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Abstract

The study analyses unfinished migration in Bolivia, understood as the phenomenon by which some families maintain double residence between the countryside and the city. From the analysis of household electricity consumption (as a proxy variable of their socioeconomic level), different livelihood strategies are evaluated, as well as their implications for poverty. The use of big data (more than 100 million observations) and the analytical methodology are certainly novel and propose alternative possibilities for research in applied economics.

Keywords: Bolivia, migration, poverty, electrical consumption.

JEL classification codes: O15, O18.

1. Introduction

Unfinished migration is a fairly well-studied phenomenon in Bolivia, at least from anthropological and sociological approaches (usually called seasonal migration). However, it has not been clearly established whether it is a successful economic strategy, which should be celebrated and promoted, or if it is rather a poverty trap, caused by some kind of restriction on full mobility. The very nature of the phenomenon, with seasonal migrants maintaining multiple residences in very different municipalities, makes it difficult to measure the poverty of families, since their access to services (health, education, water, etc.) and their income levels change depending on the municipality they live in at a given time of the year. It is unclear how unfinished migration affects traditional measures of poverty and inequality, particularly their accuracy. Since the level of residential electricity consumption is highly correlated with household income levels, the analysis of electricity consumption patterns of families can not only be a powerful tool to understand patterns of poverty, but also the phenomenon of unfinished migration in Bolivia. The main hypothesis of this research is that the unfinished migration of families -between the countryside and the city- leads to higher levels of poverty than full migration and, consequently, it is more like a poverty trap phenomenon than a successful economic strategy worthy of replication.

The remainder of the paper is organized as follows. Section 2 reviews the relationship between migration and poverty in Bolivia, seeking to understand the dynamics of the population and the main theoretical approaches that have linked migration with development, paying special attention to unfinished migration. Section 3 presents a comprehensive review of the relationships between economic growth and electricity consumption. Likewise, the possible relationship existing in Bolivia between poverty and electricity consumption is evaluated; both fundamental exercises to support the logical and argumentative structure of the entire study. In Section 4, the exhausting work carried out to consolidate the electricity consumption database is briefly explained, along with its particularities and scope. Section 5 analyzes the data, following various methodological approaches, and presents some of the most important results. Finally, Section 6 presents the conclusions and the implications of the study, and proposes potential new lines of research.

2. Migration and poverty in Bolivia

Bolivia has a population of about 12 million people (INE, 2021), distributed in three geographic regions clearly differentiated by their altitude and their corresponding ecological levels (highlands, valleys, and plains). Historically, the Bolivian population was concentrated in the highlands (located in the west of the country, with important plateaus at 4000 meters above sea level (m.a.s.l) and around the Andes Mountain range) and in the inter-Andean valleys (around 2000 m.a.s.l.), which are more fertile and temperate. The Amazonian and eastern lowlands (500 m.a.s.l.), were only sparsely populated due to difficult access and health challenges.

However, from the middle of the 20th century, there was an important migratory process towards the lowlands in search of more fertile lands and better economic opportunities, a process that was made possible thanks to important investments in the road network and better living conditions (health, education, work, etc.). This migratory dynamic has transformed the population distribution of Bolivia which, according to the latest census (INE, 2012), has a much more balanced distribution among the regions (40.2% highlands, 28.1% valleys and 31.7% lowlands)[1], although with a clear growth trend in favor of the eastern lands (Soliz, 2017), which present annual population growth rates significantly higher than the other regions (1.41% highlands, 1.54% valleys and 2.37% lowlands) (UDAPE, 2018). This migratory process from west to east, that is, from the Andean highlands to the lowlands of the Amazonian plains, does not seem to have ended and is undoubtedly the most important population dynamic in the country.

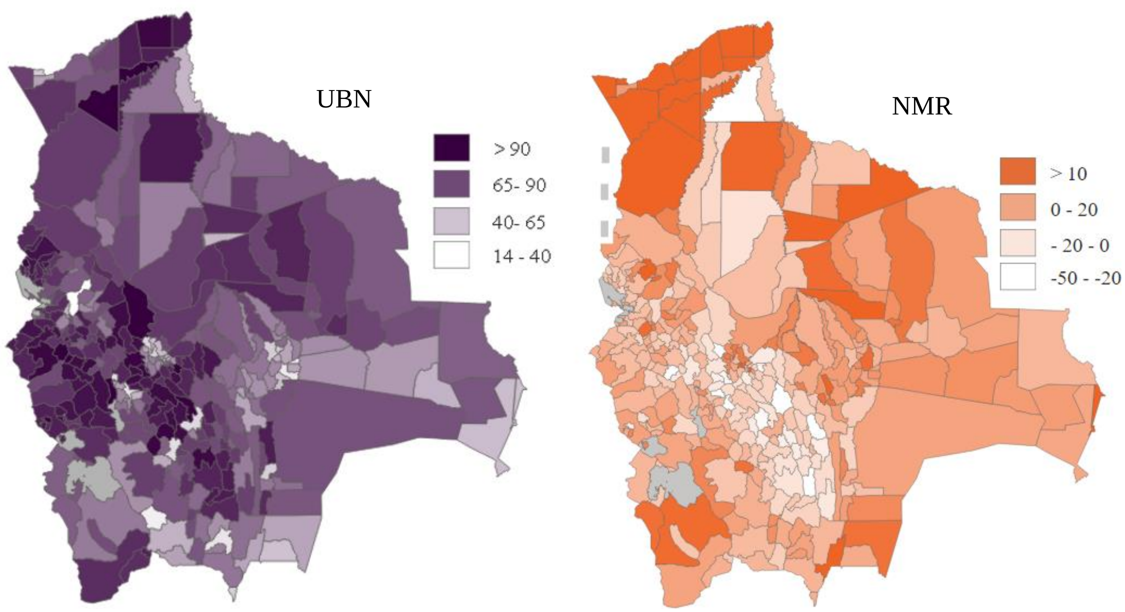

Fig. 1 – Unsatisfied Basic Needs (UBN) (left) and Net Migration Rate (NMR) (right), by municipality (2012)
Source: Authors' elaboration based on data from INE (2012), UDAPE (2018).

On the other hand, there is a parallel and older internal migration process, which flows from the countryside to the cities. This process that can be evidenced in the positive migratory balance (2001-2012) of certain growing cities (Santa Cruz de la Sierra, El Alto, Cochabamba, Cobija, Tarija) in comparison with the negative results of a large part of smaller rural municipalities (54% of the municipalities have a negative Net Migration Rate (NMR)), mainly of those located in the western part of the country (93% in highlands and valleys) (UDAPE, 2018). In short, 67.5% of the Bolivian population lives in urban areas (INE,

[1] According to forward estimates on the population of Bolivia (INE, 2021), in 2020 the population was distributed 37.7 % in highlands, 27.9 % valleys and 34.4 % lowlands; reaffirming the trend described above.

2012), with a predominance of certain cities in the so-called central axis (La Paz, El Alto, Cochabamba and Santa Cruz), but with a growing importance of intermediate cities and metropolitan areas (PNUD, 2016).[2]

This migratory dynamic is mainly explained by the search for better living conditions for families, both at the level of access to services (basic services, health, education or others) and due to the search for sources of work. It is very clear that the main cities have conditions of well-being above that of the rest of the municipalities (mainly rural). The study by Andersen *et al.* (2020), shows -from the exhaustive measurement of the Sustainable Development Goals (SDGs) at the municipal level- that in Bolivia the capital cities (and their metropolitan areas) have the best indicators and performances; although there are some exceptional municipalities with positive results explained by other factors (hydrocarbon rents, international commerce, or tourism).

In any case, it is clear that understanding migration dynamics is also understanding poverty from a geographical perspective. People migrate from the poorest municipalities (with higher Unsatisfied Basic Needs (UBN)) to those that offer better life opportunities (with positive Net Migration rates (NMR)) (see Fig. 1). This can be verified by observing the municipal level correlation (Spearman) between the variable Net Migration Rate (NMR) and UBN, which at -0.39 is statistically significant (see Fig. 2).

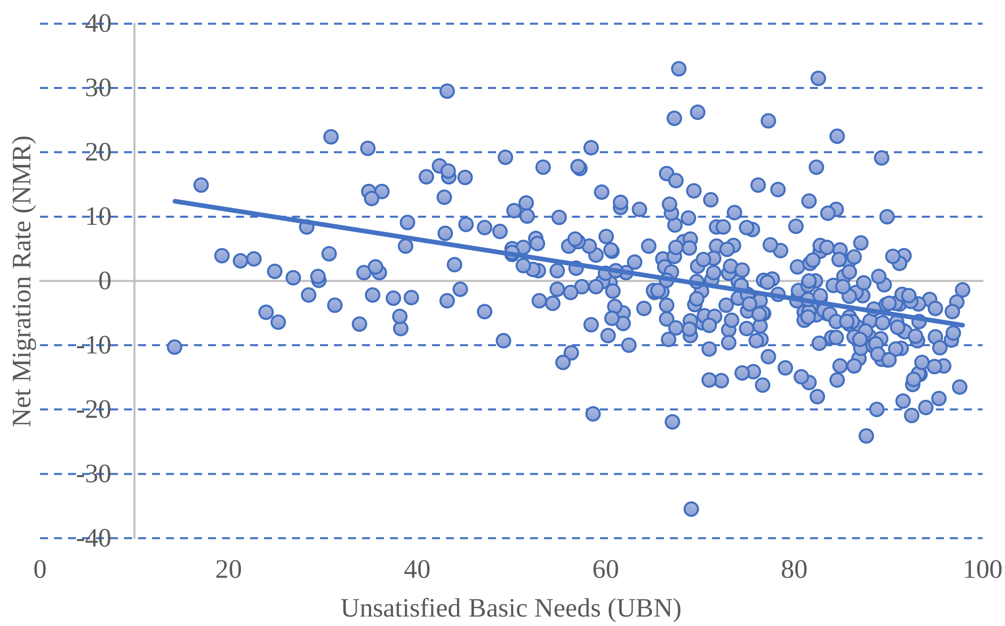

Fig. 2 – Relation between Net Migration Rate (NMR) and Unsatisfied Basic Needs (UBN), by municipalities (2012).
Source: Authors' elaboration based on data from INE (2012), UDAPE (2018).

[2] A third migratory phenomenon in Bolivia, no less important, is international migration. An important part of the Bolivian population has migrated to countries such as Argentina, USA, Spain, Brazil, to name the most important. In this regard, the studies of Yarnall and Price (2010), Román (2012), Jones (2013) can be consulted. International migration will not be addressed directly in this study.

Andersen (2002) exposes the advantages of rural-urban migration, in contrast to traditional views that see it as negative. The study shows that the benefits of this process (access to basic services, education, health, etc.) are much greater than the potential problems associated with greater urbanization in Bolivia (crime, pollution, traffic congestion, urban overcrowding, etc.). These results are supported by the evident generation of economies of scale in cities and, therefore, suggest that migration from the countryside to the city should be understood as a good mechanism for reducing extreme poverty. However, there is some evidence to challenge this argument. Gray-Molina and Yañez (2009) show that the benefits of migration processes on poverty reduction (migration dividend) could be running out and that, consequently, their convenience should be rethought. The latter study also shows that certain personal characteristics are correlated with the propensity to migrate (among which education, age, language skills and gender stand out) and that, contrary to what is traditionally assumed, the poorest people are less likely to migrate (possibly explained by the high costs of internal migration). In any case, there seem to be certain structural elements that sustain the migratory processes. In this line, Balderrama *et al.* (2011) study the cases of definitive internal migrations, particularly between poor municipalities in the north of Potosí (highlands) towards growing municipalities in Santa Cruz (lowlands), observing that the erosion of the land -together with climate change- promotes a definitive migration process to the east of the country, in search of better land.

All these studies explain rural-urban and highland-lowland migrations quite well; however, they do not consider the phenomenon of incomplete (or seasonal) migration[3], which is manifested -among other aspects- by the existence of double residences (a house in the countryside and another in the city). In this regard, the study of Jiménez (2007) understands the temporary or unfinished migration, as a successful strategy to increase family income, because it allows a diversification of incomes (agricultural activities, occasional wage employment, commerce, etc.). In the same way, Mazurek (2008) shows the complexity of migratory processes and points out the existence of a phenomenon of double residences between cities and rural communities (case of El Alto-Altiplano, Santa Cruz de la Sierra-Chaco, Oruro/Potosí-mining centers). This phenomenon could be explained by proximity migratory processes, motivated -mainly- by the search for income, but also by the generation of migration "basins" defined by cultural proximity, where mobility (unfinished migration) becomes more frequent than definitive migration.

Likewise, Cielo and Antequera (2012) explore unfinished migration through the study of double residence (or multi-location) families. This can be a livelihood strategy for families that grants them important resources (maintenance of land and community rights in the countryside, at the same time that

[3] This type of temporary or unfinished migration is different from that pointed out by Dandler and Medeiros (1988), when they describe temporary migration (as a parenthesis in the life cycle of people) between Cochabamba (Bolivia) and Buenos Aires (Argentina). In this case, it is a migration of several years in which individuals accumulate certain capital working abroad to support their respective families, consolidating -in some way- their economic position (buying a car or some land, paying for education children or building a house) and eventually returning to their homeland.

they have access to services and markets in the city) but, it can also generate potential damages (exposure to precarious conditions in the city and the duty to assume responsibilities in rural communities). Moreover, Tassi and Canedo (2019) study the case of two highland rural communities and the way in which the economy and organizational structures of the countryside are superimposed on the city. Specifically, they explain the way in which its members articulate value chains through multi-activity (production, transport, marketing), as a strategy based on the constant movement between the countryside and the city (which can be understood as another form of unfinished migration). This phenomenon would imply -according to the authors- a revaluation of agrarian and rural life, in contrast to the idea of definitive migration as the process that would end with the abandonment of the lands, and the destructuring of the communal and peasant forms of organization. With similar results, Jiménez and Fernández (2020) study the phenomenon by understanding the diversification of income (in the specific case of peasant families producing quinoa in the highlands) as a strategy of occupational mobility between agricultural activities (rural) and potential work opportunities in the city. In this way, families would be able to offer their labor in the urban market (construction, commerce, services) and return, whenever necessary, to their peasant communities (maintaining their social identity and cultural networks).

In any case, whether the unfinished migration is a positive strategy or a phenomenon associated with poverty traps; it seems that it is not isolated from the two main Bolivian migration phenomena described above, that is, migration from highlands to lowlands; and from the countryside to the city. In this context, it is likely that the unfinished migration is related to the land rights regimes which exist in the country (which vary by region). The successive agrarian reforms that the country experienced throughout its history (see Klein, 2015; Platt, 2016; Dunkerley, 2017) have given rise to a mixed system in which collective property (indigenous communities), family farming (smallholdings) and the existence of large properties (modern and industrial) coexist; the first two predominant in the highlands and valleys, and the third in the lowlands (Flores, 2017).

3. Economic growth, poverty and electricity consumption

There are many studies that present evidence about the potential relationship between electricity consumption (or energy consumption) and economic growth (and, therefore, poverty). However, there is no clear consensus on the direction of causality between these two variables. Some studies show results in favor of the hypothesis that electricity consumption drives production (Shiu and Lam, 2004; Aslan, Apergis, and Yildirim, 2014; Dogan, 2015; Iyke, 2015; Karanfil and Li, 2015; Narayan, 2016; Baz *et al.*, 2019), understanding that electricity is an important factor of production, it promotes capital formation and that its scarcity represents a serious problem for economic growth.

Another group of studies (Wolde-Rufael, 2009; Stern and Enflo, 2013; Hwang and Yoo, 2014; Salahuddin and Alam, 2015; Kyophilavong, Shahbaz, Kim, and Jeong-Soo, 2017), on the contrary, show evidence that supports the idea that economic growth increases electricity consumption, both on the side of the increase in energy demand and on the investment side (understanding that the investment needed to increase the electricity supply is more abundant under conditions of rapid economic growth).

Finally, a third group of studies (Tang and Tan, 2013; Hamdi, Sbia, and Shahbaz, 2014; Rafindadi, 2016; Sarwar *et al.*, 2017; Mezghani and Haddad, 2017; Saad and Taleb, 2018; Boukhelkhal and Bengana, 2018; Lin and Wang, 2019; Zafar *et al.*, 2019), find solid evidence that the relationship is more of bidirectional causality (feedback). In other words, the two phenomena described above probably occur and that, consequently, economic growth translates into an increase in electricity consumption and that, the latter, drives production. In any case, it seems quite clear that there is a positive and very powerful correlation between both variables, which allows us to infer that the observation of one of them (electricity consumption) can give us important clues about the other (economic growth, wealth, poverty and inequality).

Much of the evidence presented regarding the strong correlation between electricity consumption and economic growth was constructed from time series (regions, cities or countries), while in this paper we will use microdata from millions of homes over a period of time. Inferences concerning wealth/poverty from household electricity consumption data are complicated by at least two factors. First, although the benefits of many electrical devices can be shared by several people (e.g. lights, TV, radio, refrigerator, etc.), electricity consumption is to some extent determined by the number of people in the household, meaning that a certain level of electricity consumption could potentially correspond either to a wealthy household with one member or to a poor household with many members. Second, electricity consumption can vary significantly depending on geographic location. For example, households in warm climate areas surely require more food refrigeration, without this directly meaning that their consumption corresponds to a higher level of income.

A simulation exercise was carried out[4], based on the technical analysis of household appliances, to determine the relative importance of variations in family size, geographical location, and socioeconomic level (see Tab. 1).

[4] To calculate the electricity demand associated with each type of household, the RAMP (Remote-Areas Multi-energy systems load Profiles) tool was used. This tool consists of an open-source bottom-up stochastic model that requires the definition of types of users and the electrical appliances used by them. This model considers the temperature variation for each region of the country, as this is an important factor when modelling specific appliance loads (see Lombardi *et al.* (2019) for further details on the model). For this paper, a group of appliances - also considered in the National Health Survey 2016 (INE, 2016)- were taken into account. First, each electrical appliance was modelled separately, considering different types of households, according to the family composition (single-person, small and big family) and the geographical zone (highlands, valleys and lowlands). The assumed standard month was May, in all cases. It is important to note that, to the group of appliances considered in the National Health Survey 2016, appliances such as air conditioners, water pumps and electric showers were added, depending on the region, assuming that households with modern appliances will also have the added appliances. Subsequently, the National Health Survey 2016 was used to obtain data on the percentage of households that own each electrical appliance in different cities of Bolivia. Once the monthly electricity consumption was calculated for each appliance, by type of household and geographic region, these percentages were used to obtain the monthly electricity consumption for average families for each major city and for each income level. The calculated values were compared with the distribution of observed data from the database (Andersen *et al.*, 2019). the results show that the calculated power consumption values are within the distribution of measured data. For more details see Sánchez-Solís *et al.* (2022).

Tab. 1 – Estimated electricity consumption by socioeconomic levels, geographic regions and the various family sizes, Bolivia (2016)

Cities and municipalities by region		*kWh/mounth* Single person	Small family (3 people)	Large family (6 people)
Highland (La Paz, Oruro & Potosí)				
Cities	La Paz	123.7	164.6	216.2
	Oruro	105.9	139.2	182.2
	Potosí	89.7	117.5	153.9
	El Alto	75.5	98.4	129.2
Other municipalities	Low poverty	62.2	81.1	106.1
	Medium poverty	43.2	56.0	73.5
	High poverty	18.4	23.2	31.4
Valleys (Chuquisaca, Cochabamba &Tarija)				
Cities	Cochabamba	116.9	156.0	203.8
	Tarija	111.6	149.1	195.7
	Sucre	111.7	147.7	193.6
Other municipalities	Low poverty	107.9	144.1	188.4
	Medium poverty	61.5	81.7	106.7
	High poverty	20.9	27.1	36.3
Lowlands (Santa Cruz, Beni & Pando)				
Cities	Santa Cruz	150.8	193.4	247.5
	Trinidad	132.8	171.3	219.8
	Cobija	134.1	170.4	217.5
Other municipalities	Low poverty	118.5	153.8	198.0
	Medium poverty	70.9	92.2	119.5
	High poverty	74.1	97.2	126.1

Source: Sánchez-Solís *et al.* (2022).

As expected, the number of appliances in a household depends on its income level (measured here by the poverty level of the municipality in the Demographic and Health Survey (INE, 2016)) and, therefore, its electricity consumption will be higher the higher its socioeconomic level. These variations are significant and easily observable, and they support our argument and methodology. On average, electricity consumption increases by around 113% when going from a very poor municipality to one with medium poverty; about 63% when going from a municipality with medium poverty to one with low poverty; and, finally, it increases another 84% when the main cities are reached, associated with the lowest levels of poverty (analyzing the case of small families).

There are also increases, as expected, when the size of families increases; however, these changes are much less important than those mentioned above. For example, the move from a one-person family to a small family (3 people) increases consumption by 31%, and the same is the case when moving from a small family to a large one (analyzing averages). In other words, the level of household income is much more relevant to determine its electricity consumption than the number of family members. Therefore, it is difficult to confuse a large and poor household with a rich household that is made up of a single individual, because the consumption of the former is systematically much lower than that of the latter.

This result allows us to have greater confidence in the correlation between the electricity consumption variable and the different levels of wealth (or poverty) of the households.

Finally, it is important to point out the differences in electricity consumption between the different geographical regions, which would be explained by the dissimilar climatic conditions and, therefore, the diverse needs for electricity consumption that exist between them. It is quite clear that in the lowlands more energy is used to cool spaces (air conditioning equipment) and preserve food (refrigerator). It does not seem that the opposite phenomenon is observed in the high areas with respect to heating. In any case, it is important that the results found regarding electricity consumption and its implications on poverty measurement can be controlled by the geographic region to which they correspond.

4. The data: Electricity consumption

The database comes from the records -properly anonymized- of electricity meters in Bolivia and is made up of more than 116 million observations of electricity consumption (systematized by Andersen *et al.*, 2019). The characteristics of the Bolivian electricity system, with an integrated system (92% of the connections) and many isolated -off grid- systems (8%) (see Hinestroza-Olascuaga *et al.*, 2021) led to a fragmented and non-homogenized database, which, however, was standardized and unified by Andersen *et al.* (2022). The resulting database provides information on electricity consumption of about 2.49 million households (residential category, 2016), properly assigned to the different municipalities of the country (327 out of 339), with a monthly frequency from 2012 to 2016.

The data base has a special relevance in function of the notable advance in the national electricity coverage (93.7% for 2020 according to official estimates (Bolivia, 2021). The problems of obtaining reliable data on socioeconomic issues in Bolivia make advances in the processing of large databases a very interesting alternative, both because of their scope, as well as their frequency and quality. Therefore, and as pointed out before, electricity consumption is a powerful proxy for the socioeconomic level of households.

5. Analysis and results

To understand the phenomenon of unfinished migration, it is first necessary to identify the households that experience it. That is, those who have not broken their link with the countryside, but live for some months in the city and some months in the countryside. We will call them seasonal migrants. In contrast, the households that reside all year in the same municipality are called non-migrants. Specifically, seasonal migrant households will be defined as those that have at least one observation of zero electricity consumption (ZEC) during the year, while non-migrant households have positive electricity consumption for all twelve months a year.

In addition, it is also important to identify the municipalities that experience this phenomenon of seasonal migration. This is possible by identifying the municipalities with a number of observations of zero electricity consumption (ZEC) (residences without inhabitants) that are systematically higher than the national average[5] (7.6%), probably expelling or receiving municipalities. In other words, municipalities that for some months per year (not all[6]) have houses that are abandoned because their families go to live in another municipality.

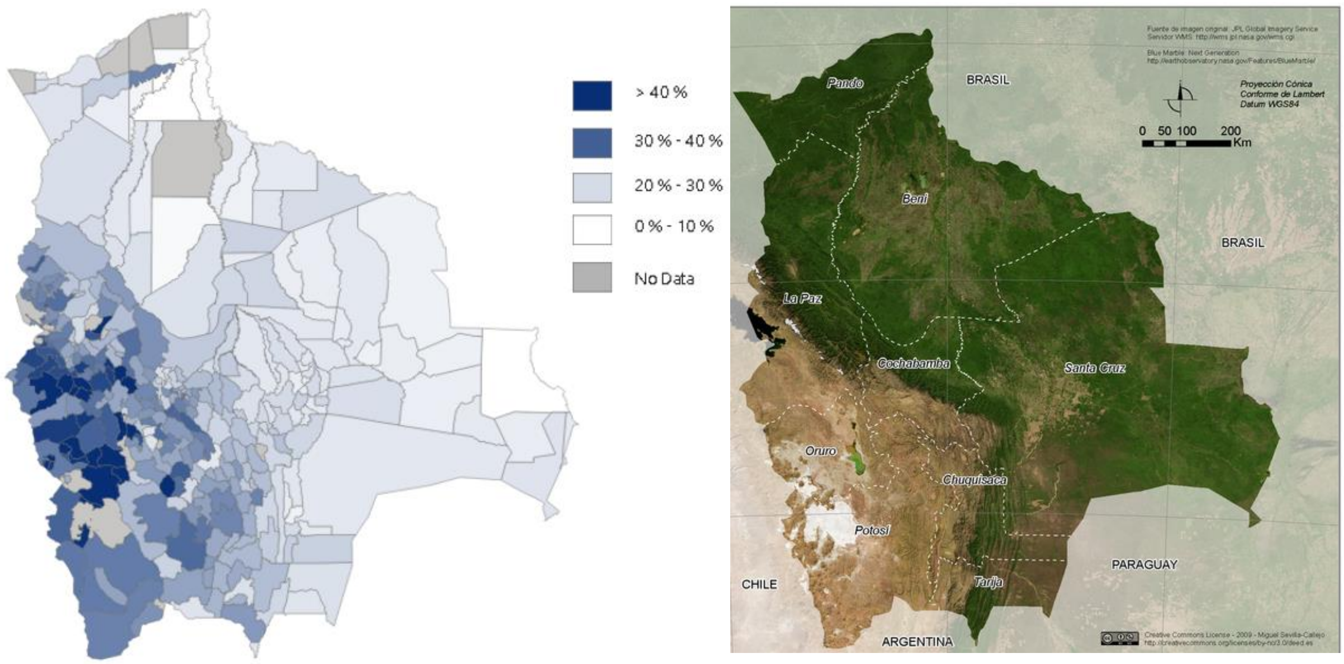

Fig. 3 – Proportion of residential electricity meters with zero electricity consumption, per municipality (2012-2016) (left) and Topographic map (right). Note: Municipalities designated as No data have no observations, or a number of observations so small that their analysis is impossible (less than 50 observations). Source: Authors' elaboration based on data from Andersen *et al.* (2019), and http://www.uam.es/cotapata .

Fig. 3 shows, clearly, that almost all the potential expelling or receiving municipalities are located in the west of the country. Indeed, 67.3% of the municipalities with above average levels of ZEC are in the highlands (Departments of La Paz, Oruro and Potosí), 30.5% in the valleys (Cochabamba, Chuquisaca and Tarija), and only 2.3% in the lowlands (Santa Cruz, Beni and Pando).

On the other hand, if we witness the percentage of observations of Zero Electric Consumption (ZEC) -by municipality- and we analyze it together with the Net Migration Rate (NMR), we can detect at

[5] There is natural ZEC average in all municipalities, this can be explained by empty houses for rent or sale, we assume this it corresponds to the national average of zero electricity consumption.

[6] The cases of meters with zero consumption during all months of the year have not been considered because they possibly correspond to definitive migrations. In addition, it is common for the electric company to remove the meter that is not being used in these cases.

least two important elements (Fig. 4). First, a relationship between the ZEC and the NMR, that is, the municipalities with higher ZEC values have mostly negative NMR values. Second, it is possible to observe that the municipalities with the highest ZEC averages are, for the most part, small municipalities (measured by the number of observations, as a proxy variable of the population size); while big municipalities usually have low ZEC values (for example, no capital city exceeds the national average of 7.6%).[7]

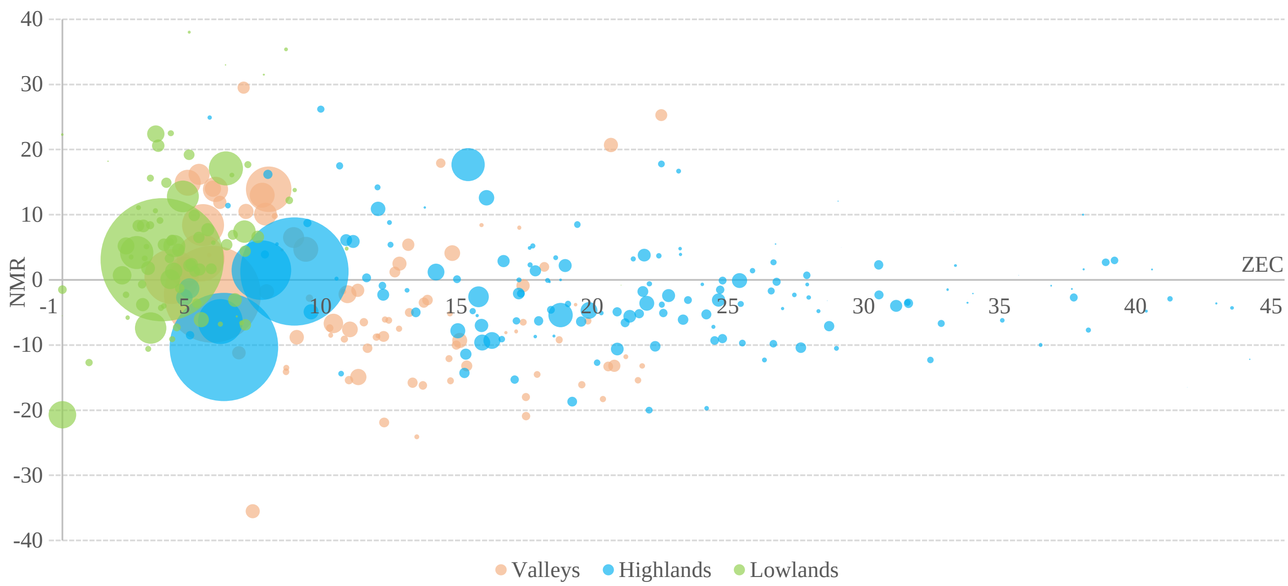

Fig. 4 – Net Migration Rate (NMR), percentages of zero consumption (% ZEC) and population size, by municipality (2012-2016).
Source: Authors' elaboration based on data from Andersen *et al.* (2019) and UDAPE (2018).

We propose a methodological approach to generate Analysis Groups that can bring us closer to the phenomenon of unfinished migration (see Fig. 5). First, we choose the set of municipalities with electricity consumption data, specifically 327 municipalities of a total of 339 municipalities that exist in Bolivia. That amounts to 116 million observations (2012-2016). Second, we separate the municipalities with a ZEC average above the national average (7.6%) from those municipalities with a lower ZEC average. The first group (220 municipalities) is made up of the potential Expelling or Receiving Municipalities, the second group (107 municipalities) contains all the municipalities that cannot be associated with the process of seasonal migration. Third, we divide the group of potential Expelling or Receiving Municipalities using the

[7] Several econometric exercises were carried out to find seasonal patterns -between expelling and receiving municipalities- that could help us better understand the phenomenon of unfinished migration. It was reasonable to think that the ZEC variable had a negative correlation between EEM and BRM, for example; that is, as homes were abandoned in the expelling municipalities, others were filled in the receiving municipalities. However, the results did not give clear signs of this behavior. Unfinished migration may no longer have such clear patterns of seasonality as it may have had in the past. It is possible that this phenomenon is related to the low percentage of land that is cultivated in the highlands, with the problem of smallholdings (described above), with the demand for labor or with other elements not yet identified.

Net Migration Rate (NMR); thereby, those municipalities with negative (less or equal to zero) NMR values can be described -with greater precision- as possible Expelling Municipalities. In contrast, those with positive NMR values are designated as possible Receiving Municipalities[8]. Finally, we define as Extreme Expelling Municipalities (E^E) those Expelling Municipalities with a ZEC value above 17.6% (the average ZEC of Expelling Municipalities), and as Moderate Expelling Municipalities (E^M) those with a ZEC value lower than 17.6%, but obviously higher than 7.6%. On the other hand, and given the importance of the size of the Receiving Municipalities, we define the top ten as Big Receiving Municipalities (R^B), and the rest as Small Receiving Municipalities (R^S). Note that the R^B have 53.2% of the observations of the analysis groups[9].

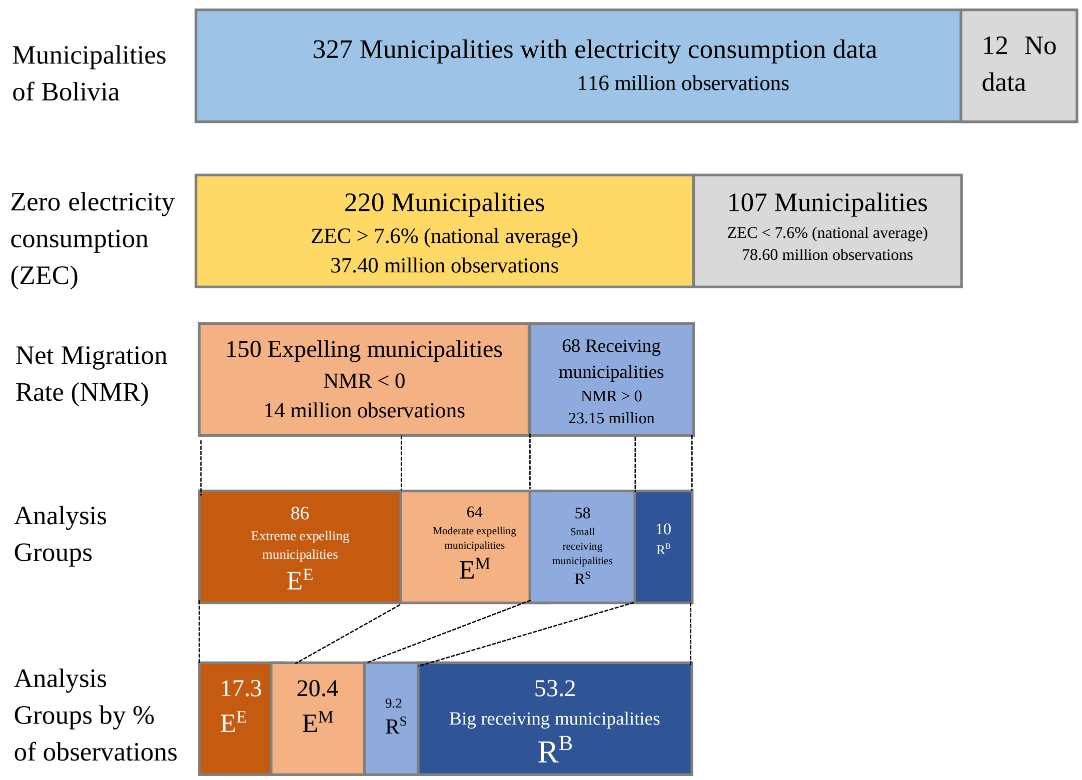

Fig. 5 – Methodological approach and Analysis Groups.

Source: Authors' elaboration based on data from Andersen *et al.* (2019).

[8] Note that municipalities that are recipients of definitive migration are not considered, such as Santa Cruz de la Sierra, which has a positive net migration rate (3.1%) but not a significant percentage of zero electricity consumption (only 3.7%).

[9] Intuitively, one might think that the number of observations in the expelling municipalities (E^E and E^M) should correspond to the number of observations in the receiving municipalities (R^S and R^B). This is not so, in the first place, because there is no reason to think that families distribute their time equally between the countryside and the city. Second, it is possible that certain (extended) families, who live together in the countryside, move to live in the city as different (smaller) families. Thirdly, it is possible to assume -with high probability- that the observations of zero consumption in the expelling municipalities correspond to families that are going to live in the city for a few months (unfinished migration), on the other hand, the same cannot be said about zero consumption observations in cities, some of which possibly correspond to homes for rent or sale, among others.

It is important to verify a certain coherence between our analysis groups and other available variables (independent of the electricity consumption data base). Tab. 2 compares the level of the Human Development Index (HDI), Unsatisfied Basic Needs (UBN) as well as Net Migration Rates (NMR), Zero Electricity Consumption share (ZEC) and average electricity consumption for different groups of municipalities.

The Extreme Expelling Municipalities (E^E) and Moderate Expelling Municipalities (E^M) clearly have the worst indicators (all five analyzed), as expected. However, although the Small Receiving Municipalities (R^S) and Big Receiving Municipalities (R^B) have better indicators than the expelling municipalities, they are not nearly as good as the indicators in the Capital Cities. This means that, within the phenomenon of unfinished migration, seasonal migrant families seem to migrate from the worst municipalities, but they do not necessarily migrate to the best, but rather to intermediate municipalities, which may be more compatible with the seasonal migration strategy[10].

Tab. 2 – Socioeconomics indicators by analysis groups

	National	Capitals	Highlands	Valleys	Lowlands	E^E	E^M	R^S	R^B
HDI (2016)	0.57	0.72	0.55	0.55	0.64	0.52	0.51	0.58	0.61
UBN (2012)	70.14	25.90	76.18	67.29	61.58	84.59	75.56	70.59	57.65
NMR (2012)	-	0.51	-1.30	-3.42	8.75	-6.83	-8.73	8.29	9.36
ZEC (%) (2012-2016)	7.59	5.02	10.43	7.15	3.85	23.15	13.17	17.05	9.30
Kwh/month (2012-2016) *	127.70	166.75	107.53	95.46	193.61	19.82	36.24	40.08	75.80

Notes: HDI = Human Development Index; UBN = Unsatisfied Basic Needs; NMR = Net Migration Rate; ZEC = Zero Electricity Consumption.
Source: Authors' elaboration based on data from INE (2012), UDAPE2 (2018), AR-LAT (2018), Andersen *et al.* (2019). * Family average.

In order to explore the central hypothesis of the research, which -in a summarized way- maintains that the unfinished migration of families leads to higher levels of poverty than full migration, we calculate the electricity consumption (as a proxy variable of income level) of the different proposed Analysis Groups. Tab. 3 shows the results for all families identified as seasonal migrants, within the different Analysis Groups, that is, E^E, E^M, R^S and R^B (for which we show the results by municipality). Likewise, the average number of observations that these families have, different from zero, are shown; that is, the months

[10] It is difficult to estimate the exact number of families that experience the phenomenon of unfinished migration. However, taking the families defined as seasonal migrants (2016) and circumscribing them to the expelling municipalities (E^E and E^M), we would have a (maximum) of 231,486 families (about 9.3% of the families in the country).

(average) per year that they reside in the different municipalities. Finally, we show these same results for families identified as non-migrants, who, as expected, reside 12 months a year in the same place.

The results of Tab. 3 show us that seasonal migrant families have systematically lower (average) electricity consumption than non-migrant families in the same municipalities. And all of these (seasonal migrants and non-migrants) have lower levels of consumption than the population that lives in the large cities of the country[11], that are municipalities that attract -in most cases- permanent migrants and remain mostly outside the phenomenon of unfinished migration. However, it is good to remember that seasonal migrants live in two different municipalities. In other words, these are families that come from the Extreme Expelling Municipalities (E^E) or the Moderate Expelling Municipalities (E^M) (they reside in these an average of 7 and 8.1 months per year, respectively), and, in addition, they reside in some other municipality among the Big Receiving Municipalities (R^B) or Small Receiving Municipalities (R^S) an average of 7.0 and 7.7 months a year, respectively. Therefore, their electricity consumption is the average of their two residences weighted by the time they inhabit them[12]. Figure 7 shows the different types of municipalities on the map of Bolivia (according to the analysis groups), showing -again- that it is a phenomenon of highlands and valleys.

Tab. 3 – Electricity consumption by Analysis Groups

Analysis Groups		*Non-migrants* *kWh / month*	*Seasonal Migrants* *kWh / month*	*Observations (per year)*
E^E		38.1	15.6	7.0
E^M		46.3	21.5	8.1
R^S		49.1	25.0	7.0
R^B		81.8	35.4	7.7
	El Alto	94.6	59.0	8.8
	Sacaba	110.9	49.2	8.0
	Viacha	71.6	29.2	7.9
	Villa Tunari	73.2	27.1	6.9
	Puerto Villarroel	86.1	32.5	7.1
	Challapata	48.8	20.0	6.8
	Villa San Lorenzo	100.1	47.2	8.1
	Achocalla	69.5	33.5	7.8
	Uyuni	90.2	32.6	7.8

[11] La Paz (157.6 kWh/month), Cochabamba (120.6 kWh /month) and Santa Cruz (245.2 kWh/month).

[12] Note that non-migrants have always twelve annual observations (months of the year), while migrants can have more than twelve (thirteen or even more); This is because the migrants can leave residence in the middle of a month (July, for example) and move to their second residence. In this case, 7 observations will be generated for the first residence (from January to July) and 6 observations for the second (from July to December). In any case, the weights were made dividing the observations by twelve months, to avoid a downward trend.

Arbieto	73.2	24.1	7.2

Note: Results are presented individually for each of the 10 Big Receiving Municipalities (R^B).
Source: Authors' elaboration based on data from Andersen *et al.* (2019).

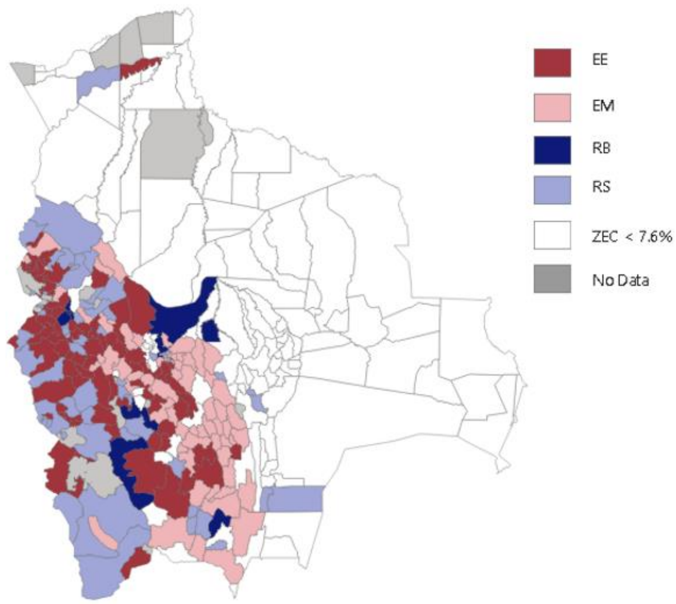

Fig. 6 – Map of Analysis Groups: Extreme Expelling Municipalities (E^E), Moderate Expelling Municipalities (E^M), Small Receiving Municipalities (R^S) and Big Receiving Municipalities (R^B). Source: Authors' elaboration based on data from Andersen *et al.* (2019).

Fig. 7 shows us a starting point (on the left) in the expelling municipalities, with the average electricity consumption of non-migrant families. Then, we move to the right through the main receiving municipalities, showing the consumption of seasonal migrants. Finally, on the right-hand side of the graph we have the consumption of families who live in a stable way in receiving municipalities (probably definitive migrants). The graph also shows us that unfinished migration has different results depending on the place from which it departs (expelling municipalities) and the place where it is reached (receiving municipalities).

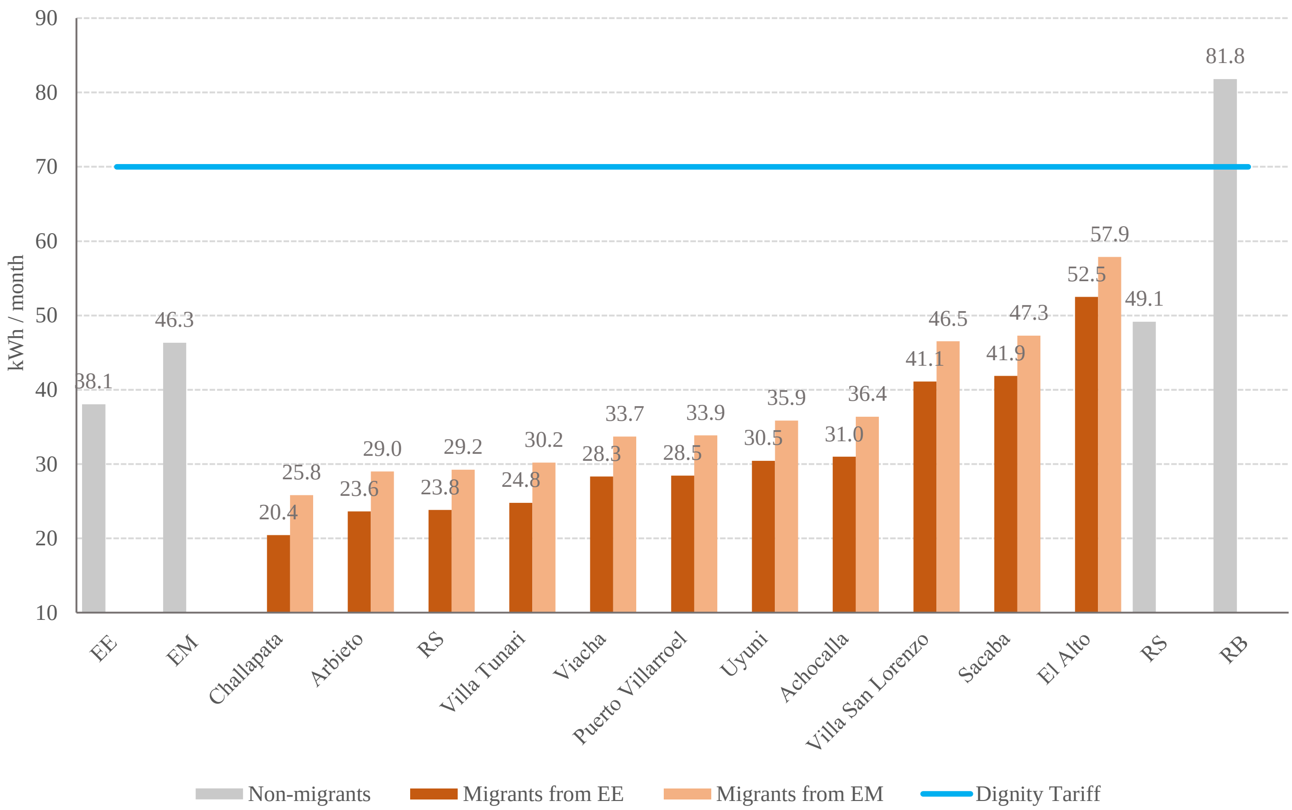

Fig. 7 – Electricity consumption (kWh/month) of Migrants and Non-migrants as a migration path from expelling to receiving municipalities.
Source: Authors' elaboration based on data from Andersen *et al.* (2019).

However, it is important to stablish some fundamental points. First, in many cases, the seasonal migrant's families have lower electricity consumption than their peers who stayed to live in the expelling municipalities (non-migrants); this may be because migrant families -probably- have worst conditions than families who decide not to migrate. Second, there are notable differences between some of the receiving municipalities, being the cities of El Alto, Sacaba and Villa San Lorenzo the municipalities where seasonal migrants have a higher average electricity consumption (exceeding their non-migrant peers from expelling municipalities); making, in these cases, seasonal migration a successful strategy. Note that for all other cases, there is no evidence in this regard. Third, all consumption associated with the phenomenon of seasonal migration are below the Dignity Tariff[13], which can be interpreted as an Energy Poverty Line, and also below the average consumption of families who live permanently in R^B (see the right side of the graph); showing us that the consumption levels of seasonal migrants do not in any case exceed those of permanent migrants in R^B.

[13] The Dignity Tariff is a policy of discounts for very low electricity consumption (70 kWh/month), which seeks to benefit the poorest families. It can therefore be considered an Energy Poverty Line.

The results suggest that unfinished migration is not a particularly successful strategy. Only in a few cases (El Alto, Sacaba and Villa San Lorenzo), do seasonal migrants have higher electricity consumption levels than their peers who stayed in their expelling municipalities (non-migrants). Finally, it is very important to note that in all cases, seasonal migrant families do not achieve higher levels of consumption than other families that live in a stable way in a defined municipality. It seems that these other families (classified as non-migrants as soon as they live 12 months in the same municipality) have consumption levels much higher than those of seasonal migrant families. Therefore, it seems that definitive migration is a better strategy than unfinished/seasonal migration.

6. Conclusions

The main hypothesis of this research was that the unfinished migration of families -between the countryside and the city- leads to higher levels of poverty than full migration. According to the results, there is no evidence to indicate otherwise, which means that this part of the hypothesis cannot be rejected. Likewise, the hypothesis stated that unfinished migration was more like a poverty trap phenomenon than a successful economic strategy worthy of replication. In this regard, the results are not so categorical, unfinished migration is a good economic strategy -if and only if- families migrate to a good receiving municipality (which are few). In all the other cases, the evidence leans more toward not rejecting the hypothesis that unfinished migration is a poverty trap.

Regarding the latter, it would seem that the legal system that governs land ownership (in the highlands and valleys) could help us understand the decision of some families to maintain an unfinished migration strategy. In any case, those families that -eventually- decide to migrate more definitively have significantly higher electricity consumption levels than the families that apply the unfinished migration strategy. In short, it seems that unfinished migration is better than living permanently in the poorest villages and towns, but that it should only be a transitory strategy, maintained by the families only until they can finally fully migrate, which would clearly lead to better living standards (at least as measured by electricity consumption). Therefore, it is important to find out which are the variables that determine the decision of a family to settle down permanently in a place.

Finally, it is necessary to reevaluate the results of this research, which has data from 2012 to 2016, in light of the global health crisis caused by the COVID-19 pandemic. It is possible that some seasonal migrant families have been more resilient in facing the crisis by having two residences (especially one in the countryside) than non-migrant families living in large cities. Undoubtedly, such a radical change in world social reality has modified the advantages of the economic strategies considered successful (before the pandemic).

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