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Working paper

The Tail End of Migration: Assessing the Climate Resilience of Migrant Households in Ethiopia

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Abstract

Climate change is associated with increasing frequencies and intensities of extreme weather events. These can, directly and indirectly, shape human (im)mobility. While most research on migration in the context of climate change focuses on climate as a migration driver in origin areas, there is a gap in knowledge on the role of migration for climate resilience in the destination areas. Consequently, this paper aims to study differences in resilience (resistance and recovery) to climatic shocks between migrant and non-migrant households at migration destination areas in Ethiopia, a country that is highly exposed and vulnerable to climate change. We use longitudinal data from the Living Standards Measurement Study (LSMS) conducted by the World Bank to construct a comprehensive Well-Being Index, which is used to analyze the impacts of climatic shocks and identify households that are more or less able to resist and recover from shocks. We use fixed effect panel regression approaches to model the impacts of climatic shocks on well-being over time for migrant and non-migrant households. Further explorative mediation analyses yield insights into mechanisms explaining differences between households. We find that migrant households have an overall lower climate resistance as they experience double as high well-being impacts when exposed to climatic shocks compared to non-migrant households. Climatic shocks significantly reduce the food security of all affected households and, in addition, negatively impact access to basic infrastructures and health for migrant households. Mediation analyses suggest that these differential climatic impacts are mainly driven by characteristics of migrant-origin regions, including poverty. Migrant households originating from less prosperous regions still face disadvantages even if they now reside in more prosperous regions. This contrasts the experience of non-migrant households whose resilience benefits from increased prosperity in their region of residence. While migrant households show a lower resistance to climate shocks, they recover faster from climatic shocks, which can be associated with diversified livelihoods and remittances that take time to unfold. This research is highly relevant to policy as it improves the understanding of underlying factors shaping differential vulnerability to climate change impacts and supports targeted interventions to increase the resilience of affected households.

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Introduction

Climate change, which is associated with increasing frequencies and intensities of extreme weather events, affects both environmental and human systems in complex ways. One example is the direct and indirect effect of climate on human (im)mobility (Black et al. 2011; Hoffmann et al. 2020). Climatic and environmental shocks can affect peoples' capability and aspiration to migrate or stay (Haas 2021). Typically, climate-related migration tends to be internal within the borders of countries and not international for various reasons such as capability constraints, social and family ties, lack of information or networks abroad, or the temporal nature of migration and/or displacement as a result of rapid-onset disasters (Rigaud et al. 2018). The capability to migrate or stay and the resulting impacts on well-being are also influenced by a household's resilience, which we define as the ability to withstand and recover from shocks without experiencing major well-being declines. Resistance refers to the immediate ability to withstand shocks, while recovery denotes the capacity to swiftly return to the pre-shock state without significant well-being losses (Fingleton et al. 2012).

Most research in the field of migration emphasizes climate as a driver of migration in origin areas, aiming to understand when households are pushed into mobility (Horton et al. 2021; McLeman 2018). However, there is a knowledge gap concerning the role of migration for climate resilience in the migrant destinations — the tail ends of migration (Kuschminder et al. 2018). Whether or not a migrant household is resilient to a climatic shock is influenced by the complex interplay of characteristics at the origin, destination, and household level. At the origin and destination level, economic (e.g., employment opportunities), social (e.g., cultural norms, integration), political (e.g., political stability, immigration laws, and policies), and environmental conditions (e.g., exposure and vulnerability to climatic shocks, degradation) influence the resilience of migrants (Obokata et al. 2014). All these factors can then directly or indirectly affect characteristics at the household level. Household composition (e.g., age or gender) and different forms of capital, such as financial (e.g., income, savings, insurance), human (e.g., health, education, previous migration experience), social (e.g., networks, cultural norms, and attitudes), and material capital (e.g., land, natural resources) are impacting migration outcomes (McKenzie and Sasin 2007).

Drawing from the few existing studies on this subject, some scholars argue that due to unfavorable conditions at the origin, household, or destination level, migrant households have a lower resilience compared to non-migrant households (Sakdapolrak et al. 2023). In contrast, other scholars argue for increased resilience due to more favorable characteristics (Link et al. 2021). On the one hand, migrants can have a lower resilience due to encountering discrimination, social isolation, and systemic inequalities at destinations, which can limit integration and access to vital resources (Warner and Afifi 2014). These adversities can erode their coping mechanisms, exacerbate vulnerabilities, and ultimately reduce their resilience to shocks. On the other hand, for example, proactive migration linked with agency can often lead to positive outcomes (Vinke et al. 2020). In these cases, migration can provide opportunities to gain knowledge and skills to improve resilience (Scheffran et al. 2012). Understanding the drivers behind differential impacts of climatic shocks is highly policy-relevant, as it can help ensure the well-being and resilience of migrants, informing infrastructure development, social programs, and interventions targeting household livelihoods, particularly migrant households.

This paper focuses on Ethiopia as a case study. The country is not only highly vulnerable to changes in climate but is also experiencing high exposure to climatic shocks such as droughts, heat waves, and floods. Ethiopia's initial high climate vulnerability is exacerbated by the country's elevated level of poverty, political, and social

unrest as well as its dependence on climate-vulnerable sectors such as agriculture, forestry, tourism, and water (Abeje et al. 2019). At the same time, Ethiopia has a strong history of internal migration, often driven by climatic shocks, making it a pertinent location to study climate resilience (Hermans-Neumann et al. 2017). Given our research's significant policy implications for Ethiopia and the Ethiopian government's proactivity in implementing policies related to climate change adaptation and migration, Ethiopia emerges as a suitable case study. This is further supported by the government taking a balanced view of migration in its National Adaptation Plan (Mombauer et al. 2023).

Based on our assessment, no study in Ethiopia compares the climate resilience of non-migrant and migrant households at migration destinations. Some studies cover the impacts of climate and the environment on migration or pastoralism (Gray and Mueller 2012; Hermans and Garbe 2019) or on the resilience of migrants or pastoralists (Mekuyie et al. 2018; Abeje et al. 2019). There are two main strains of research when it comes to the impacts of climate and environment on migration: i) environmental determinism which considers households as passive victims of climate-related problems (Parkyn et al. 1921) and ii) an approach that considers households as active and adaptive social agents (Scheffran et al. 2012). Some papers highlight that migration can be an effective adaptation strategy; however, only for certain groups and under specific conditions, for example, for households with access to financial resources (Etana et al. 2022). In other cases, migration tends to be viewed as a survival rather than a resilience-building strategy (Baker 2001). Furthermore, most research on this topic in Ethiopia relies on single cross-sectional case studies, mainly covering rural areas, not capturing potential temporal changes.

We aim to investigate the identified knowledge gaps by examining the resilience to climatic shock of households at migration destinations in Ethiopia with and without a migration background. We specifically focus on aspects of resistance and recovery, and the underlying reasons behind the identified differences. This will be accomplished by utilizing longitudinal data to evaluate the effects of climatic shocks on well-being. We use the World Bank's Living Standards Measurement Study (LSMS) to calculate a Well-Being Index, which serves as a tool for measuring the resilience of Ethiopian households to climatic shocks (droughts, floods, heavy rainfalls, and landslides). We employ fixed-effect panel regressions to examine the ability to recover and resist shocks. Moreover, we conduct exploratory mediation analyses to understand the drivers of household disparities. This study reveals that climatic shocks have substantial negative impacts on the well-being of affected households.

Substantial differences between non-migrant and migrant households exist. While migrant households exhibit significantly lower resistance to climatic shocks, they recover faster when exposed to such events. Additionally, they maintain a higher overall well-being and encounter fewer shocks. Climatic shocks significantly reduce the food security dimension of non-migrant and migrant households, whereas for migrants also the infrastructure and housing dimensions are negatively affected. Resilience differences can be attributed to characteristics of migrant-origin regions, such as poverty levels, rather than individual household characteristics. The effect of originating from a less prosperous region persists even if migrant households now reside in a relatively more prosperous region, which starkly contrasts the experience of non-migrant households. The faster recovery of migrant households after climatic shocks might be linked to more diversified livelihoods and remittances that take time to unfold. Examining both resistance and recovery is crucial for a comprehensive understanding of resilience. Focusing solely on resistance would have misleadingly characterized migrant households as less resilient without considering their ability to recover faster. Hence, our study offers policy-relevant evidence on what is driving the differential impacts of climatic shocks on household's well-being, which can help inform targeted interventions to increase the resilience of the most vulnerable.

Research Design

Data

The data used in this study comes from the longitudinal Living Standards Measurement Study (LSMS) conducted by the World Bank (Central Statistical Agency of Ethiopia 2014, 2017; Central Statistics Agency of Ethiopia 2015). The LSMS has been conducted in over 40 countries. It is a multi-purpose survey that collects data on many household and individual dimensions of well-being. While the specific modules in the survey can vary depending on the country and the year of the survey, the LSMS typically collects data on a wide range of topics, including but not limited to demographic characteristics, housing and infrastructure, education, health, employment and income, agriculture, expenditure and consumption, migration, and the environment.

We have access to Ethiopia's LSMS for three different Waves (2011-2012, 2013-2014, 2015-2016). From the LSMS data, we retrieved information on the origin and destination of the household head or his/her spouse to define whether a household is a migrant household or not. If the head's or the spouse's origin region differs from their current region of residence, the household is defined as a migrant household. Only households present in at least two Waves were included in this study to allow for a panel analysis and account for changes in the sample (e.g., households splitting up, merging, leaving, and joining the survey). We tested different definitions of what constitutes a migrant household for robustness reasons (Figure A6), all of which are leading to similar results. Considering the prerequisite of a household being present in at least two out of three Waves, the data includes 4929 households, with 292 households (6%) identified as "migrant" households.

To check for robustness of our findings, we tested four definitions of what constitutes a migrant household: i) *dynamic,* which allowed households to switch their migration status over the years allowing migrant individuals to leave or join the household; ii) *static,* where households were not allowed to change their migration status from Wave 1 to Wave 3, iii) *W1* where the migration status of Wave 1 was applied to all the other Waves, and iv) *2 out of 3* where a migrant household has to be defined as such for at least two out of three Waves. To allow for the largest sample size and due to no large differences between the regression results (Figure A6), we decided to apply the *2 out of 3* approach. Furthermore, we only use the head or the spouse of the household as references since these are the household members who tend to have the decision-making power.

Furthermore, we used the dedicated shock experience section available in the Ethiopian LSMS survey to assess whether a household was exposed to a climatic shock. These shock experiences are self-reported from the household heads or spouses and are therefore subjective. This section collects information on various shocks the household was exposed to in the past 12 months. We grouped these shock types into six shock categories: climatic (droughts, floods, heavy rains, landslides), agricultural (livestock loss, crop damage), health (death of a household member, health issues), conflict (violence, local unrest), price (price rise, price fall, price-input increase) and other (fire, job loss, land loss, project displacement, other). The "other" shock category was not considered in the analysis due to the wide range of shock types in this category, which did not result in any significant results. Due to the high vulnerability and exposure of Ethiopian households to climate change, we are mainly interested in the climatic shock and most analyses are conducted on the effects of these shocks, but other shocks are also considered.

Well-Being Index

A Well-Being Index (WBI) provides a comprehensive measure that captures multiple dimensions of a household's quality of life, going beyond mere economic or material indicators (Kusumastuti et al. 2014). Well-being indices often capture multiple dimensions of human life, including health, economic conditions, education, social relationships, and environment. Some of these indices can be used as proxies for resilience because they provide a comprehensive view of how well households are performing in various areas that are crucial for coping with and recovering from shocks or adversities. By evaluating how households maintain or improve their well-being in the face of shocks, we gain insights into their resilience and the effectiveness of adaptation strategies. The Food and Agriculture Organization has led efforts in quantifying resilience, specifically concerning food shocks, developing the resilience index and measurement analysis (RIMA). The RIMA utilizes factor analyses and structural equation models to generate indices (Alinovi et al. 2010), like the resilience capacity index (RCI) and resilience structure matrix (RSM) (D'Errico et al. 2015). They frame households' livelihood options based on foundational pillars: access to social safety nets such as food assistance and social security, essential services like water, healthcare, and electricity, and tangible assets like land, livestock, and housing. A household's resilience is characterized by the consistency and availability of these pillars over time, intertwined with the stability of each pillar. Other well-being/resilience indices are the socio-ecological index for flood events (Kotzee and Reyers 2016), the climate disaster resilience index (Joerin et al. 2014), or the integrated resilience index (Abdrabo and Hassaan 2015). Based on the LSMS data and considering strengths and weakness from previous well-being and resilience indices, we construct a multi-dimensional Well-Being Index (WBI) consisting of seven equally weighted dimensions: education, health, food security, assets & expenditures, economic livelihoods, infrastructure, and housing. Each dimension is based on two factors (Table 1). All of these variables of the WBI were dichotomized to simplify interpretations and allow for comparability across different dimensions.

Table 1: Well-Being Index dimensions, variables, and description.

Dimension	Variables	Description
Education	School absence	Whether a household has at least one child who was not absent from school throughout the survey's academic year.
	School attendance	Whether a household has at least one child who is enrolled in school throughout the survey's academic year.
Health	Health issues	Whether a household has individuals with health issues
	Health severity	Exceeding the mean of days that individuals were absent from work due to health issues.
Food security	Worry about food security	Whether a household was worried about having enough food to feed the family.
	Experienced food insecurity	Whether a household experienced food insecurity.
Assets & expenditures	Weighted Asset Index	Whether principal component analysis coefficients on ownership of the following items (bicycle, radio, fixed-line telephone, mobile telephone, motorcycle, private car, refrigerator, satellite dish, television) is larger than 3rd quantile.

	Food expenditure ratio	Food expenditure ratio from LSMS exceeds Ethiopian ratio from 2017 (U.S. Department of Agriculture 2023).
Economic livelihood	Employment status	Whether at least one member of the household is employed.
	Poverty	Whether a household is below the poverty line using the square root scale and poverty line from 2015 (World Bank).
Infrastructure	Electricity access	Whether a household experienced power outages.
	Toilet access	Whether a household has toilet or pit latrine access.
Housing	Housing ownership	Whether a household owns a building.
	Roof materials	Whether a house is made of "stable" roof material.

Some of the variables included in our WBI reflect more subjective well-being aspects, whereas others capture more objective aspects. The *education* dimension comprises two variables, which focus on whether children of the household attend school in general and whether they have recently been absent from school. The *health* dimension is based on two subjective factors, namely whether household members are experiencing health issues and the severity of illness, which is measured by using a threshold (1st quantile) of days they were absent from work due to the experienced health issues. Also, the *food security* dimension is subjective since it is based on whether a worry about food security exists and whether the household experienced food security during the last year. The *assets and expenditure* dimension is based on a self-constructed Weighted Assets Index and the food expenditure ratio, which refers to the proportion of total expenditure that is allocated to food. The Weighted Asset Index assesses summarizes the ownership of the following items: bicycle, radio, fixed-line telephone, mobile telephone, motorcycle, private car, refrigerator, satellite dish, and television. The monthly expenditures for the food expenditure ratio were added and then divided by the household size to calculate whether this percentage exceeds Ethiopia's average food expenditure ratio as calculated by the U.S. Department of Agriculture (2023). The *economic livelihood* dimension covers information on the employment status as well as an assessment of poverty by calculating the total income of the household (income from job and additional income). For this calculation, we apply the square root scale (OECD n.d.) and use the poverty line of Ethiopian households calculated by the World Bank in 2015 with 6132 Birr per year per person (The World Bank 2023). The *infrastructure* dimension covers information on power outages and access to a toilet or pit latrine. The final dimension of *housing* accounts for house ownership and whether the accommodation is made of stable material such as concrete, brick, iron, or a mix of wood and mud.

Analysis

The analysis assesses Ethiopian households' resistance to and recovery from shocks, especially climatic shocks. The household's resistance to shocks was examined by evaluating the impacts of shocks on well-being over time. We apply fixed effects (individual and time) panel regressions. The regression models are run on different subsets (all households, non-migrant households, and migrant households), allowing us to compare each subsets' resilience. The baseline model for all shocks takes the following form, whereas the climatic shock model is reduced to just climatic shocks. All results depicted below refer to the estimated β coefficients of the above regression equations. The regression equation is found below:

$$WBI_{it} = \beta_0 + \beta_1 \times clim_{it} + \beta_2 \times price_{it} + \beta_3 \times agri_{it} + \beta_4 \times conflict_{it} + \beta_5 + \beta_6 \times health_{it} + \alpha_i + \lambda_t + \epsilon_{it}$$

Where:

- WBI_{it} is the dependent variable for household *i* at time *t*.
- $clim_{it}$, $price_{it}$, $agri_{it}$, $conflict_{it}$, and $health_{it}$ are the independent variables.
- β_0 is the intercept.
- β_1, β_2…β_6 are the coefficients of the respective independent variables.
- α_i is the household fixed effect for household *i*.
- λ_t is the Wave (time) fixed effect for time *t*.
- ϵ_{it} is the error term for household *i* at time *t*.

In additional analyses, we zoom into each WBI dimension to assess how each dimension is impacted by climatic shocks. We run separate regression analyses for each dimension where the dependent variable for household *i* at time *t* is exchanged with the respective value of the Well-Being Index of each of the seven dimensions.

To yield insights into the mechanisms explaining resilience differences between non-migrant and migrant households, we conducted explorative mediation analyses covering characteristics at the household level (religion, household size, age, sex, occupation, and educational attainment) and origin and destination (level of urbanization, and Gross Domestic Product (GDP)). We run individual regression analysis for each variable where we introduce the destination, origin, or household variable as an interaction term (binary). These regressions are then rerun for the three different subsets (all, non-migrant, and migrant households).

$$WBI_{it} = \beta_0 + \beta_1 \times clim_{it} + \beta_2 \times variable_{it} + \beta_3 \times clim_{it} \times variable_{it} + \alpha_i + \lambda_t + \epsilon_{it}$$

Where (see above):

- variable is a destination, origin, or household variable.
- $clim_{it} \times variable_{it}$ is the interaction term between climatic shock and the variable.

In regards to recovery, we use fixed effects panel regression (individual) with a lag to determine how a shock experience in either the first or second Wave affects the relative well-being change of affected households in the following Waves. This approach is applied to all shock categories using subsets of the groups of interest (all households, non-migrant, and migrant households).

$$\Delta WBI\_rel = \beta_0 + \beta_1 \times lag\_clim + \beta_2 \times mig + \beta_3 \times (lag\_clim \times mig) + \beta_4 \times lag\_agri + \beta_5 \times (lag\_agri \times mig) + \beta_6 \times lag\_health + \beta_7 \times (lag\_health \times mig) + \beta_8 \times lag\_price + \beta_9 \times (lag\_price \times mig) + \beta_{10} \times lag\_conflict + \beta_{11} \times (lag\_conflict \times mig) + \alpha_{HH\_ID} + \epsilon$$

Where (see above):

- ΔWBI_rel is the relative well-being change from the Wave before to the Wave under consideration (second or third Wave).
- lag_clim, lag_agri, lag_health, lag_price, lag_conflict represent the occurrence of various shocks stated in the Wave before (lagged values).
- mig is the dummy variable for migrant status.
- α_{HH_ID} represents the household fixed effects.

Results and Discussion

Descriptive Overview

In the following, background information on the two sub-groups, non-migrant and migrant households, is provided. When considering all migrant households, even those that are only present in one out of three Waves, the majority of migrant households are internal (96%), meaning that they have migrated within the country of Ethiopia (Figure 1a). In Wave 3, Addis Ababa received the largest number of migrants (n= 164), whereas Amhara (n= 216), followed by Oromia (n= 180), experienced the largest number of outmigration. The largest share of migrant household respondents resides in Benishangul Gumuz, Gambela, and Afar, whereas the largest share of non-migrant respondents resides in SNNPR, Amhara, and Oromia (Figure 1b).

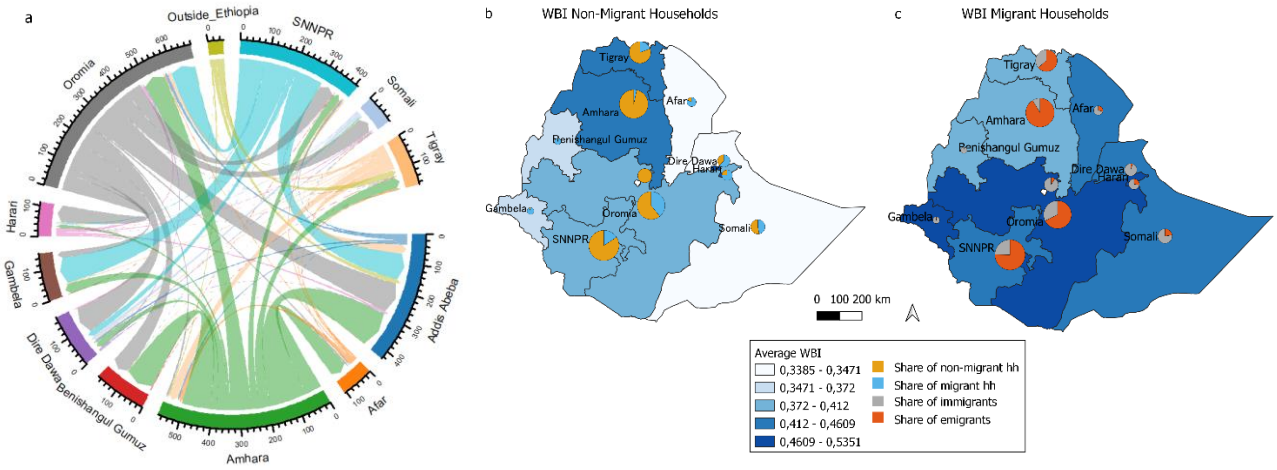

Figure 1: a) Migration of migrant households in Wave 3, b) WBI for non-migrant households and a pie chart of non-migrant (orange) and migrant households (blue) per region, and c) WBI for migrant households and share of emigrants (red) and immigrants (grey) per region.

When comparing the general demographics of migrant and non-migrant households, no major differences can be detected (Table 2). It needs to be highlighted that the households covered in the LSMS are mainly residing in rural areas and own their own farm or livestock. Most respondents reside in the regions of Tigray, Amhara, Oromia, and SNNPR, where we also see the expected number of migrant households, which only make up a small proportion of the households in this region (Figure 1b). However, for other regions with overall fewer respondents, we see a higher share of migrant households (Somali, Gambela, and Oromia).

Table 2: General demographics of non-migrant and migrant households.

	Non-Migrant Household	**Migrant Households**
Number of households	4929	292
Average household size	5.5	5.1
Rural population (%)	0.88	0.81
Main religion	Muslim	Muslim
Average number of children	2.03	1.96
Women in household (%)	0.52	0.45

Average WBI	0.34	0.36
Own farm or livestock (%)	93	89

Over the survey duration, the well-being of Ethiopian households, as reflected in the WBI, increased. Furthermore, migrant households in Ethiopia tend to have a higher well-being than non-migrant households (Figure 1b, 1c). We see strong spatial differences among and between the two sub-groups. For non-migrant households, it is the eastern regions, Somali and Afar, where households have a lower well-being. In contrast, for migrant households, it is the north-western regions such as Tigray, Amhara, and Benishangul Gumuz where households with lower well-being live. When zooming into the WBI, we determine that migrant households tend to outperform migrant households in the education, food security, and housing dimensions over all three Waves (Figure A7a). Non-migrant households outperform migrant households in all three Waves only in the health dimension.

At the same time, migrant households experience fewer shocks compared to non-migrant households (Figure A7b). This applies not only to shocks in general but also to the majority of shock categories, including climatic shocks. We also detect that the percentage of Ethiopian households that experience shocks tends to increase over the course of the survey. In Wave 3, more than half of the surveyed households (69%) experienced some type of shock. When examining the breakdown of shock categories for households, we find that price shocks take up the largest share for both non-migrant and migrant households, followed by climatic and health shocks (Figure A7c).

Migrant households have a lower resistance to climatic shocks

Exposure to climatic shocks negatively affects well-being but with considerable differences across households (Figure 2). The negative impacts are particularly strong for migrant compared to non-migrant households, with well-being declines of up to 15%. Furthermore, migrant households also have a lower resistance to agricultural shocks since they experience well-being declines of up to 9% compared to only up to 3% for non-migrant households. This suggests that strong differences in the resilience of these two sub-groups exist.

This result is particularly interesting, especially when considering that migrant households experience fewer climatic shocks and have an overall higher well-being than non-migrant households. Nevertheless, they suffer more than twice as high well-being impacts when exposed to climatic shocks. It is possible that migrant households may not be as well-adapted to micro-climates of their new environment or the local agricultural practices, making them more vulnerable to climatic and agricultural shocks. At the same time, they might also have less secure access to land or may not possess the same level of experience or knowledge about the new area's agricultural and climatic challenges compared to non-migrant households (Kosec et al. 2018). A study in the Cayman Islands identified migrant households as the most vulnerable sub-group to tropical cyclones as they tend to be part of the demographic groups most unlikely to prepare for cyclones, live in high-exposure locations, and interact primarily with other expatriates with no previous experience of cyclone impacts (Tompkins et al. 2009).

On the other hand, we find that migrant households can better cope with health and price-related shocks because here, only non-migrant households experience significant negative well-being impacts (up to 6% for health shocks and 3% for price shocks). Migrant households, being aware of the challenges and uncertainties

in new environments, might adopt more conservative health practices, emphasizing preventive care and early treatment, which might lead to a higher resistance to health shocks (Schwerdtle et al. 2017). Simultaneously, migrant households might be exposed to diverse pathogens in their place of origin, which could give migrants a broader immune defense. Additionally, there is an empirically observed mortality advantage of migrants from certain regions of origin relative to the destination region, known as the healthy migrant effect (Razum et al. 2000).

In regard to price shocks, migrant households, especially those that arrived recently at their new destination, might be more accustomed to adjusting their consumption based on fluctuating prices, having experienced this in their places of origin or during the migration process. Additionally, they might have a variety of income sources, including remittances from family members in other locations, which could insulate them from local economic downturns (Cohen 2011). Moreover, social networks, informal safety nets, and previous experiences and perceptions can shape the resistance of migrant households. While these networks can be crucial for coping with health and price shocks, they might not be as effective against widespread climatic or agricultural shocks that affect the whole community. Migrants might prioritize certain risks over others based on their past experiences. For example, if they have previously encountered severe health or price shocks, they might be more prepared for such eventualities in their new location.

For conflict shocks, we do not find any significant relationships with well-being. This could be associated with the small number of households that experience conflict shocks (Figure 2). The small sample size also explains the higher standard errors for conflict shocks and the results for migrant households in general compared to non-migrant households.

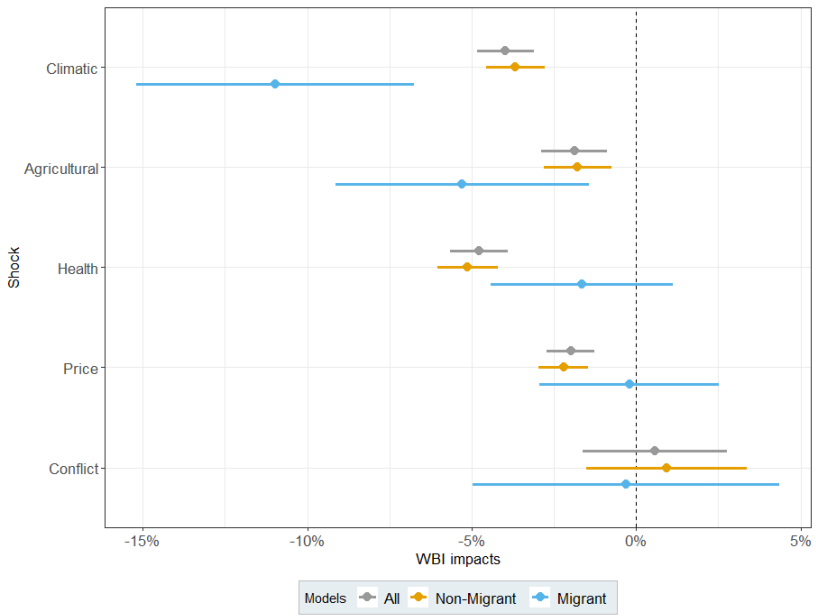

Figure 2: Impact of shock categories (climatic, agricultural, health, price, and conflict) on all, migrant, and non-migrant households Well-Being Index (WBI, 95% confidence interval).

Climatic shocks affect multiple well-being dimensions of migrant households

For all Ethiopian households, climatic shocks lead to a significant reduction in food security (Figure 3). The food security dimension includes data on worry about food insecurity and the subjective experience of food insecurity. The impact of climatic shocks on the food security of households is substantial, with up to 40% reductions for migrant households and 28% for non-migrant households. Climatic shocks can directly and indirectly impact a country's food production and supply, especially in Ethiopia, which is highly dependent on subsistence agriculture (Sisha 2020). Climatic shocks can disrupt agricultural production by reducing crop yields and livestock productivity, reducing soil quality and fertility, increasing the risk for pest and disease outbreaks, destroying stored produce, disrupting supply chains, and decreasing agricultural inputs. All in all, this compromises food availability and elevates food insecurity across affected households in the short and long run.

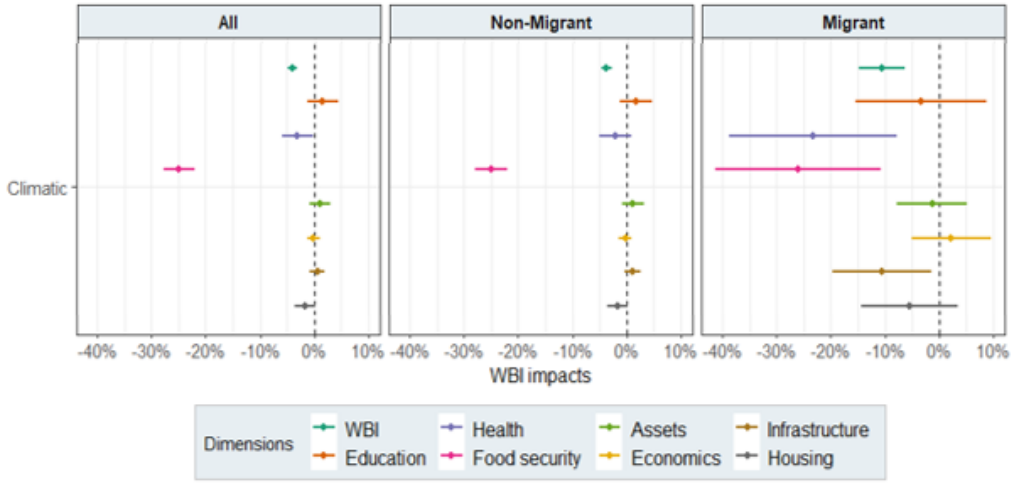

Figure 3: Impact of climatic shock on WBI and WBI dimensions for all, non-migrant and migrant households (95% confidence interval).

For migrant households, it is not just the food security dimension that is negatively affected by climatic shocks but also the health (experience of health issues, absence due to health issues) and infrastructure (power outages and access to sanitary facilities) dimension. Migrant households might experience these negative impacts on the health dimension due to an initially lower health status compared to non-migrant households, as indicated in Figure A7a. Individuals already in compromised health might have reduced physical resilience, making them more susceptible to further health complications from climatic shocks (Scheerens et al. 2021). Climatic shocks can also significantly strain health infrastructure and services, especially in areas unprepared or ill-equipped to deal with such events, and migrants may also not have the same access to medical facilities as non-migrant households. In the event of a climatic shock, their compromised health, coupled with limited healthcare access, can lead to additional adverse health consequences. It is difficult to explain why only migrant households and not also non-migrant households experience a significant negative impact on the infrastructure dimension because here we see no initial distinct differences between the two sub-groups. Especially migrant households who recently arrived at their destination (this data is not available in the LSMS) may live in areas where the electricity supply and sanitary facility access are not as stable due to the rather temporary nature of the residence (Jayaweera 2014).

Pre-migration contexts at origin explain lower climate resistance of migrant households

Different mechanisms can explain the more considerable climate burden on resistance experienced by migrant households. Our mediation analyses suggest that when exposed to climatic shocks, differences, especially at the origin and destination level, explain the lower climate resilience of migrant households. At all levels, destination, origin, and household, we see some general patterns that apply to both non-migrant and migrant households (Figure 4). At the destination level, we find that households residing in rural areas experience larger well-being declines when exposed to climatic shocks than households living in small towns. The limited number of studies comparing rural and urban resilience aligns with this finding (Link et al. 2021; Zhang et al. 2023). Rural households tend to be heavily reliant on rain-fed agriculture and, therefore, face greater climate vulnerabilities due to limited access to essential services and modern infrastructure. Conversely, small towns tend to offer diverse economic opportunities and better information dissemination, enhancing household resilience to climatic shocks.

At the origin level, we find that if migrants originate from a less prosperous region (based on GDP), they experience a significant negative well-being impact when exposed to climatic shocks. On the other hand, migrant households do not experience a positive moderating effect when residing in a more prosperous destination region. The latter starkly contrasts the experience of non-migrant households, who do experience a positive moderating effect when residing in a more prosperous region at the time of the survey. Consequently, this indicates that the socio-economic background of migrants, shaped by their origin, carries a lasting impact which is in accordance with the findings of Warner and Afifi (2014). Even after moving to a new region, the historical economic conditions and experiences from their place of origin continue to influence migrants' capacity to resist climatic shocks. Due to this higher vulnerability of migrant households originating from less prosperous regions, policymakers must recognize these differential impacts and ensure that resilience-building strategies are tailored to address the specific vulnerabilities faced by migrant populations from different origin regions. Simply improving conditions or providing resources at the destination may not be enough. Beyond just economic integration, there is a need to address the more profound socio-economic challenges that migrants carry. Holistic programs that consider their past experiences regarding skills, mental well-being, and socio-economic backgrounds can effectively ensure long-term resilience of migrant households.

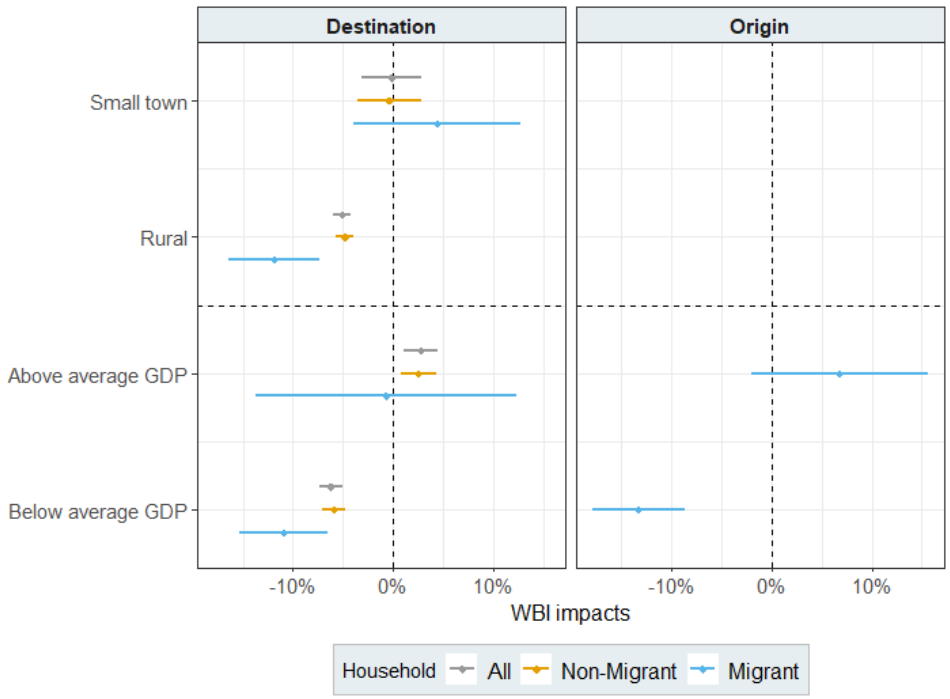

Figure 4: Mediation analysis for the impact of climatic shocks on non-migrant and migrant households at destination and origin level (95% confidence interval).

Social drivers impact climate resistance irrespective of migration status

At the household level, we find that specific social drivers impact the climate resistance of households irrespective of their migration status (Figure 5). For example, households from certain ethnicities (wakifata, muslim or orthodox), households with lower educational attainment (did not attend school, no ability to read and write), lower occupation levels (mining, agriculture, and housekeeping), smaller household size (equal or smaller than 7), fewer children (equal or smaller than 4), younger head or spouses (<30 years), no elderly person in the household, fewer female individuals (<65% of household) and a female head have a lower climate resistance compared to the respective counterparts.

Consequently, this study supports previous work by Hoffmann and Muttarak (2017), highlighting the importance of education and literacy in climate resilience. The connection between lower age and lower resilience could be explained by a lack of experience, limited resources, limited social networks, or even a higher proneness to taking risks (Ong et al. 2009). This result fits well with the negative relationship between well-being and the absence of an elderly person in the household. In many traditional societies, including Ethiopia, elders often possess a wealth of knowledge and historical memory, enabling them to offer insights and adaptive strategies in response to climatic changes based on past experiences (Aldrich et al. 2015). Additionally, their respected position in Ethiopian communities often allows them to play a crucial role in community-based decision-making processes, ensuring that adaptation and mitigation measures align with local needs and cultural practices.

With regards to the sex-disaggregated results, a higher percentage of female members may indicate a diversification of roles and responsibilities, leading to a broader set of skills and coping strategies that enhance

resilience against climate adversities (Belcore et al. 2020). However, when the head of the household is female, the household might face socio-cultural challenges and limited access to resources due to prevailing gender norms, potentially reducing their adaptive capacity and overall resilience. Contrary to our findings, the literature examined an inverse relationship between household size and resilience; however, previous studies also mostly assessed resilience to food insecurity, which is only one of the seven dimensions in our Well-Being Index (Oriangi et al. 2020). At the same time, we do not detect opposite impacts for non-migrant and migrant households at the household level. This makes us assume that the elevated climate burden of migrant households is mainly driven by the pre-migration context at the origin level (Figure 4).

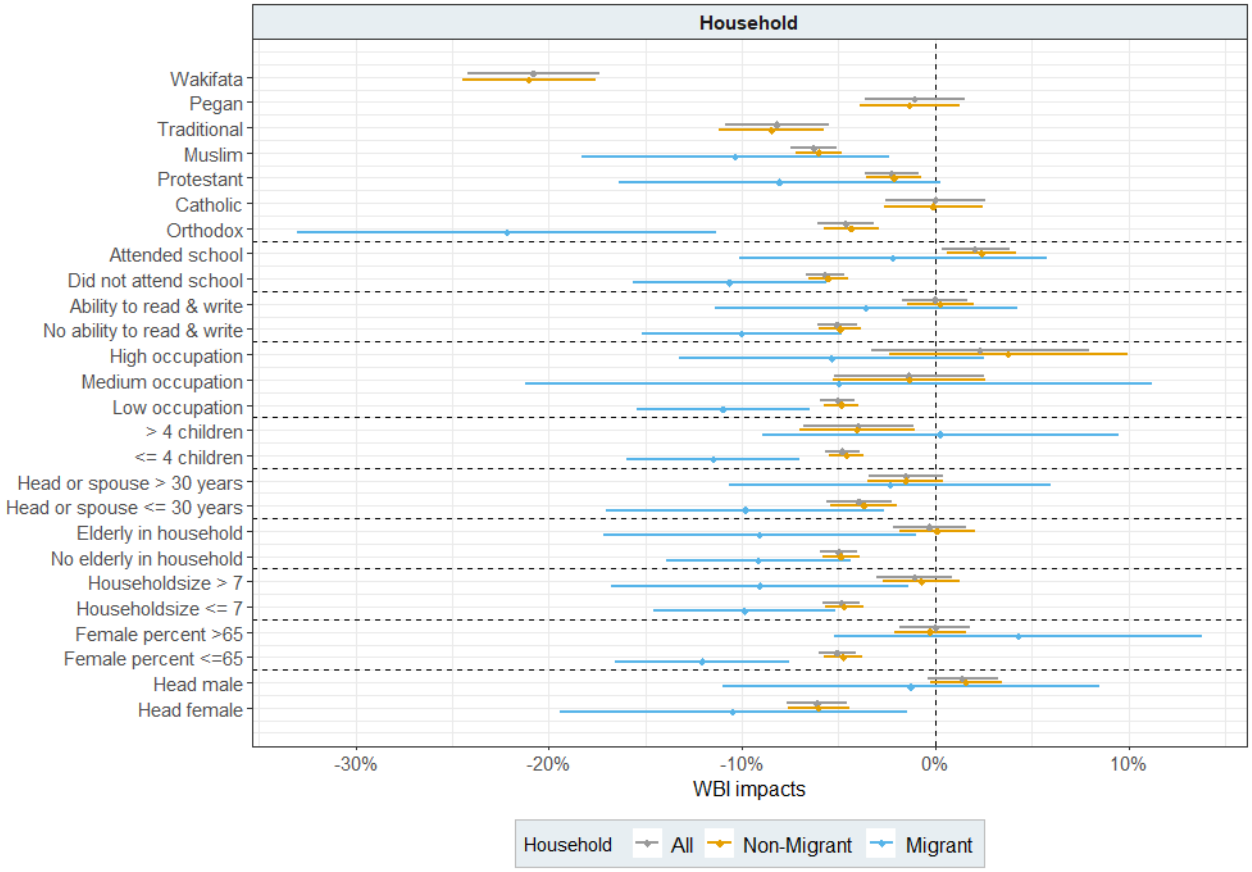

Figure 5: Mediation analysis for the impact of climatic shocks on non-migrant and migrant households at the household level (95% confidence interval; no migrants from Wakifata, Pegan, Traditional, Catholic religion).

Migrant households recover faster from climatic shocks

Resilience is not just determined by the resistance of households to shocks but also their ability to recover after a shock has occurred. We compare the relative WBI change post-shock based on a shock experience in Wave 1 or Wave 2 between non-migrant and migrant households. For non-migrant households, we only observe positive relative well-being changes post-shock, which are significant for climatic, health, and price shocks (Table 3). For migrant households, we find positive and negative correlations between shock experiences and relative WBI change post-shock. Interestingly, despite the lower resistance of migrant households to climatic shocks, they display a higher relative well-being recovery (0.66) compared to non-migrant households (0.16). The same applies to agricultural and health shocks. At the same time, migrant households do not seem to be

able to recover from price and especially conflict shocks. The latter result needs to be treated with caution due to the small sample size of migrant households who experience conflict shocks.

Table 3: Recovery of households to shock categories based on relative WBI change post-shock experience in Wave 1 or Wave 2 (`***` = 0.01, `**` = 0.05, `*` = 0.1).

Shocks	All households	Non-migrant household	Migrant households
Climatic	0.1720*** (0.0494)	0.1569*** (0.0498)	0.6550* (0.3698)
Agricultural	0.1061** (0.0540)	0.0906 (0.0564)	0.3176* (0.1613)
Health	0.2046*** (0.0447)	0.1885*** (0.0469)	0.3950*** (0.1317)
Price	0.0545 (0.0350)	0.0727** (0.0363)	-0.1938 (0.1191)
Conflict	0.0085 (0.1345)	0.0378 (0.1401)	-0.5135*** (0.1623)
Fixed-Effects:	----------	----------	----------
HH_ID	Yes	Yes	Yes
_____	_____	_____	_____
S.E.: Clustered	by: HH_ID	by: HH_ID	by: HH_ID
Observations	4,281	4,004	277
R2	0.40375	0.40418	0.43573
Within R2	0.02797	0.02612	0.11443

Migrant households often diversify their livelihoods by having family members work in different sectors and regions. This diversification can provide a safety net, as not all livelihoods will be equally affected by climatic shocks. Hence, while they might initially be less resistant to climatic shocks, they may have alternative resources to tap into during the recovery phase (Alobo Loison 2015). Furthermore, migrant households might receive remittances from family members working in other regions or countries. However, these remittances might experience delays before reaching the household or before they are invested, making them more relevant for recovery rather than immediate resistance. During and after times of climatic stress, these remittances can provide crucial financial support that aids in faster recovery (Cohen 2011).

Limitations

While providing insightful findings, this study has limitations that should be noted. First, the sample size for migrant households was relatively small, potentially limiting the robustness of conclusions drawn from this group. Second, due to the unavailability of data on individuals from medium to large towns, prominent migrant-receiving regions like Addis Ababa could not be included due to data restrictions. Third, selecting variables and thresholds for the Well-Being Index may introduce subjectivity and potentially oversimplify complex realities. Fourth, while our results offer a quantitative understanding, the absence of qualitative data means that certain household-level findings might lack a comprehensive explanation. Additionally, it is essential to recognize that migrant households are diverse. Although we aimed to consider multiple characteristics spanning destination, origin, and household contexts, a significant limitation was the absence of data regarding the time since their arrival at the current destination. In future research, to mitigate some of these challenges, we aim to expand our approach to other East African countries where LSMS data is available, including countries such as Tanzania, Uganda, and Malawi.

Conclusion

By focusing on the resilience of migrant households at migration destinations in Ethiopia, we take a more holistic approach since migration trajectories do not end after a household has migrated. We find that migrant households exhibit lower climate resistance than non-migrant households. While only food security is negatively affected for non-migrants, migrant households see their food security, health, and access to infrastructure negatively impacted by climatic shocks. Additionally, migrants experience double as high negative well-being declines after climatic shocks. This differential impact cannot be explained by household characteristics but is determined by pre-migration origin contexts. Migrant households originating from a less prosperous region experience significant well-being declines when exposed to climatic shocks but do not experience a positive mediating effect when residing in more prosperous destination regions. This situation starkly contrasts the experience of non-migrant households in destination regions. Although migrant households exhibit a reduced resistance to climate shocks, they demonstrate a swifter recovery following such shocks. This faster ability to recover can be attributed to their diversified livelihoods and the delayed benefits from remittances. Consequently, this study shows that in order to assess resilience comprehensively, it is vital to consider both resistance and recovery. Assessing only resistance could inaccurately portray migrant households as less resilient, overlooking their distinguished ability to recover. Notably, understanding that the resilience of migrants at their destinations is heavily influenced by their origins rather than destination or household factors provides key policy insights. Implementing training, capacity-building, and information dissemination about potential challenges in destination regions can be invaluable. Additionally, reinforcing feedback mechanisms between migrants and their origin regions can establish robust support networks and pave the way for pre-departure measures tailored to each unique migratory trajectory.

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Appendix

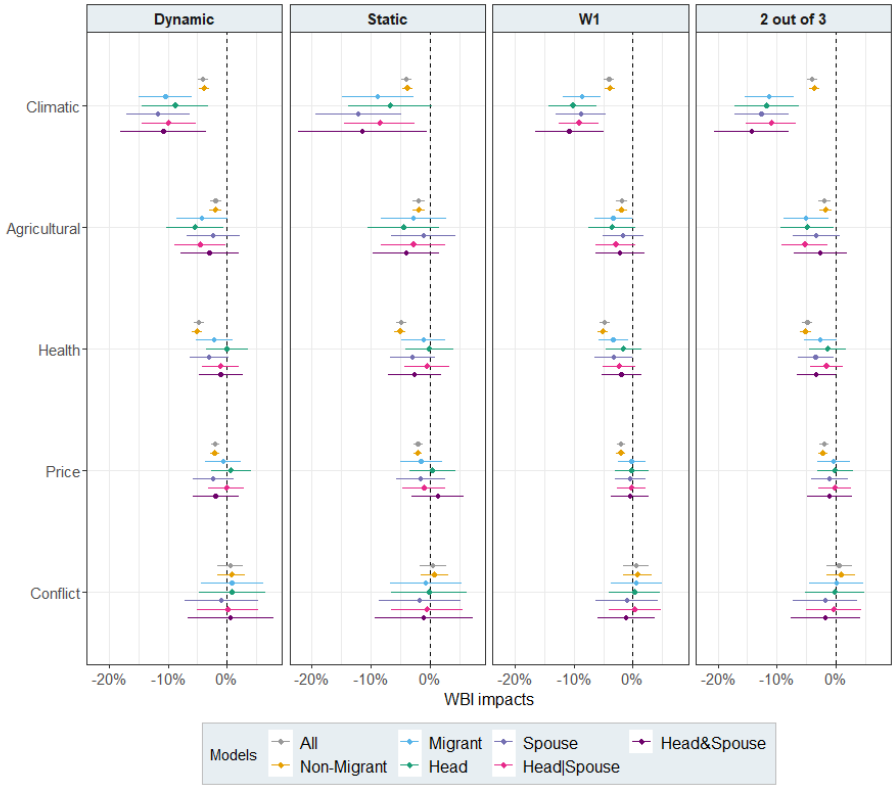

Figure A6: Impact of different shock categories on WBI based on different definitions of migrant household: dynamic, static, W1, and 2 out of 3 approaches for all, non-migrants, migrants (anyone in the household), head, spouse, head or spouse or head and spouse (95% confidence interval).

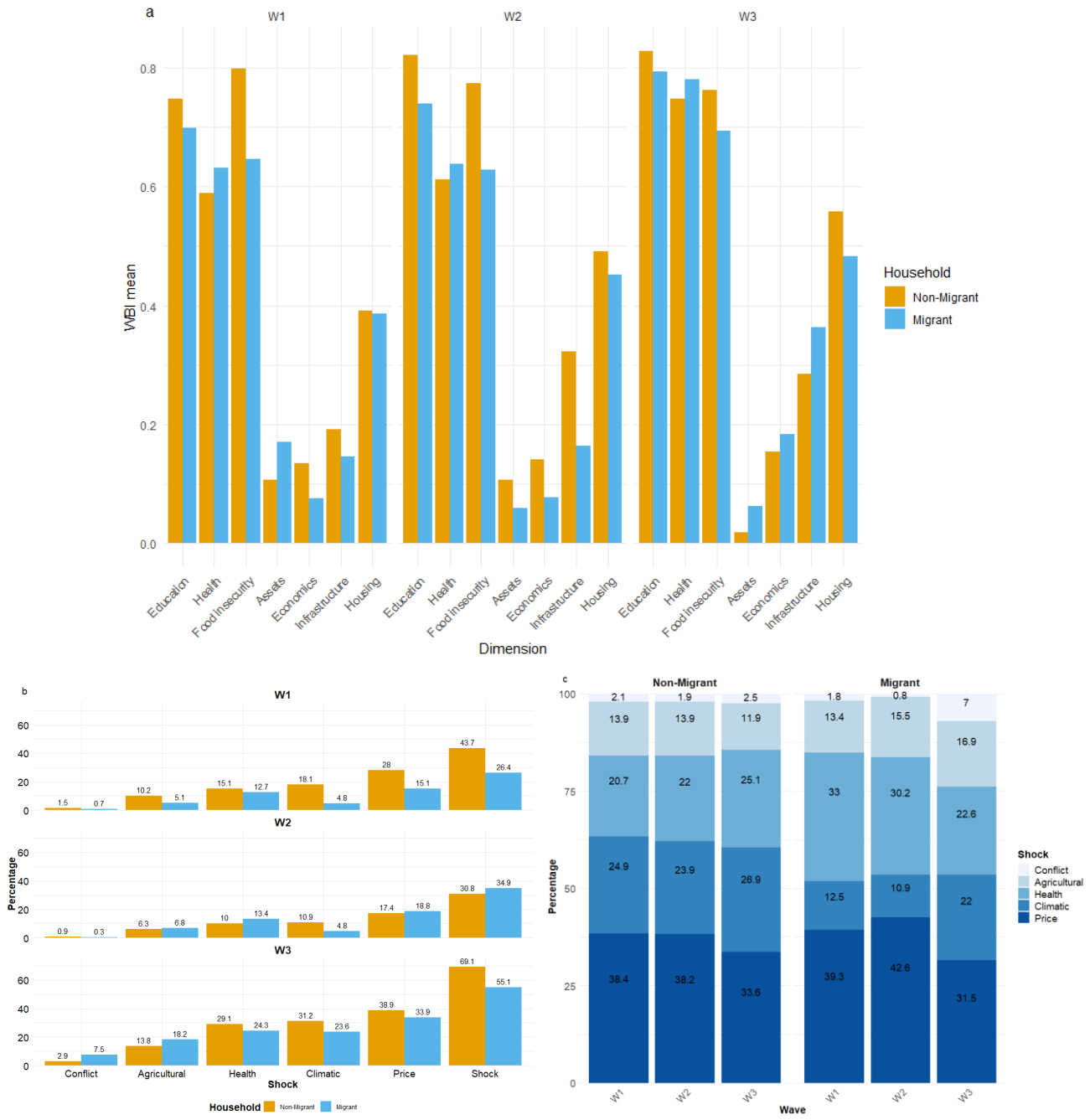

Figure A7: a) Well-Being Index per dimension, b) distribution of migrant and non-migrant households by experienced shock categories, and c) breakdown of shock categories experienced by migrant and non-migrant Households.