

Palacký University Olomouc  
University of Clermont Auvergne  
University of Pavia

**MASTER THESIS:**

**Migration and Food Security Nexus in Latin  
America and the Caribbean**

**Francisco Antonio Gavidia Carranza**

**Supervisor: Professor Maria Sassi**

**GLODEP 2020**

# **Migration and Food Security Nexus in Latin America and the Caribbean**

**Francisco Antonio Gavidia Carranza**

**Supervisor: Professor Maria Sassi**

**GLODEP 2020**

## Declaration

*I, hereby, declare that the Thesis entitled “Migration and Food Security Nexus in Latin America and the Caribbean”, submitted to the GLODEP Consortium 2020, is my original work, and any theoretical and empirical literature and dataset used in the proceedings of this study have been duly cited and referenced.*

Francisco Antonio Gavidia Carranza

Date: 20 May 2020

# UNIVERZITA PALACKÉHO V OLMOUCI

Přírodovědecká fakulta

Akademický rok: 2019/2020

## ZADÁNÍ DIPLOMOVÉ PRÁCE

(projektu, uměleckého díla, uměleckého výkonu)

Jméno a příjmení: **Francisco Antonio GAVIDIA CARRANZA**  
Osobní číslo: **R180105**  
Studijní program: **N1301 Geography**  
Studijní obor: **International Development Studies**  
Téma práce: **Linkages between migration and food security**  
Zadávající katedra: **Katedra rozvojových a environmentálních studií**

### Zásady pro vypracování

The majority of the literature analyze the impact of migration and food security on development as unrelated variables, their connection has been studied until recently. This relation it has been analyzed mostly by considering internal migration rather than international migration at a household level. This thesis would try to fill one part of the existing gap by exploring this relation through the different drivers of migration, the vulnerable groups and the different regions of the world and their respective socioeconomic context by relying on quantitative methods.

Rozsah pracovní zprávy:

Rozsah grafických prací:

Forma zpracování diplomové práce: **tištěná**

Jazyk zpracování: **Angličtina**

Seznam doporučené literatury:

1. Bowen, L., Ebrahim, S., De Stavola, B., Ness, A., Kinra, S., Bharathi, A. V., ... & Reddy, K. S. (2011). Dietary intake and rural-urban migration in India: a cross-sectional study. *PLoS one*, 6(6), e14822.
2. Choudhary, N., & Parthasarathy, D. (2009). Is migration status a determinant of urban nutrition insecurity? Empirical evidence from Mumbai city, India. *Journal of biosocial science*, 41(5), 583-605.
3. De Brauw, A. (2011). Migration and child development during the food price crisis in El Salvador. *Food Policy*, 36(1), 28-40.
4. FAO IFAD IOM WFP. 2018. The Linkages between Migration, Agriculture, Food Security and Rural Development. Rome. 80pp. (<http://www.fao.org/3/CA0922EN/CA0922EN.pdf>). Licence: CC BY-NC-SA 3.0 IGO Gray, C. L. (2009). Rural out-migration and smallholder agriculture in the southern Ecuadorian Andes. *Population and Environment*, 30(4-5), 193-217.
5. Jokisch, B. D. (2002). Migration and agricultural change: The case of smallholder agriculture in highland Ecuador. *Human Ecology*, 30(4), 523-550.
6. Jonathan Crush (2012). Migration, Development and Urban Food Security. Urban Food Security Series No. 9. Queens University and AFSUN: Kingston and Cape Town.
7. Mabrouk, F. and M. M. Mekni (2018), Remittances and Food Security in African Countries, *African Development Review*, Vol. 30, No. 3, pp. 252-263.
8. Maharatna, A. (2014). Food scarcity and migration: an overview. *Social Research: An International Quarterly*, 81(2), 277-298.
9. Pendleton, W., Crush, J., & Nickanor, N. (2014, June). Migrant Windhoek: Rural-urban migration and food security in Namibia. In *Urban Forum* (Vol. 25, No. 2, pp. 191-205). Springer Netherlands.
10. Sithole, S. and Dinbabo, M.F. (2016). Exploring youth migration and the food security nexus: Zimbabwean youths in Cape Town, South Africa. *African Human Mobility Review (AHMR)*, 2 (2): 512-537.
11. Sensi, R., & Pedrotti, M. (2019). Exploring the Migration-Food and Nutrition Security Nexus: How Aid Policies Can Maximize the Migration-Related Sustainable Development Opportunities. In *Achieving the Sustainable Development Goals Through Sustainable Food Systems* (pp. 189-208). Springer, Cham.
12. 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.

Vedoucí diplomové práce: **prof. Maria Sassi**  
University of Pavia

Datum zadání diplomové práce: **3. února 2020**

Termín odevzdání diplomové práce: **22. května 2020**

L.S.

---

**doc. RNDr. Martin Kubala, Ph.D.**  
děkan

---

**doc. RNDr. Pavel Nováček, CSc.**  
vedoucí katedry

## **ACKNOWLEDGMENTS**

I would like to express my gratitude to my thesis supervisor, Professor Maria Sassi, for all her help during this period and all the knowledge that she shared with me, and to Gopal Trital for his comments. To my family who were my first school and who are fundamental for the achievement of my goals. Thanks to Alejandra Quintanilla who inspires me to be a better person and for all the support that she always gives me.

Moreover, I want to thank the Erasmus Mundus Joint Master's Degree GLODEP Consortium, for all the support throughout the program. To my professors of GLODEP Consortium and my former professors from UCA and Externado de San José (El Salvador), not only did they build my academic background, but they also teach me to be an integral student.

Finally, but not least, to my GLODEP classmates who have been my family during the last 2 years, and to all my friends who have always wished the best for me. Thanks to all of you.

## **ABSTRACT**

Over the last two decades migration and remittances have rapidly increased. Nevertheless, its impact on food security does not have a definitive conclusion. Moreover, the migration and food security nexus has been thoroughly studied in Africa and Asia, but Latin America and the Caribbean is also a region with important challenges in both topics. In this sense, acknowledging the nexus and its interactions are fundamental for the development of efficient and effective public policies, and the achievement of the SDGs.

Using international comparable data from World Bank and FAO, the current thesis develops a dynamic empirical model based on system Generalized Method of Moments (GMM) which controls potential endogeneity and unobserved heterogeneity of the variables. Particularly, the study measures the impact of migration (using remittances as a proxy variable of migration) on the four pillars of food security in Latin America and the Caribbean countries from 2000 to 2017.

The results show a negative link for availability, access and utilization, but a positive link for stability. It seems that when remittances have a higher weight in the economy, they have a negative impact on food security.

**Keywords:** *Migration, Remittances, Food Security, Latin American and the Caribbean, GMM Estimator.*

<b>Introduction</b> .....	<b>1</b>
<b>Chapter I: Background of Migration, Remittances and Food security</b> .....	<b>3</b>
1.1 Migration and remittances .....	3
1.1.1 Definitions .....	3
1.1.2 Migration and remittances on the global development agenda.....	4
1.1.3 Drivers of migration.....	4
1.1.4 Trends.....	5
1.1.4.1 Migration .....	5
1.1.4.2 Remittances.....	7
1.1.5 Impacts .....	8
1.2 Food security .....	9
1.2.1 Definitions .....	9
1.2.2 Food security on the global development agenda.....	10
1.2.3 Drivers, trends and treats of food security .....	10
1.3 Previous studies of the migration and food security nexus.....	12
<b>Chapter II: Analytical framework and methodology</b> .....	<b>16</b>
2.1 Analytical framework.....	16
2.2 Variable selection .....	18
2.2.1 Data sources .....	19
2.2.2 Selection of dependent, main independent and control variables .....	20
2.2.2.1 Dependent variables: one for each pillar of food security .....	20
2.2.2.2 Main independent and control variables .....	21
2.3 Econometric framework.....	23
<b>Chapter III: Results and discussion</b> .....	<b>27</b>
3.1 Descriptive statistics and preliminary diagnostic .....	27
3.2 Results.....	28
3.2.1 Availability.....	29
3.2.3 Utilization.....	31
3.2.4 Stability .....	32
3.3 Robustness check.....	34
3.4 Conclusion.....	34
<b>Bibliography:</b> .....	<b>38</b>
<b>Appendix</b> .....	<b>44</b>
Table A1: Description of data. ....	44



Table A2: Correlation matrix. ....	45
Table A3: The effect of remittances on food security on the long run (one-step system GMM).....	46
Table A4: The effect of remittances on food security (Pooled OLS and LSDV).....	47
Figure A1: Bivariate relationship: Availability and remittances in LAC, 2000-2017.....	48
Figure A2: Bivariate relationship: Access and remittances in LAC, 2000-2017 .....	48
Figure A3: Bivariate relationship: Utilization and remittances in LAC, 2000-2017.....	49
Figure A4: Bivariate relationship: Stability and remittances in LAC, 2000-2017.....	49
Figure A5: Availability and remittances in LAC by income groups, 2000-2017.....	50
Figure A6: Access and remittances in LAC by income groups, 2000-2017 .....	50
Figure A7: Utilization and remittances in LAC by income groups, 2000-2017.....	51
Figure A8: Stability and remittances in LAC by income groups, 2000-2017 .....	51

## LIST OF TABLES AND FIGURES

Table 1: Control variables, description sources and evidence on research related to the migration and food security nexus.....	22
Table 2: The effect of remittances on food security (one-step system GMM).....	33

## **List of abbreviations**

Food and Agriculture Organisation (FAO)

Food and Nutrition Security (FNS)

Food Insecurity Experience Scale (FIES)

Foreign Direct Investment (FDI)

Generalized Method of Moments (GMM)

Global Compact for Safe, Orderly and Regular Migration (GCM)

Global Knowledge Partnership on Migration and Development (KNOMAD)

Gross Domestic Product (GDP)

International Labour Organization (ILO)

International Monetary Fund (IMF)

International Organization for Migration (IOM)

Last Observation Carried Forward (LOCF)

Latin America and the Caribbean (LAC)

Least-Squares Dummy-Variables (LSDV)

Low and Middle-Income Countries (LMICs)

New Economics of Labor Migration Literature (NELM)

Official Development Assistance (ODA)

Ordinary Least Squares (OLS)

Organisation for Economic Cooperation and Development (OECD)

Purchasing Power Parity (PPP)

Southern Common Market (MERCOSUR)

Standard International Trade Classification (SITC)

Sub Saharian Africa (SSA)

Sustainable Development Goals (SDGs)

United Nations (UN)

United Nations Children's Fund (UNICEF)

United Nations, Department of Economic and Social Affairs (UNDESA)

World Development Indicators (WDI)

World Food Programme (WFP)

World Governance Indicators (WGI)

World Health Organization (WHO)

## Introduction

In the past 19 years, the number of international migrants has doubled, reaching 272 million people (International Organization for Migration (IOM), 2019b) and the latest data shows that it is growing faster than the world population (Desiderio, 2020). Even more, World Bank (2019) expected a continued increase of the migrants number and an intensification of the process, due to the high inequality between countries, the effects of climate change and an increasing working-age population on low and middle-income countries (LMICs). Under this circumstances, Latin America and the Caribbean (LAC) is the third region with the largest share of international migrants, nearly 14.9% in 2019 (Desiderio, 2020), and it is part of the second largest migration corridor along with North America (United Nations Department of Economic and Social Affairs (UNDESA), 2019b). The region is characterized by an interregional migration, the large majority of the migrants migrate to other regions, rather than an intraregional, when they migrate within their region, which only represents 10.5% of their international migration (Desiderio, 2020).

Furthermore, remittances are one of the outcomes of migration, and thus, they have also grown in the last years. According to UNDESA (2019a), the past 19 years remittances have grown faster than migration, migration grew 56.5%, remittances grew 457.5% in the same period (Global Knowledge Partnership on Migration and Development (KNOMAD), 2019). In fact, trends exhibit that on 2019 remittances will be larger on LMICs than official development assistance (ODA) (by a factor of three) and larger than foreign direct investment (FDI) (Plaza et al., 2019b). Regarding this trend, LAC is the region with a greater growth rate (7.8%) and the third region with more remittances flows.

On the other hand, the last few years, food security has been marked by several food crisis in 2008 and 2011. These crisis caused volatile and high prices of food products and inputs, and as a result, undernourishment reached 1 billion people in 2009 (Sassi, 2018). Many of the effects of the crisis are still perceived, for example, the latest data shows a stagnation of 10.8% prevalence of undernourishment and an increase in the number of people undernourished in the world (Food and Agriculture Organisation (FAO), 2019). Correspondingly, hunger has grown continuously and rapidly these past years in LAC, reaching 42.5 million people in 2018 (FAO, the World Food Programme (WFP), the World Health Organization (WHO) and UN Children's Fund (UNICEF), 2019). For instance, in 2017 LAC was the second region with the highest prevalence of food insecurity (32%) and the third region with the largest share of the population in severe food insecurity (12%) (Smith & Birgit, 2019). However paradoxically, one of the biggest problems in LAC are the increased levels of obesity. Specifically, 1 out of 4 people suffers from obesity, which doubles the world's prevalence of obesity (FAO, WFP, WHO and UNICEF, 2019).

At first glance, the relation between migration and food security seems undeniable. Nevertheless, this recently studied relation remains a peripheral and neglected concern. This is evidenced for example, by the fact that the global agendas of migration and food security are completely disconnected (Crush, 2013). This is so, even though the largest share of remittances is spent on food (Mahapatro et al., 2017, Crush & Pendleton, 2009, Acosta et al., 2008 as cited in Crush & Caesar, 2017, p. 10) and countries with the highest outflows of migration and refugees are countries with the highest levels of food insecurity (WFP, 2017). This disengagement both in the political agendas as in empiric literature, can be explained partly, as it was pointed out by Zezza et al. (2011), by the difficulty to determine the overall effect of migration on food security, since previous conditions of the individual, household and community will play an important role.

In this sense, many of the previous studies privilege a perspective from the migrants in the destination country, their food security status and the income that they make, rather than the impact of migration on the household's food security in the country of origin. Moreover, the studies which address the consequences on the origin countries do not have a definitive conclusion about the nexus of these two topics (J. Crush & Caesar, 2017). Also, the baste majority are studies analyzing the situation on Africa and Asia (J. S. Crush & Caesar, 2018). Even more, as it was emphasized by Craven & Gartaula (2015) other limits to analyze the nexus arise from the methodological approach. Commonly, studies address the topic with data at the household level, limiting the information of the impact on a more aggregated level, at communities or national level for example.

Consequently, this research will focus on the effect of migration, measured with the proxy variable of remittances, on food security in LAC, using cross country data at the macro-level of analysis, which makes it, to my knowledge, the first in its kind for the LAC region. To measure the impact, international comparable data from World Bank and FAO was used to create a dynamic empirical model based on system Generalized Method of Moments (GMM) which controls potential endogeneity and unobserved heterogeneity of the variables, that can introduce bias on the estimations.

Thereby, this research follows the following structure: the first chapter addresses the essential concepts and trends of food security, migration and remittances in order to understand the problematic; as well as providing previous results of studies on the migration and food security nexus. The second chapter, describes the analytical framework behind this research, the theoretical and empirical grounds justifying the choice of the variables of study and the description of the methodology used to achieve the results. At last, the final chapter presents the results and discusses the conclusions of the study.

## **Chapter I: Background of Migration, Remittances and Food security**

This chapter reviews the issues around migration, remittances and food security from a worldwide perspective, by explaining the concepts, their role in the global development agenda, their drivers and their trends, especially in the LAC context. Moreover, it discusses previous results on the studies of migration and food security nexus. This chapter intends to introduce the reader to the essential concepts, a common explanation of the topic and the state of the art of the linkage. This baseline is key to understand the remaining gaps on the effect of migration on food security.

To this effect, the first section of this chapter gives a brief presentation of the impacts of migration and remittances trends identified in the scientific literature. The second section focusses on food security and develops the biggest treats for achieving food security in LAC. The last section describes previous studies on the nexus between migration and food security in order to understand their interaction and the gaps that remain in this topic.

### **1.1 Migration and remittances**

#### *1.1.1 Definitions*

The phenomenon of migration has always been part of the Holocene Era (an Era characterized by the proliferation, growth and impact of humanity). According to the (IOM) (2019a, 130), a migrant is defined as “*a person who moves away from his or her place of usual residence*”. According to IOM (2019a), there are different types of migration, such as internal and international migration. The first one, is related to the movement of people within a country, and the latter (or international migration), is defined as “*the movement of persons away from their place of usual residence and across an international border to a country of which they are not nationals*” (IOM, 2019a, 111).

In specific, this research focuses on international migration. Furthermore, international migration is divided into temporary, permanent and circular migration. Temporary migration is mainly induced by a specific motivation and purpose and in this case, the migrant has the intention to return to the origin country. On the other hand, in the case of permanent migration, the migrant does not have the intention to return to the country of origin. Finally, circular migration is defined as a repeated movement of back and forth between countries. From the perspective of the origin country, the outflows of these movements are called emigration, while for the destination country the inflows are immigration.

As it will be developed further in this study, remittances are one of the more relevant results of migration and is a well-known variable that links migration and development. As it will be discussed, migration has many different impacts on countries, and remittances is not the only transmission channel of migration.

However, in order to reduce the scope of the research, this paper focuses on the impact of the economic component of remittances, as a proxy variable of migration, in the four pillars of food security.

IOM (2019a, 178) defined remittances as “*private international monetary transfers that migrants make individually or collectively*”. However, there is a broader definition of remittances, the social remittances, which are ideas, behavior, identities, social capital and knowledge that are transferred to the communities of origin. These social remittances can foster networks, innovative ideas, policy reforms, new values and technological skills (Global Migration Data Portal, 2020c).

### *1.1.2 Migration and remittances on the global development agenda*

The 13th article of the Universal Declaration of Human Rights establishes that Migration is a fundamental human right. This right to leave any country and return to one’s own country was recognized by the United Nations (UN) General Assembly in 1948.

More recently, the contribution of migration on sustainable development has been acknowledged in the 2030 Agenda for Sustainable Development (Global Migration Data Portal, 2020b). Specifically, target 10.7 puts migration as part of the objective to achieve the reduction of inequality and entails the necessity to “*facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies*” (UN, 2015, 25). Remittances are also present on this goal, on target 10.7.1. (The purpose of the reduction of recruitment costs) and 10.C, which mentions the reduction to less than 3% of the remittances’ transaction cost. In addition, remittances are on target 17.3.2 which entail the increase of the volume of remittances as a percentage of gross domestic product (GDP) (UN, 2015).

Moreover, the Declaration for Refugees and Migrants adopted by the world leaders in New York in 2016, greeted the opportunity for civil society, national governments, private sector, local governments and even migrants themselves to work in an extensive comprehensive approach that considers all the dimensions of international migration. Following this declaration, the Global Compact for Safe, Orderly and Regular Migration (GCM) was adopted in 2018. This instrument is an intergovernmental agreement of twenty-three common goals to improve the managing of migration (Global Migration Data Portal, 2020a).

### *1.1.3 Drivers of migration*

There are multiple and intersecting drivers of international migration. Therefore, a holistic approach is required to address its multidimensional nature. According to Castelli (2018), the drivers can be divided into three: Firstly, micro-factors, that depend on individual characteristics and attitudes such as religion, marital status, education and personal attitude to migration. Subsequently, meso-factors, that are closely

related to the context, in which the migration takes place and is not completely under the individual's control, such as diasporic networks communication technology and land grabbing; and finally macro-factors are largely independent factors from the individual, such as demographic, environmental situations, political and socio-economic. The decision to migrate is a result of a complex combination of these factors.

Moreover, migration is deeply linked to development; its overall impact (positive or negative) will depend on efficient institutional measures. For instance, poverty, inequality, conflict, violence, human rights violations, discrimination climate change, land degradation, desertification and natural disaster tend to exacerbate socioeconomic vulnerabilities, act as drivers of migration and therefore have a negative impact on development. Most of these drivers normally lead first to internal displacement, but if the population cannot find adequate protection or return to their original places it may conduct to international migration. Some of these negative drivers can be prevented with conflict prevention and resolution, human rights protection, international accountability, promotion of inclusive growth and job creation, improvement of education, risk reduction and climate change prevention (UN Headquarters, 2017).

#### *1.1.4 Trends*

##### *1.1.4.1 Migration*

Migration is also driven by development contexts. In 2018, nine out of ten international migrants and refugees were economic migrants, thus persons who migrate, solely or primarily motivated by economic opportunities (IOM, 2019a), as a escape from poverty or to improve their economic conditions. Contrary to popular belief, the majority of the migrants from developing countries migrate to other developing countries and the 46% remaining from the total migrant percentage go to high-income countries (World Bank, 2019). However, even with these new trends, 50% of the international migration stock is concentrated in ten destination countries. From this top 10, the United States alone concentrates 19% of the stock (Desiderio, 2020). In this same year, the number of internally displaced populations (41.3 million) reached the highest figures seen since 1998 (IOM, 2019b).

Moreover, this past 19 years, international migration has increased by 56.5% reaching 272 million persons, mainly male migrants (52%) and population in working ages (20-64 years old, 74%) (IOM, 2019b). Even though international migration has grown faster than the world's population, it continues to represent a small fraction (3.5%) of the world population (Desiderio, 2020). Nonetheless, the share of migrants in countries member of the Organisation for Economic Cooperation and Development (OECD) has increased in the same period from 8.8% to 12.6% (World Bank, 2019). With it, an increased number of undocumented migrants has been detected going from 1.5 million in 2011 to 3.8 million in 2018 in the United States and from 1.4 to 6 million in Europe on the same period. Additionally, other



countries have experienced an increase in deportations, suggesting a continued increment on return forced migration (Plaza et al., 2019a).

With regards to migration by region, LAC positions itself as the third region with the largest share of international migrants (nearly 14.9% in 2019), followed only by Asia (41.1%) and Europe (22.5%). Considering the international migration flows between 2005 and 2010 in absolute terms, LAC was the second region with more interregional migrants (5.46 million persons). Only 10.5% of their emigrants migrate within the region, thus becoming the second region with the lower share of intraregional migration, just above North America (8.1%) (Desiderio, 2020). Nevertheless, the current intraregional migration in South America is significant, partly due to the new Residents Agreements established by Southern Common Market (MERCOSUR). The main drivers of migration in LAC continue to be violence and climate change. In effect, the increase in drought conditions over the last years in Central America and the vulnerability to natural disasters in the Caribbean has increased the migration effect on the region (IOM, 2019b).

In recent years, the region has experienced large movements of migrants. For instance, in 2018 around 4 million Venezuelans migrated to neighboring countries and thus became the largest source country of an asylum seeker in the world (350,000 persons, one in five asylum seekers come from Venezuela). Currently, over 1 million Venezuelans live in Colombia (IOM, 2019b).

But this is not the only example. For many years, a migration pattern has been observed in Central American countries, seeking to settle in the United States. More recently, large caravans from Honduras, El Salvador and Guatemala moving to Mexico and the United States were highly mediatized and more than 26,000 asylum requests from Nicaraguans were made after the political crisis (World Bank, 2019). The latest data from 2019 reported the corridor from LAC to North America to be the second-largest, representing 9.8% of total international migration (26.6 million persons), it is only behind the corridor from Europe to Europe, which is a region with fewer restrictions to move across it (UNDESA, 2019b).

Indeed, the largest corridor from a country to another country in the world is from Mexico to the United States, similarly, other LAC countries (El Salvador, Guatemala, Honduras, Peru, Brazil, Ecuador and Colombia) have large populations settled in the United States. Oppositely, the number of international migrants from other regions living in LAC has been stable for the last 30 years, around 3 million people, the large majority of them comes from Europe and North America (IOM, 2019b).

According to World Bank (2019), a continued increase of emigration is expected in the region, since the high inequality between countries and an increasing working-age population on LMICs will intensify this process. In addition, it is expected that the effect of climate change could display 143 million persons in the world (Rigaud et al., 2018).

#### *1.1.4.2 Remittances*

Remittances in 2019 will reach US\$551 billion in LMICs countries and US\$707 billion on the entire world, after an annual increase of 4.7% on LMICs and 3.5% in the world. In specific LAC is the region with a greater growth rate (7.8%) and the third region with more remittances flows in current U.S. dollar, just behind East Asia and Pacific and South Asia. This increment is related to the continued robustness of the United States economy (Plaza et al., 2019b). Remittances have grown faster than migration, while in the last 19 years international migration grew 56.5%, remittances grew 457.5% in the same period (UNDESA, 2019a) (KNOMAD, 2019). The top 5 recipients' countries in 2019 on current U.S. dollar are India, China, Mexico, the Philippines and Egypt; and as a percentage of GDP are Tonga, Haiti, Nepal, Tajikistan and the Kyrgyz Republic (Plaza et al., 2019b).

The trends exhibit that in 2019 remittances will be larger in LMICs than ODA (by a factor of three) and then FDI (Plaza et al., 2019b). Remittances are also more stable than FDI, from 2000 to 2017 in 123 LMICs, the coefficient of variation was 0.6 and 3.2 for the FDI in the same countries.

Unlike ODA, remittances flow directly to recipients, which fosters the reduction of poverty (Ratha, 2014 as cited in World Bank, 2019, p. 12). Mainly because 75% of family remittances are used to cover immediate basic needs (for example food, housing or bills). Another part is used as savings or investment, such as health, education or other activities that may generate income (Adams & Page 2005; Acosta et al. 2008; Roth & Tiberti, 2017; World Bank 2012; World Bank 2016a; Kinnon & Soler 2018 as cited in World Bank, 2019, p. 12). Estimations show that remittances represent on average 15% of the income generated by the immigrants and serves as 60% of the recipient households' income. As well, nearly 40% of remittances go to rural areas, fostering the agricultural economy (Ponsot et al., 2017).

Besides, remittances do not have a cyclical behavior like the capital flows, therefore during a crisis they smooth consumption (Ratha, 2014; De et al., 2016; Bettin & Zazzaro, 2016 as cited in World Bank, 2019, p. 12) (Combes & Ebeke, 2011). Nevertheless, remittances are pro-cycle to the destination economy, a recession in these economies will have a negative effect on remittances (Rosser, 2011).

A rather conservative projection showed that remittances on LMICs might reach US\$597 billion in 2021, which will represent an increase of 8.3% in respect to 2019 (Plaza et al., 2019b). Remittances can be affected in the future by more stringent financial regulations and the anti-migration sentiment (World Bank, 2019). The last point is reflected in the 2018 survey from the Pew Research Center (Connor & Krogstad, 2018). According to the survey, 45% of the respondents (100 people from each of these 27 countries: United States, Canada, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Spain, Sweden, United Kingdom, Russia, Australia, India, Indonesia, Japan, Philippines, South Korea, Israel, Tunisia, Kenya, Nigeria, South Africa, Argentina, Brazil and Mexico) would like a decrease in immigration

levels in their countries. Similarly, the 2019 -spring- Eurobarometer survey (2019 as cited in World Bank, 2019, p. 20) shows that 44% of respondents (population from 34 countries or territories: the 28 European Union (EU) Member States, five candidate countries (North Macedonia , Turkey, Montenegro, Serbia and Albania) and the Turkish Cypriot Community) consider immigration to be the most critical issue for the European Union.

Additionally, despite a downward trend of the transaction costs to send remittances on the last ten years (from 9.7% to 6.9%), the high cost is still far from the 3% target and thus keeps reducing remittances impact in the welfare of receiving households (World Bank, 2019). This reduction can be explained by an increase in the use of mobile phones, internet-based technologies and block-chain-based applications that facilitate and reduce the cost of remittances services (Plaza et al., 2019b). On this matter, LAC is the second region closer to attain this target reaching an averaging cost of 6.2% in 2019, just behind South Asia with 5% (World Bank, 2019).

#### *1.1.5 Impacts*

In this section, some consequences of migration for the destination and origin countries are developed. For the origin countries, some positive aspects of migration include an increase in income for the migrants and their families and thus their access to better health and education services. Remittances are also a way to share prosperity, by reducing significantly the share of poor population in many countries (World Bank, 2019). Nearly 800 million people are directly supported by remittances (Ponsot et al., 2017). Nevertheless, Combes & Ebeke (2011) found that remittances work better on less financial developed countries and if remittances flow is too high their smooth consumption effect is weakened. From the labor market perspective, migration could reduce unemployment, underemployment and increase wages in the origin country. Besides, migration could increase trade in the origin country, mainly through the networks created by the diaspora in the destination countries. At the same time high skill diaspora could encourage capital flows and investment towards the origin country and high skilled returned workers can facilitate the technology transfer. Finally, migration can empower migrants and give an escape from discrimination and restrictive social practices (World Bank, 2019).

On the other hand, the deprivation of skilled workers on the origin country may affect the delivery and quality of public services and institutions (World Bank, 2019). In addition, the migrants itself could be overqualified and/or unpaid/low paid workers, with a higher exposition to health hazards and higher death rates than the population in the destination country. Another negative consequence is the separation of the family, which arise with emotional cost to the family left behind (World Bank, 2019).

Moreover, the destination country can be supplied by skilled workers that could increase innovation. In addition, reduced labor-market constraints, contribute to their social security system and could

complement the native-born workers raising wages. Furthermore, Hong & McLaren (2015 as cited in World Bank, 2019, p. 18), found an increase in availability of goods and services at lower prices. Additionally, immigrants are more likely to have lower risk aversion, because they took the risky decision to emigrate, thus are more likely to become entrepreneurs (Neville et al. 2014 as cited in World Bank, 2019, p. 18). According to studies on OECD countries, 83% of the native population on the 22 richest countries have experienced welfare gained due to immigration (World Bank, 2019). Finally, immigration could be at the center of the development planning for some countries in order to reduce the negative effect of the fourth stage of the demographic transition.

Lastly, migration in the destination country could reduce employment and wages of the native population if they compete directly in the labor market. It is also argued, that the decline of social cohesion may lead to negative impacts on the destination countries, but there is no convincing empirical evidence. To conclude, high recruitment cost reduces the benefits as much as for the destination countries as for the origin countries.

## 1.2 Food security

### 1.2.1 Definitions

After the end of the cold war and a lost decade for many developing countries, the 1990s were characterized by a higher commitment of governments to establish global development plans to address socioeconomic issues. In this context, the World Food Summit in 1996 developed the definitions of food security.

*“Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”* (FAO, 1996, p. 1).

Intrinsically, this definition determined the four pillars of food security: availability, accessibility, utilization and stability. For the purpose of this study, Sassi’s (2018) research will guide the definition of these pillars as follows:

- **Food availability:** is achieved when there are sufficient quantities of adequate food (taking into account quality, people’s taste and cultural traditions). Specifically, this pillar addresses the supply side of food security and therefore, it is closely dependent of domestic production, net food stock, food imports and/or food assistance
- **Food accessibility:** it measures the physical, economic and social factors that allow (or not) access to food. The physical aspect is related to the capacity of storage, infrastructure, dynamics of the market, political stability or security and legal issues. The economic aspect is associated with the capacity to generate income of the households, so it is linked with levels of employment,

wages, access to means of production, transfers and prices. Lastly, the social aspect was introduced in the updated food security definition of FAO in 2002, it takes into consideration the ethnicity, religion and political affiliation as they might influence food consumption decisions.

- **Food utilization:** assesses the capacity within the individuals to select, distribute and process nutritive food, along with access to clean water and acquire at least the minimum sanitation requirements, to achieve proper biological use of food to provide sufficient energy.
- **Food stability:** Contrary to the above three pillars, this pillar introduces a dynamic nature of food security, ensuring the stability of these at all times for every person. In the past, food security has been more focused on production, but food availability does not ensure stable food access and utilization.

In 2012, the Committee on World Food Security (2012, p. 8) introduced the concept of food and nutrition security (FNS), to combine elements from the concepts of food security and nutrition security and thus they agreed that FNS: “*exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life*”. This new term added three more pillars to the definition of food security, which are adequate sanitation, health services and care.

### *1.2.2 Food security on the global development agenda*

Food security appears on the “2030 Agenda for Sustainable Development”, on the Sustainable Development Goal (SDG) 2, which has the target to “*end hunger, achieve food security and improved nutrition and promote sustainable agriculture*” (UN, 2015, p. 18). Nevertheless, this SDG has an emphasis on the food security pillars of availability and access and does not consider many aspects of utilization and stability.

However, food security requires a multidisciplinary approach. For instance, economic growth is necessary but not sufficient to achieve food security. The FAO has also highlighted other relevant factors, such as prices, income inequality and unequal food distribution in order to achieve food security. Addressing this issue, not only requires using a multidisciplinary approach but also a multi-level analysis like global, national/regional, households, or individuals (Sassi, 2018). In this sense, this research focuses on the assessments of the four pillars at the national/regional level.

### *1.2.3 Drivers, trends and treats of food security*

In recent years, food security has been affected by the food crisis of 2008 and 2011, a global crisis on the agri-food system combined with recessions, economic downturns and financial crises. This crisis caused

volatile and high prices of food products and inputs, reaching a peak in 2011 and causing over 1 billion undernourished people in 2009, unchaining protests in North Africa and the Middle East.

In developing countries, this crisis had a huge effect on food security, many of these problems are still perceived and they will represent a high cost in the future, due to the reduction of productivity or health issues (Sassi, 2018). The latest data from 2018, shows a stagnation of 10.8% prevalence of undernourishment in the world and an increase of 1.2% in the number of people undernourished from 2017 to 2018, reaching 821.6 million of people, which represent 1 out of 9 people on the planet (FAO, 2019).

When facing the impacts of this crisis, smallholder farmers deserve special attention. For instance, according to FAO's estimates, in 2014 around 85% of farmers in developing countries produced in less than 2 hectares (FAO, 2014) and their production represents a high share of their income. As a result, half of the undernourishment population are smallholder farmers. Although paradoxically, they produce half of the world's food (Sassi, 2018).

Using data from the 2014 Food Insecurity Experience Scale (FIES) in 134 developing countries it is possible to identify the five principal determinants of food insecurity: low levels of education, limited social capital (ability to count on family and friends in time of need), low household income, weak social networks and unemployment. Moreover, there is a heterogeneity of the determinants if its analyzed countries across different levels of economic development (Smith & Birgit, 2019).

According to FIES 2017, LAC was the second region with the highest prevalence of food insecurity (32%), just behind Sub Saharian Africa and the third region with the largest share of the population in severe food insecurity (12%), overcome by Sub Saharian Africa and South Asia (Smith & Birgit, 2019).

In addition, according to data from FIES 2014, there is an outstanding inequality of the food security state within LAC. Where the Caribbean sub-region has the higher levels of food insecurity (47%) and severe food insecurity (22%), followed by Central America and Mexico (36% and 9% respectively), the Andean States (28% and 9% respectively) and the Southern Cone (13% and 4% respectively) (Smith & Birgit, 2019). Besides, the three more relevant determinants to acknowledge food insecurity in LAC are low education level, limited social capital, living in a country with low GDP per capita, access to internet and immigrant status (Smith et al., 2017). On the other hand Ebadi et al. (2018) suggests that the determinants of food insecurity in LAC are climate change, inequalities in income distribution and lack of access to social protection.

According to the FAO, WFP, WHO and UNICEF (2019), one of the biggest problems in LAC is the increased levels of obesity. Nowadays 1 out of 4 people in LAC suffer from obesity (the world prevalence

of obesity is half of this level, 13.2%), threatening their health and having a huge economic impact. In contrast, the region has a lower prevalence of undernourishment (6.5%) with respect to the world (10.8%), as well as in wasting (1.3% versus 7.3% world level) and stunting (9% versus 21.9% world level).

Moreover, in LAC 600,000 people die every year due to diet-related disease. This problem is related to low levels of education, institutional and regulation problems and the domination of processing industries (which produce food with high levels of sugar, sodium and fat) into the food environment. In this context, poor people are the more vulnerable due to the easiest and cheaper access to this type of food rather than healthy food. Even though a large share of the population suffers from obesity rather than hunger (for 1-person suffering hunger 6 suffer obesity), hunger has grown continuously and rapidly these past years, to reach 42.5 million people in 2018 (FAO, WFP, WHO and UNICEF, 2019).

Finally, in LAC, it is estimated that 187 million people are in a situation of food insecurity, with a large gap between gender in adults, thus 69 million are women and 55 million are men and this same gap is present for the prevalence of obesity, 28% in women and 20% in men (FAO, WFP, WHO and UNICEF, 2019).

### **1.3 Previous studies of the migration and food security nexus**

As Crush & Caesar (2017) mention, migration and development research have moved forward from the initial elements of studies, as brain drain, remittances flow, circular migration, or diasporas networks. In these studies, researches were more focused on the impact in productive investment and economic growth. These studies are more likely to consider that the use of remittances on livelihood expenditure of the households has a marginally positive effect on economies (Adams, 2011; (J. Crush, 2013). Nevertheless, there is still a remaining gap to study other aspects of this phenomenon. Within these spheres, lies the nexus between migration and food security, which is a recently studied relation that remains as a peripheral and neglected concern.

Yet, evidence shows that the larger share of remittances expenditure is on food (Mahapatro et al., 2017, Crush & Pendleton, 2009, Acosta et al., 2008 as cited in Crush & Caesar, 2017, p. 10). For instance, using data from surveys carried in countries of the Southern African Development Community, Crush (2013) finds that household recipients of remittances spend more than 50% of remittances on food. It is also noted, that countries with the highest outflows of migration and refugees are countries with the highest levels of food insecurity (WFP, 2017). However, the global agendas of migration and food security are disconnected. As Crush (2013) emphasizes, both topics are in the core of the international development agenda, but the institutional separation of both topics has been distanced. This segregation seems to forget that food insecurity is a driver of migration, at the same time, as the new economics of labor

migration literature (NELM) argues, migration can be a strategy to achieve food security and operate as a household's risk-diversification strategy (Romano & Traverso, 2017).

Considering this last described interaction, the relation between food security and migration is what we called in econometrics a reverse causality relation, thus food security influences migration and migration influences food security. According to Zezza et al. (2011), remittances could positively affect food consumption, use of nutrition services, production and investment. In addition, migration could also affect productive and reproductive decisions, as well as nutritional habits that could have a negative or positive effect on the quantity and quality of food consumption. It is difficult to determine the overall effect of migration on food security, the previous conditions of the individual, household and community will play an important role.

To analyze the interaction between migration and food security, several approaches are possible. One could focus the analysis at a micro, meso or macro level. Focusing on the status of migration is also a methodological decision (migrants on transit, temporal, permanent or circular movement); or to either analyze the effects on the country of origin or destination. In this sense, for this research, it will focus on the effect of migration, measured with the proxy variable of remittances, on food security in the origin country at a macro-level of analysis. This decision was made based on the availability of the data.

Many studies privilege a perspective from the migrants in the destination country, their food security status and the income that they make. Despite the fact that some researches have already addressed the impact of migration and remittances on the food security status of the households of origin, there is not a definitive conclusion about the nexus of these two topics (J. Crush & Caesar, 2017).

A few results can give us some insights on this nexus. Romano & Traverso (2017) using Bangladesh as a case study, found that international migration has a positive impact on the food and nutrition security of the households, by allowing them to access a higher quantity and better quality of food (micronutrient-rich and high-protein diet), enhancing food availability, access and utilization. In fact, the households that receive remittances and have a member abroad have a larger impact on food security, compared to other households with an international migration experience (such as just receiving remittances, having a member abroad or having a returnee in the household). Their findings contribute to explain the Bangladeshi paradox of how significantly health and nutrition outcomes improve during a slowdown of the economy.

On the other hand, Thow et al. (2016) tried to identify the effect of remittances on nutrition through the analysis of the results of twenty previous researches. They conclude that remittances can increase access to food and may create consumption smoothing. Nevertheless, remittances appear to have little effect



on chronic undernourishment and in some cases could be used to purchase unhealthy food, affecting only in the quantity and not in the quality of the food.

Furthermore, Sharma (2012 as cited in Mabrouk & Mekni, 2018, p. 254) uses a survey report in a small village in Nepal to deduce that remittances help to achieve food security, since a large share of remittances is used for food, health and education. However, migration would have a negative impact on household farm production, since in most cases remittances are not enough to replace the workforce that left.

Similarly, other studies find rather positive impacts of migration. Among these studies, Mohapatra et al. (2012 as cited in Mabrouk & Mekni, 2018, p. 254), indicated that remittances worked to smooth consumption after the 1998 Bangladesh flood. Remittances increased after the shock and protected households from food shortage, illness and drought. Additionally, Couharde et al. (2011 as cited in Mabrouk & Mekni, 2018, pp. 254-255) showed that remittances can smooth GDP after climate shocks, contributing to macroeconomic stability and the resilience of the households. Finally, Babatunde & Martinetti (2011 as cited in Mabrouk & Mekni, 2018, p. 254), established that remittances increase income, assets, calorie supply, micronutrient supply and child nutritional status compared to the households that do not receive remittances in Nigeria.

However, few researches have analyzed the nexus of Migration and Food Security at a cross-country level. Among this few, Sulemana et al. (2018) explore that remittances influenced households food security of 32 African countries, they found that remittances, in general, have a positive effect on food security, but the frequency of receiving remittances is more relevant than the fact of just receiving remittances. Indeed, people who receive remittances frequently are less likely to be food insecure. Similarly, Ebadi et al. (2018) studied the link between receiving remittances and the status of food security in households of the global south (60 countries of LAC, Middle East, Africa and Asia). This study found a positive effect of receiving remittances in individual's food security and an association between not receiving and severe food insecurity, but these findings might not apply to all countries of their sample, due to the heterogeneity of the context of each country.

Moreover, Mabrouk & Mekni (2018) conducted the first research at a cross country and macro level for Africa using panel data. The authors intended to analyze the effect of remittances on the four pillars of food security, access, availability, stability and utilization. They found that there is a positive link between remittances and the pillars of access, stability and utilization; but at the same time, there is a negative effect on availability. The explanation of this result is probably due to the loss of productivity that results from the deprivation of the labor force caused by the migration process. In other words, consistent with other studies the amount and frequency of the remittances are not enough to replace this labor force.

This research will follow their methodological work in order to measure the possible effects of remittances on the four pillars of food security in Latin America and the Caribbean region.

Moreover, Ogunniyi et al. (2020) studied the implications of remittances and quality of governance on food and nutritional security in 15 countries of Sub Saharan Africa (SSA). Similar to, Mabrouk & Mekni (2018) they used the system GMM estimator. They found that international remittances and the quality of the governance has a positive and significant effect on the average value of food production and the average dietary energy supply adequacy.

In LAC there are some previous researches on this nexus. Acosta et al. (2007) found that in LAC children in recipient households tend to have better health outcomes than children in non-recipient households. Brauw (2011 as cited in Choithani, 2017, p. 193) found that during the shock on the prices of 2007-2008, children from recipients households in El Salvador had a slower decline in their nutritional status against the rest of the children. Besides, Orozco (2009 as cited in Rosser, 2011, pp. 14-15) found that remittances are associated with a diverse and more expensive diet in Guatemala, El Salvador and Jamaica. According to Acosta et al. (2008 as cited in Crush & Caesar, 2017, p. 10) in LAC the recipient households of remittances tend to spend between 35% and 75% of their income in food, with a higher proportion in the rural area than in the urban. Moreover, Antón (2010) found a positive effect between remittances and anthropometric indicators on the short and middle term on children younger than 5 years old in Ecuador but didn't find a significant relation on the long term.

On the other hand, according to Davis & Brazil (2016) in Guatemala, the father's absences due to international migration has a negative impact on children nutritional outcomes. In addition, remittances are not statistically significant on these outcomes, their explanation to this result is because possibly the fathers are new migrants which are not established and cannot return meaningful amounts of income.

## Chapter II: Analytical framework and methodology

Following an extensive theoretical justification of the factors influencing migration and food security, and the previous results of the studies on the nexus in chapter I, this chapter describes the analytical framework that was used in this research. It also discusses the empirical relevance of the variables chosen to conduct the econometrical approach that will allow us to characterize the quantitative relation between remittances and the four pillars of food security. Finally, it was described the econometric model and its characteristics, as well as the robustness tests that make the results validate and relevant.

### 2.1 Analytical framework

Romano & Traverso (2017) worked on a conceptual framework to identify how international migration can influence the four dimensions of food security. This research will consider their work as the basic framework of analysis. This basic framework will be completed by exploring the neoclassical framework of food security, commonly used for macro analysis; as well as, a micro perspective regarding the links among the individual food and nutrition security pillars, in order to conduct assumptions at the macro level.

First, it is necessary to clarify how households can be impacted by international migration. As mentioned before, there are different drivers that may lead to the decision to migrate, migration does not necessarily imply remittances and recipient households do not necessarily have a member abroad, they could receive remittances from other people that are not a member of their households, like friends or family. Because of this, a household may be considered involved in the migration process, for a different or a combination of reasons: either a member of their household is or was a migrant and/or the household receives remittances (of a migrant but outside their household).

Following Romano & Traverso (2017), they identified three microeconomic transmission channels where the migration process could affect the four pillars of food security. The first channel is **changes in the composition of the household**, due to the departure of a member. This channel could affect the four pillars of the food security status as it would generate a hierarchic change inside the household that could influence labor and consumption patterns. Besides, the departure implies less requirement of food for the households, but at the same time a reduction of potential labor supply (principally if the ones that migrate are the most productive) and especially for the households of smallholder farmers, that as it has been mentioned before are a vulnerable population. This could reduce their agricultural production capacity and remittances could not be enough to supersede the loss of workforce or due to credit constraints, they could not overcome the negative impacts of migration.

Nevertheless, if there is a shift towards female headship, this could have a positive effect on food security since according to a growing literature, they tend to spend more on food, education and health than the male headship (Quisumbing & McClafferty, 2006 as cited in Zezza et al., 2011, p. 2). Therefore, contrary to the common belief, the food insecurity problem is not only how much do these households produce, but it is also necessary to include the regularity and amount of the remittances as an important part to solve the problem (J. Crush, 2013). They should also be considered as part of a larger optimum function of the labor and credit markets as well (Zezza et al., 2011).

The second channel is a **variation in the economic situation of households**, principally due to the reception of remittances, which could also influence the four pillars of food security. Before we start this analysis, it is necessary to mention the problems that may arise from not taking in consideration the impact of food transfers. In this regard, Crush (2013) shows how important are remittances “in-kind” in the Southern African Development Community countries. In these member countries, 41% of the households receive clothes and 29% food as “in-kind” remittances. In some cases, food remittances are not negligible; they can go up to 60% and 45% in such as Mozambique and Zimbabwe respectively. Considering the above, either in-kind or monetary remittances could improve access, availability or even utilization. For example, they could be invested in access to sanitation facilities, health services, clean water or even education and both of them could smooth consumption during a negative shock (in prices, weather conditions, etc.) and therefore contribute to the stability pillar (Zezza et al., 2011).

Moreover, monetary remittances could relax credit and insurance constraints and can be invested in means of production, to increase productivity and production of farmers, or another activity to generate and later on diversify income. Otherwise, it could be used as savings. Zezza et al. (2011) highlights that the overall impact of remittances will be determined by the individual characteristics of the receiver.

The third channel is the **influence on social aspects of the households**; this channel is mainly driven by social remittances or returned migrants. The inclusion of the social remittances on this channel is the biggest difference to the theoretical framework made by Romano & Traverso (2017), since they consider social remittances as part of the second channel. As mentioned before social remittances are ideas, behavior, identities, social capital and knowledge that are transferred to the communities of origin (Global Migration Data Portal, 2020c). In this sense, returned migrants can influence consumption patterns, knowledge (for example on child care practices, health and nutrition) (Zezza et al., 2011), behaviors, new skills and social networks.

Moreover, as mentioned before people with migration experience are more likely to have lower risk aversion and therefore more likely to become entrepreneurs (Neville et al. 2014 in World Bank, 2019). All of these aspects influence the four pillars of food security, but there are also social and psychological

problems that come with migration and could negatively affect food security, such as the separation of the families, deserted communities and missing parents (Zezza et al., 2011).

From a macroeconomic perspective, the migration process could affect production, consumption, investments, savings and even prices within a country. The monetary flow of remittances could affect prices, generating a “Dutch disease” effect (or an appreciation of the real exchange rate, as it was proven by Acosta et al. (2009) and observed by other authors (Amuedo-Dorantes & Pozo, 2004; Bourdet & Falck, 2006; Lartey, Mandelman, & Acosta, 2008, as cited in Combes & Ebeke, 2011, p. 1077). Prices are relevant variable for the stability and access to food security. Finally, as mentioned by Combes & Ebeke (2011) the final macroeconomic effect of remittances will depend on the size of its flows.

## 2.2 Variable selection

In order to establish a causal relation between migration and food security, several methodological problems need to be addressed. As reminded in Chapter I, food security can influence migration and inversely, migration can influence food security, generating a reverse causality issue, as pointed out by Zezza et al. (2011) and Adams (2011). From an econometric point of view, the problem with reverse causation can introduce bias on the estimations.

Moreover, according to Adams (2011), there are four main methodological problems when working with international remittances:

1. **Simultaneity bias:** referring to variables that causes migration and at the same time causes food insecurity.
2. **Reverse causality bias:** while remittances may help to reduce food insecurity, food insecurity may also trigger international migration and subsequently, this process may produce international remittances.
3. **Selection bias:** it refers to a latent selectivity on an individual’s probability to receive remittances or to migrate.
4. **Omitted or unobservable variable bias:** when a relevant variable in the model, such as risk averseness is not included.

To solve some of this bias, Adams (2011) uses panel data and runs a first difference approach to solve for possible endogeneity, selection and omitted variables.

In view of the above, this research is aware of the methodological issues arising from the use of remittances as a proxy variable for migration. Particularly, chapter I exposes that migration can have impacts beyond remittances and the official data of remittances does not cover the entire definition of remittances, since even for monetary remittances it is difficult to calculate the exact amount. The

International Monetary Fund (IMF), which is the main provider of international remittances data, bases its calculations on two elements: personal transfers and compensations of employees. The last one is income from temporal migrants and the employed population in a foreign economy, such as embassies, international organizations and foreign companies. This approach of calculation partially reflects the definition of remittances, first because, it does not consider other type of transfers, as informal transfers and secondly, because it does not take into account the social remittances (Global Migration Data Portal, 2020c).

In addition, research suggests that only half of international migrants remit (Gubert, 2002; de la Briere et al., 2002 as cited in Adams, 2011, p. 810) and a large part of the households that receive remittances do not have a member abroad (Adams, 2006; Amuedo-Dorantes & Pozo, 2010 as cited in Adams, 2011, p. 810). However, with the purpose of conducting a cross-country macro analysis, this is the most relevant, coherent and available variable to use.

As mentioned by Crush & Caesar (2017), there is a broad agreement to include on researches, the analysis of the overall dimensions of food security. Nonetheless, a lively debate in the literature takes place concerning the choice of indicators that will better measure and quantify food security. Regarding this issue, Romano & Traverso (2017) suggest that because, theoretically, there is already a suitable set of indicators, the selection of these should depend on the availability of the data. Therefore, guided by Mabrouk & Mekni (2018), for this study one indicator for each pillar will be chosen as a dependent variable.

### *2.2.1 Data sources*

This research will use the international comparable data of the World Development Indicators (WDI) and World Governance Indicators (WGI) from the World Bank and the Suite of Food Security Indicators from FAO. The time period considered is from 2000 to 2017, with a round average of 3-years for all the variables, generating 6 periods (2000-02, 2003-05, 2006-08, 2009-11, 2012-14 and 2015-17). The 34 countries to be considered with that overlap within the datasets will be: Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

FAO does not have data for Aruba, Bermuda, British Virgin Islands, Cayman Islands, Curacao, Sint Maarten (Dutch part), St. Martin (French part), Turks and Caicos Islands and Virgin Islands (U.S.), and hence, won't be considered in this study.

## *2.2.2 Selection of dependent, main independent and control variables*

### *2.2.2.1 Dependent variables: one for each pillar of food security*

Based on the recommendations made by the Committee on World Food Security in 2011, FAO elaborated a suite of indicators in order to monitor food security at the national level. These indicators measure the determinants of availability, access and utilization; the outcomes of access and utilization; and the stability from the exposure to risk and shocks (Sassi, 2018).

As an indicator for availability, this research will use the average value of food production. This variable is measured in constant international dollars in per capita terms, so it can be compared across countries. It is a determinant of availability, which aims to measure the economic size of the food production sector (Sassi, 2018). The reason to choose this indicator is to measure the effect of the migration process into food production, according to the literature, there is not a clear answer concerning the direction of the correlation.

To measure the access pillar, prevalence of undernourishment has been chosen as an outcome variable. This indicator gives the probability of randomly selecting an individual within the population with an insufficient amount of calorie consumption to cover the energy requirement for an active and healthy day (Sassi, 2018). The purpose to test whether remittance flows contribute overall to the access to food, according to the majority of the literature it should expect a positive correlation. The values of “<2.5” will be considered as “2”, in order to have only numeric values. This is also necessary to have closer values to reality, since it is very unlikely to have a country with a prevalence of undernourishment of 0%. At last, this variable was used on natural logarithm due to a high Skewness (2.405853) and Kurtosis (9.810003), and in order to improve the model.

To measure utilization, a micronutrient deficiency indicator has been chosen. This indicator is the result of consuming poor micronutrient food. Specifically, the indicator measures the prevalence of anemia among children under 5 years of age from the WDI World Bank’s database. In other words, it measures the percentage of children under 5 years old whose hemoglobin level is lower than 110 grams per liter at sea level. This is a condition where the red blood cells do not carry enough oxygen to perform normal activities. Anemia can be caused by insufficiency on iron levels, acute and chronic infections, or deficiencies of vitamins and minerals. Children under 5 years old and pregnant women are the most vulnerable to obtain it, increasing the mortality of these groups (Mabrouk & Mekni, 2018; Sassi, 2018). Similar to the access pillar the literature showed mixed results on the direction of the correlation, nevertheless, the majority of the studies showed that remittances have a positive effect on utilization.

To measure stability, a shock indicator has been chosen. The per capita food production variability, which is measured in constant international dollars. It is expected that remittances reduce the variability of the per capita food production. At last, this variable was used on natural logarithm due to a high Skewness (2.939951) and Kurtosis (12.99567), and in order to improve the model.

#### *2.2.2.2 Main independent and control variables*

The main independent variable of interest is remittances, which is measured by personal remittances received flows as a percentage of the GDP, an indicator from WDI of the World Bank. Personal remittances comprise personal transfers and compensation of employees.

In order to choose the control variables, this study considers the work of Smith et al. (2017), concerning the determinants of having food insecurity in LAC. These include levels of education, limited social capital and living in a country with low GDP per capita. From this set, the variable concerning social capital will not be used due to its complexity to be precisely measured, and the lack of international comparable data at national level for this variable. In addition, the heterogeneity of these determinants (gender, age and location of their residence) will be considered.

Taking into consideration the theoretical part of this research, a set of explanatory variables has been selected. This non-exhaustive list is based on researches that have studied the nexus between migration and food security and consider exogenous determinants of food security. It is necessary to highlight that only two research of the nexus are at a macro level and cross country, Mabrouk & Mekni (2018) and Ogunniyi et al. (2020). Naturally, the availability of international comparable variables on the databases mentioned above has also been considered. For example, in the case of asset ownership, landless, marital status and household size, even when they were recommended by the authors, were discarded because they are commonly measured at the household level, not at the national level, consequently, the dataset does not have information for these variables.

The final selection of the exogenous variables also included an analysis of the correlation matrix using the commands *corr* and *pwcorr* from stata, the variables with a correlation of 0.7 or higher (and -0.7 or lower) with the dependent variables, remittances and other exogenous variables were discarded. The objective to do this is to avoid multicollinearity problems, which it is when independent variables are strongly correlated within each other, this can undermine the statistical significance of the independents' variables (Allen, 1997). According to Ratner (2009) values between -0.7 and 0.7 indicate weak or moderate linear relationships.

The variables that were discarded due to high correlation were: access to electricity (% of population); people using at least basic drinking water services (% of population); GDP per capita, purchasing power



parity (PPP) (constant 2011 international \$); informal employment (% of total non-agricultural employment); literacy rate, adult total (% of people ages 15 and above); mortality rate, infant (per 1,000 live births); population ages 65 and above (% of total population); population, male (% of population); urban population growth (annual %); and government effectiveness. Particularly, food imports showed at first glance a high correlation with remittances with the *corr* command, but after the elimination of some variables its correlation became acceptable. Nevertheless, it was included as an independent variable in the model for availability and stability in order to improve the model. In the model, an independent variable is an exogenous variable that is not in the regressors but is part of the exogenous instruments.

**Table 1: Control variables, description sources and evidence on research related to the migration and food security nexus**

Variable	Description	Source	Evidence of similar variables used
Investment	Gross fixed capital formation (% of GDP): This variable measures the investment which includes land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.	WDI (2020)	(Mabrouk & Mekni, 2018)
GDP capita growth	GDP per capita growth (annual %): Annual percentage growth rate of GDP per capita based on constant local currency.	WDI (2020)	(Mabrouk & Mekni, 2018); (Smith et al., 2017); (Ebadi et al., 2018)
Unemployment	Unemployment, total (% of total labor force): Unemployment refers to the share of the labor force that is without work but available for and seeking employment. (modeled International Labour Organization (ILO) estimate)	WDI (2020)	(Smith et al., 2017); (Sulemana et al., 2018); (Ebadi et al., 2018)
Female	Population, female (% of total population): Female population is the percentage of the population that is female. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	WDI (2020)	(Smith et al., 2017); (Sulemana et al., 2018); (Ebadi et al., 2018); (Romano & Traverso, 2017)
Rural	Rural population growth (annual %): Rural population refers to people living in rural areas as defined by national statistical offices. It is calculated as the difference between total population and urban population.	WDI (2020)	(Mabrouk & Mekni, 2018); (Smith et al., 2017); (Sulemana et al., 2018); (Ebadi et al., 2018); (Romano &

			Traverso, 2017); (Ogunniyi et al., 2020) <sup>1</sup>
Internet	Individuals using the internet (% of the population): Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.	WDI (2020)	(Smith et al., 2017)
Food imports (% of merchandise imports)	Food comprises the commodities in Standard International Trade Classification (SITC) sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels).	WDI (2020)	(Mabrouk & Mekni, 2018)
Food exports (% of merchandise exports)		WDI (2020)	(Mabrouk & Mekni, 2018)
Rainfall <sup>2</sup>	Average precipitation in depth (mm per year): Average precipitation is the long-term average in depth (over space and time) of annual precipitation in the country. Precipitation is defined as any kind of water that falls from clouds as a liquid or a solid.	WDI (2020)	(Mabrouk & Mekni, 2018); (Davis & Brazil, 2016)
Political Stability	Political stability and absence of violence measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. The estimate ranges from -2.5 (weak) to 2.5 (strong) governance performance.	FAO (2020)	(Mabrouk & Mekni, 2018); (Ogunniyi et al., 2020)

Source: Author's elaboration using WDI from the World Bank and Suite of Food Security Indicators from FAO for the descriptions.

### 2.3 Econometric framework

To address the issue of reverse causality and endogeneity the method GMM will be used. This is a dynamic panel model method that relies on instrumental variables. Specifically, I use the one-step system GMM developed by Blundell & Bond (1998), which simultaneously uses difference and level specifications, making it more consistent and efficient than the difference GMM. In addition, according to them, one-step system is more reliable when either non-normality or heteroskedasticity is suspected. Heteroskedasticity may bias the standard errors and make the estimations no longer efficient (Yobero, 2016). Moreover, on the robustness check the Pagan & Hall test (1983 as cited in Baum et al., 2002, pp.

<sup>1</sup> They tend to capture the demographic pressure at national level on food and nutrition security. In this research it was only available for the rural area, because the indicator for urban area was high correlated with remittances.

<sup>2</sup> Because the data remains unchanged in all the countries, the last observation carried forward (LOCF) method was used whenever a value was missing.

11-14) was implemented which confirmed the presence of heteroskedasticity on availability, access and utilization models.

At last, the model will also include an orthogonal deviation, which minimizes data loss in panels with gaps, which is the case for our dataset. Table A1 in the Appendix shows that only four of the variables have 0% of missing values. This may reduce efficiency and may cause bias (Madley-Dowd et al., 2019). Nevertheless, the highest percentage of missing values is 23.53% for investment, and it is particularly low for the outcome variables and remittances, except for the access variable, which has 17.65% of missing values. This also justifies the use of system GMM rather than difference GMM, the last one magnifies the gaps of missing data, and that is solved with the forward orthogonal deviation transformation in system GMM (Roodman, 2009).

The original equation can be expressed as:

$$Y_{it}^j = \varphi Y_{it-1}^j + \beta REM_{it} + \delta A_{it} + \varepsilon_{it} \quad (1)$$

where  $t$  is the time dimension (years),  $i$  is the cross-section dimension (countries),  $j$  is the four pillars of food security.

The variable  $Y$  is the dependent variables above mentioned which represents the four pillars of food security,  $Y^1$  is for access,  $Y^2$  is availability,  $Y^3$  is utilization and  $Y^4$  is stability. The lag of the dependent variable  $Y_{t-1}$ , is the endogenous variable.

The main explanatory variable is  $REM$  which represents personal remittances, as mentioned before personal remittances comprise personal transfers and compensation of employees. The control matrix is represented by  $A$ , all the control variables are strictly exogenous and finally the error term is  $\varepsilon$ , which is formed by the fixed effects and the idiosyncratic disturbance term.

The constant is not included in the equation because it affects the instruments matrix (Roodman, 2009) and normally not including it gives significance to the estimators (Labra & Torrecillas, 2014).

The presence of the lagged dependent variable on the model violates an assumption for the consistency of Ordinary Least Squares (OLS), due to its positive correlation with the error term, this is the “dynamic panel bias”, applying OLS inflates the coefficient of the lagged dependent variable by attributing prediction power which actually belongs to the countries fixed effect. Furthermore, applying the Least-Squares Dummy-Variables (LSDV) estimator to address the fixed effect through a within group transformation, even then the lagged dependent variable is correlated with the error term, the only difference is that is negatively correlated. Under both cases this would not be a problem if the number of periods ( $T$ ) is large, and in our case is 6, which is not large. A good estimation of a GMM parameter

can be verified if the coefficient of the lagged dependent variable is between the coefficient of the same variable under Pooled OLS and LSDV (Roodman, 2009).

The main problem of using a GMM estimator is the proliferation of the instruments, it is likely to generate more instruments than those that are actually needed, and this causes an overidentification of the model. It is necessary to pay careful attention when the instruments are selected. Roodman (2009), gives some suggestions on how to treat the instruments and a way to test them. These tests validate and give robustness to the model.

Firstly, the overidentification test to validate overall instruments, following his recommendation the best model in one step is Hansen. Ironically the proliferation of instruments biases this test generating implausible good p-values (1.000). In order to avoid this, the literature recommended that the number of instruments does not exceed the number of groups (in this case countries) tested in each model. A good Hansen test should be within a p-value of 0.05-0.80, and ideally should be between 0.10-0.25 (Roodman, 2009).

Secondly, it was used the autocorrelation test developed by Arellano and Bond (1991 as cited in Roodman, 2009, pp. 119-121), which tests the absence of autocorrelation between independent variables and one of the components of the error term  $\varepsilon_{it}$  (idiosyncratic disturbance term). A good p-value of this test should be higher than 0.05, and specifically, for the second-order serial autocorrelation -AR (2)-, if not some lags variables are invalid as instruments. The validity of this test depends on the size of N (number of groups), N should be large, there is not a precise definition of large but Roodman (2009) infers that should be higher than 20.

Finally, it is recommended to use time dummies variables; they reduce the probability of having correlations across individuals in the idiosyncratic disturbance. The absence of this correlation is assumed by the robust estimation of the coefficient's standard errors and the autocorrelation test (Roodman, 2009).

Moreover, equation (1),  $\beta$  and  $\delta$  only have the capacity to measure the short run or temporary impacts of remittances and the control variables respectively. However, following Pesaran & Zhao (1999) it is possible to measure the average long run parameter of the regressors using the following equations:

$$\theta_1 = \beta / (1 - \varphi) \tag{2}$$

$$\theta_2 = \delta / (1 - \varphi) \tag{3}$$

Where equation (2) and (3) measures the long run parameters for remittances and the control variables respectively. The long-run coefficient measures the total impact of a sustained unit change in remittances or the control variables on the dependent variable.

## Chapter III: Results and discussion

This chapter presents the results obtained in the research. The first part, provides a descriptive statistical analysis of the variables used. The second part, describes the results obtained from the chosen econometrical approach, that measures the quantitative impact of remittances on the four pillars of food security. Lastly, the robustness of the results found is checked and presented.

### 3.1 Descriptive statistics and preliminary diagnostic

Table A1 and A2 in the Appendix, contain the descriptive statistics and the correlation matrix of the variables used. The summary statistics (Table A1) show an acceptable coefficient of variation (according to the theory, a lower coefficient of variation enhances the precision of the estimations). In our case, the average of received personal remittances as a percentage of the GDP in LAC from 2000 to 2017 is 5.27%. The coefficient of variation for “received personal remittances as a % of GDP” is 1.15 and the data ranges from 29.04% to 0.01%. This would indicate that the data from this variable is relatively more dispersed than other variables. On the other hand, the dependent variables that measure the four pillars of food security are heterogeneous. For instance, their coefficients of variation are lower than 1. They have means that go from 2.16 for access and 289.05 for availability. All the variables have more than 76% of non-missing values (which improves the statistical power of the estimations), and the Skewness is within the acceptable intervals, from -2 to 2 in order to have normal univariate distribution (George & Mallery, 2010). Moreover, the excess of Kurtosis is not so far away from this interval (the highest value been 2.89).

Concerning the correlation matrix (Table A2), the results show that all the correlation coefficients between the independent variables and the dependent variables are less than 0.7. This suggests that multicollinearity should not be a severe problem for the model.

Moreover, the analysis of the scatterplot between the dependent variables and remittances, along with the correlation matrix, may indicate the sense of the correlations that we should expect from the model (running remittances on each pillar of food security). Figures A1-A4 in the Appendix show the scatterplot of the dependent variables with remittances. From this figure, it can be inferred that remittances have a negative relation with availability (measured by the average value of food production) in the period studied. Similarly, it can be observed that stability (measured by the per capita food production) has a negative correlation with remittances. The same is true for the variability indicator. Furthermore, the variable of access (measured as prevalence of undernourishment), as well as the variable of utilization (measured as prevalence of anemia among children), have a positive relation with remittances. These

results give a first insight of how remittances (as a percentage of GDP) may affect food security in LAC. In the next section, we contrast these presumptions with the actual results of the model.

Finally, from figures A5-A8 in the Appendix, it can be inferred that the countries with higher income have a lower level of remittances as a percentage of GDP. This could contribute to explain how higher levels of remittances as a percentage of GDP are related to lower food per capita productions, higher levels of prevalence of undernourishment and prevalence of anemia among children, as well as lower variability of food production per capita.

### 3.2 Results

To conduct the econometrical approach, a model for each pillar was developed, considering remittances and the control variables as the explanatory variables. Following the recommendations by Roodman (2009) to address the problem of instruments proliferation, all the GMM-style instruments are under the *collapse* option. Also, the *robust* option was included in all the models. It should be noted that this option requires standard errors to be robust to arbitrary patterns of autocorrelation within the countries and to heteroskedasticity.

Finally, there are two ways on how to use the instruments in GMM, the GMM-style and the iv-style. The first one, in order to improve the efficiency of the models use longer lags of the variables as additional instruments. In addition, instead of dropping the missing values these are substitute by zeros, so there will not be consequences of smaller the samples. The endogenous variables were instrumented as GMM-style treated from the second lag and longer, and the predetermined variables (which are variables independent to current disturbance but influenced by past ones, in other words, not strictly exogenous or endogenous) were instrumented as GMM-style treated from the first lag and longer. The iv-style, instrument the exogenous variables by themselves (Roodman, 2009).

It is necessary to highlight that the results will only be able to be read on average for LAC region, and in *ceteris paribus* (with other conditions remaining the same). Also, a distinction will be made to describe the short or long run effects. However, long run estimations (Table A3 in Appendix), can be biased when the number of periods is small. Theoretical and empirical evidence showed that the long run coefficient can be biased because of the “inherent non-linearity between the long run and short run coefficients” and the use of the lagged dependent variable as a regressor (Pesaran & Smith, 1995 and Pesaran, Smith & Im, 1996 as cited in Pesaran & Zhao, 1999, pp 300-301). There are different methods to correct this bias. However, as pointed by Pesaran & Zhao (1999), none of the bias reduction techniques perform well when  $\varphi \approx 0.80$  ( $\varphi$  is the coefficient of the lagged dependent variable in the model), which is the case for all the preformed models in this research. Nevertheless, they can bring important insights to the analysis.

### *3.2.1 Availability*

For availability, the lagged dependent variable and remittances were treated as endogenous instruments, all the rest of the regressors were included as exogenous instruments. In addition, food imports were included as an independent instrument, which means that it is part of the exogenous instruments but is not a regressor.

On the short run, remittances are statistically significant, which means that it explains the variability of availability. In this case, availability is measured as the average value of food production. As we stated in the previous section, a negative relationship between these two variables was expected. Our results are coherent with this suspicion; thus, a unit percentage-point increase on personal remittances as a percentage of GDP will decrease the average value of food production per capita by 10.59 international dollars (constant 2004-2006), at the 1% significance level, *ceteris paribus*. As stated by the theory before, this negative effect could be induced by the loss of labor force and productivity that may not be compensated by remittances.

Moreover, it seems that the growth population of the rural sector affect negatively the food production. A unit percentage-point increase in the rural population growth will decrease the average value of food production by 16.93 international dollars (constant 2004-2006), at the 10% significance level, *ceteris paribus*. As it had been noticed by many authors, there is a complex relation between the population growth and population density on food production, both demographic trends could shrink cultivated areas at the same time that may intensify and increase food production (Muyanga & Jayne, 2014). It seems that the overall effect of rural population growth in LAC on the period studied is, in general, negative, but this is just a first insight for a more complex research.

In addition, the usage of internet also affects negatively the food production. A unit percentage-point increase in the percentage of population using internet will decrease the average value of food production by 2.82 international dollars (constant 2004-2006), at the 1% significance level, *ceteris paribus*. However, Smith et al. (2017) found a positive relation between using internet and been food secure in LAC. Nevertheless, their measure of food insecurity is according to conditions and behaviors of individuals, our findings described a more specific relation, between the usage of internet and the size of agricultural sector at the national level. The negative relation of using internet and food production may be explained by the positive association of internet exposition and migration (Vilhelmson & Thulin, 2013), which may shrink the labor force for agricultural production. Nevertheless, this relation hasn't been studied on LAC yet.

On the other hand, an increase in the share of female population by one percentage-point increases the average value of food production by 22.11 international dollars (constant 2004-2006), at the 5%



significance level, *ceteris paribus*. However, Sharma (2012 as cited in Mabrouk & Mekni, 2018, p. 254) found a negative effect between the “feminization of agriculture”<sup>3</sup> caused mainly by migration and the agricultural production. Unlike Sharma’s research, this study does not focus on the impact of female participation in food production per se. However, the positive effect of an increase on the share of female population on the food production may be explained by the increase on labor force and productivity on the agricultural sector.

Moreover, all the variables that were significant on the short run, are also significant and their effect is more intense on the long run. One percentage-point increase in personal remittances as a percentage of GDP and one percentage-point increase in rural population growth decreases the average value of food production per capita by 53.27 and 85.13 international dollars (constant 2004-2006) respectively, at the 1% significance level, *ceteris paribus*. In addition, an increase of one percentage-point of the percentage of population using internet reduces the food production per capita by 14.18 international dollars (constant 2004-2006) at the 5% significance level, *ceteris paribus*. In contrast, an increase of one percentage-point on the share of female population increases the average value of food production by 111.20 international dollars (constant 2004-2006), at the 5% significance level, *ceteris paribus*.

If the conditions remain invariant, migration could shrink the agricultural production, one of the actions that could counter this effect is the promotion of investment in the agricultural sector, which may capture part of the remittances as an investment toward this productive activity.

### 3.2.2 Access

For access the dependent variable and its lags are in logarithm terms, as mentioned before. The dependent variable and remittances were treated as endogenous instruments and all the rest of the regressors were included as exogenous instruments.

On the short run, one percentage-point increase on personal remittances as a percentage of GDP increases by 3.3% the prevalence of undernourishment at the 10% significance level, *ceteris paribus*. Contrary to what was expected (considering the results of Mabrouk & Mekni (2018) in Africa), remittances seems to decrease the access to food security in LAC. A possible explanation is that high levels of remittances could generate a “Dutch disease” effect in developing countries affecting the prices on the economy as mentioned in Combes & Ebeke (2011). In addition, Thow et al. (2016) also found that remittances appear to have little effect on chronic undernourishment. Furthermore, according to Craven & Gartaula (2015), the literature on the subject does not consider migration having a negative impacts on household’s access to food. However, they emphasize that the problem lies in the lack of the

---

<sup>3</sup> Feminization of agriculture is the growing dominance of women in agricultural production (FAO, 1998).

temporal dimension, nonetheless, they suggest that migration not having a negative effect on access is overly optimistic. Moreover, an increase of one percentage-point on the share of female population decrease 11.56% the prevalence of undernourishment at the 5% significance level, *ceteris paribus*. This result will be better explained along with the effect of the variable in utilization.

On the long run, personal remittances as a percentage of GDP are no longer significant to explain the prevalence of undernourishment. Antón (2010) also finds an insignificant relation in the long term between remittances and nutritional status, even though, his proxy for nutritional status is related to children and not labor force population.

Moreover, one percentage-point increase of the female population decreases 41% of the prevalence of undernourishment at the 5% significance level, *ceteris paribus*.

### *3.2.3 Utilization*

On this model remittances and the dependent variables are treated as an endogenous instrument, all the rest of the regressors were included as exogenous instruments.

On the short run, an increase of one percentage-point on personal remittances as a percentage of GDP increases the prevalence of anemia among children by 0.29 percentage-point at the 1% significance level, *ceteris paribus*. Similar results were found by Davis & Brazil (2016) in Guatemala. They point out that the absence of a father due to migration has a negative impact on children's nutritional outcomes. Moreover, Thow et al. (2016), also pointed out that remittances may be used to purchase unhealthy food, impacting only in the quantity and not in the quality of the food. Additionally, a percentage-point increase on the share of population using the internet increases by 0.05 percentage-points the prevalence of anemia among children at a 10% significance level, *ceteris paribus*. Moreover, an increase of one percentage-point on the share of female population decreases in 0.74 percentage-points the prevalence of anemia among children, at the 10% significance level, *ceteris paribus*. This last outcome is consistent with the results obtained from the modelling of the “access” pillar (a bigger share of female population has positive impacts in reducing either undernourishment or anemia)

From the modeling of the pillar access and utilization in food security, we observe that the share of female population is highly important. These results complement previous findings by Quisumbing & McClafferty (2006 as cited in Zezza et al., 2011, p. 2), which suggest that a shift towards female headship, could have a positive effect on food security. An increase in the share of female population does not necessarily mean an increase of female headship, but it may influence the composition of the household and therefore it could influence the decisions of the households.

On the long run, a percentage-point increase of personal remittances as a percentage of GDP increases by 1.32 percentage-point the prevalence of anemia among children at the 1% significance level, *ceteris paribus*. Moreover, a percentage-point increase on the percentage of population using internet increase by 0.24 percentage-point the prevalence of anemia among children at the 10% significance level, *ceteris paribus*. At last, the share of female population stops being significant to explain the prevalence of anemia among children on the long run.

### *3.2.4 Stability*

Finally, on this model the dependent variable and all its lags were used in logarithm terms, as mentioned before. The lagged dependent variable is treated as endogenous instrument and remittances as a predetermined instrument, all the rest of the regressors were included as exogenous instruments and food imports was included as an independent instrument.

On the short run, an increase of one percentage-point on personal remittances as a percentage of GDP reduces the variability of the per capita food production by 6.7% at the 10% significance level, *ceteris paribus*. It can be inferred that remittances affect positively the stability of food security. As mentioned by Mohapatra et al. (2012 as cited in Mabrouk & Mekni, 2018, p. 254) and Couharde et al. (2011 as cited in Mabrouk & Mekni, 2018, pp. 254-255), this could be partially explained by the fact that remittances smooth consumption during a crisis and thus demand. Consequently, a more stable demand may reduce volatility in food production during a crisis. Lastly, a percentage-point increase on the percentage of population using internet reduces the variability of the per capita food production by 1.8%, at the 5% significance level, *ceteris paribus*.

On the long run, an increase of one percentage-point on personal remittances as a percentage of GDP reduces the variability of the per capita food production by 24.3%, at the 5% significance level, *ceteris paribus*. Moreover, the percentage of population using internet stop being significant to explain the variability of the per capita food production on the long run.

**Table 2: The effect of remittances on food security (one-step system GMM)**

	Availability		Access		Utilization		Stability	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Lagged dep. Variable(t-1)	<b>0.801***</b>	<i>0.072</i>	<b>0.718***</b>	<i>0.148</i>	<b>0.775***</b>	<i>0.074</i>	<b>0.724***</b>	<i>0.193</i>
Remittances	<b>-10.593***</b>	<i>3.423</i>	<b>0.034*</b>	<i>0.017</i>	<b>0.297***</b>	<i>0.101</i>	<b>-0.067*</b>	<i>0.033</i>
Internet	<b>-2.819***</b>	<i>0.838</i>	0.001	<i>0.006</i>	<b>0.055*</b>	<i>0.030</i>	<b>-0.018**</b>	<i>0.008</i>
GDP capita growth	4.413	<i>3.885</i>	0.003	<i>0.015</i>	0.139	<i>0.116</i>	-0.017	<i>0.031</i>
Investment	0.418	<i>1.441</i>	-0.008	<i>0.006</i>	-0.078	<i>0.073</i>	0	<i>0.012</i>
Unemployment	0.729	<i>3.178</i>	-0.01	<i>0.012</i>	-0.077	<i>0.089</i>	0.009	<i>0.019</i>
Female	<b>22.114**</b>	<i>10.721</i>	<b>-0.116**</b>	<i>0.052</i>	<b>-0.749*</b>	<i>0.412</i>	0.06	<i>0.103</i>
Rural	<b>-16.93*</b>	<i>8.372</i>	0.017	<i>0.012</i>	0.165	<i>0.233</i>	-0.055	<i>0.033</i>
Food exports	0.832	<i>0.786</i>	0	<i>0.001</i>	-0.011	<i>0.014</i>	0.005	<i>0.004</i>
Rainfall	-0.019	<i>0.013</i>	0	<i>0.000</i>	0.000	<i>0.000</i>	0	<i>0.000</i>
Political stability	2.901	<i>15.585</i>	-0.03	<i>0.061</i>	-0.078	<i>0.489</i>	-0.018	<i>0.102</i>
Time dummies	Yes		Yes		Yes		Yes	
Number of countries	25		24		25		25	
Number of instruments	24		24		24		25	
Observations	111		110		111		111	
Test (p-values)								
AR (2) test	0.475		0.159		0.634		0.635	
Hansen test	0.163		0.206		0.112		0.154	
F-test	6679.66		627.68		2602.94		219.86	
Prob > F	0.000***		0.000***		0.000***		0.000***	

Notes: The dependent and the lag dependent variable for Access and Stability are in natural logarithm form. \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

Source: Author's elaboration.

### 3.3 Robustness check

First, it is necessary to mention that all the models accept the alternative hypothesis of the F-test. This means that the regressors are on overall statistical significance and so, the models have some explanatory power.

From the robustness check of the models (Table 2), it can be observed that there is no autocorrelation with the idiosyncratic disturbance term, because all the Arellano-Bond test for second-order of serial correlation have a p-value higher than 0.05. This means that with the model solving the problem of fixed effect disturbance, the estimations are not correlated with the full disturbance term  $\varepsilon_{it}$ . This result allowed to use lag variables as valid instruments (Roodman, 2009).

In addition, all the p-values of the Hansen test are higher than 0.05. This means that it fails to reject the hypothesis of jointly valid instruments, thus, all the instruments are exogenous, or in other words, they are not correlated with the error term, which makes them valid instruments. In fact, all the p-values are in the ideal interval recommended by Roodman (2009) which is between 0.10-0.25. As mentioned before, in order to limit the weakening of the power of the test none of the models should have a higher number of instruments than groups (countries).

Concerning the lagged dependent variable, it is significant in all the models, which gives a good sign of a good estimation. In addition, the coefficients are below one, according to Roodman (2009), this is a sign of a credible estimate. Finally, comparing the results with the Table A4 in Appendix, all the coefficients, except the one from utilization, are in the range between the coefficients of the Pooled OLS estimations (upper bound) and the LSDV estimations (lower bound).

Finally, after the OLS regressions, the heteroskedasticity test proposed by Pagan & Hall (1983 as cited in Baum et al., 2002, pp. 11-14) was implemented. This is the preferred test when one or more regressors are endogenous, it was realized with the stata command *ivbtest*. For availability, access and utilization the test rejected the null hypothesis. This means that there is a presence of heteroskedasticity, which confirms that the best model for those variables is the one-step system GMM. For stability, the test does not reject the null hypothesis suggesting a presence of homoscedasticity. Nevertheless, pooled OLS and LSDV showed similar results to the ones with the one-step system GMM.

### 3.4 Conclusion

From this research, it can be concluded that migration is a complex phenomenon; the efforts on the topic should not lead to stopping it. It is preferred to maximize the benefits and minimize the negative aspects of it, by mitigating an unsafe, disorderly and irregular migration (UN Headquarters, 2017). In recent years,

LAC has experienced a large movement of migrants, where the large majority of it satisfies the unsafe, disorderly and irregular characteristics.

Moreover, the effects of the food crisis are still present in the region. Indeed, LAC is the second region with the highest prevalence of food insecurity (32%) and the third region with the largest share of population in severe food insecurity (12%) (Smith & Birgit, 2019). This along with the increased levels of obesity (FAO, WFP, WHO and UNICEF, 2019), this doubled burden of malnutrition (when there is problems of undernourishment and obesity at the same time) makes food insecurity a complex issue in the region. Certainly, addressing this issue implies acting in several other determinants, such as education level, limited social capital, income level, access to internet, immigrant status, effects of climate change, inequalities or access to social protection.

As mentioned by Zezza et al. (2011), it is difficult to determine the overall effect of migration on food security, since the previous conditions of the individual, household and community will play an important role. This research had the objective to analyze the possible impacts of migration on food security in LAC countries. In order to scope the study, it was necessary to limit it towards the economic impact of migration, measured by received personal remittances as a percentage of the GDP. Even when it is acknowledged that migration has impacts beyond remittances and the official data of remittances do not cover the entire definition of remittances, this is the most relevant, coherent and available variable to use.

Because of the methodological problems that arise when analyzing these two very closely and inversely related variables, it was necessary to rely on the GMM estimators. Because of this methodological choice, we can ensure that the estimates of this research are robust.

The data used in this research, includes information from 34 LAC countries from 2000 to 2017, the data was organized on 6 periods of analysis (2000-02, 2003-05, 2006-08, 2009-11, 2012-14 and 2015-17), using a round average method of 3-years for all the variables. This method considers the years of 2001, 2004, 2007, 2010, 2013 and 2016 at the center and creates an average tacking into account one year before and after from these centers. From this data, it was possible to identify three microeconomic transmission channels where the migration process could affect the four pillars of food security. The first channel is changes in the composition of the household, due to the departure of a member, the second channel is a variation in the economic situation of households, and the third channel is the influence on social aspects of the households. These channels among with previous research and the availability of international comparable data were the background for the selection of the variables.

The estimations from the econometric approach show that remittances have a negative effect on availability, access and utilization, but a positive effect on stability. Even more, in the event of a steady context (*ceteris paribus*), these negative effects are intensified in the long run. A possible general

explanation is that the phenomenon of migration in LAC is for the most part unsafe and unorganized, and for this reason, many collaterals and possibly negative effects arise, the separation of the family and the loss of labor force are just a few examples. Moreover, the negative effects that high flows of remittances could have in a country, have been pointed out by different authors, the array of this effects go from losing productivity to affecting the prices on the markets.

The results of this study are different from those obtained by Mabrouk & Mekni (2018) for Africa. This gap could be explained by the difference in the migration trends between the two regions. For example, while the intraregional migration in Africa represented 51% of the international migration, in LAC this migration only represented 10.5% (Desiderio, 2020). In addition, Combes & Ebeke (2011) found that remittances work better on less financially developed countries, which in contrast with African countries LAC countries are in general more developed in this aspect. However, these are just a few insights for further research on the heterogeneous impacts of remittances on food security across regions.

Nevertheless, the results contribute to the debate on the impacts of migration on food security. As mentioned by Craven & Gartaula (2015), migration has the capacity to shift the economy from an agricultural base to a remittances dependent base, in which case it can make the agricultural sector more vulnerable, unattractive, unsustainable and unproductive, generating negative impacts on food security on the long term. However, this does not mean that migration cannot generate positive effects on food security; it rather means that the nexus is more complex and that there is more to it than just promoting that migration will generate food security at the origin country.

In addition, one of the important contributions of this research, is that unlike other researches on the topic in the LAC region, we include a temporal dimension. This decision is supported by the work of Craven & Gartaula (2015), since they also consider that the migration opportunities and the cultures of migration affect the patterns surrounded food security. In fact, Antón (2010) found a positive effect between remittances and anthropometric indicators on the short and middle term on children younger than 5 years old in Ecuador but did not find a significant relation on the long term.

Finally, in order to design efficient public policies to tackle the hazards and the potential negative effects, it is important to understand how migration drives the development processes and to comprehend the non-linear relation between migration and food security. It is necessary to develop public policies that maximize the benefits of migration. For example:

- Considering changes in household composition due to migration. Public policies must be prepared and adapted to guarantee the fulfillment of their needs. Two of the most critical problems for these households are the reduction of their potential labor supply and/or the

migration of a person who has a strong influence (not only financially but also in behaviors and decisions) on the rest of the household members.

- From an economic perspective, governments should achieve the target 10.7.1. of the SDGs on reducing remittances' transaction costs to 3%. Furthermore, institutions should boost the uses of remittances as investments, especially for the economic sectors where the deprivation of the labor force caused by the migration process have affected the most. Another possible action, is creating policies to reduce the cost of migration and provide services for a facilitation of safe migration. Finally, it is necessary to involve diasporas in the decisions of their country of origin, for example by including them in the design and implementation of public policies.
- From a social approach, public policies should facilitate the adaptation of returnees, giving them opportunities to share their knowledge or contribute productively in society. In addition, it is necessary to have public policies that foster social cohesion for the proper functioning of the social contract.

However, all of these issues are currently under discussion, and there is no concrete answer on how to address them. Therefore, it is necessary to promote researches that applies to the context of each country or region.

Moreover, it is important to highlight that a strong dialogue between the main institutions addressing both topics (migration and food security) is necessary to find consensual solutions. A strategic agenda should consider the three described channels that guide the studies of the impacts of migration on food security (changes in the composition of the household, variation in the economic situation of households and influence on social aspects of the households).

In addition, further research on this nexus and its determinant remains necessary. This research been the first one of its kind for LAC just gives the firsts steps to build the much more complex dynamics and interactions behind the nexus.



## Bibliography:

- Acosta, P. A., Lartey, E. K. , & Mandelman, F. S. (2009). *Remittances and the Dutch Disease* (No. 2007-8a; Working Paper). <https://www.econstor.eu/bitstream/10419/70606/1/572362153.pdf>
- Acosta, P., Fajnzylber, P., & Lopez, J. H. H. (2007). The Impact of Remittances on Poverty and Human Capital: Evidence from Latin American Household Surveys. *World Bank Policy Research Working Paper*. <https://doi.org/10.1016/j.worlddev.2007.02.016>
- Adams, R. H. (2011). Evaluating the economic impact of international remittances on developing countries using household surveys: A literature review. *Journal of Development Studies*, 47(6), 809–828. <https://doi.org/10.1080/00220388.2011.563299>
- Allen, M. P. (1997). The problem of multicollinearity. In *Understanding Regression Analysis* (pp. 176–180). Springer, Boston, MA. [https://doi.org/https://doi.org/10.1007/978-0-585-25657-3\\_37](https://doi.org/https://doi.org/10.1007/978-0-585-25657-3_37)
- Antón, J.-I. (2010). The Impact of Remittances on Nutritional Status of Children in Ecuador. *International Migration Review*, 44(2), 269–299. <https://doi.org/10.1111/j.1747-7379.2010.00806.x>
- Baum, C. F., Schaffer, M. E., & Stillman, S. (2002). *Instrumental variables and GMM: Estimation and testing* (No. 545; Working Paper).
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8)
- Castelli, F. (2018). Drivers of migration: why do people move? *Journal of Travel Medicine*, 25(1), 1–7. <https://doi.org/10.1093/jtm/tay040>
- Choithani, C. (2017). Understanding the linkages between migration and household food security in India. *Geographical Research*, 55(2), 192–205. <https://doi.org/10.1111/1745-5871.12223>
- Combes, J. L., & Ebeke, C. (2011). Remittances and Household Consumption Instability in Developing Countries. *World Development*, 39(7), 1076–1089. <https://doi.org/10.1016/j.worlddev.2010.10.006>
- Committee on World Food Security. (2012). *Coming to Terms with Terminology Food Security, Nutrition security, Food security and nutrition, food and nutrition security*. Thirty-Nine Section. <http://www.fao.org/3/MD776E/MD776E.pdf>
- Connor, P., & Krogstad, J. M. (2018, December 10). *Many worldwide oppose more migration – both into and out of their countries*. Pew Research Center. <https://www.pewresearch.org/fact-tank/2018/12/10/many-worldwide-oppose-more-migration-both-into-and-out-of-their->

countries/

Craven, L. K., & Gartaula, H. N. (2015). Conceptualising the Migration-Food Security Nexus: Lessons from Nepal and Vanuatu. *Australian Geographer*, 46(4), 455–471.

<https://doi.org/10.1080/00049182.2015.1058797>

Crush, J. (2013). Linking Food Security, Migration and Development. *International Migration*, 51(5), 61–75. <https://doi.org/10.1111/imig.12097>

Crush, J., & Caesar, M. (2017). Introduction: Cultivating the Migration-Food Security Nexus.

*International Migration*, 55(4), 10–17. <https://doi.org/10.1111/imig.12360>

Crush, J. S., & Caesar, M. S. (2018). Food remittances and food security: a review. *Migration and Development*, 7(2), 180–200. <https://doi.org/10.1080/21632324.2017.1410977>

<https://doi.org/10.1080/21632324.2017.1410977>

Davis, J., & Brazil, N. (2016). *Migration, Remittances and Nutrition Outcomes of Left-Behind Children: A*

*National-Level Quantitative Assessment of Guatemala*. <https://doi.org/10.1371/journal.pone.0152089>

Desiderio, R. (2020). *The Impact of International Migration on Fertility: An Empirical Study* (No. 36;

KNOMAD Paper). [https://www.knomad.org/sites/default/files/2020-02/KNOMAD\\_Paper\\_MigrationFertilityPaper\\_R Desiderio.pdf](https://www.knomad.org/sites/default/files/2020-02/KNOMAD_Paper_MigrationFertilityPaper_R%20Desiderio.pdf)

Ebadi, N., Ahmadi, D., Sirkeci, I., & Melgar-Quinonez, H. (2018). The Impact of Remittances on Food Security Status in the Global South. *Remittances Review*, 3(2), 135–150.

FAO. (1998). *Rural women and food security: Current situation and perspectives*.

<http://www.fao.org/3/W8376E/W8376E00.htm>

Food and Agriculture Organisation (FAO). (1996). World food summit plan of action. In *FAO*.

<https://doi.org/10.2307/2137827>

Food and Agriculture Organisation (FAO). (2014). *The State of Food and Agriculture: Innovation in family farming*.

Food and Agriculture Organisation (FAO). (2019). *Suite of Food Security Indicators*.

<http://www.fao.org/faostat/en/#data/FS>

Food and Agriculture Organization of the UN (FAO); World Food Programme (WFP); World Health Organization (WHO) and UN Children’s Fund (UNICEF). (2019). *Panorama of Food and Nutritional Security for Latin America and the Caribbean*.

[http://www.fao.org/fileadmin/user\\_upload/rlc/docs/panorama2019/Panorama2019.pdf](http://www.fao.org/fileadmin/user_upload/rlc/docs/panorama2019/Panorama2019.pdf)

- George, D., & Mallery, P. (2010). SPSS for Windows Step by Step: Answers to Selected Exercises, 17.0 update. In *A Simple Guide and Reference* (10th ed.). Pearson.
- Global Knowledge Partnership on Migration and Development (KNOMAD). (2019). *Remittances data: Remittances inflows*. <https://www.knomad.org/data/remittances>
- Global Migration Data Portal. (2020a). *GCM Development process*. IOM Global Migration Data Analysis Centre (GMDAC). <https://migrationdataportal.org/themes/global-compact-migration>
- Global Migration Data Portal. (2020b). *Migration data for the Sustainable Development Goals (SDGs)*. IOM Global Migration Data Analysis Centre (GMDAC). <https://migrationdataportal.org/sdgs?node=0>
- Global Migration Data Portal. (2020c). *Remittances*. IOM Global Migration Data Analysis Centre (GMDAC). <https://migrationdataportal.com/themes/remittances>
- International Organization for Migration (IOM). (2019a). *International Migration Law: Glossary on Migration N° 34*. [https://publications.iom.int/system/files/pdf/iml\\_34\\_glossary.pdf](https://publications.iom.int/system/files/pdf/iml_34_glossary.pdf)
- International Organization for Migration (IOM). (2019b). *World Migration Report 2020*. UN. <https://doi.org/10.18356/b1710e30-en>
- Labra, R., & Torrecillas, C. (2014). *Guía CERO para datos de panel. Un enfoque práctico* (2014/16; UAM-Accenture Working Papers).
- Mabrouk, F., & Mekni, M. M. (2018). Remittances and Food Security in African Countries. *African Development Review*, 30(3), 252–263. <https://doi.org/10.1111/1467-8268.12334>
- Madley-Dowd, P., Hughes, R., Tilling, K., & Heron, J. (2019). The proportion of missing data should not be used to guide decisions on multiple imputation. *Journal of Clinical Epidemiology*, 110, 63–73. <https://doi.org/10.1016/j.jclinepi.2019.02.016>
- Muyanga, M., & Jayne, T. S. (2014). Effects of rising rural population density on smallholder agriculture in Kenya. *Food Policy*. <https://doi.org/10.1016/j.foodpol.2014.03.001>
- Ogunniyi, A. I., Mavrotas, G., Olagunju, K. O., Fadare, O., & Adedoyin, R. (2020). Governance quality, remittances and their implications for food and nutrition security in Sub-Saharan Africa. *World Development*, 127(January). <https://doi.org/https://doi.org/10.1016/j.worlddev.2019.104752>
- Pesaran, M. H., & Zhao, Z. (1999). Bias reduction in estimating long-run relationships from dynamic heterogeneous panels. In C. Hsiao K. Lahiri L-F Lee and Pesaran M.H. (Eds.) (Ed.), *Analysis of Panels and Limited Dependent Variable Models*. Cambridge University Press, Cambridge.

<https://doi.org/10.1017/cbo9780511493140.014>

- Plaza, S., Ratha, D., De, S., Kim, E. J., Seshan, G., & Yameogo, N. D. (2019a). *Migration and Remittances: Recent Developments and Outlook* (No. 31; Migration and Development Brief).  
<https://www.knomad.org/sites/default/files/2019-04/Migrationanddevelopmentbrief31.pdf>
- Plaza, S., Ratha, D., De, S., Kim, E. J., Seshan, G., & Yameogo, N. D. (2019b, October 16). *Data release: Remittances to low- and middle-income countries on track to reach \$551 billion in 2019 and \$597 billion by 2021*. World Bank Blogs People Move. <https://blogs.worldbank.org/peoplemove/data-release-remittances-low-and-middle-income-countries-track-reach-551-billion-2019>
- Ponsot, F., Terry, D. F., Vásquez, B., & De Vasconcelos, P. (2017). *Sending Money Home: Contributing to the SDGs, One Family at a Time*.  
<https://www.ifad.org/documents/38714170/39135645/Sending+Money+Home+-+Contributing+to+the+SDGs%2C+one+family+at+a+time.pdf/c207b5f1-9fef-4877-9315-75463fccfaa7>
- Ratner, B. (2009). The correlation coefficient: Its values range between 1/1, or do they. *Journal of Targeting, Measurement and Analysis for Marketing*. <https://doi.org/10.1057/jt.2009.5>
- Rigaud, K. K., Sherbinin, A. de, Jones, B., Bergmann, J., Clement, V., Ober, K., Schewe, J., Adamo, S., McCusker, B., Heuser, S., Midgley, A., Kanta, Sherbinin, A. de, Jones, B., Bergmann, J., Clement, V., Ober, K., Schewe, J., Adamo, S., ... Midgley, A. (2018). Groundswell - Preparing for internal climate migration. In *World Bank*. <https://doi.org/doi.org/10.7916/D8Z33FNS>
- Romano, D., & Traverso, S. (2017). *Disentangling the Effect of International Migration on Household Food and Nutrition Security and Nutrition Security of Sending Households* (12/2017; Working Paper).  
[https://www.disei.unifi.it/upload/sub/pubblicazioni/repec/pdf/wp12\\_2017.pdf](https://www.disei.unifi.it/upload/sub/pubblicazioni/repec/pdf/wp12_2017.pdf)
- Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, 9(1), 86–136.
- Rosser, E. (2011). Children's Consumption of Migration Remittances and Food Security. *Border-Lines*, 5, 181–207.
- Sassi, M. (2018). Understanding Food Insecurity: key features, indicators and response design. In *Understanding Food Insecurity*. Springer Nature. <https://doi.org/10.1007/978-3-319-70362-6>
- Smith, M. D., & Birgit, M. (2019, June 3). *Who Are the World's Food Insecure? Identifying the Risk Factors of Food Insecurity Around the World*. United States Department of Agriculture; United States Department of Agriculture. <https://www.ers.usda.gov/amber-waves/2019/june/who-are-the->

world-s-food-insecure-identifying-the-risk-factors-of-food-insecurity-around-the-world/

- Smith, M. D., Kassa, W., & Winters, P. (2017). Assessing food insecurity in Latin America and the Caribbean using FAO's Food Insecurity Experience Scale. *Food Policy*, 71, 48–61.  
<https://doi.org/10.1016/j.foodpol.2017.07.005>
- Sulemana, I., Bugri Anarfo, E., & Quartey, P. (2018). International remittances and household food security in Sub-Saharan Africa. *Migration and Development*.  
<https://doi.org/10.1080/21632324.2018.1560926>
- Thow, A. M., Fanzo, J., & Negin, J. (2016). A Systematic Review of the Effect of Remittances on Diet and Nutrition. *Food and Nutrition Bulletin*, 37(1), 42–64.  
<https://doi.org/10.1177/0379572116631651>
- United Nations (UN). (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.  
[https://sustainabledevelopment.un.org/content/documents/21252030 Agenda for Sustainable Development web.pdf](https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf)
- United Nations (UN) General Assembly. (1948). Universal Declaration of Human Rights. *United Nations Declaration of Human Rights*, 217 [III]. <https://www.un.org/en/universal-declaration-human-rights/>
- United Nations (UN) Headquarters. (2017). *Addressing drivers of migration, including the adverse effects of climate change, natural disasters and human-made crises, through protection and assistance, sustainable development and poverty eradication, conflict prevention and resolution*.  
[https://refugeesmigrants.un.org/sites/default/files/ts2\\_cofacilitators\\_summary.pdf](https://refugeesmigrants.un.org/sites/default/files/ts2_cofacilitators_summary.pdf)
- United Nations Department of Economic and Social Affairs (UNDESA). (2019a). *International Migrant Stock 2019*. United Nations Database, POP/DB/MIG/Stock/Rev.2019.
- United Nations Department of Economic and Social Affairs (UNDESA). (2019b). International migrants numbered 272 million in 2019, continuing an upward trend in all major world regions. In *Population Facts* (2019/4).  
[https://www.un.org/en/development/desa/population/migration/publications/populationfacts/docs/MigrationStock2019\\_PopFacts\\_2019-04.pdf](https://www.un.org/en/development/desa/population/migration/publications/populationfacts/docs/MigrationStock2019_PopFacts_2019-04.pdf)
- Vilhelmson, B., & Thulin, E. (2013). Does the Internet encourage people to move? Investigating Swedish young adults' internal migration experiences and plans. *Geoforum*, 47, 209–216.  
<https://doi.org/10.1016/j.geoforum.2013.01.012>
- World Bank. (2019). *Leveraging Economic Migration for Development: A Briefing for the World Bank Board*.

<http://documents.worldbank.org/curated/en/167041564497155991/pdf/Leveraging-Economic-Migration-for-Development-A-Briefing-for-the-World-Bank-Board.pdf>

World Bank. (2020). *World Development Indicators*. <https://databank.worldbank.org/source/world-development-indicators#>

World Food Program (WFP). (2017). *At the Root of Exodus: Food security, conflict and international migration*. [https://docs.wfp.org/api/documents/WFP-0000015358/download/?\\_ga=2.78668183.2024316209.1517487113-1000860428.1517487113](https://docs.wfp.org/api/documents/WFP-0000015358/download/?_ga=2.78668183.2024316209.1517487113-1000860428.1517487113)

Yobero, C. (2016, June 6). *Methods for Detecting and Resolving Heteroskedasticity*. [https://rstudio-pubs-static.s3.amazonaws.com/187387\\_3ca34c107405427db0e0f01252b3fbdb.html](https://rstudio-pubs-static.s3.amazonaws.com/187387_3ca34c107405427db0e0f01252b3fbdb.html)

Zeza, A., Carletto, C., Davis, B., & Winters, P. (2011). Assessing the impact of migration on food and nutrition security. *Food Policy*, 36(1), 1–6. <https://doi.org/10.1016/j.foodpol.2010.11.005>

## Appendix

Table A1: Description of data.

Variables	Mean	Median	Std. Dev.	Skewness	Ex. kurtosis	C.V	Nonmissing obs.	Minimum	Maximum
Availability	289.05	218.50	217.89	1.68	2.85	0.75	204.00	28.00	1176.00
Access	2.16	2.21	0.76	0.14	-0.20	0.35	168.00	0.69	4.05
Utilization	31.76	30.20	8.48	1.44	2.89	0.27	198.00	18.20	62.60
Stability	2.27	2.17	0.84	0.45	0.00	0.37	204.00	0.51	4.56
Remittances	5.27	2.60	6.07	1.57	1.78	1.15	184.00	0.01	29.04
Internet	29.47	27.02	20.99	0.57	-0.65	0.71	203.00	0.49	81.00
GDP capita growth	1.85	1.90	2.59	-0.28	1.18	1.40	203.00	-8.57	8.99
Investment	20.68	20.39	5.82	0.71	2.22	0.28	156.00	7.77	42.31
Unemployment	8.30	7.38	4.78	0.86	0.14	0.58	180.00	1.76	22.14
Female	50.57	50.40	0.88	0.63	-0.20	0.02	192.00	49.04	53.03
Rural	0.17	0.40	1.28	-0.73	0.74	7.45	204.00	-3.59	3.25
Food exports	36.58	31.77	23.88	0.43	-0.72	0.65	184.00	0.02	89.11
Food imports	13.69	13.63	5.77	0.32	-0.39	0.42	185.00	2.40	31.82
Rainfall	1817.50	1772.50	599.98	0.23	-0.20	0.33	204.00	591.00	3240.00
Political stability	0.05	0.05	0.72	-0.42	-0.38	15.78	203.00	-2.23	1.27

Notes: The maximum number for non-missing observations for all the variables is 204.

Source: Author's elaboration using WDI from the World Bank and Suite of Food Security Indicators from FAO.

**Table A2: Correlation matrix.**

	Availability	Access	Utilization	Stability	Remittances	Internet	GDP capita growth	Investment	Unemployment	Female	Rural	Food exports	Food imports	Rainfall	Political stability
Availability	1	-0.51***	-0.45***	0.78***	-0.44***	0.15	0.18	-0.26**	0.16	0.07	-0.31***	0.34***	-0.53***	-0.33***	0.24**
Access		1	0.61***	-0.33***	0.39***	-0.55***	0.17*	0.11	-0.41***	-0.40***	0.26**	0.02	0.24**	0.22*	-0.43***
Utilization			1	-0.34***	0.16	-0.27**	0.11	0.02	-0.28**	-0.28**	0.26**	-0.12	0.24**	0.14	-0.36***
Stability				1	-0.29***	0.11	0.07	-0.13	0.17	-0.09	-0.12	0.44***	-0.25**	-0.26**	0.23**
Remittances					1	-0.31***	-0.07	0.05	-0.07	0.17*	0.03	0.10	0.51***	0.12	-0.08
Internet GDP capita growth						1	-0.05	0.05	0.04	0.18*	-0.17	-0.03	-0.05	-0.09	0.37***
Investment							1	0.34***	-0.23**	-0.17	-0.10	0.01	-0.24**	0.18*	-0.07
Unemployment								1	-0.09	-0.39***	0.19*	-0.09	0.02	0.37***	0.02
Female									1	0.11	-0.19*	0.10	0.28**	0.06	0.18*
Rural										1	-0.31***	-0.13	0.01	-0.21*	0.23**
Food exports											1	0.16	0.12	0.08	-0.30***
Food imports												1	0.25**	0.01	0.31***
Rainfall													1	0.15	0.18*
Political stability														1	-0.20*

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Source: Author's elaboration.



**Table A3: The effect of remittances on food security on the long run (one-step system GMM)**

	Availability		Access		Utilization		Stability	
	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Remittances	<b>-53.27***</b>	<b>14.257</b>	0.119	0.088	<b>1.321***</b>	<b>0.513</b>	<b>-0.243**</b>	<b>0.111</b>
Internet	<b>-14.176**</b>	<b>5.981</b>	-	-	<b>0.242*</b>	<b>0.137</b>	-0.064	0.044
Female	<b>111.201**</b>	<b>55.221</b>	<b>-0.41**</b>	<b>0.2</b>	-3.331	2.187	-	-
Rural	<b>-85.132***</b>	<b>20.387</b>	-	-	-	-	-	-

Notes: The long-run coefficient on an x variable, measures the total impact of a sustained unit change in x on the dependent variable. Only the regressors that are significant on the short run are presented. \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

Source: Author's elaboration.

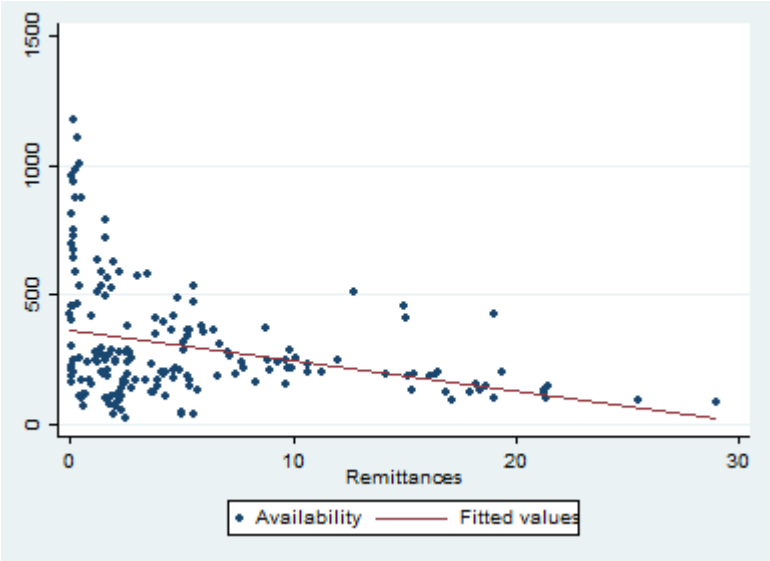
**Table A4: The effect of remittances on food security (Pooled OLS and LSDV)**

	Availability		Access		Utilization		Stability	
	Pooled OLS	LSDV	Pooled OLS	LSDV	Pooled OLS	LSDV	Pooled OLS	LSDV
Lagged dep. Variable(t-1)	0.95 (0.04)***	0.42 (0.18)**	0.86 (0.05)***	0.47 (0.08)***	0.93 (0.01)***	1.05 (0.06)***	0.87 (0.05)***	0.41 (0.10)***
Remittances	-3.18 (1.61)*	-5.07 (-7.71)	0.01 (0.00)**	0.03 (0.02)*	0.05 (0.02)**	0.10 (-0.10)	-0.02 (0.01)**	-0.05 (-0.04)
Internet	-2.37 (0.48)***	-2.19 (0.72)***	0.00 (0.00)*	-0.01 (0.00)***	0.00 (-0.01)	0.02 (0.01)**	0.00 (0.00)	-0.01 (0.00)*
GDP capita growth	7.90 (3.95)**	5.94 (-4.92)	-0.01 (-0.01)	-0.01 (-0.01)	-0.06 (-0.06)	-0.04 (-0.06)	0.00 (-0.02)	-0.02 (-0.02)
Investment	0.26 (-1.61)	5.04 (-3.97)	-0.01 (0.00)	-0.02 (0.01)**	-0.01 (-0.03)	0.01 (-0.05)	-0.01 (-0.01)	0.03 (0.02)*
Unemployment	1.18 (-1.86)	-9.65 (5.48)*	0.00 (-0.01)	0.02 (-0.01)	-0.04 (-0.03)	-0.01 (-0.07)	0.01 (-0.01)	-0.03 (-0.03)
Female	10.68 (-9.38)	-28.68 (-71.82)	-0.04 (-0.03)	0.11 (-0.17)	0.14 (-0.15)	0.36 (-0.92)	-0.04 (-0.05)	-0.6 (0.35)*
Rural	-7.00 (-6.00)	-42.14 (-27.66)	0.01 (-0.02)	-0.02 (-0.06)	-0.08 (-0.09)	0.45 (-0.33)	-0.03 (-0.03)	-0.38 (0.13)***
Food exports	-0.18 (-0.42)	0.77 (-0.91)	0.00 (0.00)	0.00 (0.00)	0.00 (-0.01)	0.02 (-0.01)	0.00 (0.00)	0.01 (0.00)
Rainfall	-0.01 (-0.01)	-	0.00 (0.00)	-	0.00 (0.00)	-	0.00 (0.00)	-
Political stability	7.13 (-13.62)	-20.50 (-39.57)	0.01 (-0.04)	0.03 (-0.09)	0.29 (-0.21)	-0.54 (-0.53)	-0.09 (-0.07)	0.05 (-0.02)
Constant	-440.55 (-486.00)	1667.73 (-3615.6)	2.26 (-1.56)	-4.16 (-8.65)	-5.11 (-8.13)	-21.72 (-45.91)	2.52 (-2.55)	31.29 (17.42)*
R <sup>2</sup>	0.93	0.27	0.93	0.72	0.98	0.87	0.84	0.38
Observations	111	111	110	110	111	111	111	111

Notes: The dependent and the lag dependent variable for Access and Stability are in natural logarithm form. \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ . Robust standard errors in parentheses.

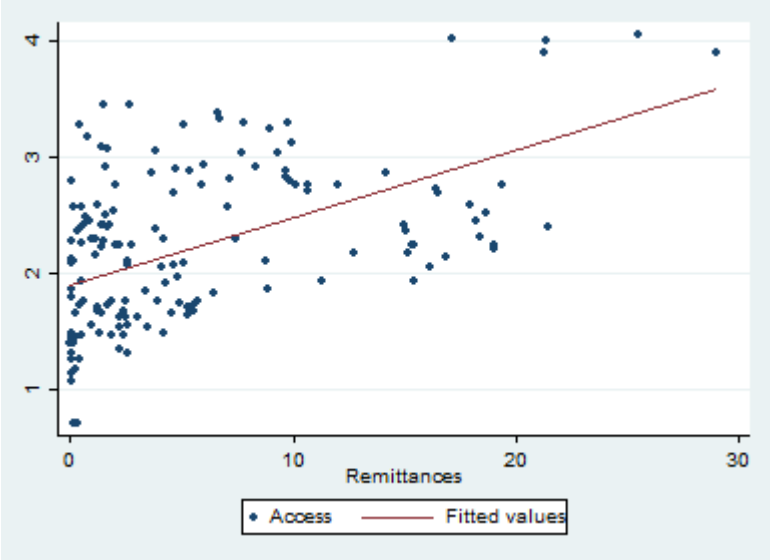
Source: Author's elaboration.

**Figure A1: Bivariate relationship: Availability and remittances in LAC, 2000-2017**



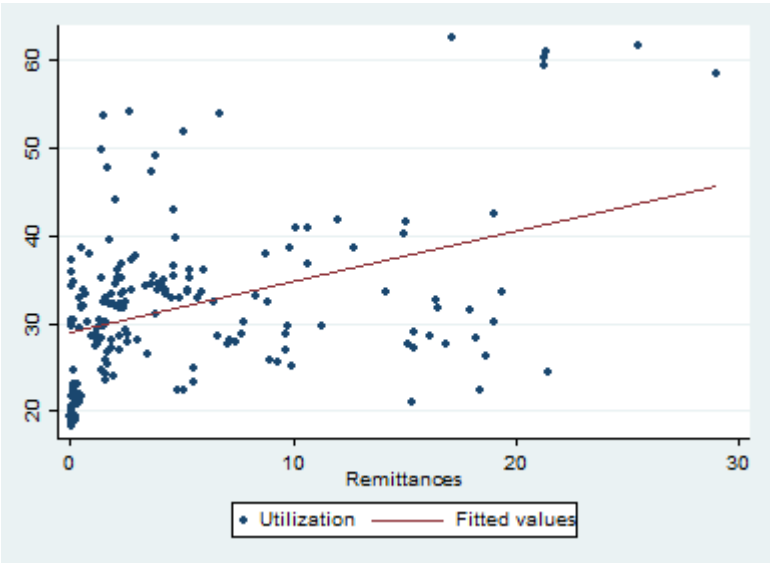
Source: Author's elaboration.

**Figure A2: Bivariate relationship: Access and remittances in LAC, 2000-2017**



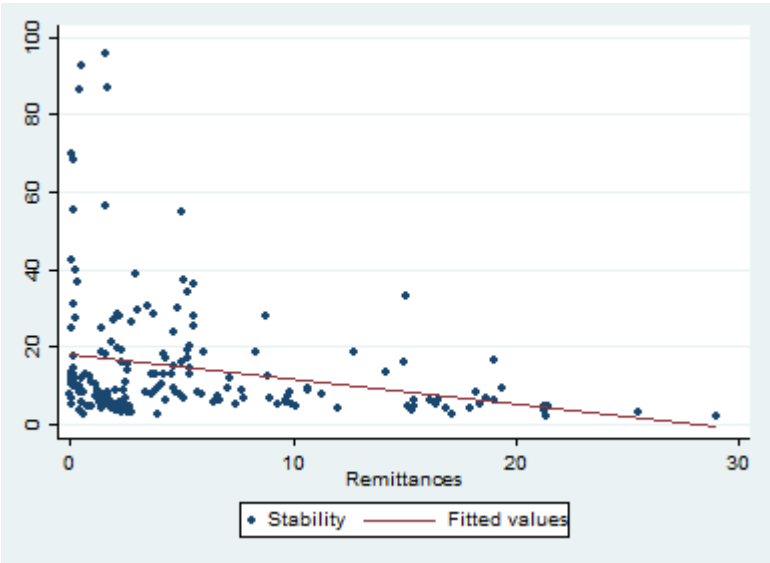
Source: Author's elaboration.

Figure A3: Bivariate relationship: Utilization and remittances in LAC, 2000-2017



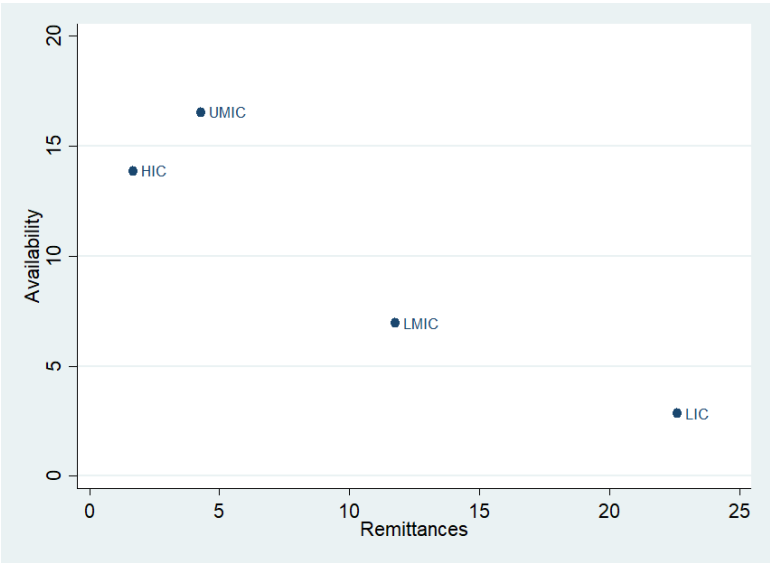
Source: Author's elaboration.

Figure A4: Bivariate relationship: Stability and remittances in LAC, 2000-2017



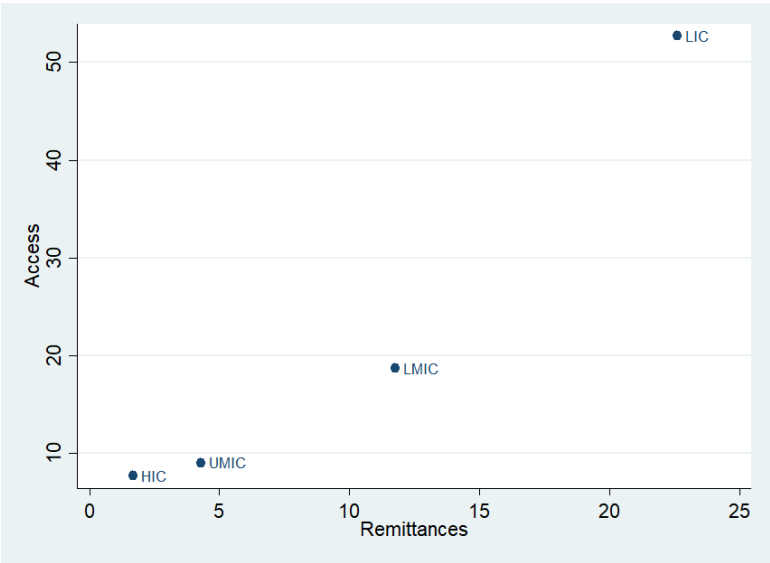
Source: Author's elaboration.

**Figure A5: Availability and remittances in LAC by income groups, 2000-2017**



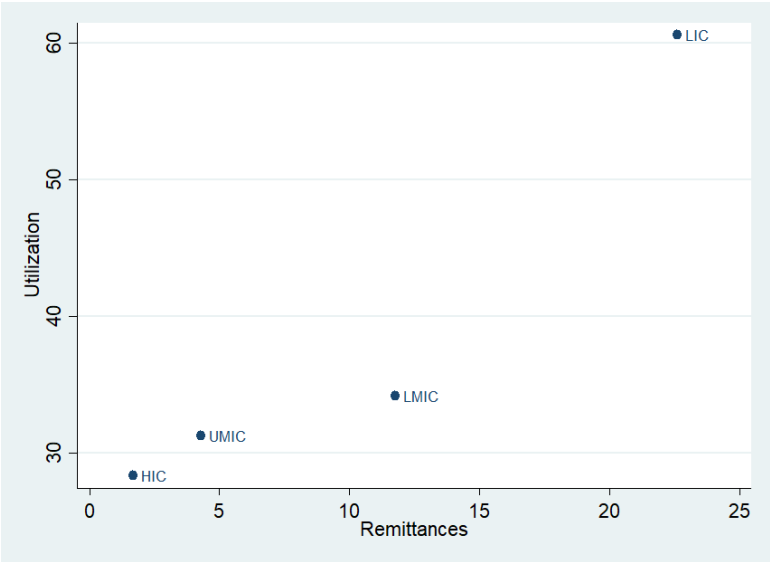
Notes: Low income countries “LIC”, Lower Middle income countries “LMIC”, Upper middle income countries “UMIC” and High income countries “HIC”.  
 Source: Author’s elaboration.

**Figure A6: Access and remittances in LAC by income groups, 2000-2017**



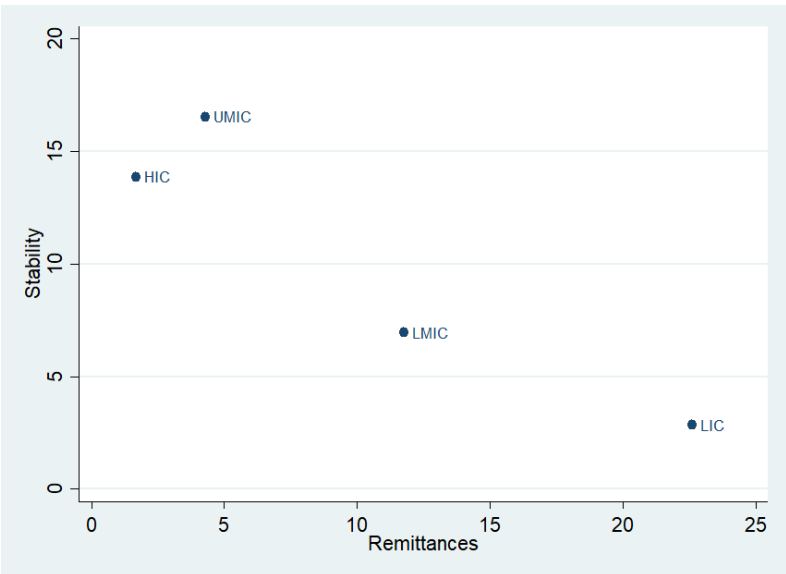
Notes: Low income countries “LIC”, Lower Middle income countries “LMIC”, Upper middle income countries “UMIC” and High income countries “HIC”.  
 Source: Author’s elaboration.

**Figure A7: Utilization and remittances in LAC by income groups, 2000-2017**



Notes: Low income countries “LIC”, Lower Middle income countries “LMIC”, Upper middle income countries “UMIC” and High income countries “HIC”.  
Source: Author’s elaboration.

**Figure A8: Stability and remittances in LAC by income groups, 2000-2017**



Notes: Low income countries “LIC”, Lower Middle income countries “LMIC”, Upper middle income countries “UMIC” and High income countries “HIC”.  
Source: Author’s elaboration.