SAPIENZA
UNIVERSITÀ DI ROMA

Dottorato di Ricerca in Geografia Economica

Tesi di Dottorato XXXIV Ciclo

Dipartimento di Metodi e Modelli per l'Economia, il Territorio e la Finanza (MEMOTEF)

A regional perspective on international migration and food insecurity

Marinella Cirillo

Advisors:

Carlo Cafiero and Sara Viviani

In memory of my father

Contents

1. Introduction and background 4

1.1. General framework 4

1.2. Research questions and thesis structure 7

1.3. Methodology 8

1.4. Geographical context 10

2. Food insecurity as a determinant of international migration: evidence from Sub-Saharan Africa 13

Ahmad Sadiddin, Andrea Cattaneo, Marinella Cirillo, and Meghan Miller

Introduction 13

Conceptual framework for determinants of international migration 15

Data and descriptive statistics 18

Methods: empirical operationalization of the migration decision process 24

Results and sensitivity analysis 26

Conclusions and policy implications 31

Appendix 33

3. Global drivers of gender disparities in access to food 37

Sara Viviani, Erdgin Mane, and Marinella Cirillo

Introduction 37

Recent trends and geography of the gender gap in food insecurity 40

Food Insecurity Experience-based Scale (FIES) 42

Data 48

Empirical strategy 52

Results 55

Conclusion 65

Annex 66

4. Establishing the link between internal and international migration: evidence from Sub-Saharan Africa 71

Marinella Cirillo, Andrea Cattaneo, Meghan Miller, and Ahmad Sadiddin

Introduction 71

Conceptual framework 73

Data and descriptive statistics 78

Methodology: empirical models and estimation 85

Results and discussion 86

Conclusions 92

Annex 94

Conclusion 103

Bibliography

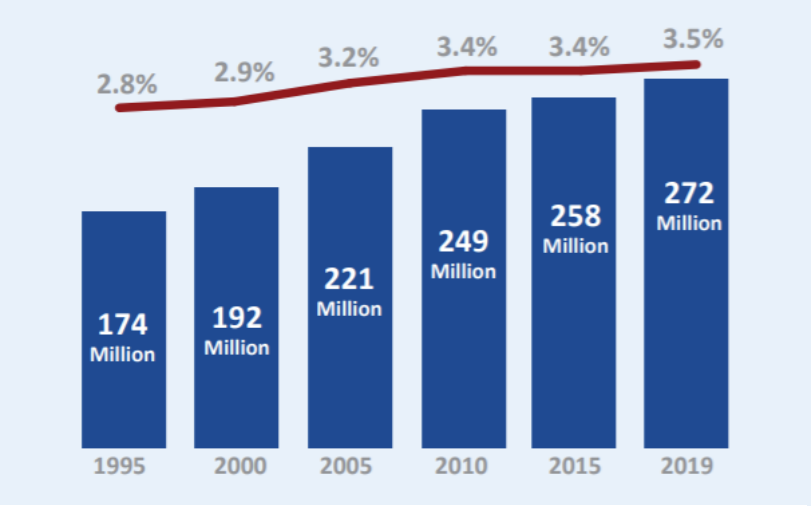
1. Introduction and background

1.1 General framework

The aim of this work is to study the effect of food insecurity on the migration process in Sub-Saharan Africa, and how migrating abroad (international migration) is often preceded by movements within the country (internal migrations). This research also intends to emphasise the gender imbalance in experiencing food insecurity in that region and all over the world.

Human Migration is generally defined as the movement of people from one place to another with intentions of settling, permanently or temporarily, at a new location. Today, the increasing number of migrants across the world, has led to various pressures and challenges being placed on origin and destination. According to the latest IOM World Migration Report 2020, 3.5 per cent of the global population were international

Figure 1 International migrant population, 1995-2019.



Source: IOM World Migration Report, 2020.

migrants in 2019 (see Figure 1). On these, 4.5 million of people were internally displaced.

But what makes people migrate? As claimed by Simpson (2017), migration is motivated by multiple factors, and "there are myriad of economic and non-economic forces behind the decision to migrate".

Migration researchers have developed a wide range of theories in order to explain the drivers, patterns, and characteristics of migratory flows over time. The first models explaining the migration process are considered the "Push-pull" models (Ravenstein, 1885) which suggested the existence of "push" and "pull"

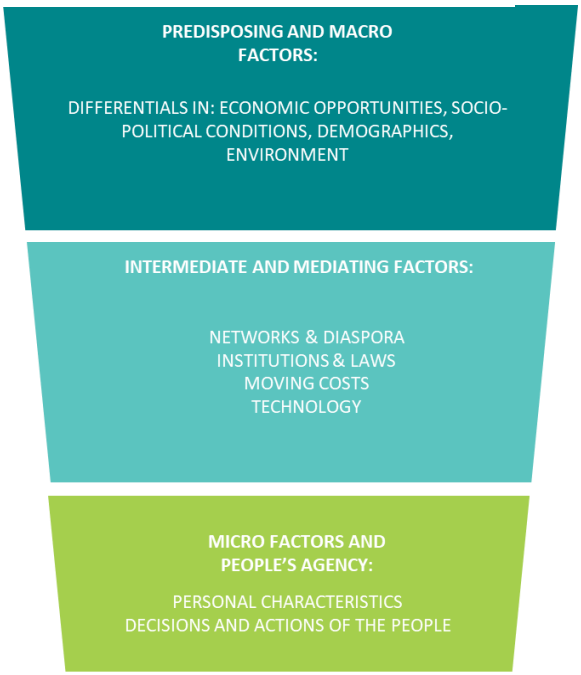
factors in both sending and receiving countries. In the past, these factors were initially identified as wages, income, or employments differentials between countries. Many neoclassical theorists (Sjaastad, 1962; Greenwood, 1975; Todaro, 1989) used to associate the intention to migrate with an individual maximization of productivity, skills, and highest wages. Other migration scholars instead, such as Borjas (1989), have drifted away from the idea that migration was necessarily determined by an individual decision only and highlighted the importance of non-economic factors such as country's political orientation, educational level and immigration policy as drivers of migration. Yorimitsu (1985), organized the determinates of migration in 4 major groups of factors discussed in the literature: Demographic characteristics of migrants (such as age, sex, etc.); Socio-economic characteristic of migrants; Socio-economic characteristics of regions; Factors accompanied by migration.

Although most of these theories initially posit widely differing models to explain migration, they do not necessarily contradict each other (Ruyssen,2013). The current trends and patterns of migration reveal that a full understanding of contemporary migratory processes will not be achieved by relying on the tools of one discipline alone (Massey et al,1993). However, studies on the determinants of migration have often considered only some of these factors, proving a reductive explanation of the complex phenomena. According to more recent studies, Migali et al (2018) summarize migration drivers' factors in both structural characteristics of countries and individual characteristics of persons. Furthermore, the latest study by de Haas (2021) conceptualises migration as a function of people's aspirations and capabilities given the perceived geographical opportunity structures, underlining the importance of people's preferences, intentions, and agency. Numerous factors are therefore at play in determining people's movements. The 2018 FAO (Food and agriculture organization of United Nations) Global Report on Food Security and Agriculture (SOFA, 2018) recapitalize all these factors in three categories interacting to influence the migration phenomena: Macro, Intermediate and Micro factors.

Drawing on FAO's concepts, I theorised the drivers of migration in three mains categories: *Predisposing and Macro determinants, Intermediate and mediating factors* and *Micro factors and people's agency*. These categories are taken up and utilized within the research articles in this thesis.

Predisposing and Macro determinants category includes all the economic, socio-political, environmental conditions that lead people to desire to migrate elsewhere. *Intermediate and mediating factors* such as social networks and moving costs, may push this desire further, but it may also constrain it. For instance, the presence of social networks at a prospective destination can help overcome bureaucratic procedures and obstacles, provide information, and assist in finding housing and jobs. This can encourage people to move one step further versus more concrete planning to take the move. However, the final decision to migrate or to stay is the consequence of *people's agency* and thus depends on *micro factors* such as personal household characteristics (Smith & Floro, 2020) and capabilities (de Haas, 2021) as decision-making actors. See Figure 2.

Figure 2 Drivers of migration



Source: Author's elaboration

Food insecurity is acknowledged as one of the micro drivers of migration, but very limited and empirical studies have directly treated food insecurity status as determinates of migration. Nevertheless, the relationship between food security and migration remains extremely important to study as situations still exist today where people have to escape from problematic access to food and hunger.

According to the United Nations' Committee on World Food Security, food security is defined as meaning that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food

that meets their food preferences and dietary needs for an active and healthy life. The Food and Agriculture Organization of the United Nations (FAO) identified the four pillars of food security as availability, access, utilization, and stability[1].

My particular interest is to understand the magnitude of food insecurity's impact in shaping the migration process in Sub-Saharan Africa focusing on the *access* dimension of food insecurity. Particularly on how the access to food can be unbalanced depending on gender. In Section 1.3 I will briefly elaborate on how access to food is measured (in the total population and by gender) and by using which measurement methodology.

By "migration process", however, I mean the stepwise process which leads individuals to first *desire*, then *plan* and finally *decide* to migrate (see Section 1.3).

In this work, which focuses on food insecurity as determinant of migration, I also attempt to investigate and evaluate both the internal and international migration processes in Sub Saharan Africa. Moreover, the linkage between the two and what I would describe as spatial mobility within the region. Can internal migration and international migration be considered as the same process? Driven by various factors (macro, intermediate and micro), do people move internally or internationally? or internally and then internationally?

What is certain is that human migration adopts numerous forms presenting challenges and opportunities for migrants and societies. Internal migration process itself could lead to international migration also depending on the internal destination of the migrants: rural or urban areas. Internal destination can make the difference in continuing the movement abroad or not. Hence the importance of analysing territorial destination areas in terms of opportunities/difficulties for a future movement. In this work, the available information on people's place of residence allowed me to account for the role of residence area in the process of migrating.

1.2 Research questions and thesis structure

Based on the introduction laid out in Section 1.1, the present work aims at offering an empirical understanding of the food insecurity impact on migration and on the linkage between internal and international migration in Sub-Saharan Africa; on the other end, by focusing on determinants of regional and

[1] FAO (2009). *Declaration of the World Food Summit on Food Security* (PDF). Rome: Food and Agriculture Organization of the United Nations.

global food insecurity, particular relevance is given to the gender disparities in accessing food and their characterization.

In this regard, the research questions concern:

a) The impact of food insecurity on international migration intention in Sub-Saharan Africa
b) The role and characterization of gender gap in experiencing food insecurity
c) The link between internal and international migration in Sub-Saharan Africa

To explore these thematic, the following papers have been developed:

- Sadiddin, A., Cattaneo, A., Cirillo, M., and Miller M. (2019). Food insecurity as a determinant of international migration: evidence from Sub-Saharan Africa. Food security journal, 11(3), 515-530. https://doi.org/10.1007/s12571-019-00927-w.
- Viviani, S., Mane, E., Cirillo, M. (2021). Global drivers of gender disparities in access to food. Economic modelling journal (forthcoming).
- Cirillo, M., Cattaneo, A., Miller, M., and Sadiddin, A. (2021). Establishing the link between internal and international migration: evidence from Sub-Saharan Africa. World development journal (forthcoming).

1.3 Methodology

The purpose of this section is to introduce the empirical methodology of my thesis. To explore the research questions presented above, I adopted a quantitative analysis approach. All articles include different techniques and methods of analysis such as data mining, visualization, descriptive statistics, statistical inference and modelling. The work was carried out through various statistical software: Excel, STATA, R and SPSS.

All the analyses are based on data collected by the Gallup World Poll (GWP), an annual and national representative survey of individuals in nearly 150 countries, covering 90% of the world's population. The GWP survey collects data on peoples' lifestyles, attitudes, beliefs, as well as characteristics of individuals

and macro indicators, with a wide rate of geographical coverage[2].Since I have been working at the Food and Agriculture Organization of United Nations- (UN-FAO) during the last five years (2016-2021), I have had the chance to access this vast database of around 3000 variables.

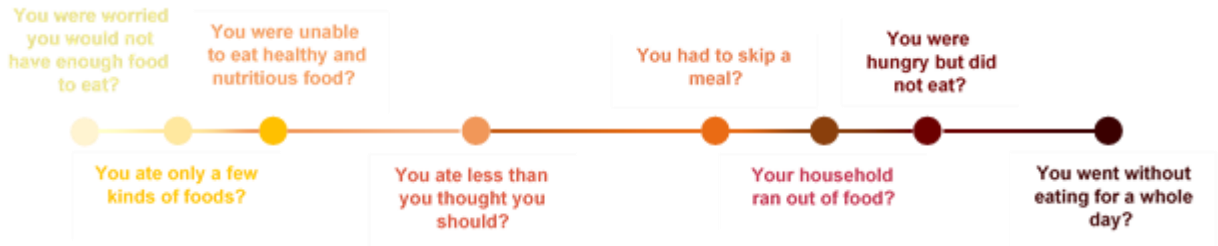
For my research purposes, I selected some variables from the GWP database and designed the following key areas and indicators of interest:

1) Prevalence of Moderate and/or Severe food insecurity
2) International migration intention
3) Internal migration

In addition, I included and used some individual and household characteristics such as area of residence, employment, education and gender.

The food insecurity indicators (Prevalence of Moderate and/or Severe food insecurity) are based on the Food Insecurity Experience Scale (FIES), a survey module composed of eight question which constitutes measurements scale aiming at capturing the severity of food condition. The FIES questions focus on food-related behaviours and self-reported experiences associated with increasing difficulties in accessing food due to resource constraints (Figure 2). Responses to these questions are analysed to obtain prevalence rates of moderate and/or severe food insecurity.

Figure 2 FIES questions



Source: Voices of the hungry project, FAO.

One of the major advantages of the FIES data is that they allow detailed disaggregated analysis of the food insecurity situation by income, gender, age, race, ethnicity, migratory status, disability, geographic location,

[2] https://www.gallup.com/178667/gallup-world-poll-work.aspx

or other policy-relevant characteristics. This important feature allowed me to compute the prevalence rates of food insecurity by gender and use them in one of the research papers of the thesis.

Box 1

Direct and indirect measure of food insecurity

The FIES is an experience-based and *direct* metric of food insecurity severity. It is designed to measure the food access dimension of food insecurity. The FIES differs from traditional approaches which assess food insecurity *indirectly*. In fact, there are multiple methods to estimate food security, but these are generally 1) measures of food security determinants - such as food availability or income/expenditure (for example: the Prevalence of Undernourishment), or 2) measures of potential outcomes - such as nutritional status (for example: the Dietary intake index).

I captured the international migration intention variable through three GWP questions investigating on the *desire*, the *plan*, and the *decision* to move permanently to another country. The variable is therefore defined using a combination of these three questions that capture what can be defined as the *intention* to migrate internationally.

Lastly, I considered internal migration variable as the status of interviewees regarding their movement from another city or area within the country in the five years preceding the interview. The interaction between this variable and the residential variable (area of residence) helped me capturing the group of internal migrants living in urban or rural areas.

Once the variables of interest had been selected, I proceeded with the data analysis process. The statistical treatment of data included, in the three research articles, both descriptive and regression analyses.

1.4 Geographical context

This paragraph highlights the importance of the geographical context within my research studies. The choice of including this section comes from the awareness that complex phenomena such as migration and food insecurity need to be necessarily contextualised to be fully understood.

Most of my work on migration and access to food focuses on Sub-Saharan African countries. Sub-Saharan Africa is one of the poorest regions in the world with an urbanization rate of around 40% (UN World Urbanization Prospects, 2018), where internal migration takes place in large part as a response to imbalances between the regions of a country (Adepoju, 1998) and is dominated by intra-rural movements (Cattaneo & Robinson, 2020). According to Plaza et al. (2011), despite the widespread perception that migrants from

Sub-Saharan Africa move predominantly to developed countries, data broadly shows that the African region is mostly characterized by intra-regional movements, which account for 65% of the total population of international migrants from the region (UN DESA, 2019). As claimed by Adepoju (2006) "Spatial mobility is a fundamental social and historical aspect of life in Africa. In a region in which various forms of migration, both voluntary and compelled, are widespread, intra-regional migration takes place within diverse social, ethnic, political and economic contexts."

Unfortunately, the undocumented and uncontrolled movements in that region have always made it difficult to have reliable information and to understand and accurately measure internal and international migration flows. Data on internal and international migrants in Africa remain mostly fragmentary and incomplete. This is often due to the porous borders of the entire continent, particularly in Sub-Saharan Africa (Lucas,2015). However, because of the intense mobility within the region there has been a faster urbanisation than any other region in the world, with rural-urban displacement constituting the main driver of urban growth (SOFA,2018) where most skilled migrants are attracted.

Nevertheless, despite the intense urbanisation growth of the recent years, high percentage of the Sub-Saharan population still lives on USD 1.90 per day or less, and insecure access to food remains a major constraint. The most recent UN report indicates that the absolute number of food-insecure individuals in SSA increased from 512.9 million in 2014-2016 to 597.9 million in 2017-2019 (SOFI,2020).

Additionally, gender disparities are particularly pronounced in Sub-Saharan Africa region. Despite woman's high contribution to the economic activities (such as agriculture and food production) they mostly lack access to education (Dube,2015), political life, markets, and credit (Asiedu et al, 2013). According to the 2020 State of food insecurity report (SOFI,2020), these differences seem, unfortunately, replicated in inequalities in access to food.

Furthermore, the geographical context influences access and other dimensions of food insecurity in multiple ways. Although it is not subject of my research, nowadays it is important to underline how climate variability and extremes is one of the main causes of increasing numbers of food insecurity, together with conflicts.

They play a role in explaining spatial and temporal trends of food insecurity and, consequently, of migration patterns.

2. Food insecurity as a determinant of international migration: evidence from Sub-Saharan Africa

Ahmad Sadiddin, Andrea Cattaneo, Marinella Cirillo, and Meghan Miller

Abstract

In this paper, we examined how food insecurity can affect international migration aspirations and subsequent actions taken in preparation to move internationally from Sub-Saharan Africa. Drawing on a conceptual framework of the determinants of migration, we developed a three-stage regression model and tested it using data from the 2014 Gallup World Poll. The results indicate that multiple determinants play different roles in the migration decision process, which is characterized by aspirations, planning and final decision to migrate. Specifically, food insecurity is an important determinant of both the desire and the decision to migrate: food insecurity raises the probability of desiring to migrate internationally, with the probability of the desire increasing along with the severity of food insecurity. However, the probability of actually deciding to migrate internationally decreased as food insecurity worsened. These findings are in line with migration literature stating that the very poor, despite wishing to migrate, face tremendous constraints in transforming this desire into concrete decisions. Our results suggest that removing or reducing constraints to migration will benefit the poorest/most food insecure and highlight the need for an increased and effective coordination between food security and international migration policy agendas.

Keywords: Migration aspiration; Migration decisions; Migration barriers; Food insecurity; Sub-Saharan Africa

Introduction

International migration, defined as movement of people across national borders with the intention of staying in the host state, has been increasing and, in parallel, has been receiving greater attention from economists and policy makers. Food insecurity, defined as the lack of reliable access to sufficient quantities of nutritious food, has been increasing in recent years as well (FAO et al. 2017, 2018). Recently, there has been a growing number of studies on the links between migration and food security, mostly focusing on the impacts of the former on the latter. Despite variation in findings, migration is widely acknowledged as having mostly positive impacts on food security and nutrition of household members left behind, owing to remittances from migrants (Zezza et al. 2011; Crush 2012). The importance of remittances in promoting food security was underlined by the World Bank's Africa Migration Project, which found that a large proportion of remittances was spent on food in Sub-Saharan Africa (Plaza et al. 2011). Food insecurity is also acknowledged as a determinant of migration. A recent study of eight developing countries suggested that food insecurity – stemming from the impacts of adverse climatic factors on agricultural productivity – can drive migration (Warner and Afifi 2014). Similar results were found in a case study in Ghana, where migration was revealed to be a typical livelihood strategy used by many rural households to cope with adverse weather conditions that reduce farm productivity and threaten food security (RademacherSchulz et al. 2014). Another study from El Salvador, Guatemala and Honduras, where nearly half of all households interviewed in 2016 were food insecure, confirmed clear links

among food insecurity, adverse climatic events and migration (IADB et al. 2017). However, very few studies directly treat food insecurity as a determinant of migration, specifically using a measure of individual-level food security status to investigate its impacts on the individual-level migration decision process. The paucity of this type of study is clearly due to the unavailability of the type of data needed to conduct such analyses. A relevant development came in 2014, however, when the Gallup World Poll (GWP) began collecting data on food insecurity at the individual level, as part of the Food and Agriculture Organization's (FAO) Voices of the Hungry Project, which developed an experiential measure of food insecurity called the Food Insecurity Experience Scale (FIES). FIES data have been collected annually through the GWP since then for approximately 150 countries. In addition to the FIES, the GWP collects information on people's lifestyle, attitudes and beliefs, as well as characteristics of individuals and households, providing an unprecedented opportunity to study the causes and consequences of food insecurity. Our study builds on the sole investigation of this kind, to the best of our knowledge, that used both FIES data and other migration-related variables from the GWP. Smith and Floro (2017) examined how individuals' food insecurity status related to both the intention (desire)[3] to migrate and the eventual decision to do so in a global sample of low- and middle-income countries, while additionally considering how the relationship varied by gender. Their findings revealed a positive relationship between the severity of food insecurity and the intention/ desire to migrate, while an inverse association was found between food insecurity and the decision to move. These trends were found to differ significantly between men and women. Our approach differs from that of Smith and Floro in two main regards. First, while they ran a global analysis, we focus only on Sub-Saharan Africa, the region with the highest prevalence of food insecurity (FAO et al. 2018). Second, we considered in our analysis the full migration decision process as measured by GWP surveys, which entails three stages. In addition to international migration desire and decision, we analyzed the determinants of migration planning as an intermediary stage in the decision process. This paper examines how individual-level food security status can affect each of the three stages of the migration decision process. We analyzed GWP data on food insecurity (using the FIES), international migration, and individual characteristics, in addition to other relevant macro-level indicators external to the Gallup dataset. The migration process was captured through three sequential migration-related questions: The first question captures the respondent's *desire* to move to another country, while the second explores *plans* to migrate internationally in the following 12 months, and the third inquires whether any *preparations* have been taken for the move. We investigated the relationship between each of these three dependent variables, respectively, and food insecurity status, controlling for individual and household characteristics as well as countries' level of development and whether they were in a protracted crisis, factors that the existing migration literature has identified as important determinants of the migration decision process. Due to data constraints, most of the available evidence on individual variation in migration choice uses representative samples from within particular countries and rarely provides any comparative analysis of micro-level determinants of emigration across different countries. Therefore, one novel aspect of

[3] Smith and Floro use the term "intention" to refer to what we prefer to call "desire," as this term reflects more closely the spirit of the associated survey question, in our opinion.

our analysis is that it provides a regional picture of the relationship between food security status and the steps of the migration decision process. The narrowed geographical scope of our paper allows for a detailed consideration of a region disproportionately affected by severe food insecurity and protracted crises.[4] Examining food insecurity as a determinant of migration is becoming increasingly relevant as the number of international migrants increases, especially those migrating for economic reasons (FAO 2018), and with the rise in the global number of undernourished people (FAO et al. 2017, 2018). It can provide valuable information to governments and relevant international organizations on how to meet their commitments to the Sustainable Development Goals (SDGs), where achieving zero hunger by 2030 is a high priority. While food insecurity creates the incentive to migrate in search of better opportunities, the more food insecure proportion of the population generally come from the poorer segments of a society, and may therefore face prohibitive economic constraints to moving. Therefore, in an attempt to address food insecurity, policies may need to consider migration as an increasingly important livelihood strategy, and a potentially effective tool to improve food security. The remainder of the paper proceeds as follows. In the second section, we present a conceptual framework that details the theoretical foundations for our empirical analysis. In the third section, we present a summary description of the data used in the analysis. The fourth section presents the econometric model we used to examine the role of individual food insecurity status in the migration decision process, which is composed of three consecutive stages: expression of migration desire and the subsequent planning and preparations required to undertake an international move. The model controls for a set of variables that are deemed important determinants of migration and considers cross-country variation. The fifth section is devoted to presenting the results and discussing their robustness through a series of sensitivity tests. The last section discusses some policy implications of the findings and concludes the paper.

Conceptual framework for determinants of international migration

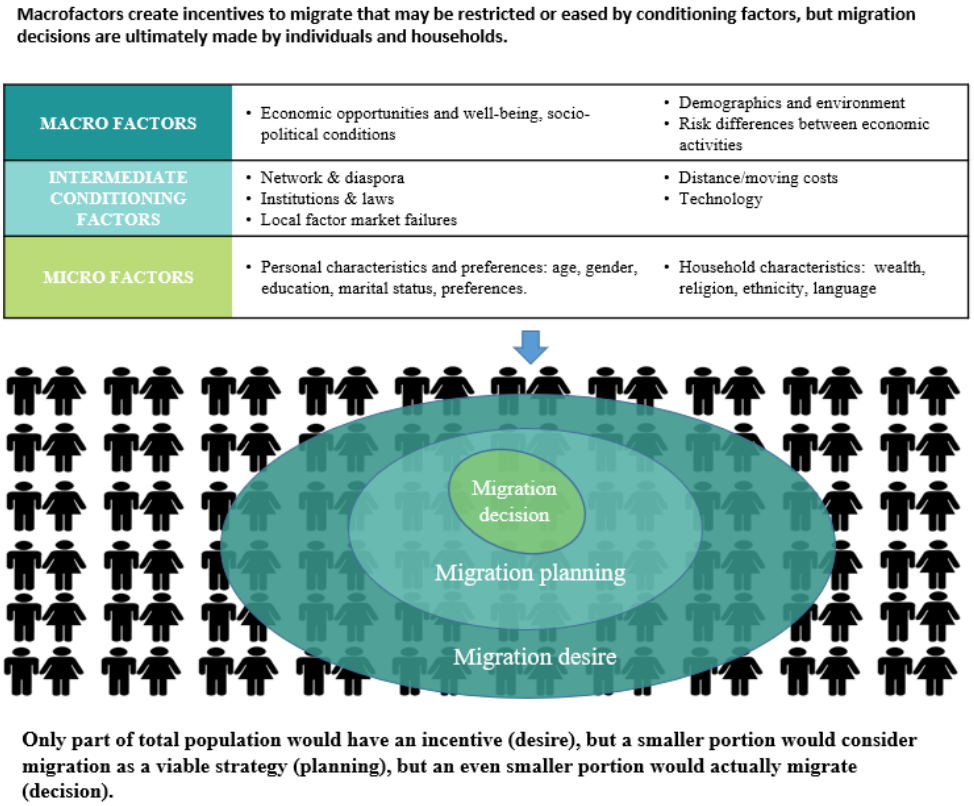
Our conceptual framework relies on the large body of literature describing the determinants of international migration, according to which the decision to move is a form of human capital investment (Schultz 1961; Sjaastad 1962; Clemens 2011). In making their decision, individuals compare the perceived differences in the expected utility of living or working in two geographical locations, net of the costs. Hence, both aggregate and microeconomic factors affect the net benefits of migration and thus affect the decision process. Evidence on cross-country variation in emigration rates show that the latter significantly depend on differences in development levels across countries, the availability of diaspora networks, and changes in the supply of legal migration opportunities (Mayda 2010; Ortega and Peri 2013; Docquier et al. 2014). By using census data on international migration stocks from a large set of countries worldwide, Clemens (2014) showed that there is a marked inverted-U relationship between economic development at origin and emigration rates. Likewise, this inverted-U relationship also applies to individuals and households within each country. Thus, for countries at every level of development, it is generally those individuals who are neither very rich nor very poor (by the

[4] According to FAO et al. (2017), there are currently 19 countries in protracted crisis situations, 8 of which are in Sub-Saharan Africa

standards of their own countries) who are more likely to desire to migrate and to be able to do so. In other words, although the very poor may want to migrate in order to escape poverty by looking for better opportunities elsewhere, they may face insurmountable obstacles to doing so. This is especially the case when international rather than internal migration within a country is considered, as moving to another country is costlier and implies higher risks that the poorest may not be able to undertake (FAO 2018). In addition, it has been shown that migrants are a self-selected sample of the population. They differ from non-migrants with respect to their personal characteristics (e.g. age, gender), skills, education and socio-economic background. This is because these individual characteristics affect the ability to bear migration costs and to reap the benefits in the future (Borjas 1987; Chiswick 1999; Chiquiar and Hanson 2005; Beine et al. 2011). Drawing on the conceptual framework developed by FAO (2018), we consider that there are three broad categories of factors interacting to influence the migration decision process. Macro factors comprise economic, socio-political, and environmental conditions that create the fundamental incentive for migration, which we call *migration desire*. These macro determinants may have differing impacts on various social groups, according to gender, age, wealth, language, and personal considerations. Nevertheless, the move from a *migration desire* to a *migration decision* by an individual is not immediate, but is largely governed by intermediate conditioning factors that either constrain or facilitate migration. These include the strength of the individual's social network at home and abroad, the functioning of local institutions and markets, the cost of migrating and access to information, among others. For instance, the presence of strong social networks at the destination can help overcome bureaucratic procedures and obstacles, provide information and assist in finding housing and jobs. These previous two sets of migration determinants are both, to a large extent, external to the actors. However, the decision to migrate or to stay is the consequence of people's agency and thus depends on personal factors, i.e. microdeterminants of migration, since no two potential migrants perceive macro structural factors or interact with the conditioning factors in the same way, as they have unique individual, household and even community capabilities and capacities. Therefore, age, gender, education and other personal factors matter, and when the decision to migrate is made collectively by the whole household, the characteristics of the household also matter, e.g. the number of children or youth, the gender composition and power distribution within the household. Based on how people are affected by intermediate factors, those desiring to migrate would proceed to *migration planning* or not, this being the intermediate step before the *migration decision*. Figure 1 illustrates how macro determinants, intermediate conditioning factors and micro-factors interact, leading to the decision to migrate or to stay. A range of macro-factors creates the incentives to migrate. The intermediate conditioning factors act to increase or reduce the incentive or the ability to migrate, i.e. they either facilitate or constrain people's mobility, and so they together determine the costs of migration, which include financial, social, cultural and psychological costs. In the end, when people decide to migrate or to stay, they interact with the external factors, based on their individual and household characteristics, including, among others, age, gender, education level, wealth, employment status, household composition, and personal preferences. The lower part of Fig. 1 links each of the three categories of determinants to an associated share of the population in question. The incentive to migrate due to the macro-factors is perceived by a share of the population (shown in dark

green). But a smaller share of those desiring to migrate may consider migration happening in the near future (in turquoise) because they are facilitated, or at least not constrained, by the intermediate conditioning factors. Finally, only a subset of the people who would be able to migrate actually decide to do so, based on their individual or household characteristics (shown in light green). The framework can also be extended to accommodate for external shocks that may have considerable implications for people's attitudes towards international migration. Political instability, conflicts, natural disasters or any type of protracted crisis can worsen the socio-economic and even the security conditions in countries of origin. Such shocks, when they last for a relatively long period, affect not only the macro differentials between countries of origin and the potential destination countries, but they also cause modifications to the intermediate conditioning factors. As an example, crossing the borders become easier under armed conflicts due to efforts of humanitarian agencies and the establishment of institutions to deal with the crisis. In the end, the pools of potential migrants, depicted in the lower part of Fig. 1, become larger due to the impacts of the crisis on each set of determinants, and consequently migration outflows increase. However, it should be emphasized that the various levels of migration determinants illustrated in Fig. 1 do not work in isolation from each other; rather, they work in combination, with their interactions depending on the context. The same determinant may play different roles depending on the phase of the decision process, for example individual and household characteristics may increase an individual's desire to migrate but constrain his or her ability to do so, depending on the macro and conditioning factors.

Fig. 1 Factors affecting the migration decision-making process



Source: adopted from FAO (2018)

Data and descriptive statistics

As mentioned previously, the GWP collects data annually for approximately 150 countries on peoples' lifestyles, attitudes, beliefs, as well as characteristics of individuals and households, including their attitudes towards international migration. Since 2014, the Food Insecurity Experience Scale (FIES) survey module at the individual level has also been applied as part of the poll. In this paper, we analyze GWP data to assess the role of food insecurity (as measured through FIES) in the international migration process, controlling for individual and household characteristics in addition to other relevant macro-level indicators external to the Gallup dataset. The international migration process is captured in the GWP through three sequential migration-related questions, which refer to permanent international migration. By international, we mean that the move is from one country to another, regardless of the distance between the two countries. By permanent, we exclude moves that are intended to be temporary, seasonal, or circular, which are typical of intra-regional migration patterns observed in some parts of the World including Sub Saharan Africa (Mercandalli and Losch 2017). The three sequential migration questions from the GWP are:

1- "Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country?" This question is asked of the full sample.
2- "Are you planning to move permanently to another country in the next 12 months, or not?" This question is asked only of those who answered "yes" to the previous one.
3- "Have you done any preparation for this move?" (Examples include buying an air-ticket, applying for a visa, or making other arrangements for the move). This question is asked of only those who answered "yes" to the previous two questions.

We consider the first question as investigative of the *international migration desire*, the first step of the migration decision process. The implicit assumption is, of course, that people will not decide to migrate unless they first desire to do so. The second question captures an important second step towards actual migration, since it focuses on planning for a move within a close and defined time-frame. We consider this question to represent *international migration planning*. As the third question concerns the specific arrangements made for the move, we consider it a proxy for an *international migration decision*[5], referring to a move that is likely to happen in the near future. These three variables are each binary and take the value of 1 if the individual answers yes; zero otherwise. We investigated the relationship between each of these three dependent variables, respectively, and food insecurity status, controlling for individual and household characteristics as well as across-country variation caused by different levels of economic development and political conditions, such as the presence of protracted crises, and factors that the existing migration literature has identified as important determinants of the migration decision process. The GWP surveys approximately 1000 individuals aged 15 years and older per year in each country. The randomly selected samples are nationally representative of the

[5] By decision, we mean that a person has decided to migrate as she/he has made preparations to implement the decision. However, we do not mean that actual migration has taken place as we do not have data on whether the decision has been successfully implemented or not. Therefore, people who decided to migrate in this paper cannot be equated with migrants who have actually moved from their areas of origins.

adult population and the survey covers the entire country (both rural and urban areas), except in the cases where safety or accessibility issues exist in certain areas. Face-to-face interviews are used in countries with less than 80% telephone coverage, and telephone interviews are conducted otherwise. A multi-stage sampling design is used to select the individuals interviewed face-to-face, while a random-digit-dialing approach is used in telephone-interview countries. The GWP also takes steps to ensure comparability across countries; for example, education is categorized into three broad levels to be comparable across countries where educational systems differ. For the same purpose of global comparability, income is converted into International Dollars using the 2011 PPP (Purchasing Power Parity) estimates (Gallup 2018). As introduced earlier, the FIES is a globally-validated experiential measure of food insecurity, developed by the FAO's Voices of the Hungry Project. FIES data are produced from binary (yes/no) responses to eight questions covering a range of behaviours and experiences associated with access to food. It is expected that more severely food insecure people will report having faced a greater number of these experiences over the previous 12 months than food secure or less severely food insecure people. Using standard thresholds, and according to their responses to the FIES questions, people are classified into groups indicating their food security status, commonly designated severely food insecure, moderately food insecure, mildly food insecure and food secure (FAO 2016). The design of the FIES survey module is based on previous research revealing that the experience of food insecurity is characterized initially by uncertainty and worry regarding access to food, followed by changes in the quality of diet as the situation worsens. When the situation becomes severe, food consumption decreases in quantity, as portions are reduced and meals skipped, up to the point where a person may go an entire day or more without eating (Radimer et al. 1990, 1992; Radimer 2002). A review published in 2006 and covering studies derived from many countries in different regions of the world concluded that these experiential dimensions of worry, compromising diet quality, and reduced food quantity appear to be common across cultures and languages (Coates et al. 2006).

To validate the FIES data, the FAO uses an approach borrowed from Item Response Theory, specifically the one parameter logistic model known also as the Rasch Model (Rasch 1960), considering the individual's severity of food insecurity to be a latent trait (Nord et al. 2016). The observable conditions that are assumed to be caused by the latent trait are the basis of the FIES survey module. A scale of food insecurity severity (Rasch 1960) is estimated for *each country*, based on the patterns of responses received, with each question in the survey module, as well as each respondent surveyed, located along the same scale. When the FIES data pass a statistical test of fit to the Rasch model's assumptions (Rasch 1960), an individual's food security status can be determined by summing the affirmative responses (i.e., the "raw score"), which provides an ordinal measure of severity. However, because each application of the FIES module results in a unique scale, two individuals from different places with the same raw score may not, in fact, have a truly similar severity of food insecurity. To achieve precise comparability of prevalence rates of food insecurity, application of the Rasch model produces the respondent parameter, which is the level of severity along a continuous scale that is associated with each raw score. Then, standard thresholds used to classify individuals into categories of food insecurity are mapped from a global reference scale onto the country's scale to place them on the same metric

of severity, a process called "equating." Respondents are then assigned *probabilistically* to classes of food insecurity severity in order to calculate rates of food insecurity at different levels of severity. In this paper, we recognize the importance of equating and the probabilistic approach for achieving comparable prevalence rates, yet have adopted the *raw score* cut-offs most closely approximating to the more precise thresholds along the continuous scale described above: raw scores 0–3 = food secure to mild food insecurity, 4–6 = moderate food insecurity, and 7–8 = severe food insecurity. This decision was made for its improved interpretation of coefficients in regression models. Additionally, data from the Sub-Saharan African countries analyzed here have been previously validated and shown to pass the tests of adherence to the Rasch model. Furthermore, due to the wide distribution of "true" food insecurity severity estimated around respondents with raw score 1 (those who answered "yes" to only one out of the eight FIES questions), there is a high risk of misclassifying someone with this raw score as incorrectly either "food secure" or "mildly food insecure." Therefore, we have opted to combine these respondents at the less severe end of the scale as "food secure or mildy food insecure" (FAO 2016). For this study, we used GWP data from 2014 for Sub-Saharan Africa. The choice of the 2014 wave was dictated by the objective of maximizing coverage in terms of variables of interest. In addition to covering more countries for the core variables of interest, i.e. FIES and international migration data, this year has also high coverage for the other control variables of interest, including gender, age, education, marital status, household size and composition, personal religious belief, social relations (network effect) and area of residence (rural or urban). Other socio-economic control variables included were personal income and employment status, as well as personal views on the quality of available services such as water, healthcare and education. For the complete list of these variables, detailed as they are in the GWP and with their summary descriptive statistics in the selected sample, see Table 1. The original subset of 2014 data for Sub-Saharan Africa contained 36 countries and 36,044 individuals. Cases with missing data, "don't know," or "refused" to answer for any of the variables included in our model were omitted from the analysis. Owing to significant missing data (entire variables), Liberia, Sierra Leone, Somalia, and Botswana were dropped, leaving 32 countries in the analytical sample. It is also important to note that coverage issues were present for Madagascar, Mali, Somalia, Sudan, and South Sudan, meaning that estimates for these countries may not be nationally representative. The reduced dataset used for the analysis included 29,492 cases. In Table 1, the summary statistics are presented for the full analytical sample, for the share of respondents desiring to migrate, for the share of respondents planning to migrate, and for the share of respondents making preparations to leave (our proxy for a migration decision). In the analytical sample, about 27.9% answered that they would move to another country if they had the opportunity. The share differs widely across countries in the sample, from 11.4% in Madagascar to 59% in the Democratic Republic of the Congo. Countries in our sample differed in various socio-economic and demographic indicators as well as in their policy and institutional settings, which created the fundamental incentives to migrate. However, the share of those planning to migrate to another country in the following 12 months was much lower everywhere, amounting to only 5.3% in our entire sample, while the share of those who have begun preparations to move is no more than 1.5%. This sharp decline is due to the complexity of the migration decision process, which entails a mix of individual and household considerations in addition to the

intermediate conditioning factors and the macro-factors. As international migration is costly, in both economic and psychological terms, only smaller proportions of those desiring to migrate under ideal conditions would be able to overcome the constraints that impede them from actually moving. Although this declining trend along the migration process is universal in our sample, the shares do not decline equally. For example, the Democratic Republic of the Congo has the highest share of those desiring to migrate in the full sample, but the highest share of planning (within those desiring to migrate) is observed in Togo (40.7%), which comes sixth in terms of desire. By the same token, among those planning to migrate, the share of those deciding to migrate is highest in Cameroon (75.0%), a country that comes twelfth in terms of desiring to migrate (29.1%) and twenty-ninth in terms of planning to migrate (10.3%). Based on our conceptual framework, these differences are explained not only by differences in individual and household characteristics within and among countries, but also by differing intermediate conditioning factors and macro differentials within and among countries. Table 1 also shows an interesting trend in our core independent variable, food insecurity, in relation to the four samples. Looking at the categories with severe (moderate) food insecurity, defined as FIES raw score of 7–8 (4–6) in the full sample, 29.9% (22.4%) were severely (moderately) food insecure, but this proportion increased to 33.1% (23.9%) among those desiring to migrate, highlighting the potential importance of food insecurity as a motivation to migrate towards better opportunities. Among those who have actually decided to migrate, the proportion of severely (moderately) food insecure dropped to 23.6% (19%). In other words, when moving from the full sample to only those desiring to migrate, the proportion of food insecure goes up, but this proportion decreases noticeably if the sample is further restricted to those actually deciding to migrate. In this respect, the patterns observed in Table 1 are in line with our conceptual understanding: among those desiring to migrate, the "worse-off," are less able to shoulder the costs of an international move. The basic premise is that food insecurity should cause outmigration in search of better opportunities, but outmigration will only occur when potential migrants (those desiring to migrate) can overcome the constraints to migration and cover the associated costs. This leads us to the following proposition: high levels of food insecurity are expected to have a strong and positive impact on the desire to migrate. However, as high levels of food insecurity reflect economic hardship, their relationships to the final decisions (taking actual preparations to migrate) and on intermediate steps (planning to migrate) may be weaker. The profile differs also in terms of other variables, when moving between the full sample and the sub-sets of those who *desire* and those who are *planning*. To highlight a few key differences (shown also in Table 1), while a higher proportion of males desire to migrate, this gender gap widens even further as respondents progress along the migration decision process, with 56.4% of those desiring to migrate, 57.2% of those planning, and 59.8% deciding to migrate being male. We also see that the profile of the sample changes according to area of residence, with the proportion of urban residents increasing along the migration decision process. Compared with 24.3% urban in the full sample, 41.0% of those deciding to migrate come from urban areas. A similar trend can be observed with regard to educational attainment: as the education level of the sub-sample of people deciding to migrate is markedly higher (12.6% with tertiary levels) than in the full sample (4.2%) or in preceding stages along the decision process. There is a strong increase in the proportion of people with support available abroad, as one moves

along the stages towards a decision to migrate: 83.1% of those ultimately deciding to move have someone they can count on in another country, compared to only 39.3% in the full sample. Access to the internet is also seen to rise, as 30.0% of those deciding to migrate are able to access resources online, while only 13.0% of the full sample are.

Table 1: Descriptive statistics for the variables of interest for the full analytical sample (n= 29,492 after cleaning), and for sub-samples resulting from affirmative answers to the three migration questions: desire, planning and preparations

Variable		**Response/unite of measurement**	**MEAN ± SD or Number (%)**			
			Full sample	***Share desiring to migrate***	***Share planning to migrate***	***Share deciding to migrate***
Dependent	Migration desire	Yes	27.9	100.0	100.0	100.0
	Migration plans	Yes	5.3	19.9	100.0	100.0
	Migration decision	Yes	1.5	5.6	28.1	100.0
Focal Independent variable	Food secure to mild food insecurity	0-3 in FIES raw scores	47.6	43.0	44.3	57.4
	Moderate food insecurity	4-6 in FIES raw scores	22.4	23.9	22.4	19.0
	Severe food insecurity	7-8 in FIES raw scores	29.9	33.1	33.3	23.6
	Area of residence	Urban	24.3	30.4	35.1	41.0
		Rural	75.7	69.6	64.9	59.0
	Gender	Male	51.1	56.4	57.2	59.8
		Female	48.9	43.6	42.8	40.2
	Age	Years	34.6 ± 15.2	28.9 ± 11.7	29.4 ± 11.2	30.5 ± 11.1
	Marital status	Not partnered	48.1	60.0	60.2	60.0

	Partnered	51.9	40.0	39.8	40.0
Children under 15y in household	Number	2.2 ± 2.2	2.2 ± 2.2	2.2 ± 2.3	.89 ± 1.9
Adults over 15y in household	Number	3.2 ± 1.9	3.3 ± 3.1	3.5 ± 2.2	3.6 ± 2.0
Household size	Number	5.4 ± 3.2	5.4 ± 3.3	5.6 ± 3.5	5.2 ± 3.2
Employment status	Unemployed/out of workforce	42.8	39.0	34.8	33.1
	Part time employment	36.0	34.6	34.9	37.6
	Full time employment	21.2	26.4	30.3	29.3
Educational attainment	Elementary or less	54.8	41.3	39.0	29.5
	Secondary	41.0	53.5	53.2	57.9
	Tertiary	4.2	5.3	7.8	12.6
Per capita household income	International Dollars	1493.4 ± 4308.9	1474.9 ± 4051.1	1554.4 ± 3945.9	2233.8 ± 5751.6

Control independent variables

Variable	**Response/unite of measurement**	**MEAN ± SD or Number (%)**			
		Full sample	***Share desiring to migrate***	***Share planning to migrate***	***Share deciding to migrate***

Continue.. Control independent variables	Access to the internet	Yes	13.0	15.8	17.8	30.0
	Importance of religion	Yes	93.1	93.2	92.7	91.0
	Support from abroad	Yes	39.3	48.1	64.1	83.1
	Satisfaction with healthcare	Yes	39.8	35.9	33.6	40.5
	Satisfaction with access to water	Yes	53.4	50.0	49.2	51.4
	Satisfaction with education system	Yes	53.2	46.9	43.8	46.7
	Satisfaction with city overall	Yes	59.4	46.2	44.4	51.0
	Satisfaction with standard of living	Yes	40.6	35.2	36.0	45.7

Source: authors' elaboration on GWP dataset (reference year: 2014)

Methods: empirical operationalization of the migration decision process

Based on the conceptual framework laid out in Section 2, combined with the data available as described in the previous section, we used three econometric equations to measure the impact of food insecurity status, as measured by FIES, on the international migration decision process. First, we consider the *desire* to migrate to be the first step of the process. Based on whether respondents desire to migrate or not, they will or will not be included in the following step, as the subsequent question on planning to migrate within the following 12 months is asked only to those desiring to migrate. The planning question captures an important step towards migration since it focuses on the presence of planning with a close and defined time-frame. Only the third question gets very close by referring to preparations for the move. This is why we consider it a proxy of the imminent *international migration decision*[6]. Our principal hypothesis is that the level of food insecurity is

[6] By "decision," we mean that a person has decided to migrate as she/he has taken preparations to implement the decision. However, we do not mean that actual migration has taken place as we do not have data on whether the decision has been

central to people's attitudes towards migration. *People may desire to migrate because they suffer from severe food insecurity or simply because they fear worsening of food security conditions* due to factors that may be beyond their direct control. However, although food insecurity at the individual and household levels can be a strong incentive to migrate, we learn from the framework laid out above that it is far from being sufficient. *As migration is costly and as those who suffer from severe food insecurity are found among the poorest, food insecure people may not be able to migrate due to lack of resources*, both economic and otherwise, to cover migration costs and overcome other constraints. People first desire or not desire to migrate. Once people do not desire to migrate they are excluded from the potential migrants' pool (people placed outside the ovals in Fig. 1), and by default they will not consider migration planning or preparations. Only those desiring to migrate in the first place will consider planning to do so within a given time-frame. By the same token, once people plan to migrate, they may later decide to go through with the plan, or not. Consequently, when studying what drives the migration decision, only those planning to migrate should be considered. In brief, the operationalization of the conceptual framework requires using three econometric equations, where the sub-samples examined in the second and the third equations are the results of responses provided to the first and the second questions, respectively. The independent variables in the three equations to be estimated are the same; they only differ in the dependent variable and the sample of data they analyze. Therefore, we examined the role of food insecurity in international migration *desire* and subsequent migration *planning* and *decision*, of both women and men from 32 developing countries located in Sub-Saharan Africa, the region where the prevalence of food insecurity is the highest globally and has worsened in recent years (FAO et al. 2017). We estimate the following three equations independently of one another, where the three binary variables are regressed on the individual food insecurity status controlling for a set of variables that are widely acknowledged in the literature to affect the migration decision process.

$$M.D_{ic} = B0 + FS_{ic} + X_{ic} + V_c + e_{ic} \quad (1)$$

$$M.P_{ic} = B0 + FS_{ic} + X_{ic} + V_c + e_{ic} \quad \text{when } M.D_{ic} = 1 \quad (2)$$

$$M.Dec_{ic} = B0 + FS_{ic} + X_{ic} + V_c + e_{ic} \quad \text{when } M.P_{ic} = 1 \quad (3)$$

Where, $M.D_{ic}$, $M.P_{ic}$ and $M.Dec_{ic}$ represent *international migration desire, international migration planning and international migration decision*, respectively of an individual *i* who lives in country *c*. FS_{ic} represents the food insecurity status taken from the FIES.

X_{ic} represents the individual characteristics of the individual *i* in country *c*, while V_c indicates the macro variables that differ by country, represented by dummy variables per country. Regressors included in X_{ic} are

successfully implemented or not. So, people who decided to migrate in this paper cannot be equated with migrants who already moved from their areas of origins.

individual socio-economic and demographic characteristics such as gender, age, age squared[7], education, marital status, number of children in the household and household size, the importance of religiosity, whether the individual has a friend or relative living overseas (network abroad) and area of residence (rural or urban). Other socio-economic controls include personal income (log of income in International Dollars as reported by GWP) and employment status. To account for people's perceptions of the quality of available services, we use a series of questions asking about whether respondents are satisfied or not regarding the local education and healthcare systems, standard of living, access to water, and city or area of residence. For a summary description of the variables whose data are taken from GWP, see Table 1 above.

The three equations were estimated with standard errors clustered at the country level by means of logit regression techniques, using country fixed effects to account for any country-specific differences that were not observed.

Results and sensitivity analysis

The regression results, as shown in Table 2, which show the results of the regressions for migration desire, migration planning and migration decision, confirm that food insecurity is a significant determinant of the decision process of international migration in Sub-Saharan Africa. Results given for migration desire are average marginal effects estimated by regressing the migration desire binary-choice variable on the independent variables using the full sample data. However, the results for migration planning (migration decision) are conditional average marginal effects estimated by regressing the migration planning (migration decision) binary-choice variable on the independent variables, using the sub-sample of those who answered "yes" to the question of migration desire (using the sub-sample of those who answered "yes" to the questions of migration desire and migration planning). We performed a series of sensitivity tests to evaluate the robustness of the results, examining the possible impact of various macro-level factors and shocks on the relationship between food insecurity and the migration decision process. We found that the relationship between food insecurity and migration variables was robust. The magnitude and significance of the food insecurity coefficients remained unchanged. For details on the sensitivity analysis, refer to Appendix 1. We also tested for multi-collinearity among the explanatory variables. Although age and age-squared seemed to have high degrees of multi-collinearity in the full sample, they did not affect the robustness of the results. For details of the multicollinearity tests, refer to Appendix 2.

Migration desire

The results in column 1 suggest that food insecurity has a statistically significant and positive impact on migration desire. The food insecurity variable is associated with a significant increase in the probability of migration desire as the magnitude of the marginal effect increases with the severity of food insecurity. In other

[7] We include *age-squared* as a regressor in addition to *age* to account for the non-linear relationship between age and migration. This is because migration literature has already established that younger people more likely to migrate than older people.

words, having moderate food insecurity increases the probability of desiring to migrate by 3.9% compared to those who are food secure or are only mildly food insecure. Furthermore, the probability of desiring to migrate increases to 5.2% for people experiencing severe food insecurity. These results indicate that greater severity of food insecurity is one of the key push factors in Sub-Saharan Africa that leads to increased desire to migrate internationally in search of better economic opportunities. We also found evidence that area of residence was significantly associated with the desire to migrate internationally. Being a rural resident decreases the probability of desiring to migrate by 5% compared to an urban resident. This can be explained by the fact that generally rural people are less aware of opportunities in other countries. In addition, many rural people are involved in agriculture, the economic activity most attached to land, and consequently less mobile, making it a pull factor that decreases people's desire to leave their areas of residence. Other individual and household characteristics seemed to significantly influence international migration desire, which was also dependent on marital status, education level and age. Being married was associated with a 4.9% percentage point lower probability of desiring to migrate, compared to being single. Having post-secondary education was associated with a 5.9% percentage-point higher probability of intending to migrate, compared to having only elementary education but this probability increased to 7.9% for those who had obtained tertiary education. In addition, the probability of migration desire decreased by 0.4% for each year an individual ages. Social networks seem to play a very influential role in determining international migration desire. Perception of the availability of help from outside the country was associated with a 10.2% percentage-point higher probability of desiring to migrate, suggesting that access to networks in destination countries was the most influential factor in determining migration desire. This result supports previous research on the importance of migrant diasporas in lowering the information, assimilation, and adaptation costs of potential migration.

Table 2. Average marginal effects and conditional average marginal effects from three binary-choice econometric equations

Variables	**Migration desire**	**Migration planning**	**Migration decision**
Moderate Food insecurity	0.039****	-0.013	-0.069**
	(0.050)	(0.090)	(0.200)
Severe Food insecurity	0.052****	0.017	-0.096***
	(0.050)	(0.090)	(0.20)
Rural area	-0.050****	-0.028**	-0.020
	(0.050)	(0.070)	(0.100)
Age	-0.004***	0.007****	0.003**
	(0.009)	(0.010)	(0.007)
Age squared	-0.000	-0.000****	0.000
	(0.000)	(0.000)	(0.000)
Gender male	0.050****	-0.010	0.017
	(0.040)	(0.060)	(0.100)

Log household income	0.020***	-0.002	0.002
	(0.040)	(0.080)	(0.200)
Married or domestic partner	-0.049****	-0.016	0.010
	(0.040)	(0.080)	(0.200)
Employed part time	0.020**	0.020	0.020
	(0.050)	(0.080)	(0.200)
Employed full time	0.059****	0.038***	0.008
	(0.050)	(0.080)	(0.200)
Number of children	-0.002	0.020	0.050
	(0.010)	(0.090)	(0.200)
Number of adults	0.003	0.002	-0.007
	(0.050)	(0.050)	(0.100)
Household size	0.005****	0.002	0.001
	(0.007)	(0.010)	(0.030)
Secondary education	0.059****	0.021*	0.019
	(0.040)	(0.080)	(0.200)
Post-secondary education	0.079****	0.056**	0.080
	(0.100)	(0.140)	(0.300)
Importance of religion	-0.008	-0.013	-0.075
	(0.070)	(0.130)	(0.200)
Support from abroad	0.102****	0.120****	0.190****
	(0.040)	(0.080)	(0.200)
Internet access	0.027**	-0.003	-0.026
	(0.072)	(0.100)	(0.200)
Variables	**Migration desire**	**Migration planning**	**Migration decision**
Satisfaction with education system	-0.021***	-0.018*	-0.012
	(0.003)	(0.070)	(0.100)
Satisfaction with access to water	-0.010	0.001	0.007
	(0.040)	(0.070)	(0.100)
Overall satisfaction with city or area of residence	-0.095****	-0.017	0.009
	(0.040)	(0.070)	(0.100)
Satisfaction with healthcare	-0.004	0.002	0.028
	(0.040)	(0.080)	(0.100)

Overall Satisfaction with standards of living	-0.020***	0.013	0.055**
	(0.040)	(0.080)	(0.100)
Pseudo-R-squared (Conditional)	0.270	0.140	0.220
Number of observations	29,492	7,732	1,525

Notes: Coefficients are average marginal effects for migration desire, and average conditional marginal effects for migration planning and preparations (decisions). Standard errors are shown in parentheses. Each equation includes country fixed effects.

***** Significant at the 0.1 percent level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.*

Migration planning

In the pool of those desiring to migrate, food insecurity's association with planning to migrate internationally is ambiguous, as shown in the second column of Table 2. The relationship is positive for those experiencing severe food insecurity and negative for those having moderate food insecurity, but it is statistically insignificant in both cases. Planning to migrate to another country in the following 12 months entails a serious consideration of international migration as a viable option to seek better opportunities. It is different from desiring to migrate in the very sense that it implies dedication to take action to achieve the move. With reference to the conceptual framework detailed in Section 2, this move involves active interaction with the conditioning factors that shape the capacity of people and their access to the resources needed to cover migration costs, which are usually high for international migration. In summary, food insecurity is a determinant of migration desire, but seems to have no clear association with migration planning, an action that is perhaps better explained by other factors. As the results indicate (in the second column of Table 2), social network effect seems to be the most important determinant of migration planning, the probability of which increases by 12% due to support from abroad. Planning to migrate entails looking for information on job opportunities, housing, basic rights, and overall life conditions in the potential destinations, all requiring a reliable source of information. In addition, migration is costly and risky, and therefore, the presence of a reliable network in the potential destination is essential in managing and coping with the risks and the uncertainties associated with the eventual migration. Another determinant factor in planning for international migration is the level of education, which also has a significant role in migration desire. For planning, the results show that having a secondary education would increase the probability of migration planning by 2.1%, compared to those with lower levels of education. The probability further increases to 5.6% for those having post-secondary education. It is worth noting that the marginal effects of education are greater for migration desire than for migration planning. In the latter case, the marginal effect increases more disproportionately when moving from secondary to post-secondary education. This indicates that the level of education matters more for migration planning than for migration desire. In the case of

migration desire, higher education would imply higher ambition to be achieved through migration. However, for migration planning, higher education implies higher capacity to collect information and find opportunities.

Migration decision

Column 3 in Table 2 shows the regression results for the determinants of migration preparations already undertaken for the international move (i.e. migration decision proxy), among those already planning to migrate. They suggest a negative and significant relationship between food insecurity and migration decision. The results present evidence that the level of food insecurity also matters when it comes to deciding to migrate. For example, being moderately food insecure decreases the probability of the decision by 6.9% compared to those with mild or no food insecurity, but having severe food insecurity decreases this probability by 9.6%. Several observations emerge from looking comprehensively at Table 2. There are two variables that are significant for migration desire (the start of decision process) and migration decision (the end of the process) but not for migration planning (the transitional phase). Those with more severe food insecurity are less likely to decide to migrate, as food insecurity is associated with lower access to resources needed to cover migration costs. This is supported by the coefficient of satisfaction with standard of living, which is positively and significantly associated with higher probability to decide to migrate, indicating that those who can migrate and decide to do so are not from the poorest segment of the society. Food insecurity is also positively associated with migration desire, indicating that the more food insecure have higher probability of wanting to move. Furthermore, satisfaction with one's standard of living is negatively associated with migration desire, indicating that those who are less satisfied are more likely to desire to migrate. Note that neither of these variables have strong associations with migration planning. Age and the presence of support abroad were significant for migration decision, and are the only two factors that are significant determinants in all three stages of the migration process. Age coefficients are negative for migration desire indicating that younger people are more likely to desire to migrate in line with the general literature finding that migrants are younger than non-migrants. However, age coefficients become positive for migration planning, which seem to contradict the literature. One possible explanation is that the bulk of the old people was excluded, leaving the sub-samples dominated by younger people. In the pool of these younger people who already desire to migrate, age plays a positive role reflecting higher capacity to overcome constraints to plan and prepare for the move. However, this needs further exploration which is beyond the scope of this paper. Support from abroad is not only significant for all three steps, but its coefficient increases as we move from desire (10.2%) to planning (12%) to preparations (19%). It is worth mentioning that, although not revealed by the results, support from abroad may be playing various roles in the process. In the migration desire phase, it is plausible that support from abroad functions as a channel of aspiration where successful stories coming from emigrants may create an incentive to migrate or enhance an existing one, thus strengthening the desire to migrate. In the planning and decision phases, it may become a source of reliable information needed to confront various options needed for concrete migration planning, and it may also represent a security asset on which the potential migrant could count when the migration decision is at stake. Several variables such as education, area of residence, gender, household

income, marital status, employment status and household size, seem to have no significant effect on the decision to migrate, having played a significant role in migration desire, while some of them were significant also in planning, such as education and employment. However, as their signs are similar across the three steps, the sample size, which becomes smaller and smaller once we move further into the decision process, is likely an important factor explaining their lack of significance in the third step. The complexity of migration determinants and the way in which they interact in affecting the decision-making process was highlighted in the conceptual framework (Fig. 1). While the operational model has highlighted solid insights into the role of food insecurity and other factors in shaping peoples' perceptions and actions towards international migration, there may still be a range of other relevant factors that are not captured by the empirical model.

Conclusions and policy implications

In this paper, we focused on studying the role of food insecurity in the decision processes of peoples in Sub-Saharan Africa to undertake international migration, a topic that is still understudied in the migration literature, which focuses much more on other determinants, such as household income, education, and social networks. This study contributes in various ways to the migration debate. Using a three-stage conceptual framework that examined individual migration desire, planning and decision, we provide evidence that the relationship between food insecurity and migration is strong and significant. However, the nature of this relationship depends upon the severity of food insecurity, which reflect the overall economic wellbeing of households and individuals, and on the stage of the migration decision process. We demonstrate that the relationship between food insecurity and migration desire was positive: food insecurity increased migration desire, and to a greater extent as the severity of food insecurity increased. However, we found that the relationship between migration decision and severe food insecurity was negative. This evidence is in line with the microlevel determinants of the mobility transition and shows that migrants are generally neither the poorest nor the richest segments of a society. The richest do not have the incentive to migrate in the first place, while the poorest, although they have strong incentives to move, are not able to do so due to lack of resources needed to cover necessary migration costs. Food insecurity is, therefore, an important push factor in the desire to migrate internationally. However, it can serve as a deterrent when it comes to making migration decisions, as food insecurity can make households hesitate to incur expenses associated with migration preparation. The net outcome on migration of worsening food security will depend on the counterbalancing effects of the increasing desire to migrate versus the constraints faced by the food insecure to migration. In this paper we limit ourselves to highlighting that food insecurity is a significant and robust determinant of both desiring to migrate and the final migration decision, but we do not quantify the net outcome. We propose this as an interesting area of potential future work that was beyond the reach of this analysis, and that such an investigation of net effect will entail certain challenges related to two factors: (i) the net impact on migration of food insecurity being small due to the counterbalancing impacts on desire versus the decision to migrate, and (ii) when trying to estimate the determinants of the migration decision directly from the overall population, bias is introduced into the estimates due to the decision to migrate being a rare event in the overall sample (1.5% of full sample).

Addressing these challenges to provide robust estimates of the net impact of food insecurity is the logical next step after having established that food insecurity is indeed a determinant of migration processes in Sub-Saharan Africa. Even with the limits highlighted, the findings of this paper are still relevant for informing policy, given the recently increased attention to international migration and the worsening global conditions regarding food security. They point to the importance of migration as a fundamental livelihood strategy that households use to hedge against uncertainties and cope with risks, and highlight the fact that it is often not viable for the food insecure. The poorer segments of developing societies do frequently use migration for survival. However, the food insecure, who are the poorest, usually migrate only for short distances as they cannot afford international migration costs. Thus, removing migration constraints, including financial ones, could be an effective tool for improving food security. One policy message that can be drawn from our results is that removing or reducing constraints to migration will benefit the poorest/most food insecure segments of any society, by enabling migration. Bilateral and multi-lateral agreements on trade and economic cooperation, including development aid, should recognize this strong relationship between food insecurity and international migration. They can serve as first platforms to incorporate organized migration schemes across countries that are to the benefits of both potential migrants from lower income countries and the more developed ones, usually in need of agricultural labour even if only seasonally.

Appendix 1: Sensitivity analysis

We performed a series of robustness and sensitivity tests on the results to examine the possible impact of various macrolevel factors and shocks on the relationship between food insecurity and the migration decision process. Macro-level factors can influence migration decisions in a given country due to the inverse U-shaped relation between a country's level of development and migration as mentioned earlier. Migration rates from poor and rich countries tend to first increase and then decrease with economic development (UNDP 2009). To control for this relationship, we included the UNDP Human Development Index (HDI), which captures three dimensions that are highly pertinent to the level of development: the GDP per capita, life expectancy at birth and the level of education. However, since the relationship between the level of development and migration flows is not linear but rather takes an inverse U-shape, we added HDI-squared to account for this non-linearity. Some political conditions also matter and may substantially affect the desire, and the subsequent decision, to migrate or to stay. Protracted crises, as mentioned in the conceptual framework, influence migration determinants at all levels. This is the case for fragile and conflict-affected countries where, in addition to direct physical threat, the socio-economic differentials between areas of origin and those of potential destinations start to widen dramatically. In addition, crises reduce opportunities and worsen services in the area of origin. As a consequence of the impacts of the crises on migration determinants, the pool of potential migrants (those desiring to migrate) increases, and ultimately, migration outflows increase as well (FAO 2018). We used the data from FAO et al. (2017) to classify the countries in question into countries facing crises or otherwise using a binary variable. Table 3 show the results of the sensitivity analysis. We first tested the results by adding only HDI and HDI_squared (columns 1), then we tested by adding only the conflict dummy (columns 2). Lastly, we tested the model by adding both macro variables, i.e. HDI, HDI squared and the conflict dummy (columns 3). The results show that including these macrolevel control variables did not alter the relationship between food insecurity and migration. Therefore, in all robustness and sensitivity checks, we found that the relationship between food insecurity and migration behaviour was robust. The magnitude and significance of the food insecurity coefficients remained within a very narrow range. Consequently, the results regarding the role of food insecurity in the migration decision process can be claimed to be robust across model specifications and samples.

Table I. Effects of macro level factors

	Migration desire			Migration planning			Migration decision		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Moderate Food insecurity	0.039***	0.039***	0.038***	-0.013	-0.014	-0.013	-0.071	-0.069	-0.074*
	(0.05)	(0.05)	(0.05)	(0.1)	(0.1)	(0.09)	(0.2)	(0.2)	(0.2)
Severe Food insecurity	0.052***	0.052***	0.052***	0.017	0.016	0.018	-0.1*	-0.1*	-0.1**

	(0.06)	(0.06)	(0.06)	(0.1)	(0.1)	(0.09)	(0.2)	(0.2)	(0.2)
Support from abroad	0.1***	0.1***	0.1***	0.1***	0.1***	0.1***	0.2***	0.2***	0.1***
	(0.04)	(0.04)	(0.04)	(0.09)	(0.09)	(0.07)	(0.2)	(0.2)	(0.2)
HDI	0.4		0.78	-2.04		-2.1	4.3 .		5.4**
	(9.1)		(9.3)	(9.3)		(11)	(0.1)		(9.4)
HDI squared	-0.4		-0.68	1.5		1.6	-3.5 .		-4.3**
	(8.1)		(8.2)	(8.3)		(9.8)	(9.9)		(8.3)
Conflict		0.02	0.03		0.03	-0.01		0.01	0.09*
		(0.2)	(0.25)		(0.3)	(0.2)		(0.3)	(0.2)

Appendix II: Tests of multicollinearity

We tested for potential multi-collinearity between the explanatory variables in the three regressions using Variance Inflation Factors (VIF). Results of the test are reported in Table II. This index quantifies the extent of correlation between any explanatory variable with other explanatory variables in a model. Higher values indicate that it is difficult and sometimes impossible to assess accurately the contribution of the relevant explanatory variable in predicting the dependent variable. The results of the test show that, in our model, only the age variables (age and age squared) have high degree of multi-collinearity, but only in the full sample which is the one used to assess migration desire. The fact that they are the only two variables with high VIF means that age and age-squared are correlated with each other but not with any of the other explanatory variables. Therefore, we tested the model again by re-running the regression for migration desire after dropping the variables age and age squared from the explanatory variables. We find that no significant changes occurred due to omitting these two variables as shown in Table III.

Table II. Variance Inflation Factors for the explanatory variables of the three logit regressions

Variables	**Migration desire**	**Migration planning**	**Migration decision**
FIES	1.2	1.2	1.2
Residence	1.1	1.1	1.1
Age	29.2	1.3	1.3
Age squared	27.5	1	1.0
Gender	1.1	1.1	1.1
Log household income	1.6	1.6	1.6
Married or domestic partner	1.4	1.4	1.4
Employ	1.2	1.1	1.1
Number of children	1.1	1.6	1.7
Number of adults	1.1	1.1	1.2
Household size	1.3	1.7	1.9
Education	1.2	1.2	1.2
Importance of religion	1.0	1.01	1.0
Support from abroad	1.1	1.1	1.0

Internet access	1.0	1.0	1.0
Satisfaction with education system	1.2	1.2	1.3
Satisfaction with access to water	1.1	1.1	1.2
Overall satisfaction with city or area of residence	1.2	1.2	1.2
Satisfaction with healthcare	1.2	1.3	1.3
Overall Satisfaction with standards of living	1.2	1.3	1.2

Table III. Average marginal effects from the binary-choice econometric equation of migration desire after dropping age and age squared as explanatory variables

Variables	**Marginal effect**	**Variables**	**Marginal effect**
Severe food insecurity	0.044****	Secondary education	0.097****
moderate food insecurity	0.036****	Post-secondary education	0.093****
Residence	-0.049****	Importance of religion	-0.012
Gender	0.049****	Support from abroad	0.103****
Log household income	0.014*	Internet access	0.024**
Married or domestic partner	-0.105****	Satisfaction with education system	-0.021***
Employed part time	0.024***	Satisfaction with access to water	-0.008
Employed full time	0.077****	Overall satisfaction with city or area of residence	-0.108****
Number of children	-0.002	Satisfaction with healthcare	-0.004
Number of adults	0.003	Overall Satisfaction with standards of living	-0.012
Household size	0.006****		

3. Global drivers of gender disparities in access to food

Sara Viviani, Erdgin Mane, and Marinella Cirillo

Abstract

This paper aims at examining the socio-economic drivers and the evolution over time of gender differences in food insecurity from 2014 to 2018 using Food Insecurity Experience Scale (FIES) data, and provides a general understanding of the ways in which households and societies' development is affected by changes in the degree of inequality between men and women in food access. Data were collected from 2014 to 2018 by Food and Agriculture Organization (FAO) through the Gallup World Poll (GWP) for approximately 650,000 adults and analyzed using FAO methods to produce internationally comparable results. We preliminarily study the differential item functioning (DIF) of each of the FIES questions between men and women to test potential differences in the ways men and women experience similar food security patterns. The study of DIF by gender at global level is an element of novelty as far as food security experience scales are concerned. Secondly, we apply a logistic regression model to explore the magnitude of the gender gap in food security after controlling for several individual and household characteristics. Interaction terms with sex of the respondent and a set of socio-economic variables are included to assess in which contexts the gender gap is more prominent. The food security (dependent) variables are built in order to ensure cross-country and time comparability for the first time. Our results reveal that gender plays an important role in food security, and women are globally more food insecure than men. Limited women's access to income, education, work or health negatively affects household and societies development given women's role in food production and ensuring access to food. In exploring the regional patterns, higher gender gap in food insecurity was found in Latin America compared to other regions.

Keywords: Food Insecurity Experience Scale; Gender gap; Food access; Intersectionality; Regional and global patterns

Introduction

FAO (Food and agriculture organization of United Nations) global report on food security and nutrition (SOFI, 2019) shows that, food insecurity has been increasing in the recent years and almost in every continent, women are more likely than men to be affected by food insecurity.

Although there is an extensive literature on gender disparities, most gender studies – apart from a few exceptions presented later below – haven't so far considered gender gap in food insecurity.

The study of gender differences in food security remains extremely important nowadays. Despite variation in the findings, an imbalanced food access is acknowledged as having noticeable impacts on household and societies' development. Women contribute to one half of the world's food production and up to 80% of the food production in developing countries (Ivers & Cullen, 2011). On the other hand, their' s food security is positively linked with their health status (Alderman and Garcia, 1994; Seligman et al., 2010), wellbeing (Jaron

& Galal, 2009), and nutritional outcomes of children (See Maitra, 2018 for a detailed review). According to Tarasuk (2001), women in households characterized by food insecurity with severe or moderate hunger have lower intakes of vegetables and fruit, and meat and alternatives than those in households with no evident hunger.

In many societies, women traditional role includes working on the family plot, tending small livestock, gathering fuelwood, fetching water, and processing food and preparing meals (Ibnouf, 2011; Tibesigwa et al, 2016). However, they reach these results despite unequal access to land, to income, to inputs and information (Quisumbing et al,1996).

Instead, when women's incomes rise, they tend to invest more in the nutrition, education, and health of their families, triggering spill-over effects that benefit entire communities and improving food security. To the best of our knowledge, the previous work on gender differences in food insecurity focused mostly on food consumption and food intakes (Prattala et al, 2016; Backstrand et al,1997). In this context, it is important to highlight how the concept of food insecurity only partially overlaps with that of monetary poverty. Several studies (see for instance Atkinson, 2003; Foster, 2007; Battiston et al, 2013) frame access to food as one dimension of poverty, along with education, access to health services, access to social security, shelter characteristics, access to basic services, and level of social cohesion. As a consequence, not necessarily population with sufficient income have access to food of good quality, being other factors such as social networks key elements for proper and continuous food security. In addition, most of the existing literature focuses on the role of women and gender equality in achieving food security (Agarwal, 2013; Asian Development Bank, 2013; Garcia & Wanner, 2017; FAO, 2017), but limited evidence (see Broussard, 2019) is specifically developed for the gender gap in food security. Food insecurity, defined as the lack of reliable access to sufficient quantity of safe and nutritious food[8] 67 (FAO, 2009), has a multi-dimensional nature that led over time to a several measuring approaches. Recent studies, such as Lele et al (2016), Jones et al (2013) or Leroy et al (2015), have reviewed hundreds of different measures of food insecurity and nutrition in the available literature, concluding that most of indicators are measured at households' level (and therefore not disaggregable by specific sex groups) and based on proxy responses.

Our study is based on an individually based and self-reported indicator of food insecurity, proven to have several advantages over proxy responses (see for instance UNSD, 2019; Kilik et al, 2021), and therefore particularly suitable to study differences by gender. The present study builds on micro-data collected by the Gallup World Poll from 2014 to 2018, a full dataset of about 650 thousand individuals worldwide, as part of the Food and Agriculture Organization's (FAO) Voices of the Hungry Project, which developed an experiential measure of food insecurity called the Food Insecurity Experience Scale (FIES). The methodology to analyze FIES data is based on rigorous analytic protocol, which involves statistical validation to ensure that country-

[8] According to the United Nations' Committee on World Food Security "Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

specific data meet several measurement properties, and a calibration process to produce prevalence rates of moderate and severe food insecurity that are cross and within country comparable (see Section 3). The FIES-based indicators were included in the global SDG monitoring framework to monitor the 2030 Agenda for Sustainable Development and in particular, the Target 2.1[9].

FIES data are particularly suitable to conduct differential analysis according to social economic characteristics, like gender (when applied at individual level) and therefore to identify intersectionalities[10] in vulnerable sub-populations and geographic areas that are more affected by food insecurity.

Therefore, in an attempt to address food insecurity disparities and design policy programs it's important to shed light on the drivers explaining if and why women are more food insecure than men, by controlling for a number of socio-economic conditions. The GWP data include a vast set of socio-economic variables, such as income, education, employment, marital and health status that can be used to explore the drivers of gender gap in food security through a cross-country analysis. Gender disparities in terms of lack of opportunities for woman may have long run consequence for food insecurity (Broussard, 2019). According to Mitra et al (2015), female education contributes to improvements in children's health, reductions in fertility rates and increases in labor force participation rates, and better quality of human capital of future generations. What is the consequence of the differential access to education, economic opportunities and productive resources on gender gap in food security? In order to address the question, this paper explores internationalities and micro factors differences between men and women as possible causes of differential access to food by men and women. The analysis developed in this paper highlight the importance of socio-economic policies in reducing food insecurity through different channels of intervention. A first attempt in analyzing the gender gap in access to food and its drivers, using the FIES data collected in the GWP, is the study done by Broussard (2019), based only on 2014 data and using a non cross-country comparable measure of food insecurity.

Building on Broussard (2019) we develop an empirical analysis of the sex-disaggregated FIES data from 2014 to 2018 of more than 140 countries to explore: a) the difference between men and women in food security using a new methodology of analysis and b) the impact of gender differences of some socioeconomic variables on the food access gender gap.

Our work aims at expanding the research previously carried out (Broussard, 2019) by using a wider time interval, allowing to understand the evolution of the gender gap in accessing food over time in recent years (2014-2018). On the other hand, we adopt a new methodology of analysis to estimates comparable prevalence rates of food insecurity among men and women. In order to ensure comparability across countries, sub120 populations within the same country and over time, we adopt the FAO methodology, see Cafiero et al. (2018), to a) assess internal consistency of each FIES application, b) test potential differential behaviors of the FIES

[9] Target 2.1: "By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round" (UN General Assembly, 2015)
[10] The term intersectionality drew on Crenshaw et al.'s (1995) study – an understanding of inequalities through the overlapping of socio-economic categories such as gender, class and race

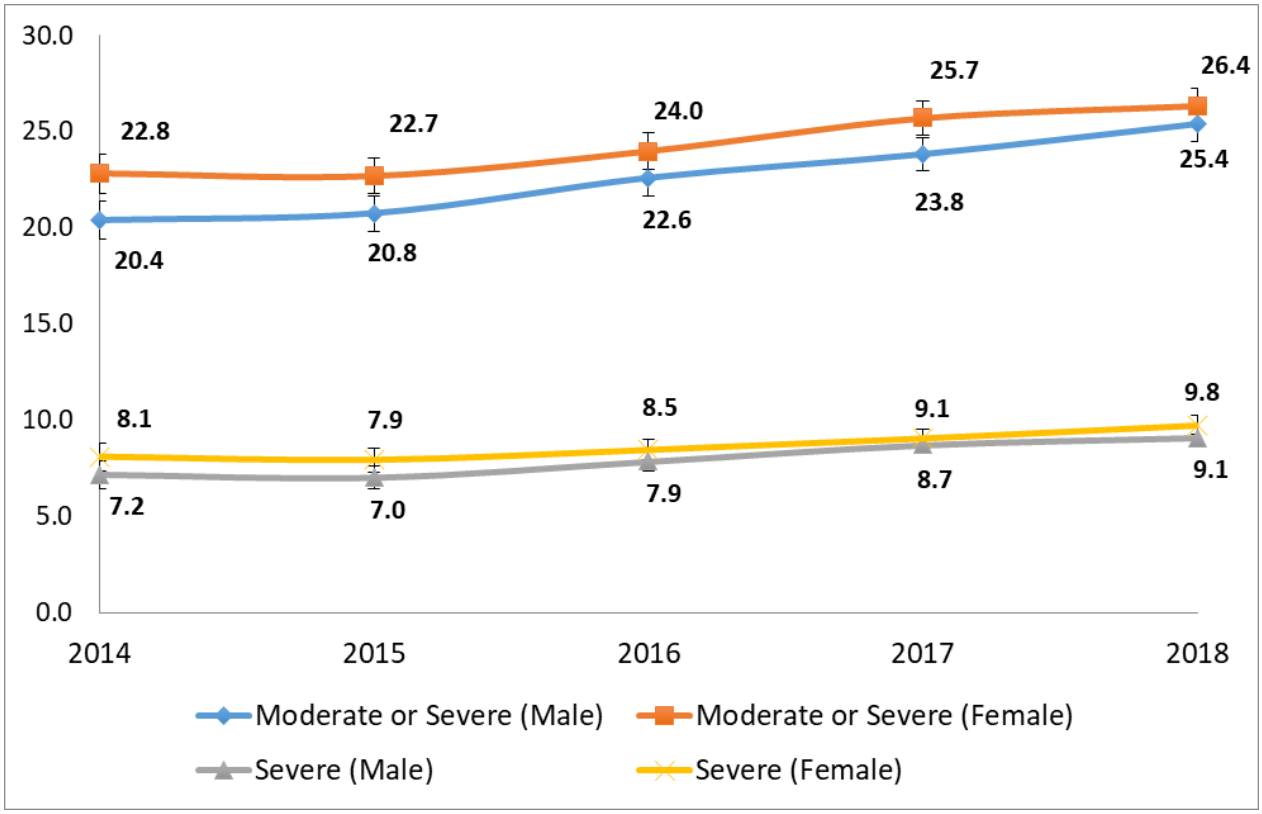
questions in different contexts (i.e. years/countries/ gender), and c) pursue a global definition of food insecurity (see FAO, 2016). The final indicators used in the analysis are expressed in terms of probability of being food insecure computed at cross-country/over-time/by gender comparable thresholds, rather than the simple sum of affirmative answers to each of the FIES questions (raw score). Finally, we give particular attention to the prelaminar study of the differential item functioning (DIF) of each of the FIES questions between men and women to test potential differences in the ways men and women experience similar food security patterns. The study of DIF by gender at global level is an element of novelty as far as food security experience scales are concerned.

This paper is organized as follows. Section 2 is devoted to present an overview on the global and regional trends of the gender gap in food insecurity levels from 2014 to 2018. Section 3 depicts a description of FIES survey module and methodology to build food insecurity variables at individual level. Section 4 presents a summary description of the data and the variables considered in the analysis and corresponding frequency tables by gender and region. In Section 5, we describe the methods to study the Differential Item Functioning (DIF) by gender and introduce the econometric models (the mixed effect logistic model with interactions) adopted to examine the role of the gender gap in determining food insecurity in more than 150 countries in the world. The results of DIF and logistic regression are described in Section 6. Finally, the last Section provides some concluding remarks and policy implication.

Recent trends and geography of the gender gap in food insecurity

This section focuses on the global and regional trends of the gender gap in food insecurity during the last five years, from 2014 to 2018. Globally, the prevalence of moderate or severe food insecurity and the prevalence of severe food insecurity is constantly higher for women, but some progress can be observed in 2018, at moderate or severe level. In contrast, the gender gap in the prevalence of severe food insecurity has been slightly rising in 2018 compared to 2017, but the observed difference remains not significant (Figure 1).

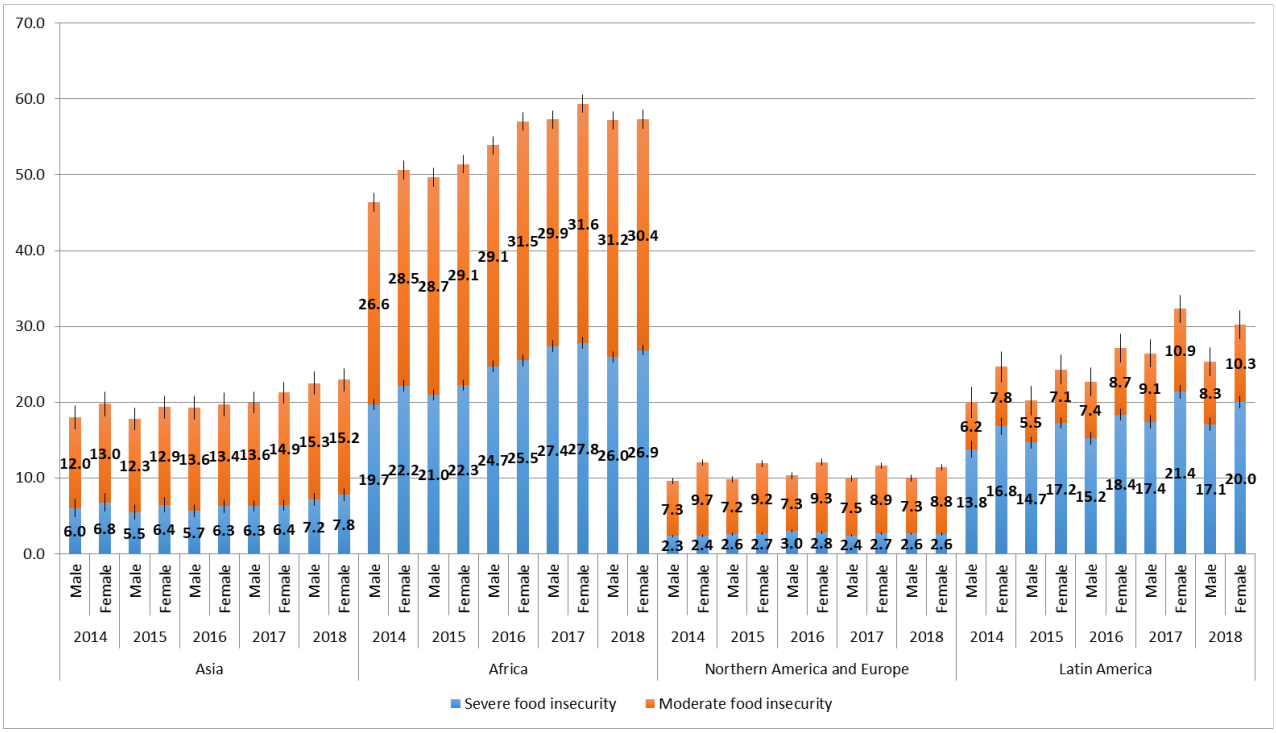
Figure 1. World evolution of gender gap in food insecurity



Source: author's elaboration

The regional level analysis conducted for both severe and moderate food insecurity confirms that women are always more food insecure than men and this is true even in North America and Europe. However, the gender gap is not always statistically significant and is larger in Latin America. It has decreased or remained stable in 2018 in all regions. Most regions show a slight progress in reducing gender differences for both moderate and severe food insecurity over time, while, in Latin America the ratio of the prevalence for women and men has remained stable around 1.2, from 2014 to 2018.

Figure 2. Regional evolution of gender gap in food insecurity



Source: author's elaboration

In the following Sections we explain in detail the methodology implemented to produce food insecurity estimates as presented in Figures 1 and 2, and we expand the trend analysis by correcting the gender gap in accessing food for a set of socio-economic individual and household characteristics.

Food Insecurity Experience-based Scale (FIES)

The Food Insecurity Experience-based Scale (FIES) measures the severity of food insecurity (i.e., inability to access adequate food, due to lack of money or other resources normally devoted to it) based on conditions and behaviors reported by responding to an 8-item questionnaire, the Food Insecurity Experience Scale Survey Module (FIES-SM; see Table 1). Dichotomous ("yes"/"no") responses data are combined to create a one-dimensional measure using the Rasch Model (see Fisher and Molenaar, 1995, and Section 2.1). The severity of food insecurity experienced by an individual or household is modelled as a latent trait—that is a characteristic not directly observable. Through the application of the Rasch model, it is possible to test whether observable conditions assumed to be a direct consequence of the latent condition and elicited in response to the FIES-SM questions, provide sufficient information to construct a proper measure.

The national prevalence rate of food insecurity beyond a specified threshold of severity is estimated based on the measured severity of food insecurity of respondents in a nationally representative sample (of individual adults reporting either only their individual experiences or also that of other members of their household). Thresholds and, thus, prevalence rates of food insecurity are made comparable across countries by calibrating the measures obtained in each different application, to a common, global reference scale. The global reference

scale is constructed using information on the severity of each of the eight items, estimated on data collected in more than 150 countries in 2014, 2015 and 2016[11].

Table 1. English version of the Food Insecurity Experience Scale Survey Module (FIES-SM)

N.	Short reference	Question wording
1	WORRIED	During the last 12 MONTHS, was there a time when You were worried you would not have enough food to eat because of a lack of money or other resources?
2	HEALTHY	Still thinking about the last 12 MONTHS, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?
3	FEWFOODS	Was there a time when you ate only a few kinds of foods because of a lack of money or other resources?
4	SKIPPED	Was there a time when you had to skip a meal because there was not enough money or other resources to get food?
5	ATELESS	Still thinking about the last 12 MONTHS, was there a time when you ate less than you thought you should because of a lack of money or other resources?
6	RANOUT	Was there a time when your household ran out of food because of a lack of money or other resources?
7	HUNGRY	Was there a time when you were hungry but did not eat because there was not enough money or other resources for food?
8	WHOLEDAY	During the last 12 MONTHS, was there a time when you went without eating for a whole day because of a lack of money or other resources?

Source: FAO

In proposing the FIES as the basis to compile an SDG indicator, FAO expects that national prevalence rates of food insecurity used for monitoring progress toward SDG Target 2.1 will eventually be based on data from national surveys conducted by national statistical agencies in each country, in accordance with the principles that govern the definition of the global SDG indicator framework by the UN Statistical Commission. To develop methods for making prevalence rates comparable across countries, however, it was necessary to process data obtained from a set of different countries as large as possible, while controlling for the survey vehicle used. To that aim, in 2013, FAO contracted with the Gallup Organization as a data collection service provider. The 8-question FIES-SM was added as a client module to the Gallup World Poll (GWP) and data

[11] The FIES global reference scale was established by using the first three years (2014-16) of the GWP data and will not change for the next years.

were collected in more than 150 countries, areas, and territories each year from 2014 to 2018. The GWP is a worldwide survey conducted annually since 2006 in about 150 countries interviewing nationally representative samples the adult population (aged 15 and older) in each country. It covers a range of topics including family economics, employment, human development, and well-being (see Gallup, 2017).

Rasch model applied to the measure of food insecurity

The Rasch model is typically applied to analyze dichotomous data coming from questionnaire administration (with possible answers being "Yes" or "No") as a function of the trade-off between a) the respondents' ability, attitude or personality trait and b) the items' (question) difficulty or severity (Rasch, 1980).

Typical application fields of Rasch model are psychometrics, educational testing, quality of life evaluation (Bond & Fox, 2015), health (Christensen & Mounir Mesbah, 2012) and, since recently, food security (Cafiero et al, 2018). Although econometrics and economics in general are still areas where its application is limited (see for instance Farcomeni et al, 2020), in principle every context in which proper measure of not directly observable phenomenon is of interest are ideal application fields for the Rasch model. Measuring a latent trait, i.e. a phenomenon that is not directly observable but only through some observable manifestations is not straightforward. Differently from what happens in natural sciences, expressing in numbers an observable phenomenon, like food insecurity, material well-being, social support, access to services, health, living standards, is quite challenging and even more challenging is developing a rigorous measurement scale capable to "express in number what we are speaking about" (Thomson, 1891). The literature on Item Response Theory (the class of models of which the Rasch model is one specification) provides an interesting approach to measure a single latent phenomenon, for example, a single dimension of poverty, or food insecurity. To be considered a proper measurement tool, the scale should satisfy some important and mandatory properties.

First of all, since the scale is a unidimensional measurement tool, only one latent trait should be involved in the response process. Only when unidimensionality is satisfied a latent trait, a single attribute or construct, can be represented by a single number line and therefore measured. Secondly, the observable manifestations (items in the response process) should contribute in an equal way to the developing of the scale, that is all items should discriminate equally between low and high level of the latent trait. This property, known as equally discrimination of the items, ensures a correct rank of the respondents conditioned on their estimated latent trait. Finally, the measurement scale should be objectivity in comparisons, making the instrument comparable and allowing for meaningful comparisons across different contexts. This property is knows as specific objectivity and refers to objectivity in measurement: the measurement tool should give the same measure irrespective to the context to which it is applied. In the Rasch model, the severity of a specific condition is assumed to be a latent trait along which each item (considered as the "observable" experience) is located. This is pursued by estimating item severity parameters from the overall pattern of responses to the questions (Nord, 2014). In the context of food insecurity measurement, the Rasch model provides a statistical method to estimate the severity of food insecurity associated with each survey item (item severity parameters) and each respondent (respondent severity parameters), on the same underlying latent trait, forming a one dimensional scale of food insecurity.

The model postulates that the probability of a respondent reporting a given experience is a logistic function of the distance along the scale between the severity of the respondent's condition and the severity of the item. Therefore, the more severe a respondent's food insecurity status is, the higher the probability of affirmative answer. By coding x (the answer given by respondent r to item i) as 1 for "yes" and 0 for "no", we have:

$$p = Prob(x_{r,i} = 1) = \frac{e^{(a_r - b_i)}}{1 + e^{(a_r - b_i)}}$$

where a is the position of the respondent and b that of the item on the same scale.

It is expected that more severe items are less frequently affirmed than less severe items in probabilistic terms. The Rasch model is a confirmatory model, i.e. only if data meet the Rasch model's requirements they can be used to form a valid measurement scale; therefore testing adherence of the data to the Rasch model assumptions is of essence (Cafiero et al., 258 2018). When the data do not properly fit Rasch model, measurement invariance is not ensured, and the raw score (the sum of affirmative answers by each respondent) may be meaningless. Model diagnostics play a fundamental role in assessing consistency between data and model assumptions. The main diagnostic statistics adopted in this paper, useful in selecting proper items in terms of quality of the measure, are the following.

- Item Infit and Outfit mean-squared statistics (see Bond & Fox (2015); Wright & Masters (1990)), based on Rasch residuals. The Rasch residuals are the differences between the observations and their expected values according to the Rasch model. Outfit is based on a sum of squared standardized residuals. Standardized residuals are modeled to approximate a unit normal distribution. Their sum of squares approximates a χ 2 distribution. Dividing this sum by its degrees of freedom yields a mean-square value, (Outfit MeanSq), with expectation 1.0 and range 0 to infinity. Values larger than 1.0 indicate unmodeled noise. Values are on a ratio scale, so that 1.2 indicates 20 percent excess noise. Values less than 1.0 indicate overfit of the data to the model, i.e., the observations are too predictable. Infit is an information-weighted form of outfit. The weighting reduces the influence of less informative, low variance, off-target responses.

- Rasch reliability index, to assess overall model fit. It is defined as the proportion of total variation in true severity in the sample that is accounted for by the model. Model variation is the sum of squares of difference of each raw score parameter from the average. Error variation is the sum of squared measurement error across raw scores. Total variation is the sum of model variation and error variation. Rasch reliability is not technically a measure of model fit, but for scales comprising the same items it is highly correlated with model fit across data sets and provides a readily accessible statistic for comparing model fit. Values above .75 suggest high model fit.

- Residual correlation matrix to check the assumption of conditional independence (or unidimensionality) of the items. It can be assessed by calculating conditional correlations among each pair of items and submitting the correlation matrix to principal components analysis. Expected correlations among items are calculated under Rasch model assumptions given the item parameters, probabilities of each response pattern within each

raw score and the distribution of cases across raw scores. Residual correlations are then calculated as partial correlations given the observed and expected correlations.

- Differential item functioning (see Section 4.1 for detailed description) to check the assumption of specific objectivity.

If all these assumptions are met, the raw score (sum of affirmative answers) can be considered as a sufficient statistic and therefore can be used as an ordinal measure of food insecurity. Respondents' severity parameters can instead be considered as interval measure of food insecurity. In case one or more items did not meet the Rasch model assumptions (for example, INFIT larger than 1.3) the FAO protocol allows to adjust the country scale in order to make it a valid measurement tool whenever possible. The standard protocol is:

- To exclude up to three questions if they are proven to violate one or more Rasch assumptions

- Re-fit the Rasch model using only the valid questions

- Calibrate the international threshold (see next section) based only on the valid items as anchoring points. If more than three questions are identified as problematic, country data are not considered reliable and are therefore excluded from the analysis.

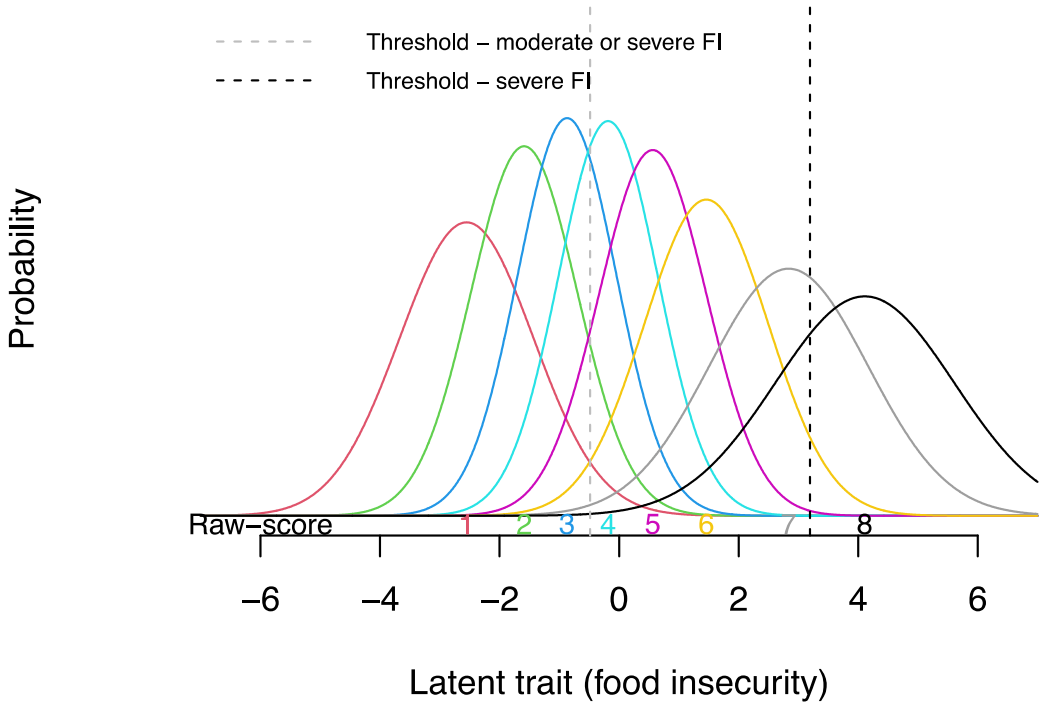
Food Insecurity variables

FAO, 2016 and Cafiero et al, 2018 describe a methodology to provide a measure of food insecurity severity that is comparable across countries and over time. The procedure is briefly as follows:

- For each country, the Rasch model using weighted conditional maximum likelihood (W-CML) is fitted (Fisher & Molenaar, 1995), considering as sampling weights the post-stratification weights provided by Gallup, to allow the sample to reflect the population structure by gender and education at least. See RM.weights package in R, https://cran.r-project.org/package=RM.weights for the ad-hoc software developed by FAO to fit the W-CML. For most of the countries, after stability of the scale over time is tested (i.e. that item severities are not changing over time), one single model considering all years pooled together is fitted. This allows comparability of the results over time.
- Only the FIES questions that pass the Rasch model assumptions of equal discrimination and unidimensionality are kept in the model. Therefore, for some countries a scale of less than 8 questions (or items) might be considered as the most suitable.
- The FIES scale fitted in each country is calibrated against the FIES global standard to explore which of the experience can be considered globally comparable and subsequently define two calibrated thresholds of food insecurity (moderate or severe, and severe only). See FAO, 2016 and Cafiero et al, 2018 for further details
- The calibrated thresholds are used to compute two variables of food insecurity for each individual in each country, which can be considered comparable across countries and over time: the probability of moderate or severe food insecurity; and the probability of severe food insecurity. Such probabilities

are computed considering a mixture of normal distributions around each calibrated raw score parameter and scaled by the raw score parameter standard error (see FAO, 2016 and Figure 3). The probabilistic assignment of cases to food security classes has two main advantages: it makes possible to tackle misclassification, i.e. it allows to assume that respondents with the same raw score belong to a distribution of food insecurity with an estimated variability that would have been remained ignored with a deterministic classification (for example, by classifying a respondent with raw score 4 to moderate or severe food insecurity class, rather than assigning a probability to be food insecure); and it allows to adjust for possible differences in the performance and alignment of the FIES scale across (and within) countries, by using a threshold on the latent trait rather than in terms of raw score. Figure 3 shows a visual representation of the probabilistic assignment procedure and placement of cross-country comparable thresholds of moderate or severe, and severe only food insecurity in one selected country.

Figure 3. Probabilistic assignment of cases to classes of food insecurity and placement of cross-country comparable food insecurity thresholds in one selected country



In this paper we define as food insecurity variables the probabilities of food insecurity (at both levels of severity) dichotomized using a threshold of 0.5.

Data

This paper is based on the analysis of Gallup World Poll (GWP) data from 2014 to 2018. The original dataset contained 154 countries and more than 780 thousand cases. Cases with "Don't know" or "Refused" answers to the considered variables were omitted from the analysis, resulting in a total of approximately 650 thousand

cases. In this section, we describe in detail the variables included in the analysis and provide for each of them at global and regional level descriptive statistics and comparison tests by sex, in order to describe the magnitude and regional distribution of the gender gaps.

Table 2 includes label and description of each of the variables considered in the analysis.

Table 2. Variable name and formulation in the Gallup World Poll

Variable	**Question Text**	**Responses/unit of measurement**
Income quintiles	Per Capita income quintiles	Poorest 20%
		Second 20%
		Middle 20%
		Fourth 20%
		Richest 20%
Education	What is your highest completed level of education?	Elementary education or less
		Secondary education
		Beyond 'high school' education
Gender	Gender	Male
		Female
Area	Do you live in . . . ?	A large city
		A suburb of a large city
		A small town or village
		A rural area or on a farm
Household size	Total number living in household for per capita income	Number
Age	Please tell me your age	Number
Marital Status	What is your current marital status?	Single/Never been married
		Married

		Separated
		Divorced
		Widowed
		Domestic partner
Employment	Respondents fall into one of six categories of employment based on a combination of answers to a series of questions about employment	Employed full time
		Employed part time
		Unemployed
		Out of workforce
Health	Do you have any health problems that prevent you from doing any of the things people your age normally can do?	Yes
		No

Source: GWP dataset

Table 3 shows percentage distributions of the categorical variables and weighted median for income for males and females at the global and regional levels. Results are weighted by post-stratification sampling weights, but they have to be interpreted as summary statistics, as they are not population weighted at country level.

In all regions, women are more food insecure than men at both severe and moderate levels, with the highest prevalence rates being in Africa and the highest gender gap in Latin America. Women are also poorer than men as confirmed by the median per capita income, expressed in international Dollars, and by the greater shares in lower income classes. A higher proportion of males has high levels of education and full-time employments, while a higher proportion of females have an elementary level of education and a part time employment. Highly educated women are more present in Northern America and Europe (57%) compared to Africa, Asia, or Latin America. On the other hand, the highest share of women with elementary education is in the African region (66.6%). Women are also more likely to report health problems. Gender gaps in employment, education and health is observed in all regions. The comparisons are more heterogeneous across regions as far as marital status is concerned. While the shares of singles are higher for males for all considered regions, the shares of married respondents is higher for females in Africa and Asia, while for males in Europe and North America and Latin America. Women are more likely to be separated, divorced, or widowed.

Table 3. Descriptive statistics by sex and region

Variable	**Weighted percentage and weighted median (Income in International Dollars)**				
	World	Africa	Asia	Northern America and Europe	Latin America

	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Moderate or Severe food insecurity	31.8	28.7	60.9	59.1	21.1	19.4	9.2	7.6	34.7	29.9
Severe food insecurity	14.8	13.6	37.4	35.8	6.2	5.8	1.8	1.7	10.1	8.9
Income (International Dollars)	3002.3	3464.5	605.5	809.9	2343.6	3189.6	9295.8	11107.5	2138.3	2739.8
Income (Poorest 20%)	21.5	18.2	21.8	18.0	20.9	19.0	21.2	18.4	22.9	16.6
Income (Middle 20%)	20.4	19.5	20.4	19.6	20.3	19.7	20.6	19.2	20.6	19.3
Income (Fourth 20%)	20.1	20.0	19.2	20.8	19.8	20.3	19.3	20.9	18.7	21.6
Income (Richest 20%)	17.8	22.4	17.7	22.5	18.5	21.6	17.9	22.5	16.1	24.3
Education (Elementary)	42.2	36.1	66.6	57.4	41.3	33.2	23.1	19.6	37.2	33.2
Education (Secondary)	12.8	13.2	2.7	4.4	13.8	17.7	20.0	18.7	11.3	12.1
Education (Beyond High School)	45.4	50.3	30.6	38.2	44.9	49.0	57.0	61.7	51.5	54.7

Marital Status (Single)	27.4	35.2	32.6	44.6	24.0	33.3	21.9	29.0	37.2	43.4
Marital Status (Married)	53.8	51.6	48.4	46.0	64.8	62.3	51.2	53.3	31.3	34.0
Marital Status (Separated)	2.4	1.5	2.9	1.7	1.1	0.8	2.1	1.7	5.0	2.9
Marital Status (Divorced)	3.9	2.2	2.8	1.2	2.3	1.2	6.6	4.5	2.8	2.0
Marital Status (Widowed)	8.7	2.4	8.5	1.9	7.1	1.8	11.5	3.8	6.5	2.7
Marital Status (Domestic partner)	6.1	5.6	4.8	4.5	0.7	0.6	6.7	7.5	17.3	15.0
Employment (Full-time)	30.6	47.8	25.4	39.8	28.8	54.6	38.6	52.1	28.3	52.5
Employment (Part-time)	16.7	15.9	22.1	24.6	12.2	12.5	12.8	10.5	17.8	16.4
Employment (Unemployed)	6.9	6.6	9.4	9.2	5.8	6.5	4.4	4.8	9.2	7.0
Employment	48.2	27.7	43.1	26.4	53.2	26.3	44.2	32.5	44.7	24.0

(Out workforce)										
Health problems (Yes)	27.2	22.1	32.2	28.4	25.2	20.7	27.1	21.8	22.0	19.0

All results are significantly different for male and female according to Median Test (Income in International Dollars) and Chi-square Test

Source: authors' elaboration on GWP data

Empirical Strategy

Differential Item Functioning

One important consequence of the use of the Rasch model is the possibility to test for Differential item functioning (DIF). DIF refers to the situation where members from different groups (age, gender, race, education, culture) on the same level of the latent trait (disease severity, quality of life) have a different probability of giving a certain response to a particular item (see for instance Chang, 2005). It can be argued that one possible source of difference in the food insecurity levels between women and men is the fact that they may experience in a different way the same food security conditions, and thus may respond differently to the FIES items (questions). Therefore, before studying the relationship between food insecurity and gender, it is crucial to assess whether the observed differences in prevalence rates of food insecurity by sex are indeed due to actual different access to food and not to differences in estimated item severity parameters for men and women. We explore whether the items have worked similarly in the sub-sample of men and women by testing the differential item functioning (DIF). Significant discrepancies in item severity between men and women may imply the existence of a gender-based difference in the interpretation of such items. A sex-based discrepancy in some of the item severity parameters would make food insecurity prevalence comparison between men and women less straightforward. Consequently, an item parameter adjustment may be required before comparing prevalence of food insecurity among men and women.

Differential item functioning (DIF) between men and women (see for instance Brunelli & Viviani, 2014) is evaluated at global level. This step is crucial to understand whether the observed difference in prevalence rates of food insecurity by gender is due to differences in estimated item severity parameters in the sub-groups of men and women, or to actual different access to food. To evaluate DIF by gender, the weighted Rasch model is fitted separately for the sub-sample of men and women in each country, providing a maximum likelihood estimate of item parameters in the corresponding sub-population (being this a weighted analysis and being the post-stratification weights built to reflect population structure by gender). Then, empirical distribution of the recorded item severity parameters (calibrated against the FIES global standard) are compared with the global ones in univariate and bivariate ways. If the distributions are detected to be the same using Kolmogorov-

Smirnov test (see Kolmogorov, 1933; Smirnov, 1948) it can be concluded that, globally, there is no difference in the way men and women experience lack of access to food. Median test is also performed on the empirical item distribution.

In addition to provide solid evidence on the comparability of food insecurity measure between men and women, and confirm the Rasch model assumption of specific objectivity, the study of DIF gives evidence on the pattern of severity of food insecurity by gender, that, at country level, it is an interesting empirical result per se. We are going to show some examples in this regard and critically discuss the implications of treating or ignoring DIF in Section 6.1.

Logistic regression model

The second step of the analysis is the microeconomic model to study the socio-economic determinants of the potential differences in access to food between men and women. This is pursued by using a logistic regression model with the dichotomized probabilities of food insecurity as dependent variables (see Section 3.1 for a more detailed description of the food insecurity variables), and a set of socio-economic individual and household characteristics as independent variables, using sub-regional fixed effects.

The econometric models implemented in the analysis are described in equation (1):

(1) $Prob(Y_{itl} = 1|\boldsymbol{\beta_l}, \boldsymbol{b_{il}}, \boldsymbol{sex_{it}}, \boldsymbol{X_{it}}) = \frac{\exp[\boldsymbol{p_{itl}}]}{1+\exp[\boldsymbol{p_{itl}}]}$

Where:

- $\boldsymbol{p_{itl}} = (\beta_{0l} + \boldsymbol{b_{i0l}}) + (\beta_{1l} + \boldsymbol{b_{i1l}})r_i + \boldsymbol{\beta_{2l}}\boldsymbol{X}_{it} + \boldsymbol{\beta_{3l}}sex_{it} * (\boldsymbol{X}_{it}, t_i) + \beta_{4l}country_i + \beta_{5l}t_i$ is the linear predictor.
- *i* indicates the individual, *t* the time (*t=2014, …, 2018*), *l* the level of food insecurity (*l*=moderate or severe, or severe only) and r_i the sub-region of the world (according to the M49 classification).
- Y_{itl} is the dichotomous food insecurity status build as described in Section 2.1, for individual *i*, time *t* and level *l*.
- $\boldsymbol{\beta_l} = (\beta_{0l}, \beta_{1l}, \beta_{2l}, \boldsymbol{\beta_{3l}}, \boldsymbol{\beta_{4l}}, \beta_{5l})$ denotes the vector of fixed effects corresponding to intercept, sub-region of the world, time, sex, a set of socio-economic characteristics for individual *i* at time *t* ($\boldsymbol{X}_{it}$), the interaction between sex and $\boldsymbol{X}_{it}$, and the country dummy, respectively (two separate estimates are produced depending on the level *l* of food insecurity). The considered explanatory variables are as described is section 3.
- $\boldsymbol{b_{il}} = (\boldsymbol{b_{i0l}}, \boldsymbol{b_{i1l}})$ is the matrix of random effects corresponding to intercept and sub-region, respectively (also separately estimated for each level of food insecurity *l*) to capture unobserved heterogeneity across observations and sub-regions. As data are not panel, no time fixed effects

are considered. Moreover, as the response variable is built in order to correct for non-equivalent measurement of food insecurity, no country specific fixed effects are considered.

In practical terms, two logistic regressions are implemented, one for moderate or severe food insecurity and another one for severe food insecurity only, as response variables.

The main parameters of interest in the analysis are:

- β_{2l}, because it provides the magnitude and the sign of gender gap in accessing food for at different levels of food insecurity
- $\boldsymbol{\beta_{4l}}$, because it characterizes the gender gap depending on different individual socio-economic characteristics and to evolution of the gender gap in time. The interpretation of $exp(\boldsymbol{\beta_{4l}})$ is as follows:
- If smaller than 1, it indicates that the gender gap (women versus men) is smaller in the considered socio-economic group compared to the socio-economic reference group (for example, among richest households compared to poorest)
- If larger than 1, it indicates that the gender gap is larger in the considered socio-economic group compared to the reference.

Two additional modeling specifications, both using as a response variable the dichotomized raw score (considering a score of 4 or more for moderate or severe food insecurity and 7 or more for severe food insecurity), have been tested and compared to the main model presented in formula (1):

1. The linear probability model (LPM) with robust standard errors. Fixed effects are considered for the intercept, and the country. Country-specific fixed effects are considered, differently from model (1), to account for unobserved heterogeneity at country level in the response. This specification can be seen as a baseline model, normally implemented within the econometric context to study the determinants on some socio-economic outcome of given individual/context/household characteristics. However, as the relationship between individual probabilities of food insecurity and the independent variables is expected not to be linear, we do not consider the LPM as the reference one.

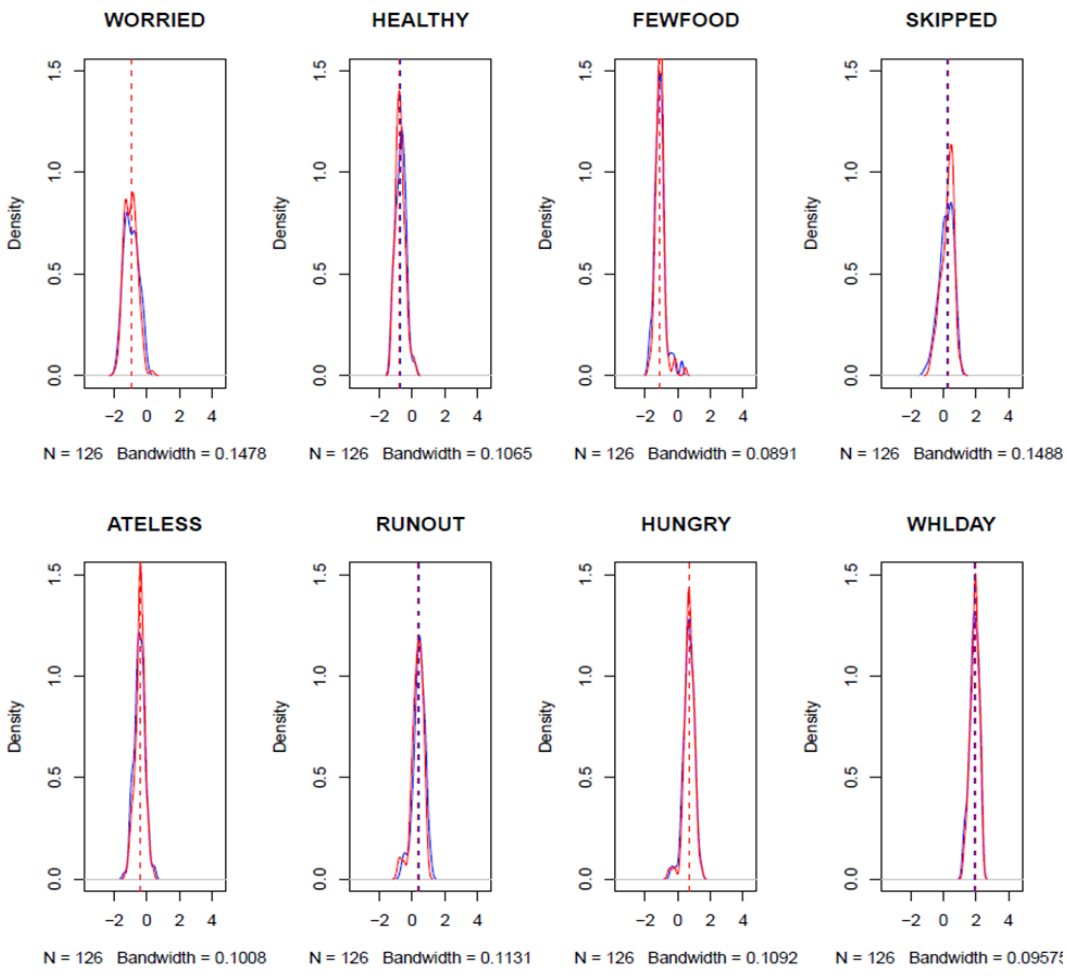
2. The logistic model, to account for non-linearity but ignore the cross-country comparable food insecurity measure, and therefore consider fixed effects for intercept as well as countries. This model can be used simpler version of model (1). By comparing the results of this model with those in model (1), it is possible to derive the value added of using a cross-country comparable measure of food insecurity.

Results

Differences in the way men and women respond to FIES

In this section, we present the results of DIF analysis at global level. Considering two sets of item severity parameters, one for women and another one for men, for each country, the item severity empirical distributions for men and women are compared with the global standard severities. This has been done at univariate (Figure 1) and bivariate (not shown) levels in order to provide a visual tool to detect possible difference in the distribution of item severity parameters between men and women.

Figure 4.Item severity distribution for men (blue line) and women (red line). Median severity is represented by vertical dashed line (blue for men and red for women).



Source: author's elaboration

Globally, it is observed that men and women experience food insecurity in the same way, i.e. the food insecurity severity for each item (question) are estimated on average in the same way for both sexes. Kolmogorov-Smirnov test is not significant for all items. However, median test shows that median severity of the item Healthy is slightly different between men and women. Therefore, this does not rule out the possibility that for specific countries the DIFs for men and women may be different, but being this a global-level analysis, we can conclude that not accounting for DIF by sex is a safe choice. In the following sections, DIF will not be considered.

Exploring the effect of gender and corresponding intersectionalities on food security

The global effect of gender on food insecurity at different levels is studied using Gallup World Poll data at micro level in the period 2014-2018 on 154 countries for a total of 626,543 individuals[12].

The logistic regression models described in section 4.2 are used to obtain the gender differential effect on food insecurity by controlling for the effect of other determinants[13]. The interaction terms between sex of respondent and other socio-economic categories are used to characterize intersectionalities related to gender gap in access to food in conjunction with other individual and household characteristics (see table below). Table 4 presents the results of two logistic models[14] estimated for each level of food insecurity: moderate or severe, and severe. The models include fixed effects for intercept and sub-regions of the world. Coefficients of the logistic model are transformed on the exponential scale and can be interpreted as protection or risk factors depending on whether they are respectively larger or lower than 1.

Table 4.Relative odds ratios of logistic regression using moderate or severe, and severe, food insecurity as dependent variable (bold coefficients are significant at 0.05 level).

Variables	Moderate or severe	Severe
Sex (Female)	**1.13**	**1.27**
Income (Second 20%)	**0.71**	**0.75**
Income (Middle 20%)	**0.54**	**0.58**
Income (Fourth 20%)	**0.40**	**0.46**
Income (Richest 20%)	**0.26**	**0.32**
Education (Secondary)	**0.68**	**0.69**
Education (Beyond High School)	**0.40**	**0.42**
Area (A large city)	**0.84**	**0.90**
Area (A suburb of a large city)	**0.82**	**0.94**
Area (A small town or village)	**0.87**	**0.97**
Household Size	**0.98**	**0.99**

[12] About 20 thousand observations were lost because of missing data in some key variables.
[13] The Oaxaca-Blinder approach was also adopted but the results were very similar and did not add much compared to the logistic regression presented in this paper. For details on the Oaxaca-Blinder analysis, refer to Annex I.
[14] Other model specifications have been tested, based directly on modelling the probability of food insecurity (beta regression) and including different covariates. The model presented here was selected as it had lower Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC).

Age (25-49)	**1.21**	**1.20**
Age (>=50)	**0.86**	**0.86**
Marital Status (Married)	**0.89**	**0.89**
Marital Status (Separated)	**1.40**	**1.33**
Marital Status (Divorced)	**1.36**	**1.30**
Marital Status (Widowed)	1.04	1.02
Marital Status (Dom.partner)	**1.25**	**1.13**
Employment (Part-time)	**1.24**	**1.22**
Employment (Unemployed)	**2.09**	**1.93**
Employment (Out of workforce)	**0.87**	**0.97**
Health (No)	**0.48**	**0.52**
Year (2015)	**1.16**	**1.12**
Year (2016)	**1.35**	**1.51**
Year (2017)	**1.52**	**1.78**
Year (2018)	**1.52**	**1.53**
Region (Northern Africa)	**3.00**	**3.16**
Region (Middle Africa)	**28.08**	**44.79**
Region (Eastern Africa)	**17.08**	**30.75**
Region (Western Africa)	**14.43**	**24.93**
Region (Southern Africa)	**15.30**	**29.84**
Region (Central Asia)	**2.03**	**2.37**
Region (Western Asia)	**3.10**	**4.17**
Region (Eastern Asia)	**0.75**	**0.59**
Region (South-eastern Asia)	**2.96**	**3.12**
Region (Southern Asia)	**3.96**	**5.16**
Region (Caribbean)	**9.66**	**23.62**

Region (Northern America)	**1.31**	**1.54**
Region (Central America)	**5.39**	**5.79**
Region (South America)	**3.98**	**4.43**
Region (Northern Europe)	**0.67**	**0.75**
Region (Western Europe)	**0.46**	0.87
Region (Eastern Europe)	0.98	**0.61**
Region (Southern Europe)	**1.21**	**1.25**
Gender Interactions		
Sex (F):Income (Second 20%)	**0.95**	**0.94**
Sex (F):Income (Middle 20%)	**0.93**	**0.94**
Sex (F):Income (Fourth 20%)	**0.91**	**0.89**
Sex (F):Income (Richest 20%)	**0.81**	**0.80**
Sex (F):Education (Secondary)	**0.93**	**0.84**
Sex (F):Education (Beyond High School)	0.96	**0.78**
Sex (F):Area (A large city)	1.03	0.99
Sex (F):Area (A suburb of a large city)	**1.05**	1.04
Sex (F):Area (A small town or village)	1.03	1.00
Sex (F):Marital Status (Married)	1.02	0.99
Sex (F):Marital Status (Separated)	1.03	0.98
Sex (F):Marital Status (Divorced)	1.08	0.92
Sex (F):Marital Status (Widowed)	**1.13**	**1.13**
Sex (F):Marital Status (Dom.partner)	1.04	0.94
Sex (F):Employment (Part-time)	**0.95**	**0.93**
Sex (F):Employment (UnEmployed)	0.96	0.97
Sex (F):Employment (Out_workforce)	**1.07**	0.98
Sex (F):Health (No)	**0.96**	0.97

Sex (F):Year (2015)	0.96	0.95
Sex (F):Year (2016)	**0.95**	**0.93**
Sex (F):Year (2017)	0.96	**0.92**
Sex (F):Year (2018)	**0.93**	**0.88**
Sex (F):Age (25-49)	1.03	0.98
Sex (F):Age (>=50)	1.01	0.96
R^2 adjusted	*0.31*	*0.26*
N. observations	*626,543*	*626,543*

Women are more likely to be food insecure then man even after controlling for a set of individual or household characteristics in both settings, moderate or severe, and severe. Globally, women are more food insecure than men, with larger odds of food insecurity of approximately 13% at moderate or severe level, and approximately 27% at severe level only. Women's access to food can be physically or economically constrained due to a gendered role of women. Such gendered roles can also create socio-cultural constraints in food access (Hadley et al, 2008). These constraints are interrelated with each other. For example, sociocultural norms toward women can limit women's mobility, imposing physical constraints, whereas physical constraints can hinder women to be engaged into the market, deteriorating their economic access to food (WB, FAO, IFAD, 2008).

The results show that the food security is highly dependent on the levels of income, education attainment, employment status, perceived health, type of location, age-group and marital status. In particular, the most food insecure are respectively the individuals in the lowest income quintile, with lower education, unemployed, with health problems, living in rural areas, belonging to the age group from 25 to 49 years old (compared to 15 to 24), separated or divorced, and living in Sub-Saharan Africa (sub-regional reference category is Australia and New Zealand). Compared to Australia and New Zealand, also Northern America (composed of United States of America and Canada) is more exposed to food insecurity. Finally, the time control (year) suggest that global food insecurity is increasing in the last few years as also highlighted by the FAO SOFI Report (FAO, 2019). As claimed by De Muro and Burchi (2007) and Bashir and Schilizzi (2013) in rural areas, education affects food security through access to agricultural information, nutrition and sanitation, increasing efficiency, production and better decision. While in urban areas, the effect of education on food security is through employment and income (Mutisya et al, 2016; Gebre 2012).

To explore intersectionalities related to gender gaps in food security, interaction terms with sex of the respondent and key socio-economic variables are included in the logistic regression. The interaction between sex and year highlights how the gender gap is slightly reducing over time and is significantly lower in 2018 as

compared to 2014. The interactions with income quintiles show that the gender gap reduces as income levels increase, up to 20% comparing the richest quintiles with the poorest one. Higher education also significantly reduces the gender gap in food, at the severe level. The interaction term of sex with location shows that in the suburbs of large cities the gender gap is higher when compared to the rural areas. The intersection with marital status shows instead that the gender gap is higher for the widowed individuals compared to single. In terms of employment, the gender gap is lower among those working part-time (compared to full-time), while it is slightly higher for those out of the workforce. Finally, the gender gap for moderate food insecurity reduces when there are no health issues, while there is no significance in the relation with age.

Results for the control variables are mostly in line with the expectations based on gender inequalities literature. They point to the evidence that unequal access to resources, especially by women, is linked to imbalanced food access. This is in line with findings from various previous studies on the role of woman in changing households and societies condition. As women's access to resources improve (income, employment, education and health), investment in nutrition, education, and health of their families increases, improving the household and community's food security. Results are, for the first time, presented at global and regional level, using cross-country comparable food security variable measured at individual level, and therefore suitable for reliable comparisons.

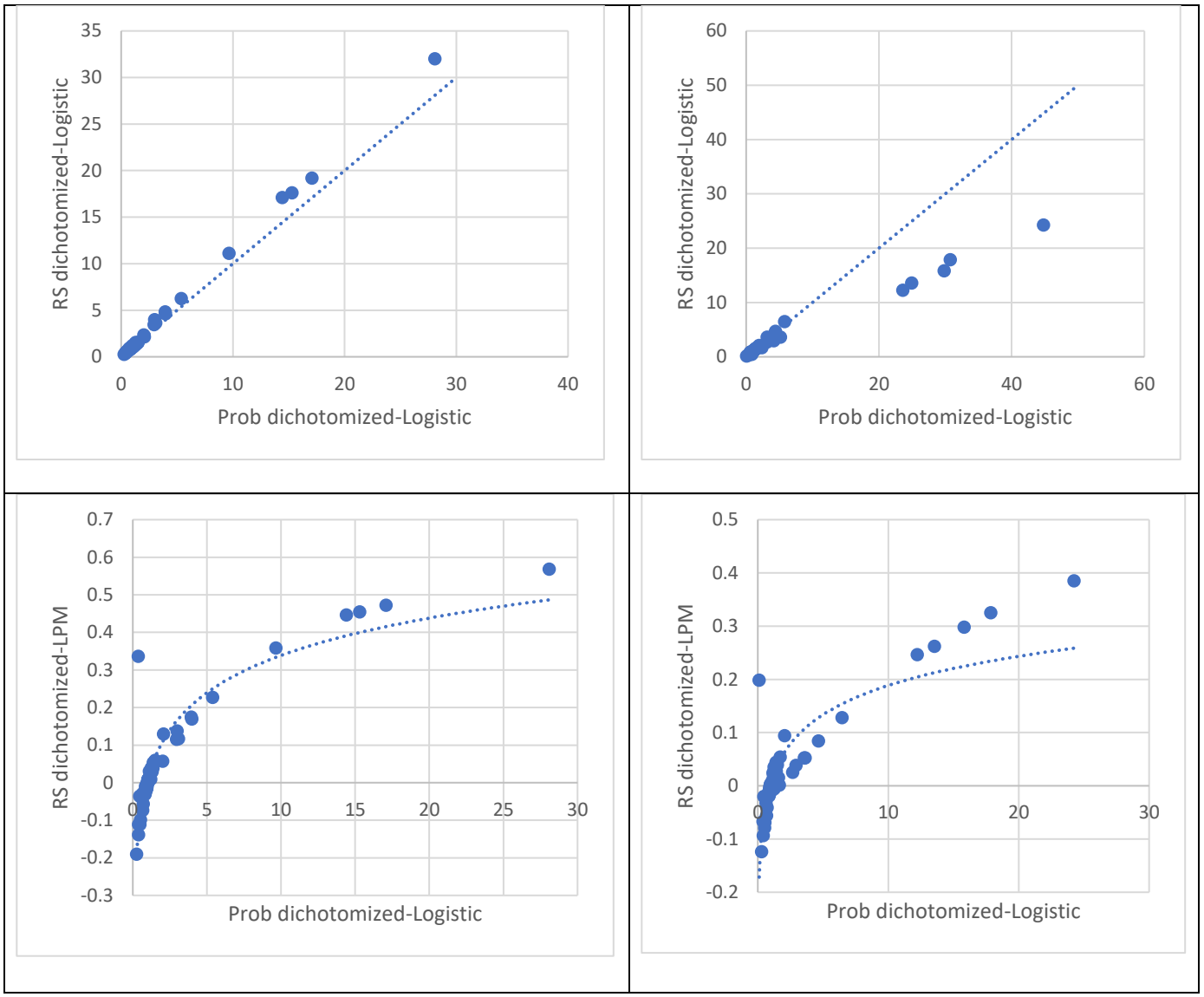
We performed additional analysis[15] (see Annex II) including access to internet ("Do you have access to the internet in any way, whether on a mobile phone, a computer, or some other device?") as covariate to the logistic model to examine possible impact of information access in ensuring access to food by all, and especially by women. More specifically, not having access to internet increases the odds of being moderately or severely food insecure by 98%; women without access to internet are more likely to experience food insecurity compared to men of 4%.

The same covariates as described in Table 4 were included in a linear probability model with robust standard errors, and in a logistic regression, using in both cases as response variable the dichotomized raw score (considering a score of 4 or more for moderate or severe food insecurity and 7 or more for severe food insecurity). Model coefficients for the new models are displayed against coefficients for model (1) in Figure 5:

Figure 5 Coefficients for logistic model (on exponential scale, and 45 degree line) and linear probability model (with logarithmic trendline) based on dichotomized raw score plotted against coefficients (on exponential scale) for model (1)

Moderate or severe food insecurity	Severe food insecurity

[15] The model has not been included as the main one as it has smaller coverage by geography and over time, although it covers all countries in all regions, it would have been less representative of the global trend than the model presented in Table 4.



Source: authors' calculation

While following a similar pattern, coefficients for logistic model and dichotomized raw score are, especially for larger effects, larger for moderate or severe food insecurity and smaller for severe food insecurity. Similarly, linear probability model provides, for most of the variables, larger coefficients for moderate or severe food insecurity and both larger and smaller for severe food insecurity, compared to model (1). The observed discrepancies are likely due to the definition of the food insecurity variable as not cross-country comparable.

In order to address potential problem of endogeneity that food insecurity variables may have with those of education, we apply Propensity Score Matching to create two matched samples of educated vs not educated individuals with similar variables' distributions. In our research we used the nearest-neighbor matching technique. The PSM hypothesizes that all differences between individuals can be captured by observable characteristics because they are highly correlated to the unobservable ones (Titus, 2007; Ruyssen & Salomone, 2018). Table 5 reports the results of the regression model on the matched samples. The robustness check shows similar patterns in the results as that of the original total sample.

Table 5. Relative odds ratios of logistic regression on the matched sample (bold coefficients are significant at 0.05 level).

Variables	Moderate or severe	Severe
Sex (Female)	**1.19**	**1.28**
Income (Second 20%)	**0.71**	**0.73**
Income (Middle 20%)	**0.53**	**0.58**
Income (Fourth 20%)	**0.40**	**0.47**
Income (Richest 20%)	**0.30**	**0.37**
Education (Secondary)	**0.26**	**0.28**
Education (Beyond High School)	**0.17**	**0.18**
Area (A large city)	0.98	1.00
Area (A suburb of a large city)	**0.88**	0.98
Area (A small town or village)	**0.86**	0.96
Household Size	**0.99**	1.00
Age (25-49)	**1.30**	**1.26**
Age (>=50)	**0.89**	**0.90**
Marital Status (Married)	**0.80**	**0.82**
Marital Status (Separated)	**1.34**	**1.21**
Marital Status (Divorced)	**1.29**	**1.27**
Marital Status (Widowed)	**0.90**	0.92
Marital Status (Dom.partner)	**1.11**	1.06
Employment (Part-time)	**1.15**	**1.20**
Employment (Unemployed)	**2.07**	**2.10**
Employment (Out of workforce)	**0.78**	0.98
Health (No)	**0.50**	**0.54**

Year (2015)	**1.15**	**1.13**
Year (2016)	**1.29**	**1.47**
Year (2017)	**1.47**	**1.71**
Year (2018)	**1.48**	**1.50**
Region (Northern Africa)	**1.36**	**1.42**
Region (Middle Africa)	**12.14**	**21.53**
Region (Eastern Africa)	**7.80**	**14.78**
Region (Western Africa)	**6.12**	**11.25**
Region (Southern Africa)	**8.84**	**18.15**
Region (Central Asia)	**1.32**	**1.49**
Region (Western Asia)	**1.98**	**2.83**
Region (Eastern Asia)	**0.36**	**0.28**
Region (South-eastern Asia)	**1.54**	**1.77**
Region (Southern Asia)	**1.97**	**3.02**
Region (Caribbean)	**4.37**	**11.93**
Region (Northern America)	**1.52**	**1.78**
Region (Central America)	**2.76**	**3.14**
Region (South America)	**1.82**	**2.23**
Region (Northern Europe)	**0.48**	**0.58**
Region (Western Europe)	**0.40**	**0.72**
Region (Eastern Europe)	**0.70**	**0.46**
Region (Southern Europe)	**0.75**	0.86
Gender Interactions		
Sex (F):Income (Second 20%)	**0.94**	1.00
Sex (F):Income (Middle 20%)	0.96	0.99
Sex (F):Income (Fourth 20%)	0.96	0.96

Sex (F):Income (Richest 20%)	**0.84**	**0.87**
Sex (F):Education (Secondary)	**0.87**	**0.77**
Sex (F):Education (Beyond High School)	0.97	**0.70**
Sex (F):Area (A large city)	1.01	0.99
Sex (F):Area (A suburb of a large city)	**0.90**	**0.88**
Sex (F):Area (A small town or village)	1.03	1.02
Sex (F):Marital Status (Married)	**1.10**	**1.08**
Sex (F):Marital Status (Separated)	1.05	1.09
Sex (F):Marital Status (Divorced)	**1.16**	0.99
Sex (F):Marital Status (Widowed)	**1.19**	**1.24**
Sex (F):Marital Status (Dom.partner)	**1.10**	0.98
Sex (F):Employment (Part-time)	0.96	**0.93**
Sex (F):Employment (UnEmployed)	1.01	0.99
Sex (F):Employment (Out_workforce)	**1.09**	**0.94**
Sex (F):Health (No)	**0.95**	**0.93**
Sex (F):Year (2015)	**0.94**	**0.92**
Sex (F):Year (2016)	0.96	0.95
Sex (F):Year (2017)	0.96	0.95
Sex (F):Year (2018)	**0.88**	**0.84**
Sex (F):Age (25-49)	0.97	**0.91**
Sex (F):Age (>=50)	**0.91**	**0.88**
R^2 adjusted	*0.37*	*0.3*
N. observations	*414,376*	*414376*

Conclusions

This paper attempts to fill an important gap in the food security literature by analyzing the gender differences in the access to food and by investigating on its drivers and intersectionalities. We pursue this by using a unique

dataset from the Gallup World Poll, which consists on about 650 thousand individuals (aged above 15 years) of over 150 countries for the period from 2014 to 2018. We analyze the estimates of SDG indicator 2.1.2 "The prevalence of moderate or severe food insecurity based on FIES" developed by FAO and its relationship with a set of other socio-economic variables collected in the GWP surveys. In the first part of the paper, we explore the global and regional trends of food insecurity and show that women are more food insecure than men in every region and year, but the gender-gap is slightly reducing in last year.

We describe the methodology used to ensure comparability across countries and time, bringing to the creation of food insecurity variables based on FIES at individual level. Then, we study the differential item functioning (DIF) of each of the FIES questions between men and women, in order to test whether part of the observed difference in food insecurity levels between women and men could be attributed to the fact that they experience in a different way the same food security conditions. We show that item severity parameters are globally similar between women and men, thus our global level estimates can be considered gender-comparable. This is key and novel result at global level, that brings the study of the gender gap at higher standards of international comparability.

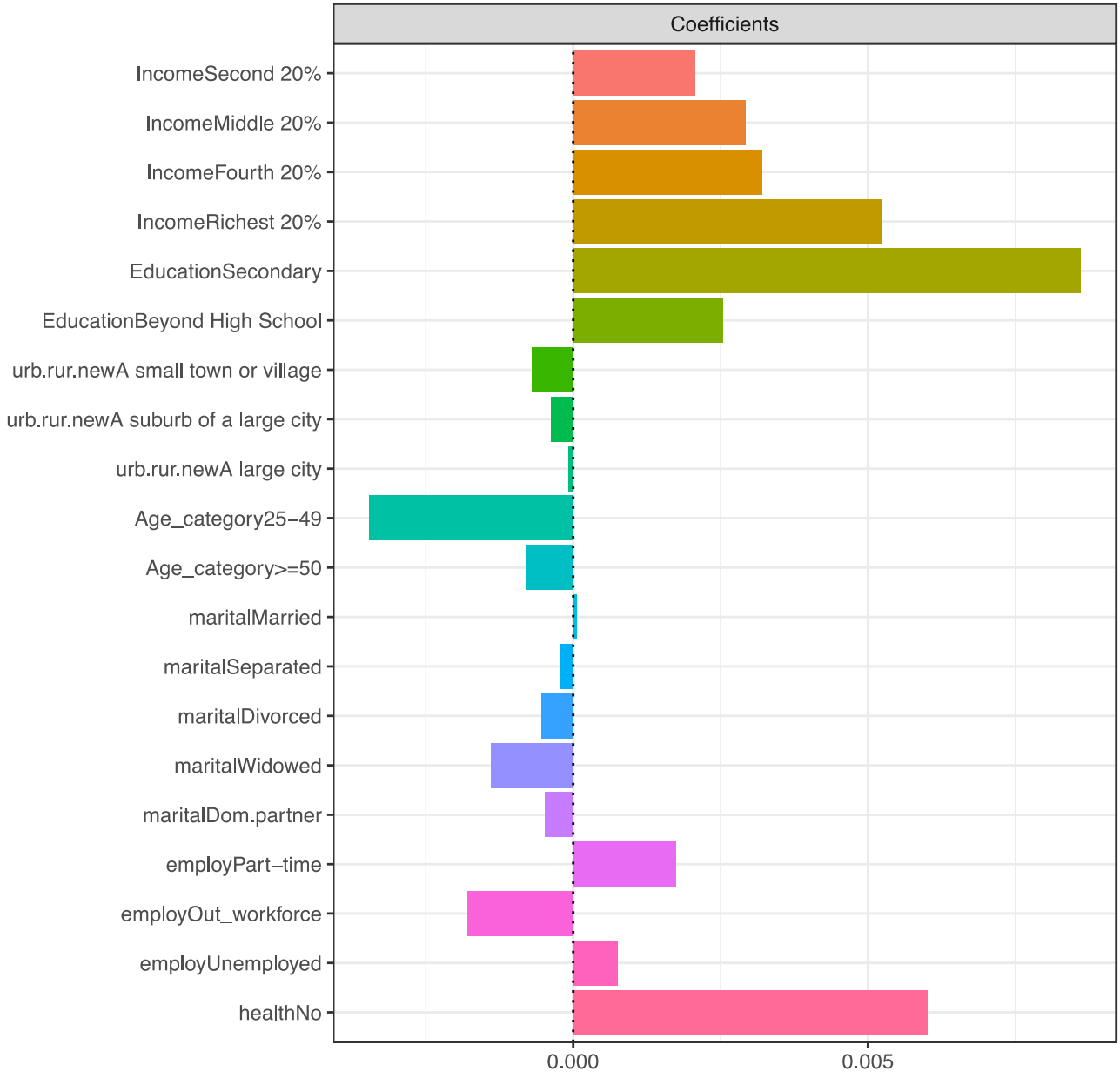
In the second part, we present some descriptive statistics to better characterize the gender gaps depending on socio-economic status. By pooling together individual data for all available countries and years, we apply a mixed-effect logit regression model to explore the magnitude of the gender gap in accessing food by controlling for a number of individual and household characteristics. In order to take into account intersectionalities related to the gender gap in food security, we include in the model interaction terms with sex of the respondent and a set of socio-economic variables. The results show that gender plays an important role in food security, and it is biased against women. The gender gap is higher for the poorest, the less educated, individuals out of the workforce, widowed and those living in suburbs of the large cities. The gender gap for moderate or severe food insecurity reduces significantly when there are no health issues and among part-time workers. We observe that the gender gap in food security persists even if we control for income levels, education, age, employment, marital status and locality. This suggests that the gender gap might also driven by a set of unobserved factors such as, access to resources, social norms, and intra-household relations. In this context, it is clear that development policies that address the gender gaps of these factors can reduce the level of food insecurity not only of women but of the whole communit

Annex I

In this Annex, we present the main results of the Oaxaca-Blinder decomposition analysis (Hlavac, 2018) with the purpose of showing how they agree with the conclusion of this paper's econometric model. The aim of the Blinder-Oaxaca decomposition is to explain how much of the difference in the outcomes across two groups is due to group differences in the levels of explanatory variables, and how much is due to differences in the magnitude of regression coefficients (Oaxaca, 1973). There are two possible alternative decompositions: threefold and twofold. In the threefold decomposition, the difference in the outcome across two groups is decomposed into endowments term plus coefficients term plus an interaction term. The endowments term

represents the contribution of differences in explanatory variables across groups, and the coefficients term is the part that is due to group differences in the coefficients. Finally, the interaction term accounts for the fact that cross-group differences in explanatory variables and coefficients can occur at the same time. The threefold decomposition can also be estimated separately for each explanatory variable. The twofold decomposition divides the difference in outcome into a portion that is explained by cross-group differences in the explanatory variables, and a part that remains unexplained by these differences. The "coefficient" component in the threefold decomposition can be easily compared with the interaction terms of the econometric model used in this paper, leading to the same conclusions that income, education and health problems are key determinants of gender gap in food insecurity.

Figure A1. Coefficients' component in the threefold Oaxaca decomposition



Source: authors' elaboration on FAO data

Annex II: Results of logistic regression analysis including internet access

Variables	Moderate or severe	Severe
Sex (Female)	**1.13**	**1.27**
Income (Second 20%)	**0.71**	**0.75**
Income (Middle 20%)	**0.54**	**0.58**
Income (Fourth 20%)	**0.40**	**0.46**
Income (Richest 20%)	**0.26**	**0.32**
Education (Secondary)	**0.68**	**0.69**
Education (Beyond High School)	**0.40**	**0.42**
Area (A large city)	0.84	0.90
Area (A suburb of a large city)	**0.82**	0.94
Area (A small town or village)	**0.87**	0.97
Household Size	**0.98**	0.99
Age (25-49)	**1.21**	**1.20**
Age (>=50)	**0.86**	**0.86**
Marital Status (Married)	**0.89**	**0.89**
Marital Status (Separated)	**1.40**	**1.33**
Marital Status (Divorced)	**1.36**	**1.30**
Marital Status (Widowed)	**1.04**	1.02
Marital Status (Dom.partner)	**1.25**	1.13
Employment (Part-time)	**1.24**	**1.22**
Employment (Unemployed)	**2.09**	**1.93**
Employment (Out of workforce)	**0.87**	0.97
Health (No)	**0.48**	**0.52**
Year (2015)	**1.16**	**1.12**

Year (2016)	**1.35**	**1.51**
Year (2017)	**1.52**	**1.78**
Year (2018)	**1.52**	**1.53**
Region (Northern Africa)	**3.00**	**3.16**
Region (Middle Africa)	**28.08**	**44.79**
Region (Eastern Africa)	**17.08**	**30.75**
Region (Western Africa)	**14.43**	**24.93**
Region (Southern Africa)	**15.30**	**29.84**
Region (Central Asia)	**2.03**	**2.37**
Region (Western Asia)	**3.10**	**4.17**
Region (Eastern Asia)	**0.75**	**0.59**
Region (South-eastern Asia)	**2.96**	**3.12**
Region (Southern Asia)	**3.96**	**5.16**
Region (Caribbean)	**9.66**	**23.62**
Region (Northern America)	**1.31**	**1.54**
Region (Central America)	**5.39**	**5.79**
Region (South America)	**3.98**	**4.43**
Region (Northern Europe)	**0.67**	**0.75**
Region (Western Europe)	**0.46**	**0.87**
Region (Eastern Europe)	**0.98**	**0.61**
Region (Southern Europe)	**1.21**	1.25
Gender Interactions		
Sex (F):Income (Second 20%)	**0.95**	0.94
Sex (F):Income (Middle 20%)	0.93	0.94
Sex (F):Income (Fourth 20%)	0.91	0.89
Sex (F):Income (Richest 20%)	**0.81**	**0.80**

Sex (F):Education (Secondary)	**0.93**	**0.84**
Sex (F):Education (Beyond High School)	0.96	**0.78**
Sex (F):Area (A large city)	1.03	0.99
Sex (F):Area (A suburb of a large city)	**1.05**	**1.04**
Sex (F):Area (A small town or village)	1.03	1.00
Sex (F):Marital Status (Married)	**1.02**	**0.99**
Sex (F):Marital Status (Separated)	1.03	0.98
Sex (F):Marital Status (Divorced)	**1.08**	0.92
Sex (F):Marital Status (Widowed)	**1.13**	**1.13**
Sex (F):Marital Status (Dom.partner)	**1.04**	0.94
Sex (F):Employment (Part-time)	0.95	**0.93**
Sex (F):Employment (UnEmployed)	0.96	0.97
Sex (F):Employment (Out_workforce)	**1.07**	**0.98**
Sex (F):Health (No)	**0.96**	**0.97**
Sex (F):Year (2015)	**0.96**	**0.95**
Sex (F):Year (2016)	0.95	0.93
Sex (F):Year (2017)	0.96	0.92
Sex (F):Year (2018)	**0.93**	**0.88**
Sex (F):Age (25-49)	1.03	**0.98**
Sex (F):Age (>=50)	**1.01**	**0.96**
R^2 adjusted	*0.6*	*0.5*
N. observations	*439,179*	*439179*

4. Establishing the link between internal and international migration: evidence from Sub-Saharan Africa

Marinella Cirillo, Andrea Cattaneo, Meghan Miller and Ahmad Sadiddin

Abstract

Internal and international migration are often thought of as separate processes, rarely analysed together in a coherent framework. This paper examines, based on data for 21 Sub-Saharan African countries, how previous internal migration can shape international migration intentions – i.e. desiring and planning to move abroad. We find that individuals who migrated to urban areas are on average the most likely to develop international migration intentions, followed by those who migrated to rural areas, those who live in urban areas and have not moved internally, and lastly come rural residents who have not moved internally. This highlights the role of migration to urban areas as a potential driver of international emigration. The findings support our conceptual framework, which hypothesizes internal migrants have lower international migration costs, both monetary and non-monetary, and accumulate resources and experience that help overcome constraints related to international migration. Internal migration is also found to have a stronger association with desire to migrate abroad than with planning, indicating that weakening the attachment to place of origin may be the dominant mechanism linking internal and international migration processes.

Keywords: Internal migration, International migration intentions, Sub-Saharan Africa, Urban-rural linkages, Regional development planning and policy

Introduction

In a world with over 270 million international migrants (UN DESA, 2019) and 1.3 billion people who have migrated internally (FAO, 2018), little is known about the connection between these two migratory processes. Despite an extensive literature on migration, most migration studies – apart from a few exceptions presented below – have considered either internal migration or international migration. Reviewing the literature, Selod and Shilpi (2021) note that the two types of migration are typically analysed in complete isolation of each other, and that understanding how they are interconnected is a priority for future research. Notwithstanding the importance of the topic, research on the link between the two types of migration is constrained by limited availability of statistics on both internal and international migration and the relation between the two (Adepoju, 2002; Plaza et al, 2011; Bell & Charles-Edwards, 2013).

Whether moving internally or abroad, people migrate when they are unable to satisfy their aspirations within the existing opportunity structure in their locality or country (Skeldon, 2002). This means the two types of migration, although they encounter different constraints (Adepoju, 1998), are fundamentally driven by similar factors, and can thus be analysed in a single framework (Skeldon, 2009). As two processes of a linked system, internal migration can function as a precursor to international migration by allowing migrants to accumulate experience as well as social, human and financial resources to move abroad (King & Skeldon, 2010; Vullnetari,

2012). Reinforcing this notion is the finding that migrating in steps is a consolidated practise (Cattaneo & Robinson, 2020).

This study addresses an important gap in the migration literature by analysing the links between internal and international migration, using a dataset that covers 21 Sub-Saharan African countries. Although several previous papers have established the links between the two types of migration; to the best of our knowledge, these were mostly either conceptual (King and Skeldon, 2010; Adepoju, 2002) or very location-specific. Examples of the interconnection between internal and international migration reported in the literature are limited to Albania (Vullnetari, 2012), Mexico (Lozano-Ascencio, 2002; del Rey Poveda, 2007; Aguayo-Téllez & Martínez-Navarro, 2013), Thailand (Skeldon, 2006), and Turkey (King, 1976). The study analyses and quantifies how and under what conditions previous internal migration may subsequently drive an intention to migrate abroad. We conclude that individuals' migration history becomes a fundamental element to take into consideration when predicting intentions to migrate abroad. Thus, we also contribute to the policy debate on international migration by indicating how policies that alter internal migration patterns are likely to also affect decisions to emigrate.

We focus on Sub-Saharan Africa, a region with a rich history of both internal and international migration, where undocumented movements across frontiers, fostered by shared culture, language and colonial experience, and frontier labour migration, may blur the distinction between internal and international migration in the region (Adepoju, 2002). Our paper uses data from the 2013 survey of the Gallup World Poll (GWP), a source of annual surveys of individuals in over 140 countries that cover questions on characteristics of individuals and their households, including their experiences and ways of life as well as views on migration. The GWP surveys provide a unique opportunity to study various aspects of international migration and has been used accordingly (Sirkeci & Esipova, 2013; Burrone et al,2018; Ruyssen & Salomone, 2018; Sadiddin et al, 2019; Smith & Floro, 2020). The GWP 2013 survey is uniquely suited to address this research topic as it includes two questions about people's intentions to leave their own countries permanently, as well as a question on previous internal migration. The 2013 survey also includes information on place of residence and individual and household characteristics. This allows us to address the research question of whether migrants who moved internally are more likely to develop intentions for permanent international migration, accounting for the role of residence area in that process, while controlling for other factors that are acknowledged by the relevant literature to affect decisions to emigrate.

There is a growing literature on migration intentions, which are often defined as an aspiration, willingness, likelihood or interest to migrate, but may also include an element of planning or preparations to migrate (Becerra , 2012; Carling, 2002; Creighton, 2013; Dustmann and Okatenko, 2014; Drinkwater and Ingram, 2009; Ruyssen & Salomone, 2018; Smith & Floro, 2020). In this paper, we define international migration intentions as an expression of both desire and capacity to permanently leave one's own country.

The use of intentions to migrate internationally, instead of actual movements, is driven by data availability. However, understanding the drivers of migration intentions is very relevant due to the strong relationship between intentions and actual behaviour as found across social and population studies (Bankole & Westoff, 1998; Westoff, 1990; Tjaden et al, 2018). According to the theory of planned behaviour (Ajzen, 1991; Ajzen, 2011), "intentions" are central to performing a given behaviour, as they capture the motivational factors that influence a behaviour and indicate how hard people are willing to try in order to perform it. Specifically, a number of studies from various contexts have found a strong correlation between migration intention and actual migration (Creighton, 2013; van Dalen & Henkens, 2013; Tjaden et al, 2018). This is not to say that migration intentions can be a proxy of actual migration, rather that migration intentions can be considered as the first step of the migration decision-making process, without which actual migration would not take place (Tjaden et al, 2018).

The rest of the paper is structured as follows: in the second section, we present a conceptual framework that lays out the theoretical foundations for our empirical analysis. In the third section, we present a summary description of the data used in the analysis. In the fourth section, we present the econometric models used in the empirical analysis. The fifth section is devoted to presenting the results and discussing their robustness. The last section concludes the paper by summarizing the findings and discussing some of their policy implications.

Conceptual framework

Previous internal migration can alter the views of an individual regarding international migration by creating incentives or by overcoming constraints to move abroad (King & Skeldon, 2010; King, 1976; Skeldon, 2006; del Rey Poveda, 2007). We build on the classical contributions suggesting that migrants were pushed by low incomes in their countries or regions and pulled by better prospects in more affluent areas as outlined by Lee(1966) and Harris & Todaro (1970), and on their further extensions highlighting the importance of non-economic factors such as countries' political conditions, migration policies and structural characteristics (Borjas, 1989). We rely in particular on the perspective articulated by Van Hear, Bakewell & Long (2018) as well as de Haas (2021) underlining the importance of people's preferences, intentions and agency. The main premise is that migration is driven by a combination of factors external to prospective migrants, as well as their own socioeconomic and demographic characteristics. The external drivers involve structural and institutional factors that create the incentives to migrate when prospective migrants perceive differentials in life conditions - such as in employment, wages, education, social services and environmental quality - between areas of origin and potential destinations (Van Hear, Bakewell & Long, 2018). Yet, the move is ultimately driven by people's agency, i.e. their ability to make choices and act upon them (Fussell, 2012; de Haas, 2021). Due to their unique individual, household and community capabilities that "are shaped by people's gender, generation, class and ethnicity", prospective migrants perceive the differentials in life conditions in different ways (Van Hear, Bakewell & Long, 2018).

In addition to the incentives to migrate, a key element in migration is the capacity to migrate. Migration is costly, and the costs usually rise when moving larger distances as in the case of international migration, which also involves high transaction costs. Yet, migration costs can also be non-monetary or psychological, due to movement from a familiar place to a new environment, as demonstrated from the rich literature initiated from an economic perspective by Sjaastad (1962), and from a behavioural science angle by Speare (1974) focusing on the bond between people and places. Therefore, we introduce a framework where movement is driven by the interaction between migration's expected benefits, prospective migrant characteristics, and the associated monetary and psychological costs. Our framework acknowledges that "attachment to place" and social networks are key factors that affect migration costs. It is found that social ties in areas of origin can increase the non-monetary cost of migration (DaVanzo, 1981; Beegle, de Weerdt & Dercon, 2011; Adams, 2016; Manchin & Orazbayev, 2018; Lagakos et al., 2020; Meghir et al., 2021), but their availability in potential destinations can reduce migration monetary and non-monetary costs (Massey, 1990; Manchin & Orazbayev, 2018; Sadiddin et al, 2019). This implies people who migrated internally may be more prone to consider a subsequent international move because they have already, partially or totally, lost ties with their areas of origin, and may have acquired the ability and confidence to develop new ones beyond their areas of origin. Benefits and costs of migrating internationally also vary depending on place of residence and socioeconomic characteristics. Previous internal migration affects both of these dimensions. For example, migrating into an urban area often facilitates accumulating the financial resources and contacts and to obtain documentation that are needed for international migration (King & Skeldon, 2010; Adepoju, 2006; Fussell, 2012). Therefore, urban residence and previous internal migration are likely to increase the intentions of international migration. However, we envisage that these two factors do not work in isolation but interact and can lead to different outcomes in terms of subsequent international migration depending on internal migration pathways. Given the above, the focus and novelty of the conceptual framework we are presenting lies in formalizing how internal migration history and place of residence (urban vs. rural) shape international migration intentions. It is, therefore, essential to define what we mean by migration intentions. As defined earlier, in this paper the term 'international migration intentions' is conceptualized as having two aspects: 1) the desire to migrate and 2) the capacity to migrate. This considers that if one perceives life conditions can be better at another location – i.e. the expected benefits exceed the expected costs of relocation – then that individual will develop a desire to migrate internationally. Yet if the individual faces financial constraints, the desire to migrate may never materialize into a realistic plan. Only individuals that can afford the move - given the perceived costs - will develop a plan to do so. Conversely, for individuals who are better-off in the home country, the capacity to move abroad may be higher, but their desire to migrate may be limited. Migration intentions will therefore depend on the interplay between desire and capacity to move abroad. To formalize the framework, we follow the approach of Grogger & Hanson (2011) who adopt a linear utility model in describing the utility associated with migrating internationally as a linear function of the difference between the financial benefit of migrating and its costs. Assume that individuals compare their utility of staying in their current location, and of migrating

to a potential destination country. This is a utility maximization problem where the expected utility of an individual can be expressed as follows:

$$E(u_{irk}) = E[B(X_{irk}) - C(Z_{irk}) + \varepsilon_{irk}]$$

Here $E(u_{irk})$ is the expected utility of migrating internationally for an individual i who lives in region r (rural/urban) of country k[16]. $B(X_{irk})$ represents the benefits of migrating internationally and depends on personal and household attributes X_{irk} affecting said benefits. Instead $C(Z_{irk})$ represents the costs associated with migrating internationally and depends on personal and household attributes Z_{irk} affecting them. Finally, ε_{irk} represents the random individual heterogeneity. For simplicity, and without loss in the framework generality, we do not account for different international destinations[17]. The benefits of international migration will depend on individual specific characteristics such as skill level and current employment that shape earnings at home and income opportunities at destination, as well as on age since benefits will accrue over time. For costs, following Bianchi (2013) in the tradition of Sjaastad (1962), we distinguish between monetary costs (C^M) and psychological costs of migration (C^P), which may reflect individual characteristics like age, family ties, access to networks in the origin and destination country. Migration costs can thus be decomposed as follows: $C(Z_{irk}) = C^M(Z_{irk}) + C^P(Z_{irk})$[18].

For given individual and household attributes, X_{irk} and Z_{irk} , an individual will desire to migrate internationally if $E(u_{irk}) > 0$. However, not all those who desire to migrate will have the necessary financial resources. If an individual has the capacity to cover the costs, then migration planning can take place. X_{irk} also determines the ability of an individual to cover monetary migration costs, such as individual and the household wellbeing and their access to a social network on which she or he can rely, so $F(X_{irk})$, where F represents the funds available to an individual to cover international migration monetary costs. Summarizing, an individual will then develop a plan for international migration if:

1) the individual desires to migrate abroad, i.e. the expected benefits from migration exceed the costs: $E[B(X_{irk}) - C(Z_{irk}) + \varepsilon_{irk}] > 0$
2) the individual has the funds to cover the monetary migration costs i.e. $F(X_{irk}) \geq C\,M(Z_{irk})$.

The above framework takes into consideration all factors, X_{irk} and Z_{irk} , that may influence the individual's desire and capacity to migrate. However, we will now focus on how internal migration and place of residence affect these international migration intentions. In the empirical analysis we consider the full set of factors

[16] Choosing a destination is a complex search problem for a prospective migrant. Here we make the simplifying assumption that an individual has already narrowed down the options to a preferred one, which is implied in our stylized model.

[17] This simplifying assumption is driven by lack of data on potential destinations. It should not affect the validity of the framework since we are interested in testing whether previous internal migration affects the intentions to migrate internationally and not the actual moves; therefore, knowing the destination is not central. The only case where intentions may be affected is if migrating internally expands the number of potential international destinations. In this case, the link between internal migration and international migration intentions would be reinforced.

[18] The two components of costs, C^M and C^P, will depend on separate subsets of Z_{irk}; however, to simplify notation we do not distinguish between the subsets in the theoretical model.

affecting migration intentions and their expected impacts according to our framework and as documented in the existing literature.

Focusing on place of residence and previous internal migration, or lack thereof, we hypothesize that these will affect points (1) and (2) in different ways depending on the pathway pursued. Possible combinations of place of residence and internal migration status are presented in Table 1 (in the rows) together with their potential impact on points (1) and (2) in the columns. In Table 1 we distinguish four groups: stayers in rural areas, stayers in urban areas, migrants to rural areas and migrants to urban areas[19]. These are organized in the three rows of Table 1 in the order we expect international migration intentions to increase. Table 1 shows how internal migration status affects the monetary and non-monetary costs of international migration as well as the capacity to overcome migration constraints (Columns 1-3).

The expected effects on desire and capacity to migrate internationally are illustrated in Columns 4 & 5. We assume that benefits of international migration are not affected by internal migration status, so the expected effect on desire is obtained by looking at the expected effect reported in the first two columns since these determine the expected monetary and non-monetary costs[20]. The overall expected effect on the capacity to migrate (column 5) is obtained by combining the expected impact on monetary costs (column 1) and on the capacity to overcome constraints (column 3).

First, we examine how place of residence can affect the desire and capacity to migrate internationally (Table 1, first row). In doing so we contribute to the debate on the role of urbanization as a major driver of international emigration and the mediatory role of cities in the process (King & Skeldon, 2010; Skeldon, 2018; Vullnetari, 2012; Lerch, 2020). We expect urban residents to incur lower monetary costs for international migration since cities are generally more connected to international travel routes and relevant sources of information. Similarly, in urban areas social relations and interactions are generally not based on kinship bonds, making the psychological costs for urban dwellers who have not moved internally lower than for their rural peers. We therefore expect urban residents (for an equivalent level of skill) to experience greater desire to migrate abroad. In terms of capacity to overcome constraints we expect that more options are available to urban residents to overcome financial constraints leading to a higher capacity, on average, to cover the financial cost of emigrating when compared to their rural peers.

Table 1. Expected effects of residence and internal migration history on the desire and capacity to migrate internationally (ceteris paribus on other socio-economic variables)

[19] Theoretically there are six combinations: two for stayers (rural and urban) and four for migrants (rural-to-urban, rural-torural, urban-to-urban, and urban-to-rural). Since data is lacking for the place of origin, the group of migrants to rural (urban) areas include those coming from both urban and rural origin. To simplify exposition and provide a direct link to the hypotheses we want to test, migrants and stayers in the second row of Table 1 are aggregations of all migrants and stayers, respectively, regardless of place of residence.

[20] Internal migration can have an impact on expected benefits as well, but it is reasonable to assume it is small since these will depend mostly on education and skill. Even in countries where large productivity gaps do exist between rural and urban sectors, the productivity gains from rural-to-urban migration are found to be small when accounting for individual selection between sectors (Hamory et al., 2021).

Internal migration pathway		1 **Reduction in monetary costs of international migration**	2 **Reduction in non-monetary costs of international migration**	3 **Increased capacity to overcome constraints to international migration**	4 **Expected effect on DESIRE to migrate** (qualitative assessment of columns 1 &2)	5 **Expected effect on CAPACITY to migrate** (qualitative assessment of columns 1 & 3).
Expected increasing migration intentions ↓	**Rural stayer** vs. **Urban stayer**	better information & connections in urban areas	psychological costs of moving are likely lower in urban than in rural areas	Better resources & networks in urban than in rural areas	Desire (urban) > Desire(rural)	Planning(urban) > Planning(rural)
	Stayers vs. **Internal Migrants**	Depends on migrant origin and internal destination	Expect big reduction in psychological costs of migrating by moving internally	Bigger improvements in resources & networks associated with internal move	Desire (internal migrants) > Desire(stayers)	Planning(internal migrants) > Planning(stayers)
	Migrant-to-rural vs. **Migrant-to-urban**	better information & connections in urban areas	Similar - both types of migrants have lowered their psychological cost of migrating	Further improvement in resources & networks associated with internal move to an urban area	Desire (migrant-to-urban) > Desire(migrant-to-rural)	Planning(migrant-to-urban) > Planning(migrant-to-rural)

Note: Migrants and stayers in the second row are aggregations of all migrants and stayers, respectively, regardless of place of residence.

Source: authors' elaboration.

Next we move to discuss how internal migration may impact both the desire to migrate internationally and the capacity to do so (Table 1, second row). We hypothesize - based on the literature - that previous internal migration makes a big difference in the reduction of non-monetary costs, and in increasing the financial capacity to overcome migration costs, which are driven, respectively, by: 1) the loss of social ties to the area of origin and; 2) the improved experience and resources gained through the previous internal migration. Based on the literature presented earlier in this section, we assume that previous internal migration would weaken these social ties and attachment to place of origin, reducing the nonmonetary or psychological costs of a further international move.

Finally, we focus on the intentions to migrate internationally of individuals who migrated internally to urban versus to rural areas (Table 1, third row). Concerning non-monetary costs, we expect that migrants to rural and urban areas to be similar since both have already gone through the migration experience.

However, migrating to an urban area can reduce the monetary costs of international migration more than migrating into a rural area since cities are generally more connected to international travel routes and relevant sources of information. In addition to reducing monetary costs, previous internal migration to an urban area is assumed to increase people's capacity to cover the costs of a further international move due, generally, to better

income opportunities compared to those available in rural areas (column 3). For example, de Brauw, Mueller & Woldehanna (2018) in Ethiopia and Beegle, Weerdt & Dercon (2011) in Tanzania, both find that benefits from internal migration were much larger when associated with an exit from agriculture and moving to urban areas. In other words, even though migration into rural areas may have contributed to welfare gain, this effect was much larger for migration into urban areas[21].

In brief, the framework enables us to qualitatively rank the four combinations of place of residence and internal migration status in terms of expected effect on international migration desire and planning. Given this, the empirical analysis will specifically test whether: (i) urban residents who have not moved internally are more likely to have intentions to migrate internationally than their rural peers (i.e. rural residents who have not moved internally), (ii) people who have migrated internally are more likely to develop intentions for international migration (desire and capacity) than stayers, and (iii) the role of internal migration in shaping international migration intentions depend on the destination of internal migration being rural or urban, with those arriving to an urban destination being more likely to develop intentions to migrate internationally than those arriving to a rural destination.

Data and descriptive statistics

For this study, we use GWP data collected in 2013 from Sub-Saharan African countries. The choice of the 2013 wave of the survey was dictated by the availability of variables of interest, namely those related to internal and international migrations as well as those related to relevant individual and household characteristics. The GWP surveys approximately 1000 individuals in each year in each country. The samples are probability-based and nationally representative of the resident population. The coverage area is the entire country including urban and rural areas, and the sampling frame represents the entire civilian, non-institutionalized, aged 15 and older population of the entire country (Gallup, 2017).

We narrow the scope of the paper to the region of Sub-Saharan Africa due to its own international migration patterns dominated by movements within the region (FAO, 2018). We focus specifically on low and lower-middle income countries, using the World Bank classification of countries according to their income levels, which generally face similar demographic and socio-economic challenges such as youth bulge, high unemployment, and large but low productivity agriculture sectors, among others. We had also to exclude a number of countries due to lack of data on migration-related factors or other control variables[22]. The countries

[21] When the internal move is towards rural areas, the impact would depend on the place of origin. If rural in origin (rural to-rural migration), it can still be substantial. If urban in origin (urban-to-rural migration), the effect is uncertain depending on whether it is driven by reallocation of labour based on skills (Young, 2013) or it is a return to a rural area that is common in Sub-Saharan Africa (Cattaneo and Robinson, 2020).

[22] We initially identified 25 countries in Sub-Saharan Africa that fall under two income groups. However, due to lack of data on important variables, we had to drop Liberia, Mauritania, Nigeria, and Sierra Leone.

covered by the analysis are thus 21 low and low-middle income countries from Sub-Saharan Africa[23]. From these countries, the total sample was originally composed of data from 21,056 individuals.

After omitting all the cases with missing data, as a consequence of "don't know," or "refused" answers for any of the relevant variables, the number of individuals decreased to 20,256. We also tested whether the omitted observations (less 4% of the original sample) could have impacted the randomness of the analytical sample and we found no such evidence[24]. Finally, we acknowledge, as a limitation of the empirical analysis, that the results capture a snapshot at a given point in time. With a cross-sectional dataset we are not able to examine time-variant factors. For example, migratory phenomena that occurred before 2013 may have affected the composition of a country's population and its propensity to migrate internationally both from rural and urban areas. We cannot account for these changes over time.

An empirical perspective on migration intentions: specifying the dependent variables

For our empirical analysis we build on how migration intentions were represented by scholars who used similar data from the GWP along the lines of Ruyssen and Salomone (2018) and Smith and Floro (2020). Following our conceptual framework, the term 'international migration intentions' will be used here to refer to the combination of desire and capacity to migrate internationally. The GWP data allow us to capture the two conditions characterizing international migration intentions as outlined in the conceptual framework. This is thanks to two questions that give rise to two linked dependent variables. The first question is addressed to all interviewees and has the following wording: *Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country?* This is the question that was used by Ruyssen and Salomone (2018) and Smith and Floro (2020) to refer to migration intentions. Yet, in our paper this question refers to the first layer of migration intention that we call international migration *desire*, following Sadiddin et al (2019), since it refers to what would happen under ideal conditions.

A second question is then asked only to those who expressed a desire to migrate abroad (i.e. answered yes to the previous question) and has the following wording: *Are you planning to move permanently to another country in the next 12 months, or not?* This one captures a concrete intention to leave the country since it focuses on planning within a close and defined timeframe. We refer to this question as measuring international migration *planning*, and can be viewed as a proxy for the capacity to migrate internationally introduced in our

[23] The following countries are included in the analysis: Benin, Burkina Faso, Cameroon, Chad, Republic of the Congo, Democratic Republic of the Congo, Ethiopia, Ghana, Guinea, Ivory Coast, Kenya, Madagascar, Malawi, Mali, Niger, Rwanda, Senegal, United Republic of Tanzania, Uganda, Zambia, and Zimbabwe.

[24] The test was done by: i) identifying whether a variable has missing observations; ii) Sorting the observations of the other variables into two groups: one matching the missing observations and one matching the present ones; iii) calculating the means of each group; iv) conducting T-statistic and chi-square tests on these two means. We repeated this process for all the variables that have missing observations. All the conducted tests were insignificant and therefore the dropped observations did not affect the sample randomness.

conceptual framework[25]. It is worth noting that these two questions, as of their wordings, do not regard temporary or seasonal migration, but concern the intention to make a permanent move abroad.

In the full analytical sample, about 25.6% (or 5,195 individuals) answered that they would move to another country under ideal conditions i.e. expressed a desire to migrate abroad, from whom 19.9% (or 1,036 individuals) are planning to migrate abroad in the following 12 months.

Construction of the core explanatory variable: interaction of internal migration status and current place of residence

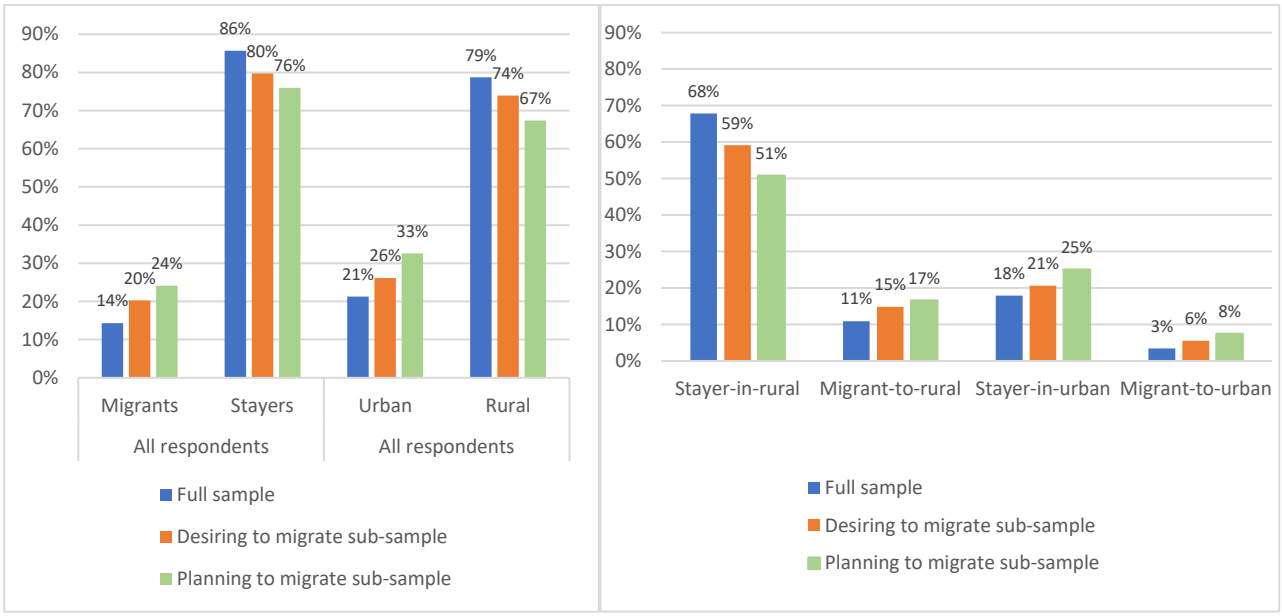
In this section, we describe the process and the justifications for how we construct the core explanatory variable, for which two questions from GWP 2013 survey are used. The first captures internal migration and is asked to all interviewees with the following wording: *Did you move from another city or area within this country in the past five years?* The question refers to past actions and thus is used to classify interviewees into internal migrants or stayers. However, it captures internal migration only in the five years preceding the survey, which is a limitation that we acknowledge since many individuals who migrated internally six years or more before the survey will be classified as stayers. The second question that we use to construct the explanatory variable is the one on current place of residence that allows us to sort all interviewees as living either in rural or in urban areas[26]. Here it is worth recalling another limitation of the data, which lacks information on the area of origin of those who migrated internally. The current place of residence allows us to identify their destinations but no information is available on where they come from. As noted in the conceptual framework, this limits our ability to capture all possible internal migration pathways, and this was already reflected in Table 1.

Figure 1 (left-side panel) shows how the shares of internal migrants and urban dwellers change when we move from the full sample to the sub-samples of those who expressed desire and subsequent planning to migrate abroad (refer to Section 3.1). In the full sample, internal migrants (regardless of place of residence) account for 14% of all respondents, but this share increases to 20% and 26% in the subsamples of those who expressed desire and planning to migrate abroad, respectively. Similarly for urban dwellers (regardless of internal migration status), they account for 21% in the full sample but increase to 26% and 33% in the sub-samples of those who expressed desire and planning to migrate abroad, respectively. This pattern implies that, on average, internal migrants and urban residents are more likely to have migration intentions (desire and planning) than stayers and rural residents, respectively.

[25] Our planning variable is only a proxy for those having the capacity to migrate internationally. First, it does not capture those who have the capacity but no desire to migrate. This is not a problem since this category of people is not of interest for our empirical analysis. Secondly, the 12-month timeframe does not capture the full set of those desiring to migrate and having the capacity to do so since some may be planning to migrate later.

[26] The question on the current place of residence asks the interviewees whether they live in 1) a large city, 2) a suburb of a large city, 3) a small town or village; 4) a rural area or on a farm. For sake of simplicity, we group responses of "a large city" and "a suburb in a large city" into one urban category, while those with responses of "a small town or village" and "a rural area or farm" are grouped under the rural category.

Figure 1. Summary statistics of internal migration status and place of residence: the rationale behind the core explanatory variable



Note1: the left panel shows how the respondents are sorted between migrants and stayers and between urban and rural, separately for the full sample and the sub-samples of those who expressed desire and subsequent planning to migrate abroad. For each sample/sub-sample, the percentages of migrants and stayers (urban and rural) sum to 100%. Note2: the right panel shows the distribution of all respondents between the four categories resulting from the interaction of migration status and place of residence for the full sample and the sub-samples of those who expressed desire and subsequent planning to migrate abroad. For each sample/sub-sample, the percentages of the four categories sum to 100%.

Source: authors' elaboration on GWP dataset (reference year: 2013)

However, the conceptual framework predicts that the pathway pursued by internal migrants also matters due to the differences in opportunities and socio-economic structures that migrants face between rural and urban areas. To check for this, we combine migration status with place of residence as done in Table 1. This means we have four groups: stayers in rural areas (stayer-in-rural), stayers in urban areas (stayerin-urban), migrants to rural areas (migrant-to-rural) and migrants to urban areas (migrant-to-urban).

The right-side panel of Figure 1 shows how respondents, in the full sample as well as in the sub-samples of those desiring and planning to migrate abroad, are distributed across these four groups. It clearly shows the category of "stayer-in-rural" - i.e. rural dwellers who have not migrated internally – is the only one that has a declining share when moving from the full sample (68%) to the sub-samples of those desiring (59%) and planning (51%) to migrate internationally. The other three categories, including the stayer-inurban category, all have rising shares. These differences indicate that internal migration status and place of residence do not work in isolation in influencing intentions to migrate internationally, as predicted by the conceptual framework. Therefore, the core explanatory variable we adopt is categorical, obtained by combining the

internal migration status with current place of residence, resulting in the following four categories: 1) stayer-in-rural, 2) stayer-in-urban, 3) migrant-to-rural, and 4) migrant-to-urban.

Other control variables

We recall from the conceptual framework that migration intentions are shaped by the combination of the expected benefits and costs of international migration. Our core explanatory variable presented above is connected to the monetary and non-monetary costs of moving abroad, but other variables - beyond place of residence and internal migration status - may affect migration costs. Moreover, the benefits of migrating internationally play an equally important role as costs. The GWP 2013 includes questions that are connected to benefits and costs of migration. We therefore control for individual and household attributes reflecting demographic and socioeconomic factors relevant to international migration. For example, we include an *age* variable since young people can better reap the benefits from migration and therefore we expect they have a greater desire to migrate. Another aspect that is central to benefits of moving abroad is that of the skill level of the prospective migrant, which is controlled for with the *educational attainment* variable with the expectation that lower skilled workers would benefit less from international migration. Access to information, which we proxy through *internet access,* is another factor considered as it may increase the benefits and reduce the costs of moving abroad.

Social networks are another factor widely acknowledged in the migration literature to affect migration. For instance, the availability of a reliable network in potential international destinations (*support from abroad*) reduces the cost of moving abroad (both monetary and non-monetary) while reliable social networks in areas of origin (*local support*) may have the opposite effect by increasing non-monetary costs. *Marital status* is expected to play a similar role to that of local networks because it increases the psychological costs of emigration.

Other factors such as *employment* (part-time and full time) are considered as they can also play a role. However, the role they play is more ambiguous and depends on the local contexts and how they are measured. For example, when locally available employment opportunities are poor, it would not make a big difference between employed or not when it comes to outmigration.

To capture various aspects of household wellbeing we also use per capita household income, as well as two questions that measure access to adequate shelter and food. We also make use of two additional questions that measure personal assessment of wellbeing and quality of life. The first expresses whether the individual is satisfied or not with one's own standard of living and the second regards personal overall satisfaction with the city or area where one lives and considered as a proxy for how an individual regards the general services and quality of life in the place of residence. Both these variables are expected to be negatively associated with the desire to migrate. Finally, the last control variable is the GWP's positive experience index, which measures

individuals' perceptions of their current wellbeing from what happened to them the day before the survey[27]. We use this variable as an exclusion restriction in the empirical model (see Section 4).

The full list of questions used to generate the variables are listed in Annex I. Some answer options have been consolidated for the sake of simplifying the analysis by reducing the scale of responses as in the case of to education level[28] and marital status[29].

Descriptive statistics

Table 2 explores who are the internal migrants and how they differ from stayers, accounting for their current place of residence. The numbers are the shares relative to the totals within each subgroup. The left panel shows the descriptive statistics for the total sample; the right panel shows the descriptive statistics only for those who have a stated a desire to migrate abroad. In addition to what is illustrated in Figure 1, the following observations are worth highlighting. First, internal migrants are generally younger, less likely to be partnered and have smaller families. Second, they are often more educated and also better-off than stayers as they have higher incomes. They are also more connected: they have better access to the internet and more support from networks, locally and abroad. On the other hand, the table shows a clear rural-urban gap in income opportunities, access to internet, and education attainments which are consistently higher for urban dwellers regardless of migration status. It is worth noting for the variable "support from abroad", the share of rural-stayer category is much lower than the shares of the other three categories which are very close to each other. Here the rural-urban gap is observed only when we look at the stayers' categories.

[27] The index is composed of 5 items measuring the respondent's experience of wellbeing on the day before the survey. Respondents were asked whether they felt well rested, were treated with respect, smiled or laughed a lot, learned or did something interesting, or felt enjoyment the day before the survey (Gallup, 2017)

[28] Here the responses where simplified to "primary or less" and "above primary". This is because the GWP surveys cover people from the age of 15 years old who are unlikely to be deciding whether or not to continue their primary school education. In other words, people at age of 15 years old would have either completed their primary school or dropped to enter the labour market. Considering other categories such as those who completed high school may be imperfect since people at the age of 15-25 may be deciding whether to migrate, work, or pursue higher education

[29] Here the original categories were simplified to either "partnered" – including married or with domestic partner – or "nonpartnered" – including people who never been married, separated, widowed, or divorced.

Table 2. Descriptive statistics for the variables of interest for the full sample, presented in terms of sub-groups created from the combination of internal migration status and place of residence

Variable name (response/unit of measurement)	Full Sample					Sub-sample of those who expressed international migration desire				
	Total sample	Stayer-rural	Migrant-rural	Stayer-urban	Migrant-urban	Total Subsample	Stayer-rural	Migrant-rural	Stayer-urban	Migrant-urban
Migration desire OR planning (Yes)	0.26	0.22	0.35	0.30	0.42	0.20	0.17	0.22	0.24	0.27
Gender (male)	0.54	0.54	0.56	0.51	0.55	0.57	0.59	0.59	0.53	0.56
Age (years)	34.7	35.5	31.8	34.4	31.4	28.7	28.6	28.7	28.9	29.2
Marital status (non-partnered)	0.44	0.41	0.46	0.51	0.54	0.57	0.54	0.54	0.65	0.62
Household size (number)	6.1	6.4	5.3	5.7	4.9	6.2	6.7	5.2	5.9	5.2
Educational attainment (primary or less)	0.56	0.66	0.40	0.36	0.26	0.43	0.52	0.36	0.25	0.22
Employment (unemployed)	0.35	0.33	0.27	0.45	0.39	0.39	0.37	0.30	0.50	0.45
Employment (part-time employment)	0.25	0.26	0.27	0.19	0.20	0.23	0.24	0.28	0.19	0.18
Employment (full-time employment)	0.40	0.41	0.47	0.36	0.42	0.37	0.39	0.42	0.31	0.37
Access to the internet (Yes)	0.08	0.04	0.10	0.18	0.27	0.10	0.05	0.10	0.18	0.25
Support from abroad (Yes)	0.44	0.39	0.52	0.53	0.51	0.52	0.47	0.58	0.59	0.58
Local support (Yes)	0.74	0.73	0.77	0.74	0.75	0.75	0.74	0.76	0.74	0.76
Per capita HH income (International USD)	1166	864	1494	1877	2289	1201	887	1476	1612	2304
Not enough money for shelter (Yes)	0.55	0.33	0.32	0.32	0.33	0.36	0.36	0.39	0.35	0.34
Not enough money for food (Yes)	0.55	0.57	0.52	0.49	0.47	0.56	0.59	0.57	0.51	0.50
Satisfaction with standard of living (Yes)	0.40	0.38	0.42	0.44	0.45	0.35	0.33	0.37	0.40	0.41
Satisfaction with city overall (Yes)	0.62	0.62	0.56	0.65	0.61	0.49	0.48	0.58	0.59	0.52
Positive experience index	68.8	68.1	70.16	69.3	67. 5	67.9	68.1	68.7	67.5	64.3
Number of observations	20,256	13,729	2,213	3,626	688	5,195	3,068	770	1,071	286

Source: authors' elaboration on GWP dataset (reference year: 2013)

Methodology: empirical models and estimation

Based on the conceptual framework laid out in Section 2, combined with the data available as described in Section 3, we use econometric methods to explore the determinants of intentions of international migration – i.e. the desire and subsequent planning to leave permanently one's own country – and what roles are played by previous internal migration and current place of residence. Both the *desire* and the subsequent *planning* of international migration are binary-choice variables. However, as explained in Section 3.1, *planning* is observed only when *desire* equals unity i.e. for only a portion of the data (those *desiring* to migrate internationally). Drawing from Vella (1998), this means that planning is observed only for a sub-sample that is not randomly selected, giving rise to sample selection bias. Therefore, to account for this bias, we use binary-choice models with sample-selection (Heckman, 1979) that jointly estimate the determinants of the desire and planning to migrate abroad.

Therefore, the probabilities of and individual i living in country k to *desire* and subsequently *plan* to migrate abroad can be expressed as follows:

$$D_{ik}^{*} = \alpha_D + \beta_D IMPR_{ik} + \gamma_{DB} X_{ik} + \gamma_{DC} Z_{ik} + V_{D,k} + e_{D,ik} \quad (1)$$

$$D_{ik} = \begin{cases} 1, & D_{ik}^{*} > 0 \\ 0, & D_{ik}^{*} \leq 0 \end{cases} \quad (A)$$

$$P_{ik}^{*} = \alpha_p + \beta_p IMPR_{ik} + \gamma_{pB} X_{ic} + \gamma_{pC} X_{ik} + V_{p,k} + e_{p,ik} \quad (2)$$

$$P_{ic} = \begin{cases} 1, & P_{ik}^{*} > 0, \quad given\ D_{ik} = 1 \\ 0, & P_{ik}^{*} \leq 0, \quad given\ D_{ik} = 1 \end{cases} \quad (B)$$

Equation 1 is the selection equation where D_{ik}^{*} indicates the latent dependent variable of international migration desire of individual i living in country k. The coefficients β_D are associated with the vector of core explanatory variables capturing Internal Migration and Place of Residence, expressed by the acronym $IMPR_{ik}$, reflecting the residence and migration status of individual i living in country k. Finally, X_{ik} and Z_{ik} are vectors denoting the other control variables – with coefficients γ_{DB} and γ_{DC} - that represent individual socio-economic and demographic characteristics connected to benefits and costs as explained in Section 3.3, $V_{D,k}$ denotes the country fixed effects to account for unobserved characteristics common to all inhabitants in each country, and $e_{D,ik}$ represents unobserved individual heterogeneity. Similarly, in Equation 2, P_{ik}^{*} indicates the latent dependent variable of international migration planning of individual i living in country k, while $IMPR_{ic}$ (with coefficients β_p), X_{ik} and Z_{ik} (with coefficients γ_{pB} and γ_{pC}), $V_{p,k}$ and $e_{p,ik}$ are the same as in Equation 1. The only difference between Equations 1 and 2 in terms of explanatory variables is that the positive experience index (see Section 3.3 and Annex I) is considered only in Equation 1. This variable is important as an exclusion restriction in the selection equation (Equation 1) that is recommended when applying the Heckman approach (Ruyssen & Salomone, 2018; Smith & Floro, 2020). The rationale for choosing the positive experience index as an exclusion restriction is that it expresses an individual's experience on the day before the survey, as such

it can affect international migration desire. However, it is extremely unlikely that the individual would have the time to plan in just one day a move abroad within the following 12 months. To support our decision of considering it as an exclusion restriction variable we conduct a few tests whose results are summarized in Annex II.

Formulas A and B state that D_{ik}^{*} and P_{ik}^{*} are latent variables and only their signs are observed. However, in Formula B, the sign of P_{ik}^{*}, is observed only when D_{ik} equals unity. This is to reflect that planning to migrate is observed only for those who expressed a desire to migrate, meaning that the subsample of those who expressed the desire is not randomly selected.

It is important to note that each of the vectors β_D and β_p will have three estimated values depending on the four possible combinations of internal migration status and place of residence, taking into account that the combination "stayer-in-rural" is used as the reference group (Refer to Section 3.2). Linking this to the hypotheses laid out in Section 2, we expect the three estimates of β_D and β_p to be positive expressing that individuals in the reference category - rural stayers - are the least likely to develop international migration intensions. More importantly, based on our conceptual framework, we anticipate the estimates to be highest when internal migration status is combined with urban residence (i.e. migrantto-urban), followed by the estimates for internal migrants to rural areas, then by urban stayers.

The equations, i.e. the probabilities D_{ik} and P_{ik} and the associated parameters: of β_D, β_p, γ_{DC}, γ_{DB}, γ_{PB} and γ_{PC} are estimated using maximum-likelihood by means of logit techniques, with standard errors clustered at the country level and corrected for heteroscedasticity. The explanatory variables were also tested for multicollinearity and the test results show the absence of serious related problems[30].

Results and discussion

The estimation results are presented in Table 3 and the coefficients refer to marginal effects reflecting the probabilities of desire and planning to migrate abroad of the explanatory variables. In the following, we first discuss the results of the core explanatory variable and how they relate to the three hypotheses presented in the conceptual framework. Then we present some insights from the coefficients of the other control variables and discuss the limitation of the model estimation.

Table 3. Results of estimating the binary model with sample selection

	Benchmark model (BM)		**BM with income dropped**	
Variables	**Desire**	**Planning**	**Desire**	**Planning**
Migrant-rural	0.219***	0.091***	0.223***	0.104***

[30] We tested for multicolliearity by calculating the Generalized Inflation Factors (GVIF). This measure describes how much the variance of an estimated coefficient is increased because of collinearity. If a variable is highly correlated with the remaining predictors, its variance inflation factor will be very large. A general rule is that the VIF should not exceed 10 (Belsley, Kuh & Welsch, 1980). The results indicate lack of problems related to multicollinearity as detailed in Annex III.

	Benchmark model (BM)		BM with income dropped	
Variables	**Desire**	**Planning**	**Desire**	**Planning**
	(0.032)	(0.032)	(0.031)	(0.032)
Stayer-urban	0.107***	0.045**	0.123***	0.047**
	(0.029)	(0.021)	(0.028)	(0.022)
Migrant-urban	0.361***	0.128**	0.369***	0.165***
	(0.053)	(0.052)	(0.052)	(0.052)
Gender (male)	0.185***	0.018	0.187***	0.027
	(0.021)	(0.025)	(0.021)	(0.025)
Age (log_year)	-0.808***	-0.127	-0.826***	-0.168
	(0.031)	(0.106)	(0.031)	(0.105)
Marital status (non-partnered)	-0.108***	-0.040**	-0.106***	-0.044**
	(0.023)	(0.018)	(0.023)	(0.018)
Household size (number)	0.015***	0.008***	0.012***	0.007***
	(0.003)	(0.003)	(0.003)	(0.002)
Educational attainment (Primary education or less)	-0.238***	-0.058*	-0.236***	-0.072**
	(0.024)	(0.033)	(0.023)	(0.032)
Employed (part time)	0.026	0.028*	0.041	0.048***
	(0.028)	(0.016)	(0.027)	(0.016)
Employed (full time)	0.021	0.002	0.031	0.007
	(0.025)	(0.014)	(0.024)	(0.015)
Internet access	-0.024	0.062***	0.003	0.067**
	(0.039)	(0.021)	(0.038)	(0.021)
Support from abroad	0.250***	0.131***	0.252***	0.146***
	(0.022)	(0.034)	(0.022)	(0.033)
Local support	-0.049**	-0.076***	-0.042*	-0.068***
	(0.025)	(0.015)	(0.024)	(0.015)
Per capita HH income (log_int.USD)	0.014*	0.007		
	(0.007)	(0.004)		
Not enough money for shelter	0.038	0.042***	0.033	0.029**
	(0.024)	(0.014)	(0.023)	(0.014)
Not enough money for food	0.0271	0.025*	0.034	0.044***
	(0.023)	(0.013)	(0.023)	(0.014)
Satisfied with the standard living	-0.104***	0.021	-0.107***	0.009
	(0.023)	(0.019)	(0.023)	(0.019)
Satisfied with city overall	-0.363***	-0.084*	-0.373***	-0.111**
	(0.022)	(0.048)	(0.022)	(0.048)
Positive experience index	-0.007*		-0.008*	
	(0.004)		-0.004	
Constant	1.980***	0.227*	2.131***	0.332**
	(0.132)	(0.132)	(0.122)	(0.142)
Observations	20,473	20,473	21,452	21,452
Country FE	YES	YES	YES	YES

Note: *Coefficients are average marginal effects. Standard errors are in parentheses. Standard errors are clustered by country and robust to heteroskedasticity. Each model also includes country fixed effects.*

**** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.*

Results and discussion in relation to the research hypotheses

The relevant results to the three research hypotheses are illustrated in the first three rows of Table 3 which show the coefficients of the three categories (stayer-in-urban, migrant-to-rural and migrant-tourban) relative to the omitted category (stayer-in-rural) that is used as a reference in the regression. They show that the coefficients of the core explanatory variable are significantly and positively associated with both desire and planning to migrate abroad with the expected sign. Therefore, the coefficients generally indicate that previous internal migration and urban residence increase the probability of developing intentions to migrate abroad, compared to staying in the same place or residing in rural areas, respectively[31].

Next we discuss the three hypotheses presented in the closing of the conceptual framework. The results are in line with the first hypothesis showing that urban stayers have higher intentions to migrate abroad than their rural peers. Compared to stayer-in-rural, being stayer-in-urban, the probabilities of desiring and planning to migrate abroad are greater by 10 and 4 percentage points respectively, and these higher probabilities are significant at 1% as shown in Table 4 (first row). In the conceptual framework, this is attributed to higher baseline propensity to consider international migration by urban dwellers, compared to their rural peers for a number of reasons including better information and connections and lower psychological costs than in rural areas. This empirical result, indicating that rural dwellers have less interest in migrating abroad than their urban counterparts, is in line with the hypothesis proposed by Gamso & Yuldashev (2018) to explain their finding that aid targeting rural development reduces emigration from aid recipient countries, while aid targeting urban areas increases emigration rates.

The results also show that internal migrants are more likely to desire and plan to migrate internationally than people who have not moved internally (stayers). This is in line with the second hypothesis. Being a migrant-to-rural increases, on average, the probabilities of desiring and planning to migrate abroad by 21.9 and 9 percentage points, respectively, compared to being a stayer-in-rural[32]. Similarly, by comparing the coefficients of stayer-in-urban and migrant-to-urban, those of the latter are noticeably larger for both desire and planning. In both cases, the coefficients of migrants are significantly greater than those of stayers at 1% as shown in Table 4 (rows 2-5). In line with the conceptual framework, these differences might be driven by the reduction of non-monetary (psychological) costs related to any potential international move and - for planning - the improvement in the capacity to overcome constraints through experience and resources gained in the process of internal migration.

[31] In our findings the effect on desire and on planning complement each other, enabling a strong conclusion about how internal migration is associated with the number of people intending to migrate. If the coefficients of internal migration were found negative for desire but positive for planning, or vice versa, then the net the number of those intending to migrate would have been ambiguous.

[32] Each of the migrant categories (i.e. migrant-to-urban and migrant-to-rural) includes two groups of internal migrants depending on the area of origin. For instance, the migrant-to-rural category includes urban-to-rural migrants and rural-to rural migrants. The reported coefficients represent the overall effect of these two pathways, but there may be significant differences between them that we cannot verify due to the data limitation on place of origin as we mentioned in the conceptual framework.

Table 4. Significance tests for the differences between categories of the core explanatory variable

		Migration desire	**Migration planning**
Stayer-in-urban > stayer-in-rural	T-statistic	93.25***	37.22***
	p-value	0.000	0.000
Migrant to-rural > stayer-in-rural	T-statistic	124.63***	49.19***
	p-value	0.003	0.056
Migrant to-urban > stayer-in-rural	T-statistic	175.34***	72.09***
	p-value	0.000	0.003
Migrant-to-rural > stayer-in-urban	T-statistic	22.04***	9.79***
	p-value	0.000	0.001
Migrant-to-urban > stayer-in-urban	T-statistic	52.93***	26.85***
	p-value	0.000	0.006
Migrant-to-urban > migrant-to-rural	T-statistic	31.24***	16.98***
	p-value	0.000	0.000

*Note: *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.*
Note2: the absolute values of T-statistic are reported

Now we come to see how internal migration interacts with current place of residence, which is the core of the third hypothesis. If we compare the coefficients of migrant-to-rural with those of migrant-to-urban, we see that those of the latter are greater and the differences are statistically significant at 1% (Table 4, row 6). This implies that the third hypothesis cannot be rejected; consequently, migrating to an urban area increases the likelihood of developing intentions to migrate abroad more than migrating to rural areas. In line with the conceptual framework, the differences might be driven by a stronger reduction in psychological costs when migrating to an urban area and by better opportunities in urban areas to access information through expanded networks. This is likely a further mechanism, not considered by Gamso & Yuldashev (2018), that could explain their finding that aid targeting urban areas increases emigration rates - if such targeted aid increases internal migration to urban areas.

In brief, the results are in line with the three hypotheses laid out in the conceptual framework. They can be summarized as follows: on average, migrants to urban areas are the most likely to develop international migration intentions, followed by those who migrated to rural areas, those who live in urban areas and have not moved internally, and lastly come rural residents who have not moved internally.

Additionally, it is also worth noting that the coefficients of the core explanatory variable for desire are consistently higher than those for planning (Table 3). Being in migrant-to-rural, stayer-in-urban or migrant-to-urban would increase the probability of desiring to migrate abroad by 21.9, 10.7 or 36.1 percentage points, respectively, but when it comes to planning these coefficients are 9.1, 4.5 and 12.8 percentage points. This indicates internal migration is more strongly associated with the desire than with the planning to migrate abroad. The interpretation we propose –in line with the conceptual framework – is that the reduced non-

monetary costs, which affect desire but not the capacity to plan (see Table 1), is the dominant mechanism linking internal migration and the intention to migrate internationally[33].

Insights on the other explanatory variables: discussing the model limitations

In this section, we broaden the discussion to the results of the other explanatory variables and how they link to the conceptual framework. In doing so, we shed light on the limitations of the model estimation, the sources of these limitations and their implications for the interpretation of the results.

Table 3 shows the results for the other control variables too indicating that the coefficients of age, gender, marital status, and education level are all significant with the expected sign regarding international migration desire, but some are insignificant for planning. Individuals desiring, and eventually planning, to migrate abroad are generally male, younger, non-partnered, and more educated. These results are in line with findings of several papers that used GWP data to analyse the determinants of migration intentions such as Manchin and Orazbayev (2018), Sadiddin et al (2019), and Smith and Floro (2020).

The results also indicate that coefficients for social networks are significant with expected signs. The availability of support from abroad is associated with increased desire and planning to migrate abroad by 25 and 13 percentage points, while that of local support is associated with reduced desire and planning to migrate abroad by 5 and 7 percentage points, respectively. This is in line with findings from previous studies on the role of networks in changing migration costs. The presence of migrant diasporas lowers the costs of information (Deléchat, 2001), assimilation (Pescosolido, 1986), and finding jobs and housing for prospective migrants who are still in areas or countries of origin (Beine & Salomone, 2013; Bertoli & Ruyssen, 2018; Manchin & Orazbayev, 2018). On the other hand, the availability of local support seems to play the role of attaching individuals to their countries of origin (Manchin & Orazbayev, 2018).

Concerning employment, the coefficients results (Table 3) show a significant association whereby being employed part-time increases the probability of planning to migrate by about 3 percentage points but has no role in migration desire, compared to being unemployed. Full-time employment is insignificant for both desire and planning to migrate abroad. Overall, this indicates a weak and mostly insignificant association between employment status and international migration intentions. This could be driven by the generally low quality of jobs in most of the region and thus being employed would not make a significant difference on the quality of life and prospects linked to international migration. This interpretation is in line with findings of previous studies indicating low levels of job satisfaction in sub-Saharan Africa (Michaelowa, 2002; Abugre, 2014).

The marginal effects of income and other welfare-related factors are worth discussing due to their potential endogeneity with migration behaviours. The results show that an increase in the per capita household income

[33] Table 1 shows how migration desire depends on monetary and non-monetary costs. The capacity to migrate abroad (i.e. migration planning here in the empirical analysis) instead depends on the monetary costs and the capacity to overcome constraints. Since reducing monetary costs affects both desire and planning in a similar manner, the larger coefficient for desire will be associated with a reduction in the non-monetary psychological costs, which dominates over the improved capacity to overcome constraints.

is associated with increased probability to desire to migrate abroad and is statistically significant, but it is insignificant for planning. The two measures of personal assessment of wellbeing and satisfaction with quality of life are significant, and as expected are associated with a decreased probability to desire to migrate abroad. However, the coefficients on the lack of money for food and shelter indicate significantly positive association for planning but not significant for desire.

One related point that is worth mentioning is that from Table 2 we see internal migrants have noticeably higher incomes than stayers, controlling for the place of residence. For example, the income of migrantto-rural is 70% higher than that of stayer-in-rural; that of migrant-to-urban is higher by 22% than that of stayer-in-urban. This is an indication of potential endogeneity with the internal migration status because income, being a function of job types, may not be independent of previous migration and the associated employment opportunities. However, Table 2 does not show noticeable differences between internal migrants and stayers regarding neither capacities to cover food and shelter needs, nor personal assessments of well-being and satisfaction.

Nevertheless, we conducted a number of checks to see how the model results change if we drop one or more of these variables (those of employment and income-related variables). The detailed results are presented in Annex IV, but what is important to report is that we do not observe noticeable changes in the magnitude of the coefficients or in the significance.

However, the most serious sources of endogeneity that may cause our estimated coefficients to be biased are those related to data limitations. The control variables included in the analysis do not capture all characteristics that simultaneously influence the behavioural choices regarding migration, especially that the analysis is conducted on cross-sectional data that do not capture variation over time. Therefore, the coefficients of Table 3 may have captured other unobserved, but fundamental characteristics, rather than solely the role of the control variables that are included in the estimation. Examples of unobserved, but important factors, may be skills and cognitive abilities (beyond scholastic education level) as well as other various aspects of agency such as personal motivations and risk aversion. Not including such attributes in the regression may cause estimates to be biased.

To address these sources of endogeneity, one would ideally use the instrumental variable (IV) estimation method (Reiersøl, 1950) that is widely acknowledged to be very efficient in detecting and treating the endogeneity bias (Scott, 2019). However, the most important condition for applying the IV method is finding a variable that influences the relevant explanatory variable (i.e. previous internal migration in our case) but has no effect on the dependent variable (migration desire and planning). As both variables have the same nature (migration), it is conceptually impossible to find the relevant IV i.e. to apply this method (Titus, 2007). In alternative, we conducted a number of tests whose results show that the model estimation is stable to the changes imposed by those tests (for details, see Annex V). However, not being able to verify the model robustness through the IV method means that our results are only descriptive, on the basis of which we cannot establish causality between previous internal migration and international migration intentions. Further, we

cannot claim either that the significant coefficients associated with previous internal migration are solely attributed to reductions in psychological costs (for international migration desire) or to improved capacity to overcome financial constraints (for international migration planning).

Conclusions

The point of departure for this analysis has been that people who migrated internally are more prone to consider a subsequent international migration because they have already, partially or totally, lost ties with their areas of origin, while they have accumulated experience, skills, resources and networks that would enable them to tackle the high costs of international migration. Results indicated that people who migrated internally are more likely, on average, to develop international migration intentions – i.e. desire and subsequently plan to migrate abroad - than people who did not move within the country (stayers).

Those migrating to urban areas are the most likely to develop migration intentions, followed by migrants to rural areas. Among the stayers, urban dwellers are found to have significantly higher intentions to migrate abroad compared to rural dwellers.

The results highlight the role of agency, where previous internal migration plays an important role in shaping the desire and subsequent planning to migrate abroad. This is because people who have already migrated internally have reduced the non-monetary costs associated with attachment to place of origin and may have increased their capacity to undertake an international move. They also confirm that urbanization itself is a factor that may promote international migration, and further indicate that internal migration to urban areas plays an important supporting role in amplifying this phenomenon.

Among the caveats of the analysis we have that, due to data limitations, the results are only descriptive and cannot establish a causal relationship between previous internal migration and international migration intentions.

Another data-related caveat that is worth highlighting is the lack of information on the internal on the place of origin of internal migrants, which does not allow to further disaggregate how internal migration flows are associated with international migration intentions. For example, in the case of migrants to rural areas, this means that urban-to-rural migrants are combined with rural-to-rural migrants, and we could only test the average effect over these two subpopulations.

A further data limitation is that internal migration is captured only for the five years preceding the survey, so that individuals who migrated internally six years or more before the survey are classified as ‘stayers’. However, this limitation is not of great concern, since the link between internal and international migration processes could emerge as being even stronger if we were able to capture internal migration that occurred earlier than 5 years ago.

Despite the limitations of the study, the results presented highlight that regional development policies likely have a role in determining international migration. Policies that address the rural-urban gaps through more

equitable territorial development can reduce the incentives to migrate internally, which in turn, would lead to a reduction in international migration intentions. Assuming that the intention to migrate abroad is practically the first step towards actual migration, we expect that policies that alter internal migration rates will also affect international migration.

Annex I:

Table I.1. Analytical variables and associated questions in the GWP

GWP code	Variable	Question Text	Responses/unit of measurement
WP1325	International migration desire	Ideally, if you had the opportunity, would you like to move PERMANENTLY to another country, or would you prefer to continue living in this country?	Yes No Don't know or refused
WP10252	International migration plans	Are you planning to move permanently to another country in the next 12 months, or not?	Yes No Don't know or refused
WP12327	Internal migration	Did you move from another city or area within this country in the past five years?	Yes No Don't know or refused
WP14	Current place of residence	Do you live in . . . ?	A large city A suburb of a large city A small town or village A rural area or on a farm Don't know or refused
WP1219	Gender	Gender	Male Female Don't know or refused
WP1220	Age	Please tell me your age	Number Don't know or refused
WP1223	Marital Status	What is your current marital status?	Single/Never been married Married Separated Divorced Widowed Domestic partner Don't know or refused
HHsize	Household size	Total number living in household for per capita income	Number Don't know or refused
WP3117	Educational attainment	What is your highest completed level of education?	Elementary education or less Secondary education Beyond 'high school' education Don't know or refused
EMP_2010	Employment	Respondents fall into one of six categories of employment based on a combination of answers to a series of questions about employment	Employed full time Employed part time Unemployed Out of workforce Don't know or refused

GWP code	Variable	Question Text	Responses/unit of measurement
WP39	Access to the internet	Does your home have access to the Internet?	Yes No Don't know or refused
WP3333	Support available abroad	Do you have relatives or friends who are living in another country whom you can count on to help you when you need them, or not?	Yes No Don't know or refused
WP27	Local support	If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?	Yes No Don't know or refused
INCOME_4	Per capita HH income (International USD)	Per Capita income dollars	Number Don't know or refused
WP40	Not enough money for shelter	Have there been times in the past 12 months when you did not have enough money to provide adequate shelter or housing for you and your family?	Yes No Don't know or refused
WP43	Not enough money for food	Have there been times in the past 12 months when you did not have enough money to buy food that you or your family needed?	Yes No Don't know or refused
WP30	Satisfied with the standard living	Are you satisfied or dissatisfied with your standard of living, all the things you can buy and do?	Satisfied Dissatisfied Don't know or refused
WP83	Satisfaction with city overall	Are you satisfied or dissatisfied with the city or area where you live?	Satisfied Dissatisfied Don't know or refused
INDEX_PX	Positive experience index	1) Did you feel well-rested yesterday? 2) Were you treated with respect all day yesterday? 3) Did you smile or laugh a lot yesterday? 4) Did you learn or do something interesting yesterday? 5) Did you experience the following feelings during a lot of the day yesterday? How about enjoyment?	Yes No Don't know or refused

Additional variables used in the robustness tests

WP145	Corruption	Is corruption widespread within businesses located in this country, or not?	Yes No Don't know or refused
WP4657	Born	Were you born in this country, or not?	Yes Don't know or refused

Source: GWP dataset

Annex II:

Table II.1 presents the tests for the validity of the exclusion restriction variable. The independence condition requires the positive experience index affect the probability of migration desire but have no effect on migration planning. The regression results (column 2 and 3) confirm that the index has a significant impact on migration desire, but not on planning. Column 3 confirm that even the residuals component of the positive experience index has no significant effect on planning. Column 4 shows that there is no effect of the index on the residual component of planning.

Table II.1. Exclusion restriction validity tests

Variables	**Migration desire**	**Migration planning**	**Migration planning - with positive experience index residuals**	**Migration planning residuals**
Positive experience index	-0.00736* (0.00445)	0.00208 (0.00259)		0 0
Positive experience index residuals			0.00291 (0.00234)	
Control	yes	yes	yes	no
F-statistic			12.64	0
Prob > F			0	
R^2			0.0823	0
Number of Observations	20,473	20,473	5,059	5,059

Notes: Data source is GWP, 2013. Positive experience index (PEI) residuals were created by regressing the PEI on migration desire. Migration planning residuals were created by regressing migration planning on the PEI residuals and control variables. Column 4 shows the regression of the migration planning residuals on the instrument PEI. Standard errors are in parentheses.

** Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.*

Annex III:

Table III.1 reports the result of the Generalized Variance Inflation Factors. As all values are far below 10, we infer no serious multicollinearity problems are present among the variables included in our model.

Table IV.1: Generalized Variance Inflation Factors (GVIF) of the benchmark econometric model

Variables	**Migration desire**	**Migration planning**
Internal migration*place of residence	1.15	1.15
Gender	1.05	1.04
Ln_Age	1.22	1.42
Marital status	1.23	1.39
Household size	1.11	1.12
Employment status	1.11	1.19
Educational attainment	1.29	1.21
Ln_Per capita household income	1.24	1.21
Support available abroad	1.12	1.13
Local support	1.11	1.14
Not enough money for shelter	1.19	1.2
Not enough money for food	1.27	1.28
Access to the internet	1.15	1.14
Satisfaction with city overall	1.15	1.15
Satisfaction with the standard of living	1.21	1.19
Positive experience index	1.09	1.1

Source: authors' elaboration on GWP dataset (reference year: 2013)

Annex IV:

Nevertheless, we conducted a number of checks to see how the model results change if we drop one or more of variables associated with wealth. As income can potentially affect the capacity of individuals to secure sufficient food and adequate shelter, we went one step further and re-estimated the benchmark model dropping also these two variables. We also re-estimated the benchmark model dropping the employment variable, but we obtained results that are negligibly different from the benchmark results. The detailed results are presented in Table IV.1. As shown, we do not observe noticeable changes in the magnitude of the coefficients or in the significance.

Table IV.1. Results of the benchmark model (BM) after dropping income and shelter (left panel), income, shelter and food (middle panel) or employment (right panel)

	BM with income dropped		BM with income and shelter dropped		BM with income, shelter and food dropped		BM with employment dropped	
VARIABLES	Desire	Planning	Desire	Planning	Desire	Planning	Desire	Planning
Migrant-to-rural	0.223***	0.104***	0.222***	0.104***	0.183***	0.086***	0.220***	0.0880***
	(0.031)	(0.032)	(0.031)	(0.032)	(0.03)	(0.028)	(0.032)	(0.032)
Stayer-in-urban	0.123***	0.047**	0.125***	0.049**	0.130***	0.043**	0.105***	0.041**
	(0.028)	(0.022)	(0.028)	(0.022)	(0.027)	(0.022)	(0.030)	(0.020)
Migrant-to- urban	0.369***	0.165***	0.369***	0.166***	0.352***	0.131***	0.359***	0.119**
	(0.052)	(0.052)	(0.052)	(0.052)	(0.049)	(0.05)	(0.053)	(0.051)
Employed (part time)	0.041	0.048***	0.041	0.050***	0.047*	0.054***		
	(0.027)	(0.016)	(0.027)	(0.016)	(0.026)	(0.016)		
Employed (full time)	0.031	0.007	0.032	0.007	0.032	0.012		
	(0.024)	(0.015)	(0.025)	(0.015)	(0.024)	(0.014)		
Per capita HH income (log_int.USD)							0.014**	0.007
							(0.007)	(0.004)
Not enough money for shelter	0.033	0.029**					0.038	0.042***
	(0.023)	(0.014)					(0.024)	(0.014)
Not enough money for food	0.034	0.044***	0.045**	0.054***			0.027	0.024*
	(0.023)	(0.014)	(0.021)	(0.013)			(0.023)	(0.013)
Other control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	21,452	5,303	21,519	5,322	22,454	5,662	20,474	5,060

Note: Coefficients are average marginal effects. Standard errors are in parentheses. Standard errors are clustered by country and robust to heteroskedasticity. Each model also includes country fixed effects.

**** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.*

Annex V:

Various causes of endogeneity can be present because of data limitations. Individuals have both observed and unobserved characteristics that simultaneously influence their behavioural choices with respect to both previous internal migration and international migration intentions. When the instrumental variable (IV) estimation method (Reiersøl, 1950) is not feasible, the propensity score matching (PSM) method (Rosenbaum & Rubin, 1983) was proposed by scholars to address endogeniety (Butry, 2007). We follow Titus (2007) and use the PSM to mitigate the endogeneities. The PSM is also useful to reduce any attrition bias in the data and generate results similar to those obtained under randomized experiments (Dong & Lipsey, 2018). This is also relevant for our paper because internal migrants in our study may not be randomly observed since migration is a choice and not a random variable and therefore capturing internal migration depends on how the sampling frame captures the destinations of internal migrants, potentially creating an attrition bias in the sample.

Table V.1 Balance check for original versus matched samples of internal migrants and stayers

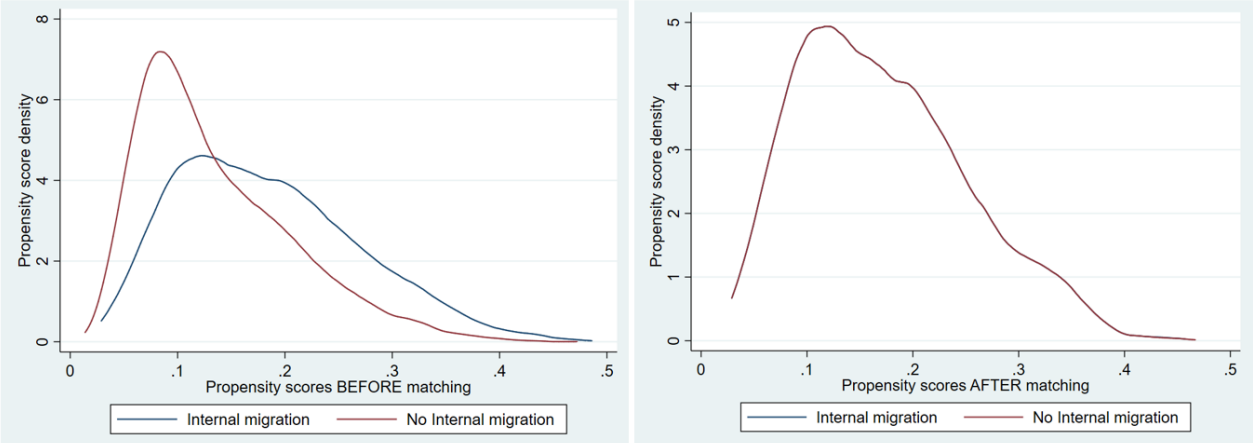
Variables	**Original sample**				**Matched sample**			
	Treated	**Control**	**t-test**	**p value**	**Treated**	**Control**	**t-test**	**p value**
Area of residence	0.748	0.776	3.662	0.000	0.763	0.762	0.060	0.951
Gender	0.554	0.531	-2.529	0.011	0.554	0.556	-0.080	0.937
Age (log_year)	3.437	3.507	9.798	0.000	3.421	3.417	0.510	0.612
Marital status	1.523	1.565	4.809	0.000	1.519	1.519	-0.030	0.979
Household size	5.281	6.240	14.995	0.000	5.191	5.155	0.460	0.645
Education attainment	0.378	0.578	22.958	0.000	0.371	0.377	-0.540	0.587
Employment	2.136	2.014	-8.003	0.000	2.157	2.164	-0.320	0.748
Internet access	0.150	0.079	-14.104	0.000	0.139	0.149	-1.080	0.279
Support from abroad	0.493	0.421	-8.232	0.000	0.520	0.518	0.160	0.875
Local support	0.759	0.727	-4.168	0.000	0.767	0.779	-1.160	0.246
Per capita HH income (log_int.USD)	6.552	6.075	-14.911	0.000	6.558	6.563	-0.130	0.898
Not enough money for shelter	0.358	0.352	-0.665	0.506	0.324	0.316	0.620	0.536
Not enough money for food	0.525	0.560	3.915	0.000	0.509	0.498	0.840	0.401
Satisfied with the standard living	0.416	0.395	-2.412	0.016	0.427	0.439	-0.930	0.354
Satisfied with city overall	0.561	0.623	7.181	0.000	0.574	0.590	-1.230	0.221
Positive experience index	6.564	6.555	4.280	0.838	6.684	6.704	-0.320	0.747
Observation	20,256				4,224			

Note: The table shows that after matching to reach balanced distribution of variables, the number of observations decreases to 4,223. For example, the left-side panel shows the t-tests and associated p-values for the differences between the treatment and control groups before matching all are statistically significant with the exceptions of "not enough money for shelter" and "positive experience index". However, the right-side panel shows that after matching the

differences for each variable between treatment and control are no longer statistically significant. Since t-test validation of a balanced sample can be affected by sample size.

We apply the PSM by creating two matched samples of internal migrants vs stayers. All control variables were used to match the treatment and control observation groups. The PSM assumes that all differences between individuals can be captured by observable characteristics because they are highly correlated to the unobservable ones (Titus, 2007; Ruyssen & Salomone, 2018). In this study we used the nearest-neighbour matching technique with replacement and found a balanced covariates distribution (Figure V.1) between treated and untreated groups where the differences between the means of the two groups for each covariate is not statistically significant (Table V.1).

Figure V.1 Balance checks for total sample and matched samples on internal migration. Kernel density distributions of treated (internal migration) and non-treated (no Internal migration) groups, before and after matching.



The results of the model estimation when applied to the matched samples is shown in the left-side panel of Table V.2. Despite losing more than three quarters of the sample size due to the matching, the sensitivity check shows similar patterns in the results as that of the original total sample. The only major difference is that with the matched samples, being stayer-in-urban is not significantly different from rural-stayer when it comes to migration desire.

Table V.2. Results of the benchmark model excluding those born abroad and with matched samples

Variable	BM excluding those born abroad		BM with matched samples	
	Desire	Planning	Desire	Planning
Migrant-to-rural	0.220***	0.0739**	0.130***	0.119**
	(0.033)	(0.034)	(0.0496)	(0.0510)
Stayer-in-urban	0.108***	0.0460**	0.0726	0.107**
	(0.029)	(0.021)	(0.0754)	(0.0489)
Migrant-to-urban	0.363***	0.103*	0.306***	0.180*
	(0.055)	(0.055)	(0.0726)	(0.105)
Control variables	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES
Observations	19,810	4,850	4,224	1,305

Note: Coefficients are average marginal effects. Standard errors are in parentheses. Standard errors are clustered by country and robust to heteroskedasticity. Each model also includes country fixed effects.

**** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.*

Another concern we address is the endogeneity that can result from the fact that some individuals are born within immigrant households making migration itself an attribute of these individuals. In the GWP dataset, this is captured by a question that distinguishes people born within the country from those born abroad. Following Ruyssen and Salomone (2018) and Smith and Floro (2020) we re-estimated the benchmark model after excluding people born abroad. As one can see from Table V.2 (left-side panel), we find no noticeable differences between the results of the benchmark model and the one after excluding those born abroad.

Another way to address endogeneity driven by omitted variables is to include additional control variables that could affect the dependent variable. When specifying the benchmark model, we faced a trade-off between variables and observations because many questions in the GWP dataset lacked valid answers. As a consequence, we limited the benchmark model to the variables that are widely acknowledged to be relevant while having a wide coverage across and within countries. Individuals' perceptions on the spread of corruption in the country is one variable that can be relevant but it has a considerable number of invalid answers. Hence, we did not include it in the benchmark model because it would have considerably lowered the number of observations (by more than 6%) and induced a bias by distorting the sample representation. Nevertheless, we re-estimated the benchmark model after including the corruption variable to check the stability of results.

A different source of threats to identification is posed by country level factors that might influence migration behaviour. It should be noted that unobserved country characteristics are already captured by the country fixed effects in the benchmark model. However, to further mitigate the concerns of macro level factors, we followed Smith and Floro (2020) and re-estimated the benchmark model adding the country level indicators of civil and ethnic violence (MEPV, 2021).

The results of both estimations are reported in Table V.3, which indicates that the benchmark results are not sensitive to the inclusion of these additional control variables.

Table V.3. Results of the benchmark model adding perceptions on corruption and country level factors

Variable	BM including corruption		BM with country level factors	
	Desire	Planning	Desire	Planning
Migrant-to-rural	0.228***	0.0800**	0.219***	0.0913***
	(0.0331)	(0.0330)	(0.032)	(0.032)
Stayer-in-urban	0.111***	0.0391*	0.107***	0.0451**
	(0.0297)	(0.0212)	(0.029)	(0.0209)
Migrant-to-urban	0.362***	0.118**	0.361***	0.128**
	(0.055)	(0.051)	(0.053)	(0.052)
Corruption	0.0825***	0.0272		
	(0.0279)	(0.0187)		
Civil violence			-0.0898	0.225***
			(0.072)	(0.046)

Ethnic violence			0.623***	0.0607
			(0.066)	(0.087)
Other control variables	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES
Observations	19,237	4,796	20,473	5,059

Note: Coefficients are average marginal effects. Standard errors are in parentheses. Standard errors are clustered by country and robust to heteroskedasticity. Each model also includes country fixed effects.

**** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.*

Conclusion

The results and reflections of this work are intended to contribute to the debate, not only academic, on the phenomena of migration and food insecurity in Sub-Saharan Africa and more in general, on the determinants of food insecurity at regional and global level.

In the first article of the thesis, I explained how the migration process can have different trigger factors and I demonstrated empirically how food insecurity can be one of them. However, it is important to bear in mind that in most cases only a minority of the people exposed to food insecurity do migrate. The probability that people desiring to migrate will be able to do so decreases as the severity of food insecurity increases. People who are most likely to decide to move abroad are those non-poor with a moderate level of food insecurity. This is in part because there are a number of factors, such as the cost of migration, that prevent severe food insecure people who desire to leave from actually doing so. Targeting population groups affected by moderate chronic food insecurity may be very effective in preventing migration.

The second article of this work describes the global and regional trends in food insecurity (from 2014 to 2018) and the differential access to food by men and women, with particular attention being given to regional analysis and to the determinants of such gap. Results have shown how people living in Sub-Saharan Africa are more exposed to food insecurity than any other region in the world. Also, it is highlighted how gender disparities favouring men are ubiquitously present in the whole of Africa, despite not being the region where gender differences are predominant (as in Latin America for example).

In the third article, I analysed the linkages between internal and international migration and migrant circulation in Sub-Saharan Africa through rural or urban areas. I explained how internal movers end up having their inclination to migrate internationally increased compared to non-movers; but the magnitude of this increase depends on their moving pathways. Movers to urban areas end up with higher inclination compared to movers to rural areas. These results suggest that spatial mobility really depends on access to and accumulation of resources available in the destination area. As a consequence, urban-rural differences indirectly encourage migration, and policies aimed at reducing this gap might have an impact on migration flows.

Through my research, I aim at providing an analytical framework that could be used to inform policy makers about people's exposure to food insecurity and about people's movement within and out of the Sub-Saharan region, and, possibly, to inspire policy recommendations.

However, despite the interesting findings, the results should be taken with caution as the empirical analyses included in the thesis present some limitations. Most of the findings rely on cross-sectional data, rather than longitudinal data. This may not precisely reflect the evolution of both migration and food security over time. Additionally, international migration intention is not a proxy of actual migration even though a strong relationship between the two has been demonstrated in the literature. Lastly, qualitative methods could deepen the quantitative approach and vice-versa.

Finally, further efforts and research are required to understand the migration patterns and to measure the impact of food insecurity on migration in other regions of the world.

Moreover, it could be of great importance to investigate how climate shocks and increasing variability are influencing desire, plans, and decision to migrate.

Bibliography

Abugre, J. B. (2014). Job satisfaction of public sector employees in sub-Saharan Africa: Testing the Minnesota satisfaction questionnaire in Ghana. International Journal of Public Administration, 37(10), 655-665. https://doi.org/10.1080/01900692.2014.903268.

Adams, H. (2016). Why populations persist: mobility, place attachment and climate change. Population and Environment, 37(4), 429-448. https://doi.org/10.1007/s11111-015-0246-3.

Adepoju, A. (1998). Linkages between internal and international migration: the African situation. International Social Science Journal, 50(157), 387-95. https://doi.org/10.1111/1468-2451.00151.

Adepoju, A. (2002). Fostering free movement of persons in West Africa: Achievements, constraints, and prospects for intraregional migration. International migration, 40(2), 3-28. https://doi.org/10.1111/1468-2435.00188.

Adepoju, A. (2006). Internal and international migration within Africa. In: P. Kok, D. Gelderblom, J. O. Oucho and J. Zyl (eds) Migration in South and Southern Africa. Cape Town: HSRC Press, pp. 26– 45.

Agarwal, B. (2013). Food Security, Productivity, and Gender Inequality. The Oxford Handbook of Food, Politics, and Society.

Aguayo-Téllez, E., & Martínez-Navarro, J. (2013). Internal and international migration in Mexico: 1995–2000. Applied Economics, 45(13), 1647-1661. https://doi.org/10.1080/00036846.2011.633894.

Ajzen, I. (1991). The theory of planned behavior. Organizational behavior and human decision processes, 50(2), 179-211.

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. Psychology and Health, 26 (9), 1113–1127. https://doi.org/10.1080/08870446.2011.613995.

Alderman, H., & Garcia, M. (1994). Food Security and Health Security: Explaining the Levels of Nutritional Status in Pakistan. Economic Development and Cultural Change, 42(3), 485-507.

Asian Development Bank. (2013). Gender Equality and Food Security - Women's Empowerment as a Tool against Hunger.

Asiedu, E., Kalonda-Kanyama, I., Ndikumana, L., & Nti-Addae, A. (2013). Access to credit by firms in Sub-Saharan Africa: How relevant is gender?. American Economic Review, 103(3), 293-97.

Atkinson, A.B. (2003). Multidimensional Deprivation: Contrasting Social Welfare and Counting Approaches. Journal of Economic Inequality.

Bankole, A., & Westoff, C. F. (1998). The consistency and validity of reproductive attitudes: evidence from Morocco. Journal of biosocial science, 30(4), 439-455. https://doi.org/10.1017/S0021932098004398.

Battiston D., Cruces G., Lopez-Calva L. F., Lugo M. A., & Santos M. E. (2013). Income and Beyond: Multidimensional Poverty in Six Latin American Countries. Social Indicators Research, 112, 291–314.

Becerra, D. (2012). The impact of anti-immigration policies and perceived discrimination in the United States on migration intentions among Mexican adolescents. International Migration, 50 (4), 20–32. https://doi.org/10.1111/j.1468-2435.2012.00770.x.

Beegle, K., De Weerdt, J., & Dercon, S. (2011). Migration and economic mobility in Tanzania: Evidence from a tracking survey. Review of Economics and Statistics, 93(3), 1010-1033.

Beine, M., & Salomone, S. (2013). Network effects in international migration: education versus gender. The Scandinavian journal of economics, 115(2), 354-380. https://doi.org/10.1111/j.1467-9442.2012.01733.x.

Beine, M., Docquier, F., & Özden, Ç. (2011). Diasporas. Journal of Development Economics, 95(1), 30–41.

Bell, M., & Charles-Edwards, E. (2013). Cross-national comparisons of internal migration. An update of global patterns and trends. United Nations Department of Economic and Social Affairs. Population Division. Technical Paper No 2013/1. New York, United Nations. https://doi.org/10.13140/RG.2.1.3489.1769

Belsley, D. A., Kuh, E., & Welsch, R. E. (2005). Regression diagnostics: Identifying influential data and sources of collinearity (Vol. 571). John Wiley & Sons.

Bertoli, S., & Ruyssen, I. (2018). Networks and migrants' intended destination. Journal of Economic Geography, 18(4), 705-728. https://doi.org/10.1093/jeg/lby012.

Bianchi, M. (2013) Immigration Policy and Self- Selecting Migrants. Journal of Public Economic Theory, 15(1), 1-2. https://doi.org/10.1111/jpet.12007.

Bond, T., & Fox, C. (2015) Applying the Rasch Model. Fundamental Measurement in the Human Sciences.

Borjas, G. J. (1987). Self-selection and the earnings of immigrants. American Economic Review, 77(4), 531–553.

Borjas, G. J. (1989). Economic theory and international migration. International migration review, 23(3), 457-485. https://doi.org/10.1177/019791838902300304.

Broussard, N. H. (2019). What explains gender differences in food insecurity?. Food Policy, 83.

Brunelli, C., & Viviani, S. (2014). Exploring gender-based disparities with the FAO Food Insecurity Experience Scale. Global forum on gender statistics.

Burrone, S., & Holmqvist, G. (2018). Child-Related Concerns and Migration Decisions: Evidence from the Gallup World Poll. Office of Research - Innocenti Working Paper 2018-17. UNICEF.

Cafiero, C., Viviani, S., & Nord, M. (2018). Food security measurement in a global context: The Food Insecurity Experience Scale. Measurement Journal, 116, 146-152.

Carling, J. R. (2002). Migration in the age of involuntary immobility: Theoretical reflections and Cape Verdean experiences. Journal of ethnic and migration studies, 28(1), 5-42. https://doi.org/10.1080/13691830120103912.

Cattaneo, A., & Robinson, S. (2020). Multiple moves and return migration within developing countries: A comparative analysis. Population, Space and Place, 26(7), e2335. https://doi.org/10.1002/psp.2335.

Chang, C. H. (2005). Item response theory and beyond: Advanced in patient-reported outcomes measurement. In W. R. Lenderking & D. A. Revicki (Eds.), Advancing health outcomes research methods and clinical applications (pp. 37–55).

Chiquiar, D., & Hanson, G. H. (2005). International migration, self-selection, and the distribution of wages: Evidence from Mexico and the United States. Journal of Political Economy, 113(2), 239–281.

Chiswick, B. (1999). Are immigrants favorably self-selected? American Economic Review, 89(2), 181–185.

Christensen, K. B., & Mounir Mesbah, S. K. (2012). Rasch Models in Health. John Wiley & Sons, Inc.

Clemens, M. (2011). Economics and emigration: Trillion-dollar bills on the sidewalk? Journal of Economic Perspectives, 25(3), 83–106.

Clemens, M. (2014). Does development reduce migration? In R. Lucas (Ed.), International handbook on migration and eco nomic development (Chap. 6, pp.152–185). London: Edward Elgar.

Coates, J., Wilde, P. E., Webb, B., Rogers, L., & Houser, R. F. (2006). Comparison of a qualitative and a quantitative approach to develop ing a household food insecurity scale for Bangladesh. Journal of Nutrition, 136, 1420S–1430S.

Creighton, M. J. (2013). The role of aspirations in domestic and international migration. The Social Science Journal, 50(1), 79-88. https://doi.org/10.1016/j.soscij.2012.07.006.

Crenshaw, K., Gotanda, N., Peller, G., & Inglis, C. (1995). Critical Race Theory: The Key Writings that Formed the Movement. The New York Press.

Crush, J. 2012. Migration, Development and Urban Food Security. Urban Food Security Series No. 9. Kingston and Cape Town, Queen's University and African Food Security Network (AFSUN).

DaVanzo, J. (1981). Repeat migration, information costs, and location-specific capital. Population and environment, 4(1), 45-73. https://doi.org/10.1007/BF01362575

De Brauw, A., V. Mueller, and T. Woldehanna (2018). Does Internal Migration Improve Overall WellBeing in Ethiopia? Journal of African Economies, 27(3), 347-65. https://doi.org/10.1093/jae/ejx039

De Haas, H. (2021). A theory of migration: the aspirations-capabilities framework. Comparative Migration Studies, 9(1), 1-35. https://doi.org/10.1186/s40878-020-00210-4.

De Muro, P., & Burchi, F. (2007). Education for rural people: a neglected key to food security. Department of Economics - University Roma Tre.

del Rey Poveda, A. (2007). Determinants and consequences of internal and international migration: The case of rural populations in the south of Veracruz, Mexico. Demographic research, 16, 287-314. https://doi.org/10.4054/DemRes.2007.16.10

Deléchat, C. (2001). International migration dynamics: The role of experience and social networks. Labour, 15(3), 457-486. https://doi.org/10.1111/1467-9914.00173.

Docquier, F., Peri, G., & Ruyssen, I. (2014). The cross-country determinants of potential and actual migration. International Migration Review, 48(S1), S37–S99.

Drinkwater, S., & Ingram, P. (2009). How different are the British in their willingness to move? Evidence from international social survey data. Regional Studies, 43(2), 287-303. https://doi.org/10.1080/00343400701827378

Dube, T. (2015). Gender disparities in educational enrollment and attainment in sub-Saharan Africa.

Dustmann, C., & Okatenko, A. (2014). Out-migration, wealth constraints, and the quality of local amenities. Journal of Development Economics, 110, 52-63. https://doi.org/10.1016/j.jdeveco.2014.05.008.

FAO, IFAD, UNICEF, WFP and WHO. (2017). The state of food security and nutrition in the world 2017. Building resilience for peace and food security. Rome, FAO.

FAO. (2009). Declaration of the World Summit on Food Security.

FAO. (2016). Methods for estimating comparable rates of food insecurity experienced by adults throughout the world.

FAO. (2017). Strengthening Sector Policies for Better Food Security and Nutrition Results: Gender.

FAO. (2018). The State of Food and Agriculture 2018: Migration, agriculture and rural development. Food and Agriculture Organization of the United Nations (FAO). Rome.

FAO. (2018). The state of food security and nutrition in the world 2018. Building climate resilience for food security and nutrition. Rome.

Farcomeni, A., Pittau, M.G., Viviani, S., & Zelli, R. (2020). A methodology for measuring material well-being in different contexts. Conference paper presented at 9th ECINEQ meeting.

Fisher, G. H., & Molenaar, I. W. (1995). Rasch Models: Foundations, Recent Developments, and Applications.

Foster, J. E. (2007). A Report on Mexican Multidimensional Poverty Measurement. Oxford Poverty & Human Development Initiative (OPHI), Oxford Department of International Development Queen Elizabeth House (QEH), University of Oxford, Working Paper N. 40.

Fussell, E. (2012). Space, Time, and Volition: Dimensions of Migration Theory. Oxford Handbook of the Politics of International Migration. https://doi.org/10.1093/oxfordhb/9780195337228.013.0002

Gallup. (2017). Worldwide research: methodology and codebook. Gallup World Poll.

Gallup. (2018). Worldwide research: methodology and codebook. Gallup World Poll. 81 pp.

Gamso, J., & Yuldashev, F. (2018). Does rural development aid reduce international migration?. World Development, 110, 268-282.

Garcia, A.S., & Wanner, T. (2017). Gender inequality and food security: lessons from the gender-responsive work of the International Food Policy Research Institute and the Bill and Melinda Gates Foundation. Food Security, 9, 1091-1103. https://doi.org/10.1007/s12571-017-0718-7

Gebre, G. G. (2012). Determinants of food insecurity among households in Addis Ababa City, Ethiopia. Interdisciplinary Description of Complex Systems, 10(2), 159–173

Greenwood, M. J. (1975). Research on internal migration in the United States: A survey. Journal of economic literature, 397-433.

Grogger, J. and Hanson, G.H., 2011. Income maximization and the selection and sorting of international migrants. Journal of Development Economics, 95(1), pp.42-57.

Hadley, C., Lindstrom, D., Tessema, F., & Belachew T. (2008). Gender bias in the food insecurity experience of Ethiopian adolescents. Social Science and Medicine.

Hamory, J., Kleemans, M., Li, N. Y., & Miguel, E. (2021). Reevaluating agricultural productivity gaps with longitudinal microdata. Journal of the European Economic Association, 19(3), 1522-1555.

Harris, J. R., & Todaro, M. P. (1970). Migration, unemployment and development: a two-sector analysis. The American economic review, 126-142. URL: https://www.jstor.org/stable/1807860

Heckman, J. J. (1979). Sample selection bias as a specification error. Econometrica: Journal of the econometric society, 47(1), 153-161. https://doi.org/10.2307/1912352.

IADB, IFAD, IOM, OAS & WFP. 2017. Food security and emigration. Why people flee and the impact on family members left behind in El Salvador, Guatemala and Honduras. Rome, WFP.

IOM. (2020).The World migration report 2020.

Ibnouf, O.F. (2011). Challenges and possibilities for achieving household food security in the Western Sudan region: the role of female farmers. Food security, 3, 215-231.

Ivers, C.L., & Cullen, A.K. (2011). Food insecurity: special considerations for women. The American Journal of Clinical Nutrition, 94(6), 1740S-1744S.

Jaron, D., & Galal, O. (2009). Food security and population health and well-being. Asia Pac J Clin Nutr.,18(4),684-7.

Jones, A.D., Ngure, F.M., Pelto, G., & Young, S.L. (2013). What are we assessing when we measure food security? A compendium and review of current metrics. Advances in Nutrition, 4(5), 481-505. https://doi.org/10.3945/an.113.004119

Kilic T., Moylan H., & Koolwal G. (2021). Getting the (gender-disaggregated) lay of the land: impact of survey respondent selection on measuring land ownership and rights. World Development, 146, 105-545.

King, R. (1976). The evolution of international labour migration movements concerning the E.E.C. Tijdschrift voor Economische en Sociale Geografie, 67(2), 66-82. https://doi.org/10.1111/j.1467-9663.1976.tb01388.x

King, R., & Skeldon, R. (2010). 'Mind the gap!'Integrating approaches to internal and international migration. Journal of Ethnic and Migration Studies, 36(10), 1619-1646. https://dx.doi.org/10.1080/1369183X.2010.489380.

Kolmogorov, A. (1933). Sulla determinazione empirica di una legge di distribuzione. G. Ist. Ital. Attuari, 4,

83–91.

Lagakos, D., Marshall, S., Mobarak, A. M., Vernot, C., & Waugh, M. E. (2020). Migration costs and observational returns to migration in the developing world. Journal of Monetary Economics, 113, 138-154. https://doi.org/10.1016/j.jmoneco.2020.03.013.

Lee, S. E. (1966). A theory of migration. Demography, 3 (1), 47-57. https://doi.org/10.2307/2060063.

Lele, U., Masters, W.A., Kinabo, J., Meenakshi, J.V., Ramaswami, B., Tagwireyi, J., Bell, W., & Goswami, S. (2016). Measuring Food and Nutrition Security: An Independent Technical Assessment and User's Guide for Existing Indicators. Food Security Information Network.

Lerch, M. (2020). International migration and city growth in the global south: an analysis of IPUMS data for seven countries, 1992–2013. Population and Development Review, 46(3), 557-582. https://doi.org/10.1111/padr.12344

Leroy, J.L., Ruel, M., Frongillo, E.A., Harris J., & Ballard T.J. (2015). Measuring the Food Access Dimension of Food Security: A Critical Review and Mapping of Indicators. Food and Nutrition Bullettin, 36(2),167-95.

Lozano Ascencio, F. (2002). Interrelación entre la migración internacional y la migración interna en México. Papeles de población, 8(33), 81-100.

Lucas, R. E. (2015). African migration. In Handbook of the economics of international migration (Vol. 1, pp. 1445-1596). North-Holland.

Maitra, C. (2018). A review of studies examining the link between food insecurity and malnutrition. FAO Technical Paper, 70.

Manchin, M., & Orazbayev, S. (2018). Social networks and the intention to migrate. World Development, 109, 360-374. https://doi.org/10.1016/j.worlddev.2018.05.011

Massey, D.S. (1990). Social Structure, Household Strategies, and the Cumulative Causation of Migration. Population Index, 3-26. https://doi.org/10.2307/3644186.

Mayda, A. M. (2010). International migration: A panel data analysis of the determinants of bilateral ows. Journal of Population Economics, 23(4), 1249–1274.

Meghir, C., Mobarak, A. M., Mommaerts, C. D., & Morten, M. (2021). Migration and informal insurance: evidence from a randomized controlled trial and a structural model. The Review of Economic Studies, 89(1), 452-480. https://doi.org/10.1093/restud/rdab021.

Mercandalli, S. & Losch, B. (Eds.). (2017). Rural Africa in motion. Dynamics and drivers of migration south of the Sahara. Rome: FAO and CIRAD. 60 pp. (also available at http://www.fao.org/3/I7951EN/i7951en.pdf).

Michaelowa, K. (2002). Teacher job satisfaction, student achievement, and the cost of primary education in Francophone Sub-Saharan Africa. Discussion Paper No. 188. University of Zurich and Hamburg Institute of International Economics (HWWI).

Migali, S., Natale, F., Tintori, G., Kalantaryan, S., Grubanov-Boskovic, S., Scipioni, M., ... & Barbas, T. (2018). International migration drivers. Joint Research Centre: Ispra, Italy.

Mutisya, M., Ngware, M., Kabiru, W.C., & Kandala, B.N. (2016). The effect of education on household food security in two informal urban settlements in Kenya: a longitudinal analysis. Food security, 8(4).

Nord, M. (2014). Introduction to item response theory applied to food security measurement. FAO.

Nord, M., Cafiero, C., & Viviani, S. (2016). Methods for estimat ing comparable prevalence rates of food insecurity experi enced by adults in 147 countries and areas. Journal of Physics: Conference Series, 772(1), 012060 IOP Publishing.

Oaxaca, R. L. (1973). Male-female wage differentials in urban labor markets. International Economic Review, 14, 693–709.

Ortega, F., & Peri, G. (2013). The effect of income and immigration policies on international migrations. Migration Studies, 1(1), 1–28.

Pescosolido, B. A. (1986). Migration, medical care preferences and the lay referral system: A network theory of role assimilation. American Sociological Review, 51(4), 523-540. URL: https://www.jstor.org/stable/2095585

Plaza, S., Navarrete, M., & Ratha, D. (2011). Migration and remittances household surveys in sub-Saharan Africa: methodological aspects and main findings. World Bank, Washington, DC.

Prättälä, R., Levälahti, E., Lallukka,T., Männistö, S.,Paalanen, L., Raulio, S.,Roos E.,Suominen, S., & Mäki-Opas, T. (2015).From margarine to butter: predictors of changing bread spread in an 11-year population follow-up. Public Health Nutrition, 19 (9),1707-1717.

Quisumbing, R. A., Brown, R. L., Feldstein, S.H., Haddad, L., & Peña, C. (1996). Women: The Key to Food Security. Food and Nutrition Bulletin, 17(1), 1-2.

Rademacher-Schulz, C., Schraven, B., & Mahama, E. S. (2014). Time matters: Shifting seasonal migration in northern Ghana due to rainfall variability and food insecurity. Climate and Development, 6(1), 46–52.

Radimer, K. L. (2002). Measurement of household food security in the USA and other industrialized countries. Public Health Nutrition, 5(6A), 859–864.

Radimer, K. L., Olson, C. M., & Campbell, C. C. (1990). Development of indicators to assess hunger. Journal of Nutrition, 120(Suppl (11)), 1544–1548.

Radimer, K. L., Olson, C. M., Greene, J. C., Campbell, C. C., & Habicht, J. P. (1992). Understanding hunger and developing indicators to assess it in women and children. Journal of Nutrition Education, 24(Suppl), 36–45.

Rasch, G. (1960). Probabilistic models for some intelligence and attainment tests. Copenhagen: Danish Institute for Educational Research.

Rasch, G. (1980). Probabilistic model for some intelligence and achievement tests. University of Chicago Press.

Ravenstein, E. G. (1885). The laws of migration. Journal of the statistical society of London, 48(2), 167-235.

Reiersøl, O. (1950). Identifiability of a linear relation between variables which are subject to error. Econometrica: Journal of the Econometric Society, 375-389. URL: https://www.jstor.org/stable/1907835

Ruyssen, I. (2013). Determinants of international migration (Doctoral dissertation, Ghent University).

Ruyssen, I., & Salomone, S. (2018). Female migration: A way out of discrimination?. Journal of Development Economics, 130, 224-241. https://doi.org/10.1016/j.jdeveco.2017.10.010

Sadiddin, A., Cattaneo, A., Cirillo, M., & Miller, M. (2019). Food insecurity as a determinant of international migration: evidence from Sub-Saharan Africa. Food Security, 11(3), 515-530. https://doi.org/10.1007/s12571-019-00927-w.

Schultz, T. (1961). Investment in human capital. American Economic Review, 51(1), 1–17.

Scott, P. W. (2019). Causal Inference Methods for selection on observed and unobserved factors: Propensity Score Matching, Heckit Models, and Instrumental Variable Estimation. Practical Assessment, Research, and Evaluation, 24(1), 3. https://doi.org/10.7275/7tgr-xt91

Seligman, H. K., Laraia, B. A., & Kushel, M. B. (2010). Food insecurity is associated with chronic disease among low-income NHANES participants. The Journal of nutrition, 140(2), 304–310.

doi:10.3945/jn.109.112573

Selod, H., & Shilpi, F. (2021). Rural-Urban Migration in Developing Countries. : Lessons from the Literature. Policy Research Working Paper; No. 9662. World Bank, Washington, DC. URI http://hdl.handle.net/10986/35610

Simpson, N. B. (2017). Demographic and economic determinants of migration. IZA World of Labor.

Sirkeci, I., & Esipova, N. (2013). Turkish migration in Europe and desire to migrate to and from Turkey. Border Crossing, 3, 1-13.

Sjaastad, L. (1962). The costs and returns of human migration. Journal of Political Economy, 70(5), 80-93.

Skeldon, R. (2002). Migration and Poverty. Asia-Pacific population journal, 17, 67-82. https://dx.doi.org/10.18356/7c0e3452-en.

Skeldon, R. (2006). Interlinkages between internal and international migration and development in the Asian region. Population, Space and Place, 12(1), 15-30. https://doi.org/10.1002/psp.385.

Skeldon, R. (2009). Linkages Between Internal and International Migration. In DeWind, J., Holdaway, J. (Eds.), Migration and development within and across borders: Research and policy perspectives on internal and international migration, International Organization for Migration and Social Science Research Council, 29-38.

Skeldon, R. (2018). International migration, internal migration, mobility and urbanization: Towards more integrated approaches. United Nations. https://doi.org/10.18356/a97468ba-en

Smirnov, N. (1948). Table for estimating the goodness of fit of empirical distributions. Annals of Mathematical Statistics,19(2), 279–281. doi:10.1214/aoms/1177730256

Smith, D.M., & Floro, M.S. (2017). Food insecurity, gender and interna tional migration. UNU-WIDER, Migration and Mobility, Conference Proceedings. Accra, Ghana, October 5, 2017.

Smith, M. D., & Floro, M. S. (2020). Food insecurity, gender, and international migration in low- and middle-income countries. Food policy journal, 91, 101837. https://doi.org/10.1016/j.foodpol.2020.101837

Speare, A., (1974). Residential satisfaction as an intervening variable in residential mobility. Demography, 11(2), pp.173-188.

Tarasuk, S.V. (2001). Household Food Insecurity with Hunger Is Associated with Women's Food Intakes, Health and Household Circumstances. The Journal of Nutrition, 131 (10), 2670–2676.

Thomson, W. (1891). Popular lectures and addresses (Vol. 1). Cambridge University Press.

Tibesigwa, B., & Visser, M. (2016). Assessing Gender Inequality in Food Security among Small-holder Farm Households in urban and rural South Africa. World Development, 88, 33-49.

Titus, M. A. (2007). Detecting selection bias, using propensity score matching, and estimating treatment effects: An application to the private returns to a master's degree. Research in Higher Education, 48(4), 487-521. https://doi.org/10.1007/s11162-006-9034-3

Tjaden, J., Auer, D., & Laczko, F. (2019). Linking migration intentions with flows: Evidence and potential use. International Migration, 57(1), 36-57. https://doi.org/10.1111/imig.12502.

Todaro, M. P. (1976). Urban job expansion, induced migration and rising unemployment: a formulation of simplified empirical test for LDCs. Journal of Development Economics, 3, 221– 225. https://doi.org/10.1016/0304-3878(76)90049-3.

UN DESA. (2019). International migrant stock. Retrieved from https://www.un.org/en/development/desa/population/migration/data/estimates2/estimates19.asp.

UNDP, 2009. Human development report 2009: Overcoming barriers: Human mobility and development. The United Nations Development Programme.

UNSD. (2019) Guidelines for Producing Statistics on Asset Ownership from a Gender Perspective, New York, NY.

Van Dalen, H. P., & Henkens, K. (2013). Explaining emigration intentions and behaviour in the Netherlands, 2005–10. Population Studies, 67(2), 225-241. https://doi.org/10.1080/00324728.2012.725135

Van Hear, N., Bakewell, O., & Long, K. (2018). Push-pull plus: reconsidering the drivers of migration. Journal of ethnic and migration studies, 44(6), 927-944. https://doi.org/10.1080/1369183X.2017.1384135

Vella, F. (1998). Estimating models with sample selection bias: a survey. Journal of Human Resources, 127-169. https://doi.org/146317

Vullnetari, J. (2012). Albania on the move: Links between internal and international migration (p. 282). Amsterdam University Press. https://doi.org/10.1515/9789048514939.

Warner, K., & Afifi, T. (2014). Where the rain falls: Evidence from 8 countries on how vulnerable households use migration to manage the risk of rainfall variability and food insecurity. Climate and Development, 6(1), 1–17.

Westoff, C. F. (1990). Reproductive intentions and fertility rates. International Family Planning Perspectives, 84-96. https://doi.org/10.2307/2133304.

Wright, B., & Masters, G. (1990) Computation of OUTFIT and INFIT statistics. Rasch Measurement Transactions, 84–5.

Yorimitsu, M. (1985). A Review on the Determinants of Migration. Hitotsubashi journal of social studies, 17-27.

Young, A. (2013). Inequality, the urban-rural gap, and migration. The Quarterly Journal of Economics, 128(4), 1727-1785. https://doi.org/10.1093/qje/qjt025.

Westoff, C. F. (1990). Reproductive intentions and fertility rates. International Family Planning Perspectives, 84-96. https://doi.org/10.2307/2133304.

Zezza, A., Carletto, C., Davis, B., & Winters, P. (2011). Assessing the impact of migration on food and nutrition security. Food Policy, 36(1), 1–6.