consumption-based measures is mainly driven by practicalities and data issues. Difficulties in measuring income are numerous and hard to bypass, especially for rural households whose income largely depends on self-employment in agriculture. To get rid of seasonal fluctuations and satisfactorily estimate living standards, an annual income computation is needed. This requires multiple visits or recall data, whereas a reliable consumption measure can be constructed exploiting observations over few weeks (Deaton, 1997). Widen time intervals may lead to measurement errors since people tend to forget about items they may have sold or bought and transfers received long time before the interview. Finally, people may be reluctant to reveal the full extent of their income for tax evasion reasons or because it has been earned illegally. These arguments are likely to be reversed in developed countries, where consumption surveys are much less widespread than income surveys. Here, obtaining a reliable and economical estimate of income is relatively easier, as a large part of household earnings comes from wages and salaries, the fraction of self-employed population is smaller and seasonality is much less of an issue (Blundell and Preston, 1998; Haughton and Khandker, 2009).

In most cases, the level of y_i is retrieved from household surveys, therefore the information on consumption (or income) are reported at the household level. Furthermore, even if some data on expenditures, income or assets are individually collected, there

is still a component of their value which is not separably assignable to each household member. As regards consumption, there are public goods and services which can be contemporaneously and non-exclusively consumed by several household members. When constructing per capita consumption (income), it is implicitly assumed that consumption is equally shared among household members and all individuals in the household have the same preferences. These are strong assumptions to be verified in reality: household members do not have all the same needs and control on collective resources, e.g. children vs. adults (Kanbur and Haddad, 1994; Chiappori, 1992). The simple comparison of welfare measures across households which differ in size and composition can be quite misleading about real individual well-being. In addition, if there are economies of scale, per capita consumption (income) will understate individual welfare levels, even if all household members are adults.

In case of consumption-based welfare indicators, a solution to this problem consists in applying a system of weights, through equivalence scales. For any given family size and composition, equivalence scales compute the number of adult males to which that household is deemed to be equivalent, allowing to convert household real expenditures into money metric utility measures of individual welfare. Both the construction and the use of equivalence scales require specific assumptions, whose implications on welfare estimation and comparisons are not negligible. Therefore, how these weights should be attributed is a debated issue. Equivalence scales can be derived relying on behavioural analyses of household consumption, such as demand system estimations (Deaton, 1997). Alternatively, subjective evaluations of the necessary amount of resources to reach some perceived level of welfare can be used to construct a weight system. Anyway, the most reliable approach consists in applying *ad hoc* corrections through arbitrary criteria (Deaton and Zaidi, 2002). An example is the computation of the number of adult equivalents as follows:

$$N_{AE} = (N_{adults} + \alpha N_{children})^{\theta} \tag{1.3}$$

Both the parameters α and θ lie somewhere between 0 and 1 and represent respectively the cost of a child relative to that of an adult, and the extent of economies of scale. The smaller is θ, the more important economies of scale are considered to be. In developing countries, economies of scale are likely to be less pronounced than in rich countries as a large part of household budget is for food, while children are relatively more expensive in industrialized countries (school fees, entertainment, clothes, etc.) (Deaton, 2003). Equivalence scales can reflect the difference in calorie needs of individuals with different

characteristics. In this case, as the caloric intake is lower for children, conditional on per capita consumption, calorie consumption per capita falls with household size, due to the fact that larger households have a larger proportion of children. A widely used scale inspired to this idea is the *OECD scale* which sets $\alpha = 0.5$ and $\theta = 0.7$ (Haughton and Khandker, 2009). Several researchers have estimated the value of these parameters with counteracting conclusions according to the context of analysis (Jenkins and Cowell, 1994; Pendakur, 1999). Anyway, scarce attention has been devoted to whether and what extent intra-household consumption allocation differs according to gender and age of the family members (Deaton, 1997).

These elements provide the theoretical motivations for choosing consumption as proxy for household welfare. As money metric utility measure, consumption reveals the utility level the household can reach. In Chapter 4 per capita consumption is exploited to analyse recovery performances from a natural disaster, as it provides reliable information on household well-being. In order to deal with the welfare comparability issues mentioned above, sensitivity analysis are conducted harmonizing household consumption with different arbitrary-based equivalence scales. On the other hand, the demand system estimation conducted in Chapter 2 adopt a behavioural approach to assess how households allocate total consumption across different budget items. Through this analysis some features of the utility maximization process can be identified.

The next three chapters presents the empirical analysis introduced in this chapter. In each part the research questions are specifically defined, and the data and the methodology implemented to conduct the analysis are illustrated. Particular attention is devoted to the explanation of how some methodological challenges concerning selectivity and endogeneity issues are overcome. Finally, the results obtained are widely commented at the end of each section.

Chapter 2

Remittances and healthcare consumption: human capital investment or response to shocks? Evidence from Peru.

joint with Gabriella Berloffa

2.1 Introduction

Remittance inflows [1] have surged during the last decades, becoming a fundamental source of external funds for developing countries. Their amount at a global

[1] The term "remittances" indicates the money and goods that are transmitted to households by migrants working outside of their origin communities, either in urban areas or abroad (Adams, 2011). Remittances can be sent through either formal or informal channels. Formal channels include money transfer services offered by banks, post office banks, non-bank financial institutions, foreign exchange bureaus, and money transfer operators (MTOs), e.g. Western Union and MoneyGram. Informal remittances are defined as money transfers that do not involve formal contracts and thus, are unlikely to be recorded in national accounts. Cash transfers occurring through personal relationships, or carried out by unofficial courier companies, friends or relatives are the most common forms of informal remittances (Freund and Spatafora, 2008).

level was three times larger than official development assistance in 2013, and their flows are more regular than both private debt and portfolio equity [2]. The economics of migration has devoted increasing efforts to the analysis of the effects of remittances on sending communities (Clemens et al., 2014). The potential additional income provided by remittances may relax household liquidity constraints, fostering poverty reduction, human and physical capital accumulation and ensuring against income volatility. These potential benefits may be counterbalanced by the direct costs of migration and the indirect costs in terms of reduced incentives to labour supply and rural productivity of members left behind, and skilled workers being lost (brain drain) (Acosta et al., 2007; Adams and Cuecuecha, 2013; Randazzo and Piracha, 2014; Taylor and López-Feldman, 2010; De Haas, 2010)

Particular attention has been devoted to the impact of remittances on human capital accumulation. Several studies have confirmed that these income flows support resource-constrained households for the enrolment and maintenance of children in school and for improving the quality of their educational investment (Cox Edwards and Ureta, 2003; Salas, 2014). A more recent literature contradicting the "brain drain" hypothesis suggests that, since the returns of education are higher when migrating, the prospect of future migration raises the overall expected returns to education, stimulating higher domestic investment in schooling (Docquier and Rapoport, 2012). There is also evidence of some negative effects of migration due to parental absenteeism, such as school drop-outs and child labour employment (Hanson and Woodruff, 2003; Hildebrandt et al., 2005; McKenzie and Rapoport, 2011).

The impact of migration on the health status of family members left behind has received less attention. The main contributions investigate the influence of migration on child health outcomes (Kanaiaupuni and Donato, 1999; Frank and Hummer, 2002; Hildebrandt et al., 2005). Only a few studies analysed the effects of migration and remittances on health inputs, i.e. expenditures for health services provision (preventive and curative), family planning activities, drugs, etc. Contrasting evidence has emerged by two studies investigating the effects of migration

[2] Aggregate data for Peru confirm the trends registered at the global level. The amount of remittance inflows from abroad reported in 2013 represents the 1.3% of GDP (Migration and Remittances Team, 2014)

on consumption patterns of Mexican households. Amuedo-Dorantes and Pozo (2011) observe that the sensitivity of household healthcare expenditures to variations in the level of international remittances is almost three times greater than their sensitivity to changes in other sources of income. On the contrary, Mora and Taylor (2006) observe larger marginal health budget shares for rural households receiving domestic transfers, while no significant difference is noticed for families receiving international remittances. Such divergence is probably due to the characteristics of the migratory phenomena considered. Indeed, the migration flows analysed in the second study are mostly characterized by low-skilled temporary migrants from rural areas with different migration perspectives with respect to those migrating from urban areas. Although heterogeneous in magnitude, positive evidence of the impact of migrant transfers on health expenditure has been verified in other contexts too. Adams and Cuecuecha (2010a, 2013) report an increase in health marginal budget shares both for internal and international remittance receiving households (RRHs) in Ghana and Guatemala.

This paper investigates the impact of international remittances on the consumption of healthcare services. It overcomes some methodological limitations of the previously mentioned studies related to the functional form adopted to model consumption behaviour. In addition, we aim to assess whether the observed healthcare consumption preferences reflect a choice of investing in human capital [3] or a response to health shocks. A larger investment in human capital may be triggered by several interrelated factors linked to migration, which modify the household decision-making process and consequently the resource allocation outcomes: changes in income composition due to remittance inflows, migrants' influence on income allocation decisions, existence of a sort of commitment to address resources coming from remittances towards specific consumption items, transmission of knowledge and good practices by migrants to sending families. On the other hand, an increase in health spending can be caused by health shocks affecting members left behind (Ambrosius and Cuecuecha, 2013). In the occurrence of a negative shock, remittances may constitute an *ex-post* coping strategy to reduce

[3] "Investment in human capital" is often used along the text as a synonymous of investment in health. This is prompted by the fact that expenditure in healthcare can represent a substantial part of household investment in human capital, especially in developing countries. Many studies have documented that even poorest households in developing countries spend large portion of their budgets on healthcare (Dupas, 2011).

the adverse consequences. Therefore, reverse causality problems may occur in the two-way relationship between the migrant decision to send transfers at home and the healthcare consumption choices of relatives left behind. In order to disentangle these two effects, we consider whether households report a recent health shock or not and we test if consumption preferences react to the shock differently according to household remittance status. Moreover, we conduct separate estimations for households experiencing a health shock and not.

In order to deal with the fragmentation of medical care provision by the health supply sector in Peru, we consider the total amount of health consumption instead of direct expenditures only, as it has been done in all the studies mentioned above. Indeed, households may have access to healthcare through other channels besides out-of-pocket outlays, and this element cannot be detected considering only direct expenditures. In this way, we also take notice of households getting access to medical care by expenditures covered by public or private insurance, donations, or other informal channels. Therefore, we are able to identify whether receiving income from migrants widens the overall level of medical care consumption.

The identification of the link between remittance income and health demand is obtained by comparing the consumption behaviour patterns of transnational and national households. In order to do that we estimate an Almost Ideal Demand System (AIDS) using data from the "Peruvian National Survey of Households" of 2011. We find that RRHs allocate more resources to healthcare consumption than no remittance receiving households (NRRHs) and this outcome is robust to a potential reverse causality bias due to the occurrence of a health shock. Therefore, our results confirm the positive role of international remittances in fostering human capital investment.

The next sections are organized as follows. Section 2 presents an overview of theoretical and empirical studies investigating the impact of migration on health status of sending households. The main empirical challenges faced in the estimation of the net effect of remittances on health consumption are outlined. Section 3 presents the Peruvian context, identifying how remittance may contribute to improve household healthcare access. Dataset characteristics and some descriptive statistics are introduced in Section 4. Section 5 describes the empirical strategy

pursued in our estimation and, finally, Section 6 presents and comments the main findings.

2.2 Migration and health status of those staying behind

Several studies have tried to identify the net impact of migration on health outputs, considering both the direct income effects provided by remittances and the direct and indirect costs of migration. The mechanisms through which potential improved economic conditions due to migrant transfers may enhance health outcomes are various (Deaton and Paxson, 1998; Case et al., 2002; Fletcher and Wolfe, 2014). Individuals in better socio-economic conditions experience lower exposure to communicable diseases, risky behaviours and sedentary lifestyles. Heterogeneity in the access to healthcare, knowledge about good health practices, and intergenerational transmissions of healthy behaviours are other commonly used arguments to explain reported differences in health status across income groups (Smith, 1999). Kanaiaupuni and Donato (1999); Frank and Hummer (2002); Hildebrandt et al. (2005) test the various effects of parental migration to US on child health in Mexico, measured in terms of infant mortality, birth weight, undernutrition and anthropometric outcomes. The receipt of remittances is significantly and negatively associated with the odds of low birth weight (Frank and Hummer, 2002). On the other side, the absenteeism of a family member worsens some of the outcomes observed for children left behind, as it weakens caregiver attention and disrupts the division of labour within the household. Such drawbacks tend to shrink over time as migrants accumulate experience and households adapt to their absence (Kanaiaupuni and Donato, 1999). A further channel through which migration to US affects health preferences of sending households is the transfer of health knowledge. The awareness about healthcare practices and lifestyle behaviours accumulated by migrants guides relatives' decisions in terms of both preventive and curative medical care consumption, and improves the effectiveness of the healthcare provided. Knowledge flows generate spillover effects also on non-migrant households, inducing an additional contribution in terms of "social remittances" (Hildebrandt et al., 2005; Lindstrom and Munoz-Franco, 2006).

Few contributions have investigated the impact of migration on health inputs, analysing the link between the amount of remittance income received and healthcare expenditures, or comparing the spending behaviour of RRHs with similar NRRHs. Household decisions in terms of healthcare consumption may be directly affected by remittances: if the additional resources provided by transfers overcome the income reduction due to a lower number of wage earners, household liquidity constraints are relaxed. The increase in income may stimulate RRHs to allocate more resources to medical care expenditures, fostering the access to healthcare and increasing the quality of services accessed. Such effect has been verified in several contexts. Amuedo-Dorantes and Pozo (2011) test whether and to what extent remittances contribute to the purchase of healthcare services in Mexican households. Medical care outlays seem to rise with the amount of income transfers from abroad, and the responsiveness of healthcare expenditure to remittance income is greater than its responsiveness to other sources of income (Amuedo-Dorantes and Pozo, 2011).

Other studies have identified a positive effect of migrant transfers on health expenditures, examining the differences in consumption patterns between RRHs and NRRHs using the Working-Leser model [4]. Adams and Cuecuecha (2010b, 2013) identify a slight increase in health marginal budget share for both internal and international RRHs in Guatemala and Ghana. Castaldo and Reilly (2007) use a similar specification to describe consumption patterns of Albanian families. The findings show significant and positive effects of external remittances on household health expenditures, while no relevant differences emerge between households receiving domestic transfers and NRRHs. Tabuga (2007) investigates the general relationship between remittances and household consumption patterns in the Philippines underlying that the model does not perform well in explaining the decision-making process determining budget shares allocated to medical care [5].

However, these studies have some limitations. Firstly, those estimating a demand

[4] The Working-Leser (W-L) (1943, 1963) model relates budget shares linearly to the logarithm of total household expenditure. The estimation of the W-L model is carried out using Ordinary Least Squares (OLS), separately estimating each equation of the demand system. The OLS coefficients and the average budget shares are used to calculate the marginal budget shares and the expenditure elasticity of good i

[5] The measures of goodness-of-fit reported, i.e. Pseudo R-squared and Adjusted R-squared, are very low.

system use a specification which is linear in expenditure [6], assuming constant marginal budget shares with respect to the level of prices and total expenditure (Pollak and Wales, 1992). An exception is the study by Mora and Taylor (2006) who adopt a locally flexible functional form [7] as the Almost Ideal Demand System (AIDS) by (Deaton and Muellbauer, 1980a) to estimate the impact of migration on the expenditure patterns of rural Mexican households. The linearity assumption has often been contradicted by empirical analyses as inconsistent with the predictions of the Engel law (Barnett and Serletis, 2008). Figure A.2.1 and A.2.2 in Appendix A confirm that the consumption shares addressed to health and food do not vary linearly along with total consumption in our sample either. Recognizing a non-linear relationship of total consumption with budget shares, we estimate a demand system using the AIDS specification. The AIDS belongs to a class of demand systems called price-independent generalized logarithmic (PIGLOG), which assumes budget shares being linear in the logarithm of total expenditure [8].

A second limitation of the early mentioned contributions is that they do not verify whether the re-allocation of resources from remittances to health expenditures reflects a shift in migrant household preferences towards human capital investment or it constitutes a response to health shocks, that create demand for alternative financial sources by liquidity-constrained households. This would be in line with the predictions of the New Economics of Labor Migration theory which identifies international migration as a household strategy to reduce vulnerability to negative shocks through income diversification. Ambrosius and Cuecuecha (2013) test this hypothesis comparing the impact of health-related shocks on debt levels between national and transnational households in Mexico. They report no effect of the shocks on the debt-burden of RRHs, while the average debt burden is doubled for NRRHs. In order to assess whether the health consumption behaviour observed corresponds to a variation of household preferences or a reaction to health shocks, we conduct further estimations. In particular, we investigate if consumption choices react differently to shocks according to household remittance status,

[6] In addition to Working-Leser model, Rotterdam model and Linear Translog models belong to this category of systems.

[7] A demand system is composed by flexible functional form equations if it is capable to provide a second order approximation to the behaviour of any theoretically plausible demand system at a point in the price-expenditure space (Pollak and Wales, 1992).

[8] AIDS is a complex demand system with several desirable properties: it satisfies the aggregation restriction, and with simple parametric restrictions, homogeneity and symmetry.

confirming the idea of remittances as insurance against negatives episodes. Moreover, we run separate estimations for households recently experiencing a health shock and not, to see whether the positive effect of transfers persists even in absence of a shock, reflecting an increased investment in preventive healthcare.

2.3 Access to health in Peru

In order to figure out how remittances may contribute to raise health consumption, facilitating the access to healthcare and improving the quality of the health services accessed, some features of the Peruvian healthcare system need to be pinpointed. Although some efforts to integrate the health sector supply side have been done since the early 2000s, it continues to be fragmented among various providers belonging to both public and private sector. Public health providers are the Ministry of Health, the regional governments, the social security health insurance institution under the Ministry of Labour (EsSalud) and the police, army, air force, and navy health funds. Each of this institution provides healthcare to specific population subgroups, through heterogeneous source of fundings. EsSalud guarantees health insurance to formal employees and their families and is financed by payroll contributions. The Ministry of Health and the regional governments co-manage the Comprehensive Health Insurance Scheme (Seguro Integral de Salud—SIS), which ensures access to health services for workers in the informal sector and the poor, and it is subsidised directly by the Minister. The private health sector includes private providers and insurance companies, nonprofit entities, private medical doctors and other health professionals, as well as suppliers of traditional or indigenous medicine. Users of private sector services can access to them throught out-of-pocket outlays, private insurance coverage, or even donations (Vermeersch et al., 2014).

The Universal Health Insurance Law of 2009 created a regulatory framework to achieve universal health coverage, promoting coordinated institutional efforts between previously mentioned actors. However, the affiliation to different health insurance programmes corresponds to heterogeneous ranges of available services and access costs. Moreover, actual availability of services at the local level, wait-

ing time and low quality of public provision may induce patients to get access to healthcare through more than one channel contemporaneously, and overlapping different paying systems to cover healthcare costs (Maeda et al., 2014).

Therefore considering only direct expenditure, as most of the studies presented above do, could be misleading. Services supplied by the public sector are not covered by out-of-pocket outlays and the price charged to the households may vary according to the provider and the type of insurance policy. Thus, a consumption variable is built up considering in addition to out-of-pocket outlays (both direct expenditures and outlays for private insurance), all the expenditures covered by public insurance or any other public institutions, private institutions, members of other households, or other informal channels. These expenditure items are calculated asking the respondents to impute the value of services consumed at market prices. Analogously to what is done for the health item, the annual amount of total consumption is computed for each consumption category.

Remittances may help to get quicker and higher standard access to diagnostic and curative services, and support the direct and indirect costs of therapies in case of lack of insurance coverage. On the other hand, this source of money can be addressed to preventive healthcare, immunization or pregnancy care. Nevertheless, remittances may be used to pay health insurance premia, preventing for future health shock risk exposure. International migration out of Peru is essentially a labour migration phenomenon, prompted by the will to improve the standards of living of both migrants themselves and relatives left behind. The vast majority of Peruvian migrants send money home on a regular basis and long after having left the country pitching in to current expenditures, covering children education fees and investing in house construction (International Organization of Migration, 2012). The nature of the phenomena corresponds to the understanding of migration as a household level investment decision to improve well-being in the medium and long run. Therefore, investing in human capital through preventive healthcare consumption may constitute a priority for RRHs. Household members left behind could be incentivized to address resources sent by migrants to health investment by the commitment to an intra-household informal agreement on remittance use.

2.4 Data and descriptive statistics

The data used in this analysis are retrieved from the "Peruvian National Survey of Households" of 2011 (*ENAHO - Metodologia Actualizada - Condiciones de vida y pobreza*), conducted by the "Peruvian National Institute of Statistics and Informatics" (INEI). The ENAHO is a yearly survey, nationally representative, and it collects information on dwellings, household expenditures and income, and on demographic, education, health and employment status of each household member. The sample consists of about 24700 observations.

As regards migration and remittance status, the survey provides details on the frequency with which households receive international remittances, the annual amount of transfers received, and the absence of any household member [9]. RRHs represent 2.10 per cent of the sample. The annual amount of remittances received is 5360 Nuevo Soles [10]. Table 2.1 summarizes descriptive statistics according to household remittance status. RRHs are non-poor (90%), mostly living on the Coast or in Lima (78%), and settled in urban areas (90.73%). About 55 per cent of the household heads have completed at least the secondary level of education, compared to less than 40 per cent for NRRs. Household head average age is higher in transnational families. Almost 70 per cent of them has more than 50 years, compared to 50 per cent in the other group. The percentage of female household heads is larger than in NRRHs. RRHs report a remarkably higher average total consumption. As regards self-reported health status, transnational families are more likely to have a member experiencing chronic discomfort or being recently affected by a health shock. As a proxy for the occurrence of a health shock we consider reporting an episode of hospitalization in the 12 months before the survey.

The average annual healthcare consumption varies from 1192 Nuevo Soles in Sierra regions to 2801 Nuevo Soles in the Metropolitan area of Lima. Families headed by a woman seem to demand for medical care less than families with a male household head. The level of healthcare consumption reported when the household head is highly educated is significantly higher. Summary descriptive statistics in Ta-

[9] A member is considered "absent" if it is absent from the household for 30 days or more.

[10] Official exchange rate (Nuevo Soles per US dollars, yearly average 2011) is 2.75; International Monetary Fund, International Financial Statistics.

Table 2.1: ENAHO - Descriptive statistics

	RRHs	**NRRHs**
Household composition (%)		
Household size	4.00	3.98
Number of children	0.92	1.16
Number of elderly	0.58	0.34
Poverty status (%)		
Extremely Poor	0.19	7.21
Poor	4.83	19.85
No poor	94.98	72.94
Geographical area (%)		
Costa	38.42	27.44
Sierra	40.42	12.55
Selva	9.65	21.09
Lima	39.38	11.05
Urban	90.73	60.05
Education household head (%)		
No education	17.76	29.31
Primary education	25.87	30.47
Secondary education	35.14	25.53
High school or more	21,24	14,41
Gender household head (%)		
Female	38.80	23.44
Age of the household head (%)		
0-49	30.50	49.03
50-69	44.02	36.56
70 +	25.48	14.41
Total consumption (nuevo soles)	33,607	19,976
Rented House (%)	8.11	7.12
Member with chronic discomfort (%)	87.45	74.64
Member hospitalised in the last 12 months (%)	27.41	17.87

ble 2.2 (panel A) show that RRHs tend to spend more for healthcare, both in terms of direct expenditures and regarding outlays covered by public or private institutions and by members of other households. In particular, we observe that out-of-pocket outlays and expenditures covered by public institutions are more than double for RRHs, while the amount of expenditures covered by private insurances or by members of other households are more than three times larger than that reported by NRRHs . Table 2.2 (panel B) presents the average consumption shares for the consumption categories included in the demand system by remittance status. Relevant divergences in consumption allocation emerge between the two groups: RRHs report higher consumption shares for health, education, housing and transports, while smaller budget shares are observed for food and clothes.

In line with what emerged in Table 2.1, these differences could simply reflect different geographical locations and overall economic status of the two household groups. Thus, in order to identify a specific tendency to address resources from transfers towards human capital investment, it is necessary to disentangle the overall income effect from the remittance effect. As Table 2.3 shows, divergences in the level of the health consumption shares are reported not only between RRHs and NRRHs, but also between the two groups in the same income quartile. Since the share of medical care outlays is larger for RRHs across all income quartiles, a specific contribution of migrant transfers to healthcare funding could be hypothesized.

Table 2.2: ENAHO - Outcome variables

	Remittance Households	No remittance Households	Test of means (*)
Panel A: Healthcare consumption (Nuevo Soles)			
Healthcare consumption (direct expenditure)	2017	927	-11.99***
Healthcare consumption (covered by public insurance or institution)	1113	531	-6.77***
Healthcare consumption (covered by private institution or members of other households)	730	203	-10.12***
Panel B: Average consumption shares			
Health	.098	.072	-6.85***
Food	.398	.508	16.52***
Education	.070	.053	-6.53***
Clothing	.043	.051	3.91***
Housing	.221	.180	-9.56***
Transports	.112	.082	-9.99***
Other	.058	.054	-2.09**
Total	1.000	1.000	

**Test of means for remittance status: significant at 0.01 (***), 0.05 (**), 0.1 (*).*

Table 2.3: ENAHO - Health consumption by income quartile and remittance status

	1st quartile	2nd quartile	3rd quartile	4th quartile	Total
International remittances	0.079	0.082	0.103	0.099	0.098
No remittances	0.053	0.064	0.069	0.088	0.071

2.5 Empirical strategy

2.5.1 Identification

As mentioned above, there are various sources of endogeneity in the relationship between remittance status and consumption decisions. Firstly, RRHs may differ from NRRHs for unobserved characteristics (e.g. skills, ability, motivation of migrant members, propensity to risk, previous migratory experiences), which affect both the decision to send a migrant abroad and household preferences in terms of consumption allocation, giving rise to self-selection issues. Moreover, there exists a reverse causality concern in the two-way relationship between the decision of sending money back and the health conditions of members left behind. An individual may decide to migrate and send remittances because a household member suffers from bad health conditions, while at the same time remittances may foster health investment by loosening liquidity constraints.

Following previous contributions [11], we use an instrumental variable technique (IV) to overcome these potential sources of bias. The choice of the instruments is driven by the idea that migration networks, together with cultural, community or political factors of the area of origin influence the probability to migrate and remit, but not consumption decisions of the households. The argument sustaining this criterion is that past migration facilitates present migration, as a larger network of migrants provides contacts, information and logistic support for new migrants. Moreover, international migration is more likely to be undertaken when people get in touch with successful experiences reported by neighbours or acquaintances. Since recent Peruvian migration history is mostly characterized by labour migration and remittance patterns seem to be very selective at the geographical level, historical migration and remittance flows at the local level may represent suitable instruments. Therefore, we include the historical migration rates at the departmental level (1995-2005) [12] and the remittance rate at the provincial level in 2007 [13] in the first-stage regression. The choice of the time spells for the instruments

[11] Hanson and Woodruff (2003) ,Hildebrandt and McKenzie (2005), McKenzie and Rapoport (2011) all employ historical migration rates as instruments for current migration.

[12] See https://www.inei.gob.pe/estadisticas.

[13] The remittance rate at the province level is obtained from the 2007 wave of the ENAHO survey.

is partly driven by data constraints but it also complies with the historical trends of Peruvian migration. Indeed, until the second half of the 1990s, international migration involved exclusively an élite of the urban population in Lima. The economic crisis caused by the escalation of the civil war acted as a push-factor for labour out-migration for all social groups, especially middle class young people (International Organization of Migration, 2012). Thus, a surge in the outflows occurred at the end of the 1990s, while they became flatter after 2006 [14].

Although for many households remittances constitute the most tangible consequence of migration, they might not be the only channel through which migration influences the well-being of relatives left behind (McKenzie, 2005). To determine the impact of remittances on health consumption decisions we need to disentangle the specific effect of remittances from the overall consequences related to the migration phenomenon. Consequently, instrumenting household remittance status with a predictor of household likelihood of having a migrant may result in a violation of the exclusion restriction. The bias risen by adopting a weak instrument might be either positive or negative according to what effect of migration on relatives' health prevails. To overcome this potential source of bias we adopted remittance rates at the province level in 2007 as an instrument. These should predict more precisely which households will receive remittances rather than households having a migrant among its members. It is important to remark here that there is a positive and statistically significant correlation (0.79) between remittance and migration rates. This suggests that most transnational households receive money transfers from migrant abroad [15].

To ensure the validity of the exclusion restriction, these historical rates should not affect household health consumption behaviour apart from their influence through

[14] See http://webinei.inei.gob.pe:8080/sirtod-series/.

[15] To shed light on the extent of the bias due to the adoption of an IV predicting household probability to have a migrant, the demand system has been estimated employing a specific instrument of migration status (historical migration rates at the departmental level (1995-2005)) both separately and together with the remittance rate. Comparing the results obtained across the different specifications we can get a better sense on whether migration influences household health consumption decisions through other channels besides remittances, presuming the presence of some bias. Table 9 in Appendix A summarizes these estimates. As expected, the historical remittance rates are stronger predictors of household remittance status than migration rates. The direction of the effect of remittances on health budget share does not change across models. However, using a predictor of the likelihood of having a migrant may overestimate the positive effect of remittances, suggesting a role of migration in influencing consumption decisions that goes beyond the remittance channel.

current migration. A potential threat to this assumption is that previous migration may have boosted economic development, with positive consequences on health infrastructure development. Indeed, sizeable remittance inflows, return migration or transmission of knowledge from migrants to those left behind may have provided resources to enhance the supply of health facilities and increased the demand for higher quality services. As such, the historical migration rate in a province could be positively correlated with the current level of health infrastructure in that same area. To deal with this possibility, we control for two proxies of geographical variation in health supply: the number of hospitals per 1000 population at the provincial level and a dummy for the presence of healthcare establishments in the district. The data on available healthcare supply at the local level are retrieved from El Registro Nacional de Municipalidades (2008) [16]. After adding these controls, historical remittance rates still remain strong instruments, while none of controls are individually significant. This provides further evidence for the validity of the instruments chosen.

2.5.2 The model

We model household consumption behaviour using an Almost Ideal Demand System. This model overcomes the linearity assumption between budget shares and total consumption fixed by the Working-Leser demand systems (Working, 1943; Leser, 1963). The idea inspiring the class of models to which the AIDS belongs is to define a functional form which allows to perform a second-order approximation to any direct or indirect utility function or to a cost function. Correspondingly, the demand functions, expressed in terms of budget shares, become:

$$w_{ih} = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \left(\frac{x_h}{P_h} \right), \tag{2.1}$$

where P is a price index defined by

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_j \sum_k \gamma_{kj} \log p_k \log p_j. \tag{2.2}$$

[16] For more details, see http://ineidw.inei.gob.pe/ineidw.

The adding up restriction requires that $\sum_{i=1}^{n} \alpha_i = 1$, $\sum_i \beta_i = 0$, $\sum_{i=1}^{n} \gamma_{ij} = 0$. Homogeneity condition is satisfied if and only if for all j, $\sum_j \gamma_{ij} = 0$, while the symmetry condition requires that $\gamma_{ij} = \gamma_{ji}$. However, since our analysis is based on cross-sectional data, we do not have information on the time variation of prices to separately identify price elasticities. Thus, a conventional normalization for cross-sectional data is applied setting $p_i = 1$ and $\log p_i = 0$. Consequently, the budget shares can be written in the form:

$$w_{ih} = \alpha_i + \beta_i \log x_h - \beta_i \alpha_0. \tag{2.3}$$

Changes in real consumption operate through the β_i coefficients: these are positive for luxuries and negative for necessity goods (Deaton and Muellbauer, 1980a,b). According to this empirical framework, different specifications are implemented, extending the model to include remittance status dummies and interactions of these dummies with total consumption. Separate models are estimated to distinguish between average and marginal effects of remittances on consumption allocation. The specific forms of the estimated equations are respectively:

$$w_{ih} = \alpha_i + \beta_{1j} \log Y_h + \beta_{2i} R_h + \beta_{3i} Z_h + u_{hi}, \tag{2.4}$$

$$w_{ih} = \alpha_i + \beta_{1j} \log Y_h + \beta_{2i} \log (Y_h) * R_h + \beta_{3i} Z_h + u_{hi}, \tag{2.5}$$

where w_{ih} corresponds to the consumption share on commodity i for household h, Y_h is total consumption for household h, R_h is the remittance status and Z_h is a vector of household characteristics including both household-level and province-level variables. Such specification permits remittance status to shift the propensity to allocate available income across the different consumption categories, and the functional form holds the attractive theoretical properties of the AIDS model.

The demand system equations have been simultaneously estimated using an iterative three-stage least squares procedure (3SLS). In this way, the information contained in the cross-equation error correlations are exploited. To eliminate another potential source of endogeneity, total consumption has been instrumented by total household income and number of household members with high educational levels (Banks et al., 1997; Berloffa et al., 2006). To satisfy the adding-up restrictions required by the AIDS framework, a consumption category, that is other

goods, is omitted and the estimation of those parameters is residually determined. The explanatory variables are identical for all the equations. They include variables describing household size and composition (total household size, number of children and elderly members), in order to control for heterogeneous healthcare necessities across age groups. Characteristics of the household head, that are gender, age group and educational level, are encompassed to consider the role of education and informal knowledge in determining the demand for healthcare. The model includes also a set of 4 regional dummies (Costa, Sierra, Selva, Metropolitan area of Lima) and a rural/urban dummy to take into account heterogeneity across different areas of the country. A dummy indicating whether household dwelling is rented is considered to control for household assets.

In order to detect whether the observed health consumption behaviour corresponds to a choice of investing in preventive healthcare or a response to negative health conditions, some proxies of household members health status are included. In particular, we consider a dummy reporting the occurrence of a case of hospitalisation among family members during the 12 months before the survey, as a proxy of a negative health shock, and a dummy for the presence of chronic discomforts, in order to control for permanent health conditions. A specification including the interaction between remittance status and the occurrence of the shock is performed to test if resource allocation decisions vary between the two household groups when the shock happens. As a supplementary test, we split the sample according to the hospitalization dummy and we estimate the model considering only household not reporting health shocks during the last year to verify whether the positive effect of transfers on health consumption shares is confirmed also in these circumstances.

2.6 Results

Second-stage equations (Equation (2.4)) for the demand system estimated with instrumental variables reported in Table 2.4 are in line with standard consumption patterns. The food share increases with household size and for households living in rural areas but decreases with total consumption, educational level and age of the household head. For what concern the health dimension, we observe that, as expected, total consumption, number of children, number of elderly, age and

education level of the household head, as well as presence of a member with chronic discomfort, all increase healthcare consumption shares. Geographical variation in health supply at the local level, instead, has no significant effect on household healthcare consumption decisions. Focusing on the role of remittances, our results reveal significant differences in the consumption patterns of RRHs with respect to the others. Getting migrant transfers has a positive and significant average effect on the consumption shares of health and housing and a negative (and significant) effect on those of education, clothing and transports.

To better appreciate the value added of applying this estimation technique, Table A.2.8 in Appendix A compares the results obtained estimating the demand system as a series of single equations by OLS, single equations by IV and simultaneous equations by IV. Sizes and directions of total consumption coefficients are consistent across the three estimation methods. Thus, patterns of the propensity to address additional resources to specific consumption items remain similar regardless of the estimation technique implemented. The same cannot be said regarding coefficients measuring the impact of remittance status on consumption allocation. Remarkable differences can be observed comparing OLS and IV estimations. OLS estimates suffer from a bias due to the violation of remittance status' independence from the error term. As regards health consumption shares, the remittance status coefficient increases in size and becomes statistically significant in IV models, indicating that RRHs tend to have unobserved characteristics that make them less likely to address resources to health consumption than observationally similar households in NRRHs group. As mentioned in the methodological section, estimating the demand system with a 3SLS approach allows to overcome another source of endogeneity linked to simultaneity: as resource allocation across budget shares is simultaneously determined, total consumption in each equation would be correlated with its error term. As expected, we observe that remittance status coefficients in the 3SLS estimates go in the same direction as in single equation IV model. However, the level of statistically significance generally increases.

The average effect of receiving transfers on healthcare consumption shares is around 11 percentage points. This means that, for a level of annual total consumption of 30000 Nuevo Soles (corresponding to around 10900 $), RRHs address 1200 $ more than NRRHs to healthcare consumption. In order to assess if the size of the impact of remittances changes with the level of total consumption, the

estimates of Equation (2.5) reported in Table A.2.4 (Appendix A) show that the marginal effect of receiving transfers is almost 1.1 percentage points. This results in an effect of remittances on healthcare consumption shares of 9.2 and 11.4 percentage points, respectively for a level of total consumption of 5000 and 35000 Nuevo Soles. Therefore, although the impact of remittances grows with the level of total consumption, the magnitude of this effect does not vary so much along the consumption distribution.

The consumption elasticities of demand for each consumption category confirm that the size of the consumption shares addressed to healthcare does not vary so much with the level of total consumption. The outcomes displayed in Table 2.5 [17] give a measure of the propensity to redistribute additional resources towards healthcare for the two household groups as long as total consumption increases. Coherently with the elements emerged until now, the consumption elasticity of demand for healthcare is larger for RRHs with respect to NRRHs. However, the difference in the size of this elasticity is not very large: indeed, if total consumption increases by 10 per cent, healthcare consumption augments by 13.3 per cent for RRHs and by 11.8 per cent for NRRHs.

[17] According to the definition of elasticity and in line with the model estimated with the interaction variable, see Table A.2.6 in Appendix A, the consumption elasticity of good j for household i can be derived as $\eta_{ij} = (\alpha_{1j} + \overline{w}_j) * \frac{1}{\overline{w}_j} = \frac{\beta_{ij}}{\overline{w}_j} + 1$. In our case, the consumption elasticity for RRHs becomes $\eta_{ij}^R = \frac{\beta_{1j} + \beta_{2i}^R}{\overline{w}_j} + 1$. In this way we obtain the consumption elasticities of demand for RRHs and NRRHs at the same (average) level of consumption shares

Table 2.4: ENAHO - AIDS with Instrumental Variables - Dummy Variable Model

	(1) Health	(2) Food	(3) Education	(4) Clothing	(5) Housing	(6) Transports
Ln (total consumption)	0.0138***	-0.1286***	0.0320***	0.0076***	0.0006	0.0490***
	(0.0025)	(0.0039)	(0.0017)	(0.0014)	(0.0028)	(0.0019)
Receiving international remittances (dummy)	0.1103***	-0.0066	-0.0834***	-0.0688***	0.2416***	-0.0829***
	(0.0356)	(0.0556)	(0.0244)	(0.0201)	(0.0407)	(0.0270)
Household size	-0.0052***	0.0305***	0.0024***	-0.0009**	-0.0178***	-0.0035***
	(0.0007)	(0.0010)	(0.0005)	(0.0004)	(0.0008)	(0.0005)
Number of children	0.0047***	-0.0137***	0.0015***	0.0053***	0.0089***	-0.0073***
	(0.0008)	(0.0012)	(0.0005)	(0.0004)	(0.0009)	(0.0006)
Number of elderly	0.0139***	-0.0098***	-0.0089***	-0.0012*	0.0109***	-0.0038***
	(0.0012)	(0.0019)	(0.0008)	(0.0007)	(0.0014)	(0.0009)
Educational level household head (Primary)	0.0013	-0.0050**	-0.0026**	-0.0012	0.0052***	0.0014
	(0.0015)	(0.0023)	(0.0010)	(0.0008)	(0.0017)	(0.0011)
Educational level household head (Secondary)	-0.0008	-0.0214***	0.0046***	-0.0006	0.0109***	0.0066***
	(0.0019)	(0.0029)	(0.0013)	(0.0011)	(0.0021)	(0.0014)
Educational level household head (High School or more)	0.0171***	-0.0023*	0.0270***	0.0121***		
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0018)
Age (group) household head 50-69	0.0049***	-0.0171***	-0.0066***	-0.0055***	0.0225***	0.0022**
	(0.0013)	(0.0021)	(0.0009)	(0.0008)	(0.0015)	(0.0010)
Age (group) household head 70+	0.0116***	-0.0388***	-0.0039**	-0.0060***	0.0375***	0.0012
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0018)
Urban	-0.0071***	-0.0170***	-0.0036***	-0.0114***	0.0454***	-0.0050***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0019)	(0.0012)
Geographical area - Sierra	0.0026*	-0.0074***	0.0138***	0.0065***	-0.0072***	0.0021*
	(0.0015)	(0.0024)	(0.0010)	(0.0009)	(0.0017)	(0.0011)

Geographical area - Selva	0.0006	0.0185***	-0.0085***	-0.0019**	-0.0048***	-0.0018
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Geographical area - Lima	-0.0058**	0.0096**	0.0080***	-0.0129***	0.0144***	0.0061***
	(0.0028)	(0.0044)	(0.0019)	(0.0016)	(0.0032)	(0.0021)
Absent member (dummy)	-0.0072***	0.0473***	-0.0010	-0.0081***	-0.0143***	-0.0054***
	(0.0022)	(0.0034)	(0.0015)	(0.0012)	(0.0025)	(0.0017)
Rent	0.0011	0.0088***	0.0013	0.0040***	-0.0132***	-0.0007
	(0.0020)	(0.0032)	(0.0014)	(0.0011)	(0.0023)	(0.0015)
Chronic discomfort (dummy)	0.0233***	-0.0100***	-0.0018**	-0.0030***	-0.0037***	-0.0027***
	(0.0012)	(0.0019)	(0.0009)	(0.0007)	(0.0014)	(0.0009)
Hospitalization (dummy)	0.0704***	-0.0286***	-0.0109***	-0.0016**	-0.0143***	-0.0092***
	(0.0014)	(0.0022)	(0.0010)	(0.0008)	(0.0016)	(0.0011)
Gender household head	-0.0025*	-0.0182***	0.0068***	0.0046***	0.0045***	0.0011
	(0.0014)	(0.0022)	(0.0009)	(0.0008)	(0.0016)	(0.0010)
Hospitals per 1000 population	-0.0007	0.0030	0.0026**	-0.0022**	0.0015	-0.0006
	(0.0017)	(0.0026)	(0.0011)	(0.0009)	(0.0019)	(0.0013)
Healthcare district (dummy)	-0.0006	0.0036	0.0003	-0.0023***	0.0015	-0.0034***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Constant	-0.0785***	1.7074***	-0.2706***	-0.0138	0.1785***	-0.3621***
	(0.0215)	(0.0336)	(0.0147)	(0.0122)	(0.0246)	(0.0163)
Observations	24,760	24,760	24,760	24,760	24,760	24,760
R-squared	0.147	0.334	0.164	0.042	0.152	0.175

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reference category for education level of the household head: no education.

Reference category for age group of the household head: no education:15-49.

Reference category for geographical area: Costa.

These findings present both similarities and divergences with the previously mentioned studies. The results are consistent with what observed by Adams and Cuecuecha (2010a, 2013) for health and food, while they are hardly comparable with (Castaldo and Reilly, 2007), as the consumption categories adopted are different. Nonetheless, the evidence emerged in our estimation is conflicting with their findings showing that households receiving external remittances report higher food budget shares relative to those receiving no transfers. Undoubtedly, these divergences in the results are partly due to the fact that we consider consumption shares rather than direct expenditures only. As regards education, the results obtained seem to contradict most of the contributions mentioned above (Calero et al., 2009; Salas, 2014), claiming that additional liquidity from migrant transfers increases the level of available resources to be allocated to education investment. However, this effect may be overturned by some negative drawbacks due to the migratory process, as parental absence (Hildebrandt et al., 2005). Besides, the argument pursued by brain drain literature that the return to education is higher at destination than at home may not be confirmed in the case of Latin American migration to the US and Europe (Chiquiar and Hanson, 2005). These two elements may explain a lower propensity to invest resources in education by transnational households. Moreover, although controlling for household demographic composition, we do not observe eventual differences in kinship relationships between adult and child members in RRHs and NRRHs, which may determine heterogeneous outcomes of household decision-making on schooling. This effect may not be detected by OLS estimates in Appendix because of bias from unobservables.

As suggested by the first-stage regression in Table B.4.2 in Appendix A, the occurrence of a health shock among household members, proxied by a reported case of hospitalization during the previous 12 months, has a positive and statistically significant effect on the probability of receiving remittances. This may imply that the additional resources coming from migrant transfers and addressed to healthcare constitute a coping strategy against health shocks rather than a choice of human capital investment. In order to distinguish between these two interpretations, Table 2.6 reports the outcomes of the health demand equation estimation across different specifications (Columns 4 - 6).

Column 4 shows the results of the model including an interaction term between the occurrence of a health shock and the remittance status. Similarly to what

observed in the other specifications, RRHs address more resources to health in general. As expected, healthcare consumption increases for both household groups in case of shock. However, the interaction term between remittance status and the shock dummy is negative, indicating that in case of shock the two groups of households report the same level of healthcare consumption and the overall positive effect of remittances on healthcare consumption share is nullified. Coherently with what observed by Ambrosius and Cuecuecha (2013), the full results for this last specification (see Table A.2.5 Appendix A) suggest that RRHs use migrant transfers to cope with the additional healthcare consumption related to the shock, while NRRHs resort to other sources to cover these outlays. Therefore, remittances provide an insurance instrument to cope with the indirect costs of a negative health shock, supporting liquidity-constrained families and preventing them from reducing the amount of resources addressed to other consumption categories.

As a robustness check, we estimate separate models for households experiencing a health shock or not. We observe that the positive effect of remittances on health consumption shares is confirmed also for the subsample of households not experiencing any shock, with even a larger average effect than the one estimated in the original specification (from 11 to 16.8 percentage points - see Table 2.6, Column 2 and 5). Thus, not controlling for the occurrence of a health shock gives rise to a downward bias in the estimation of the impact of remittances. These findings provide further support to the idea that the higher health consumption levels reported by RRHs are mostly driven by purchases of preventive medical care services rather than extraordinary outlays due to unexpected adverse health conditions.

However, given money fungibility if international remittances are used differently from other income sources, this does not necessarily mean that a shift in preferences occurred. To draw some conclusions on whether transnational remittances cause a shifting in household preferences, we should test what happens to budget allocation decisions when households get access to alternative income sources. In case other types of money transfers report different effects on health consumption, we have a further element in support of changing in household's consumption preferences due to receiving transfers from relatives abroad. An option to assess this hypothesis is provided by internal remittances. In the context of domestic transfers the role of knowledge transmission played by social remittances is nullified. Thus, the original

Table 2.5: ENAHO - AIDS: Consumption Elasticity

	(1) Health	(2) Food	(3) Education	(4) Clothes	(5) Housing	(6) Transports
Consumption Elasticity (receiving international remittance=1)	1.334	0.744	1.451	1.019	1.131	1.496
Consumption Elasticity (receiving international remittance=0)	1.184	0.746	1.603	1.155	0.999	1.594

Table 2.6: ENAHO - AIDS: Health Demand Equations

	(1) Full sample Exogenous	(2) Full sample IV	(3) Full sample IV	(4) Full sample IV	(5) Health shock=0 IV	(6) Health shock=1 IV
Ln (total consumption)	0.0168***	0.0138***	0.0134***	0.0141***	0.01225***	0.0230***
	(0.0022)	(0.0025)	(0.0026)	(0.0024)	(0.00258)	(0.0073)
Remittances	0.0053	0.1103***		0.1680***	0.19965***	-0.0840
	(0.0035)	(0.0356)		(0.0482)	(0.04577)	(0.0732)
Remittances*Ln(total consumption)			0.0109***			
			(0.0035)			
Health shock				0.0753***		
				(0.0018)		
Remittances*Health shock				-0.1774***		
				(0.0476)		
Observations	24,760	24,760	24,760	24,760	20,285	4,475
R-squared	0.179	0.147	0.146	0.130	0.112	-0.005

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

model is replicated including a dummy identifying households receiving internal remittances. A few cases where external and internal remittances overlap have been dropped to avoid confusion in the interpretation of the findings. Similarly to what has been done for transnational remittances, household internal remittance status is instrumented by historical remittance rates at the province level. The outcomes reported in Table A.2.10 in Appendix A clearly show a negative effect of receiving money by domestic migrants on health consumption shares. Thus, receiving income from migrant abroad does not impact as any other source of income, supporting the idea that international remittances may alter household consumption preferences through the channels previously described.

In conclusion, the findings reveal that receiving transfers from migrants abroad has a significant impact on household consumption decisions. Notably, transnational transfers seem to reshape household demand not only through an overall income effect, but by shifting household preferences in favour of higher human and real capital investments (healthcare and housing), with corresponding lower consumption of non-durable goods (food and clothing). Although confirming that households experiencing a shock are more likely to receive transfers from abroad, the analysis shows that the propensity to allocate additional resources to healthcare is not directly related to the occurrence of a negative health shock. In fact, a positive impact of remittances on healthcare consumption is found considering only those households who do not experience a shock.

Such evidence confirms that the healthcare consumption behaviour of RRHs responds to a specific choice of investing in human capital through the acquisition of preventive medical care. This choice could be driven by several aspects related to migration which are not separately identified by the analysis, i.e. changes in income composition due to remittance inflows, role of migrants in determining income allocation decisions, intra-household informal agreements about the intended use of these resources. Anyway, the estimates highlight the important role of migrant transfers in enhancing health investments of members left behind, with positive implications for their long-term health status.

It is widely acknowledged that fostering communication between migrants and their international networks contributes to rise the extent and value of remittance flows sent back home (Batista and Narciso, 2016). Ashraf et al. (2015) find that migrants value opportunities to exert greater control over financial activities in their home countries. Among El Salvador migrants based in the US, those who were offered the greatest degree of control accumulated the most savings in their home country. Therefore, supporting informational and financial exchanges within transnational families through suitable policies, i.e. encouraging the deployment of user-friendly money transfer technologies, reducing money transfer fees and spreading internet access, increases migrant propensity to address resources back home. Reducing asymmetry of information between migrants and relatives left behind would augment the probability to enforce those intra-household mutually beneficial cooperative agreements that are behind migration decisions. Consequently, since income transfers from migrants are preferably addressed to health

investment, incrementing migrants' control on remittance allocation should have a positive impact on household demand for preventive healthcare.

Appendix A

Table A.2.1: ENAHO - Consumption categories

Category	Description
Health	Medical care expenditures. Doctor fees, medicines, examinations fees, hospitalization, prenatal check-ups, contraceptives.
Food	Purchased and non-purchased food, both consumed at home or outdoor.
Education	Uniforms, transport, registration fees, school supplies, accommodations. Amusement and cultural consumption.
Clothing	Clothing and footwear consumption.
Housing	Expenditures for rent, fuel, electricity, house maintenance. Payments for furniture and equipment.
Transports and communications	Payments for private and public transportations, travel expenditures, telephone, internet, mail expenditures.
Other	Extraordinary housing and services expenditures, family celebrations, and other type of sporadic expenditure.

Table A.2.2: ENAHO - First-stage regression (Equation 4)

Dep. var.: Receiving international remittances (dummy)	Coef.
Household size	0.0002
Number of children	0.0018
Number of elderly	0.0085***
Absent member (dummy)	0.0016
Education level household head	
No education: reference category	
Primary	0.0063**
Secondary	0.0136***
High school or more	0.0106***
Gender of the household head (female)	0.0164***
Age group household head	
0-49: reference category	
50 - 69	0.0095***
70 +	0.0169***
Geographical Area	
Reference Category: Costa	
Sierra	0.0003
Selva	0.0017
Lima	0.0008
Urban	0.0009
Rent (dummy)	-0.0019
Chronic discomfort (dummy)	0.0023
Hospitalization (dummy)	0.0078***
Hospitals per 1000 population	-0.0012
Healthcare district	0.0006
Total income	2.73e-07***
Number of high education members	-0.0014
Remittance rate 2007 (province level)	0.5822***
Historical migration rate (department level)	8.65e-09
Constant	-.04456***
R-squared	0.0423
Number observations	24760

*** p<0.01, ** p<0.05, * p<0.1

Table A.2.3: ENAHO - AIDS: exogenous variables

	(1) Health	(2) Food	(3) Education	(4) Clothing	(5) Housing	(6) Transports
Ln (total consumption)	0.0168***	-0.1274***	0.0294***	0.0052***	0.0071***	0.0465***
	(0.0022)	(0.0035)	(0.0015)	(0.0012)	(0.0024)	(0.0016)
Receiving international remittances	0.0053	-0.0129**	0.0032	0.0022	0.0039	0.0012
	(0.0035)	(0.0056)	(0.0024)	(0.0020)	(0.0039)	(0.0027)
Household size	-0.0057***	0.0302***	0.0029***	-0.0004	-0.0190***	-0.0030***
	(0.0006)	(0.0010)	(0.0004)	(0.0004)	(0.0007)	(0.0005)
Number of children	0.0053***	-0.0135***	0.0010**	0.0048***	0.0102***	-0.0078***
	(0.0007)	(0.0012)	(0.0005)	(0.0004)	(0.0008)	(0.0006)
Number of elderly	0.0150***	-0.0097***	-0.0098***	-0.0019***	0.0133***	-0.0047***
	(0.0012)	(0.0018)	(0.0008)	(0.0007)	(0.0013)	(0.0009)
Educational level household head (Primary)	0.0014	-0.0052**	-0.0026***	-0.0012	0.0056***	0.0013
	(0.0015)	(0.0023)	(0.0010)	(0.0008)	(0.0016)	(0.0011)
Educational level household head (Secondary)	-0.0004	-0.0218***	0.0043***	-0.0006	0.0120***	0.0063***
	(0.0018)	(0.0029)	(0.0012)	(0.0010)	(0.0020)	(0.0014)
Educational level household head (High school or more)	0.0001	-0.0544***	0.0176***	-0.0017	0.0263***	0.0126***
	(0.0024)	(0.0038)	(0.0016)	(0.0013)	(0.0026)	(0.0018)
Age (group) household head 50-69	0.0062***	-0.0170***	-0.0076***	-0.0063***	0.0252***	0.0013
	(0.0012)	(0.0020)	(0.0008)	(0.0007)	(0.0014)	(0.0009)
Age (group) household head 70+	0.0138***	-0.0386***	-0.0057***	-0.0075***	0.0425***	-0.0006
	(0.0023)	(0.0036)	(0.0015)	(0.0013)	(0.0025)	(0.0017)
Urban	-0.0076***	-0.0175***	-0.0030***	-0.0109***	0.0443***	-0.0045***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0017)	(0.0012)
Geographical area - Sierra	0.0015	-0.0072***	0.0146***	0.0071***	-0.0097***	0.0030***
	(0.0014)	(0.0023)	(0.0010)	(0.0008)	(0.0016)	(0.0011)

Geographical area - Selva	-0.0008	0.0185***	-0.0073***	-0.0010	-0.0079***	-0.0007
	(0.0015)	(0.0024)	(0.0010)	(0.0008)	(0.0016)	(0.0011)
Geographical area - Lima	-0.0017	0.0098**	0.0046***	-0.0157***	0.0238***	0.0028
	(0.0024)	(0.0038)	(0.0016)	(0.0014)	(0.0026)	(0.0018)
Absent member (dummy)	-0.0074***	0.0471***	-0.0008	-0.0079***	-0.0148***	-0.0052***
	(0.0021)	(0.0034)	(0.0014)	(0.0012)	(0.0023)	(0.0016)
Rent (dummy)	0.0008	0.0088***	0.0015	0.0041***	-0.0137***	-0.0006
	(0.0020)	(0.0032)	(0.0013)	(0.0011)	(0.0022)	(0.0015)
Chronic discomfort (dummy)	0.0233***	-0.0101***	-0.0018**	-0.0030***	-0.0037***	-0.0026***
	(0.0012)	(0.0019)	(0.0008)	(0.0007)	(0.0013)	(0.0009)
Hospitalization (dummy)	0.0708***	-0.0288***	-0.0112***	-0.0018**	-0.0133***	-0.0095***
	(0.0014)	(0.0022)	(0.0009)	(0.0008)	(0.0015)	(0.0010)
Gender household head	-0.0008	-0.0181***	0.0053***	0.0034***	0.0085***	-0.0003
	(0.0012)	(0.0019)	(0.0008)	(0.0007)	(0.0013)	(0.0009)
Hospitals per 1000 population	-1.2135	2.9227	3.1081***	-1.8122**	0.2932	-0.1419
	(1.6121)	(2.5625)	(1.0933)	(0.9059)	(1.7555)	(1.2187)
Healthcare district (dummy)	-0.0008	0.0035	0.0005	-0.0022**	0.0010	-0.0032***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0017)	(0.0012)
Constant	-0.1060***	1.6974***	-0.2459***	0.0086	0.1180***	-0.3389***
	(0.0186)	(0.0295)	(0.0126)	(0.0104)	(0.0202)	(0.0140)
Observations	24,760	24,760	24,760	24,760	24,760	24,760
R-squared	0.179	0.335	0.211	0.089	0.259	0.211

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reference category for education level of the household head: no education.

Reference category for age group of the household head: no education:15-49.

Reference category for geographical area: Costa.

Table A.2.4: ENAHO - AIDS: interaction variables

	(1) Health	(2) Food	(3) Education	(4) Clothing	(5) Housing	(6) Transports
Ln (total consumption)	0.0134***	-0.1286***	0.0323***	0.0079***	-0.0003	0.0493***
	(0.0026)	(0.0040)	(0.0017)	(0.0014)	(0.0029)	(0.0019)
Receiving remittances*Ln (total consumption)	0.0109***	-0.0006	-0.0081***	-0.0069***	0.0239***	-0.0082***
	(0.0035)	(0.0055)	(0.0024)	(0.0020)	(0.0040)	(0.0027)
Household size	-0.0051***	0.0305***	0.0024***	-0.0009**	-0.0177***	-0.0035***
	(0.0007)	(0.0011)	(0.0005)	(0.0004)	(0.0008)	(0.0005)
Number of children	0.0047***	-0.0137***	0.0016***	0.0053***	0.0088***	-0.0073***
	(0.0008)	(0.0012)	(0.0005)	(0.0004)	(0.0009)	(0.0006)
Number of elderly	0.0138***	-0.0098***	-0.0089***	-0.0011	0.0107***	-0.0038***
	(0.0012)	(0.0019)	(0.0009)	(0.0007)	(0.0014)	(0.0009)
Educational level household head (Primary)	0.0013	-0.0050**	-0.0026**	-0.0012	0.0053***	0.0013
	(0.0015)	(0.0023)	(0.0010)	(0.0008)	(0.0017)	(0.0011)
Educational level household head (Secondary)	-0.0007	-0.0214***	0.0045***	-0.0006	0.0111***	0.0065***
	(0.0019)	(0.0029)	(0.0013)	(0.0011)	(0.0021)	(0.0014)
Educational level household head (High school or more)	0.0006	-0.0536***	0.0170***	-0.0024*	0.0273***	0.0120***
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0018)
Age (group) household head 50-69	0.0049***	-0.0171***	-0.0065***	-0.0054***	0.0224***	0.0023**
	(0.0013)	(0.0021)	(0.0009)	(0.0008)	(0.0015)	(0.0010)
Age (group) household head 70+	0.0116***	-0.0388***	-0.0039**	-0.0059***	0.0374***	0.0012
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0018)
Urban	-0.0069***	-0.0170***	-0.0037***	-0.0115***	0.0458***	-0.0051***
	(0.0016)	(0.0026)	(0.0011)	(0.0009)	(0.0019)	(0.0012)
Geographical area - Sierra	0.0025	-0.0074***	0.0139***	0.0065***	-0.0075***	0.0022*
	(0.0015)	(0.0023)	(0.0010)	(0.0009)	(0.0017)	(0.0011)

Geographical area - Selva	0.0006	0.0185***	-0.0084***	-0.0019**	-0.0048***	-0.0018
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Geographical area - Lima	-0.0060**	0.0096**	0.0081***	-0.0127***	0.0139***	0.0063***
	(0.0029)	(0.0045)	(0.0020)	(0.0016)	(0.0033)	(0.0022)
Absent member (dummy)	-0.0071***	0.0473***	-0.0011	-0.0081***	-0.0142***	-0.0055***
	(0.0022)	(0.0034)	(0.0015)	(0.0012)	(0.0025)	(0.0017)
Chronic discomfort (dummy)	0.0233***	-0.0100***	-0.0018**	-0.0031***	-0.0036**	-0.0027***
	(0.0012)	(0.0019)	(0.0009)	(0.0007)	(0.0014)	(0.0009)
Hospitalization (dummy)	0.0704***	-0.0286***	-0.0109***	-0.0016**	-0.0143***	-0.0092***
	(0.0014)	(0.0022)	(0.0010)	(0.0008)	(0.0016)	(0.0011)
Rent (dummy)	0.0010	0.0088***	0.0013	0.0040***	-0.0133***	-0.0007
	(0.0020)	(0.0032)	(0.0014)	(0.0011)	(0.0023)	(0.0015)
Gender household head	-0.0026*	-0.0182***	0.0068***	0.0047***	0.0044***	0.0011
	(0.0014)	(0.0022)	(0.0009)	(0.0008)	(0.0016)	(0.0011)
Hospitals per 1000 population	-0.0007	0.0030	0.0026**	-0.0022**	0.0015	-0.0006
	(0.0017)	(0.0026)	(0.0011)	(0.0009)	(0.0019)	(0.0013)
Healthcare district (dummy)	-0.0006	0.0036	0.0003	-0.0024***	0.0016	-0.0034***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Constant	-0.0749***	1.7072***	-0.2729***	-0.0165	0.1866***	-0.3647***
	(0.0222)	(0.0346)	(0.0152)	(0.0125)	(0.0254)	(0.0168)
Observations	24,760	24,760	24,760	24,760	24,760	24,760
R-squared	0.146	0.334	0.163	0.039	0.149	0.174

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reference category for education level of the household head: no education.

Reference category for age group of the household head: no education:15-49.

Reference category for geographical area: Costa.

Table A.2.5: ENAHO - AIDS: Interaction with health shock

	(1) Health	(2) Food	(3) Education	(4) Clothing	(5) Housing	(6) Transports
Ln (total consumption)	0.0141***	-0.1302***	0.0324***	0.0073***	0.0024	0.0491***
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0019)
Receiving international remittances	0.1680***	0.0550	-0.1620***	-0.0981***	0.3196***	-0.1377***
	(0.0482)	(0.0748)	(0.0339)	(0.0273)	(0.0556)	(0.0369)
Hospitalization (dummy)	0.0753***	-0.0273***	-0.0155***	-0.0043***	-0.0056***	-0.0130***
	(0.0018)	(0.0029)	(0.0013)	(0.0010)	(0.0021)	(0.0014)
Hospitalization*Receiving remittances	-0.1774***	-0.0511	0.1716***	0.0982***	-0.3217***	0.1386***
	(0.0476)	(0.0737)	(0.0335)	(0.0269)	(0.0548)	(0.0364)
Household size	-0.0051***	0.0307***	0.0022***	-0.0009**	-0.0177***	-0.0036***
	(0.0007)	(0.0010)	(0.0005)	(0.0004)	(0.0008)	(0.0005)
Number of children	0.0045***	-0.0139***	0.0019***	0.0054***	0.0086***	-0.0071***
	(0.0008)	(0.0012)	(0.0006)	(0.0005)	(0.0009)	(0.0006)
Number of elderly	0.0137***	-0.0104***	-0.0085***	-0.0012	0.0111***	-0.0036***
	(0.0013)	(0.0019)	(0.0009)	(0.0007)	(0.0014)	(0.0010)
Educational level household head (Primary)	0.0009	-0.0050**	-0.0022**	-0.0009	0.0044**	0.0017
	(0.0015)	(0.0024)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Educational level household head (Secondary)	-0.0016	-0.0214***	0.0054***	0.0000	0.0091***	0.0072***
	(0.0019)	(0.0029)	(0.0013)	(0.0011)	(0.0022)	(0.0015)
Educational level household head (High school or more)	-0.0000	-0.0528***	0.0177***	-0.0016	0.0247***	0.0125***
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0019)
Age (group) household head 50-69	0.0046***	-0.0181***	-0.0060***	-0.0055***	0.0229***	0.0026**
	(0.0014)	(0.0021)	(0.0010)	(0.0008)	(0.0016)	(0.0010)
Age (group) household head 70+	0.0115***	-0.0403***	-0.0034**	-0.0062***	0.0387***	0.0015
	(0.0024)	(0.0038)	(0.0017)	(0.0014)	(0.0028)	(0.0019)

Urban	-0.0074***	-0.0161***	-0.0032***	-0.0108***	0.0432***	-0.0047***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0019)	(0.0012)
Geographical area - Sierra	0.0028*	-0.0067***	0.0134***	0.0065***	-0.0076***	0.0019
	(0.0015)	(0.0024)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Geographical area - Selva	0.0005	0.0194***	-0.0086***	-0.0016*	-0.0059***	-0.0019
	(0.0016)	(0.0024)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Geographical area - Lima	-0.0057**	0.0083*	0.0090***	-0.0128***	0.0147***	0.0064***
	(0.0028)	(0.0043)	(0.0020)	(0.0016)	(0.0032)	(0.0021)
Absent member (dummy)	-0.0071***	0.0474***	-0.0013	-0.0082***	-0.0140***	-0.0056***
	(0.0022)	(0.0034)	(0.0016)	(0.0012)	(0.0025)	(0.0017)
Chronic discomfort (dummy)	0.0231***	-0.0101***	-0.0016*	-0.0030***	-0.0039***	-0.0025***
	(0.0013)	(0.0020)	(0.0009)	(0.0007)	(0.0015)	(0.0010)
Gender household head	-0.0025*	-0.0190***	0.0072***	0.0046***	0.0049***	0.0013
	(0.0014)	(0.0021)	(0.0010)	(0.0008)	(0.0016)	(0.0011)
Hospitals per 1000 population	-0.0011	0.0032	0.0029**	-0.0020**	0.0006	-0.0003
	(0.0017)	(0.0026)	(0.0012)	(0.0009)	(0.0019)	(0.0013)
Healthcare district (dummy)	-0.0005	0.0037	0.0001	-0.0024***	0.0018	-0.0035***
	(0.0016)	(0.0025)	(0.0011)	(0.0009)	(0.0019)	(0.0012)
Constant	-0.0816***	1.7221***	-0.2738***	-0.0101	0.1611***	-0.3626***
	(0.0210)	(0.0325)	(0.0148)	(0.0119)	(0.0242)	(0.0160)
Observations	24,760	24,760	24,760	24,760	24,760	24,760
R-squared	0.130	0.329	0.098	0.020	0.119	0.144

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reference category for education level of the household head: no education.

Reference category for age group of the household head: no education:15-49.

Reference category for geographical area: Costa.

Table A.2.6: ENAHO - AIDS: Positive health shock

	(1) Health	(2) Food	(3) Education	(4) Clothing	(5) Housing	(6) Transports
Ln (total consumption)	0.0230***	-0.1212***	0.0255***	0.0037	0.0048	0.0422***
	(0.0073)	(0.0079)	(0.0037)	(0.0026)	(0.0052)	(0.0038)
Receiving international remittances (dummy)	-0.0840	-0.0342	0.0760**	-0.0256	0.0921*	0.0019
	(0.0732)	(0.0796)	(0.0371)	(0.0265)	(0.0520)	(0.0384)
Household size	-0.0143***	0.0274***	0.0023***	-0.0000	-0.0131***	0.0001
	(0.0016)	(0.0017)	(0.0008)	(0.0006)	(0.0011)	(0.0008)
Number of children	0.0074***	-0.0107***	0.0005	0.0044***	0.0074***	-0.0085***
	(0.0021)	(0.0023)	(0.0011)	(0.0008)	(0.0015)	(0.0011)
Number of elderly	0.0184***	-0.0122***	-0.0097***	-0.0033**	0.0134***	-0.0055***
	(0.0037)	(0.0040)	(0.0019)	(0.0013)	(0.0026)	(0.0019)
Educational level household head (Primary)	-0.0083*	-0.0035	0.0003	0.0010	0.0055	0.0027
	(0.0047)	(0.0051)	(0.0024)	(0.0017)	(0.0034)	(0.0025)
Educational level household head (Secondary)	-0.0114**	-0.0165***	0.0058**	0.0011	0.0136***	0.0060**
	(0.0055)	(0.0060)	(0.0028)	(0.0020)	(0.0039)	(0.0029)
Educational level household head (High school or more)	-0.0150**	-0.0461***	0.0181***	0.0022	0.0288***	0.0122***
	(0.0070)	(0.0076)	(0.0035)	(0.0025)	(0.0050)	(0.0037)
Age (group) household head 50-69	0.0214***	-0.0164***	-0.0073***	-0.0086***	0.0148***	-0.0012
	(0.0040)	(0.0044)	(0.0020)	(0.0015)	(0.0029)	(0.0021)
Age (group) household head 70+	0.0454***	-0.0412***	-0.0100**	-0.0109***	0.0261***	-0.0028
	(0.0077)	(0.0083)	(0.0039)	(0.0028)	(0.0055)	(0.0040)
Urban	-0.0225***	-0.0176***	0.0001	-0.0048***	0.0438***	0.0014
	(0.0049)	(0.0053)	(0.0025)	(0.0018)	(0.0035)	(0.0026)
Geographical area - Sierra	-0.0030	-0.0051	0.0145***	0.0023	-0.0042	0.0071***
	(0.0046)	(0.0051)	(0.0024)	(0.0017)	(0.0033)	(0.0024)

Geographical area - Selva	-0.0129***	0.0226***	-0.0036	-0.0033*	-0.0023	-0.0005
	(0.0048)	(0.0052)	(0.0024)	(0.0017)	(0.0034)	(0.0025)
Geographical area - Lima	-0.0028	0.0136	-0.0030	-0.0164***	0.0224***	0.0084*
	(0.0083)	(0.0091)	(0.0042)	(0.0030)	(0.0059)	(0.0044)
Rent (dummy)	0.0106*	0.0009	-0.0039	0.0051**	-0.0094**	-0.0018
	(0.0061)	(0.0066)	(0.0031)	(0.0022)	(0.0043)	(0.0032)
Absent member (dummy)	-0.0151**	0.0444***	-0.0007	-0.0043*	-0.0110**	-0.0067**
	(0.0061)	(0.0067)	(0.0031)	(0.0022)	(0.0044)	(0.0032)
Chronic discomfort (dummy)	0.0258***	-0.0129***	-0.0005	-0.0036**	-0.0038	0.0004
	(0.0044)	(0.0048)	(0.0023)	(0.0016)	(0.0032)	(0.0023)
Gender household head	0.0005	-0.0109**	-0.0022	0.0033**	0.0045	-0.0006
	(0.0045)	(0.0049)	(0.0023)	(0.0016)	(0.0032)	(0.0024)
Hospitals per 1000 population	-0.0058	0.0085	0.0060**	-0.0033*	0.0018	-0.0030
	(0.0051)	(0.0055)	(0.0026)	(0.0018)	(0.0036)	(0.0027)
Healthcare district (dummy)	-0.0125**	0.0091	0.0021	-0.0015	-0.0004	0.0040
	(0.0055)	(0.0059)	(0.0028)	(0.0020)	(0.0039)	(0.0029)
Constant	-0.0360	1.5997***	-0.2140***	0.0187	0.1090**	-0.3318***
	(0.0665)	(0.0723)	(0.0337)	(0.0241)	(0.0473)	(0.0349)
Observations	4,475	4,475	4,475	4,475	4,475	4,475
R-squared	0.112	0.327	0.137	0.106	0.207	0.193

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reference category for education level of the household head: no education.

Reference category for age group of the household head: no education:15-49.

Reference category for geographical area: Costa.

Table A.2.7: ENAHO - AIDS: No health shock

	(1) Health	(2) Food	(3) Education	(4) Clothing	(5) Housing	(6) Transports
Ln (total consumption)	0.0130***	-0.1324***	0.0341***	0.0083***	0.0001	0.0512***
	(0.0025)	(0.0044)	(0.0020)	(0.0016)	(0.0033)	(0.0022)
Receiving international remittances	0.1642***	0.0452	-0.1683***	-0.0821***	0.3029***	-0.1328***
	(0.0398)	(0.0695)	(0.0317)	(0.0254)	(0.0522)	(0.0343)
Household size	-0.0031***	0.0320***	0.0021***	-0.0011**	-0.0187***	-0.0047***
	(0.0007)	(0.0013)	(0.0006)	(0.0005)	(0.0009)	(0.0006)
Number of children	0.0043***	-0.0151***	0.0023***	0.0055***	0.0089***	-0.0067***
	(0.0008)	(0.0014)	(0.0007)	(0.0005)	(0.0011)	(0.0007)
Number of elderly	0.0120***	-0.0095***	-0.0082***	-0.0005	0.0104***	-0.0030***
	(0.0013)	(0.0022)	(0.0010)	(0.0008)	(0.0017)	(0.0011)
Educational level household head (Primary)	0.0018	-0.0049*	-0.0029**	-0.0013	0.0051**	0.0015
	(0.0015)	(0.0026)	(0.0012)	(0.0010)	(0.0020)	(0.0013)
Educational level household head (Secondary)	-0.0001	-0.0223***	0.0051***	-0.0005	0.0095***	0.0073***
	(0.0019)	(0.0033)	(0.0015)	(0.0012)	(0.0025)	(0.0016)
Educational level household head (High school of more)	0.0022	-0.0545***	0.0171***	-0.0029*	0.0262***	0.0124***
	(0.0025)	(0.0043)	(0.0020)	(0.0016)	(0.0033)	(0.0021)
Age (group) household head 50-69	0.0029**	-0.0178***	-0.0054***	-0.0048***	0.0228***	0.0029**
	(0.0014)	(0.0024)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Age (group) household head 70+	0.0077***	-0.0395***	-0.0019	-0.0051***	0.0384***	0.0019
	(0.0024)	(0.0043)	(0.0019)	(0.0016)	(0.0032)	(0.0021)
Urban	-0.0048***	-0.0158***	-0.0043***	-0.0126***	0.0455***	-0.0065***
	(0.0017)	(0.0029)	(0.0013)	(0.0011)	(0.0022)	(0.0014)
Geographical area - Sierra	0.0042***	-0.0084***	0.0135***	0.0074***	-0.0081***	0.0012
	(0.0015)	(0.0027)	(0.0012)	(0.0010)	(0.0020)	(0.0013)

Geographical area - Selva	0.0034**	0.0177***	-0.0096***	-0.0015	-0.0057***	-0.0020
	(0.0016)	(0.0028)	(0.0013)	(0.0010)	(0.0021)	(0.0014)
Geographical area - Lima	-0.0060**	0.0073	0.0113***	-0.0122***	0.0127***	0.0061**
	(0.0029)	(0.0050)	(0.0023)	(0.0018)	(0.0037)	(0.0025)
Absent member (dummy)	-0.0052**	0.0486***	-0.0018	-0.0092***	-0.0147***	-0.0053***
	(0.0023)	(0.0039)	(0.0018)	(0.0014)	(0.0030)	(0.0019)
Rent (dummy)	-0.0003	0.0113***	0.0018	0.0035***	-0.0136***	-0.0011
	(0.0021)	(0.0036)	(0.0016)	(0.0013)	(0.0027)	(0.0018)
Chronic discomfort (dummy)	0.0227***	-0.0097***	-0.0020**	-0.0030***	-0.0037**	-0.0029***
	(0.0012)	(0.0021)	(0.0010)	(0.0008)	(0.0016)	(0.0011)
Gender household head	-0.0018	-0.0202***	0.0089***	0.0048***	0.0041**	0.0014
	(0.0014)	(0.0024)	(0.0011)	(0.0009)	(0.0018)	(0.0012)
Hospitals per 1000 population	0.0000	0.0016	0.0023*	-0.0017	0.0009	0.0003
	(0.0017)	(0.0029)	(0.0013)	(0.0011)	(0.0022)	(0.0014)
Healthcare district (dummy)	0.0016	0.0028	-0.0002	-0.0024**	0.0021	-0.0050***
	(0.0016)	(0.0028)	(0.0013)	(0.0010)	(0.0021)	(0.0014)
Constant	-0.0826***	1.7426***	-0.2909***	-0.0199	0.1872***	-0.3762***
	(0.0214)	(0.0374)	(0.0171)	(0.0137)	(0.0281)	(0.0185)
Observations	20,285	20,285	20,285	20,285	20,285	20,285
R-squared	-0.005	0.310	0.073	0.031	0.119	0.141

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reference category for education level of the household head: no education.

Reference category for age group of the household head: no education:15-49.

Reference category for geographical area: Costa.

Table A.2.8: ENAHO - Demand systems with Dummy variables for Remittances - OLS, IV, AIDS with IV

	(1) Health	(2) Food	(3) Education	(4) Clothes	(5) Housing	(6) Transports
			OLS single equation model			
Ln (Total Consumption)	0.0293***	-0.0775***	0.0182***	0.0068***	-0.0231***	0.0303***
	(0.0010)	(0.0016)	(0.0007)	(0.0006)	(0.0011)	(0.0008)
Receiving International Remittances	0.0022	-0.0257***	0.0060**	0.0018	0.0116***	0.0053**
	(0.0035)	(0.0055)	(0.0024)	(0.0020)	(0.0038)	(0.0026)
			IV single equation model			
Ln (Total Consumption)	0.0279***	-0.0743***	0.0181***	0.0084***	-0.0294***	0.0307***
	(0.0013)	(0.0020)	(0.0009)	(0.0007)	(0.0015)	(0.0010)
Receiving International Remittances	0.0649*	-0.1764***	0.0075	-0.0737***	0.2987***	-0.0138
	(0.0349)	(0.0551)	(0.0235)	(0.0201)	(0.0415)	(0.0261)
			AIDS with instrumental variables			
Ln (Total Consumption)	0.0138***	-0.1286***	0.0320***	0.0076***	0.0006	0.0490***
	(0.0025)	(0.0039)	(0.0017)	(0.0014)	(0.0028)	(0.0019)
Receiving International Remittances	0.1103***	-0.0066	-0.0834***	-0.0688***	0.2416***	-0.0829***
	(0.0356)	(0.0556)	(0.0244)	(0.0201)	(0.0407)	(0.0270)
Observations	24,760	24,760	24,760	24,760	24,760	24,760

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.2.9: ENAHO - AIDS with different instruments for remittance status

	(1) Health	(2) Health	(3) Health
Ln (Total Consumption)	0.0139***	0.0108***	0.0138***
	(0.0025)	(0.0033)	(0.0025)
Receiving International Remittances	0.1096***	0.2275***	0.1103***
	(0.0358)	(0.0873)	(0.0356)
First stage regressions			
Remittance rate 2007 (province level)	0.5970***		0.5822***
	(0.0365)		(0.0385)
Historical migration rate (department level)		4.35e-08***	8.65e-09
		(6.86e-09)	(7.21e-09)
Observations	24,760	24,760	24,760

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.2.10: ENAHO - AIDS internal and international remittances

	(1) Health	(2) Food	(3) Education	(4) Clothes	(5) Housing	(6) Transports
Ln (Total Consumption)	0.0096***	-0.1310***	0.0327***	0.0121***	-0.0000	0.0465***
	(0.0031)	(0.0047)	(0.0020)	(0.0020)	(0.0034)	(0.0023)
Receiving international remittances	0.1399***	-0.0179	-0.1032***	-0.0824***	0.3098***	-0.1068***
	(0.0482)	(0.0715)	(0.0313)	(0.0302)	(0.0530)	(0.0357)
Receiving internal remittances	-0.0682***	-0.0410	0.0104	0.0789***	-0.0102	-0.0463**
	(0.0262)	(0.0389)	(0.0170)	(0.0164)	(0.0288)	(0.0194)
Observations	24,644	24,644	24,644	24,644	24,644	24,644
R-squared	0.037	0.322	0.153	-0.324	0.114	0.117

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure A.2.1: ENAHO - Health budget shares

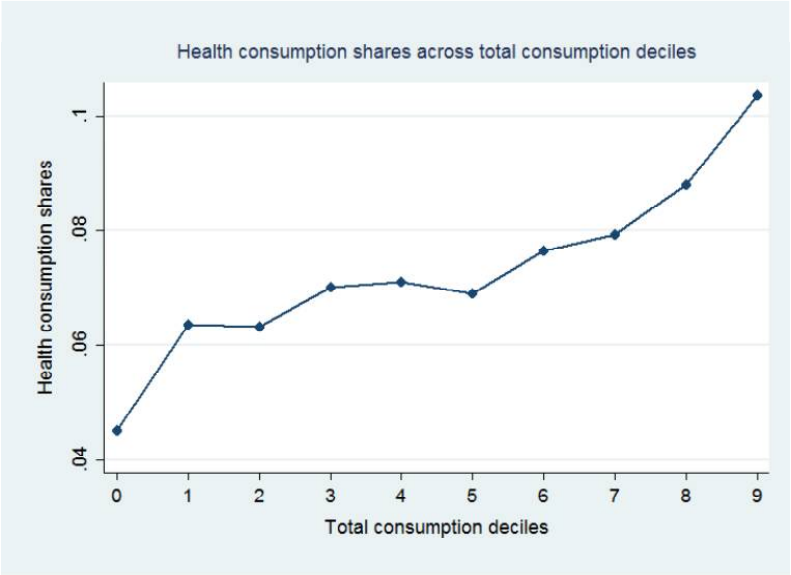
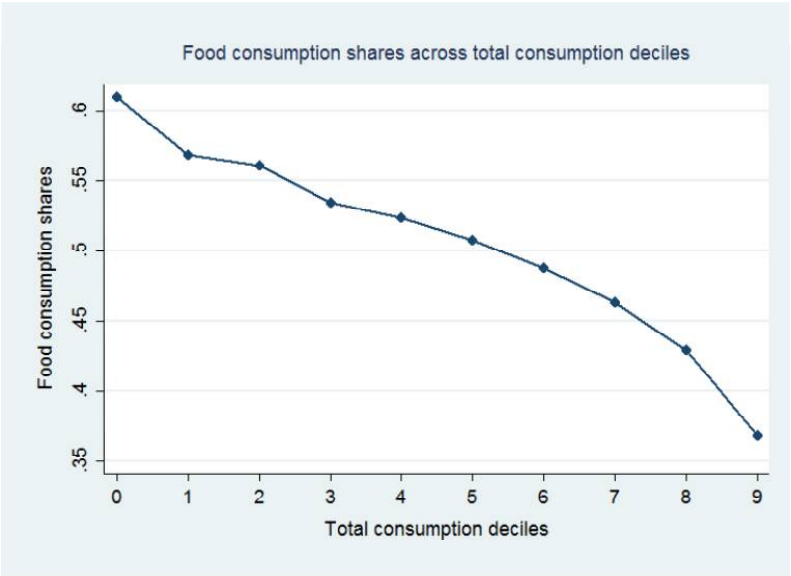


Figure A.2.2: ENAHO - Food budget shares



Chapter 3

Environmental Shocks and Migration Decisions: Evidence from Hurricane Mitch in Nicaragua

3.1 Introduction

According to the projections of the Intergovernmental Panel on Climate Change (IPCC, 2014) a substantial increase in the number of environmental displaced people will occur over the course of this century. As reported by the UNHCR (2009), the majority of these people are concentrated in the most vulnerable areas around the world. Thus, natural disasters and climate-related events are nowadays considered one of the main sources of negative shocks affecting developing countries, especially agricultural and natural resource-dependent households. In case of lack of assets to support the adaptation and recovery costs, the long-term implications of these shocks may conduct to poverty traps, jeopardizing the opportunities for future development (Carter et al., 2007)

The effectiveness of usual risk-management institutions is limited by the fact that weather shocks are spatially covariant. The mechanisms working in case of idiosyncratic risks may not be effective when all the households in a geographical area are

exposed to the same stress (Kubik and Maurel, 2016). Therefore, migration may constitute a spatial income diversification strategy. The New Economics of Labour Migration (NELM) theory has stressed the role of migration as risk management tool, considering individual mobility as a household-level collective decision driven by mutual insurance purposes (Katz and Stark, 1986; Lucas and Stark, 1985).

Migration as a response to climate events has been widely discussed, trying to determine if climate anomalies and natural disasters act as direct push factors or they interact with cultural, social, political or economic determinants in shaping migration patterns (Piguet et al., 2011). The relationship between climate change and out-migration varies according to the characteristics of environmental events (Halliday, 2006), migration episodes (Gray and Bilsborrow, 2013) and individuals observed (Gray and Mueller, 2012). Climatic changes may also indirectly influence human migration, interacting with the common recognised determinants of migration and modifying the incentives to move. Beine and Parsons (2015) claim that long-term changes in climatic factors influence international migration only indirectly through wage differentials. Kubik and Maurel (2016) observe that droughts represent a push factor for migration through their impact on crop production.

However, the large body of literature examining the consequences of climatic stress on human mobility comes to contradictory conclusions on the ways augmenting exposure to environmental risks influences migration choices, leaving room for further contributions. This paper investigates the effects of unexpected sudden-onset climatic shocks on out-migration decisions, examining the case of Hurricane Mitch in Nicaragua. In particular, the study focuses on international migration flows, considering both regional mobility across Central American countries and migration to US and Canada. In addition, it sheds light on the interactions between climate-related and economic determinants of migration, identifying for which population groups the occurrence of a natural shock may interfere on subsequent migration decisions.

The findings obtained show that the severity of the shock, measured in terms of average rainfall levels during the Hurricane, does not act as push factor as a whole. Only individuals belonging to agricultural households experiencing high exposure to rainfalls increase their likelihood to move abroad in the aftermath of the Hurricane. As agricultural households are usually the most affected by natural shocks,

this might suggest that severe unexpected natural disasters provide incentives for migration within the most vulnerable groups. The positive effect of the shock is higher for individuals who do not have relatives employed as wage labourers. This seems to suggest that those households who cannot rely on alternative guaranteed sources of income tend to select migration as coping strategy. However, the decision to migrate is also linked to household assets. Indeed, the impact of shock exposure on mobility decisions increases along with land endowments.

3.2 Migration and climate change

3.2.1 Literature review

Although an unambiguous evidence about the direction of the relationship between climate change and migration flows is far to be emerged, climate change and environmental instability are widely perceived as a source of risk for households in developing countries (Piguet and Laczko, 2013; Cattaneo and Peri, 2016; Maurel and Tuccio, 2016; Halliday, 2006). Counteracting findings on the role of climate change as push factor for migration have been observed according to the geographical area, the type of environmental degradation and the characteristics of the migration flows investigated.

Long-term environmental deterioration turns out to be only partly related to human mobility within Nepal, as its effect varies substantially across gender and ethnic group (Massey et al., 2010). Similarly, Gray and Mueller (2012) show that only male long-distance labour migration increases with droughts in Ethiopia. As migration remains selective with important barriers to participation, adverse conditions can actually reduce mobility because of exacerbated liquidity constraints. Gray and Bilsborrow (2013) observe that detrimental environmental factors do not consistently increase migration out of rural areas in Ecuador and, in some cases, diminish the outflows. Indeed, as internal migrants originate disproportionately from poor areas, adverse climatic conditions further decrease household available resources to cover migration costs. Cattaneo and Peri (2016) observe that higher temperatures decrease the probability of internal and international migration in

poor countries, due to the presence of severe liquidity constraints. Indeed, the effect turns into positive in middle-income economies. Individual perceptions of long-term environmental changes reduce internal mobility also in rural Vietnam, suggesting that adaptation is the most selected strategy to cope with gradual climatic degradation (Koubi et al., 2016).

On the contrary, weather anomalies have been found to have an indirect positive impact on internal migration in rural Tanzania, through their negative effect on crop production. However, mobility decisions are conditioned on initial endowments, since only households in the middle of the wealth distribution respond to adverse circumstances migrating (Kubik and Maurel, 2016). Evidence of a positive relationship between detrimental climatic conditions and rural-urban migration has been reported also in sub-Saharan Africa (Barrios et al., 2006). The increasing flows of workers to urban labour markets exert a downward pressure on local wages, providing incentives for international outflows (Maurel and Tuccio, 2016; Marchiori et al., 2012). Beine and Parsons (2015) use a panel of global bilateral migration flows to show that anomalies in temperatures and rainfalls influence international migration only indirectly through wage differentials.

As regards short-term environmental shocks, Lewin et al. (2012) find a negative association between rainfall shocks and rural out-migration in Malawi. Paul (2005) reports no upsurge of migration after a tornado in Bangladesh and prove that humanitarian aid served to contain outflows. A reduction in the likelihood of moving out after the occurrence of earthquakes, volcanic eruptions and floods has been reported also in Indonesia (Tse, 2011). Extending the analysis to a wider array of exogenous economic shocks, Halliday (2006) finds that the dollar amount of damages due to the 2001 earthquake in El Salvador is associated with a substantial decrease in out-migration flows. The explanation of such evidences relies on the argument that the earthquake created exigencies that increased incentives for families to retain labour at home, while at the same time it constrained migration financing through diminishing savings or restricting access to credit.

Boustan et al. (2012) observe different responses to natural disaster across US states, probably due to the level of public efforts in disaster recovery. Looking at the inter-cantonal migration gross rates in Costa Rica, Robalino et al. (2015) assess that hydro-meteorological outstanding events affect internal migration pat-

terns, with opposite sign according to the severity of the emergencies. Natural disasters with the most severe consequences in terms of loss of lives, tend to reduce mobility flows. On the other hand, the perception of sudden unexpected natural disasters acts as a push factor for human mobility within Vietnam (Koubi et al., 2016). Focusing on international migration, Reuveny and Moore (2009) suggest that the number of people affected by weather-related natural disasters, exploited as a proxy of shock intensity, is positively related to international out-migration. Epidemics and miscellaneous climatic events spur international migration, as they result in greater urbanization and the pressures from which might generate greater incentives to migrate abroad Beine and Parsons (2015).

Therefore, controversial findings about the influence of climatic factors on migration decisions have emerged. In particular, it is far from being clear how and to what extent environmental changes interact with other migration drivers. As regards rural households, climatic change seems to influence migration decisions through its indirect effects on agricultural productivity and rural livelihoods. Damaging crops and livestock assets, environmental degradation reduces household income, especially in case of lack of alternative working opportunities or adaptation strategies (Black et al., 2011). A reduction in the reliability of income from agricultural activities may constitute an incentive for migration, but at the same time it drastically diminishes the liquidity needed to bear migration costs (Lilleør and Van den Broeck, 2011; Halliday, 2006).

However, how this translates into mobility decisions it is still uncertain. The channels through which the degree of exposure interacts with pre-shock characteristics determining the recovery strategies to undertake are still unexplored (Carvajal and Medalho Pereira, 2009). Although the level of pre-shock household assets has been recognised to be determinant in orienting mobility decisions, to the best of my knowledge no contribution has investigated if household income composition plays a role in selecting the *ex-post* coping strategy to adopt. In line with the theoretical framework of the NELM, I assume that migration decisions respond to intra-household mutual insurance requirements. Therefore, I test whether household income composition determines the circumstances under which moving abroad turns out to be a preferred response to natural disaster exposure.

3.2.2 Hurricane Mitch

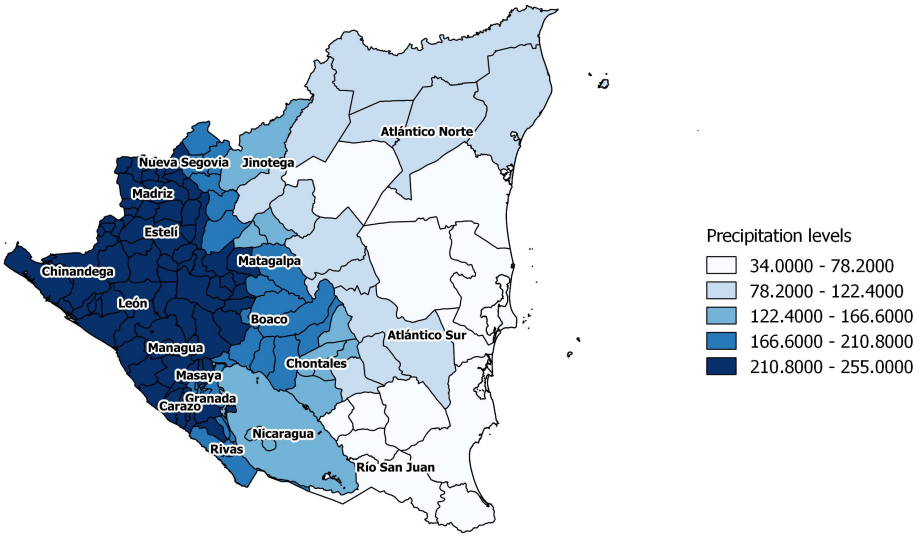
Nicaragua is vulnerable to hurricanes. Fourteen passed through this area between 1960 and 2010 with increasing frequency and intensity due to climate change. However, the level of destruction caused by Hurricane Mitch was unique and unpredictable. Indeed, this tropical storm has been classified as an event of category 5 - highest level - on the Saffir Simpson Scale [1]. Mitch provoked about 11,000 total deaths in the region (including 3,800 in Nicaragua), vastly more than those caused by other storms. Furthermore, evidence of a raise in the prevalence of malnutrition and infectious diseases (i.e. malaria and dengue) has been identified in the aftermath of the disaster. As it is shown in Figure 3.1 [2], the region mostly affected by the storms was the Pacific, in particular the departments of León and Chinandega which hold more than 83% of all deaths (INEC, 2000). The total damages in Nicaragua have been estimated at $ 1 billion to $ 1.3 billion (around 50% of the country GDP in 1998), with 20% of the population left without habitable dwellings, 1500 miles of roads destroyed along with infrastructures, and one-third of agricultural crops severely damaged (CEPAL, 1999). As the afro-exporter sector is particularly relevant for the country, the whole economy suffered enormously the impact of Mitch. Production losses caused both short- and long-term unemployment, with consequences on poverty especially in rural areas (Carter et al., 2007).

As regards the impact of the Hurricane on migration flows, there has been no systematic evidence of the consequences of the damages on human mobility. Carvajal and Medalho Pereira (2009) show that the exposure to the Hurricane affects subsequent migration decisions differently according to wealth quartile and area of residence. Anyway, no details are provided about the mechanisms through which household assets and income composition influences the decision to move abroad after the disaster. However, both USA and Costa Rica launched a series of immigration policies during the months following October 1998 directed to foreign citizens coming from Central American countries hit by the disaster. The Tempo-

[1] The Saffir-Simpson Hurricane Scale is a 1-5 rating based on the hurricane's intensity. The scale is used to proxy the potential property damages and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale.

[2] The map reports the average daily rainfalls at the *municipio* level during the Hurricane, exactly between October, 21 and November, 4 1998.

Figure 3.1: Daily average rainfalls during Hurricane Mitch



rary Protected Status (TPS) was granted to around 6000 working migrants coming from Nicaragua in US since January 1999. Moreover, the Nicaraguan Adjustment and Central American Relief allowed irregular migrants already resident in the US to obtain the documents. Similarly, Costa Rica facilitated the regularization of Nicaraguan immigrants immediately after the Hurricane. These elements seem to suggest that migration flows towards the canonical destinations experienced a boost in the aftermath of the shock. (IOM, 2001 and 2012).

3.2.3 Migration patterns in Nicaragua

The main destinations of migration out of Nicaragua are Costa Rica and the United States. However, the size and the composition of these migration flows have changed over time. Migration to the US was initially triggered by the economic and political crisis of the 1980s [3] and the subsequent mobility flows have continued along these patterns: the 2000 U.S. Census, shows that 51 per cent of Nicaraguan migrants into the United States arrived 25 years earlier. Differently, migration to Costa Rica is historically grounded in the 1990s, initially pushed by agricultural seasonal labour migration (Murrugarra and Herrera, 2011). The emigration patterns started to shift towards Costa Rica since that time and have lasted in that direction at the beginning of the 20th century.

Anyway, a distinct migration profile between individuals moving to the different destinations can be defined. Migration to the United States requires higher travel costs and indirect costs due to cultural and linguistic barriers. On the contrary, moving to Costa Rica is less expensive and the temporary and circular nature of migration flows shrinks the difficulties related to the integration process. Consequently, migration decisions are driven by socio-economic backgrounds determining heterogeneous opportunity to access to education, social networks, and infrastructures. As regards education for instance, migrant's average number of years of schooling is higher than the national average; however, a distinction exists between those migrating to Costa Rica, who usually have completed primary education, and those directed to the United States, who generally have some secondary education. This distinction reflects the reported activities they perform in the destination country. Similarly, wealthier families are more likely to have a migrant abroad. The proportion of migrants to US is higher within the richest quartile of the income distribution (Murrugarra and Herrera, 2011).

Some differences between the two types of flows exists even regarding the geographical origin of migrants. Nicaraguan emigration to US is essentially an urban

[3] The Sandinista revolution that started in the mid-1970s and the Contra war that followed brought the first large waves of Nicaraguan refugees into the U.S. Between 1983 and 2002 more than 10000 Nicaraguans obtained the status of political refugee in US. The Nicaraguan community is mainly concentrated in three major urban areas: Metropolitan Miami, Greater Los Angeles, and San Francisco Bay Area (US Census Bureau 2000).

phenomenon: more than 90 per cent of migrants comes from urban areas, 45 percent of them are from Managua. On the other hand, more than 38 percent of those going to Costa Rica originates in rural areas, mostly from the Pacific region. The paper takes into account these dynamics and tests whether the impact of the Hurricane on migration flows differs according to the destination.

3.3 Data and methodology

The analysis are based on data from the 1998 and 2001 Nicaraguan Living Standard Measurement Studies (NLSMS), carried out by the National Institute of Statistics and Census of Nicaragua, with the support of the World Bank. The surveys are representative of the population at the national, urban and rural, and departmental levels. Conducted using a multi-stage stratified sampling technique, they collect information on household demographics, consumption, assets, migration and economic activities. The 1998 survey includes around 23,500 individuals and 4080 households and it covers all 15 departments and the two autonomous regions of the country. However, the panel sample consists of around 17,000 individuals from 3520 households. The field work for the 1998 wave was carried between April and August 1998, a few months before the Hurricane occurs. As such, it is a good basis to assess *ex ante* conditions. The second wave was conducted between April and August 2001.

The migration history information collected in the second wave allows to identify individuals migrated abroad during the time in between. Therefore, the analysis are conducted cross-sectionally including only the individuals belonging to the panel. The 1998 wave is exploited to collect individual and household characteristics before the shock, while the 2001 wave provides information about migration. As the paper focuses on economically-driven migration rather than displacement, I consider only mobility episodes which occurred at least two months after the shock (from January 1999), in order to avoid including temporary displacement cases. Thus, the dependent variable is a dummy taking value 1 if the individuals moved abroad between January 1999 and April 2001. Individuals migrated in this time interval are 290, corresponding to the 3 per cent of the sample. The study focuses on international mobility as precise details are available about migration

episodes abroad occurring throughout the whole period between the two surveys. Moreover, migration towards other Central American countries is not so different from internal movements in terms of costs. Therefore, regional migration may be considered as an alternative strategy to internal migration, as long as the whole Nicaraguan economy had been negatively affected by the Hurricane.

The level of shock exposure is measured considering the rainfall intensity during the days of the Hurricane. As GPS coordinates are not provided, precipitation data have been elaborated by QGIS interpolation procedures and aggregated at the lowest level of geographical identification reported by the survey, i.e. municipalities [4]. Rainfall data are retrieved from the Precipitation L3 1 day 0.25 degree x 0.25 degree version 7 database of the Tropical Rainfall Measuring Mission (TRMM) [5]. The data are available for a grid of 0.25 degrees, corresponding to about 25 km. Average daily rainfalls range between 34 mm/day in the municipality of Nueva Guinea in the Atlantico Sur to 255 mm/day in some areas of Chinandenga and Leon. I use both a continuous measure of rainfall levels and a dummy for severe exposure to the shock, i.e. average daily rainfalls higher than 250 mm/day [6].

The sample includes also children aged 6 or more at the time of the Hurricane. Indeed, according to the *Encuesta Nacional de Trabajo Infantil y adolescente* conducted in 2000, on average 14 per cent of children aged 5–17 were working and another 20 per cent were employed in domestic activities. The rates are even higher in rural areas. The NLSMS provides a range of individual and household characteristics which are included in the regression models as control variables. Age, gender and education level of the respondents at the baseline period are considered. Having in mind the NELM approach for which individual migration responds to a collective decision taken at the household level, several household characteristics are taken into account. Household income composition is depicted through dummy variables reporting whether families get income from wage, self-employed, entrepreneurial or informal labour. In addition, agricultural households

[4] According to the 1995 Census Population used as reference basis for the 1998 NLSMS, a total of 147 municipios are reported in Nicaragua.

[5] Goddard Earth Sciences Data and Information Services Center (2016), TRMM (TMPA) Precipitation L3 1 day 0.25 degree x 0.25 degree V7, version 7, , Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed [04 April 2016] `http://disc.gsfc.nasa.gov/datacollection/TRMM_3B42_Daily_7.html`.

[6] This threshold corresponds to the highest quartile of the rainfall distribution. Referring to the map in Figure 1 the areas considered as seriously damaged are those corresponding to dark blue areas.

and families depending on other sources of income, i.e. retirements, rents, profits, insurances, are identified. Household size and composition information are also available. Total consumption per capita [7] and household asset endowments are also embodied as migration determinants. Finally, distance from the main road is taken as a proxy of remoteness and migration costs. Following the social network theory of migration, I include a dummy variable capturing whether another family member has migrated before.

Some important differences in baseline characteristics can be observed according to migration status after the Hurricane (see Table 3.1). In line with the migration patterns depicted above, the percentage of males and individuals having some education is higher among migrants. Migrants are two times more likely of being 15-29 and more than one fourth of them has already a relative abroad. As expected, around two thirds of them come from urban and less remote areas. As regards income composition, the percentage of households having at least a member working as wage labourer is higher among migrants, while self-employed and informal labourer members are more common among non-migrants. Migrant households depend more on other sources of income and less on agricultural activities. They are slightly more likely to be in the highest consumption quartile and report higher asset endowments. Regarding household composition, transnational families tend to have less children and more elderly members. Finally, migrant households are slightly less likely to have received aid between the two waves.

In order to assess whether the exposure to the shock has a significant effect on the decision to migrate abroad, probit regression models are estimated. The analyses are replicated using different proxies of disaster exposure, and considering only the subsample of individuals migrated in the 12 months after the Hurricane. Furthermore, a multinomial logit model is estimated distinguishing between two destinations: regional migration within Central American countries and international migration towards US and Canada. These analyses are conducted to verify whether the impact of the climate disaster varies according to the characteristics of the migratory phenomenon and along with the time elapsed from shock occurrence. Moreover, the study tests if the effect is different for agricultural households, which are widely recognised as the most exposed to climatic disasters. In order

[7] The variable included is already divided by the number of household members and adjusted for differences in prices between different areas of the country.

Table 3.1: NLSMS - Descriptive statistics (individuals)

	Migrants after Mitch	**No migrants**
Average daily rainfalls (mm/day)	206.98	202.64
High exposure (%)	35.45	31.05
Individual characteristics		
Female (%)	0.46	0.51
Education Level (%)		
No education	5.05	21.33
Primary	49.83	50.39
Secondary	39.73	21.64
Full Secondary or more	5.39	6.63
Age (%)		
6-14	22.74	31.81
15-29	60.54	31.33
30-49	14.05	22.97
50+	2.68	13.89
Household characteristics		
Employee or worker income (%)	65.55	50.94
Self-employed income (%)	46.13	52.48
Entrepreneur income (%)	7.69	7.60
Informal labour income (%)	28.76	39.58
No labour income (%)	48.49	30.41
Agricultural activities (%)	24.57	39.39
Consumption per capita (%)		
1st quartile	21.89	29.88
2nd quartile	25.25	25.82
3rd quartile	25.25	23.91
4th quartile	27.61	20.39
Household size (#)	7.00	7.00
# of children	2.74	2.96
# of elderly	0.29	0.26
Land size (manzanas)	13.69	8.58
# rooms per capita	0.47	0.41
Urban (%)	64.88	53.13
Distance from road (km)	27.65	11.16
Migrant relative (%)	26.42	2.00
Receiving aid after the Hurricane(%)	69.90	72.53
N	299	13461

to do that separated regressions are run for individuals coming from agriculture-dependent households. In all the regression models, standard errors are clustered by departments to control for the fact that individuals from the same area might show more similar response patterns [8]. This may be related to previous local migration dynamics and the level of public efforts for disaster recovery, which varies with the quality of local institutions.

The estimated probit coefficients might be biased because of endogeneity of the variable capturing whether another family member lived abroad before the Hurricane. An IV strategy has been chosen to address this problem and assess to what extent this source of bias affects probit estimates. The "migrant relative" variable has been instrumented with historical migration rates at the department level. Geographical variation in those rates is exploited as an exogenous source of variation in the probability of moving abroad, following the idea that migration networks influence current probability to migrate providing contacts, information and logistic support for new migrants. Referring to the historical evolution of migration flows out of Nicaragua, the rate of residents abroad at the department level in 1971 [9] has been identified as a suitable instrument. Since the endogenous variable is binary, I have adopted a maximum-likelihood bivariate probit approach (Heckman, 1978). Results reported in Table 3.3 show that coefficients of probit models do not seem to be biased by the endogeneity of the "migrant relative" variable. The direction of the impact of the Hurricane on the likelihood to migrate is consistent across the two estimates. An exception is represented by equation 5 (agricultural households subsample), whereas a lower and not statistically significant impact of having a relative abroad is reported by biprobit model. However, first stage regression results point out that the instrument perform weakly in instrumenting migrant relative status on this subsample of households.

[8] All models have been run also clustering standard error at the household levels. The results obtained confirm all the findings emerged in non clustered estimations.

[9] Data on residents abroad are retrieved from the 1971 National Census of Dwellings

3.4 Results

The results of the probit model estimations reported in Table 3.2 identify the determinants of migration decisions in the aftermath of the Hurricane. As expected by the migration profiles previously depicted, men and people aged 15 - 30 are more likely to migrate. Education has a positive effect on the probability to migrate: in particular, individuals with primary education are more likely to move to Costa Rica and nearby countries, while secondary education is a determinant of migration to North America. Household asset endowments positively affect the probability to move abroad, especially towards US and Canada. Not surprisingly, distance from the main road limits mobility, as the direct costs to afford migration are higher. On the other hand, having a relative already resident in the destination countries reduces indirect costs, boosting migration decisions. As regards household income composition, it influences migration decisions especially immediately after the disaster. Having at least one member working as wage labourer or receiving income from other sources than labour augments the probability to migrate. Therefore, it seems that at the very beginning having a guaranteed source of income helps to cover migration costs fostering mobility. However, such mechanism tends to run out over time. Depending on agricultural activities reduces mobility during the 12 months after the shock. However, as it is widely discussed in the next paragraphs, this effect is not homogeneous at all levels of shock exposure. Receiving humanitarian or governmental aid during the time between the Hurricane and the follow-up survey has an overall negative effect on mobility decisions, which becomes significant considering only migration within the 12 months after and to US. This can be due to the fact that getting recovery resources may encourage individual to stay at home and employ themselves in recovery activities.

Indeed, focusing on the main variable of interest, it is confirmed across all specifications (Columns 1-4, 6 7) that shock exposure does not have a significant impact on the probability to migrate. This has been corroborated considering either continuous or discrete measures of shock exposure, distinguishing among destinations and for time elapsed from the shock. Such results indicate that overall the damages suffered because of the Hurricane do not affect the likelihood to move. Thus, the natural disaster does not act as a direct push factor for human mobility. However, as Column 5 shows, this is not confirmed for agricultural households. Indeed, esti-

mating the regression model on the subsample of households reporting agricultural activities, it turns out that severe rainfalls significantly foster migration decisions. Exposure to high damages, other things being equal, increases the probability to move abroad from 1.07 to 2.75 per cent. Such evidence seems to be coherent with the idea that, as individuals coming from natural resource-dependent households are the most affected by climatic events, they are more likely to choose migration as intra-household spatial risk-coping strategy.

However, the results in Table 3.4 provide more details about the circumstances fostering the choice of migration as coping strategy for agricultural households. The outcome variable is the same as for models in Table 3.2, i.e. a dummy variable equal to 1 if an individual migrated abroad in the time interval between the Hurricane and the second wave. In the first model I tested whether the magnitude and the significance of the impact of a severe exposure to the Hurricane on migration choices changes according to household income sources. The interaction term between severe exposition to disaster and a dummy equal to 1 for households relying on dependent labour income is negative and significant. Comparing marginal effects of shock exposure at different values of income composition variables, it turns out that having a household member working as wage labourer nullifies the positive effect of shock exposure on the probability to migrate. In particular, being exposed to severe damages increases the likelihood to migrate by 3 percentage points if households do not have wage labourers, while the effect is negative and not significant in case of positive wage labour income (see Table 3.5). Relying on all other sources of income do not have a significant effect on individual migration decisions.

This might suggests that in case of a severe shock, only households not accessing alternative guaranteed sources of income, as formal sector contracts ensure, choose migration as coping strategy. However, as Model 2 shows, also baseline assets influence the effect of the Hurricane on migration decisions. The interaction term between size of land owned by the household and shock exposure is positive and significant, confirming that the magnitude of the positive impact of the shock raises with the dimension of the land owned. The effect of severe rainfalls on the probability to move out is positive and significant for individuals coming from households owning 50 *manzanas* [10] or more and it increases along with land

[10] 1 *manzana* corresponds to around 0.7 hectares (INIDE - Censo Nacional Agropecurario 2001)

size. Thus, migration constitutes an affordable coping strategy only for wealthier households. This is further validated by the specification in Column 3. Here, the double interaction between land dimension and the dummy for wage labour income confirms that shock exposure is a significant push factor only for individuals belonging to households who do not have wage workers. However, the magnitude of this effect varies from 3 percentage points for households owning no land to 15 percentage points for those owning 500 manzanas (see marginal effects in Table 3.5).

In summary, both the significance and the magnitude of the impact of shock exposure on individual mobility decisions vary according to household income before the shock occurs. In particular, asset endowments and income composition determine household adaptive capacity and influence the choice of the coping strategy to recover from the Hurricane damages. The exposure to a severe shock turns out to be a determinant of subsequent migration only for agricultural households not having other source of guaranteed income, but enough endowed to afford migration costs and risks. Migration, through remittance inflows, can contribute to finance recovery costs for those families not accessing other regular and ensured sources of liquidity. These findings reflect the controversial elements highlighted by the literature. The heterogeneity in the relevance of shock intensity for mobility decisions according to population group and characteristics is line with what observed for long-term environmental degradation (Massey et al., 2010; Gray and Mueller, 2012; Gray and Bilsborrow, 2013). Overall, the results are consistent with those studies reporting no direct impact of sudden-onset natural disasters on migration (Paul, 2005; Robalino et al., 2015). However, the positive effect of shock exposure on mobility decisions of individuals from agricultural households seems to confirm that natural shocks indirectly affect household choices through their negative effect on crop and livestock assets (Kubik and Maurel, 2016). Finally, the role of household income and assets in determining if migration is a preferred coping strategy is coherent with what observed by other contributions: sending a member abroad is an optimal income diversification strategy to fund recovery costs, especially when households do not have access to regular income from other sources; anyway, some level of income endowments is necessary to deal with mobility costs (Gray and Mueller, 2012; Kubik and Maurel, 2016; Cattaneo and Peri, 2016).

Table 3.2: NLSMS: Determinants of migration after Hurricane Mitch

	(1) Probit All	(2) Probit All	(3) Probit 1999	(4) Probit 2000/1	(5) Probit Agricultural	(6) Probit No agricultural	(7) Mlogit Regional	(7) Mlogit International
Rainfalls (daily)	-0.0004							
	(0.0007)							
Severe damages		0.0053	0.0448	-0.0161	0.4534***	-0.1119	-0.2597	0.3754
		(0.1092)	(0.1309)	(0.1019)	(0.1671)	(0.0872)	(0.3564)	(0.2938)
Female (dummy)	-0.1057***	-0.1063***	-0.0216	-0.1433**	-0.0599	-0.1153**	-0.2663***	-0.2250
	(0.0292)	(0.0294)	(0.0443)	(0.0459)	(0.0683)	(0.0545)	(0.0889)	(0.2077)
Education: *no education*								
Primary	0.3870***	0.3850***	0.5114***	0.2631	0.3865*	0.3722**	0.9305**	1.4830*
	(0.1442)	(0.1440)	(0.1687)	(0.1916)	(0.2236)	(0.1876)	(0.4238)	(0.8455)
Secondary	0.3651**	0.3608**	0.4515***	0.2747*	0.4861**	0.3158*	0.6455	2.1182**
	(0.1444)	(0.1430)	(0.1738)	(0.1663)	(0.2210)	(0.1705)	(0.4278)	(0.9621)
Higher	-0.1236	-0.1287	0.1902	-0.3153	0.3126	-0.2418	-0.9077	12.150
	(0.2320)	(0.2327)	(0.2662)	(0.2413)	(0.2840)	(0.2902)	(0.8326)	(0.9483)
Age: *6 - 14*								
15 - 29	0.4904***	0.4921***	0.3398**	0.5219***	0.5916***	0.4778***	1.4643***	0.1444
	(0.0894)	(0.0900)	(0.1096)	(0.0930)	(0.1502)	(0.1082)	(0.2316)	(0.2459)
30 - 49	0.0077	0.0075	0.1162	-0.0949	-0.2592	0.0693	0.0153	-0.1946
	(0.0619)	(0.0621)	(0.0871)	(0.0755)	(0.2494)	(0.0974)	(0.1328)	(0.3336)
50 +	-0.4854***	-0.4858***	-0.1838*	-0.7080**	-0.1939	-0.6229***	-1.2183***	-1.8516***
	(0.1327)	(0.1337)	(0.1094)	(0.2816)	(0.2296)	(0.1503)	(0.4071)	(0.6987)
Employee or worker	0.1256	0.1246	0.2370***	0.0428	-0.1537	0.2285***	0.4809**	-0.0918
	(0.0855)	(0.0842)	(0.0812)	(0.1186)	(0.2639)	(0.0540)	(0.2403)	(0.3040)
Self-employed	0.0656	0.0664	0.1791**	-0.0056	0.1751	0.0771	0.0748	0.4935

	(0.0565)	(0.0566)	(0.0757)	(0.0693)	(0.1085)	(0.0618)	(0.1848)	(0.3487)
Entrepreneur	0.0885	0.0944	0.1901	0.0262	0.0819	0.0283	0.4542	-0.4771
	(0.1694)	(0.1625)	(0.2216)	(0.1995)	(0.2317)	(0.2148)	(0.4175)	(0.7294)
Informal worker	-0.1138	-0.1112	-0.1794	-0.0323	0.1564	-0.2159*	0.0545	-1.6891**
	(0.1086)	(0.1057)	(0.1676)	(0.0875)	(0.1402)	(0.1169)	(0.1537)	(0.7366)
Agricultural activities	-0.1476	-0.1443	-0.3856***	0.0416			-0.1036	-1.4929***
	(0.1013)	(0.1033)	(0.0993)	(0.1346)			(0.3332)	(0.5120)
No labour income	0.2352**	0.2366***	0.2154**	0.2382**	0.2205	0.2755***	0.3898*	0.9252**
	(0.0938)	(0.0879)	(0.1032)	(0.0948)	(0.1540)	(0.0960)	(0.2109)	(0.4056)
Consumption per capita : *1st quartile*								
2nd quartile	-0.1031	-0.1017	-0.3156**	0.0658	-0.0122	-0.2007	-0.2319	-0.3491
	(0.0685)	(0.0677)	(0.1338)	(0.0875)	(0.1829)	(0.1374)	(0.1722)	(1.0306)
3rd quartile	-0.0377	-0.0379	-0.2999**	0.1413	0.1789	-0.1989*	-0.0391	-0.2974
	(0.0957)	(0.0928)	(0.1459)	(0.1037)	(0.1699)	(0.1206)	(0.2554)	(0.7887)
4th quartile	-0.0381	-0.0402	-0.3725**	0.1736	-0.1697	-0.0876	-0.3553	0.2457
	(0.1531)	(0.1500)	(0.1878)	(0.1656)	(0.2333)	(0.1818)	(0.4190)	(0.8665)
Household size	0.0289	0.0281	0.0270	0.0219	-0.0346	0.0422	-0.0213	0.2713***
	(0.0248)	(0.0249)	(0.0330)	(0.0259)	(0.0332)	(0.0275)	(0.0581)	(0.0968)
Number of children	-0.0189	-0.0171	-0.0668*	0.0108	0.0561	-0.0375	0.0172	-0.2110
	(0.0242)	(0.0253)	(0.0378)	(0.0372)	(0.0487)	(0.0352)	(0.0639)	(0.1561)
Number of elderly	0.0318	0.0343	-0.2163***	0.1434+	-0.0254	0.0404	-0.0191	0.1169
	(0.0700)	(0.0696)	(0.0823)	(0.0836)	(0.1123)	(0.1050)	(0.2095)	(0.2281)
Land size (manzanas)	0.0010**	0.0010**	0.0016***	0.0006	0.0008**		-0.0024	0.0055***
	(0.0005)	(0.0005)	(0.0004)	(0.0006)	(0.0004)		(0.0023)	(0.0011)
Rooms per capita	0.1765**	0.1787**	0.1288	0.1890**	0.4155***	0.1413*	0.2457	0.7916**
	(0.0756)	(0.0737)	(0.1445)	(0.0782)	(0.1392)	(0.0764)	(0.2769)	(0.3314)
Urban	-0.0475	-0.0432	-0.1894	0.0881	0.2515	-0.1196	0.0000	-0.4028
	(0.1103)	(0.1178)	(0.2110)	(0.1079)	(0.1857)	(0.1032)	(0.3488)	(0.6875)

Distance from the main road	-0.0000***	-0.0000***	-0.0000**	-0.0000***	-0.0000	-0.0000***	-0.0000**	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Migrant relative	1.3722***	1.3753***	1.2084***	1.2772***	1.2215***	1.3793***	2.8838***	2.5075***
	(0.0630)	(0.0641)	(0.1337)	(0.0976)	(0.2214)	(0.0943)	(0.1415)	(0.3017)
Aid (dummy)	-0.0914	-0.0914	-0.1623**	-0.0135	-0.1044	-0.1022	0.0431	-0.7556***
	(0.0667)	(0.0682)	(0.0814)	(0.0917)	(0.1134)	(0.0641)	(0.2399)	(0.2348)
Constant	-2.6361***	-2.7257***	-2.7643***	-3.1293***	-3.2246***	-2.5939***	-5.7196***	-7.6890***
	(0.1967)	(0.1830)	(0.2352)	(0.2315)	(0.2651)	(0.2149)	(0.5388)	(1.1696)
N	13167	13167	13167	13055	5236	7931	13167	
r2_p	0.1752	0.1750	0.1662	0.1735	0.1859	0.1852	0.1997	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3.3: Bivariate probit model (migrant relative endogenous)

	(1) All	(2) All	(3) 1999	(4) 2000/1	(5) Agricultural	(6) Non-agricultural
			Probit regression model			
Rainfalls (daily)	-0.0004					
	(0.0007)					
Severe damages		0.0053	0.0448	-0.0161	0.4534***	-0.1119
		(0.1092)	(0.1309)	(0.1019)	(0.1671)	(0.0872)
Migrant relative	1.3722***	1.3753***	1.2084***	1.2772***	1.2215***	1.3793***
	(0.0630)	(0.0641)	(0.1337)	(0.0976)	(0.2214)	(0.0943)
			Bivariate probit with instrumental variable			
Rainfalls (daily)	-0.0003					
	(0.0007)					
Severe damages		0.0085	0.0482	-0.0140	0.4750***	-0.1011
		(0.1047)	(0.1245)	(0.0992)	(0.1834)	(0.0869)
Migrant relative	2.5136***	2.4890***	2.4886***	1.8729	0.7069	2.0226*
	(0.5735)	(0.6047)	(0.6395)	(1.1788)	(0.6490)	(1.1946)
N	13167	13167	13167	13055	5236	7931
rho	-0.4747**	-0.4546**	-0.5748**	-0.1793	0.2249	-0.2985
aic	5077	5092	3843	4159	1257	3692

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3.4: NLSMS - Determinants of migration (agriculture households)

	(1) Income	(2) Assets	(3) Income*Assets
Dependent variable: migration episode after the Hurricane			
Damaged	0.9684*+	0.3090*	0.6746***
	(0.4115)	(0.1733)	(0.1519)
Employee	0.2321	-0.1222	0.2084
	(0.1790)	(0.2628)	(0.2049)
Employee*Damaged=1	-1.1247***		-1.0228***
	(0.3254)		(0.3442)
No labour income	0.2934*	0.1923	0.2617*
	(0.1713)	(0.1561)	(0.1355)
Damaged*No labour income	-0.2297		
	(0.2928)		
Self-employed=1	0.2324	0.1588	0.1875*
	(0.1477)	(0.1095)	(0.0968)
Damaged*Self-employed	-0.1792		
	(0.2220)		
Entrepreneur	-0.0875	0.1151	0.1049
	(0.2573)	(0.2264)	(0.2194)
Damaged*Entrepreneur	0.5042+		
	(0.3061)		
Informal sector	0.2307	0.1148	0.1366
	(0.1409)	(0.1460)	(0.1564)
Damaged*Informal sector	-0.2126		
	(0.3023)		
Land size	0.0009***	-0.0012	-0.0014
	(0.0003)	(0.0011)	(0.0016)
Nr. rooms	0.4429***	0.4533**	0.5206***
	(0.1111)	(0.1997)	(0.1334)
Damaged*Land size		0.0024**	0.0031*
		(0.0010)	(0.0016)
Damaged*Nr. Rooms		0.1005	

		(0.3392)	
Employee*Land size			0.0005
			(0.0013)
Employee*Damaged*Land size			-0.0067**
			(0.0029)
Female	-0.0754	-0.0574	-0.0761
	(0.0678)	(0.0688)	(0.0704)
Education level: no education			
Primary	0.4212*	0.3842*	0.4228*
	(0.2261)	(0.2333)	(0.2249)
Secundary	0.5372*	0.4942**	0.5222**
	(0.2145)	(0.2359)	(0.2232)
Higher	0.4765*	0.4274	0.4851*
	(0.2891)	(0.2795)	(0.2846)
Age group: 6-15			
15 to 30	0.5950***	0.5793***	0.6035***
	(0.1382)	(0.1457)	(0.1386)
30 to 49	-0.2884	-0.2815	-0.3022
	(0.2468)	(0.2529)	(0.2563)
50+	-0.2183	-0.2034	-0.2167
	(0.2369)	(0.2401)	(0.2408)
Distance from main road	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
Migrant relative	1.2448***	1.2393***	1.2548***
	(0.2022)	(0.1935)	(0.1834)
Consumption quartile: First			
Second	-0.0617	-0.0246	-0.0374
	(0.1868)	(0.1879)	(0.1980)
Third	0.2404	0.2069	0.2668
	(0.1702)	(0.1723)	(0.1842)
Fourth	-0.1072	-0.0740	-0.1315
	(0.2245)	(0.2407)	(0.2641)
Household size	-0.0119	-0.0216	-0.0065
	(0.0350)	(0.0355)	(0.0372)

Nr. children	0.0405	0.0494	0.0442
	(0.0467)	(0.0521)	(0.0491)
Nr. elderly	-0.0409	-0.0224	-0.0831
	(0.1299)	(0.1325)	(0.1477)
Constant	-3.6222***	-3.2620***	-3.5749***
	(0.3079)	(0.2750)	(0.2420)
N	5236	5236	5236
r2_p	0.2112	0.1849	0.2147

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Table 3.5: Marginal effects - agricultural households

	Delta-method					
Damaged	dy/dx	Std. Err.	z	P>z	[95% Conf.	Interval]
		Model1				
Employee=0	0.0306	0.0086	3.56	0.000	0.0138	0.0475
Employee=1	-0.0010	0.0061	-1.57	0.117	-0.0216	0.0024
No labour income = 0	0.0199	0.0059	3.36	0.001	0.0083	0.0316
No labour income = 1	0.0155	0.0130	1.19	0.234	-0.0100	0.0410
Self-employed = 0	0.0198	0.0097	2.04	0.042	0.0007	0.0388
Self-employed = 1	0.0174	0.0045	3.89	0.000	0.0087	0.0262
Entrepreneur = 0	0.0141	0.0066	2.17	0.030	0.0014	0.0269
Entrepreneur = 1	0.0458	0.0185	2.48	0.013	0.0096	0.0820
Informal worker = 0	0.0210	0.0143	1.47	0.141	-0.0070	0.0490
Informal worker = 1	0.0167	0.0063	2.66	0.008	0.0044	0.0289
		Model3				
Employee = 0 Land size = 0	0.0298	0.0087	3.43	0.001	0.0128	0.0469
Employee = 0 Land size = 100	0.0472	0.0128	3.69	0.000	0.0221	0.0722
Employee = 0 Land size = 500	0.1569	0.0367	4.27	0.000	0.0849	0.2289
Employee = 1 Land size = 0	-0.0085	0.0067	-1.26	0.208	-0.0217	0.0047
Employee = 1 Land size = 100	-0.0106	0.0060	-1.77	0.076	-0.0222	0.0011
Employee = 1 Land size = 500	-0.0057	0.0072	-0.78	0.434	-0.0198	0.0085

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Chapter 4

Migration as copying strategy for environmental shock recovery: Evidence from Hurricane Mitch in Nicaragua

4.1 Introduction

A vast literature has examined the implications of risk exposure for households in developing countries (Udry, 1994; De Weerdt and Dercon, 2006). Constraints to the access to credit and insurance markets raise household *ex ante* exposure to adverse exogenous shocks and affect *ex post* capability to quickly re-establish previous livelihoods (Fafchamps and Lund, 2003). The long term implications of these shocks may conduct to poverty traps, especially when assets held by the household are insufficient to support recovery costs (Carter et al., 2007). Moreover, the risk-diversification strategies adopted to cope with unexpected income variability may be costly and not profitable in the long run perspective (Rosenzweig and Wolpin, 1993).

As climatic systems have been changing worldwide, increasing both the frequency and the intensity of extreme meteorological episodes, natural disasters are nowadays considered one of the main sources of shocks in developing countries, affecting especially natural resource-dependent households. Therefore, burgeoning interest has been devoted to the analysis of how weather shocks affect human well-being and whether the available strategies to cope with them turn out to be adequate (Field, 2012). The effectiveness of usual risk-management institutions is limited by the fact that weather shocks are spatially covariant. Therefore, the mechanisms that establish oneself in case of idiosyncratic risk, they may not be effective when all the households in a geographical area are exposed to the same stress (Kubik and Maurel, 2016; McKenzie, 2003).

The idea of migration as a risk diversification strategy has been widely analysed by the New Economics of Labour Migration (NELM) literature (Lucas and Stark, 1985; Katz and Stark, 1986; Stark and Bloom, 1985). According to such approach, migration constitutes a household level collective decision driven by mutual insurance purposes. Given that wages and shocks at home and destination are usually not positively correlated, the decision to migrate can be interpreted as the outcome of an informal familiar arrangement, with benefits in terms of risk insurance and consumption smoothing for all the members (Rapoport and Docquier, 2006; De Weerdt and Hirvonen, 2013). Several contributions have ascertained the role played by remittances in providing liquidity to households of origin in case of exogenous income shocks (Gubert, 2002; De la Briere et al., 2002; Yang and Choi, 2007). This mechanism seems to operate also in case of natural shock occurrence (Clarke and Wallsten, 2004; Bettin and Zazzaro, 2016). Anyway, how and to what extent these income flows contribute to long term recovery from natural disaster is an under-explored issue.

This study contributes to fill this gap in the literature, testing whether remittance receiving households (RRHs) from abroad recover more easily than their counterparts from the damages of a sudden-onset climatic shock. The case study selected to test this hypothesis is the Hurricane Mitch hitting Nicaragua and other Central American countries on October, 1998. Focusing on the long run recovery process, the paper exploits the subsample of panel households surveyed by the Nicaraguan Living Standard Measurement Studies (NLSMS) to analyse household welfare patterns after being exposed to severe damages. In particular, the study assess if

RRHs are more likely to recoup their standards of living before the Hurricane. In order to have some details about how migrant transfers contribute to household recovery, two major dimensions are investigated: growth in consumption per adult equivalent and difference in household wealth scores between the two surveys. In this way, we can establish if remittances constitute a source of liquidity sustaining household consumption and play a role in preserving and restoring household asset endowments.

The results obtained highlight a positive impact of remittances on long run consumption standards. Income flows from migrants help households to maintain higher consumption growth rates. Furthermore, remittances support household assets preservation, reducing the risk of being trapped into poverty. This seems to be valid especially for agricultural households, who are the most deeply affected by the consequences of a natural disaster. In order to deal with selection into migration issues, the estimates are conducted with an instrumental variable (IV) approach. Indeed, RRHs may present specific unobservable characteristics which determines both the decision to send a family member abroad and the capability to recover after a shock. Therefore, historical migration and remittance rates at the department level are used to instrument for household remittance status.

4.2 Literature review

4.2.1 Migration as an intra-household insurance strategy

Several contributions referring to the NELM theory have identified migration among the mechanisms used by households in developing countries to cope with risk exposure and reduce income volatility. Rosenzweig and Stark (1989) show that marriage-related migration reduces consumption volatility in rural India. Migration of one or more household members substitutes formal insurance through the diversification of household income sources (Stark and Bloom, 1985; Lucas and Stark, 1985).

A number of studies have tested whether income transfers from both internal and

international migrants compensate for income shortfalls experienced by sending families. De la Briere et al. (2002) observe that the amount of money sent home by Dominican female migrants in US increases in response to unanticipated home family income shocks. Crop shortages experienced by those who stay behind are shown to significantly raise remittances to Western Mali (Gubert, 2002). Yang and Choi (2007) observe that changes in income are negatively related to changes in remittances from overseas to the Philippines. Molina Millán (2014) provides further evidence about the co-insurance mechanisms driving remittance behaviour, assessing that not only internal and regional migrants provide insurance to their origin households in rural Nicaragua, but also the other way round. At macro level, Bettin et al. (2015) observe that remittance flows raise strongly in response to different kinds of adverse exogenous shocks in sending countries. Migration turns out to be a valid strategy to mitigate exposure to price volatility too. De Brauw (2011) explores the implications of 2008 worldwide food price crisis on anthropometric statistics among young children in El Salvador, showing that children in households with access to international migration were not affected as negatively as those in households without such access.

The contribution of migration as insurance against natural shock consequences has been mainly investigated observing the response of migrant remitting behaviour to the occurrence of natural disasters in the sending country. At macro level, Bettin and Zazzaro (2016) observe that remittances increase in the aftermath of a disaster contributing to the reconstruction process and support risk preparedness for those countries that experienced more disruptive events in the past. In particular, climate-related events have been proven to lead to a substantial increase of remittance flows towards poorer countries (Yang, 2008) and countries with a larger number of migrants abroad (Mohapatra et al., 2012). Households with internal migrants settled before the Typhoon Ketsana in Vietnam started to receive more remittances than ahead of the shock (Gröger and Zylberberg, 2016). Clarke and Wallsten (2004) claim that remittances did act as household level insurance in the context of the Hurricane Gilbert in Jamaica, but they only partially covered the reported damages.

The adoption of migration as an *ex post* copying strategy to deal with climate-related events has been also widely analysed. A vast body of literature investigates whether climate anomalies or natural disasters act as direct push factors for out-

migration, or if they interact with social, political or economic factors, playing a role in shaping migration patterns (Piguet et al., 2011). Non-univocal conclusions on the direction and size of these relationships have been reached, according to the geographical area, the type of environmental degradation and the characteristics of the migration flows investigated. Long run environmental deterioration turns out to be positively related to human mobility only for some population groups and under certain circumstances (Gray and Bilsborrow, 2013; Koubi et al., 2016; Halliday, 2006). Even for sudden-onset natural disaster, the evidence is controversial. A negative association between shocks and out-migration has been frequently reported (Lewin et al., 2012; Tse, 2011; Halliday, 2006). On the other hand, Gröger and Zylberberg (2016) observe that around 17% of non-migrant households sent members away immediately after Typhoon Ketsana.

All these studies focus on verifying whether this intra-household insurance mechanism activates in case of shock occurrence. However, determining the efficacy of these money transfers in driving household *ex post* recovery remains an underexplored issue. Indeed, very few contributions consider whether RRHs are better able to recover from the drawbacks of a natural disaster. To the best of my knowledge, Mohapatra et al. (2012) show that RRHs perform better in terms of per capita consumption immediately after a flood in Bangladesh. Anyway, no details are provided about the efficacy of remittances in driving long run recovery patterns.

4.2.2 Recovering from natural disaster exposure

Environmental shocks, similarly to other economic shocks, may have a dramatic impact on household welfare, with both short and long term implications for family livelihoods (Skoufias, 2003). Instantaneous increases in poverty and deprivation due to a drop in consumption levels are frequently reported in correspondence to shock exposure (IADB,2000). Natural disasters generate also large losses in terms of physical assets with strong implications for ensuing welfare. Indeed, they damage the productive capital of firms and self-employed workers. The occurrence of a natural shock may force physical capital liquidation to fund reconstruction and rebuild or reacquire household non-productive assets such as houses. Moreover,

climate shocks can also negatively affect public productive infrastructures and disrupt marketing chains, with major consequences also on people not directly hit by the shock (Gignoux and Menéndez, 2016).

Exposure to a temporary income shock may push households below the poverty line. However, the long term implications of such drawbacks depend on whether this event affects household asset base. In case the natural disaster does not degrade asset endowments, households can easily recover to *ex ante* well-being levels. On the contrary, if shock exposure wrecks the resources supporting household livelihoods, this may lead them to fall into poverty traps (Carter and Barrett, 2006; Arouri et al., 2015; Nakamura et al., 2017). Carter et al. (2007) follow the evolution of household assets along time since shock occurrence, in order to shed light on factors influencing household resilience. The authors compare asset endowments of rural Honduran households during Hurricane Mitch and Ethiopian households along a series of prolonged droughts between 1998 and 2000. Critical minimum asset thresholds, below which families are unable to successfully recover are identified. As regards the Honduran sample, the medium term effects of the shock vary by initial household wealth, with wealthier households able to partially rebuild their lost assets throughout the three years after the disaster.

The capability to preserve asset endowments depends on both the level of shock exposure and *ex-ante* or *ex-post* strategies households can adopt in response to the shock. The efficacy of usual risk management institutions, i.e. risk sharing networks, informal credit, is limited by the fact that weather shocks are spatially covariant (De Weerdt and Dercon, 2006; Fafchamps and Lund, 2003). Natural disasters affecting whole villages or even regions affect the capacity of local group-based institutions that in normal circumstances may be quite effective to provide some insurance. More broadly, as this kind of aggregate shocks hit wide geographical regions, they may also upset market-based coping mechanisms such as borrowing from formal financial institutions (Carter et al., 2007). In these circumstances migration, through the intra-household insurance mechanism provided by remittances, may constitute an effective spatial income diversification strategy.

On the other side, several claims have been done regarding the creative destruction component of natural disasters (Hallegatte and Dumas, 2009). Damages provoked by natural shocks force a renewal of productive assets and stimulate the adoption

of more up-to-date production technologies. Moreover, the mobilization of external aid and the involvement of international organizations in recovery interventions may incentive local institutions to invest in infrastructure improvement. Gignoux and Menéndez (2016) analyse the long term effects of a series of earthquakes in Indonesia on individual economic outcomes showing that affected individuals, despite suffering short term economic losses, display welfare gains in the long run. The mechanisms driving such positive transformations can be activated also by the mobilization of savings and other household resources, as migrant remittances.

4.2.3 Hurricane Mitch and migration trends in Nicaragua

Hurricane Mitch hit Central American countries on October 1998. Although Nicaragua is vulnerable to tropical storms, the destruction intensity of Hurricane Mitch was totally unpredictable [1]. Approximately 45,000 households were directly affected by Mitch. Entire areas of the country were cut off for several months because of floods and highway and bridges collapse. The region mostly touched by the storms was the Pacific, in particular the departments of León and Chinandega which hold more than 83% of all deaths (INEC, 2000). The total damages at country level have been estimated at $ 1 billion to $ 1.3 billion (around 50% of the country GDP in 1998), with 20% of the population left without habitable dwellings, 1500 miles of roads destroyed, and one-third of agricultural crops severely damaged (CEPAL, 1999). Hundreds of schools, health clinics, civic buildings and public markets were wrecked. As the agro-exporter sector is particularly relevant for the country, the whole economy suffered enormously the impact of Mitch. Production losses caused both short and long term unemployment, with consequences on poverty especially in rural areas (Carter et al., 2007).

As regards the historical evolution of migration flows out of Nicaragua we observe that until the beginning of 1970s, international migration was a limited phenomena, involving less than 2% of the population. A first flow of emigrants left Nicaragua shortly after the December, 1972 earthquake epicentred in Managua (IOM, 2001). Out-migration leakages started to growth with the escalation of the

[1] This tropical storm has been classified as an event of category 5 - highest level - on the Saffir Simpson Scale which is a 1-5 rating based on the hurricane's present intensity. Mitch provoked about 11,000 total deaths in the region (including 3,800 in Nicaragua), vastly more than those caused by other storms.

civil war against the Somoza regime in 1979. They intensified during the 1980s because of the outbreak of the armed conflict between the Sandinista Government and the counter-revolutionary forces (known as *Contras*). After 1990, some of the war refugees returned in Nicaragua. Anyway, emigration flows have continued to rise during the 1990s driven by economic reasons.

Overall, distinct profiles for individuals moving abroad can be defined. Some differences emerge also within the migrant group according to destination. Migration to the United States requires higher travel and indirect costs due to cultural and linguistic barriers. On the contrary, migration to Costa Rica is less expensive and the integration process easier. Consequently, the probability of receiving remittances from a migrant abroad is driven by household socio-economic backgrounds determining heterogeneous opportunities to access to education, labour markets and social networks. Wealthier and more educated families are more likely to have a migrant abroad. The proportion of households having a relative in US is higher within the richest quartile of the income distribution (Murrugarra and Herrera, 2011). As regards the geographical distribution, more than 90 per cent of migrants to US comes from urban areas, while almost the 40 per cent of those going to Costa Rica comes from rural areas. Anyway, the propensity to send a member abroad is lower among agricultural households.

The Hurricane had some implication also on migration flows. Both US and Costa Rica, the two main destinations of migration out of Nicaragua, launched a series of immigration policies during the months following October 1998 directed to foreign citizens coming from Central American countries hit by the disaster. These elements seem to suggest that migration flows towards the canonical destinations experienced a boost in the aftermath of the shock (IOM, 2001 and 2012). Carvajal and Medalho Pereira (2009) show that the exposure to the Hurricane affects subsequent migration decisions differently according to wealth quartile and area of residence. In the previous chapter, I showed that shock exposure does not act as a direct push factor as a whole. Only individuals belonging to agricultural households experiencing the highest exposure to rainfalls increase their likelihood to move abroad during the two years and half after the Hurricane.

4.3 Data

4.3.1 Data sources

The analysis are based on data from the NLSMS, carried out by the National Institute of Statistics and Census of Nicaragua, with the support of the World Bank. The surveys are representative of the population at the national, urban and rural, and departmental levels and collect information on household demographics, consumption, assets, migration and economic activities. The panel subsample includes around 3500 households and it covers all 15 departments and the two autonomous regions of the country. The field work for the first wave was carried out between April and August 1998, while the second wave was conducted between April and August 2001.

The 1998 wave is exploited as baseline to collect *ex ante* household information, including demographic and socio-economic characteristics, geographical location and welfare indicators, i.e. asset endowment, consumption level and income composition. Information on household access to credit and savings are also provided. The migration history information collected in the second wave allows to identify households who receive international remittances. In addition, information on household access to aid and public transfers in-between the shock and the survey are available, and measurements of welfare indicators two years and half after the Hurricane are provided. Households receiving remittances from abroad are about 600, corresponding to 20 per cent of the sample.

The level of shock exposure is measured considering the intensity of rainfalls during the days of the Hurricane. As household GPS coordinates are not provided, rainfall data have been elaborated by QGIS interpolation procedures and aggregated at the lowest level of geographical identification reported by the survey, i.e. municipalities [2]. Rainfall data are retrieved from the Precipitation L3 1 day 0.25 degree x 0.25

[2] According to the 1995 Census Population used as reference basis for the 1998 NLSMS, a total of 147 *municipios* are reported in Nicaragua

degree version 7 database of the Tropical Rainfall Measuring Mission (TRMM) [3]. The data are available for a grid of 0.25 degrees, corresponding to about 25 km. Average daily rainfalls range between 34 mm/day in the municipality of Nueva Guinea in the Atlantico Sur to 255 mm/day in some areas of Chinandenga and Leòn (see Figure 3.1).

4.3.2 Descriptives

Some important differences in baseline household characteristics according to remittance status in the follow-up survey can be observed (Table 4.1). In line with the country-level migration patterns depicted above, education level of the household head is on average higher among RRHs. As regards income composition, the percentage of households having at least a member working as wage labourer is larger among RRHs, while self-employed and informal labour members are more frequent among no remittance households. RRHs depend more on other sources of income and less on agricultural activities. They are more likely to be in the highest wealth quartile and their per capita consumption level is higher. On average, RRHs report smaller household size, less children and more elderly members. As expected, almost three out of four of them come from urban areas. Regarding access to aid and reconstruction programs between the two time periods, RRHs are slightly more likely to be an aid program beneficiary.

To estimate the long term effects of the Hurricane on household welfare and compare the outcomes of the recovery process across the two groups of households, two dimensions are considered. Firstly, the study analyses the variation in consumption per adult equivalent [4]. To better quantify the variation in real consumption along the time interval, consumption levels reported in 2001 are deflated to baseline values. The impact of the disaster on household physical assets is measured

[3] Goddard Earth Sciences Data and Information Services Center (2016), TRMM (TMPA) Precipitation L3 1 day 0.25 degree x 0.25 degree V7, version 7, , Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed [04 April 2016] `http://disc.gsfc.nasa.gov/datacollection/TRMM_3B42_Daily_7.html`.

[4] The consumption measure adopted include consumption of non-durables in the previous 12 months. It is adjusted for the number of household members and for the difference in geographic prices. Robustness checks are conducted considering the consumption per adult equivalent computed applying several equivalence scales.

considering variation in a wealth score index. The index is constructed following the Demographic Health Survey guidelines (Shea and Johnson, 2004). The indicator variables considered summarise information on assets and utility services, house and land tenure. In order to be able to compare rural agricultural households with urban counterparts, agricultural productive assets are also included. Following Filmer and Pritchett (2001), Principal Component Analysis (PCA) is applied to aggregate indicator variable information in a single index, which at the baseline period varies between -4.21 and 10.20.

Comparing reported consumption levels in the two waves, we see that on average consumption increases along time for both household groups. This may provide evidence in support of the idea of the creative destruction component of natural disasters. Consequently, in order to identify whether RRHs performed better in terms of consumption expansion, gaining more from the recovery process, consumption growth between the two time periods is considered. As it is shown in the lower part of Table 4.1, RRHs report on average an almost double growth rate with respect to their counterparts in all the consumption scales adopted. Similarly, the average difference in the wealth score between 1998 and 2001 is positive for both household groups but is higher for RRHs (0.18 against 0.01).

4.4 Empirical framework

4.4.1 Empirical methodology

In order to estimate the causal effect of receiving remittances on household long term recovery performances, multivariate models are estimated assuming consumption or asset outcomes as dependent variables and controlling for household *ex ante* characteristics, degree of shock exposure and access to different coping strategy, including migrant remittances. The regression specification is the following:

$$Y_{i,t+1} = \alpha_0 + \alpha_1 R_{i,t+1} + \alpha_2 P_i + \alpha_3 Z_{i,t+1} + \alpha_4 X_{i,t} + u_i, \tag{4.1}$$

Table 4.1: NLSMS - Descriptive statistics by remittance status

	Remittance Households	**No Remittance Households**
Average daily rainfalls (mm/day)	211.70	201.64
Baseline characteristics		
Education Level household head (%)		
No education	23.11	36.00
Primary	41.64	45.38
Secondary	23.93	14.06
Full Secondary or more	11.31	4.56
Female household head (%)	37.12	25.56
Employee or worker income (%)	56.89	47.33
Self-employed income (%)	42.63	51.41
Entrepreneur income (%)	8.27	7.26
Informal labour income (%)	22.85	36.65
No labour income (%)	51.22	26.82
Agricultural activities (%)	19.87	41.10
Household size (#)	5.56	5.79
# of children	2.14	2.55
# of elderly	0.32	0.23
Credit constrained (%)	47.18	58.71
Savings (%)	11.33	5.82
Wealth score (%)		
1st quartile	8.83	29.16
2nd quartile	16.81	27.35
3rd quartile	26.32	24.76
4th quartile	48.05	18.73
Urban (%)	74.23	49.45
Access to aid between the Hurricane and 2001		
Aid (%)	74.88	70.44
Aid for house (%)	13.78	18.59
Aid for infrastructure	56.56	47.49
Outcomes		
Consumption per capita		
Consumption 2001 (cordobas)	9559	5821
Consumption growth (1998 - 2001)	0.27	0.13
Consumption per adult equivalent (OECD modified scale)		
Consumption 2001 (cordobas)	10266	7103
Consumption growth (1998 - 2001)	0.35	0.19
Consumption per adult equivalent (Haughton and Khandker (2009))		
Consumption 2001 (cordobas)	11743	8239
Consumption growth (1998 - 2001)	0.31	0.19
Wealth score (1998)	1.81	-0.49
Wealth score (2001)	1.99	-0.50
Difference Wealth scores (1998 - 2001)	0.18	0.01

where $Y_{i,t+1}$ correspond to the outcome considered and $R_{i,t+1}$ is the remittance status, a dummy being 1 if the household receives remittances from abroad during the 12 months before the second wave. P_i is the average daily rainfall level experienced during the Hurricane, $Z_{i,t+1}$ is a dummy equal to 1 if the household get access to public aid or international cooperation programmes between the disaster and the 2001 wave, $X_{i,t}$ is a vector of household baseline characteristics and u_i is the zero-mean error term. The vector of controls entails socio-demographic characteristics (education level of the household head, household size and composition), wealth proxies (wealth score index, consumption level) and income composition dummies before the shock occurs. In addition, dummies for saving availability and the presence of constraints to the access to credit are included, in order to control for the presence of consumption smoothing strategies mitigating the damages.

Indeed, liquidity and credit constraints are widely recognised reasons limiting the general applicability of the consumption life-cycle model (Deaton, 1992). Having access to credit market allows individuals to maximize lifetime utility through inter-temporal consumption allocation, where inter-temporal preferences depend on only market interest rates and individual time preference rate. However, as getting access to credit institutions in developing countries can be extremely complex and fragmented, the possibility to anticipate consumption through loans is very rare. This should adapt to our context as households with deposit availability at the baseline correspond to the 6.89% of the sample, while credit constrained families represents the 56.39% in the full sample and the 62.55% among agricultural households. Where borrowing is difficult, or even impossible, consumption allocation decisions would be determined by the level of individual (or household) wealth. Therefore, in order to proxy for household wealth before the disaster, baseline asset endowments are included in the consumption growth equation. Indeed, as selling assets may represent a strategy to smooth consumption after a negative unexpected shock, initial asset base is determinant in predicting whether households are able to recover and expand long run consumption or they find themselves trapped in poverty[5].

Referring to Carter et al. (2007), difference in wealth score equations include the

[5]Referring to Deaton (1992), if borrowing is impossible, the Euler equation for inter-temporal consumption allocation takes the form: $\lambda(c_t) = max(\lambda(x_t), (1+r)/(1+\delta)E_t\lambda(c_{t+1}))$, where x_t is some measure of assets or current income.

initial asset level, to get the idea that there is a long run equilibrium asset level towards which households converge. In case the baseline asset coefficient turned out to be less than zero, it would indicate a convergent accumulation process, with low-wealth households accumulating assets more rapidly than wealthier households. The theoretical model inspiring this empirical specification are a microeconomic adaptation of the standard neoclassical growth model used to study convergence in standards of livings among countries (Carter and Barrett, 2006; Carter et al., 2007). Analogously to what has been noticed by this literature, a question about the potential endogeneity of wealth levels can be raised. Although these initial levels are temporally pre-determined, they may be correlated with household specific characteristics not captured by the model. In order to get rid of this, several household characteristics are included in the regressions as controls.

4.4.2 Identification

As already mentioned above, selection into migration and consequently into remittances is an important concern, since households having migrants abroad may present different characteristics with respect to no remittance households. Although we control for an array of observable household demographic and socioeconomic factors, there are potentially unobservable characteristics that might affect both the migration decision and the outcome observed. For example, more enterprising and less risk-adverse households may be more likely to invest in international migration of a family member. At the same time, they could show more spirit of initiative in recovering from a shock and undertaking challenging but more profitable recovery strategies. Another endogeneity issue regards the fact that households more exposed to this type of climate events may be more likely to adopt migration as an *ex ante* household level insurance strategy against natural disaster occurrence. However, the unforeseeable magnitude of this exogenous shock is exploited to deal with this concern.

To overcome this selectivity issue, an IV approach is implemented. Geographical variation in historical migration rates is exploited as an exogenous source of variation in the probability of getting transfers from migrant abroad. The choice of the instruments is driven by the idea that migration networks influence the

probability to migrate and remit, but not household capability to recover after a shock, neither the degree of exposure to the shock. The argument sustaining this criterion is that intense past migration flows from the home region facilitates more recent migration. A larger network of migrants provides contacts, information and logistic support for new migrants. Moreover, international migration is more likely to be undertaken when people get in touch with successful experiences reported by neighbours or acquaintances (Adams and Cuecuecha, 2010a; Calero et al., 2009).

In order to identify suitable instruments, I refer to the historical evolution of migration flows out of Nicaragua (see section 2.3). Therefore, two variables have been selected to instrument household remittance status. Firstly, the rate of residents abroad at the department level is retrieved from the 1971 National Census of Dwellings and exploited to proxy geographical origin of migrants at the dawn of the international migration phenomena. Secondly, the department rate of RRHs has been computed using data from the *Encuesta Nacional de Hogares sobre Medición de Niveles de Vida* 1993. This second instrument catches the variation in geographical location of households still having a member abroad after the end of the Contra war contributing to household budgeting. Figure B.4.1 and Figure B.4.2 in Appendix B show the correlation of the two instruments with the remittance rates at the department level reported by the survey. As expected, first stage regressions reported in Table B.4.1 in Appendix B confirm that historical migration and remittance rates are powerful predictors of current remittance status. The F statistics reported in Table 4.2 and Table 4.3 rule out the concern for weak instruments.

However, RRHs may present different characteristics with respect to the broader group of migrant sending households. They are more likely to have a successful migrant to be sent abroad among their family members. Besides, as predicted by the NELM theory, they are more capable to set a long-term intra-household agreement guaranteeing constant remittance inflows overtime. As migration affects households' outcomes in more complex ways than through remittances only, these unobservable differences may undermine the reliability of an IV strategy based on historical migration flows. In order to deal with this potential source of bias, geographical variation in historical remittance rates has been exploited to instrument current household remittance status. Indeed, migration flows of RRHs may differentiate in terms of geographical origin and place of destination from

those of migrant households who do not receive remittances, resulting in different social networks across the two groups.

Data confirm a greater likelihood of receiving money transfers from migrants in US or Canada (80%) with respect to those living in Costa Rica and other Central American countries (65%). This is hardly surprising as migration to North America requires larger travel and indirect costs than regional migration to neighbouring countries. However, it is expected to produce higher returns in terms of remittances sent back. Intuitively household capacity to plan and support a long-term investment as sending a member to US may also influence the ability to recover after a shock. Therefore, in order to identify the net effect of remittances on household recovery outcomes, original models have been re-estimated controlling for a dummy reporting whether households have a relative currently living in North America. As this variable works as a proxy of unobservables mentioned above, I should be able to detect the effect of remittances net of household capacity to support a long-term investment. Results summarized in Table B.4.3 Appendix B shows that the effect of remittances on both the outcomes considered remains more or less unchanged with respect to outcomes presented in the next section. These findings confirm the idea that the positive effect of remittances is not driven by a number of unobservables differentiating RRHs from the generic profile of migrant households.

4.5 Results

4.5.1 Consumption growth patterns

Table 4.2 presents the estimations of Equation (4.1) for the regressions having as dependent variable the consumption per adult equivalent growth between the two surveys, computed according to Haughton and Khandker (2009) guidelines. OLS results show that RRHs report significantly higher growth rates than their counterparts in the full sample (Model 1). The effect is analogous within the agricultural subsample, even if the coefficient is not significant. Similar results are obtained adopting different measures of consumption per adult equivalent (see Table B.4.2

in Appendix B) [6]. However, this effect is still significant when instrumental variable estimations are conducted (see Model 2 and 4). The magnitude of the coefficients becomes larger once I instrument for remittance status, suggesting a downward bias in the OLS estimations of the remittance effect. These elements are in line with the interpretation of migration as intra-household insurance contract, with remittances providing an external source of liquidity helping families to regain and maintain higher living standards in the long term [7].

The degree of shock exposure, measured through average daily rainfalls during the Hurricane, has a slight negative but not significant effect on consumption growth, confirming that being more intensively exposed to natural disaster corresponds to lower performance in terms of long run welfare trends. Household *ex ante* economic background plays a role in driving *ex post* recovery. Physical capital endowments at the baseline negatively affect household consumption trends after the Hurricane, suggesting that wealthier households experience a relative lower expansion in their consumption standards after the shock occurrence. Family income composition influences consumption patterns: having a household member working as wage labourer rises the growth rates reported. Relying on a guaranteed source of income allows to cope with liquidity shortages in the short run preventing from remaining stuck at low consumption levels. Similarly, owning some savings before shock occurrence fosters consumption growth in the aftermath, as it contributes to reconstruction costs and helps to fund expensive but more effective income diversification strategies, including household member migration. On the contrary, having access to credit negatively impact on welfare performances. This may be due to the fact that having access to credit allows to anticipate consumption, according to inter-temporal preferences, reporting relatively lower consumption level in the following period. However, these effects are no more significant considering only the agricultural subsample.

[6] Consumption per adult equivalent variables are constructed applying a system of weights. For a household of any given size and demographic composition, an equivalence scale measures the number of adult males to which that household is considered to be equivalent. Thus, each member of the household corresponds to some fraction of an adult male. Different equivalence scales are implemented to explore the robustness of results. The OECD-modified equivalence scale, first proposed by Hagenaars et al. (1994) assigns a value of 1 to the household head of 0.5 to each additional adult member, and of 0.3 to each child. Other consumption per adult equivalent measures are computed applying different parameters to the formula $(N_{adults} + \alpha N_{children})^{\theta}$. The estimates reported in Table 4.2 assume $\alpha = 0.76$ and $\theta = 0.71$ (see Haughton and Khandker (2009))

[7] As it is shown in Table B.4.2 in Appendix B the positive effect of remittances is verified on both the level of consumption growth and the probability of reporting a positive consumption growth rate.

In line with the fact that natural resource dependent households are usually the most deeply hit by climatic shocks, agricultural households report smaller consumption growth rates. The losses in terms of productive assets for crop and livestock activities caused by the Hurricane may jeopardize subsequent welfare performances. As regards household size and composition, larger families seem to report higher consumption growths. Finally, having benefited from aid has a slight negative impact on consumption growth patterns of agricultural households. This unexpected effect may be due to the fact that households accessing to aid may be more vulnerable and consequently more likely to get trapped at low consumption levels in the medium and long run.

4.5.2 Difference in wealth score index

As findings reported in Table 4.3 suggest, household remittance status significantly determines asset accumulation patterns after the shock. The OLS outcomes (Model 5 and 7) show that the difference in wealth indexes is significantly more positive for RRHs with respect to their counterparts. The magnitude of the effect rises if we consider only agricultural households. The instrumental variable estimations (Model 6 and 8) confirm the significance of the remittance terms within both the full sample and the subsample of agricultural households. The coefficient estimated with IV for this subgroup is larger than OLS.

Average daily rainfall levels have a positive impact on wealth score difference, providing further evidence in support of the hypothesis of a creative destruction component of natural disasters. Coherently with what found by Gignoux and Menéndez (2016), damages provoked by natural shocks appear to force a renewal of both productive and non-productive assets. Two dummy variables identifying if households have benefited from aid programmes specifically directed to home and infrastructure reconstruction and amelioration are included in this specification. In this way, it is possible to assess if the mobilization of external aid contributes to asset endowments preservation. The positive coefficients obtained in Model 5-8 seems to confirm this idea.

Household head education at the baseline has a positive effect on ensuing wealth

accumulation. Conversely, asset base levels before the shock, measured by wealth score index in 1998, report negative coefficients across all the models. Lower wealth households appear to have gained more in terms of asset values with respect to wealthier households. As expected, agricultural households are more deeply damaged by the Hurricane even in terms of assets, reporting significantly smaller differences in wealth scores. The positive effect of relying on wage income on household welfare performances after the shock is confirmed. In this case, also getting income from entrepreneurial activities positively influences the asset accumulation trends. This may constitute another element in support of the creative destruction argument, as long as the asset renovation may be more necessary for entrepreneurial households. Demographic characteristics also play a role, with household size and number of dependent members being respectively positively and negatively associated with wealth score indexes.

Therefore, the elements emerged indicate that remittance flows from international migrants constitute an effective insurance tool to recover from natural disaster damages in the long run. RRHs perform better than their counterparts as regards both the welfare indicators considered. Particularly relevant is the positive effect of receiving income flows from migrants on agricultural household asset endowments. This proves that remittances contribute to maintain or quickly re-establish *ex ante* livelihoods and assets, reducing the risk of being pushed into poverty traps, from which recovery would be extremely hard. The fact that the protective effect of remittances is significant and larger for natural resource dependent households, more vulnerable to climatic shocks, further confirms the effectiveness of the insurance role played by migrant transfers.

The size of the remittance status coefficients estimated with OLS suffers of a very relevant downward bias with respect to IV models, both in consumption and wealth score equations. The extreme downward bias observed indicates that RRHs have unobserved characteristics that make them less likely to experience better recovery performances than observationally similar households in NRRHs group. For instance, RRHs can exhibit an increased future propensity to migrate. Indeed, members of transnational households would have stronger incentives to migrate themselves in the near future to rejoin relatives in their destination countries. Therefore, they might be less interested to accumulate assets in the areas of origin. This is even more the case after a natural disaster, as the substitution of all

damaged items would require consistent lump sum disbursements, which may not be convenient in case either part or the whole family is planning to move shortly. Similarly, migrant households may be less likely to expand consumption if they are planning to bear sizeable travelling costs soon.

Table 4.2: NLSMS - Consumption growth equations

	Full sample		Agricultural sample	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Remittance household	0.1020**	1.0324***	0.1423	1.7169***
	(0.0430)	(0.3429)	(0.0811)	(0.5499)
Rainfalls (daily)	-0.0003	-0.0002	-0.0004	-0.0001
	(0.0003)	(0.0003)	(0.0004)	(0.0004)
Access to aid	0.0033	-0.0407	-0.0694	-0.1987**
	(0.0361)	(0.0422)	(0.0557)	(0.0789)
Baseline characteristics				
Education - reference category: no education				
Primary	0.0034	0.0042	0.0164	0.0591
	(0.0391)	(0.0423)	(0.0525)	(0.0631)
Secondary	0.0275	-0.0205	0.1150	0.1913
	(0.0576)	(0.0647)	(0.1191)	(0.1417)
Higher	-0.0347	-0.1085	0.0518	0.1910
	(0.0826)	(0.0933)	(0.2675)	(0.3164)
Female household head	0.0366	-0.0114	0.1547**	0.0871
	(0.0381)	(0.0447)	(0.0742)	(0.0899)
Employee or worker	0.0745	0.1130**	0.1333**	0.1852**
	(0.0406)	(0.0461)	(0.0666)	(0.0799)
Self-employed	-0.0390	-0.0234	-0.0527	-0.0281
	(0.0374)	(0.0408)	(0.0619)	(0.0729)
Entrepreneur	-0.0678	-0.0714	-0.0711	-0.1105
	(0.0657)	(0.0710)	(0.0828)	(0.0978)
Informal work	-0.0292	-0.0029	-0.0641	-0.0201
	(0.0400)	(0.0443)	(0.0567)	(0.0680)
Agricultural household	-0.1122**	-0.0923		
	(0.0469)	(0.0512)		
No labour income	-0.0514	-0.1707***	0.0499	-0.1184
	(0.0375)	(0.0595)	(0.0606)	(0.0915)
Household size	0.0332***	0.0217	0.0216	0.0091
	(0.0113)	(0.0129)	(0.0168)	(0.0202)
Number of children	-0.0260	-0.0132	-0.0028	0.0126
	(0.0155)	(0.0174)	(0.0223)	(0.0266)
Number of elderly	0.0258	-0.0016	0.0115	-0.0160
	(0.0325)	(0.0366)	(0.0451)	(0.0536)
Savings available	0.0776**	0.0888**	0.0906	0.0952
	(0.0341)	(0.0370)	(0.0521)	(0.0609)
Credit constrained	0.2144***	0.2078***	0.1506	0.0947
	(0.0686)	(0.0742)	(0.1811)	(0.2126)
Wealth score - reference category 1st quartile				
2nd quartile	-0.0569	-0.0895	-0.0623	-0.0985
	(0.0494)	(0.0547)	(0.0597)	(0.0710)
3rd quartile	-0.0551	-0.1338	-0.1709	-0.2133
	(0.0607)	(0.0716)	(0.0930)	(0.1097)
4th quartile	-0.0829	-0.2891***	-0.3110**	-0.6707** *
	(0.0722)	(0.1085)	(0.1524)	(0.2169)
Urban	0.0862	0.0820	0.1293	0.0529
	(0.0463)	(0.0500)	(0.0756)	(0.0922)
Constant	-0.3735**	-0.3563	-0.4277	-0.3226
	(0.1724)	(0.1865)	(0.3897)	(0.4571)
N	2638	2638	966	966

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Table 4.3: NLSMS - Difference in wealth score index

	Full sample		Agricultural sample	
	OLS	IV	OLS	IV
	(5)	(6)	(7)	(8)
Remittance household	0.3486***	1.2768***	0.4002***	1.8794***
	(0.0577)	(0.4661)	(0.0923)	(0.6102)
Rainfalls (daily)	0.0009***	0.0011***	0.0005	0.0008
	(0.0003)	(0.0004)	(0.0004)	(0.0005)
Access to aid (home)	0.2124***	0.2212***	0.2621***	0.2481***
	(0.0580)	(0.0607)	(0.0657)	(0.0735)
Access to aid (infrastructure)	0.0945**	0.0372	0.1147**	0.0022
	(0.0435)	(0.0536)	(0.0570)	(0.0783)
Baseline characteristics				
Education - reference category: no education				
Primary	0.0751	0.0794	0.1184**	0.1606**
	(0.0520)	(0.0544)	(0.0594)	(0.0685)
Secondary	0.3024***	0.2635***	0.3485**	0.4172***
	(0.0772)	(0.0829)	(0.1340)	(0.1522)
Higher	0.5126***	0.4741***	1.1566***	1.2592***
	(0.1122)	(0.1187)	(0.2995)	(0.3369)
Female household head	0.0061	-0.0425	0.1388	0.0872
	(0.0506)	(0.0581)	(0.0836)	(0.0956)
Employee or worker	0.2339***	0.2778***	0.2111***	0.2646***
	(0.0538)	(0.0602)	(0.0756)	(0.0871)
Self-employed	0.1232**	0.1410***	0.0609	0.0739
	(0.0498)	(0.0527)	(0.0697)	(0.0779)
Entrepreneur	0.1329	0.1462	-0.0099	-0.0400
	(0.0889)	(0.0931)	(0.0943)	(0.1059)
Informal work	-0.0287	-0.0067	0.0021	0.0456
	(0.0534)	(0.0568)	(0.0643)	(0.0739)
Agricultural household	-0.3661***	-0.3544***		
	(0.0621)	(0.0651)		
No labour income	0.0896	-0.0222	0.1154	-0.0317
	(0.0502)	(0.0765)	(0.0691)	(0.0976)
Household size	0.0344*	0.0251	-0.0044	-0.0145
	(0.0151)	(0.0164)	(0.0190)	(0.0216)
Number of children	-0.0693***	-0.0615***	-0.0026	0.0078
	(0.0208)	(0.0221)	(0.0253)	(0.0285)
Number of elderly	-0.0847	-0.1152**	-0.0456	-0.0799
	(0.0432)	(0.0476)	(0.0513)	(0.0589)
Credit constrained	-0.0620	-0.0590	-0.0571	-0.0557
	(0.0457)	(0.0477)	(0.0590)	(0.0659)
Savings available	0.1076	0.0937	-0.2813	-0.2828
	(0.0928)	(0.0971)	(0.2144)	(0.2393)
Wealth score 1998	-0.2120***	-0.2451***	-0.1816***	-0.2145***
	(0.0125)	(0.0210)	(0.0208)	(0.0268)
Urban	0.4279***	0.4396***	0.4916***	0.4319***
	(0.0613)	(0.0643)	(0.0873)	(0.1004)
Constant	-0.9167***	-0.9917***	-0.5047	-0.6448
	(0.2284)	(0.2414)	(0.4529)	(0.5088)
N	2635	2635	958	958

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Appendix B

Figure B.4.1: Remittance rates at the department level (1993 and 2001)

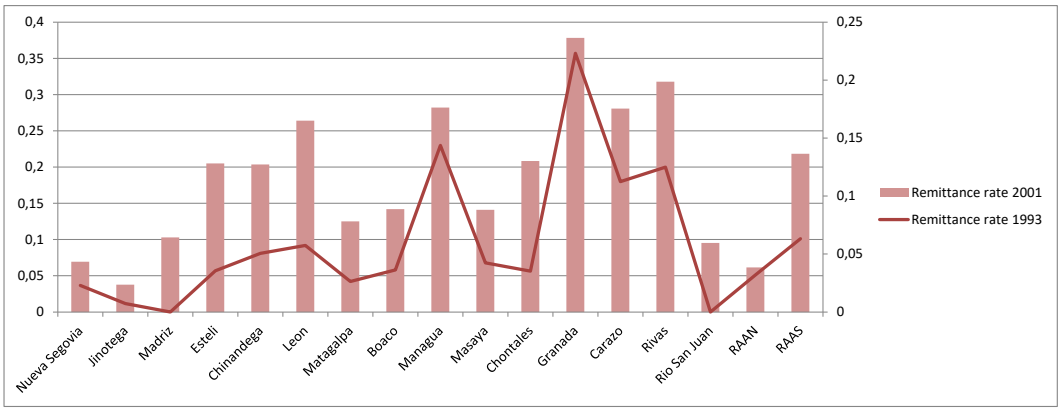


Figure B.4.2: Migration rates (1971) and remittance rates (2001) at the department level

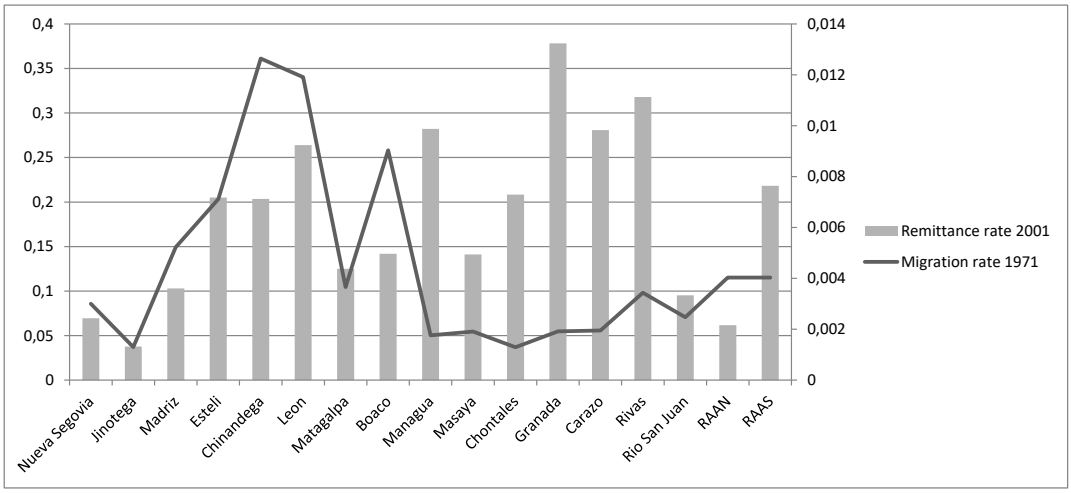


Table B.4.1: NLSMS - First stage equations

	Consumption growth		Wealth score differences	
	Full sample	Agricultural sample	Full sample	Agricultural sample
Rainfalls (daily)	-0.0004***	-0.0004**	-0.0005***	-0.0004**
	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Access to aid	0.0421***	0.0734***		
	(0.0163)	(0.0219)		
Access to aid (home)			-0.0153	0.0085
			(0.0195)	(0.0229)
Access to aid (infrastructure)			0.0530***	0.0616** *
			(0.0146)	(0.0199)
Baseline characteristics				
Education - reference category: no education				
Primary	-0.0031	-0.0250	-0.0058	-0.0269
	(0.0176)	(0.0206)	(0.0175)	(0.0207)
Secondary	0.0525**	-0.0375	0.0433	-0.0351
	(0.0258)	(0.0465)	(0.0260)	(0.0468)
Higher	0.0841**	-0.0854	0.0500	-0.0717
	(0.0372)	(0.1054)	(0.0378)	(0.1045)
Female household head	0.0562***	0.0518	0.0570***	0.0459
	(0.0171)	(0.0292)	(0.0170)	(0.0292)
Employee or worker	-0.0417**	-0.0397	-0.0465**	-0.0410
	(0.0182)	(0.0263)	(0.0181)	(0.0264)
Self-employed	-0.0093	-0.0073	-0.0117	-0.0018
	(0.0169)	(0.0244)	(0.0168)	(0.0244)
Entrepreneur	0.0164	0.0299	0.0004	0.0271
	(0.0296)	(0.0326)	(0.0300)	(0.0329)
Informal work	-0.0264	-0.0292	-0.0217	-0.0308
	(0.0180)	(0.0223)	(0.0180)	(0.0224)
Agricultural household	-0.0131		-0.0047	
	(0.0211)		(0.0209)	
No labour income	0.1205***	0.0985***	0.1139***	0.0938***
	(0.0169)	(0.0241)	(0.0169)	(0.0244)
Household size	0.0118**	0.0081	0.0098	0.0070
	(0.0050)	(0.0066)	(0.0051)	(0.0067)
Number of children	-0.0134	-0.0096	-0.0091	-0.0071
	(0.0069)	(0.0087)	(0.0070)	(0.0088)
Number of elderly	0.0284	0.0128	0.0302**	0.0178
	(0.0146)	(0.0178)	(0.0145)	(0.0179)
Credit constrained	-0.0021	0.0025	0.0044	0.0050
	(0.0154)	(0.0206)	(0.0154)	(0.0206)
Savings available	0.0119	0.0365	0.0198	0.0106
	(0.0309)	(0.0714)	(0.0312)	(0.0748)
Wealth score - reference category 1st quartile				
2nd quartile	0.0396	0.0291		
	(0.0222)	(0.0237)		
3rd quartile	0.0802***	0.0245		
	(0.0275)	(0.0373)		
4th quartile	0.2093***	0.2063***		
	(0.0326)	(0.0593)		
Urban	0.0008	0.0488	-0.0167	0.0425
	(0.0208)	(0.0298)	(0.0207)	(0.0305)
Remittance rate 1993 (department)	0.9681***	0.9650***	0.9061***	0.8993***
	(0.1456)	(0.2180)	(0.1460)	(0.2203)
Rate of residents abroad (departmnet)	9.0852***	10.8412***	9.2566***	11.5097***
	(2.1699)	(3.1427)	(2.1629)	(3.1334)
Wealth score 1998			0.0333***	0.0207***
			(0.0042)	(0.0073)
Constant	-0.0826	-0.1404	0.0114	0.0005
	(0.0782)	(0.1543)	(0.0776)	(0.1591)
N	2651	971	2635	958
r2	0.1419	0.1101	0.1485	0.1085
F-stat	24.5198	24.8714	22.1539	22.3178
	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Table B.4.2: NSLMS - Consumption growth equations (Equivalence scales)

	Consumption per adult equivalent -Haughton and Khandker (2009)							
	Full sample				Agricultural sample			
	OLS	IV	Probit	IV probit	OLS	IV	Probit	IV probit
Remittance household	0.1020**	1.0324***	0.2095***	0.3923**	0.1423	1.7169***	0.2947**	0.6641**
	(0.0430)	(0.3429)	(0.0664)	(0.1952)	(0.0811)	(0.5499)	(0.1385)	(0.3203)
	Consumption per adult equivalent - OECD equivalence scale							
	Full sample				Agricultural sample			
	OLS	IV	Probit	IV probit	OLS	IV	Probit	IV probit
Remittance household	0.1159***	1.1100***	0.2366***	0.5248***	0.1575	1.8460***	0.3552**	0.7243**
	(0.0437)	(0.3510)	(0.0668)	(0.1989)	(0.0825)	(0.5683)	(0.1395)	(0.3212)
N	2638	2638	2638	2638	966	966	966	966

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Table B.4.3: NLSMS - Consumption growth equations with migration variable

	Full sample		Agricultural sample	
	OLS	IV	OLS	IV
	Consumption growth			
Remittance household	0.1246***	1.0193***	0.1693***	1.6848***
	(0.0447)	(0.3434)	(0.0823)	(0.5440)
Migration North America	-0.1503**	-0.6022***	-0.3973**	-1.1084***
	(0.0819)	(0.1928)	(0.2164)	(0.3540)
	Difference in wealth score index			
Remittance household	0.3036***	1.2010***	0.3999***	1.8291***
	(0.0615)	(0.4621)	(0.0956)	(0.5973)
Migration North America	-0.0139	-0.4654**	0.2038	-0.4271
	(0.1127)	(0.2582)	(0.2588)	(0.3852)
N	2635	2635	958	958

Standard errors in parentheses
*** p<0.01, ** p<0.5, * p<0.1

Conclusions

This thesis fits into the academic debate on human mobility and development nexus, analysing the implications of transnational migration on the well-being of households left behind. In order to contribute to fill some existing gaps in this field of studies, two major issues are investigated. Firstly, the effects of migration on human capital investment decisions of relatives left behind are considered, with a particular focus on the health dimension. Secondly, the role of migration as a household level risk management strategy in response to natural shock exposure is investigated. The research questions are designed referring to the theoretical perspective of the New Economics of Labour Migration (NELM). This approach considers the household as the central unit of analysis, and models migration as a strategy to differentiate risk, minimize income volatility, and possibly improve household living standards (Stark and Bloom, 1985). Adopting such household level perspective reveals the interactions going on between migration and the development processes of sending communities. In order to explore the mentioned topics, three distinct research questions have been designed and developed in as many empirical chapters.

Chapter 2 concerns the impact of receiving remittances on healthcare consumption decisions of Peruvian households. Modelling household consumption behaviour through a system of demand equations, I observe that receiving transfers from migrants abroad reshapes household demand by shifting household preferences in favour of higher human and real capital investments (healthcare and housing). The work is of particular interest as it overcomes some methodological limitations of the previous studies related to the functional form adopted to model consumption behaviour. Moreover, the analysis shows that the observed propensity to allocate

additional resources to healthcare is not directly related to the occurrence of a negative health shock. This element suggests that the healthcare consumption behaviour of remittance receiving households (RRHs) reflects a deliberate choice of investing in human capital through the acquisition of preventive medical care, rather than a response to health shocks.

Secondly, the impact of climatic shocks on out-migration episodes is investigated in Chapter 3, examining the case of Hurricane Mitch in Nicaragua in October 1998. This work contributes to a burgeoning literature reviewing how weather shocks affect human mobility. Indeed, as climatic systems have been changing worldwide, increasing both the frequency and the intensity of extreme meteorological events, natural disasters are nowadays considered a relevant risk factor in developing countries. Migration has been commonly identified as a risk-diversification strategy to cope with spatially covariant shocks. This study provides some further insights about the relationship between environmental risk vulnerability and mobility decisions, focusing on the interactions between shock exposure and canonical determinants of migration. Specifically, the population groups for which the occurrence of a natural shock may interfere on migration decisions during the two years and half after the disaster are identified. The findings obtained show that the severity of the shock, measured in terms of average rainfall levels during the Hurricane, does not act as push factor as a whole. Only individuals belonging to agricultural households experiencing high exposure to rainfalls increase their likelihood to move abroad in the aftermath of the Hurricane. The positive effect of the shock is higher for individuals who do not have relatives employed as wage labourers, suggesting that those households who cannot rely on alternative guaranteed sources of income are more likely to engage in migration. However, the decision to move is also linked to household assets. Indeed, the impact of shock exposure on mobility decisions increases along with land endowments.

The effectiveness of remittances as an insurance tool to recover from the damages provoked by natural shocks is studied in Chapter 4. In particular, I test whether Nicaraguan households receiving transfers from abroad recoup more easily than their counterparts from the drawbacks caused by the Hurricane Mitch. In order to have some details about how remittances contribute to household recovery, two major dimensions are investigated: growth in per capita consumption and difference in wealth scores between the two surveys. In this way, we can establish if

migrant transfers constitute a source of liquidity sustaining household consumption and play a role in preserving and restoring household asset endowments. The results obtained highlight a positive impact of remittances on both long run consumption standards and household assets preservation, reducing the risk of being trapped into poverty. This seems to be valid especially for agricultural households, who are the most deeply affected by the consequences of a natural disaster.

Summarizing, the findings obtained in the three empirical chapters identify some channels through which international human mobility contributes to the development of those left behind. Some relevant details about the link between migration and household well-being are depicted, focusing on the potentialities offered by migration and remittances to both improving human capital endowments and ensuring households against income volatility. The elements emerged highlight the role of migrant transfers in enhancing health investments of members left behind, with positive implications for their long-term health status. Furthermore, migration, which turns out to be a preferred coping strategy for agricultural households experiencing severe shock exposure, constitutes an effective tool to fund household recovery from natural disaster. In particular, remittances are helpful in preventing household assets depletion after the shock, with important consequences on long-term development patterns.

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