Preliminary Draft

Spatial Inequality and Rural Decline: The Determinants of Internal Mobility in Spain

Pau Costa Capdevila

Departament d'Economia Aplicada – Universitat Autònoma de Barcelona

Edifici B – Campus UAB, 08193 Bellaterra (Barcelona), Spain

Correspondence to: pau.costa@uab.cat

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Abstract

In this study, we explore the determinants of internal mobility in Spain, focusing on rural-urban disparities. Using microdata from the Estadística de Variaciones Residenciales (EVR) from INE, we built a novel origin and destination matrix dataset on migration flows at the municipal level for Spain. We exploit this database by elaborating an internal migration model based on gravity analysis. We also use breakthrough data on income levels per capita at the municipal level from the Atlas of Income Distribution elaborated by the Instituto Nacional de Estadística (INE), which serves as a proxy for PIB per capita at the destination over the period from to 2016-2021. We then evaluate the role of income, infrastructure, renewable energy, and housing rent in shaping these flows using a Poisson Pseudo-Maximum Likelihood (PPML) approach with extensive destination and origin-year fixed effects. Our findings show that income per capita acts as a significant pull factor, whereas distance and housing rent act as push components. We document substantial heterogeneity by urban-rural and immigrant-native origins, which provides relevant insights for policies oriented toward reducing regional disparities.

Keywords: Internal mobility; Spatial inequality; Urban-Rural; Native-Immigrant; Spain.

JEL Classification: J61, O18, R12, R23.

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1 Introduction

Internal mobility has played a significant role in determining regional disparities in development, adjusting labor markets, and shaping demographic changes (Greenwood, 1997). Internal mobility can also lead to a relocation of human capital over space; thus, it can affect its spatial distribution (Moretti, 2012). This relocation of people over space can also lead to the persistence of territorial inequalities. These dynamics are important because they determine the convergence or divergence of economic development across space. Hence, understanding internal mobility and its determinants is crucial for policies aimed at reducing spatial inequalities.

Empirical evidence suggests a decline in internal mobility in recent decades in most developed countries (Bell et al., 2015; Jia et al., 2023). Specifically, Olney and Thompson (2024) highlight this declining trend for the case of the US, and Alvarez et al. (2021) finds the same result for non-European OCDE countries. The evidence on the evolution of internal mobility in European countries is more mixed. This reduction is of paramount importance, as it can have significant implications for spatial and regional disparities in economic outcomes. However, it should be taken into account that these studies focus on units of observation more aggregated than municipalities, such as regions or provinces, thus failing to spot mobility patterns at a more granular level. At a more local level of analysis, we can gain valuable insights into the heterogeneity across municipalities, especially between urban and rural contexts.

In countries with strong regional heterogeneity, such as Spain, internal mobility serves as a key adjustment mechanism for individuals to respond to spatial differences in economic conditions and amenities (Molloy, Smith and Wozniak, 2011), as well as a cushion against economic shocks (Basso and Peri, 2020).

Spain has a comparatively low level of internal mobility compared to Western and Northern European countries (Bell et al., 2015;, 2020; Rowe et al., 2019). From the Estadística de Variaciones Residenciales (EVR), we see that Spain has an overall rate of internal migration of 3.3% over the period 2016-2020. This level is similar to that of Southern and Eastern European countries such as Italy, Greece, Romania, the Czech Republic, and Russia (Alvarez et al., 2021; Rowe et al., 2020) but is much lower than the 18% internal migration rate of neighboring France (Rees et al., 2017).

Over the period 2000 to 2020, the Spanish population grew 17.2%, while 63% of municipalities experienced a decrease in inhabitants (González-Lenardo et al., 2023). Despite the overall population growth, specific regions have recorded significant population decline. These areas are mainly located in rural northwestern and central Spain (Castilla y León, Galicia, Asturias, and Castilla-La Mancha)[1] (Collantes and Pinilla 2011; Delgado Urrecho, 2018).

In this study, we provide several novel contributions to the current state of the literature. The first contribution is a novel dataset in which we track all internal mobility movements in Spain over

[1]See Figure 6 in the Appendix for the location of Spanish Autonomous Communities.

the period 1998–2021 at the municipality level. Using data from the Estadística de Variaciones Residenciales (EVR) that tracks all movements of residence across Spanish municipalities, we are able to build an origin and destination matrix with all the mobility flows.

We then use the approach by Peri & Ortega (2013) to derive an empirical specification that can be estimated using aggregated-level data on migration flows, adding a set of fixed effects. Thus, we adapt a model from international migration flows to a much more granular level of analysis, internal mobility between municipalities. Because of the prevalence of zeros in origin-destination corridors, we estimate the model via Poisson Pseudo-Maximum Likelihood (PPML), which includes origin-year and destination fixed effects to account for the substitutability component among destinations with similarities and to control for origin-specific time-varying elements. (Beine et al., 2025).

The results of the estimations of the determinants of mobility flows in Spain yield four main findings. First, we confirm the role of income as a pull factor, as well as distance and housing rent as push components, at the municipal level. Second, exploiting heterogeneity by urban-rural and immigrant-native, we find an inverse pattern of responsiveness to purely economic factors. For immigrants, they play a significant role when coming from urban origins, and they vanish as you de-urbanize, whereas for natives, they play a role in all specifications, but their importance is higher in rural contexts. Third, we document that determinants such as highway accessibility and PV play a role in rural contexts, the former for immigrants and the latter for natives. Finally, we find a diminution in the role of purely economic factors after COVID-19, especially for natives.

The remainder of this paper is structured as follows. Section 2 reviews the literature. Section 3 describes the data used in this study and presents descriptive statistics. Section 4 discusses the empirical framework. Section 5 discusses the results of the study. Section 6 discusses the mechanisms, and Section 7 concludes the paper.

2 Literature Review

This paper retrieves a framework from the literature on international flows of goods (trade). The gravity approach has been used in previous papers on trade flows, such as Anderson & van Wincoop (2003), Chaney (2008) or Helpman, Melitz & Rubinstein (2008). The literature on migration flows with this gravity specification is posterior; examples include Beine et al. (2011), who focus on the role of networks, Mckenzie et al. (2014), who focus on the case of the Philippines, and Bertoli and Fernández-Huertas Moraga (2012), who find a smaller effect of GDP per capita and a larger effect of migration policies on bilateral rates. A key conceptual component of this gravity approach are the push and pull factors. Push factors are drivers that encourage an individual to leave a location (e.g., unemployment, low wages), and pull factors attract individuals to a new site (e.g., income differential, amenities). Previous papers on international migration flows have used less refined approaches, such as focusing on a single destination or using reduced-form models (Clark et al.

2008 or Garcia-Gómez & López-Casasnovas 2006).

There is also existing international evidence on internal migration. The theory suggests that internal migration contributes to the convergence of regional disparities. However, evidence shows unclear results, even that it can contribute to an exacerbation of spatial disparities. For example, Bayraktar and Özyılmaz (2017) found that regions losing population experience a rise in inequality. In the case of the United States, Molloy et al. (2011) found that internal migration has declined in recent decades, and there has been an increase in regional disparities. Moreover, Chetty et al. (2018) show that US citizens born in lower-income counties show fewer cross-area moves.

Previous studies have provided insights into the context of Spanish internal mobility. For example, Hierro et al. (2018) focused on the determinants of internal mobility following a similar gravity approach but with a higher level of aggregation (province) as origins and destinations. Some studies have used strategies other than gravity models to determine the effects of variables of interest on internal migration. For example, Vall-Castelló et al. (2023) exploit country-wide child labor regulations to determine the effects of education on internal migration in Spain. There are also studies from outside economics that have looked into the phenomenon of internal migration in Spain. E.g. Gónzalez-Leonardo and Rowe (2022) performed a descriptive analysis of the impact of Covid-19 on internal migration patterns in Spain.

This study is also related to the literature on housing costs as barriers to mobility. Empirical evidence shows that higher housing prices increase the cost of moving, thereby reducing migration flows to areas with expensive housing. For example, the OECD (2021) employs a gravity approach to document housing costs as a push factor for internal mobility across OECD countries. Ganong and Shoag (2017) found a similar result for the US.

Another growing body of literature examines the role of infrastructure and transport accessibility in determining migration choices. Transport infrastructure can lead to a reduction in mobility costs and increases in labor market access, but it also has implications for spatial adjustments. For example, Faber (2014) documents that highway expansion can lead to regional disparities, benefiting specific core regions at the detriment of more peripheral ones. Studies suggest that transport connectivity can affect internal migration patterns, especially in rural areas (Crescenzi et al., 2016). However, at the local level of granularity, such as municipalities, evidence remains scarce.

Finally, this study relates to a growing body of literature linking renewable energy, local amenities, and migration. Direct evidence of the effects of renewable energy on internal mobility remains limited. However, some studies suggest that the deployment of renewable energy systems has implications for local labor markets, economic outcomes, and quality of life, especially in rural contexts (del Río et al., 2019). Thus, these factors could have implications in shaping internal mobility decisions, but they are hardly incorporated in this type of gravity-based migration model.

These strands of literature point to the need for a more granular approach to internal mobility that also considers economic conditions, infrastructure, housing costs, and renewable energies. This study fills this gap in the literature using a gravity framework and Spanish municipality-level data.

3 Data & Descriptive Statistics

In this section, we present our variables and data sources, as well as provide some descriptive and summary statistics in the context of Spanish internal mobility.

Mobility Flows Data.-The internal mobility flows dataset is constructed using data from the Estádistica de Variaciones Residenciales (EVR), compiled by the Instituto Nacional de Estadística. This statistic captures all officially registered changes of residency between Spanish municipalities from the register (Padrón).We use the microdata (individual-level) of the EVR over the period 1998-2021 and we aggregate the residential changes by municipality to build an origin-destination matrix of municipal internal mobility flows.

Spain is formed by 8,132 municipalities, 50 provinces and 17 autonomous communities (excluding Ceuta and Melilla). This number of municipalities generates over 66 million potential corridors of mobility flows (8,132 $\times$ 8,131). Although most of the corridors are empty, this dataset provides an unusual level of spatial granularity in the literature, as most studies rely on regional or provincial aggregation. This granularity allows us to documenton heterogeneity. in this mobility patterns across the urban-rural divide.

Figure 1 displays the spatial distribution of internal mobility flows.

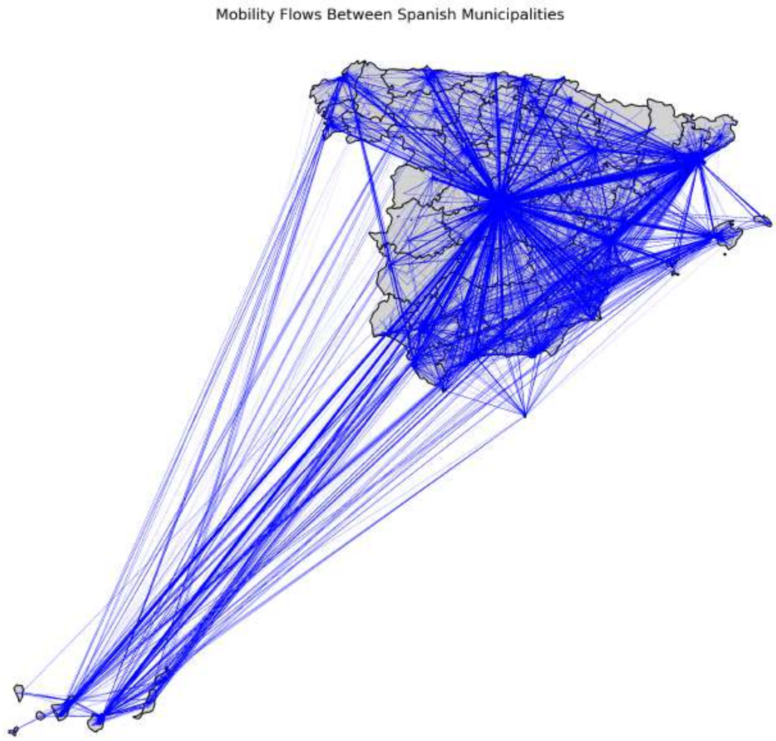

Figure 1: Mobility Flows

Income Data.- To capture local income per capita characteristics, we use a detailed dataset on socioeconomic indicators from the Instituto Nacional de Estadística (INE, 2023), which uses population statistics and administrative tax data to provide information on income distribution and other socioeconomic variables at the municipal, district, and census track levels of granularity.

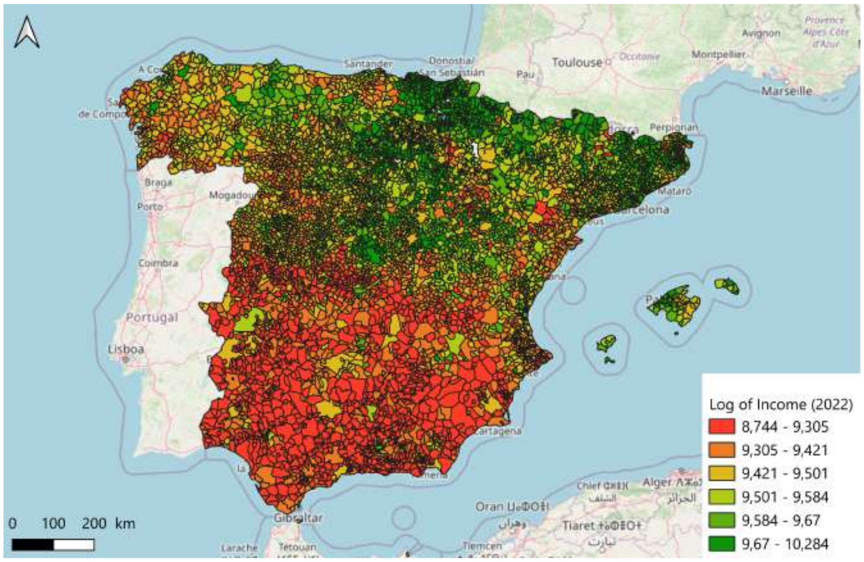

Figure 2: Income per Municipality in Spain

Transport Access Data.- Transport Accessibility is proxies by using data on highway entries from the Instituto Geográfico Nacional (IGN). With these data in shapefile format, we can filter by highway entry and combine them with the municipalities data. Thus, enabling us to create a dummy variable for Transport Accessibility. We chose this measure instead of, for example, railways, because access to trains in Spain is more limited, whereas access to highways is more spatially extensive throughout the Spanish territory.

Figure 3: Highway Access and Spanish Municipalities. *Source*: Instituto Geográfico Nacional (IGN).

Renewable Energy Data.-To retrieve data on the deployment of renewable energies in Spain, we used the novel SOWISP database (Jiménez-Garrote et al., 2023), which is a retrospective high spatial and temporal resolution database of the installed wind and solar PV power in the Spanish territory. In this dataset, we can find the number of systems and the amount of power (in MW) installed in every Spanish municipality over the period 2015–2020. We include the amount of power by municipality as a measure in our analysis, as it is the most representative indicator of renewable energy intensity. We then logarithmically transformed this variable to include it in the PPML specification.

Housing Rent Data.-For housing rent at the municipal level, we use the State Housing Rental Price Reference System (SERPAVI in Spanish), elaborated by the Spanish Ministry of Housing and Urban Agenda, which exploits tax data on primary residence rentals. This database covers the period from 2011 to 2023. We take the median rent at the municipality level of granularity for our analyses.

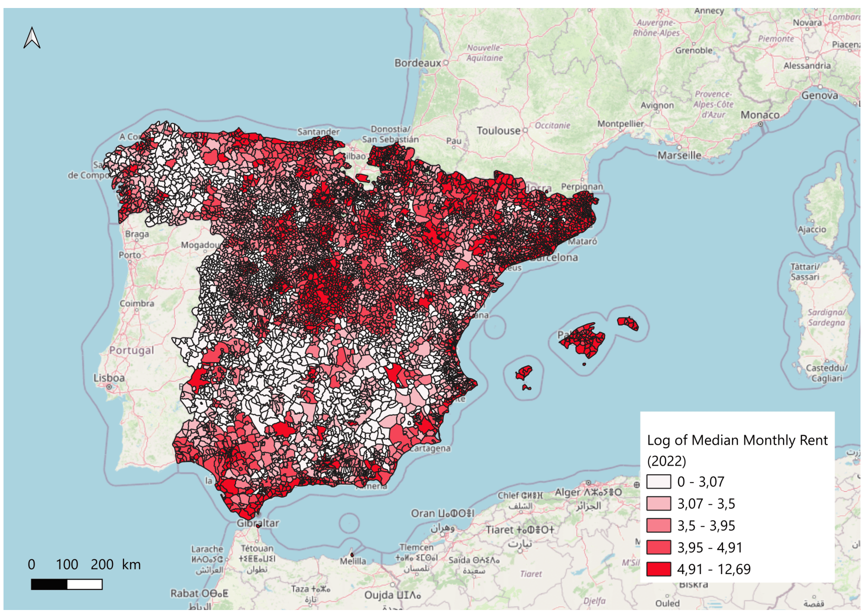

Figure 4: Housing Rent price per Muncipality in Spain

Figure 5 shows an upward trend in internal migration at the beginning of the 2000s, which was disrupted by the Great Recession. After 2007, the trend reversed until 2016. In the last years of analysis, we can see that internal migration had a positive slope, aligning with Spain's positive economic performance. With the exception of 2020, when the disruption of Covid-19 produced a clear negative shock in aggregate internal mobility.

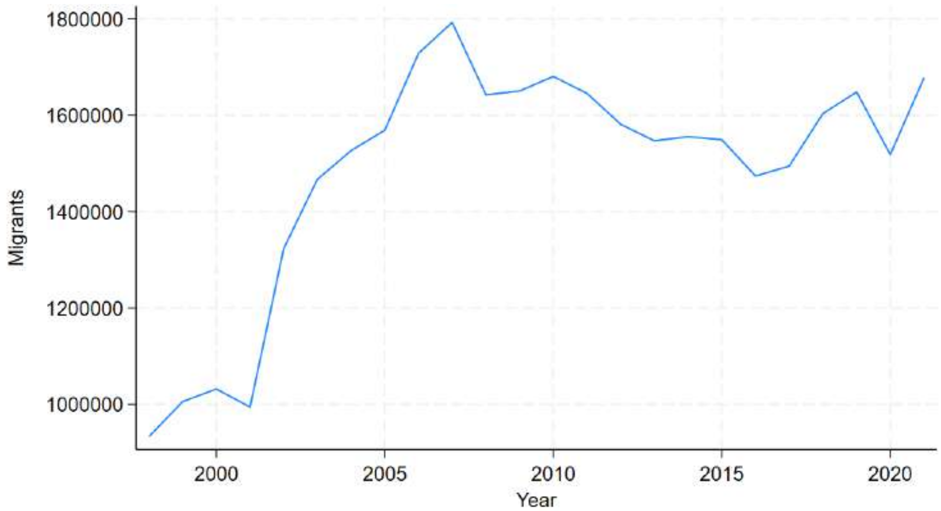

Figure 5: Internal Mobility in Spain over time. *Source*: Own elaboration with data from INE

For baseline estimates, the analysis period was reduced to 2016-2021, dictated by the availability of harmonized data at the municipal level with 361,342,314 municipality–municipality–year observations.

Two restrictions were imposed. For computational reasons, we exclude municipalities with fewer than 100 inhabitants from the sample when performing the estimations. These municipalities represent a very small share of the rural population and thus do not quantitatively affect the results and patterns documented in the following sections. We also restrict the sample of municipal corridors to those greater than 120 km, following the approach of De La Roca (2017).

Table 1 presents the main descriptive statistics for bilateral mobility flows and key drivers at the destination.

The mean values for the flow were close to 0, showing that the distribution of the flows is sparse and highly skewed. This prevalence of zeros drives us to employ a Poisson Pseudo-Maximum Likelihood (PPML)[2] estimation in gravity models.

The bilateral distance (in logarithmic units) has a mean of 5.93 (SD=0.53), indicating substantial variation between pairs of municipalities. The minimum variable is 4.79, which is equivalent in raw distance to 120 km, due to the restriction we performed in our sample. Our range (4.93-7.83) confirms that the sample includes a meaningful variation in distance, which is essential for our gravity framework.

The municipal income per capita at the destination (in logs) has a mean of 9.28 and ranges

[2]Blackburn (2015) demonstrates that the PPML is more robust and better designed to overcome overdispersion than negative binomial estimators.

between 8.10 and 10.36. This suggests considerable heterogeneity in local economic conditions among Spanish municipalities.

Housing rent (in logs) displays an even higher dispersion than income, ranging from 0.27 to 3.36, consistent with disparities among housing markets, especially between urban and rural settings.

Highway accessibility is present in 21% of our sample of destination locations, highlighting significant heterogeneity in transport access across the Spanish territory.

Both wind and photovoltaic patterns have a mean of 0.20 (in logarithms) in our sample, with a maximum value of 6.27 in the case of wind and 4.20 in the case of PV, which indicates that renewable energy is highly clustered and provides significant variation for identification across municipalities.

The mean value for the COVID-19 dummy variable is 0.33, suggesting that a third of our observations took place in the post-COVID period.

Table 1: Summary Statistics of Migration Flows and Destination Characteristics

	Mean	Std. Dev.	Min	Max
Total migration flow	0.01	0.75	0.00	2690.00
Native migration flow	0.01	0.53	0.00	1601.00
Immigrant migration flow	0.00	0.25	0.00	1221.00
Log distance	5.93	0.53	4.79	7.83
Log income per capita	9.28	0.20	8.10	10.36
Log housing rent	1.50	0.25	0.27	3.36
Highway access	0.21	0.41	0.00	1.00
Log wind power capacity	0.20	0.84	0.00	6.27
Log solar PV capacity	0.20	0.49	0.00	4.20
COVID-19 dummy	0.33	0.47	0.00	1.00
Observations	361,342,314			

4 Empirical Framework

We adopt the framework by Ortega and Peri (2013) on international migration and adapt it to internal migration. We analyzed the phenomenon of migration across multiple destinations. In our framework, the origins and destinations are Spanish municipalities. We denote d as every possible destination, where the destination is any Spanish municipality except the origin.

Thus, we study internal migration choices across multiple destinations: $d \in D = \{1, \ldots, N_D\}$. Agent i, born in municipality of origin $o \in \mathcal{D}$, decides whether to stay in o or to migrate to any other municipality.

We define $\mathcal{D}_o = \mathcal{D} \setminus \{o\}$ as the set of potential destinations for individuals residing in a specific municipality o, excluding the municipality of origin.

We define the utility of staying at the origin as follows:

$$U_{ooi} = V_{oo} + \varepsilon_{ooi} \tag{1}$$

with V_{oo} as a level of utility homogenoeus across individuals and specific for each municipality of origin and ε_{ooi} as a stochastic individual component.

Following the same structure, then the utility of migrating to $d \in \mathcal{D}$ is the following:

$$U_{odi} = V_{od} + \varepsilon_{odi} \tag{2}$$

It is noticeable that in equation 2, the utility level component varies by origin and destination pair. This allows us to include bilateral costs of migration such as distance. To put it more clearly, we can define this deterministic utility level component as $V_{od} = W_d - C_{od}$ where W_d denotes the present value of the expected earnings at destination municipality d and C_{od} denotes the bilateral cost of migration from municipality of origin o to municipality of destination d.

The stochastic terms of both equations, that is, ε_{ooi} and ε_{odi} capture the unobserved characteristics of the choice of staying at origin or moving to any destination municipality d. There are different approaches on the assumptions on these terms. For example, Grogger & Hanson (2011) make the straightforward assumption that all stochastic terms are identically and independently distributed as type-I extreme value as in a standard logit. This assumption could be too strong, as migrant might have different unobserved characteristics than non-migrants such as risk-aversion or psychological cost of moving abroad.

Therefore, in this paper we follow the approach by Ortega & Peri (2013) where they relax this assumption by allowing for individual random effects that can be correlated. We simply define $\varepsilon_{ooi} = \epsilon_{ooi}$ but for each destination d we have $\varepsilon_{odi} = \gamma_i + \epsilon_{odi}$ where γ_i comes from a probability distribution uncorrelated with ϵ_{odi} and with zero mean. Similarly as before, ϵ_{ooi} and ϵ_{odi} are all i.i.d. with a type-I extreme value distribution. With these assumptions, now we are facing a nested-logit model, firstly used by McFadden (1978). This specification allows for closed-form solutions for both the probability of staying at the municipality of origin o and the probability of migrating to any municipality of destination d. We define these probabilities as follows:

$$P_o = \frac{e^{V_{oo}}}{e^{V_{oo}} + \left(\sum_{j \in \mathcal{D}_o} e^{V_{oj}^t/\tau}\right)^{\tau}} \tag{3}$$

$$P_d = \left(\frac{\left(\sum_{j \in \mathcal{D}_o} e^{V_{oj}^t/\tau}\right)^{\tau}}{e^{V_{oo}} + \left(\sum_{j \in \mathcal{D}_o} e^{V_{oj}^t/\tau}\right)^{\tau}} \right) \cdot \frac{e^{V_{od}/\tau}}{\sum_{j \in \mathcal{D}_o} e^{V_{oj}^t/\tau}} \tag{4}$$

In this step, we use algebra to derive the log-odds ratio of the probabilities:

$$\ln\left(\frac{P_d}{P_o}\right) = (V_{od}^{\tau} - V_{oo}) - (1-\tau)\left(\ln\sum_{j\in\mathcal{D}_o} e^{V_{oj}^t/\tau}\right), \quad \text{for } d \in \Delta_o \tag{5}$$

$$\ln\left(\frac{P_d}{P_f}\right) = V_{od} - V_{of}, \quad \text{for } d, f \in \Delta_o \tag{6}$$

Similarly as in the logit model, we have that relative attractiveness between two destination define the odds ratio. However, in this nested-logit approach we also have another term that allows for correlation across destinations.

Now we can apply the law of large numbers to approximate the probability that one individual chooses a location as the share of individuals residing in municipality of origin o that choose a specific municipality j. That is, $P_d = \frac{v_{od}}{\sum_{\phi=1}^{\Delta} v_{o\phi}}$, approximating the probability with the number of individuals from municipality of origin o that choose location j. Therefore, now we can write equation 5 the following way:

$$\ln v_{od} = \ln v_{oo} + \left(\frac{V_{od}}{\tau} - V_{oo}\right) - (1-\tau)\left(\ln\sum_{j\in\mathcal{D}_o} e^{V_{oj}^t/\tau}\right) \tag{7}$$

By looking at the equation, one can observe that the only right-hand side term that varies for destination is V_{od}, while the rest remain constant across destinations and only vary by municipality of origin. Because income and transport accessibility can vary over time and alterate the relative attractiveness of destination municipalities, we add a time dimension to equation 7. Thus, we get the following multi-period specification:

$$\ln n_{od}^t = \ln n_{oo}^t + \left(\frac{V_{od}^t}{\tau} - V_{oo}^t\right) - (1-\tau)\left(\ln\sum_{j\in\mathcal{D}_o} e^{V_{oj}^t/\tau}\right) \tag{8}$$

for any destination $d \in \mathcal{D}_o$ in time period t.

4.1 Estimating Equation

The next step is to estimate the equation we just derived with the panel database on migration flows. To perform this, we rewrite equation (8) as follows:

$$\ln n_{odt} = \alpha_{ot} + \beta V_{odt} + \epsilon_{odt} \tag{9}$$

where we have fixed effects constant across destinations and that vary by origin and year (α_o^t). The third term on the right-hand side of the equation (ϵ_{od}^t) accounts for the measurement error of the approximation of probabilities with frequencies in our sample.

The second term on the right-hand side of the equation accounts for the attractiveness of destination locations. Now we can be more specific and define βV_{od}^t as:

$$V_{odt} = \beta_1 \ln Y_{dt} + \beta_2 T_{dt} + \beta_3 \ln R_{dt} + \beta_4 \ln RE_{dt} + \beta_5 (\ln Y_{dt} \times \text{COVID}_t) + \gamma \ln D_{od} + \alpha_d \tag{10}$$

The first term on the right-hand side Y_{dt} refers to the expected earnings, which we proxy as GDP per capita, in a destination municipality d at time t. The following term T_{dt} accounts for the access to transport (highway) in a municipality d at time t. The term R_{dt} accounts for housing rent at destination. The term RE_{dt} describes the renewable energy power (wind and PV) installated in the municipality of destination. The term $(\ln Y_{dt} \times \text{COVID}_t)$ accounts for the interaction with income per capita at destination and the COVID-19 pandemic. The term D_{od} refers to any municipality pair od characteristics such as geographical distance. Finally, the term α_d accounts for time-invariant characteristics of any destination municipality d.

5 Results

Table 2 presents the results for our baseline specification with the full set of municipalities of origin. We then exploit heterogeneity by place of residence and origin of the migrants. Because we include origin-year and destination fixed effects, the coefficient captures the partial correlations between changes in bilateral mobility flows and destination time-varying components.

In the first column, we present the estimation results of the parameters from Equation (10) using the full sample of movers. We find that, similar to the empirical evidence from international migration (Mayda 2010, Groger & Hanson 2011), income per capita at the destination acts as a pull factor for inter-municipal mobility in Spain. Specifically, a 1% increase in destination income per capita is associated with a 0.73% increase in mobility flows, which is consistent with the existing literature (Olney and Thompson 2024 estimate a coefficient of 0.77% for the US). Second, we find a negative partial correlation between distance and internal mobility. That is, a 1% increase in the distance between the origin and destination is associated with a 0.78% decrease in mobility flows (in line with Bertoli and Fernández-Huertas Moraga, 2013). We also document a small negative partial correlation between highway accessibility and internal mobility: gaining highway access is associated with a 6.3% decrease in expected mobility flows, conditional on fixed effects. For the entire sample, there is no clear partial correlation between PV nor Wind power and mobility flows. We find a clear negative partial correlation between rent prices and mobility inflows: a 1% increase in rent is associated with a 0.42% decrease in mobility flows, consistent with existing evidence (Siriban, Bernard & Pojani, 2025). Finally, we also find that the coefficient for the partial correlation between income per capita at the destination and mobility flows reduced its magnitude by 16.5% after COVID-19, which is in line with evidence suggesting that after the pandemic, purely economic factors lost influence (Turati et al. 2025). We exploit heterogeneity by country of origin by estimating the parameters for immigrants and natives. For income and distance, we obtain partial correlations similar to those in the full sample. The negative partial correlation between highway accessibility and mobility flows is mainly driven by immigrants, as gaining highway access is associated with a 17.6% decrease in immigrant mobility flows. The coefficient for the negative partial correlation between housing rent and mobility flows in the full sample is larger for natives than for immigrants. For the former we find that 1% increase in rent is associated with a 0.48% decrease in mobility flows and for the latter we find a 0.39% decrease in immigrants mobility flows. The partial correlation between income per capita and mobility flows decreased more for natives than for the immigrant sample. The partial correlation reduced was reduced by a 4.9% for immigrants and by a sizable 17.7% for natives.

Table 3 presents the results of the model estimation, restricted by urban origins. Income per capita and distance act as pull and push factors, respectively, as in the full sample of municipalities of origin. We find that a 1% increase in this variable is associated with a 0.63% increase in mobility flows, whereas a 1% increase in the distance between the origin and destination is associated with a 0.70% decrease in mobility flows. Notably, highway accessibility ceases to play a significant role in the case of individuals with urban origins. PV and Wind power do not act as pull or push factors in the case of urban origins, as in the full sample of municipalities. It can be seen in column 2 and 3 that the purely economic coefficients, income per capita and housing rent, are more sizable for the case of immigrants than for natives. Specifically, an increase of income per capita at destination by 1% is associated with a 0.98% increase in immigrant mobility flows from urban origins and with a 0.62% increase in natives mobility flows. For the case of housing rent, we document a negative partial correlation with both immigrant and native mobility, but the magnitudes differ. A 1% increase in housing rent is associated with a 0.58% decrease in immigrant mobility flows and a 0.37% decrease in native mobility flows from urban origins.

This pattern of behavior, where immigrants are more sensitive to purely economic factors than natives, gets progressively inverted when we move from urban to intermediate and rural origins. Table 4 presents the results for the subsample of intermediate (towns and suburbs) municipalities of origin according to the degree of urbanization (DEGURBA) classification. In column 1, we can observe that the estimates for income per capita and housing rent at the destination act as pull and push factors, respectively, as in the full and urban origin samples. However, in this case, natives are more sensitive to these two factors, contrary to what we observed in Table 3. Columns 2 and 3 exploit the heterogeneity between immigrants and natives. A 1% increase in income per capita at the destination is associated with a 0.72% increase in immigrant flows and a 0.98% increase in native mobility flows. Natives of intermediate municipalities of origin are more sensitive to housing rents than immigrants. A 1% increase in housing rent at the destination is associated with a 0.53%

decrease in native mobility flows and a 0.33% decrease in immigrant mobility. Highway accessibility and renewable power do not significantly influence mobility flows from intermediate origins. We also document a reduction in the partial correlation between income per capita at the destination and mobility flows after COVID-19. This reduction is entirely driven by natives, as this partial correlation reduced its magnitude by 14.2% after COVID for the case of natives, whereas for the case of immigrants, the reduction is not significant.

Table 5 presents the results for the subsample of rural origins, which, without distinguishing by the country of origin of individuals, aligns with the previous estimations. However, when we exploit heterogeneity between immigrants and natives, they draw an entirely different picture. Looking at column 2, we see that immigrants from rural origins are no longer responsive to purely economic factors, as the partial correlations between income per capita and housing rent with mobility flows are not significant. We found a significant negative partial correlation between highway accessibility and immigrant mobility flows. Specifically, this semi-elasticity implies that following gained highway access, these municipalities receive approximately 43% fewer immigrants from rural origins. Column 3 shows the estimates for native mobility flows, where we can observe that PV power acts as a pull factor. An increase of 1% PV power at the destination is associated with a 0.29% increase in native mobility flows from rural origins.

Therefore, we document substantial heterogeneity in the role of the determinants of internal mobility by urban-rural and immigrant-native origins. Immigrants and natives follow an opposite pattern in their sensitivity to economic factors. On the one hand, immigrants from urban origins respond greatly to income and housing costs, whereas their homologous from rural origins do not respond significantly to these factors. On the other hand, natives respond to these purely economic factors across all the different degrees of urbanization, but this response is more sizable in the case of natives from rural origins. The mechanisms of these resulting patterns could involve financial constraints, different sectors of specialization between immigrants or natives and divergent behavioral characteristics in the case of immigrants from rural origins.

We also show that highway accessibility plays no significant role in determining mobility flows for urban environments. However, for the case of rural municipalities of origin it is associated with a sizable in immigrant mobility flows. Another worth-noting result of the paper is that photovoltaic capacity acts as a pull factor for natives from rural origins.

Finally, our results show a reduction in the partial correlations between purely economic determinants and mobility flows after the COVID-19 pandemic in the long run. This is in line with a growing body of evidence suggesting that structural changes have led to an increase in the preference for amenities at the expense of pecuniary conditions. Therefore, this has lead to a weakening in the role of income and housing differentials in shaping the choice of location (Delventhal et al., 2022; Ramani & Bloom, 2021).

Table 2: PPML Gravity Model – Full Sample

	Dependent variable		
	All	Immigrants	Natives
Income	0.733***	0.797***	0.782***
	(0.0404)	(0.0761)	(0.0459)
Distance	−0.780***	−0.752***	−0.796***
	(0.00519)	(0.00585)	(0.00557)
Highway Access	−0.0633*	−0.176**	−0.0321
	(0.0346)	(0.0706)	(0.0387)
PV Power	−0.00257	−0.0135	−0.0107
	(0.0324)	(0.0581)	(0.0397)
Wind Power	−0.0200	−0.0360	−0.0154
	(0.0140)	(0.0317)	(0.0153)
Rent	−0.422***	−0.389***	−0.478***
	(0.0234)	(0.0462)	(0.0264)
Income COVID	−0.165***	−0.0494***	−0.177***
	(0.00946)	(0.0172)	(0.0107)
Origin × Year FE	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	234,886,735	124,732,643	225,197,395
Pseudo R^2	0.510	0.486	0.501

Standard errors in parentheses

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

Table 3: PPML Gravity Model – Urban Origins

	Dependent variable		
	All	Immigrants	Natives
Income	0.633***	0.976***	0.617***
	(0.0558)	(0.103)	(0.0630)
Distance	−0.697***	−0.662***	−0.724***
	(0.00793)	(0.00876)	(0.00859)
Highway Access	−0.0678	−0.159	−0.0417
	(0.0460)	(0.0973)	(0.0508)
PV Power	−0.0192	−0.0177	−0.0421
	(0.0418)	(0.0765)	(0.0528)
Wind Power	−0.0292	−0.0486	−0.0220
	(0.0190)	(0.0406)	(0.0204)
Rent	−0.360***	−0.580***	−0.371***
	(0.0320)	(0.0652)	(0.0356)
Income COVID	−0.143***	−0.0653***	−0.167***
	(0.0133)	(0.0238)	(0.0150)
Origin × Year FE	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	9,050,429	6,984,475	8,935,156
Pseudo R^2	0.483	0.492	0.471

Standard errors in parentheses

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

Table 4: PPML Gravity Model – Intermediate Origins

	Dependent variable		
	All	Immigrants	Natives
Income	0.850***	0.715***	0.978***
	(0.0681)	(0.127)	(0.0785)
Distance	−0.724***	−0.766***	−0.727***
	(0.00642)	(0.00717)	(0.00692)
Highway Access	−0.0544	−0.0615	−0.0528
	(0.0600)	(0.120)	(0.0682)
PV Power	−0.0720	−0.0737	−0.0773
	(0.0557)	(0.100)	(0.0676)
Wind Power	−0.0192	0.0121	−0.0252
	(0.0231)	(0.0566)	(0.0258)
Rent	−0.452***	−0.325***	−0.531***
	(0.0403)	(0.0757)	(0.0461)
Income COVID	−0.137***	−0.0329	−0.142***
	(0.0156)	(0.0280)	(0.0179)
Origin × Year FE	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	37,175,073	26,600,751	36,094,562
Pseudo R^2	0.398	0.375	0.387

Standard errors in parentheses

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

Note: Observation counts differ due to PPML separation with high-dimensional fixed effects.

Table 5: PPML Gravity Model – Rural Origins

	Dependent variable		
	All	Immigrants	Natives
Income	0.690***	0.351	0.763***
	(0.108)	(0.223)	(0.122)
Distance	-1.099***	-1.028***	-1.122***
	(0.00760)	(0.0104)	(0.00842)
Highway Access	-0.0803	-0.570***	0.0432
	(0.0959)	(0.196)	(0.108)
PV Power	0.270***	0.194	0.290***
	(0.0931)	(0.181)	(0.109)
Wind Power	0.0104	-0.136	0.0319
	(0.0401)	(0.0939)	(0.0429)
Rent	-0.472***	-0.0163	-0.601***
	(0.0627)	(0.123)	(0.0714)
Income COVID	-0.212***	-0.0669	-0.179***
	(0.0233)	(0.0483)	(0.0261)
Origin × Year FE	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	160,224,989	57,218,008	145,833,779
Pseudo R^2	0.348	0.264	0.349

Standard errors in parentheses

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

Note: Observation counts differ across columns due to PPML estimation with group-specific flows and high-dimensional fixed effects.

6 Discussion of potential mechanisms

In this section, we discuss the potential mechanisms that could underlie the partial correlations documented in the results section. Because we employed a gravity framework approach, the estimates should not be considered causal effects. Thus, we initiate a discussion on the economic interpretations of the observed patterns that align with existing theoretical and empirical frameworks.

In all specifications except for immigrants from rural origins, we find that income per capita at the destination acts as a robust pull factor for mobility, whereas housing rent plays a significant role as a push component. This result aligns with most canonical immigration models, in which individuals choose their location by comparing expected earnings and local living expenses (Sjaastad, 1962; Greenwood, 1997; Glaeser & Gottlieb, 2009). In this conceptual framework, higher expected destination incomes lead to increasing returns of migration, whereas higher housing rents increase living costs at the destination, thus acting as a deterrent to mobility.

The heterogeneity of the findings suggests that the trade-off between expected earnings and living costs differs across immigrants and natives or urban and rural contexts. When they come from urban origins, immigrants tend to be more responsive to income differentials and housing rents than their native counterparts. This is in line with the literature suggesting that immigrants choices of location are more affected by labor market opportunities and short-run economic outcomes (Borjas, 2001; Monras, 2015; Cadena Kovak, 2016). Moreover, lower rates of ownership and credit constraints among immigrants could further increase their response to housing rent (Painter et al., 2001; Munch et al., 2006).

On the other hand, natives could be putting more weight on amenities or other non-pecuniary components such as family ties or local social capital, which would reduce their sensitivity to income and housing cost differentials, especially in urban contexts (Dahl and Sorenson, 2010; Moretti, 2011; Chetty et al., 2018).

We observe that this pattern of responsiveness gradually reverses when moving from urban to rural areas. Natives from less urbanized areas respond greatly to income and housing rent differentials, as do natives from the same origin type. One possible mechanism could be that this type of mobility among natives is more selective and only takes place when economic incentives are high enough to overcome the higher psychological or social costs of moving (Rodríguez-Pose & Ketterer, 2020). On the other side of the coin, immigrants from rural origins could have stronger attachment to local labor markets (primary sector) and fewer outside options, which reduces their sensitivity to economic outcomes at the destination (Collantes et al., 2014).

One striking finding of our study is the negative partial correlation between highway accessibility and mobility flows for immigrants from rural origins. Although transport infrastructure is normally linked to an increase in economic integration, we propose a mechanism that could explain this negative association.

This negative association can be rationalized through housing markets. Empirical evidence has shown that improvements in transport accessibility are associated with increases in land and housing prices. That is, better accessibility makes these locations more desirable (Baum-Snow & Kahn, 2005; Gibbons & Machin, 2005; Ahlfeldt & Kavetsos, 2014). Especially in settings such as rural areas, where housing supply is limited, the capitalization of infrastructure into housing prices can have substantial implications for housing costs. Therefore, this increase in housing rents can act as a deterrent to mobility flows, particularly affecting lower income groups (Ganong & Shoag, 2017; Molloy et al., 2011). Because immigrants display higher rental rates and are more sensitive to housing rents (Painter et al., 2001), this channel could be especially relevant for them. This conceptual framework is consistent with the negative partial correlation we found.

We found a positive association between photovoltaic (PV) power and mobility flows, acting as a pull factor for native individuals from rural origins. This aligns with evidence suggesting that renewable energy projects are associated with an increase in local employment and municipal revenue, particularly in rural areas with greater land availability (Vona et al., 2019).

Moreover, the deployment of renewable energy has been documented to make certain destinations more attractive (Bayer et al., 2009). The fact that we do not find the same partial correlation with immigrants could reflect differences in occupational sorting as well as a predilection for local public goods (Dustmann & Okatenko, 2014).

7 Conclusions

This study analyzed the determinants of internal mobility in Spain, with special emphasis on urban-rural disparities and behavioral heterogeneity between natives and immigrants. By using microdata from the Estadística de Variaciones Residenciales (EVR), we were able to construct a novel origin-destination matrix of mobility flows. This allowed us to model the patterns of internal mobility flows over the period 2016-2021 in a gravity framework, incorporating a set of drivers consisting of economic outcomes, housing market conditions, infrastructure, and renewable energies.

The results highlight the role of economic factors in shaping internal mobility. We find that income per capita at destination acts as a pull factor, while distance and housing rent prices act as push factors. However, the responsiveness to these determinants is significantly heterogeneous: immigrants are more responsive to these factors when originating from urban areas, but this sensitivity weakens in rural contexts, whereas natives respond to economic drivers across all origins, but with more salient elasticities in rural areas. These findings underscore that internal mobility may reduce or reinforce existing spatial inequalities depending on territorial origin and population group.

The findings of this study on municipal-level dynamics and mobility drivers are policy-relevant on reducing spatial inequalities and reducing rural decline. Reducing spatial inequality and rural decline could require policies oriented toward the expansion of economic opportunities in lagging regions or reducing housing pressures in certain urban areas, having heterogenous effects across different population groups.

This study faces several limitations to be acknowledged. First, the estimates reflect partial correlations rather that causal effects, thus, unobserved time-varying characteristics could still influence the mobility patterns. Second, the specification abstracts from potentially relevant individual-level characteristics other than migrant origin. Third, the analysis period is relatively short, which limits the ability to assess the persistence of the role of the determinants. Future research could incorporate a longer time horizon, exploring other individual-level characteristics such as education or utilizing causal identification strategies to identify the mechanisms behind the results.

Overall, the findings of this study show that mobility is not only shaped by economic drivers, but also by the interaction of these determinants with migrant and territorial origins. Understanding these heterogeneous responses in mobility is key for designing policies directed to a balanced regional development.

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8 Appendix

Figure 6: Spanish Autonomous Communities

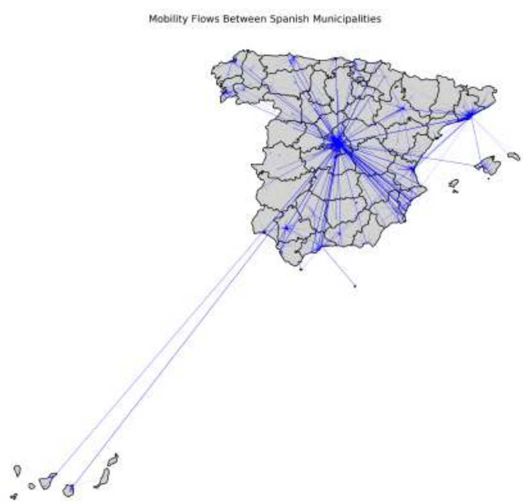

Figure 7: Retirees Mobility Flows

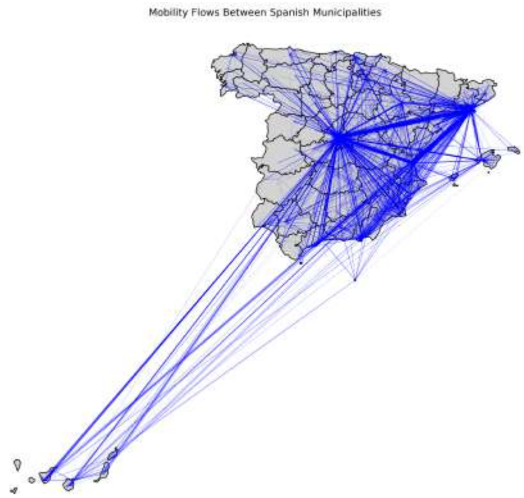

Figure 8: Non-natives Mobility Flows

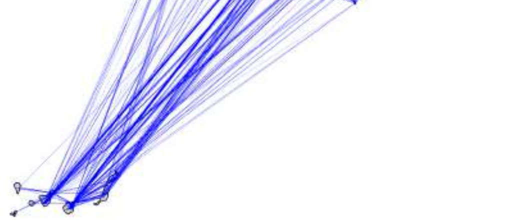

Figure 9: Natives Mobility Flows

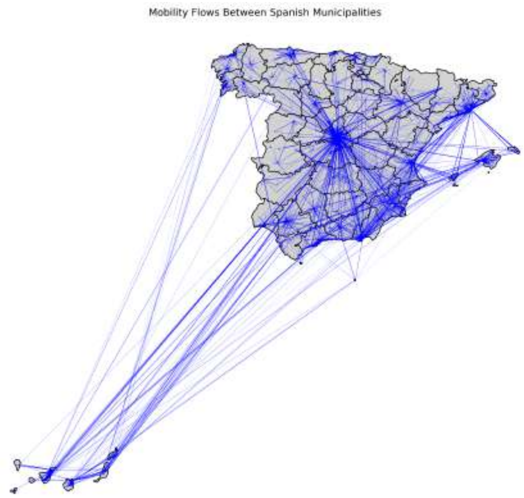

Figure 10: Rural Origin Mobility Flows

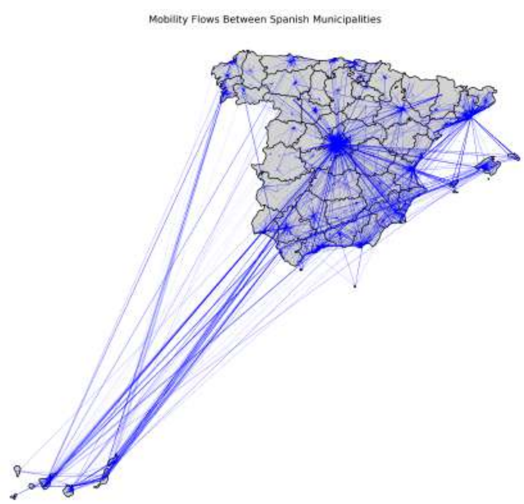

Figure 11: Rural Destination Mobility Flows