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Ensayos sobre el fenómeno de la migración en España

Tesis Doctoral presentada por **Dña. María Gutiérrez Portilla** para obtener el título de Doctor con Mención Internacional.

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Essays on the phenomenon of migration in Spain

Doctoral Thesis presented by **Ms. María Gutiérrez Portilla** to obtain the degree of Doctor of Philosophy with the International Distinction.

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A mis padres

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Introducción

El fenómeno migratorio ha suscitado, desde hace mucho tiempo, gran interés en el ámbito económico y social en buena parte de los países europeos. El caso de España ha sido especialmente relevante en las dos últimas décadas. Entre las razones que pueden explicar este hecho, se ha de destacar la entrada masiva de inmigrantes desde finales de la década de los noventa, debido a lo cual España ha pasado de ser un país cuya población emigraba al extranjero a convertirse en uno de los principales receptores de inmigrantes a nivel mundial (Bover y Velilla, 1999; Carrasco et al., 2008; Reher y Requena, 2009; Reher y Silvestre, 2009; Amuedo-Dorantes y De la Rica, 2010; Hierro y Maza, 2010a; Izquierdo et al., 2016; Duque y Hierro, 2016; Hierro, 2016).

Conscientes de la importancia del estudio de las migraciones en un país como España, debemos tener en cuenta también los efectos a corto y largo plazo en la economía derivados del estallido de la crisis económica global en el año 2008, así como los cambios en los patrones migratorios. De más está decir que se espera que una crisis de esta magnitud altere los flujos de migración a nivel mundial, y por lo tanto, la distribución espacial de la población. Tanto los flujos migratorios internos (dentro de un país) como internacionales (entre países) se ven afectados por cambios en el ciclo económico.

En lo que respecta al escenario de la migración interna en España, éste se ha vuelto más complejo mostrando un marcado punto de inflexión en los años noventa. Hasta la fecha, la literatura sobre sus determinantes no es concluyente. Algunos trabajos ponen de relieve los factores económicos (García-Ferrer, 1980; Santillana, 1981; Bentolila y Dolado, 1991; Antolín y Bover, 1997; Devillanova y García-Fontes, 2004; Mulhern y Watson, 2009, 2010), mientras que otros apuntan hacia el creciente papel de las 'amenities' como determinantes cruciales de la migración interna (Ródenas, 1994; De la Fuente, 1999; Lago y Aguayo, 2004; Maza y Villaverde, 2004).

Asimismo, dada la gran proporción de inmigrantes que han llegado a España desde finales de la década de los noventa (Reher y Requena, 2009; Reher y Silvestre, 2009; Amuedo-Dorantes y De la Rica, 2010; Hierro, 2016) y dado que los extranjeros tienden a ser más propensos a mudarse que los nativos (Recaño, 2002; Recaño y Roig, 2006; Reher y Silvestre, 2009; Hierro y Maza, 2010b), los patrones y la composición de la migración interna en España han experimentado cambios significativos durante la última década. En este sentido, otro aspecto crucial que no ha sido abordado en la literatura sobre migración interna en España es la distinción entre población extranjera y nativa. Sólo unos pocos estudios basados en la movilidad del colectivo extranjero han subrayado la importancia de comprender sus diferentes motivaciones con respecto a los nativos (Recaño y Roig, 2006; Reher y Silvestre, 2009; Maza et al., 2013). Además, como se ha mencionado anteriormente, las consecuencias de la crisis económica han sido especialmente pronunciadas en España. Nuestra economía ha sufrido bruscos incrementos en las tasas de desempleo provinciales y se ha producido una reducción en los salarios y una ralentización, o incluso descenso, en la productividad de todas las provincias. Por lo tanto, parece obligado conocer cómo la crisis económica ha afectado a ambos grupos de población a la hora de desplazarse internamente entre las provincias españolas con el objetivo de diseñar recomendaciones de política económica eficaces.

Centrándonos ahora en la migración internacional, la fuerte inmigración en España ha generado preocupación sobre el impacto negativo que pudiera tener en las oportunidades laborales y en particular, en los salarios. Por consiguiente, un gran número de estudios, principalmente para Estados Unidos, se han centrado en investigar el impacto de la inmigración sobre los salarios. Sin embargo, hasta donde sabemos, sólo existen dos trabajos que abordan este tema en España (Carrasco et al., 2008; González y Ortega, 2011). Esta preocupación social se ha visto agravada, en cierta medida, a raíz de la Gran Recesión. A este respecto, esta crisis sin precedentes ha coincidido con el final de un largo periodo de migración internacional hacia España dando lugar a una nueva era de emigración (Izquierdo et al., 2016).

En este contexto, el objetivo de la presente Tesis Doctoral es analizar diferentes aspectos del fenómeno de la migración en España. Este trabajo se estructura en cuatro capítulos, independientes pero relacionados.

El Capítulo 1 analiza los patrones migratorios de la población extranjera y nativa entre las provincias españolas para determinar en qué medida difieren entre sí. Una de las principales hipótesis que se plantea es si los factores laborales juegan un papel más importante para explicar los flujos de migración interna entre los extranjeros con respecto a los nativos. Por otro lado, este capítulo investiga cómo el estallido de la crisis económica ha modificado la decisión de emigrar. Se utilizan técnicas de regresión basadas en thresholds para identificar de forma endógena thresholds en la variable salario esperado.

Para completar el estudio anterior, el Capítulo 2 profundiza en los factores explicativos de la movilidad interna en España pero, esta vez, la estrategia econométrica empleada tiene en cuenta la influencia de destinos alternativos sobre las tasas bilaterales de migración, lo que se conoce como 'multilateral resistance to migration' (Bertoli y Fernández-Huertas Moraga, 2013). Para ello, se incluyen diferentes estructuras de efectos fijos, tanto monódicos como diádicos. Este es el primer trabajo que, además de controlar por el concepto de 'multilateral resistance', permite no linealidades en los salarios y el desempleo, dos determinantes económicos claves en la migración.

El Capítulo 3 se centra en analizar la relación entre inmigración y salarios. A pesar de ser un tema que genera inquietud a raíz de la crisis, no ha sido investigado en profundidad. Este trabajo contribuye a la literatura examinando el impacto de la inmigración sobre los salarios en las provincias españolas. Para ello, se emplean técnicas de econometría espacial. Se presta atención a la potencial dependencia espacial en el modelo propuesto para detectar si existen spillovers espaciales en la determinación de los salarios. La omisión de dependencia espacial puede ocasionar graves problemas econométricos en la estimación como estimaciones sesgadas, inconsistentes o ineficientes, así como inferencia imprecisa (Anselin, 1988; LeSage y Pace, 2009).

En el último capítulo se presenta un análisis de los factores explicativos del proceso de emigración de la población nativa desde España hacia países europeos durante la Gran Recesión y el período inmediatamente siguiente. El agravamiento de la situación socio-económica y en particular, el alto desempleo a raíz de la crisis económica provocó que muchos nativos decidieran abandonar España. Este estudio adopta un enfoque espacial, el cual permite detectar la existencia de efectos spillover en los determinantes de la migración de los nativos en edad de trabajar. También se desagrega este grupo de población entre jóvenes y adultos.

Diferentes versiones de los cuatro capítulos se han presentado en diversos congresos y seminarios especializados tanto nacionales como internacionales. Asimismo, los resultados obtenidos en esta Tesis Doctoral han sido publicados o se encuentran en proceso de revisión en diferentes revistas académicas, todas ellas de impacto *JCR*. En concreto, los Capítulos 1 y 3 han sido publicados (en colaboración) en *The Annals of Regional Science* y *Regional Studies*, respectivamente, mientras que los Capítulos 2 y 4 se encuentran bajo revisión.

Introduction

Introduction

The phenomenon of migration has long been an economic and social issue of interest for many European countries. The case of Spain has been especially relevant over the last two decades. Among the different reasons that can explain it, one of the most prominent is the fact that, since the end of the nineties, this country has undergone a massive arrival of foreign migrants, it turning from being a country whose people emigrated abroad into one of the highest recipients of immigrants across the globe (Bover and Velilla, 1999; Carrasco et al., 2008; Reher and Requena, 2009; Reher and Silvestre, 2009; Amuedo-Dorantes and De la Rica, 2010; Hierro and Maza, 2010a; Izquierdo et al., 2016; Duque and Hierro, 2016; Hierro, 2016).

Conscious of the relevance of focusing in a country such as Spain to study migrations, we have to add the short and long-term effects on the economy derived from the eruption of the global economic crisis in the year 2008, as well as the changes in migration patterns. Needless to say that a crisis of this magnitude is expected to alter migration flows all around the world and thus, the spatial distribution of the population. Both internal (within a country) and international (between countries) migratory flows are altered due to changes in the business cycle.

As for the Spanish internal migration scenario, it has become more and more complex, the nineties marking a clear turning point. To date, the existing literature analyzing its determinants is not very conclusive. Some papers emphasize the relevance of economic drivers (García-Ferrer, 1980; Santillana, 1981; Bentolila and Dolado, 1991; Antolín and Bover, 1997; Devillanova and García-Fontes, 2004; Mulhern and Watson, 2009, 2010) while others point to the increasing role of amenities as critical determinants of internal migration (Ródenas, 1994; De la Fuente, 1999; Lago and Aguayo, 2004; Maza and Villaverde, 2004).

Additionally, given the large proportions of immigrants coming to Spain since the end of the nineties (Reher and Requena, 2009; Reher and Silvestre, 2009; Amuedo-Dorantes and De la Rica, 2010; Hierro, 2016) and due to the fact that foreigners tend to be more prone to move out than natives (Recaño, 2002; Recaño and Roig, 2006; Reher and Silvestre, 2009; Hierro and Maza, 2010b), the patterns and composition of internal migration in Spain have experienced significant changes over the last decade. In this vein, another crucial aspect that has been disregarded by the literature on internal migration in Spain is the distinction between the native and foreign population. Only a few existing analyses based on the mobility of foreigners highlight the importance of understanding their different motivations with respect to natives (Recaño and Roig, 2006; Reher and Silvestre, 2009; Maza et al., 2013). Besides, as pointed out before, the consequences of the economic crisis have been particularly salient in Spain. Our economy has suffered sharp increases in provincial unemployment rates and there has been a reduction in wages and a slowdown, or even decrease, in productivity in all provinces. So, understanding how the economic crisis has affected both groups of population when migrating internally across Spanish provinces seems mandatory to design some effective policy recommendations.

Shifting the focus now to international migration, large-scale immigration to Spain has raised concerns about the negative impact that it could have on labor market opportunities and particularly, on wages. Consequently, a large body of literature, mainly for the United States, has been devoted to study the impact of immigration on wages. However, to the best of our knowledge, there are only two papers addressing this issue in Spain (Carrasco et al., 2008; González and Ortega, 2011). This social concern has been fueled, to some extent, by the Great Recession. Along these lines, this unprecedented crisis has also coincided with the end of a long period of international migration to Spain, giving rise to a new era of emigration (Izquierdo et al., 2016).

In this context, the objective of this Doctoral Thesis is to analyze different aspects of the phenomenon of migration in the country of Spain. It is structured in four independent but connected chapters.

In Chapter 1, migration patterns of foreigners and natives across the Spanish provinces are analyzed to assess in how far they differ from each other. One of the main hypothesis to be tested is whether labor factors play a higher role in explaining internal migration flows among the foreign than native population. Besides, this chapter delves into the effect of the eruption of the economic crisis on modifying migrants' decision making. Threshold regression techniques to identify endogenous thresholds in the expected wage variable are employed.

To complement the previous study, Chapter 2 investigates the determinants of internal mobility in Spain but, this time, the econometric strategy controls for the influence of alternative destinations on bilateral migration rates. This concept is known as 'multilateral resistance to migration' (Bertoli and Fernández-Huertas Moraga, 2013). This is done by including different fixed-effects structures, both monadic and dyadic. As far as we know, this is the first paper that, apart from controlling for multilateral resistance, allows for nonlinearities in wages and unemployment, two key economic determinants of migration.

Chapter 3 deals with the immigration-wages nexus. Although it has become an issue of increasing concern as a result of the crisis, it has not yet been analyzed in depth. This chapter contributes to the literature by examining the impact of immigration on wages across Spanish provinces. To address this objective, spatial econometric techniques are employed. We pay attention to the spatial dependence that may exist in the proposed model to detect whether there are spatial spillovers in wage determination. The omission of spatial dependence can lead to serious econometric problems in the estimation such as biased, inconsistent or inefficient estimates as well as inaccurate inferences (Anselin, 1988; LeSage and Pace, 2009).

In the last chapter, the driving factors of the process of out-migration of native population from Spain to European countries during the Great Recession and its aftermath are analyzed. The worsening socio-economic environment and in particular the high unemployment derived from the economic crisis entailed that many natives decided to leave Spain. This study adopts a spatial approach which allows the emergence of spillover effects in the migration determinants of working-age natives. It also disaggregates this group of population into youth and adults.

Different versions of the four chapters have been presented in a variety of national and international conferences and seminars. Besides, the results obtained in this Doctoral Thesis have been published or are under review in different academic journals, all of them with *JCR* impact factor. In particular, Chapters 1 and 3 have been published (in collaboration) in *The Annals of Regional Science* and *Regional Studies*, respectively, while Chapters 2 and 4 are currently under review.

Chapter 1

Foreigners versus natives in Spain: different migration patterns? Any changes in the aftermath of the crisis?

1.1 Introduction

Probably one of the most important processes of social transformation of the Spanish society has been its turn from being a migrant-producing country to being one of the highest migrant-hosting countries across the globe since the end of the nineties (Bover and Velilla, 1999; Carrasco et al., 2008; Reher and Requena, 2009; Reher and Silvestre, 2009; Amuedo-Dorantes and De la Rica, 2010; Hierro and Maza, 2010a; Izquierdo et al., 2016; Duque and Hierro, 2016; Hierro, 2016). As a result, some patterns of the Spanish internal migration scenario have changed. Indeed, the relatively high mobility of immigrants within the country (Recaño, 2002; Recaño and Roig, 2006; Reher and Silvestre, 2009; Hierro and Maza, 2010b), as well as their apparently different motivations (Recaño and Roig, 2006; Reher and Silvestre, 2009; Maza et al., 2013), have added an extra element of complexity to an already quite multifaceted internal migration setting.

These differences between natives and immigrants bring immediately to mind the debate regarding the so-called 'disequilibrium' and 'equilibrium' models of migration. As it is well known, the 'disequilibrium' models view migration as a response to differentials in economic opportunities, amenities playing no role.

These differentials in economic opportunities are often called as non-compensating differentials since they are associated with spatial disequilibrium (Muth, 1971; Greenwood 1975, 1985; Greenwood and Hunt, 2003). In the 'equilibrium' models, however, spatial differences in economic opportunities are seen as compensating differentials for distinct amenity endowments. In this case, amenities are considered crucial determinants of migration (Graves, 1976, 1980, 1983; Roback, 1982; Knapp and Graves, 1989). Recent economic literature has been able to reconcile both approaches and individuals seeking to migrate maximize their utility by taking into account both economic factors and amenities in potential alternative destinations. Evidence from Spain, making no distinction between native and foreign migrants, is not conclusive but tends to support the disequilibrium model. García-Ferrer (1980), Ródenas (1994) and Juárez (2000) point to the importance of wage and employment differentials. Bentolila and Dolado (1991) and Antolín and Bover (1997) include additional controls to assess internal migration determinants, showing the relevance of individual characteristics through their interaction with economic variables. Additional work on this issue suggests that, along with labor factors, housing prices and distance also matter (Devillanova and García-Fontes, 2004; Mulhern and Watson, 2009, 2010). On the contrary, De la Fuente (1999), Lago and Aguayo (2004) and Maza and Villaverde (2004) find that Spanish internal migration is heavily driven by amenities such as climate conditions, giving support to the equilibrium model of migration.[1]

But nowadays, more than ever, the comparison between migration patterns of natives and foreigners seems to be pertinent for two reasons. Firstly because, as consequence of the international migration wave toward Spain, the number of foreigners has increased significantly.[2] Secondly, because foreigners seem to

[1] Regarding international evidence, Biagi et al. (2011) study the differences between long- and short-distance migration across Italian provinces for the years 2001 and 2002, concluding that economic determinants mainly affect long-distance migration, whereas quality of life and amenities are more relevant to explain short distance migration.

[2] According to the Spanish National Statistics Institute (INE), the number of foreigners in the country increased by more than 80% over our sample period 2004-2013 (from 3,034,326 to 5,546,238).

migrate driven by different motivations than natives. As to this last point, our hypothesis here is that labor factors might play a higher role in explaining internal migration flows among the foreign than among the native population. This being so, foreigners' movements would be closer to the postulates of the disequilibrium model than natives' ones.

Therefore, this paper tries to add to the literature by analyzing in how far patterns of internal migration across the Spanish provinces (NUTS-3 level of territorial disaggregation) differ among natives and foreigners (see Figure 1.1 for a provincial map of Spain). To the best of our knowledge, this is the first paper dealing with an issue that turns out to be instrumental when it comes to knowing the whole picture of internal migrations in Spain.[3] An additional contribution of the paper lies in taking the view that the outbreak of the economic crisis has probably affected internal migration movements. To test this premise, the analysis is carried out for what we call the 'pre-crisis' (2004-2007) and 'crisis' periods (2008-2013).

From a methodological point of view, this paper also departs from previous studies in two main points. First, it estimates an extended gravity model[4] by using an origin-destination perspective rather than a single origin —or destination— one. It seems reasonable to assume that the consideration of origin-destination flows can provide more accurate and plausible results. Second, the paper employs threshold regression techniques in order to detect and identify potential nonlinearities regarding the effect of wages on internal migration.[5] To accomplish this goal, and in order to

[3] The work published by Schündeln (2014) addresses the mobility behavior of natives and foreigners in Germany for the period 1996-2003. The author proves that, after taking into account a set of individual characteristics, immigrants are more likely than natives to internally migrate within Germany and that the immigrant population shows higher responsiveness to labor market differentials. These results, however, cannot be generalized to the Spanish case as labor market characteristics differ (Casares and Vázquez, 2016).

[4] We can also find papers making use of extended gravity models in the field of internal migration for countries such as Canada (Foot and Milne, 1984), Unites States (Plane, 1984; Vias, 1998), Mexico (Peeters, 2012; Flores et al., 2013) and Italy (Etzo, 2011).

[5] In line with Basile and Lim (2017), we choose wages as the variable used to detect nonlinearities.

avoid arbitrary cut-off values, we rely on Hansen's (1999) panel threshold models, so threshold levels are endogenously determined.

Figure 1.1 Provincial map of Spain.

Note: regions are represented by bold lines.

Summing up, this paper tries to provide answers to the following questions: Are labor factors, as expected, more important for foreigners than for natives? Do changes in the business cycle modify migrants' decision-making? Is there any nonlinearity in the relationship between migratory flows and wages?

To accomplish this aim, the remainder of the paper is organized as follows. Section 1.2 takes a descriptive overview at internal migrations in Spain. In Section 1.3, the paper proceeds with a succinct theoretical framework to justify the variables selected in the specification of the augmented gravity model. Section 1.4 specifies and presents the results of the extended gravity model, once the thresholds for the expected wages have been endogenously estimated, for both foreigners and natives. Finally, the main conclusions of the paper are summarized in Section 1.5.

1.2 Internal migration in Spain: an overview

Over the last few decades, internal migration patterns have changed markedly in Spain. Tracing back to the sixties, Spanish interprovincial mobility was high and predominantly unidirectional, mainly involving long-distance movements from poor to rich provinces in a context of very polarized industrial growth and strong unemployment and income differentials between provinces (Bover and Velilla, 1999; García-Coll and Stillwell, 1999; García-Greciano, 2000).

Following the economic crisis spurred by the first oil price shock in the 1970s, and in response to the process of industrial restructuring in traditional sectors, inter-regional migration fell in Spain despite large and widening regional unemployment differentials (Bentolila, 1997; De La Fuente, 1999; García-Coll and Stillwell, 1999; García-Greciano, 2000; Ahn et al., 2002; Ródenas and Martí, 2005).

In the mid-eighties, the previous trend of 'poor to rich' migration stopped being dominant as a result of a new phenomenon of 'return migration' in Spain. Despite the persistence of regional unemployment differences, movements of people from rich to poor provinces started to gain importance (Antolín and Bover, 1997; Bover and Velilla, 1999; García-Coll and Stillwell, 1999; Maza and Villaverde, 2004). An increasing number of people moving internally across Spain started to feel attracted not so much by economic factors but by other ones related to quality of life (Greenwood, 1985; Bentolila, 1997; Bover and Velilla, 1999; De La Fuente, 1999; Maza, 2006).[6] In other words, location-specific amenities began to exert great influence on migrants' decision. Additionally, short-distance movements (intra-regional migration) became increasingly important since mid-eighties, associated with high employment opportunities in the service sector of large cities, in parallel with the upsurge in residential mobility of upper-middle-class urban population to

[6] As suggested by Ródenas (1994), the idea behind this process is known as 'regional equilibrium systems with compensating differences'. It is possible that differences in economic variables (such as wages, unemployment rates or housing prices) are not due to imperfect markets, but instead to some specific factors of each province (such as amenities).

low-density residential suburbs (Bernabé and Albertos, 1986; Raymond and García-Greciano, 1996; Bover and Velilla, 1999; Bover and Arellano, 2002; Ródenas and Martí, 2005). Some direct consequences of these new migration patterns were an overall decrease in net migration rates and pronounced changes in patterns of population redistribution (Bentolila, 1997; Bover and Velilla, 1999; García-Coll and Stillwell, 1999; Ródenas, 1994; Ródenas and Martí, 2005).

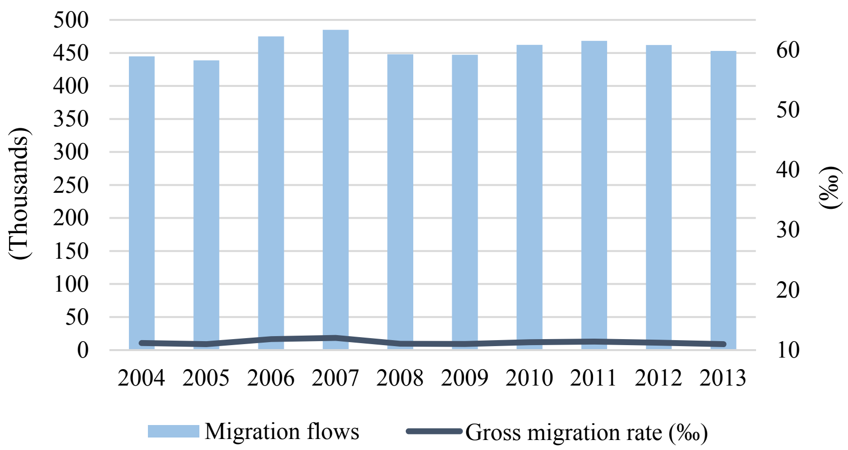
In the late nineties, there was another turning point booming in internal migration: the growing weight of foreigners in internal migration movements coinciding with massive international migration inflows to the country. This circumstance, linked to the high mobility of immigrants within the country and their less job tenure, contributed further to add a lot of extra complexity to the current internal migration scenario (Duque and Hierro, 2016).

Following on from that, it seems pertinent to present some descriptive discussion on the patterns of internal migration of foreigners and natives across Spanish provinces over our sample period. We employ annual migration data classified by province of origin and province of destination coming from the 'Statistic of Residential Variations' provided by INE.[7] Figure 1.2 displays the gross migration rates (‰) for foreigners and natives from 2004 to 2013, computed as the ratio between the sum of internal migratory outflows from all provinces (only considering interprovincial flows) and the corresponding population in Spain (foreign or native, in each case) in the previous year. The most prominent feature is that foreigners are significantly more mobile than natives. This population reached an internal migration rate of 62.45‰ in the year 2004, more than five times that for the native population (11.14‰) in the same year. Apart from that, Figure 1.2 also reveals the uneven evolution of interprovincial migration rates: while in the case of natives, although with some ups and downs, it has remained almost

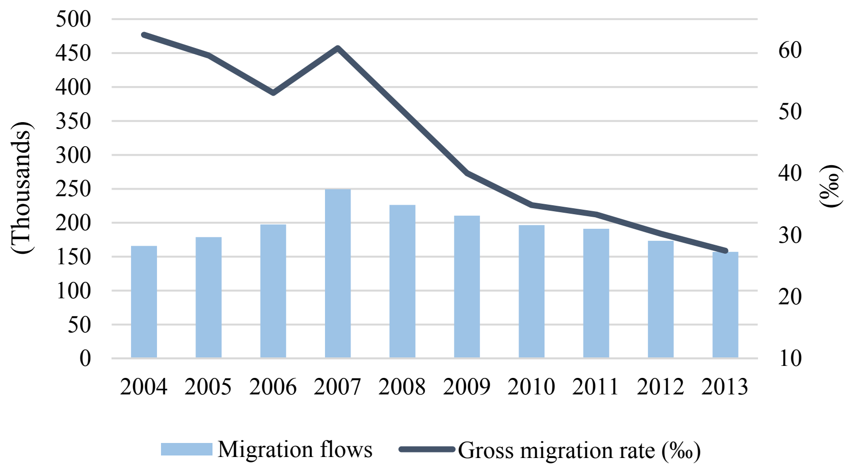
[7] This database is annually elaborated based on the information regarding registrations and cancellations in the Municipal Register due to changes in residence between Spanish municipalities, and it is considered to be the most reliable source of information for the analysis of migration of foreign and native population (Martí and Ródenas, 2004).

unchanged, the internal migration rate for foreigners has decreased to the point of reaching a value of 27.48‰ in 2013. It is also important to note that this decrease has not followed a stable path, being sharper from the year 2007 onwards; as pointed out by Gil-Alonso et al. (2015), two-thirds of the overall decrease in the internal mobility in Spain from 2007 should be attributed to foreigners' downward mobility.

Figure 1.2 Evolution of internal migration rate.



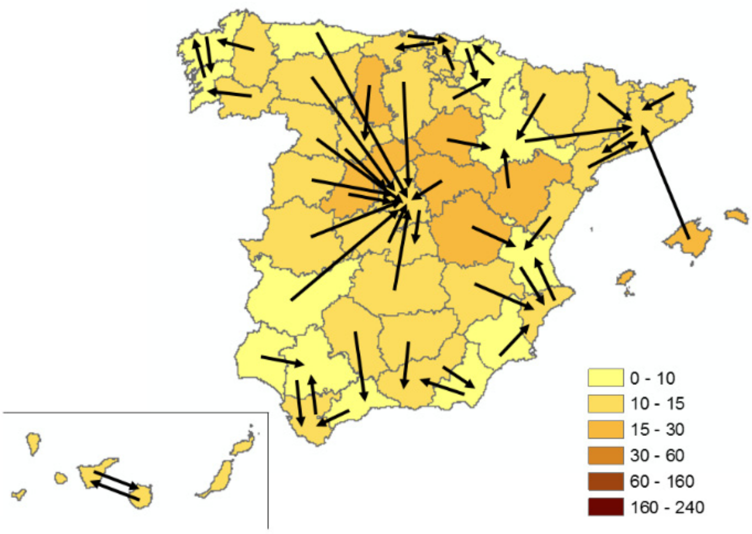
(a) Natives



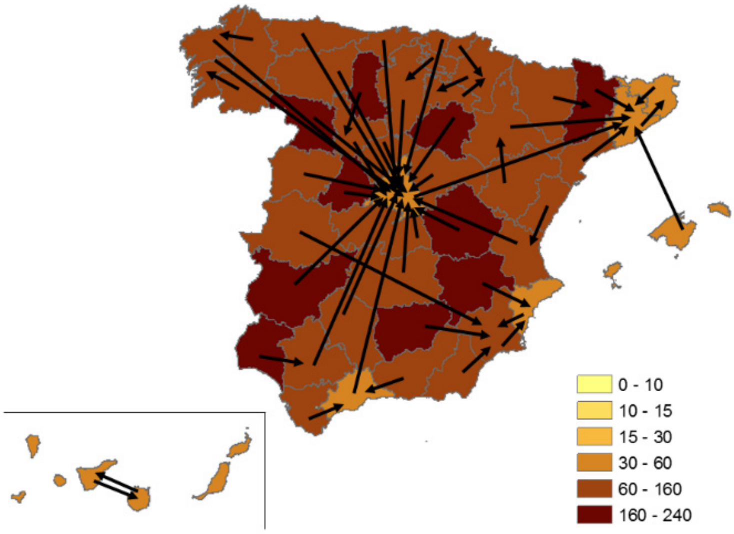
(b) Foreigners

Once the temporal dimension has been covered, it seems pertinent to illustrate where the internal migration flows come from and where they head to. To accomplish this aim, Figures 1.3 and 1.4 display a pair of provincial maps of Spain (for the initial and final years of the sample) showing the (native and foreign) internal gross migration rates for each province. It should be highlighted that the darker the color of a province, the higher the gross internal migration rate of that province. Moreover, the black arrows on the maps indicate the main destination of each of the fifty Spanish provinces, both in the case of natives (a) and foreigners (b); in other words, the province of destination that receives the highest number of migrants.

Figure 1.3 Provincial gross migration rates (‰): year 2004.



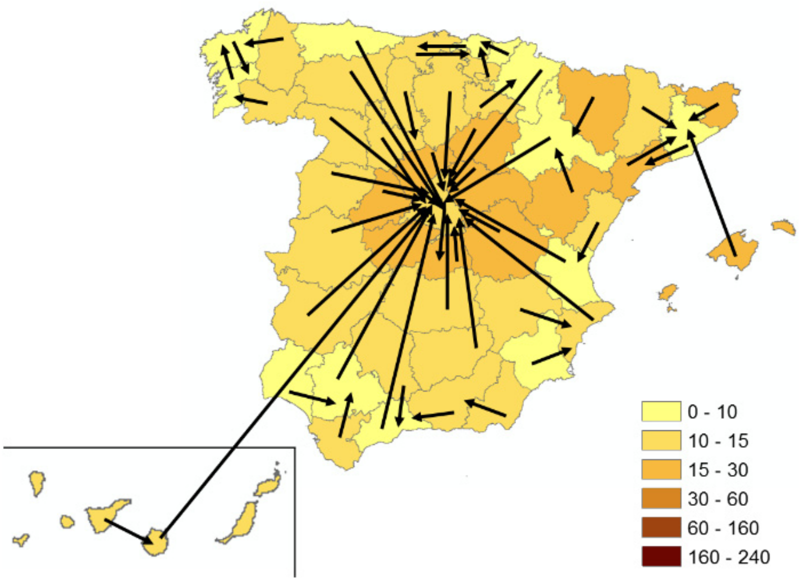
(a) Natives



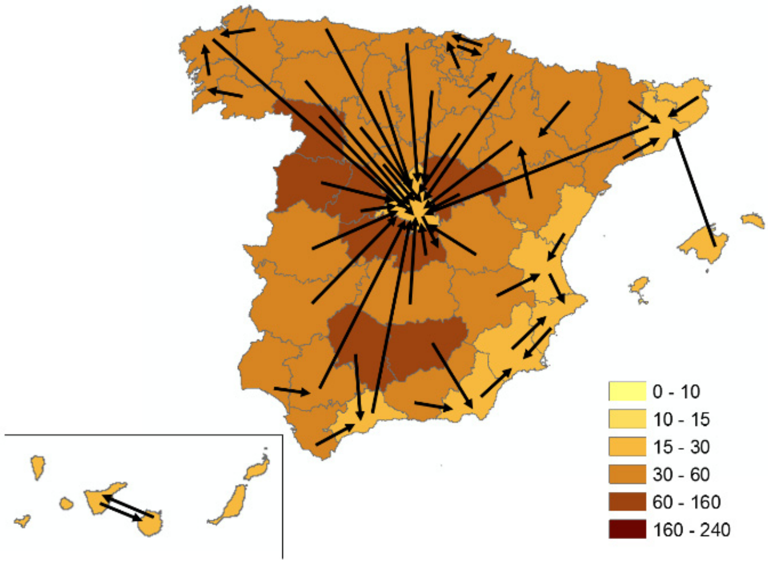
(b) Foreigners

Note: black arrows indicate the main destination of each of the fifty Spanish provinces, in the case of natives (a) and foreigners (b).

Figure 1.4 Provincial gross migration rates (‰): year 2013.



(a) Natives



(b) Foreigners

Note: black arrows indicate the main destination of each of the fifty Spanish provinces, in the case of natives (a) and foreigners (b).

Thus, a cursory glance at Figures 1.3 and 1.4 immediately reveals the following aspects. Firstly, as previously seen, the internal mobility of foreigners across the Spanish provinces is much higher than for natives, regardless of their province of origin. Secondly, the provinces with the highest migration rates tend to be concentrated around Madrid and Barcelona, these areas being characterized by high economic activity (Martori et al., 2016). Besides, on the whole and according to the previous information, it appears that Madrid and, to a much lesser extent, Barcelona are the most preferred provinces of destination, this fact being more evident for foreigners.[8] Additionally, as far as the year 2004 is concerned (Figure 1.3), natives living in North and South provinces, as well as those in Eastern Spain and The Canary Islands, seem to move within the same region (NUTS-2) rather than

[8] Due to their large job markets, *"they provide better expectations regarding future job availability and reemployment probability among the unemployed"* (Ahn et al., 2002, p.8).

choosing to locate in farther away provinces.[9] Instead, only does this happen between Barcelona and its surrounding provinces (Girona, Lleida and Tarragona) and in The Canary Islands for the case of foreigners.

Fully aware of the limited information provided by the descriptive analysis carried out above, it seems necessary to inquiry into the factors that are behind the recent settlement patterns of both, foreigners and natives. That is the aim of the next section.

1.3 Theoretical framework

In this section, we shall establish the theoretical framework to identify the main factors that shape internal migration patterns of foreigners and natives in Spain.[10] To do so, a gravity model is considered as a base model. It should be pointed out that the use of gravity models in the field of international trade dates back from the sixties (Tinbergen, 1962) and continued in force during the early eighties with authors such as Anderson (1979) and Bergstrand (1985). Since then, gravity models have been widely and successfully applied in migration research to integrate the concept of distance into the empirical models. In fact, recently there has been a comeback of this gravity model approach (see, for instance, Head and Mayer, 2014; Ramos, 2016; Poot et al., 2016).

To start, we must consider an economy where individuals are considering whether they will move from one province i to another j on the grounds that their welfare could be higher. Taking the Harris-Todaro specification as a benchmark, as done in Maza and Villaverde (2004), the utility of individuals either staying in province i

[9] This result is in line with the evidence found by Gámez and García-Pérez (2003). They proved that migration in the South of Spain during the period 1979-1997 is mainly due to movements between provinces in this area, although when controlling by distance the principal destinations are Madrid and The Balearic Islands.

[10] An alternative approach to analyze migration based on a random utility maximization model can be seen in Beine et al. (2016), where different dummy variable structures are taken into account. An example of the application of this framework for Ecuador is Royuela and Ordóñez (2016).

or migrating to another j will depend on the expected wage in both provinces (w_i^e and w_j^e, respectively) and the costs associated to the migration decision (c_{ij}).[11] As proposed by Harris and Todaro (1970), expected wages are defined as the product of wages and the probability of being employed, this probability being defined by the unity minus the unemployment rate ($w_{i(j)}^e = w_{i(j)} * (1 - u_{i(j)})$). On the other hand, the migration costs borne by the individual will depend directly on the physical distance between provinces (d_{ij}). In consequence, individuals will decide to migrate from a province *i* to another *j* based on the following cost-benefit relation:

$$w_j^e - w_i^e \geq c_{ij}(d_{ij}) \tag{1.1}$$

Building on this simple framework, some additional control variables traditionally affecting migration are incorporated into our model. To begin with, the level of human capital in a destination province relative to that in the origin province (hc_{ji}) is included. According to the Neoclassical Microeconomic Theory, migration constitutes a form of investment in human capital, so that workers might feel attracted by provinces with higher levels of human capital. This is because, as indicated by Sjaastad (1962), individuals might benefit from the human capital investment rewarded in terms of the difference in income earned in the place of origin and destination. Additionally, the "Push-pull" Theory of Migration pioneered by Lee (1966) highlights the relevance of housing prices differences (hp_{ji}). It seems clear that low housing prices may provide an additional incentive to migrate (Antolín and Bover, 1997; Bover and Arellano, 2002; Maza and Villaverde, 2004).

Furthermore, the shares of sectors in GDP for a province of destination relative to that in the origin one are included in our model to assess whether native and/or foreign migrants are more attracted by one particular sector or, by contrast, whether

[11] That is to say, we follow a 'human capital investment' theoretical framework for our empirical analysis, assuming that migration is driven by the difference in expected earnings between home and host province, adjusted for the cost of migration (Sjaastad, 1962).

a higher share of a sector in a province discourages them from moving to that location. As it is not possible to include all the sectors (it would cause problems of multicollinearity in the estimate), we include agriculture (agr_{ji}), construction $(const_{ji})$ and services (ser_{ji}), leaving aside the industry sector.

Finally, it is also reasonable to include variables capturing the potential influence of some amenities (or quality of life variables) on migration decision (Greenwood, 1985; Ródenas, 1994; Maza, 2006; Biagi et al., 2011; Rodríguez-Pose and Ketterer, 2012; Buch et al., 2014; Rodríguez-Pose et al., 2015; Dotzel, 2017). For this reason, a variable of climate condition differences $(clim_{ji,t-1})$ is also entered into the model as a proxy of amenities. The justification of that variable seems straightforward: to capture the widespread preference for mild temperature and pleasant climate rather than extreme climate conditions.

Bearing all these considerations in mind, the gross migratory rate between pairs of provinces (m_{ij}) can be expressed as follows:

$$m_{ij,t} = \beta\, w^{e}_{ji,t-1} + \delta_1\, hc_{ji,t-1} + \delta_2\, hp_{ji,t-1} + \delta_3\, agr_{ji,t-1} + \delta_4\, const_{ji,t-1} + \delta_5\, ser_{ji,t-1} + \delta_6\, clim_{ji,t-1} + \delta_7\, d_{ij} + \varepsilon_{ij,t} \qquad (1.2)$$

where i, j and t stand for province of origin, province of destination and year, respectively. Our dependent variable (i.e., the gross migration rate (‰) between pairs of provinces ($m_{ij,t}$)) is defined as the ratio between internal migratory flows (only considering interprovincial flows) and the corresponding population (foreign or native, in each case) of the province of origin in the previous year. In any case, for precise definitions and sources of each variable see Table 1.1. For additional information, namely the descriptive statistics of the variables included in Equation (1.2), see Table 1.2.

Table 1.1 Variables and definitions.

Variable	Definition	Source
Dependent variable		
$m_{ij,t}$	Gross migration rate (‰) between pairs of provinces: the ratio between internal migratory flows (taking into account only interprovincial flows) and the corresponding population, foreign or native, in each case, of the province of origin in the previous year	Statistic of Residential Variations, Spanish National Statistics Institute (INE)
Independent variables		
$w^{e}_{ji,t-1}$	Ratio of the expected wages of the province of destination *j* and the province of origin *i*, where the expected wage is defined by multiplying wage by the employment probability (the unity minus the unemployment rate)(1)	INE
$hc_{ji,t-1}$	Ratio of human capital of the province of destination *j* and the province of origin *i*, where human capital is defined as the percentage between the active population with higher education and the total active population	Valencian Institute of Economic Research (IVIE)
$hp_{ji,t-1}$	Ratio of housing prices of the province of destination *j* and the province of origin *i*, where housing prices are expressed in euros per square meter	Ministry of Development
$agr_{ji,t-1}$	Ratio of the share of agriculture in GDP of the province of destination *j* and the province of origin *i*	INE
$const_{ji,t-1}$	Ratio of the share of construction in GDP of the province of destination *j* and the province of origin *i*	INE
$ser_{ji,t-1}$	Ratio of the share of services in GDP of the province of destination *j* and the province of origin *i*	INE

$clim_{ji,t-1}$	Ratio of the index of climate conditions of the province of destination j and the province of origin i, where climate conditions are defined following Boyer and Savageau's (1985) methodology: a score of 1000 points is assigned to each province and subsequently points are subtracted depending on the values of a set of partial indicators: 1. Very hot or very cold months; 2. Seasonal variation in the temperature; 3. Cloudy or overcast days; 4. Days of rain; 5. Extremely high temperatures; 6. Extremely low temperatures(2)	INE
d_{ij}	Distance between pairs of capitals, expressed in thousand road kilometers(3)	Repsol guide(4)
$policy_j$	Dummy variable: 1 in the year 2012 in the provinces of destination belonging to the regions that restricted the public health care to undocumented immigrants	Own construction

Notes: the Consumer Price Index in base year 2011 is used to deflate the nominal variables. (1) As it is frequent in the literature (Redding and Venables, 2004; Brakman et al., 2009; Bruna et al., 2016), we take per capita income as a proxy for wages. (2) When no data of an indicator in a particular province and year are available, data for the closest year available are used. The amount of missing data was in any case not substantial (around 6%). (3) It could also be measured in terms of travel time (Courchene, 1970; Poot et al., 2016; Royuela and Ordóñez, 2016). (4) *http://aim-andalucia.com/distancias.html.*

Before going any further, it is important to clarify two points. First, the independent variables, apart from distance, are expressed as the ratio between the value of the province of destination j and that of origin i, which enables an easier and more logical interpretation of the results.[12] We also take lagged variables, except in the case of the distance and the climate conditions variable for obvious reasons, so as

[12] Although the specification of the gravity model that here we present has been extensively used in the literature of internal migration (see, for instance, Pissarides and McMaster, 1990; Bentolila and Dolado, 1991; Ródenas, 1994; Raymond and García-Greciano, 1996; De La Fuente, 1999; Maza and Villaverde, 2004; Rodríguez-Pose et al., 2015), alternative specifications are of course possible. For instance, by expressing the number of people who migrate as a function of, apart from distance, population and other pull and push factors that are considered separately for origin and destination provinces (Ramos, 2016; Poot et al., 2016; Royuela and Ordóñez, 2016).

to reduce endogeneity problems and to capture the fact that when it comes to moving, migrants take into consideration the value of each variable in the previous period. Second, we will include an additional variable (dummy variable denoted by $policy_j$), but only in the equation for foreigners over the crisis subperiod.[13] In the year 2012 the Spanish government passed a law (RDL 16/2012) restricting the access to health care services for undocumented immigrants (Gallo and Gené-Badía, 2013), but finally only 18 provinces decided to implement the policy; the remaining provinces[14] however, decided to attend, with some restrictions, immigrants. It seems appropriate to address whether that political decision made a difference in terms of attractiveness. To do so, a dummy taken value 1 if the province implemented the law and 0 otherwise is considered, so a negative value is expected, indicating that whenever the province of destination restricts the health service to undocumented migrants, foreigners may choose alternative destinations.

Bearing all these considerations in mind, it is also important to note that Equation (1.2) will be henceforth our benchmark model. In the next section, the model is extended to allow for nonlinearities in the effect of expected wages on migration by the introduction of endogenous thresholds (Hansen, 1999).

[13] We also assessed the possibility of including, for foreigners, another variable regarding migration networks, as there are many studies pointing to their importance and the so-called 'herd effect' (Massey et al., 1993; Bauer et al., 2002; Munshi, 2003; Epstein, 2008; Pedersen et al., 2008; Crescenzi et al., 2017). However, the network effect is really relevant when analyzing international migration rather than internal migration (Curran and Rivero-Fuentes, 2003). In fact, we tested the inclusion of this variable and did not result statistically significant. For this reason, it is not included.

[14] Provinces belonging to the following regions: Catalonia, Galicia, Andalusia, The Basque Country, Asturias, The Canary Islands, Navarre and Castile and León.

Table 1.2 Descriptive statistics of variables.

Variable	Mean	Standard deviation			Min	Max
		Overall	Between	Within		
m ($natives$)	0.261	0.739	0.730	0.117	0	22.023[(1)]
m ($foreigners$)	1.618	3.947	3.550	1.726	0	124.395[(1)]
w^e	1.060	0.368	0.359	0.082	0.342	2.918
hc	1.079	0.436	0.410	0.146	0.248	4.017
hp	1.080	0.439	0.432	0.082	0.298	3.344
agr	2.616	6.930	6.727	1.673	0.005	178.212
$const$	1.029	0.252	0.228	0.109	0.389	2.566
ser	1.011	0.154	0.152	0.02	0.614	1.626
$clim$	1.011	0.151	0.134	0.071	0.581	1.719
d	0.671	0.493	0.493	0	0.047	2.657
$policy$	0.063	0.244	0.086	0.228	0	1

Notes: the independent variables, except for distance and the dummy $policy$, are expressed as the ratio between the specific values of the province of destination and the province of origin. [(1)] The maximum value of the migration rate in the case of natives (22.023) corresponds to migration from Guadalajara to Madrid in the year 2012, while in the case of foreigners (124.395), it corresponds to migration from Ávila to Madrid in 2007.

1.4 Empirical analysis

Here we shall conduct a comparative assessment of the main factors shaping internal migration patterns of natives and foreigners in Spain over the pre-crisis (2004-2007) and crisis (2008-2013) subperiods.[15] As mentioned, our approach relies on an extended gravity model that introduces nonlinearity in the expected wage variable (Basile and Lim, 2017, although using a different approach, also deals with the existence of nonlinearities between wages and internal migration). This is because it would be reasonable to think that markedly beneficial labor

[15] Apart from our interest in analyzing the effects of the economic crisis pointed out in the Introduction, there are also econometric reasons supporting the split of our sample, as the Chow test proves the existence of a structural change in the year 2008.

factors in a province of destination will make this province considerably more attractive for migrants. So, intuitively we are assuming that, when the expected wages in the province of destination are much higher, migrants are much more likely to move to that area. However, if the economic gain is relatively low, they will probably pay more heed to other variables. In consequence, our hypothesis is that there exist some threshold levels in the expected wage variable above which the attitude toward migrating changes.

In order to address this possible nonlinearity, the method of threshold selection (Hansen, 1999) allows us to determine the number of thresholds in the so-called threshold variable (in our case, the expected wage variable) and estimate the threshold parameter(s) (see Appendix 1 for more details). Table 1.3 displays the results for the tests on the number of thresholds proposed by Hansen, namely the tests statistics F_1 and F_2 along with their bootstrap p-values, as well as the estimated thresholds $\hat{\gamma}$, for natives and foreigners and for each subperiod. As can be appreciated, the null hypothesis of no threshold (or linearity hypothesis) in the expected wage variable can be rejected at the 5% significance level, while the presence of one threshold cannot be rejected. This indicates that the correct specification of our model is based on one single threshold. Besides, the estimated thresholds for the group of natives (foreigners) for the pre-crisis and crisis subperiods are 1.258 and 1.298 (1.258 and 1.292), respectively. These values mark a turning point in the intensity of the effect of the expected wages on the internal migration of natives and foreigners.

Accordingly, before carrying out the estimation of our model we have to define two interaction variables to capture the change in the economic behavior that has been endogenously determined. So, dummy variables (D) are constructed gathering those pairs of origin-destination provinces for which the value of the expected wage variable is below/above the estimated threshold ($\hat{\gamma}$). After that, the interaction variables are created as the product between the threshold variable ($w^e_{ji,t-1}$) and these two dummies ($D < \hat{\gamma}$ and $D > \hat{\gamma}$).

Table 1.3 Tests and threshold estimates for $w^{e}_{ji,t-1}$.

	Natives		Foreigners	
	Pre-crisis	Crisis	Pre-crisis	Crisis
Test for single threshold				
F_1	457.569	702.383	473.471	743.400
p-value	0.000	0.000	0.000	0.000
Test for double threshold				
F_2	221.315	226.111	126.529	402.963
p-value	1.000	1.000	1.000	1.000
Threshold estimates				
$\hat{\gamma}$	1.258	1.298	1.258	1.292
95% confidence interval	[1.257,1.280]	[1.271,1.302]	[1.257,1.280]	[1.271,1.302]
Residual sum of squares	2449.318	5150.868	109539.040	52636.451

Notes: p-values are computed from 50 simulations. F_1 denotes the Fisher type statistic associated to the test of the null of no threshold. F_2 corresponds to the test of one threshold against two thresholds. The confidence interval for the threshold parameter corresponds to the no rejection region of confidence level 95% associated to the likelihood ratio statistic for test on the values of the threshold parameter (Hansen, 1999).

Accordingly, the model to be estimated is specified as follows:

$$m_{ij,t} = \beta_1\, w^{e}_{ji,t-1} * (D < \hat{\gamma}) + \beta_2\, w^{e}_{ji,t-1} * (D > \hat{\gamma}) + \delta_1\, hc_{ji,t-1} + \delta_2\, hp_{ji,t-1} + \delta_3\, agr_{ji,t-1} + \delta_4\, const_{ji,t-1} + \delta_5\, ser_{ji,t-1} + \delta_6\, clim_{ji,t-1} + \delta_7\, d_{ij} + \alpha_i + \alpha_j + \varepsilon_{ij,t} \quad (1.3)$$

By comparing Equations (1.2) and (1.3), apart from the interaction variables, there is another point that has to be highlighted. According to the Hausman test (results available upon request), we have included in Equation (1.3) fixed effects by province of origin (α_i) and destination (α_j) to account for time-invariant unobserved heterogeneity and to remove the effect of omitted variable bias (Ruiz and Vilarrubia, 2007; Bell and Jones, 2015).[16] They comprehend specific behaviors

[16] The inclusion of fixed effects of origin and destination already accounts for the multilateral resistance to migration when the database has not the appropriate longitudinal dimension to apply the Common Correlated Effects estimator (Bertoli and Fernández-Huertas Moraga, 2013; Ramos, 2016; Ramos and Suriñach, 2016).

not collected in the specification of the model and associated to social, political and institutional factors which might affect interprovincial migration in Spain.

The estimation of Equation (1.3) is carried out by Generalized Least Squares (GLS), as the Breusch-Pagan test pointed to the presence of heteroscedasticity, being the results reported in Table 1.4. The coefficients linked to the interaction variables for expected wages below and above the threshold are significant and show positive signs, for natives and foreigners and over the two subperiods. With respect to intensity and, therefore, our first hypothesis *(are labor factors, as expected, more important for foreigners than for natives?),* it turns out to be supported by our results. The effect of expected wages on migration is higher for foreigners than for natives, this being especially so before the outbreak of the crisis.

The previous finding gives support, indirectly, to our second hypothesis *(do changes in the business cycle modify migrants' decision-making?)* as, at least with regard to the expected wage variable, it reveals the existence of a significant change in the migration behavior due to the crisis. But not only this, there are additional results which tend to confirm that the economic crisis has altered the decision-making process of both groups of population. First, with regard to the sectoral structure. The general conclusion is that the service sector is the one drawing more people, which is in agreement with the evidence found in Bover and Arellano (2002) and Paluzie et al. (2009), but our findings also reveal that, in the case of natives, the service sector tends to attract more migrants during the crisis period; this result seems to support the idea that this sector is shelter in crisis situations given the lack of opportunities in other sectors such as construction. Regarding the shares of agriculture and construction, their coefficients only result statistically significant before the crisis; the construction sector seems to slightly encourage natives' mobility while it deters migration among the foreign population. Second, as for amenities. Both groups of population seem to be attracted by good weather conditions although, in the case of foreigners, the results indicate that amenities lose importance in a context of crisis. Third, as regards the distance variable. It provides the expected negative result, in line with evidence from Spain found by Santillana

(1981), Ródenas (1994), Recaño and Roig (2006), Martínez-Torres (2007) and Mulhern and Watson (2009), but its deterrent effect decreases during the crisis among the foreign population.

Table 1.4 Determinants of internal migration of natives and foreigners (Equation 1.3).

Dependent variable: $m_{ij,t}$	Natives		Foreigners	
	Pre-crisis	Crisis	Pre-crisis	Crisis
$w^e_{ji,t-1} * (D < \hat{\gamma})$	0.263*** (0.015)	0.261*** (0.013)	0.381*** (0.107)	0.292*** (0.047)
$w^e_{ji,t-1} * (D > \hat{\gamma})$	0.292*** (0.014)	0.314*** (0.012)	0.493*** (0.100)	0.331*** (0.044)
$hc_{ji,t-1}$	0.012*** (0.004)	0.055*** (0.007)	0.183*** (0.036)	0.128*** (0.023)
$hp_{ji,t-1}$	-0.029*** (0.008)	-0.025** (0.010)	0.476*** (0.062)	-0.032 (0.036)
$agr_{ji,t-1}$	0.002*** (0.000)	0.000 (0.000)	0.005*** (0.001)	-0.000 (0.000)
$const_{ji,t-1}$	0.030*** (0.010)	-0.012 (0.008)	-0.214*** (0.071)	0.022 (0.029)
$ser_{ji,t-1}$	0.139*** (0.033)	0.378*** (0.034)	0.583** (0.257)	0.538*** (0.119)
$clim_{ji,t-1}$	0.026** (0.011)	0.029*** (0.011)	0.167** (0.077)	0.081** (0.040)
d_{ij}	-0.653*** (0.006)	-0.707*** (0.006)	-3.095*** (0.045)	-1.596*** (0.023)
$policy_j$				-0.104*** (0.010)
FE_{Madrid} (1)	1.678*** (0.064)	2.041*** (0.045)	16.426*** (0.316)	7.998*** (0.157)
Adjusted R-squared	0.356	0.357	0.437	0.424

Notes: standard error in parenthesis; *** Significant at 1%; ** Significant at 5%; * Significant at 10%. Fixed effects by province of origin and destination are included in all the estimates. Methodology: GLS. (1) For the sake of space, we decide just to show the value for the fixed effect of Madrid as a province of destination with the aim to verify whether it captures all the specific features that make Madrid worth living in, because as seen in Figures 1.3 and 1.4, Madrid turns out to be an outlier.

As for the third hypothesis *(is there any nonlinearity in the relationship between migratory flows and wages?)*, the coefficients linked to the interaction variables for expected wages show the expected results, that is, when the dummy above the threshold is considered, the wages effect on migration is higher; the coefficients below and above the threshold always statistically differ.[17] This confirms that there exists a certain threshold in the expected wages for which different behaviors of both, natives and foreigners, are observed.

Some further comments about other migration determinants are worth mentioning; they provide additional evidence for the existence of different patterns of internal migration between natives and foreigners. On the one side, concerning human capital variable, both natives, but especially foreigners, are found to migrate to provinces with higher levels of human capital. On the other, housing prices coefficients are negative and statistically significant in both equations for natives, in line with the results of other studies (Bover and Arellano, 2002; Maza and Villaverde, 2008). In the case of foreigners, however, it has a positive and significant effect for the pre-crisis period which, in line with the postulates by Cameron and Muellbauer (1998), could be due to the fact that housing prices represented, for them, income expectations which arose in the labor market.

Finally, with respect to the dummy capturing the restriction of the health service for undocumented immigrants in some provinces, its coefficient shows a negative and statistically significant value; this result confirms our suspicion that foreigners will certainly prefer provinces that do not restrict public health care to undocumented migrants.[18] Regarding fixed effects and for the sake of space, simplicity and coherence with the descriptive section that showed the key role played by Madrid as potential destination of migrants, only the fixed effect accounting for this region is reported. The results confirm that both groups of population show a preference

[17] Wald tests for equality of parameters were performed over the coefficients for these interactions variables in the four regressions estimated, their results leading to reject the null hypothesis.

[18] As suggested by De La Fuente (1999), the concept of amenities can be explained not only by climatic factors but also by the availability of basic social services and recreational opportunities.

for Madrid, its positive impact being much higher for the case of the foreign population, especially during the pre-crisis period.[19] A tentative explanation for this result is Madrid's abundance of employment opportunities (Ahn et al., 2002).

1.5 Conclusions

This paper provides new interesting insights, from a comparative perspective, into the factors that shape internal migration flows of natives and foreigners in Spain both before and after the outburst of the economic crisis. To be precise, we try to ascertain the effect of different variables on modeling internal movements, comparing how natives and foreigners respond to them. Apart from that, we try to prove whether there exist some nonlinearities in the relationship between migratory flows and labor factors.

As a starting point, a descriptive overview of the reality of interprovincial migration in Spain reveals that the degree of internal mobility across Spanish provinces is much higher for foreigners than for natives and that the major destination for both groups of population is Madrid.

In the main part of the paper, an extended gravity model of migration (framed within the neoclassical model), combined with a methodology that identifies endogenous thresholds for the expected wage variable, was performed. From the results, we draw a number of interesting conclusions: 1) foreigners show more responsiveness than natives to labor factors, especially before the eruption of the crisis; 2) the economic downturn has affected migrants' decision-making process. Apart from the point just mentioned, the relative size of the service sector and, to a lesser extent, some amenities are gaining importance as attraction factors for natives over the crisis, while the opposite happens for foreigners; and 3) the effect of the

[19] In any case, if we compare the remaining fixed effects by province of destination, it can be seen that the provinces of Barcelona, Valencia and Las Palmas, followed by Tenerife, Murcia and Alicante are more attractive for foreigners, while in the case of natives those are Tenerife and Las Palmas, followed by Barcelona, Alicante and Málaga.

expected wage variable is not linear, both in the pre-crisis and crisis subperiods, as it discloses different effects below and above the estimated threshold. Specifically, above that threshold expected wages have a major impact on the willingness to migrate for both groups of population.

Needless to say that, if our empirical results are corroborated by further studies, so that preferences of migrants to choose destination province differ between natives and foreigners, it seems reasonable to assume that internal migration of foreigners might act, especially when the economic situation is buoyant, as an important mechanism of equilibrium helping to reduce income disparities. To achieve this aim, information channels among foreigners should be improved, as they usually do not have enough information and tend to suffer more restrictions of access to the labor market than natives. If so, they would enjoy equal opportunities in the labor market, and thus, labor mobility would become more effective when it comes to fostering economic convergence.

Chapter 2

Internal migration in Spain: dealing with multilateral resistance and nonlinearities

2.1 Introduction

Identifying the determinants of labor mobility has attracted considerable attention in the field of regional economics for decades. Ravenstein's pioneering work 'The Laws of Migration' (1885) formulated some of the hypotheses on which most of migration research has been based, highlighting the role played by economic factors as major causes of migration. The neoclassical migration theory (Lewis, 1954), which regards internal labor migration as a part of economic development, focused on wage differentials as the main reason for migration. Subsequently, Todaro (1969) extended this model to account for the fact that migrants take the decision to move by choosing the labor market location that maximizes their expected rather than their current earnings.

Later on, two main distinct approaches appeared in the debate on the factors shaping interregional migration flows. On the one hand, the so-called 'disequilibrium' model (Muth, 1971; Greenwood, 1975, 1985), which postulates that migration is simply a response to economic incentives (economic differentials) in labor markets, restoring eventually the equilibrium between them; among the most recent papers in this group, Etzo (2011) and Détang-Dessendre et al. (2016) stand out. On the other hand, an alternative approach, known as 'equilibrium' model of migration, emerged from the works of Graves (1976, 1980, 1983) and Knapp and Graves

(1989). Unlike the previous one, it postulates that differences in economic variables are partially compensated by non-economic factors and, then, keep in time; in other words, it underscores the role of the so-called amenities or local attributes (quality of life factors, such as climate) in shaping migrant's decisions, as they are able to increase their utility. The basic idea of this approach is that *"migration takes place as a result of changes in demand for location-fixed amenities"* (Graves, 1980, p. 227).

Although opposite in nature, both approaches are still relevant and have become complementary over the years. Individuals seeking to migrate maximise their utility by taking into account a set of economic and non-economic factors in potential alternative destinations. In any case, as pointed out by Biagi et al. (2011), there seems to be a consensus in the literature devoted to the European case that, when it comes to internal migration, economic motivations are dominant while amenities seem to play a minor role (see, for instance, Etzo, 2011; Piras, 2012; Détang-Dessendre et al., 2016). In the United States, on the contrary, it seems that internal migration is more amenity-driven (see, for example, Deller et al., 2001; Partridge and Rickman, 2003; Rappaport, 2007; Partridge, 2010).

Against this backdrop, this paper uses the Spanish case as a sort of laboratory to analyze internal migration. There are two main reasons in support of this choice. First, the literature on internal migration focused on this specific case study is not very conclusive. Some papers emphasize the relevance of economic drivers (García-Ferrer, 1980; Santillana, 1981; Bentolila and Dolado, 1991; Antolín and Bover, 1997; Devillanova and García-Fontes, 2004; Mulhern and Watson, 2009, 2010) while others point to the increasing role of amenities as key migration determinants (Ródenas, 1994; De la Fuente, 1999; Lago and Aguayo, 2004; Maza and Villaverde, 2004). Second, the pattern and composition of internal migration in Spain has changed remarkably over the last decade; this is the result of the massive arrival of immigrants since the early 2000s (Reher and Requena, 2009; Reher and Silvestre, 2009; Amuedo-Dorantes and De la Rica, 2010; Hierro, 2016) and the greater mobility of foreigners compared to natives (Recaño, 2002; Recaño and Roig, 2006; Reher and Silvestre, 2009; Hierro and Maza, 2010b).

Accordingly, this paper has two aims: on the one hand, to assess whether economic or quality of life factors are more relevant when shaping internal migration in Spain and, on the other, to unveil whether there are significant differences between natives and foreigners' migration patterns. To do so, it carries out the analysis separately for both groups of population; specifically, the hypothesis to be tested is that natives' preferences are more amenity-based/less economic-oriented than those of foreigners. To the best of our knowledge, there are no previous studies for Spain (and just a few for other countries)[1] carrying out a comparative assessment of internal migration motives between foreigners and natives.

Apart from the above contribution, this study also differs methodologically from others in two respects. First, it relies on an extended gravity model where, to account for the multilateral resistance to migration (i.e. the influence of alternative destinations on bilateral migration rates), different structures of fixed effects (monadic and dyadic) are used. Second, the paper tries to provide new insights into the existence of nonlinearities in the main economic variables explaining migration, and this is done by resorting to panel threshold techniques where the threshold level is endogenously determined (Hansen, 1999). Although here already exists some evidence confirming the existence of nonlinear effects, most of these previous papers tend to select arbitrary or exogenous cut-off values (see, for instance, Burda et al., 1998; Juárez, 2000; Andrienko and Guriev, 2004; or Congregado et al., 2011)

[1] International evidence on the determinants of internal migration comparing natives and foreigners is rather scarce: Schündeln (2014) points to higher responsiveness to labor market differentials in the immigrant than in the native population in Germany. Lamonica and Zagaglia (2013) conclude that economic and demographic factors affect Italians and foreigners differently: first, the demographic situation of the sending regions is proved to be a push factor only for the mobility of the Italian population; and second, while the economic conditions of the sending regions have a much greater impact on the Italians, foreigners are more influenced by better economic conditions in the destination regions. Although dealing with a different topic, Auer et al. (2017) find that migration-related factors such as weaker work values or lower quality of informal networks help to explain the overall disadvantage in unemployment duration of immigrants with respect to Swiss nationals.

instead of endogenous ones.[2] As far as we know, this is the first paper in which, apart from controlling for multilateral resistance, the threshold level for variables affecting migration is endogenously determined.

To accomplish these goals, the sample period spans, for reasons of data availability, from 2004 to 2014. Bilateral origin-destination gross migration flows among Spanish provinces are used in the analysis, our definition of province corresponding to the third level of the Nomenclature of Territorial Units for Statistics (NUTS-3), which encompasses the 50 Spanish provinces.

The remainder of the paper is structured as follows. Section 2.2 presents the variables and data used. Section 2.3 introduces the model specification and discusses the results. Finally, the main conclusions and implications for policy are outlined in Section 2.4.

2.2 Variables and data

As pointed out in the Introduction, on the basis of the pioneering work of Ravenstein (1885) and the neoclassical approach of Todaro (1969) and Harris and Todaro (1970), the decision to migrate is viewed as the outcome of an utility-maximization process of the expected gains from migration. Specifically, individuals choose to stay in location *j* or migrate to location *k* subject to differences in the expected earnings in both locations and the costs associated to migration (Sjaastad, 1962). Subsequently, the neoclassical approach was extended to include additional factors influencing the migration decision: differences in the unemployment rates (Pissarides and McMaster, 1990), amenities (Graves, 1976, 1980, 1983; Knapp and Graves, 1989), and other variables (see below) that can be perceived as push or pull factors (Lee, 1966).

[2] The only exception is the paper by Clemente et al. (2016).

With these considerations in mind, we specify our general model as follows:

$$MIGR_{jkt} = \beta\, \boldsymbol{X}_{kj,t-1} + \alpha_{(k)(j)(t)} + \varepsilon_{jkt} \tag{2.1}$$

where the dependent variable, $MIGR_{jkt}$, refers to the gross migration rate between pairs of provinces *j* and *k* at time *t*, $\boldsymbol{X}_{kj,t-1}$ is a vector of independent variables that is defined in relative terms (ratio destination/origin) —as migrants compare the situation of these variables in the potential destination (*k*) to that in their origin province (*j*)— and also lagged one year (apart from those variables that are time-fixed) to avoid endogeneity problems and to reflect that they normally affect migration in the following period,[3] and finally α —by combining the three data dimensions (origin *j*, destination *k*, and moment in time *t*)— denotes the alternative structures of fixed effects we consider to deal with the "multilateral resistance to migration". This phenomenon, overlooked in most migration studies, is defined as the confounding influence that the attractiveness of alternative destinations exerts on the bilateral migration rate. Its importance has been highlighted by Bertoli and Fernández-Huertas Moraga (2013) who show that multilateral resistance to migration is properly captured with the inclusion of different structures of fixed effects, giving rise to consistent estimates.[4]

Regarding the dependent variable, it refers to annual internal migration by province of origin and destination, for both foreigners[5] and natives, between 2004 and 2014. Internal migration data come from the Statistic of Residential Variations provided by the Spanish National Statistics Institute (INE). This archive consists of official changes of residence between municipalities registered in the Civil Register, and it

[3] In this regard, as indicated by Beine et al. (2016, p. 504), *"controlling for multilateral resistance to migration can make instrumentation unnecessary as long as endogeneity problem is not due to reverse causality, or as long as the resistance terms capture a big part of the omitted factors"*.

[4] Different justifications for the inclusion of these dummies can be found in Beine et al. (2011), Ortega and Peri (2013), McKenzie et al. (2014) and Beine and Parsons (2015).

[5] Foreigners are defined by nationality.

is considered to be the most reliable database on internal migration in Spain (Martí and Ródenas, 2004).

As for the selection of the deterministic factors associated to the utility function of the individual, we rely upon previous empirical studies on migration. Here $\boldsymbol{X}_{kj,t-1} = \begin{bmatrix} WAGE_{kj,t-1}, UR_{kj,t-1}, HOUS_{kj,t-1}, AGR_{kj,t-1}, CONST_{kj,t-1}, \\ SER_{kj,t-1}, DIST_{jk}, CLIM_{kj}, CFI_{kj}, SSI_{kj} \end{bmatrix}$, and some reasons supporting this selection of variables are given in the next paragraphs. Table 2.1 describes all the variables employed in the estimation, their definition and source.

To begin with, it has been proved in the literature that migrants are attracted by labor-market opportunities that maximize their expected wages, choosing areas with higher wages and lower unemployment rates (Mulhern and Watson, 2009, 2010; Etzo, 2011; Maza et al., 2013). We then include wages ($WAGE$) and unemployment rates (UR) as the economic determinants of migration.

Additionally, and as highlighted in the Introduction, amenities or quality of life factors are also considered to be important drivers of migration (Knapp and Graves, 1989; Rappaport, 2007; Partridge, 2010; Rodríguez-Pose and Ketterer, 2012; Krivokapic-Skoko and Collins, 2016). We use three different variables to measure amenities. Firstly, as suggested by Rappaport (2007), people tend to move toward places with nice weather. To reflect it, we use a climatic conditions index ($CLIM$) which penalizes extreme weather conditions in favor of mild climate. Second, based on the quality of the life index computed in Royuela et al. (2003), two variables measuring human-made amenities are taken into account: the cultural facilities index (CFI) and the social services index (SSI).

The accessibility of each destination is usually proxied by the distance from origin to destination, so migrants show less willingness to move as distance ($DIST$) increases (evidence for Spain can be found in Ródenas, 1994; Recaño and Roig, 2006; Mulhern and Watson, 2009, 2010). Furthermore, it is also well accepted that housing prices differentials ($HOUS$) are a major determinant of migration decisions, making people move toward places where these prices are lower (Jackman and Savouri, 1992a,b), so this variable is incorporated into our analysis. Finally, we also control for the sectoral structure of the economy by including the shares of agriculture (AGR), construction ($CONST$) and service (SER) sectors of GDP; we leave the industry sector out of the model to avoid multicollinearity problems. The inclusion of these industry-mix variables allows us to detect the role of each sector in fostering or discouraging migration.

Table 2.1 Variables definitions and sources.

Variable	Definition	Source
Dependent variable		
$MIGR_{jkt}$	Gross migration rate (‰) between pairs of provinces Internal migratory flows (considering only interprovincial flows) divided by the corresponding population, foreign or native, in each case, of the province of origin	Statistic of Residential Variations, Spanish National Statistics Institute (INE)
Independent variables		
$WAGE_{kj,t-1}$	Wage (proxied by per capita income)(1)	INE
$UR_{kj,t-1}$	Unemployment rate	INE
$HOUS_{kj,t-1}$	Housing prices, expressed in euros per square meter	Ministry of Development
$AGR_{kj,t-1}$	Share of the agriculture sector over GDP	INE
$CONST_{kj,t-1}$	Share of the construction sector over GDP	INE
$SER_{kj,t-1}$	Share of the service sector over GDP	INE
$DIST_{jk}$	Distance between pairs of capitals, expressed in thousand road kilometers	Repsol guide: *http://aim-andalucia.com/distancias.html*

$CLIM_{kj}$	Climate Conditions Index[(2)] A score of 1000 points is assigned to each province, and subsequently, points are subtracted depending on the values of a set of partial indicators: 1. Very hot or very cold months; 2. Seasonal variation in the temperature; 3. Cloudy or overcast days; 4. Days of rain; 5. Extremely high temperatures; 6. Extremely low temperatures[(3)]	INE
CFI_{kj}	Cultural Facilities Index[(4)] 0.3*libraries per 1000 inhabitants + 0.4*museums per 1000 old age inhabitants + 0.3*cinemas per 1000 inhabitants	http://directoriobibliotecas.mcu.es http://directoriomuseos.mcu.es http://www.filmaffinity.com/es/theaters.php
SSI_{kj}	Social Services Index[(4)] 0.5*number of old age residences per 1000 old age inhabitants + 0.5*number of old age open-day residences per 1000 old age inhabitants	http://envejecimiento.csic.es/recursos/residencias/por_provincia.html http://envejecimiento.csic.es/recursos/centrosdia/index.htm

Notes: The explanatory variables, except for distance, are defined as the value of the province of destination *k* divided by the value of the province of origin *j*. [(1)] Following Redding and Venables (2004), Brakman et al. (2009) and Bruna et al. (2016) we take per capita income as a proxy for wages. [(2)] We apply Boyer and Savageau's (1985) methodology to define this variable. [(3)] The mean of the monthly data for the longest period available has been considered whenever there is no data for the whole period. [(4)] We follow the work by Royuela et al. (2003), in which the authors compute a composite quality of life index for the area of Barcelona, to create these variables.

2.3 Empirical analysis

After presenting the data and variables employed, this section is aimed at estimating the main factors behind internal movements across Spanish provinces of foreigners and natives. To do so, it specifies the model with different structures of fixed effects (after the methodology to identify endogenous thresholds has been explained) and, then, discusses the results.

2.3.1 Model specification and estimation

Before specifying the different versions of the general model depicted in Equation (2.1), we have to recall that this paper is the first one combining a gravity equation which deals with multilateral resistance to migration with threshold regression techniques to test for the existence of some nonlinearities. We think that this feature cannot be overlooked, as some papers have already reported the existence of thresholds, or nonlinear behaviors, in labor market variables. To address this issue, however, they have mainly used arbitrary or exogenous thresholds (Burda et al., 1998; Andrienko and Guriev, 2004; Juárez, 2000; Congregado et al., 2011), while here we draw upon endogenous methods. Specifically, we follow Hansen (1999), which allows us to test for the existence of one or multiple thresholds in a specific explanatory variable and obtain an endogenous estimation of the threshold parameter(s). In consequence, there are two stages in the estimation procedure: firstly, the threshold parameter estimation; secondly, the gravity model estimation including the thresholds previously obtained.

With regards to the first stage, and as mentioned before, we want to test for nonlinearities in the two key economic variables affecting migration: wages and unemployment rates. To consider both variables at the same time, we built the so-called expected wage variable ($ExpWAGE$) defined as wages multiplied by employment probabilities (1-unemployment rates), as the threshold variable to apply the methodology we explain below. To do so, Equations (2.2) and (2.3) are used.

$$MIGR_{jkt} = \rho_1 ExpWAGE_{kj,t-1} + \theta_2 HOUS_{kj,t-1} + \theta_3 AGR_{kj,t-1} + \theta_4 CONST_{kj,t-1} + \theta_5 SER_{kj,t-1} + \theta_6 DIST_{jk} + \theta_7 CLIM_{kj} + \theta_8 CFI_{kj} + \theta_9 SSI_{kj} + \varepsilon_{1,jkt} \quad if\ ExpWAGE_{kj,t-1} \leq \gamma \tag{2.2a}$$

$$MIGR_{jkt} = \rho_2 ExpWAGE_{kj,t-1} + \theta_2 HOUS_{kj,t-1} + \theta_3 AGR_{kj,t-1} + \theta_4 CONST_{kj,t-1} + \theta_5 SER_{kj,t-1} + \theta_6 DIST_{jk} + \theta_7 CLIM_{kj} + \theta_8 CFI_{kj} + \theta_9 SSI_{kj} + \varepsilon_{2,jkt} \quad if\ ExpWAGE_{kj,t-1} > \gamma \tag{2.2b}$$

$$MIGR_{jkt} = \rho_1 ExpWAGE_{kj,t-1} + \theta_2 HOUS_{kj,t-1} + \theta_3 AGR_{kj,t-1} + \theta_4 CONST_{kj,t-1} + \theta_5 SER_{kj,t-1} + \varepsilon_{1,jkt} \quad if\ ExpWAGE_{kj,t-1} \leq \gamma \qquad (2.3a)$$

$$MIGR_{jkt} = \rho_2 ExpWAGE_{kj,t-1} + \theta_2 HOUS_{kj,t-1} + \theta_3 AGR_{kj,t-1} + \theta_4 CONST_{kj,t-1} + \theta_5 SER_{kj,t-1} + \varepsilon_{2,jkt} \quad if\ ExpWAGE_{kj,t-1} > \gamma \qquad (2.3b)$$

The difference between them is that while Equation (2.2) encompasses all the variables previously defined, Equation (2.3) does not include the time-invariant explanatory variables. We proceed in this way as different structures of fixed effects will then be incorporated, and thus, we seek to be consistent with the specification.[6]

With regards to the threshold methodology,[7] it can be assumed that for a given value of the threshold parameter linked to the expected wages variable (γ), $\hat{\rho}_1(\gamma)$ and $\hat{\rho}_2(\gamma)$ denote the corresponding estimates of the slope coefficients. Then, the most straightforward computing method to estimate the threshold parameter is through concentration. Consequently, the sum of squared errors $S(\gamma)$ conditioned to a value of γ can be expressed as follows:

$$S(\gamma) = \sum_{j=1}^{N} \sum_{k=1}^{N} \sum_{t=1}^{T} \hat{\varepsilon}_{jk,t}^{2}(\gamma) \qquad (2.4)$$

Therefore, the level of the threshold that minimizes $S(\gamma)$ is the consistent estimate of the threshold:

$$\hat{\gamma} = \underset{\gamma}{ArgMin}\, S(\gamma) \qquad (2.5)$$

To avoid that during the minimization process a threshold $\hat{\gamma}$ sorts too few observations into each regime, it is convenient to restrict the search in (2.5) to values of γ so that a minimal percentage of the observations lie on each side of the

[6] To be more precise, the specification of these two equations (required to endogenously estimate the threshold) must be such that, in the subsequent stage, when four different combinations of fixed effects are included, there are no variables that might cause multicollinearity problems.

[7] We are explaining the case of one-single-threshold model. Our results confirm that there is a single threshold.

threshold (Hansen, 1999). So, we use a grid search over the potential values of the threshold variable with a 5% trimming.

Apart from that, we should determine the number of thresholds to specify the correct model. So, the first step consists of testing whether the threshold effect is statistically significant in the one-single-threshold model. In this case, the null hypothesis (H_0: $\rho_1 = \rho_2$), which corresponds to a linear model, could be tested using a standard test. If S_0 denotes the sum of squares of the linear model, the approximate likelihood ratio test of H_0 can be specified as:

$$F_1 = \frac{S_0 - S(\hat{\gamma})}{\hat{\sigma}^2} \tag{2.6}$$

being $\hat{\sigma}^2$ a convergent estimate of σ^2. The main problem here is that the threshold parameter γ is not identified under the null hypothesis of no threshold effect and the asymptotic distribution of F_1 is not standard. To overcome this issue, Hansen (1999) proposes to use bootstrap simulations to compute the p-value of the distribution in the context of panel models and test for the nonlinearity hypothesis. Then, if the p-value associated to F_1 led to rejecting the linear hypothesis, the hypothesis of one threshold against the alternative of two thresholds should be tested, with the likelihood ratio statistic given by:

$$F_2 = \frac{S(\hat{\gamma}) - S(\hat{\gamma}_1, \hat{\gamma}_2)}{\hat{\sigma}^2} \tag{2.7}$$

where obviously $S(\hat{\gamma}_1, \hat{\gamma}_2)$ denotes the corresponding residual sum of squares and $\hat{\gamma}_1$ and $\hat{\gamma}_2$ are the threshold estimates of a double-threshold model. Likewise, if the bootstrap p-value associated to F_2 led to rejecting the null hypothesis of one threshold, we then should discriminate between two and three thresholds and so on. Conversely, if the p-value is such that we cannot reject the null of one threshold, the correct specification is the model with one threshold, as it is our case.

Finally, once threshold estimates are obtained, we have to construct interaction variables with the economic determinants depending on whether the value of the expected wage of each dyad origin-destination lies below or above this estimated threshold. To do so, firstly two dummy variables ($d < \hat{\gamma}$ and $d > \hat{\gamma}$) are defined, which encompass the dyads for which the value of the expected wage is lower or higher than the estimated threshold in each case (Equations 2.2 and 2.3); then, we create the interaction variables as the product between these two dummies and the key economic determinants of our model (wages and unemployment). The resulting variables allow us to capture the magnitude of the change in the behavior (of both natives and foreigners depending on the case) with respect to these factors when migrating internally across Spanish provinces. In other words, the resulting interaction variables, for wages, $WAGE_{kj,t-1}*(d < \hat{\gamma})$ and $WAGE_{kj,t-1}*(d > \hat{\gamma})$ and unemployment, $UR_{kj,t-1}*(d < \hat{\gamma})$ and $UR_{kj,t-1}*(d > \hat{\gamma})$, will identify potential nonlinearities once the value of the threshold in the expected wage variable has been endogenously determined.

With regard to the second step of the estimation process, as previously mentioned, different combinations of fixed effects are included in the final model to account for the multilateral resistance to migration. More specifically, as the data employed has three dimensions (origin, destination and time), four different structures of fixed effects have been considered (models (i) to (iv)). Specifically, for models (i), (iii) and (iv), we draw on the results regarding thresholds obtained in Equation (2.2), and for model (ii), in Equation (2.3).[8]

(i) Model with monadic fixed effects of origin, destination and time:

$$\begin{aligned} MIGR_{jkt} = {} & \beta_1 WAGE_{kj,t-1} * (d < \hat{\gamma}) + \beta_2 WAGE_{kj,t-1} * (d > \hat{\gamma}) + \beta_3 UR_{kj,t-1} * \\ & (d < \hat{\gamma}) + \beta_4 UR_{kj,t-1} * (d > \hat{\gamma}) + \beta_5 HOUS_{kj,t-1} + \beta_6 AGR_{kj,t-1} + \\ & \beta_7 CONST_{kj,t-1} + \beta_8 SER_{kj,t-1} + \beta_9 DIST_{jk} + \beta_{10} CLIM_{kj} + \beta_{11} CFI_{kj} + \\ & \beta_{12} SSI_{kj} + \alpha_j + \alpha_k + \alpha_t + \varepsilon_{jkt} \end{aligned} \tag{2.8}$$

[8] This is so because model (ii) incorporates dyadic fixed effects of origin-destination to control for time-invariant characteristics of each pair of provinces, so it would not be possible to use the results of thresholds obtained in Equation (2.2) as it encompasses all the variables (including the time-invariant ones) and consequently, multicollinearity problems would arise in the estimation.

where α_j and α_k represent provincial fixed effects of origin and destination, respectively. As shown in the literature (Mayda, 2010; Beine and Parsons, 2015; Royuela and Ordóñez, 2016), they allow to control for specific effects of each origin and destination that are not taken into account by deterministic components of utility, either time-invariant origin push (destination pull) factors or time-invariant origin (destination) related costs variables. For instance, these dummies control for specific migration policies (McKenzie et al., 2014; Beine et al., 2016). Besides, temporal fixed effects, denoted by α_t are also included to capture common shocks to all provinces considered in the sample in each year.

(ii) Model with dyadic fixed effects of origin-destination and monadic fixed effects of time:

$$MIGR_{jkt} = \beta_1 WAGE_{kj,t-1} * (d < \hat{\gamma}) + \beta_2 WAGE_{kj,t-1} * (d > \hat{\gamma}) + \beta_3 UR_{kj,t-1} * (d < \hat{\gamma}) + \beta_4 UR_{kj,t-1} * (d > \hat{\gamma}) + \beta_5 HOUS_{kj,t-1} + \beta_6 AGR_{kj,t-1} + \beta_7 CONST_{kj,t-1} + \beta_8 SER_{kj,t-1} + \alpha_{jk} + \alpha_t + \varepsilon_{jkt} \quad (2.9)$$

where, apart from temporal fixed effects, α_{jk} denotes fixed effects for each combination of origin and destination provinces; they are introduced to control for time-invariant features common to each pair of provinces (Mayda, 2010; Ortega and Peri, 2013). Some of the factors that are captured with this dyadic structure include migration networks between pairs of provinces and bilateral migration costs such as distance or culture proximity (Beine et al., 2016). As can be appreciated, in this case we leave out of the equation the variables $DIST_{jk}$, $CLIM_{kj}$, CFI_{kj} and SSI_{kj} since they are constant within province pairs and, consequently, would be perfectly collinear with this structure of fixed effects.

(iii) Model with dyadic fixed effects of origin-time and monadic fixed effects of destination:

$$MIGR_{jkt} = \beta_1 WAGE_{kj,t-1} * (d < \hat{\gamma}) + \beta_2 WAGE_{kj,t-1} * (d > \hat{\gamma}) + \beta_3 UR_{kj,t-1} * (d < \hat{\gamma}) + \beta_4 UR_{kj,t-1} * (d > \hat{\gamma}) + \beta_5 HOUS_{kj,t-1} + \beta_6 AGR_{kj,t-1} + \beta_7 CONST_{kj,t-1} + \beta_8 SER_{kj,t-1} + \beta_9 DIST_{jk} + \beta_{10} CLIM_{kj} + \beta_{11} CFI_{kj} + \beta_{12} SSI_{kj} + \alpha_{jt} + \alpha_k + \varepsilon_{jkt} \quad (2.10)$$

where α_{jt} represents dyadic fixed effects that are specific to each province of origin and each year. They allow us to capture all the push determinants of migration together with the multilateral resistance derived from heterogeneity in migration preferences by origin (Royuela and Ordóñez, 2016). Provincial fixed effects by province of destination (α_k) have also been considered in this equation.

(iv) Model with dyadic fixed effects of destination-time and monadic fixed effects by origin:

$$MIGR_{jkt} = \beta_1 WAGE_{kj,t-1} * (d < \hat{\gamma}) + \beta_2 WAGE_{kj,t-1} * (d > \hat{\gamma}) + \beta_3 UR_{kj,t-1} * (d < \hat{\gamma}) + \beta_4 UR_{kj,t-1} * (d > \hat{\gamma}) + \beta_5 HOUS_{kj,t-1} + \beta_6 AGR_{kj,t-1} + \beta_7 CONST_{kj,t-1} + \beta_8 SER_{kj,t-1} + \beta_9 DIST_{jk} + \beta_{10} CLIM_{kj} + \beta_{11} CFI_{kj} + \beta_{12} SSI_{kj} + \alpha_{kt} + \alpha_j + \varepsilon_{jkt} \quad (2.11)$$

where apart from provincial fixed effects by province of origin (α_j), we also include dyadic fixed effects that are specific to each province of destination and year (α_{kt}). This structure of fixed effects enables us to control for the pull determinants of migration and the multilateral resistance derived from heterogeneity in the expectations about each potential province of destination (Royuela and Ordóñez, 2016).[9]

2.3.2 Results

Table 2.2 presents the results of the tests to determine the number of thresholds (tests statistics F_1 and F_2 and their bootstrap p-values (Hansen, 1999)) for natives

[9] These dummies can also capture migration policies, which are difficult to be considered otherwise (Beine and Parsons, 2015).

and foreigners and for Equations (2.2) and (2.3). As can be seen, the p-values associated to F_1 lead us to reject the null hypothesis of no threshold at the 5% significance level; with respect to the test for double threshold, the null hypothesis of one threshold cannot be rejected. This evidence confirms that we should specify and estimate the one-single-threshold model. As regards the estimated thresholds, Table 2.2 shows that, when all variables are included (Equation 2.2), the estimated thresholds in the expected wage variable for natives and foreigners are 1.473 and 1.594, respectively; in Equation (2.3), the estimated threshold coincides for natives and foreigners, 1.474.

Table 2.2 Tests for threshold effects and threshold estimates: $ExpWAGE_{kj,t-1}$.

	Equation 2.2		Equation 2.3	
	Natives	Foreigners	Natives	Foreigners
Test for single threshold				
F_1	1616.731	1631.049	2230.530	2205.517
p-value	0.000	0.000	0.000	0.000
Test for double threshold				
F_2	410.657	572.886	453.312	658.816
p-value	1.000	1.000	1.000	1.000
Threshold estimates				
$\hat{\gamma}$	1.473	1.594	1.474	1.474
95% confidence interval	[1.472,1.474]	[1.593,1.616]	[1.472,1.474]	[1.472,1.474]
Residual sum of squares	10579.442	223319.306	11550.180	245615.052

Notes: p-values are computed from 50 simulations. F_1 denotes the Fisher type statistic associated to the test of the null of no threshold. F_2 corresponds to the test of one threshold against two thresholds. The confidence interval for the threshold parameter corresponds to the no rejection region of confidence level 95% associated to the likelihood ratio statistic for test on the values of the threshold parameter (Hansen, 1999).

Table 2.3 presents the results of estimating Equations (2.8) to (2.11) for natives and foreigners. The estimation is performed by Generalized Least Squares (GLS) as the Breusch-Pagan test points to the presence of heteroscedasticity.

Table 2.3 Results of Equations (2.8) to (2.11).

	Equation 2.8		Equation 2.9		Equation 2.10		Equation 2.11	
	Natives	Foreigners	Natives	Foreigners	Natives	Foreigners	Natives	Foreigners
$WAGE_{kj,t-1} * (d < \hat{\gamma})$	0.227***	2.215***	0.029***	2.290***	0.437***	2.410***	0.380***	1.591***
	(0.012)	(0.105)	(0.033)	(0.071)	(0.016)	(0.110)	(0.015)	(0.087)
$WAGE_{kj,t-1} * (d > \hat{\gamma})$	0.293***	2.264***	0.033***	2.355***	0.475***	2.411***	0.435***	1.604***
	(0.011)	(0.095)	(0.003)	(0.070)	(0.014)	(0.100)	(0.0.13)	(0.096)
$UR_{kj,t-1} * (d < \hat{\gamma})$	0.021***	-0.102***	-0.001**	-0.123***	0.048***	-0.194***	0.022***	0.059***
	(0.001)	(0.015)	(0.0005)	(0.010)	(0.002)	(0.018)	(0.002)	(0.013)
$UR_{kj,t-1} * (d > \hat{\gamma})$	-0.018*	-0.225***	-0.005***	-0.348***	0.041***	-0.222***	-0.006*	0.167**
	(0.011)	(0.079)	(0.002)	(0.069)	(0.012)	(0.076)	(0.004)	(0.066)
$HOUS_{kj,t-1}$	-0.029***	0.096**	-0.012***	0.486***	-0.039***	0.144***	-0.044***	0.008
	(0.005)	(0.047)	(0.001)	(0.038)	(0.006)	(0.049)	(0.006)	(0.040)
$AGR_{kj,t-1}$	-0.001*	-0.001*	-0.001***	0.004***	-0.0002***	-0.002***	-0.0002***	-0.001*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.0004)	(0.000)	(0.000)
$CONST_{kj,t-1}$	-0.019***	0.238***	-0.009***	0.198***	-0.031***	0.238***	-0.015***	0.041
	(0.004)	(0.036)	(0.001)	(0.023)	(0.005)	(0.041)	(0.005)	(0.038)
$SER_{kj,t-1}$	0.139***	1.561***	-0.043***	1.933***	0.251***	0.950***	0.267***	1.684***
	(0.018)	(0.158)	(0.005)	(0.105)	(0.025)	(0.179)	(0.024)	(0.159)
$DIST_{jk}$	-0.644***	-2.137***	-	-	-0.651***	-1.971***	-0.652***	-1.984***
	(0.004)	(0.027)			(0.004)	(0.027)	(0.004)	(0.025)
$CLIM_{kj}$	0.185***	-0.849*	-	-	0.123**	-0.678	0.084	-0.643*
	(0.057)	(0.483)			(0.059)	(0.455)	(0.057)	(0.344)
CFI_{kj}	0.051***	0.168***	-	-	0.044***	0.200***	0.051***	0.205***
	(0.003)	(0.022)			(0.003)	(0.019)	(0.002)	(0.015)
SSI_{kj}	0.014***	0.203***	-	-	0.021***	0.212***	0.020***	0.180***
	(0.002)	(0.023)			(0.002)	(0.019)	(0.002)	(0.016)
Fixed effects	Origin, destination and time		Origin-destination and time		Origin-time and destination		Destination-time and origin	
Observations/Groups	26950/ 2450		26950/ 2450		26950/ 2450		26950/ 2450	
Adjusted R2	0.357	0.398	0.977	0.821	0.357	0.409	0.360	0.441

Notes: standard error in parenthesis. Significance: *** 1%; ** 5%; * 10%. Methodology: Generalized Least Squares.

To begin with, as regards the economic determinants of internal migration, it can be seen that the relative wage between the provinces of origin and destination shapes internal migration flows. The two associated interaction variables result positive and statistically significant in all equations for both natives and foreigners. As for natives, the interaction variable above the threshold shows a higher coefficient than below it. This nonlinear effect is more evident when controlling for origin, destination and time fixed effects (Equation 2.8), and for destination's specific circumstances (Equation 2.11). Foreigners seem to be more affected than natives by wage differentials between provinces of origin and destination; the coefficients linked to interaction variables below and above the threshold are higher. However, only Equation 2.9 (which controls for time-invariant features common to each pair of provinces) does reflect a nonlinear behavior on the wage variable.[10]

As for unemployment rate, some relevant results arise: firstly, in the case of natives, when above the endogenously estimated threshold, a higher unemployment rate in the province of destination than in the province of origin seems to discourage them from migrating, except when controlling for specific factors in origin (Equation 2.10). On the other hand, below the threshold, that is, when there exist small economic differentials between origin and destination, only the inclusion of features common to each pair of provinces gives rise to a negative and statistically effect of unemployment (Equation 2.9); when other combinations of fixed effects are considered, a rather small, although positive effect is found. Consequently, we can conclude that the effect of unemployment in the group of natives is nonlinear (Juárez, 2000, Clemente et al., 2016). In the case of foreigners, the deterrent effect of higher unemployment rates in the province of destination with respect to the province of origin on internal migration is greater than the effect found for natives, although this does not happen, however, when dyadic fixed effects of destination-

[10] Wald tests for equality of parameters suggest that, in the case of foreigners, the coefficients of the interaction variables below and above the threshold do not statistically differ from each other in Equations (2.8), (2.10) and (2.11).

time are considered (Equation 2.11). For foreigners, as in the case of wages, the parameters below and above the threshold only statistically differ from each other when dyadic fixed effects of origin-destination are taken into account. Thus, the nonlinear behavior of the unemployment for foreigners is not as clear as for natives.

The housing price variable also discloses interesting findings: it shows a negative (positive) and statistically significant coefficient in the case of natives (foreigners), regardless of the structure of fixed effects considered, with the exception of Equation (2.11) for foreigners, which shows a non-significant effect. This implies that natives look for lower housing prices when moving internally across Spanish provinces. This preference for cheaper housing has been reported by previous literature (Berger and Blomquist, 1992; Bover and Arellano, 2002; Maza and Villaverde, 2004). When the foreign population is analyzed, however, two possible explanations could be behind the positive effect: first, as pointed out by Rappaport (2007, p. 377) *"individuals are willing to endure greater crowdedness and the associated higher price of housing in order to directly enjoy higher quality of life and indirectly enjoy higher productivity via the higher wage it affords"*, and, second, it could be due to the fact that foreign population is more likely to rent rather than own a house.

Concerning sectoral structure, the results suggest that, in most cases, a relatively higher share of the agricultural (service) sector in destination with respect to origin hinders (fosters) migration, both for foreigners and natives. This is a rather expected finding due to the greater employment opportunities offered in the service sector when compared with the agriculture one (Bover and Arellano, 2002; Paluzie et al., 2009). Only in Equation (2.9), when controlling for specific characteristics for each pair of origin-destination provinces, agriculture (services) shows a positive (negative) and statistically significant coefficient for foreigners (natives). As for construction, it exhibits huge differences between foreigners and natives (Fromentin, 2016); more specifically, it slightly discourages migration for natives whereas it reveals a positive impact in the migration process for foreigners.

With regard to distance variable, which represents the main costs associated to the migration decision, it is shown that it has the expected negative sign, in line with previous evidence (Ródenas, 1994; Recaño and Roig, 2006; Mulhern and Watson, 2009, 2010). Generally speaking, the dissuasive effect of distance is greater for foreigners than natives; this difference becomes especially high after controlling for specific effects of each origin and destination (Equation 2.8).

Finally, as for amenities or quality of life factors, several features are worth being highlighted. First, more pleasant climatic conditions in the province of destination than in origin seem to be a pull factor for internal migration among native population. This conclusion is in accordance with those obtained by Maza and Villaverde (2004) and Faggian and Royuela (2010). This effect is higher when specific characteristics of the origin and destination provinces are captured individually (Equation 2.8). Second, foreigners are affected by cultural facilities and social services to a higher degree than natives; the coefficients associated to these variables show positive and statistically significant values in both cases. As can be appreciated, the sign and value of these coefficients as well as their level of significance are quite similar in all the specifications, irrespective of the combination of fixed effects used. This provides evidence on the fact that the effect of quality of life factors on internal migration is not biased by the multilateral resistance to migration. This also happened with the distance variable, whose effect is robust to variations in the model specification.

To sum up, the main conclusion is that the hypothesis laid out in the Introduction that natives' preferences are more amenity-based/less economic-oriented than foreigners' is partly true. On the one hand, the impact of economic determinants (wages and unemployment) is higher for foreigners than for natives, although a nonlinear effect of these two variables is more frequently detected in the native population. Only does it occur within the group of foreigners when time-invariant features common to each pair of provinces are taken into account. On the other hand, the nature of the most influential amenities for each group of population differs: while natives tend to look for provinces with good climate, foreigners tend to be attracted by provinces with more cultural and social amenities.

2.4 Conclusions

This paper examines the factors driving internal mobility of foreign and native population across Spanish provinces over the period 2004-2014. Specifically, it focuses on two types of factors, economic and quality of life, besides some other additional ones influencing as well the migration decision. To accomplish this aim, a gravity model with different combinations of fixed effects is estimated. By proceeding in this way, we obtain robust estimations of the parameters, which are free from the bias induced by multilateral resistance to migration. A further feature of our analysis is the consideration of nonlinearities in the economic determinants. This allows us to verify whether there exists a nonlinear effect of wage and/or unemployment on internal movements of foreigners and natives. In the empirical analysis, the Hansen (1999)'s endogenous method of threshold selection is used, with data for the expected wage variable; and then, the estimated thresholds are employed to create interaction variables with the wage and the unemployment rate, the economic determinants of the gravity model. Apart from this, four specifications of the gravity model are estimated, whose main difference lies in the structure of fixed effects considered.

The findings of the paper indicate that, in line with the evidence found in Germany (Schündeln, 2014), foreigners show more responsiveness to economic determinants than natives when moving across Spanish provinces. As for their nonlinear effect on internal migration, there exist differences between foreigners and natives. With respect to the native population, when above the endogenously determined threshold, the impact of a higher wage in the province of destination with respect to the province of origin is greater than below it, regardless of the structure of fixed effects considered; as regards unemployment, there also seems to exist a nonlinear behavior, although less marked than that found in wages. In the case of foreigners, a nonlinear effect of both variables is just found when controlling for dyadic origin-destination fixed effects.

Results concerning the rest of variables reveal that distance between the province of origin and destination arises as a deterrent factor to migration for both groups of population, and that quality of life variables emerge as determining factors behind the decision to migrate for foreigners and natives as well. The nature of the amenities playing a higher role is different between both groups, though; foreigners look for social services and cultural amenities, while pleasant climate conditions are more appealing to natives.

In conclusion, the evidence found in this paper points to the fact that the disequilibrium and the equilibrium models of migration cannot be totally separated in order to explain internal migration of foreigners and natives in Spain. Although specific for Spain, these results are somehow related to those found by Biagi et al. (2011) for internal migration in Italy, and by Rodríguez-Pose and Ketterer (2012) for migration across European regions, which tend to suggest that both approaches (disequilibrium and equilibrium) can be considered as the two sides of the same coin.

Some recommendations for policy-making can be drawn from this study. Firstly, from a national point of view, as foreigners show more responsiveness to economic determinants than natives when moving across Spanish provinces, policies such as the improvement of information channels and the promotion of job opportunities that facilitate foreigners' integration into the labor market should be fostered to reduce economic disparities and strengthen social cohesion. Secondly, local governments in those provinces facing shortages in population should combine the policies above mentioned with the enhancement of quality of life factors (namely, cultural and social amenities) which have been proved to be, along with economic factors, especially effective in the case of foreigners.

Chapter 3

A spatial approach to the impact of immigration on wages: evidence from Spain

3.1 Introduction

Nowadays, immigration has become a prominent feature of the economic and social landscape of many European countries. This has raised several issues, among which the consequences on the labor market opportunities and wages of native workers stand out. Consequently, a large body of literature has been devoted to the study of the impact of immigration on wages. The vast majority of studies that have tried to quantify this effect focuses on the United States (Grossman, 1982; Butcher and Card, 1991; Altonji and Card, 1991; Card, 2001; Borjas, 2003; Orrenius and Zavodny, 2007; Ottaviano and Peri, 2012), but there are also some works for countries such as the United Kingdom (Dustmann et al., 2005, 2013; Nickell and Saleheen, 2009; Manacorda et al., 2012), Germany (De New and Zimmermann, 1994; Pischke and Velling, 1994; Winter-Ebmer and Zimmermann, 1999; Brücker and Jahn, 2008; D'Amuri et al., 2010) and Austria (Winter-Ebmer and Zimmermann, 1999).

Although it has not been analyzed in-depth yet, the immigration-wages issue has also become relevant in Spain in the last few years. This is so because in scarcely a decade and a half the country has become one of the major recipients of migrants in Europe (Carrasco et al., 2008; Reher and Requena, 2009); as reflected in Table 3.1, the foreign population in Spain grew by 55.8% over the study period (2004-2015). However, and to the best of our knowledge, only two papers (Carrasco et al., 2008; González and Ortega, 2011) have estimated the effects of immigration on wages in Spain. Neither found a significant impact of immigration on wages.

Table 3.1 Foreign population in Spain (2004-2015).

Year	Number	Annual growth (%)	Percentage of the total population
2004	3,034,326	-	7.0
2005	3,730,610	22.9	8.5
2006	4,144,166	11.1	9.3
2007	4,519,554	9.1	10.0
2008	5,268,762	16.6	11.5
2009	5,648,671	7.2	12.1
2010	5,747,734	1.7	12.3
2011	5,751,487	0.06	12.2
2012	5,736,258	-0.3	12.2
2013	5,546,238	-3.3	11.8
2014	5,023,487	-9.4	10.8
2015	4,729,644	-5.8	10.2

Bearing all these considerations in mind, the contribution of this paper is twofold. Firstly, regardless the country under study, none of the papers devoted to the assessment of the effect of immigration on wages pays any attention to the spatial dependence that may exist in the proposed models. This paper intends to shed some light on this issue and, in particular, to detect whether or not there are spatial spillovers in wage determination.[1] Secondly, to address the immigration-wages issue, this paper uses Spain as 'laboratory' to fill the gap that exists in the empirical literature. For reasons given above, this is a really interesting case study, especially

[1] The importance of using spatial econometrics to capture spillover effects among neighbors was recently pointed out by, among others, Bruna et al. (2016) and Andersson et al. (2016).

currently because of the economic crisis and the fact that it produced an undoubted side effect: a cut in wages.

To accomplish these aims, the paper estimates a spatial wage equation for 46 Spanish provinces over the period 2004-2015.[2] Apart from the standard variables involved in a wage-curve equation —such as unemployment, productivity and industry mix—, and in order to assess the impact of immigration on wages, the stock of foreigners in each Spanish province (as a percentage of the total population of that province) is also included as an explanatory variable.

The remainder of the paper is organised as follows. Section 3.2 provides a succinct literature review. Then, Section 3.3 describes the data employed, specifies the model, estimates it and discusses the results. Finally, Section 3.4 summarizes the main conclusions of the paper and offers some policy remarks.

3.2 Literature review

The immigration phenomenon and its impact on the labor market of the receiving countries have been widely researched in the economic literature. Although the bulk of these studies[3] has traditionally focused on the United States, a fact justified by the wealthy data sources on the issue and the experience gained from previous waves of immigration,[4] in the last decade there has been some research devoted to various European countries.

Starting with the seminal paper by Grossman (1982), it uses 1970 data and estimates a production function to compute elasticities of substitution between the stock of immigrants and the native workforce in order to determine the effect of immigrants

[2] The provinces belonging to the regions of Navarre and the Basque Country, together with Ceuta and Melilla, have been excluded from the sample for data availability reasons.

[3] For recent surveys see Okkerse (2008) and Longhi et al. (2005, 2010).

[4] Although the US has traditionally been a country of immigrants, and most studies find little support for this idea, there is still the fear that the newcomers take jobs away from natives, displace them, and/or depress their wages (Friedberg and Hunt, 1995).

on factor prices. The paper concludes that a 10% increase in the number of employed immigrants reduces native wages by 1%. Butcher and Card (1991) provide evidence on the effects of immigration based on changes in the distributions of wages over the period 1979-1989. They calculate the effect of higher immigration on the various percentiles of the wage distribution, controlling for the overall population growth rate, the fraction of immigrants initially living in each city and the initial level of wages in the city. The paper finds little indication of an adverse wage effect of immigration, either cross-sectionally or within cities over time.

A few studies have focused on the effect of immigration on wages within occupations and/or skill groups. That is the case of Altonji and Card (1991), who, by using data from the 1970 and 1980 US censuses and adopting an Instrumental Variables (IV) approach, analyze the wage effects on less-skilled natives. The results reveal that a 1% increase in the foreign share of the population in a city reduces the wages of unskilled natives by a maximum of 1.2%. Furthermore, Card (2001), also using IV estimates, studies the effects of immigrant inflows on the labor market outcomes of six different occupation groups. Card shows that a 10% increase in the immigrant inflows between 1985 and 1990 reduced wages of low-skilled service native workers in traditional gateway cities such as Miami and Los Angeles by 1-3%. Similarly, Camarota (1997), using data from the 1991 Current Population Survey and comparing the wages of natives in occupations with different proportions of immigrants, finds that a 1% increase in immigration reduces the weekly earnings of low-skilled native workers by 0.8%. For his part, Borjas (2003), when defining skill groups in terms of educational attainment and work experience and using an IV approach, concludes that US immigration over the period 1980-2000 lowered average native wages by about 3% and the wages of the least-educated natives by 9%.

Another work on this issue is by Orrenius and Zavodny (2007). By using data on natives' wages within occupations groups in the United States over the period 1994-2000, they prove that larger immigrant inflows reduce average wages among natives working in manual labor occupations, the least skilled group, but do not appear to have a significant negative effect among natives in professional and service occupations, in which workers tend to be more skilled. More recently, Ottaviano and Peri (2012) calculate the effects of immigration on the wages of native US workers of various skill levels by estimating elasticities of substitution across different groups. They find that from 1990 to 2006, immigration had a small positive effect on both the wages of native workers with no high-school degree (between 0.6% and 1.7%) and on average native wages (0.6%).

Within this strand of the literature, some studies for European countries, although fewer in number than those for the US, should also be highlighted. Dustmann et al. (2005) analyze the impact of immigration on the British labor market by skill groups over the period 1983-2000. By using Ordinary Least Squares (OLS), IV as well as Generalized Method of Moments (GMM) estimators, their results provide little evidence that immigration has had any impact on aggregate employment, unemployment and wages, although there seem to exist some differences according to education. As for wages, immigration seems to have led, if anything, to slightly positive effects. Dustmann et al. (2013) estimate the wage effects along the distribution of native wages in the UK during the period 1997-2005, defining skill by the position in the wage distribution. Their results, obtained by applying OLS and IV estimates, suggest that immigration depresses wages below the 20th percentile of the wage distribution but leads to slight wage increases in the upper part of it. They also find that the average effects of immigration on wages are slightly positive. Another paper that provides evidence on the impact of immigration on wages in Britain is by Nickell and Saleheen (2009). By using occupation as a proxy for skills over the period 1992-2006 and the OLS and Generalized Least Squares (GLS) estimators, the results reveal that the immigrant-to-native ratio has a small negative impact on average wages, with the biggest impact registered in the semi-skilled/unskilled services sector; namely, for this group, a 10% rise in the proportion of immigrants is associated with a 5% reduction in pay. Finally, Manacorda et al. (2012) consider the period 1975-2005; starting from a multi-level Constant Elasticity of Substitution (CES) production function and using two education groups (university and secondary), the study shows that immigration over the last 30 years has had, on average, little discernible effect on natives' wages in Britain.

Apart from the studies for the United States and the United Kingdom, some others have been conducted for the case of Germany.[5] First, De New and Zimmermann (1994) examine the wage functions of white- and blue-collar natives in a random-effects panel model estimated by two-stage GLS over the period 1984-1989. They demonstrate that foreigners negatively affect average wages (a 1% increase in the share of foreign labor implies a reduction of 4.1% in the hourly wage). A further breakdown reveals that relatively small gains are made by white-collar employees with fewer than 20 years of experience (3.5%), while the wages of blue-collar employees decline by 5.9%. A second study by Pischke and Velling (1994), making use of a dataset of county-level variables over the period 1985-1989 and using IV estimates, finds no significant adverse effect of immigration on either natives' employment, unemployment or wages. The paper by Brücker and Jahn (2008), based on a wage curve approach for the period 1980-2004 and using two-stage Least Squares (2SLS) and GMM, finds moderate wage and employment effects (a 1% increase in the German labor force through immigration increases the aggregate unemployment rate and reduces average wages by less than 0.1%). More recently D'Amuri et al. (2010), by using a labor market equilibrium model over the period 1992-2001, find that immigration had very little adverse impact on native wages, although, contrary to expectation, the effect is negative on the highly educated and positive on the less-educated workers.

Furthermore, the study of Winter-Ebmer and Zimmermann (1999) examines the effects of immigration change on wage growth in Austria and Germany over the

[5] Although dealing with a slightly different topic, the paper by Niebuhr et al. (2012) estimates the effects of labor mobility (including migration and also commuting) on regional wages and unemployment in Germany from 1995 to 2005. Its findings suggest that labor mobility tends to reduce unemployment disparities, whereas evidence with respect to regional wages is rather weak.

period 1986-1994. By applying IV and weighted regression techniques with the sectoral employment shares as weights, they show that in Austria immigration exerted a small negative impact on native wages (a 1% increase in immigration reduces native wages by 0.16%), this effect being lower in already low-wage industries. No negative effect, however, was found for Germany.

Focusing on our case study, to the best of our knowledge only two papers have addressed the issue of the impact of immigration on wages in the Spanish labor market.[6] Carrasco et al. (2008), by using data from the 1991 and 2001 Censuses of Population and the 2002 Wage Structure Survey, and carrying out OLS and IV estimates, conclude that there is no significant negative impact of immigration on either the employment rate or the wages of native workers. In the same vein, the study developed by González and Ortega (2011) for the period 2001-2006 adopts a correlation approach and IV estimates; the results, reinforcing those obtained by Carrasco et al. (2008), suggest that the relatively unskilled migration inflows affect neither the wages nor the employment rates of unskilled workers in receiving regions.

In conclusion, there is an ample literature in this field (summarized in Table A2.1 of Appendix 2), the general thought being that immigration has no effects or very small negative effects on wages (Longhi et al., 2005). However, and despite migrations having explicit geographical components, no paper has addressed this issue by adopting a spatial econometric perspective. Additionally, the number of papers for the Spanish case is very small. As mentioned above, this paper aims to contribute to the existing literature with regards to these two respects.

[6] Nevertheless, other papers analyzing different aspects of the Spanish labor market can be highlighted; Amuedo-Dorantes and De la Rica (2008), which studies the impact of immigration on Spanish natives' income in terms of the net immigrant surplus as a percentage of the national GDP, and Amuedo-Dorantes and De la Rica (2010), which investigates the immigrants' responsiveness to employment opportunities relative to natives.

3.3 The effect of immigration on wages: an empirical analysis

This section aims to capture the impact of the stock of foreigners relative to the total population on average Spanish wages at provincial level. To do so, it discusses the data, then (and after confirming the existence of spatial dependence) specifies a spatial model, next the model is estimated and, finally, the results obtained are discussed.

3.3.1 Data and model specification

As a starting point, we consider an extended traditional wage-curve equation such as:[7]

$$WAGE_{it} = \alpha_1 UNEM_{it-1} + \alpha_2 PROD_{it-1} + \alpha_3\, IMMIGR_{it-1} + \alpha_4\, CONST_{it-1} + \alpha_5\, IND1_{it-1} + \alpha_6\, IND2_{it-1} + \alpha_7\, SERV1_{it-1} + \alpha_8\, SERV2_{it-1} + \alpha_9\, SERV3_{it-1} + \mu_i + \mu_t + \varepsilon_{it} \quad (3.1)$$

where *i* denotes province and *t* year; μ_i and μ_t refer to provincial fixed effects and time fixed effects respectively, which are included to reduce the omitted variables bias,[8] and ε_{it} is the error term.[9]

The endogenous variable is the provincial wage ($WAGE$),[10] collected from the statistics published by the Tax Administration National Agency (Agencia Estatal de Administración Tributaria - AEAT). Generally speaking, provincial wages

[7] See, for instance, the papers by García-Mainar and Montuenga-Gómez (2003) and Ramos et al. (2015) for estimates of wage curves for Spain.

[8] The inclusion of temporal dummies is mandatory because of the economic crisis outbreak; as our sample period is quite small, it is not convenient to split it into two sub-periods.

[9] Although, due to the lack of data on wages and other variables at a highly disaggregated geographical level, the analysis is carried out for NUTS-3 (Nomenclature of Territorial Units for Statistics) provinces, we agree that, as shown by Rubiera-Morollón and Viñuela (2013) and Viñuela et al. (2014), the use of analytical regions and more disaggregated data at a spatial level would be recommended. It could avoid the presence of the Modifiable Areal Unit Problem (MAUP), as analytical areas are internally more homogeneous and spillovers are proved to appear at a very local level.

[10] To deflate nominal variables the Consumer Price Index has been used. 2011 is taken as the base year.

increased until 2008/09 and, because of the economic crisis, they decreased afterward up to 2013/14; in 2015, an increase in wages was recorded in all provinces.

As exogenous variables, first we include, as in any wage equation, the unemployment rate ($UNEM$), which was taken from the Spanish Survey of Economically Active Population published by the Spanish National Statistics Institute (Instituto Nacional de Estadística - INE). Because of the economic crisis, provincial unemployment rates increased sharply in 2008 and kept increasing from then to 2013. From this year onward, unemployment rates started to decrease in most provinces.

Apart from unemployment, which obviously should keep an inverse relationship with wages, we included the following additional explanatory variables:

- Productivity ($PROD$), since, together with the unemployment rate, is theoretically considered as one of the most important factors shaping the level of wages. As is clear, a significant and positive coefficient is expected for productivity. $PROD$ was computed as the ratio between the Gross Domestic Product (GDP) and total employment, both taken from the National Accounts at Regional Level (INE).[11] Data reveal a slowdown or even decrease in productivity in all provinces after the outburst of the economic crisis.
- Share of employment in the construction ($CONST$), industry ($IND1-2$) and service ($SERV1-3$) sectors, collected from the 'National Accounts at Regional Level' (INE).[12] As provincial wages are computed as the (weighted) average of wages paid in different sectors, it seems reasonable to think that some of the wage differences among provinces are due to differences in the

[11] Given that we are analyzing the effect of immigration on wages, we consider labor productivity to be more relevant than total factor productivity.

[12] In order to avoid multicollinearity problems, the share of employment in agriculture was not included in the equation.

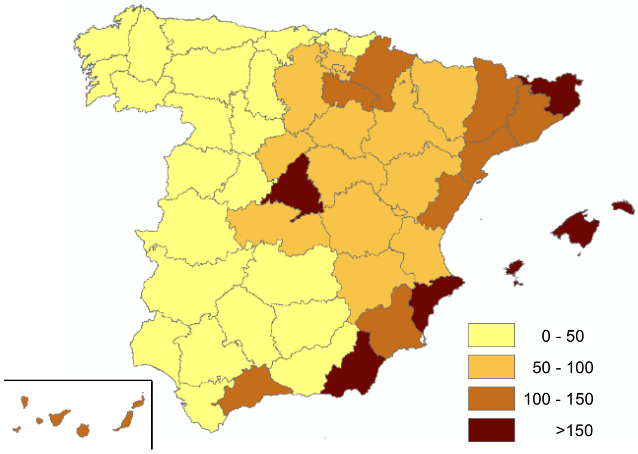
employment structure across them. Table 3.2 provides information about the sectors and branches considered.

Table 3.2 Disaggregation of the industry mix.

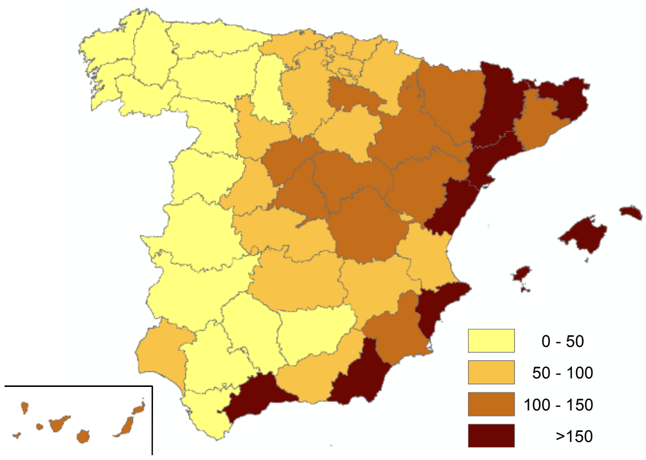
Sector	Disaggregation
$CONST$	Construction.
$IND1$	Extractive industry; electricity, gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities.
$IND2$	Manufacturing industry.
$SERV1$	Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities; information and communication activities.
$SERV2$	Financial and insurance activities; real estate (property), professional, scientific and technical activities; administrative and support services activities.
$SERV3$	Public administration and defence; compulsory social security, health, social and cultural services.

- Stock of foreigners relative to the total population ($IMMIGR$). This variable is included to test the hypothesis of whether the relative stock of foreigners has put downward pressure on provincial wages in Spain. Data on the officially registered foreign population have been specifically collected from the Municipal Register databank (INE). Figure 3.1 displays the geographical distribution of the relative stock of foreigners for the initial and final years of the sample. The data have been normalized with respect to the national average (Spain=100) in such a way that Spanish provinces are classified as those having a relative stock of foreigners between 0% and 50%, between 50% and 100%, between 100% and 150%, and more than 150% of the national average. As can be appreciated, the bulk of foreigners tends to be located in the Central and Eastern Spanish provinces, although foreigners in 2015 tend to be more concentrated in the north-eastern part of the country.

Figure 3.1 Relative stock of foreigners (Spain= 100).



(a) Year 2004



(b) Year 2015

Note that, as usual, all explanatory variables included in Equation (3.1) are lagged one year in order to capture the fact that their potential effects on provincial wages are not immediate.[13] Additionally, the dependent variable together with $PROD$ and

[13] In any case, we have also performed the estimation using two lags (available upon request) and the results are very similar. The only difference is that the direct effect of the productivity becomes slightly significant.

$IMMIGR$ are expressed in logs; consequently, their estimated coefficients will be interpreted as elasticities, while those associated with the rest of variables will be interpreted as semi-elasticities. For additional information, Table 3.3 presents the descriptive statistics of the variables included in Equation (3.1).

Table 3.3 Descriptive statistics of variables.

Variable	Mean$^{(2)}$	Stand. Dev.	Minimum		Maximum	
$WAGE^{(1)}$	17.311	2.253	13.000	(Jaén)	24.472	(Madrid)
$UNEM$	16.350	4.507	9.567	(Soria)	26.788	(Cádiz)
$PROD^{(1)}$	52.910	3.705	47.142	(Badajoz)	61.586	(Madrid)
$IMMIGR^{(1)}$	8.807	5.305	2.482	(Córdoba)	21.348	(Alicante)
$CONST$	10.602	1.421	7.789	(Barcelona)	13.639	(Ávila)
$IND1$	1.373	0.457	0.700	(Valladolid)	3.524	(León)
$IND2$	12.708	4.801	4.384	(Tenerife)	22.076	(La Rioja)
$SERV1$	29.436	4.351	22.003	(Soria)	44.147	(Las Palmas)
$SERV2$	10.381	2.464	7.174	(Cuenca)	19.967	(Madrid)
$SERV3$	27.706	2.721	22.595	(Castellón)	33.803	(Salamanca)

Note: $^{(1)}$ these three variables are expressed in logs in Equation (3.2) below. $^{(2)}$ Computed as the mean of the provincial means.

Once the initial model has been specified, the next step is to test for the presence of spatial dependence in it because, if this were to happen, the results of an aspatial approach could be inconsistent (e.g., LeSage and Pace, 2009). To do so, we first estimate Equation (3.1) by OLS and test for the presence of spatial dependence, for which we apply the robust Lagrange multiplier (LM) tests: the robust LM-LAG (i.e., the LM test for a spatially lagged dependent variable), whose null hypothesis is the absence of substantive dependence, and the robust LM-ERR (i.e., the LM test for residual spatial autocorrelation), whose null hypothesis is the absence of residual spatial autocorrelation. The results, displayed in the first two rows of Table 3.4, reveal that both hypotheses are rejected at the 1% level. Thus, there is spatial dependence (mainly substantive dependence) in the estimation and, therefore, the model based on Equation (3.1) would not yield plausible results.

Table 3.4 Tests for spatial dependence.

Tests	Statistic	*p*-value
Robust LM-LAG	62.61	0.00
Robust LM-ERR	41.95	0.00
LR test for Spatial Autoregressive Model	104.06	0.00
LR test for Spatial Error Model	130.05	0.00

Subsequently, to determine the appropriate spatial model, we follow the general-to-specific approach. Specifically, we perform the Likelihood Ratio (LR) tests to examine whether the spatial Durbin model (SDM) can be reduced to a spatial autoregressive model (SAR) or a spatial error model (SEM). As shown in the last two rows of Table 3.4, the results indicate that both hypotheses can be rejected at the 1% level. Thus, the SDM, which enables one to model spatial spillovers arising from the dependent as well as from the explanatory variables, arises as the preferred specification to analyze the effect of immigration on average wages across Spanish provinces. Hence, the final SDM model is as follows:

$$\begin{aligned} WAGE_{it} = {} & \alpha_1\, UNEM_{it-1} + \alpha_2\, PROD_{it-1} + \alpha_3\, IMMIGR_{it-1} + \alpha_4\, CONST_{it-1} + \\ & \alpha_5\, IND1_{it-1} + \alpha_6\, IND2_{it-1} + \alpha_7\, SERV1_{it-1} + \alpha_8\, SERV2_{it-1} + \\ & \alpha_9\, SERV3_{it-1} + \rho \textstyle\sum_j w_{ij}\, WAGE_{jt} + \theta_1 \sum_j w_{ij}\, UNEM_{jt-1} + \\ & \theta_2 \textstyle\sum_j w_{ij}\, PROD_{jt-1} + \theta_3 \sum_j w_{ij}\, IMMIGR_{jt-1} + \mu_i + \mu_t + \varepsilon_{it} \end{aligned} \quad (3.2)$$

where ρ is the spatial autoregressive coefficient; the term $\sum_j w_{ij}\, WAGE_{jt}$ is the spatial lag of wages; and θ_1, θ_2 and θ_3 are the coefficients linked to the spatial lags of the explanatory variables $UNEM_{it-1}$, $PROD_{it-1}$ and $IMMIGR_{it-1}$. Additionally, W is the so-called spatial weight matrix whose elements reflect the intensity of the interdependence between provinces *i* and *j*, and which has been row-standardized. Here we follow Elhorst et al. (2013) and Chatterjee (2017) and choose the spatial weight matrix that best describes the data, being the criterion of selection the highest value of the log-likelihood function in the estimation. In our case, it turns out to be the exponential distance ($exp^{-distance}$) matrix.[14]

3.3.2 Estimation results and discussion

This section estimates the SDM model (Equation 3.2) by maximum likelihood,[15] for which it uses the Driscoll-Kraay standard errors robust to general forms of spatial and temporal dependence. Table 3.5 displays the results.

Table 3.5 Spatial Durbin model (SDM), (2004-2015).

Dependent variable: $WAGE_{it}$	Coefficients
$UNEM_{it-1}$	-0.064** (0.026)
$PROD_{it-1}$	0.019 (0.023)
$IMMIGR_{it-1}$	-0.047*** (0.007)
$CONST_{it-1}$	0.001 (0.001)
$IND1_{it-1}$	-0.007 (0.006)
$IND2_{it-1}$	0.003*** (0.001)
$SERV1_{it-1}$	-0.002** (0.001)
$SERV2_{it-1}$	-0.000 (0.001)
$SERV3_{it-1}$	-0.001 (0.001)
$\sum_j w_{ij}\, WAGE_{jt}$	0.466*** (0.055)
$\sum_j w_{ij}\, UNEM_{jt-1}$	-0.253*** (0.046)
$\sum_j w_{ij}\, PROD_{jt-1}$	0.116*** (0.032)
$\sum_j w_{ij}\, IMMIGR_{jt-1}$	-0.070*** (0.016)
LIK	1619.827
AIC	-3215.653
SIC	-3163.89
Number of observations	552

Notes: results are derived by using the exponential distance matrix. Driscoll-Kraay standard errors in parenthesis. *** (**) Significant at 1% (5%) respectively. LIK: logarithm of maximum likelihood; AIC: Akaike information criterion; SIC: Schwarz information criterion. Provincial and time fixed effects are included.

[14] In any case, the results obtained with different distance matrices —namely, inverse of the distance, inverse of the square of the distance, matrices considering different cut-offs, as well as matrices taking into account a different number of neighboring provinces— are quite similar.

[15] Shapiro-Wilk test for normality supports the use of ML.

Note that all the goodness-of-fit measures that are comparable between the aspatial model (Equation 3.1) and the spatial model (Equation 3.2), namely the logarithm of maximum likelihood (LIK), Akaike information criterion (AIC) and Schwartz information criterion (SIC), demonstrate that the spatial model achieves a better fit.[16] As regards the spatial lag of the dependent variable, its associated coefficient results positive and statistically significant (0.466), this reinforcing the idea that the OLS model (Equation 3.1) was misspecified. The finding suggests that the wage of each province is closely related to that of its neighbors; in other words, it confirms the existence of spatial linkages between provincial wages. Two facts, among others, could be behind this effect. First, a higher wage in the surrounding provinces makes it more appealing and likely for a local worker to move there; this, somehow, exerts pressure on the local employers to increase the wage they pay in order to attract or retain their employees. Second, wages in neighboring provinces constitute a proxy for spatial spillover effects such as agglomeration advantages, through which industry clusters emerge with a higher level of wages and productivity (Longhi et al., 2006).

Regarding the rest of variables, there seem to be negative effects of immigration and unemployment on wages, while productivity does not seem to affect wages. With respect to their three spatial lags, their results are statistically significant and show the expected signs: negative in the case of the unemployment and the relative stock of foreigners, which means that a high value in these variables in provinces other than i leads to decreases in the wage of province i, and positive for the productivity, which indicates that higher productivity in neighboring provinces increases the wage of a considered province. As for sectors, manufacturing industry and one of the branches of services (basically trade, information and communication activities) exert a positive (negative) effect on wages. Finally, although not reported, note that both time effects (μ_t) and provincial fixed effects

[16] The results for the aspatial model are at readers' disposal.

(μ_i) are mostly significant;[17] regarding the former, its decline over the crisis is a clear indicator of the toll it has taken on wages.

However, the point estimates reported in Table 3.5 should be interpreted with caution as they are only a preliminary step to obtain both the direct and the indirect effects of the different variables on wages (LeSage and Pace, 2011). This is so because an SDM model allows one to consider global spillovers. As a result of a Leontief expansion, spillovers arising from spatial lags of the dependent variable allow for spillovers to neighbors, neighbors to neighbors, and so on, coming back in the end to the area from which they originated. In other words, this means that a change in an explanatory variable at any province will be transmitted to all other provinces, including the feedback effects.

Table 3.6 shows the average direct and indirect effects. The first ones are interpreted as the effect of a change in a particular explanatory variable in province *i* on the dependent variable of that same province; the indirect (spillover) effects capture the cumulative effect of the changes in a variable in provinces other than *i* on the wage of any province *i* through wages of the rest of provinces. The sum of both direct and indirect effect is the so-called total effect.

A relevant result concerning our key variable is that the total effect is negative; that is, an increase in the relative stock of foreigners has a negative impact on the wage of any particular Spanish province. More precisely, the results suggest that an increase of 1% in the relative stock of foreigners reduces the average wage of any particular province by 0.220%, of which a reduction of 0.165% is due to the indirect effect and a decrease of 0.055% comes from the direct one.

As regards the rate of unemployment, an increase of 1% in this variable in either the province itself or the other provinces has a negative and statistically significant impact on the average wage of that province (-0.086% and -0.507%, respectively).

[17] The inclusion of provincial fixed effects in Equation (3.2) was supported by the Hausman test, as it rejects the null hypothesis. The results obtained also concurred with the importance of including fixed effects to control for the heterogeneity caused by the crisis.

Paying attention to the productivity, the results reveal that, as expected, it has a positive influence on provincial wages (a total effect of 0.256%). The direct effect of productivity, however, is not statistically significant. Although partially unexpected, this result is not in contradiction to those obtained in previous studies. For example, Maza and Villaverde (2009) showed that the effect of productivity on wages in Spain is only notable when there is an outstanding increase in the former. As for the industry mix, the following conclusions can be drawn: first, manufacturing seems to have a small positive impact on the average provincial wage (a total effect of 0.006), this effect being shared by direct and indirect effects evenly; and second, the coefficients linked to branch $SERV1$ are negative and statistically significant (a total effect of -0.003), while those for $SERV2$ and $SERV3$ are non-significant.

Table 3.6 Spatial Durbin model (SDM): direct, indirect and total effects.

Variable	Direct effects	Indirect effects	Total effects
$UNEM_{it-1}$	-0.086*** (0.029)	-0.507*** (0.039)	-0.593*** (0.040)
$PROD_{it-1}$	0.030 (0.021)	0.226*** (0.084)	0.256*** (0.093)
$IMMIGR_{it-1}$	-0.055*** (0.007)	-0.165*** (0.010)	-0.220*** (0.011)
$CONST_{it-1}$	0.001 (0.001)	0.001 (0.001)	0.002 (0.002)
$IND1_{it-1}$	-0.006 (0.005)	-0.005 (0.004)	-0.011 (0.010)
$IND2_{it-1}$	0.003*** (0.001)	0.003*** (0.001)	0.006*** (0.001)
$SERV1_{it-1}$	-0.002** (0.001)	-0.001** (0.001)	-0.003** (0.001)
$SERV2_{it-1}$	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.002)
$SERV3_{it-1}$	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.002)

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) Significant at 1% (5%) respectively. Results were obtained by using the exponential distance matrix. Provincial and time fixed effects are included.

In essence, one clear conclusion emerges from the previous analysis: spatial spillovers (or indirect effects) matter a lot. From an economic point of view, the importance of spillovers can be justified by the existence of *'differentiated spatial behaviors in response to changes in labor activity'* (Viñuela et al., 2010, p. 502). There also exist spatial interactions across labor markets such as the commuting flows that help one understand the larger magnitude of the indirect effect in relation to the direct one (Viñuela et al., 2010; Viñuela and Fernández-Vázquez, 2012).

Having commented on the results, we turn our focus to the hypothesis outlined at the beginning of the paper. The findings make clear the existence of a negative, although weak, effect of immigration on wages, and the importance of spillovers. The aim now is to go one step further and decompose the previous summary measures of direct and indirect effects into the responses of the average wage to a change in the stock of immigrants for each pair of provinces. To do so, a decomposition of the matrix of effect estimates associated to the relative stock of foreigners is carried out.

Threfore, in the estimated SDM model the matrix of effect estimates for the $IMMIGR_{it-1}$ variable, $S(W)$, takes the following form:

$$S(W) = V(W) * (I_n \alpha_3 + W\theta_3) \tag{3.3}$$

where $V(W)$ stands for the spatial multiplier:

$$V(W) = (I_n - \rho W)^{-1} \tag{3.4}$$

where ρ is the spatial autoregressive coefficient; α_3 and θ_3 are the estimated coefficients linked to the $IMMIGR_{it-1}$ variable and its spatial lag; and I_n is the identity matrix of order 46*46. The main-diagonal elements of this matrix (see Table A3.1 of Appendix 3) represent the own-partial derivatives (and their average is the average direct effect shown in Table 3.6), while its off-diagonal elements represent the cross-partial derivatives (and the average of their cumulative sum from each row is the average indirect effect shown in Table 3.6) (LeSage and Pace, 2009).[18]

[18] To be precise, the indirect effects are the result of averaging the indirect effect of each of the 46 provinces, each being, in turn, the result of adding up each of the indirect effects between pairs of provinces (that is, each province has 45 indirect effects with the rest of provinces).

Looking at the matrix, it can be seen that for each province the highest value corresponds to the diagonal, that is, to the direct effect.[19] From the analysis of the cross-partial derivatives, a distinctive feature arises: whichever province that is chosen, and all the province-to-province indirect effects being negative in magnitude, the ones with the highest values in absolute terms correspond to provinces located in the surrounding area of the province under consideration. Apart from this, it happens that, in all cases, Madrid is placed within the provinces with the highest spillover effects, which means that the immigration to Madrid seems to play an important role in the downward pressure exerted over the wage of any other province. Taken as a whole, these findings cast some light on the relevance of direct and indirect effect: the first is, separately, the most important one, while the spillover effects (especially those of neighboring provinces), when jointly considered, turn out to be of utmost importance to determine the impact of immigration on the average wage.

3.4 Conclusions and policy remarks

This paper provides new interesting insights, from a comparative perspective, into the factors that shape internal migration flows of natives and foreigners in Spain both before and after the outburst of the economic crisis. To be precise, we try to ascertain the effect of different variables on modeling internal movements, comparing how natives and foreigners respond to them. Apart from that, we try to prove whether there exist some nonlinearities in the relationship between migratory flows and labor factors.

The impact of immigration on the wages of native workers has been widely studied in the economic literature. Nevertheless, so far the empirical evidence is not entirely conclusive (though it tends to find small negative effects) and it is mostly devoted

[19] The only exceptions are the islands Tenerife and Las Palmas. In each of these two cases, the highest value corresponds to Las Palmas and Tenerife respectively; the direct effect is the second highest value.

to the case of the United States. This paper is concerned with filling two gaps in this area of research: on the one hand, to account for the potential existence of spatial spillovers, an issue highly neglected in the literature; and, on the other, to analyze the Spanish case because even though this country has experienced substantial increases in the number of foreigners during the last decade, there is still scant evidence about the relationship between immigration and wages. To accomplish these aims, the paper estimates an SDM for Spanish provinces over the period 2004-2015.

The results reveal that the average wage of each Spanish province is closely related to that of its neighboring provinces. Additionally, they show that an increase in the relative stock of foreigners appears to have a small negative impact on provincial wages, which is mainly determined by the presence of spillover effects coming from the rest of provinces. However, a more thorough analysis of this variable discloses that, when all the effects are considered individually, the change in wages in each province is mainly affected by changes in its own stock of immigrants.

As for the rest of explanatory variables included in the model, the findings show that the rate of unemployment, productivity and industry mix are relevant to determine average wages. More precisely, an increase (decrease) in the rate of unemployment (productivity) leads to a reduction in provincial wages. Moreover, it seems that provinces with a higher (lower) share of manufacturing activity (trade, information and communication activities) present higher wages. By combining these results with the one shown above, an additional conclusion can be drawn: the reduction of wages in Spain during the crisis period has not been triggered by immigration but rather by the sharp increase in unemployment rates and the slowdown in productivity. In any case, note that the decline in the time fixed effects (μ_t) after 2008 reinforces the negative effect of crisis on wages.

Summing up, the main finding of this paper is that the fear that migrants are 'cutting our wages' is, at least for the case of Spain, very much misplaced. According to our results, if the stock of foreigners relative to the total population had not increased by 3.2% during the sample period, the average wage in 2015 would have been €9.4 higher, which is €1,341.1 rather than €1,331.7 (0.7%). Although this is a strong enough result, note that it might be masking a significant effect of immigration on specific wage ranges and/or activities. This is clearly a topic for further research, providing that data are available.

Even accepting that the results obtained in a study of this nature can depend critically on both place and time, it is still possible to draw some lessons and/or policy implications from this unique case study. However, these should be taken with due caution.

First, it is important to stress that our findings, although specific for the Spanish case, are in line with those most often found in the literature (Longhi et al., 2005) and that, as such, could be somehow considered as a rule of thumb: the effects of immigration on average wages, either negative or positive, tend to be rather small. Therefore, there does not seem to be any strong reason for being concerned about the effects of immigration on wages. Consequently, and with the caution previously referred to, the first political lesson that can be drawn is that the effects of immigration on wages should not be used by national governments as an argument in the design of immigration policy, let alone to pursue policy measures to strengthen controls over immigration flows. In the same vein, we agree with Peri (2014) in that there is no room for policies aimed at reducing potential losses for native workers and/or taxing firms that hire immigrants.

This being said, the literature agrees that although the impact of immigration on average wages is small, it clearly affects its distribution, as wages of low-skill workers tend to be more negatively affected than others. This should have clear policy implications. On the one hand, it suggests the advisability of conducting immigration policies aimed explicitly at selecting immigrants depending on their skill level and, as far as possible, favoring the high-skilled group. On the other hand, it supports the idea that there is an urgent need to assist high-skilled immigrants when it comes to validating their studies to Spanish standards, as otherwise they will probably end up working in jobs for which a lower level of education is required. Should we make more progress in this direction, the effect of immigration on wages could be even lower as these workers could find better jobs.

Although not directly linked to the potential, but not likely, negative effect of immigration on wages, what is openly needed is a system that helps to overcome other problems usually associated with immigration. Needless to say that, concerning this, the existence of inefficiencies in the job matching process clearly stands out. In other words, it would be advisable that immigrants are integrated into the labor market according to the specific requirements of the sectors of activity in each province. To accomplish this goal, the improvement of information channels to match best the availability of vacancies and the number of jobseekers in both sender and receiver provinces is mandatory. This would be especially important among foreigners because, on the one hand, they have less knowledge about the country, which implies less capacity to detect job opportunities and, on the other, they are more prone to move as foreigners have weaker family ties.

Finally, and especially to face economic downturns as the one that Spain has undergone and is still going through, the promotion of a somewhat modified version of the typical circular migration scheme (trying to make easier regular movements of immigrants across provinces) might be welcome. Without doubt, if the matching process previously mentioned were improved, the chances of achieving this goal would be much higher. Two important strong points are linked to this type of approach: first, it is generally accepted as a ‘win-win-win situation’ (Constant et al., 2013) helping to loosen social tensions emerging in economic recession phases; and second, it could be particularly useful among low-skilled workers.

Chapter 4

Out-migration of natives from Spain to Europe during the Great Recession and its aftermath: what are the main determinants?

4.1 Introduction

Nowadays, as we live in the era of globalization, the devastating consequences of an economic crisis spread beyond national boundaries and are bound to affect different aspects of society. Within this context, international migration is far from being an exception. As postulated by the neoclassical migration theory, migration across countries is expected to occur at times of recession. As it is obvious, countries most severely hit by the recession will expel emigrants, while countries with more prosperous economies are more likely to receive immigrants from abroad (González-Ferrer and Moreno-Fuentes, 2017).

Looking around Europe, the Great Recession seriously affected every single country, but it did so with different intensity. The southern European countries (Greece, Italy, Portugal and Spain) were by far the most heavily impacted. Among them, the case of Spain is especially salient as it suffered the largest increases in the unemployment rate. Specifically, the unemployment rate in Spain rocketed from 8.2% in 2007 to a peak of 26.1% in 2013; after this year, it began to decrease, and in 2016, it was 19.6%.[1] Additionally, it is also important to highlight the severe impact of the crisis on young labor opportunities. According to figures from Eurostat, the youth unemployment rate[2] was 18.1% in the year 2007, and after the beginning of the crisis, reached its highest level (55.5%) in 2013; from then on, and albeit it slowly decreased to 44.4% in 2016, it has remained notably high. The massive levels of unemployment and the limited capacity of families to cope with the crisis placed many Spaniards, especially young people, in a difficult situation during those years of the economic downturn (González-Ferrer and Moreno-Fuentes, 2017).[3] As a result, many people found themselves forced to move abroad in search of better labor opportunities.

This paper is aimed at analyzing the main factors behind the out-migration of Spanish natives (aged between 16 and 64 years) to European countries during the crisis. The paper focuses on Europe since around half of the native population leaving Spain during the crisis moved to European countries, especially to northern ones where the consequences of the crisis were not as devastating (Lafleur and Stanek, 2017). Although the flow of natives migrating to American countries was also substantial, they were mostly citizens with dual nationality so, probably, it turns out to be return migration. This kind of migration, due to its idiosyncratic traits, would add a strong bias to the sample. Our case study deals with natives because, even for Europe, if we included total population the bias due to return migration would also take place.[4] Finally, and for reasons given above, our sample is split between young people (16-34 years) and adult people (35-64 years).

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[1] Job losses during the recession were concentrated in four major sectors: construction, manufacturing, financial services and travel-related services.

[2] It is defined as the unemployment rate of people aged 15-24 as a percentage of the labor force in that age group.

[3] The housing bubble burst (sharp fall in housing prices, credit crunch, mortgage foreclosures and the resulting bankruptcy of construction firms), which coincided with the economic crisis, left a construction sector heavily hit by the unemployment crisis (Fromentin, 2016).

[4] For countries such as Romania, for example, foreigners' emigration accounts for 99% of total emigration.

By doing this, the paper tries to fill a gap in the literature. Although recent years have witnessed the upsurge of a relatively new strand of literature focusing on the impact of the global economic recession on international migration flows worldwide (Castles and Vezzoli, 2009; Fix et al., 2009; Hatton and Williamson, 2009; Martin, 2009; Papademetriou and Terrazas, 2009; Findlay et al., 2010; Green and Winters, 2010; Koehler et al., 2010; Tilly, 2011), there is still scant research in this field for Spain (Arango and González-Quiñones, 2009; Domingo and Sabater, 2013; Larramona, 2013; Domínguez-Mujica et al., 2014; Izquierdo et al., 2016; González-Ferrer and Moreno-Fuentes, 2017; Bermudez and Brey, 2017). To be more precise, only two of these papers adopt an empirical approach to analyze different aspects of out-migration patterns. The first one, by Larramona (2013), differs from this paper as it analyzes out-migration of foreign-born population. By using micro-data from the Statistic of Residential Variations (EVR) database over the period 2002-2009, it distinguishes between return and non-return out-migration. The second one is the study by Izquierdo et al. (2016), which compares natives and foreigners' out-migration flows. It shows that the sensitivity of migration to unemployment is similar between natives and foreigners and highlights the importance of the rapid creation of networks of Spaniards abroad to keep their emigration rates growing.

Another important contribution of the paper lies in methodological issues. As far as we know, it is the first one employing spatial econometric techniques, which allow us to test for the presence of spatial spillovers in the migration process. Specifically, a spatial panel Durbin model (SDM) is estimated. The omission of spatial dependence can lead to serious econometric problems in the estimation such as biased, inconsistent or inefficient estimates as well as inaccurate inferences (Anselin, 1988; LeSage and Pace, 2009).

The remainder of the paper is organized as follows. Section 4.2 offers an overview of the phenomenon of migration from Spain. Section 4.3 specifies the model and presents the results obtained for the total sample and its disaggregation by ages. Finally, Section 4.4 outlines the main conclusions.

4.2 Out-migration from Spain: an overview

As explained above, the economic crisis has significantly affected out-migration intensity in Spain. In this section, we present a quick overview to get a picture of the evolution of out-migration of the working-age native population (henceforth natives) during the Great Recession and its aftermath. Data were taken from the Statistic of Residential Variations (EVR) database published by the Spanish National Statistics Institute (INE).

Prior to that, it is pertinent to take a first look at the evolution of the net migration rate (‰)[5] of the natives over the period 2002-2016 (Figure 4.1). As can be seen, the eruption of the economic crisis marked a turning point in the net external migration balance, as it was in 2008 that the net migration rate turned from positive to negative. That is, over the years 2002 to 2007, immigration of natives from abroad was higher than out-migration; however, from the year 2008 on the outflows of natives surpassed inflows. This fact provides support for the sample period considered in our analysis.

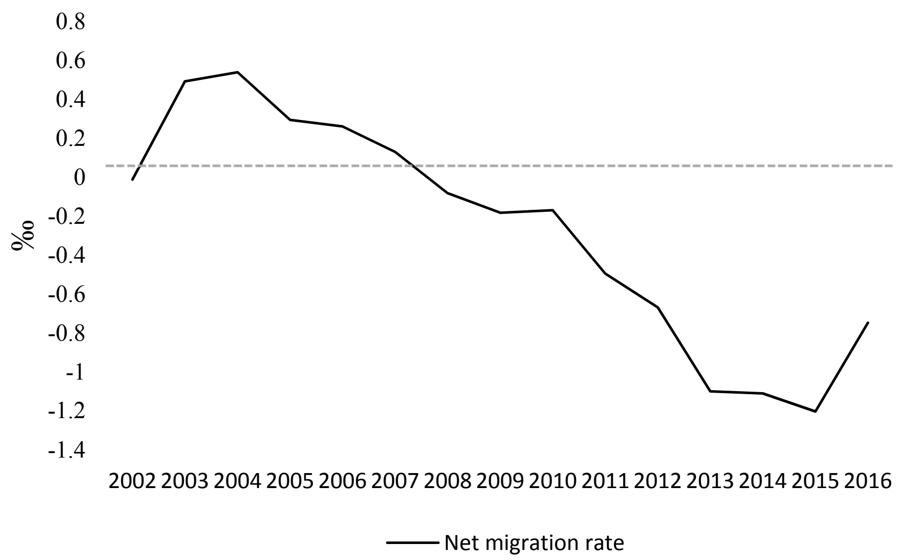
Focusing now on out-migration, as being the scope of the study, Table 4.1 displays some figures showing the evolution of out-migration (flows and rates) of natives from Spain over the years 2008-2016. The first two columns reveal that out-migration rose steadily from the year 2010, the emigration rate[6] reaching 2.6‰ in 2015. It is worth noting that when considering flows disaggregated by continent of destination, on average 51.5% of natives migrated to Europe, 39.2% to America and only around 5%, 3% and 1% to Asia, Africa and Oceania, respectively.

[5] It is computed as the net migration of natives aged 16-64 from Spain divided by the Spanish population in that age group.

[6] Outflows of natives aged 16-64 from Spain divided by the Spanish population in that age group.

Focusing, first, on the flow of natives to Europe, it was 12,915 in 2008 and increased to 35,705 natives in 2016; emigration rate in that year was 1.32‰. In the case of America, the emigration flow has continuously increased from 8,379 to 27,261 natives over the period 2008-2016. Natives' migration to Africa and Asia has not been so stable over time. Finally, migration to Oceania, although very scarce, rose steadily since the year 2009.

Figure 4.1 Net migration rate of natives (2002-2016).



Considering out-migration of natives disaggregated by age groups, it can be seen that the flow of young natives surpassed that of adults in the first three years of the crisis, while from 2011 onward the opposite happened. However, the size of the rates reveals that out-migration of natives was more intense among the young population over the whole period of crisis, almost doubling out-migration intensity among adults. Higher unemployment rates among the youth, as well as the lack of family responsibilities, might be tentative explanations behind this result.

Now, we shift our attention to the distribution of natives leaving Spain to the countries we are going to include in the below empirical analysis. The sample comprises the 26 EU-27 members, except Spain for obvious reasons, together with Switzerland and Norway given the importance of the flows received by these two countries. Table 4.2 shows out-migration rates to each of these European countries over the period 2008-2016 (for every two years, for the sake of space). As can be appreciated, the highest emigration rate corresponded to the United Kingdom, both for young and adult natives. France and Germany, followed by Switzerland had also significant rates. On the other hand, the Baltic countries (Estonia, Latvia and Lithuania) together with Slovakia, Slovenia, Bulgaria, Cyprus showed the lowest rates during this period.

Table 4.1 Emigration of natives during the Great Recession (2008-2016).

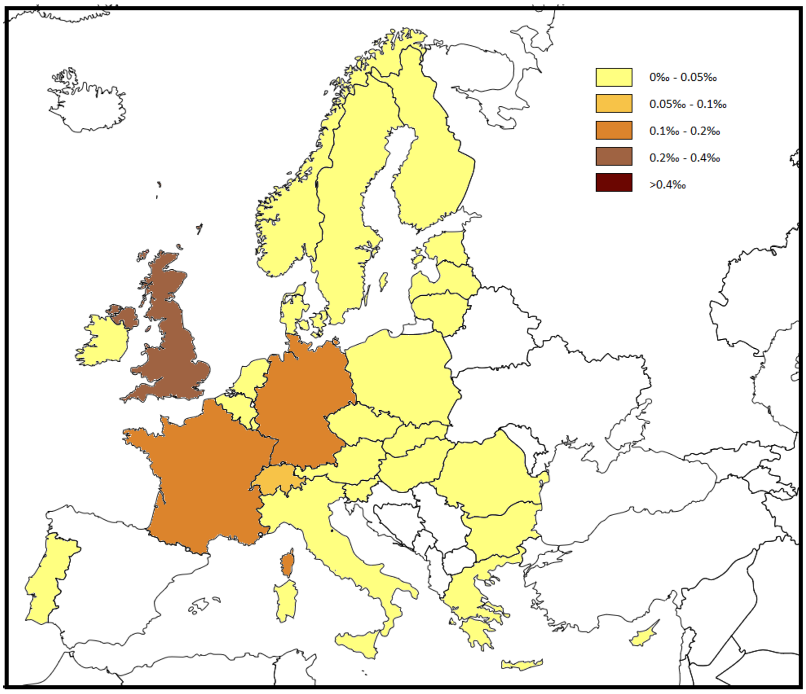
			Distribution per continent of destination										Distribution by age groups			
			Europe		Africa		America		Asia		Oceania		Youth (16-34 years)		Adults (35-64 years)	
Year	Flow	Rate (‰)	Flow	Rate (‰)	Flow	Rate (‰)	Flow	Rate (‰)	Flow	Rate (‰)	Flow	Rate (‰)	Flow	Rate (‰)	Flow	Rate (‰)
2008	24,126	0.887	12,915	0.475	1,216	0.045	8,379	0.308	1,368	0.050	245	0.009	13,083	1.269	11,043	0.654
2009	23,792	0.875	12,550	0.462	1,240	0.046	8,444	0.311	1,327	0.049	231	0.008	12,498	1.241	11,294	0.660
2010	26,242	0.966	14,374	0.529	1,223	0.045	8,848	0.326	1,460	0.054	335	0.012	13,404	1.367	12,838	0.739
2011	38,980	1.437	21,123	0.779	1,606	0.059	13,404	0.494	2,451	0.090	391	0.014	19,038	1.998	19,942	1.133
2012	40,713	1.505	21,121	0.781	1,191	0.044	15,770	0.583	2,167	0.080	460	0.017	20,286	2.201	20,427	1.145
2013	52,745	1.956	26,015	0.965	1,319	0.049	22,178	0.823	2,697	0.100	534	0.020	25,474	2.856	27,271	1.511
2014	59,984	2.227	30,430	1.130	1,266	0.047	24,917	0.925	2,802	0.104	565	0.021	29,560	3.397	30,424	1.669
2015	71,492	2.656	35,271	1.311	1,549	0.058	30,093	1.118	3,806	0.141	767	0.028	34,554	4.065	36,938	2.006
2016	68,347	2.544	35,705	1.329	1,397	0.052	27,261	1.015	3,218	0.120	765	0.028	32,706	3.935	35,641	1.921

Table 4.2 Emigration to Europe (2008-2016). Rates (‰).

	2008			2010			2012			2014			2016		
Countries	Natives	Youth	Adults	Natives	Youth	Adults	Natives	Youth	Adults	Natives	Youth	Adults	Natives	Youth	Adults
United Kingdom	0.1195	0.2202	0.0580	0.1420	0.2527	0.0795	0.1969	0.3668	0.1092	0.2960	0.5744	0.1631	0.3938	0.7285	0.2439
France	0.0808	0.1153	0.0598	0.0966	0.1309	0.0772	0.1446	0.2094	0.1110	0.2180	0.3145	0.1720	0.2393	0.3539	0.1880
Germany	0.0639	0.0972	0.0435	0.0699	0.1035	0.0509	0.1329	0.2239	0.0859	0.2219	0.4115	0.1314	0.2453	0.4574	0.1503
Switzerland	0.0381	0.0488	0.0316	0.0494	0.0632	0.0416	0.0878	0.1230	0.0696	0.1016	0.1505	0.0782	0.1261	0.1943	0.0956
Belgium	0.0284	0.0309	0.0269	0.0375	0.0431	0.0343	0.0528	0.0621	0.0480	0.0629	0.0897	0.0500	0.0536	0.0753	0.0439
Netherlands	0.0223	0.0367	0.0135	0.0187	0.0311	0.0116	0.0249	0.0451	0.0144	0.0391	0.0708	0.0240	0.0420	0.0774	0.0261
Italy	0.0245	0.0359	0.0175	0.0223	0.0322	0.0167	0.0234	0.0339	0.0180	0.0270	0.0404	0.0206	0.0340	0.0507	0.0265
Ireland	0.0174	0.0375	0.0051	0.0139	0.0295	0.0051	0.0149	0.0280	0.0081	0.0245	0.0483	0.0132	0.0265	0.0541	0.0142
Portugal	0.0130	0.0181	0.0099	0.0133	0.0162	0.0116	0.0154	0.0200	0.0131	0.0143	0.0162	0.0133	0.0177	0.0227	0.0154
Sweden	0.0044	0.0071	0.0028	0.0084	0.0140	0.0052	0.0101	0.0170	0.0065	0.0166	0.0265	0.0118	0.0209	0.0395	0.0126
Austria	0.0050	0.0097	0.0022	0.0054	0.0083	0.0038	0.0110	0.0217	0.0055	0.0156	0.0323	0.0076	0.0156	0.302	0.0091
Norway	0.0048	0.0090	0.0022	0.0049	0.0082	0.0030	0.0088	0.0151	0.0055	0.0146	0.0250	0.0095	0.0181	0.0306	0.0125
Denmark	0.0042	0.0084	0.0015	0.0048	0.0095	0.0022	0.0057	0.0112	0.0028	0.0087	0.0151	0.0056	0.0127	0.0270	0.0064
Luxembourg	0.0037	0.0053	0.0027	0.0005	0.0007	0.0003	0.0052	0.0081	0.0036	0.0055	0.0084	0.0042	0.0103	0.0161	0.0078
Finland	0.0028	0.0057	0.0011	0.0024	0.0048	0.0010	0.0033	0.0071	0.0013	0.0062	0.0133	0.0028	0.0043	0.0085	0.0024
Poland	0.0024	0.0037	0.0017	0.0025	0.0040	0.0017	0.0039	0.0071	0.0023	0.0048	0.0094	0.0026	0.0079	0.0154	0.0045
Czech Republic	0.0014	0.0019	0.0010	0.0026	0.0046	0.0014	0.0026	0.0042	0.0018	0.0030	0.0062	0.0015	0.0041	0.0096	0.0016
Romania	0.0031	0.0044	0.0023	0.0020	0.0018	0.0020	0.0017	0.0015	0.0017	0.0017	0.0010	0.0021	0.0012	0.0014	0.0011
Hungary	0.0034	0.0077	0.0008	0.0014	0.0023	0.0009	0.0011	0.0021	0.0006	0.0018	0.0031	0.0012	0.0018	0.0040	0.0009
Greece	0.0020	0.0023	0.0018	0.0017	0.0020	0.0014	0.0011	0.0013	0.0010	0.0022	0.0036	0.0015	0.0017	0.0028	0.0012
Malta	0.0002	0.0003	0.0002	0.0000	0.0001	0.0000	0.0013	0.0027	0.0006	0.0028	0.0062	0.0012	0.0040	0.0088	0.0019
Bulgaria	0.0019	0.0021	0.0018	0.0012	0.0021	0.0006	0.0009	0.0007	0.0011	0.0008	0.0014	0.0005	0.0015	0.0023	0.0011
Slovakia	0.0004	0.0006	0.0002	0.0003	0.0006	0.0002	0.0007	0.0011	0.0005	0.0011	0.0022	0.0006	0.0013	0.0026	0.0006
Lithuania	0.0007	0.0012	0.0005	0.0007	0.0012	0.0005	0.0005	0.0012	0.0001	0.0009	0.0023	0.0002	0.0005	0.0011	0.0003
Estonia	0.0004	0.0009	0.0002	0.0000	0.0000	0.0001	0.0003	0.0004	0.0002	0.0006	0.0013	0.0003	0.0007	0.0017	0.0003
Latvia	0.004	0.0005	0.0004	0.0001	0.0003	0.0001	0.0003	0.0004	0.0002	0.0006	0.0014	0.0002	0.0004	0.0007	0.0003
Cyprus	0.0003	0.0003	0.0002	0.0001	0.0004	0.0000	0.0004	0.0008	0.0002	0.0004	0.0009	0.0002	0.0008	0.0017	0.0004
Slovenia	0.0003	0.0006	0.0002	0.0002	0.0002	0.0002	0.0004	0.0008	0.0002	0.0006	0.0013	0.0003	0.0003	0.0004	0.0003

To get a geographical view, Figure 4.2 depicts the spatial distribution of emigration rates of natives as a whole over the sample period, while the spatial distribution of young and adult natives is displayed in Figures 4.3 and 4.4, respectively. The darker the color of a country, the higher the emigration rate to that country. A relevant feature can be drawn from the three maps: there seems to exist spatial dependence. To check for the presence of spatial dependence, we compute Moran's I statistic on the emigration rates (‰) of natives, and disaggregating into young and adult natives. To do so, we use a binary spatial weight matrix with a distance-based critical cut-off of 1,500 kilometers.[7] The results, displayed in Table 4.3, confirm the presence of positive spatial dependence in the emigration rates for the three groups of population, which decreases over time until it disappears in the year 2013.

Figure 4.2 Emigration rates of natives (16-64 years) from Spain (2008-2016).



[7] This matrix is employed since it is the appropriate one to develop the empirical analysis, as we will explain below.

Figure 4.3 Emigration rates of young natives (16-34 years) from Spain (2008-2016).

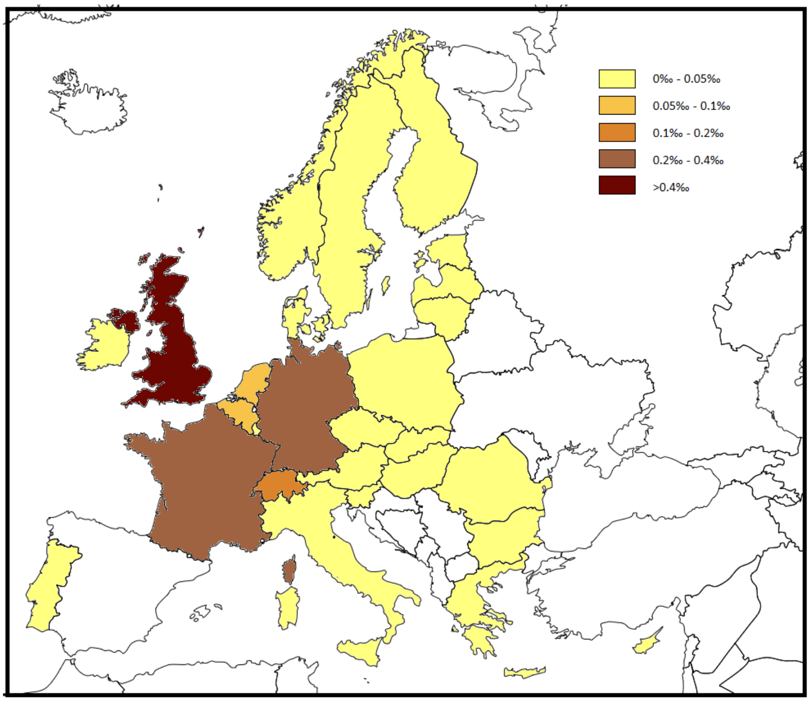


Figure 4.4 Emigration rates of adult natives (35-64 years) from Spain (2008-2016).

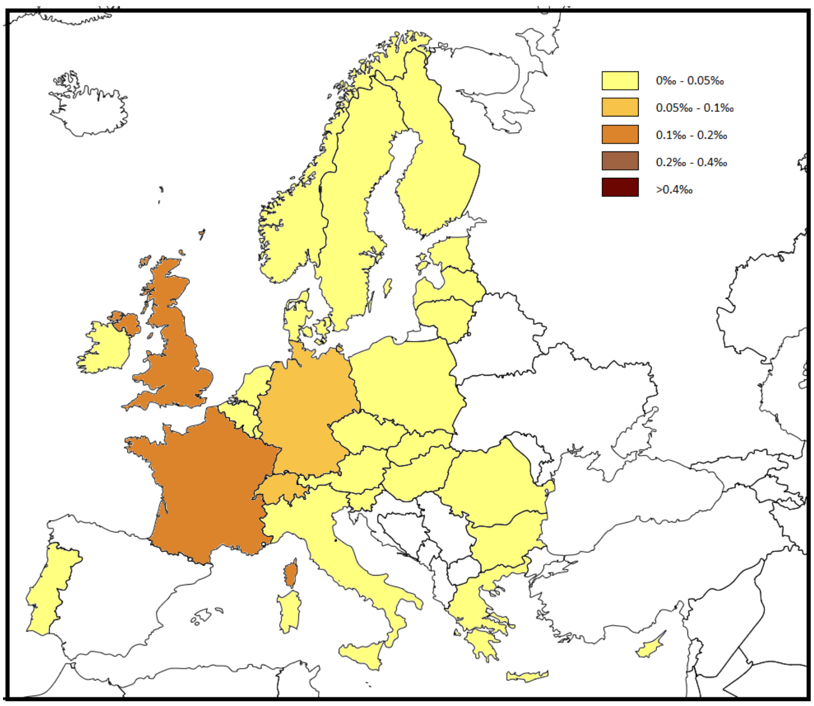


Table 4.3 Spatial dependence in emigration rates (‰).

	Natives		Young natives		Adult natives	
Year	Moran's I	p-value	Moran's I	p-value	Moran's I	p-value
2008	0.06	0.02	0.06	0.02	0.06	0.03
2009	0.05	0.04	0.05	0.04	0.06	0.03
2010	0.05	0.04	0.05	0.04	0.05	0.04
2011	0.04	0.06	0.04	0.06	0.05	0.05
2012	0.03	0.09	0.03	0.09	0.04	0.07
2013	0.02	0.15	0.02	0.15	0.02	0.15
2014	0.02	0.15	0.02	0.15	0.02	0.13
2015	0.01	0.15	0.01	0.15	0.04	0.13
2016	0.02	0.14	0.02	0.14	0.02	0.12

4.3 Empirical analysis

This section is devoted to studying the factors behind the process of emigration of native population from Spain to Europe over the crisis. The analysis is carried out for natives, as well as for young and adult natives to assess whether some differences arise between both groups. To do so, we first specify an extended gravity model. Subsequently, we test for the presence of spatial dependence in the model since, as mentioned in the Introduction, the results would be misleading in the presence of spatial effects. After confirming the existence of spatial dependence, the corresponding spatial model is specified. Finally, we estimate the model and discuss the main results.

4.3.1 Model specification

To begin with, we consider the following extended gravity specification (Equation 4.1):

$$em_{it} = \alpha_1\, gdppc_{it-1} + \alpha_2\, unem_{it-1} + \alpha_3\, health\_exp_{it-1} + \alpha_4\, clim_{it-1} + \alpha_5\, herd_{it-1} + \alpha_6\, dist_i + \mu_t + \varepsilon_{it} \quad (4.1)$$

where i and t denote country of destination and year, respectively; μ_t refers to time fixed effects and ε_{it} is the error term. With respect to the variables employed, we include as dependent variable the emigration rates (‰) of, depending on the case, natives, young and adult natives. Once again, data were collected from the EVR database published by INE.

As for independent variables, in line with traditional migration models (Ravenstein, 1885; Harris and Todaro, 1970), two classical economic determinants are taken into account to assess whether out-migration effectively follows economic incentives (Pissarides and McMaster, 1990; Rodríguez-Pose et al., 2015). Specifically, we use per capita gross domestic product (PPP, constant 2011 international dollar) ($gdppc$), to proxy income opportunities, and the unemployment rate ($unem$) to proxy employment prospects. Data on these two variables were extracted from the World Bank Development Indicators (WDI) database. In addition, given that location-specific amenities have been prominent features of migration analyses (Knapp and Graves, 1989), we consider two indicators related to the availability of basic social services as well as environmental amenities (De la Fuente, 1999). Firstly, the public health expenditure as a percentage of GDP ($health\_exp$) to test whether social expenditure as a welfare indicator affects migration (Pedersen et al., 2008; Warin and Svaton, 2008). Data were also extracted from the WDI database. Secondly, we use a climate variable defined as the average annual temperature ($clim$) since it has been proven that nice weather conditions contribute to higher quality of life (Rappaport, 2007; Rodríguez-Pose and Ketterer, 2012; Coniglio and Pesce, 2015). These data were extracted from the National Climatic Data Center (NCDC).

Given the importance of the so-called ‘herd effect’ when analyzing international migration, we also incorporate it in the model as an additional pull factor (Massey et al., 1993; Bauer et al., 2000; Curran and Rivero-Fuentes, 2003; Epstein, 2008; Pedersen et al., 2008; Maza et al., 2013; Rodríguez-Pose et al., 2015; Izquierdo et al., 2016; Taylor, 2016; Nowotny and Pennerstorfer, 2017). The herd or network effect in migration refers to linkages stretching from home to host countries, that is, the fact that the presence of groups from the same geographical origin who are living in another place (or who previously migrated in a given country) allows future members of those communities to reduce their costs of assimilation and to ease their settlement in the new country (Massey et al., 1993). People at the country of destination help newcomers find accommodation, comply with legal constraints, gain easier access to jobs or learn the local language. The herd effect ($herd$) is measured as the stock of Spanish population resident abroad (in logs), in each of the European countries considered.[8] Data from the Register of Spaniards Resident Abroad (PERE), provided by INE, were used.

Finally, we add the distance (in logs) between Spain and the host countries ($dist$). In gravity models, it is generally measured in terms of the absolute geographic distance. So, we computed it as the great circle distance between capital cities. Needless to say, it has to be considered as a proxy for the direct cost associated to the migration process. Data, in this case, come from CEPII database.

That said, two important points have to be made. First, that all explanatory variables, except distance for obvious reasons, are as usual lagged one year to capture the fact that their impact on out-migration is not immediate. Second, that the independent variables, with the exceptions of the herd effect and distance, are defined in relative terms with respect to Spain, as we assume that migrants compare the situation of these variables in the country of destination with that in Spain.

Additionally, before estimating the model we should rule out a potential, previously unstudied and quite important problem: the existence of spatial effects in Equation (4.1). This issue becomes instrumental when performing cross-section analysis, as it has already been proven that the omission of spatial effects can lead to inefficient

[8] This information was not available for the years 2007 and 2008. Consequently, we proxied the stock in the year 2008 by subtracting the flow of natives that migrated from Spain to each European country in 2008 from the stock of Spanish population in each country in 2009. After that, we did the same for the year 2007.

and inconsistent estimators (LeSage and Pace, 2009). To test for the presence of spatial dependence, we estimated Equation (4.1) by ordinary least squares (OLS) and, then, we applied the robust Lagrange multiplier (LM) tests: namely the robust LM-LAG (i.e., the LM test for a spatially lagged dependent variable), whose null hypothesis is the absence of substantive dependence, and the robust LM-ERR (i.e., the LM test for residual spatial autocorrelation), whose null hypothesis is the absence of residual spatial autocorrelation. The results, reported in Table 4.4, reveal that both hypotheses are rejected at the 1% level. Hence, it can be concluded that there exist substantive dependence and residual spatial autocorrelation in the three cases. In view of the above results, the model based on Equation (4.1) should be enlarged to consider spatial dependence.

Table 4.4 Lagrange multiplier (LM) tests for spatial dependence.

	Statistic	*p*-value
Tests	Natives	
Robust LM-LAG	47.23	0.00
Robust LM-ERR	31.52	0.00
	Young natives	
Robust LM-LAG	37.04	0.00
Robust LM-ERR	33.26	0.00
	Adult natives	
Robust LM-LAG	24.57	0.00
Robust LM-ERR	31.02	0.00

Accordingly, the next step is to determine the correct specification of the spatial model. To do so, we followed the general-to-specific approach. We estimated an SDM for natives, as well as for each subsample of young and adult natives. Then, we computed the Likelihood Ratio (LR) tests to examine whether the SDM in each case could be simplified into a Spatial Autoregressive Model (SAR) or a Spatial Error Model (SEM). The results, displayed in Table 4.5, reveal that both hypotheses can be rejected at the 1% significance level in the three cases. Therefore, we conclude that the SDM is the most appropriate model.

Table 4.5 Likelihood ratio (LR) tests for spatial dependence.

	Statistic	*p*-value
Tests	Natives	
LR test for spatial autoregressive (SAR) model	2227.53	0.00
LR test for spatial error model (SEM)	1954.57	0.00
	Young natives	
LR test for spatial autoregressive (SAR) model	3170.35	0.00
LR test for spatial error model (SEM)	3287.86	0.00
	Adult natives	
LR test for spatial autoregressive (SAR) model	462.66	0.00
LR test for spatial error model (SEM)	1493.68	0.00

Thus, the final specification of the SDM models is as follows (Equation 4.2):

$$em_{it} = \alpha_1\, gdppc_{it-1} + \alpha_2\, unem_{it-1} + \alpha_3\, health\_exp_{it-1} + \alpha_4\, clim_{it-1} + \alpha_5\, herd_{it-1} + \rho \sum_j w_{ij}\, em_{jt} + \theta_1 \sum_j w_{ij}\, gdppc_{jt-1} + \theta_2 \sum_j w_{ij}\, unem_{jt-1} + \theta_3 \sum_j w_{ij}\, health\_exp_{jt-1} + \theta_4 \sum_j w_{ij}\, clim_{jt-1} + \theta_5 \sum_j w_{ij}\, herd_{jt-1} + \alpha_6\, dist_i + \mu_t + \varepsilon_{it} \quad (4.2)$$

where w_{ij} denotes the elements of the spatial weight matrix W in row-standardized form. Following Elhorst et al. (2013), we use the spatial weight matrix associated to the highest value of the log-likelihood function. In our case, it is a binary spatial weight matrix with a distance-based critical cut-off of 1,500 kilometers.[9] Once this distance has been exceeded, the influence among countries is assumed to be negligible. Finally, ρ denotes the spatial autoregressive coefficient, and θ are the parameters linked to the spatial lags of the independent variables.

[9] Provided that each country had at least one neighbor, we ran different permutations by increasing the distance 100 kilometers. As a reference, the minimum distance between countries is 59.6 km and the maximum distance is 9322.4 km.

4.3.2 Empirical results

This subsection is aimed at estimating the SDM model and discussing its main results. The model is estimated by maximum likelihood, using Driscoll-Kraay standard errors robust to general forms of spatial and temporal dependence. Tables 4.6, 4.7 and 4.8 show the point estimates for natives, young and adult natives, respectively.

Table 4.6 Spatial Durbin model (SDM) for natives (2008-2016).

Dependent variable: em_{it}	Coefficients
$gdppc_{it-1}$	0.038*** (0.007)
$unem_{it-1}$	-0.057** (0.024)
$health\_exp_{it-1}$	0.023*** (0.004)
$clim_{it-1}$	0.022*** (0.006)
$herd_{it-1}$	0.018*** (0.004)
$\sum_j w_{ij}\, em_{jt}$	-0.587*** (0.182)
$\sum_j w_{ij}\, gdppc_{jt-1}$	0.105** (0.051)
$\sum_j w_{ij}\, unem_{jt-1}$	0.117 (0.124)
$\sum_j w_{ij}\, health\_exp_{jt-1}$	0.202* (0.116)
$\sum_j w_{ij}\, clim_{jt-1}$	0.015 (0.040)
$\sum_j w_{ij}\, herd_{jt-1}$	-0.021* (0.011)
$dist_i$	-0.026*** (0.003)
R squared	0.640

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) (*) Significant at 1% (5%) (10%) respectively. Time fixed effects are included.

To begin with, the coefficients associated to the spatial lags of the dependent variable are negative and statistically significant for the three population groups. This reveals the presence of negative spatial dependence between the out-migration of natives from Spain to European countries. This would indicate that the positive spatial dependence that existed in the emigration rates at least in the first years of the sample period (as previously seen with the computation of the Moran's I statistic) seems to be captured by the factors driving out-migration included in the model.

Concerning the rest of variables, it seems that the higher the per capita GDP and the value of amenities (public health expenditure and good climate) in a European country with respect to Spain, the higher the out-migration of natives. Besides, higher unemployment rates in destination with respect to origin discourage migration. As for the herd effect, results indicate that social networks play an essential role as a pull factor of Spanish natives. This is in line with the evidence found by Izquierdo et al. (2016), who highlight the importance of recent network effects of Spaniards abroad in shaping migration during the crisis. The disaggregation by age groups discloses that, as expected, the positive impact of social networks is significantly higher in the case of young natives (0.029) with respect to adults (0.012). Regarding distance, this factor discourages migration of natives, the deterrent effect being stronger among adults than among young natives.

Table 4.7 Spatial Durbin model (SDM) for young natives (2008-2016).

Dependent variable: em_{it}	Coefficients
$gdppc_{it-1}$	0.064*** (0.013)
$unem_{it-1}$	-0.116** (0.048)
$health\_exp_{it-1}$	0.036*** (0.007)
$clim_{it-1}$	0.046*** (0.011)
$herd_{it-1}$	0.029*** (0.007)
$\sum_j w_{ij}\, em_{jt}$	-0.717*** (0.193)
$\sum_j w_{ij}\, gdppc_{jt-1}$	0.210** (0.091)
$\sum_j w_{ij}\, unem_{jt-1}$	0.210 (0.220)
$\sum_j w_{ij}\, health\_exp_{jt-1}$	0.430* (0.236)
$\sum_j w_{ij}\, clim_{jt-1}$	0.051 (0.077)
$\sum_j w_{ij}\, herd_{jt-1}$	-0.038* (0.021)
$dist_i$	-0.023*** (0.006)
R squared	0.580

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) (*) Significant at 1% (5%) (10%) respectively. Time fixed effects are included.

Table 4.8 Spatial Durbin model (SDM) for adult natives (2008-2016).

Dependent variable: em_{it}	Coefficients
$gdppc_{it-1}$	0.025*** (0.004)
$unem_{it-1}$	-0.030** (0.014)
$health\_exp_{it-1}$	0.015*** (0.003)
$clim_{it-1}$	0.010*** (0.004)
$herd_{it-1}$	0.012*** (0.002)
$\sum_j w_{ij}\, em_{jt}$	-0.452*** (0.157)
$\sum_j w_{ij}\, gdppc_{jt-1}$	0.058 (0.036)
$\sum_j w_{ij}\, unem_{jt-1}$	0.072 (0.079)
$\sum_j w_{ij}\, health\_exp_{jt-1}$	0.100 (0.062)
$\sum_j w_{ij}\, clim_{jt-1}$	0.001 (0.024)
$\sum_j w_{ij}\, herd_{jt-1}$	-0.013* (0.007)
$dist_i$	-0.027*** (0.004)
R squared	0.697

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) (*) Significant at 1% (5%) (10%) respectively. Time fixed effects are included.

As regards the spatial lags of the explanatory variables, they are statistically significant for natives (Table 4.6) and young natives (Table 4.7) except for the unemployment rate and the climate variable. On the other hand, for adult natives (Table 4.8) only the spatial lag associated to the herd effect is found to be statistically significant.

Although revealing, the results obtained by point estimates can only be used as an approximation for the actual effects. Indeed, the use of point estimates may lead to erroneous conclusions when interpreting the impact of changes in the explanatory variables over the dependent one (LeSage and Pace, 2009). This is so because point estimates do not consider feedback effects, what moreover becomes especially risky in the case of the SDM model as it produces global spatial spillovers.[10] The interpretation of direct, indirect and total effects is as follows: the direct effect

[10] Spillovers arising from spatial lags of the dependent variable allow for spillovers to neighbors, neighbors to neighbors, and so on, coming back in the end to the area they originated from.

captures the effect of a change in a particular explanatory variable in country *i* on the out-migration rate from Spain to that country, while the indirect effect (or spillover) can be interpreted as the cumulative effect of the changes in a variable in countries other than *i* on the out-migration rate from Spain to country *i* through the out-migration to the rest of European countries. The total effect is the sum of both, direct and indirect effects. The results are shown in Tables 4.9, 4.10 and 4.11.

Table 4.9 Spatial Durbin model (SDM) for natives: direct, indirect and total effects.

Variable	Direct effects	Indirect effects	Total effects
$gdppc_{it-1}$	0.042*** (0.009)	0.084** (0.036)	0.126*** (0.028)
$unem_{it-1}$	-0.062** (0.028)	0.099 (0.089)	0.037 (0.061)
$health\_exp_{it-1}$	0.028*** (0.008)	0.142** (0.071)	0.170*** (0.065)
$clim_{it-1}$	0.021*** (0.005)	0.001 (0.023)	0.023 (0.027)
$herd_{it-1}$	0.019*** (0.004)	-0.020** (0.008)	-0.001 (0.005)

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) (*) Significant at 1% (5%) (10%) respectively. Time fixed effects are included.

Table 4.10 Spatial Durbin model (SDM) for young natives: direct, indirect and total effects.

Variable	Direct effects	Indirect effects	Total effects
$gdppc_{it-1}$	0.073*** (0.018)	0.158*** (0.058)	0.231*** (0.064)
$unem_{it-1}$	-0.126** (0.058)	0.181 (0.154)	0.055 (0.097)
$health\_exp_{it-1}$	0.051*** (0.017)	0.281** (0.133)	0.332* (0.159)
$clim_{it-1}$	0.046*** (0.010)	0.011 (0.040)	0.057 (0.047)
$herd_{it-1}$	0.032*** (0.009)	-0.036** (0.016)	-0.004 (0.009)

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) (*) Significant at 1% (5%) (10%) respectively. Time fixed effects are included.

Our findings confirm the idea that most natives migrating from Spain to Europe over the period 2008-2016 had labor incentives (González-Enríquez, 2013) and also looked for better economic prospects. Regarding spillovers, we can see that while positive and significant spillover effects are found in the case of per capita GDP, which are higher in magnitude than the corresponding direct effects, there does not seem to exist spillover effects for unemployment. The effects associated to both variables were higher in the case of young natives with respect to adults.

Table 4.11 Spatial Durbin model (SDM) for adult natives: direct, indirect and total effects.

Variable	Direct effects	Indirect effects	Total effects
$gdppc_{it-1}$	0.027*** (0.005)	0.049* (0.026)	0.076*** (0.022)
$unem_{it-1}$	-0.032** (0.016)	0.061 (0.060)	0.028 (0.044)
$health\_exp_{it-1}$	0.017*** (0.004)	0.076* (0.042)	0.094** (0.039)
$clim_{it-1}$	0.010*** (0.003)	-0.002 (0.016)	0.008 (0.018)
$herd_{it-1}$	0.012*** (0.002)	-0.013** (0.005)	-0.001 (0.004)

Notes: Driscoll-Kraay standard errors in parenthesis. *** (**) (*) Significant at 1% (5%) (10%) respectively. Time fixed effects are included.

Concerning amenities, both public health expenditure and the climate variable present positive and statistically significant direct effects regardless of age. No spillovers are found in the case of climate, which conveys the message that natives only cared about the climate conditions of the destination country but not that of neighboring countries. However, positive and significant spillovers arise for health expenditure, that is, natives leaving Spain during the crisis, mainly of younger ages, also felt attracted by the higher level of health expenditure of the surrounding area of the destination country.

Finally, as for the variable capturing the herd effect, both direct and indirect effects are, in all cases, statistically significant. In addition, it is worth pointing out that both effects compensate each other, giving rise to a negligible and non-significant total effect. Despite this, the direct effect (higher among young natives (0.032) than among adults (0.012)), reveals the presence of social networks of previous native migrants in the country of destination exerted a positive influence on natives' decision to migrate across Europe. Besides, the existence of negative spillovers in this variable reinforces that native migrants chose those countries of destination with the most robust natives' networks during the crisis. As shown in Figures 4.2 to 4.4, significant emigration rates of natives to the United Kingdom, France, Germany and Switzerland over the period 2008-2016 created networks in these countries.

4.4 Conclusions

This paper examines the factors shaping out-migration of natives from Spain toward a sample of 28 European countries during the Great Recession and its aftermath. The study also explores potential differences between out-migration of young and adult natives. To do so, a spatial panel Durbin model is estimated for the period 2008-2016.

The descriptive analysis of the first part of the paper clearly shows the influence of the outbreak of the crisis on migration patterns. Indeed, the net migration rate of natives turned from positive to negative in the year 2008, and since then the outflows of natives, as well as those of youth and adults, steadily increased (except for a slight fall in 2009). Consequently, the out-migration rate of natives rose over the crisis period. As for age groups, out-migration rates reveal that emigration flows were particularly prominent among the young population, almost doubling that of adults. Regarding main destinations, on average 51.5% of natives migrated to Europe, followed by 39.2% to America. With respect to the geographic distribution of out-migration to Europe, emigration rates of natives to the United Kingdom, France, Germany and Switzerland were the highest ones, irrespective of the age of natives.

After describing the main features of the new migration scenario in Spain, the article centers on the analysis of the main factors behind the out-migration of natives from Spain to the main continent of destination: Europe. Some important conclusions can be drawn from this analysis. First, Spanish migrants have been moving mainly to countries with better economic prospects (higher per capita GDP and lower unemployment rates), although the effect of amenities (higher public health expenditure and better climate) on the decision to migrate has also been significant. Second, social networks have played a major role as pull factor in migration decisions, this effect being higher among young natives. Third, distance, chosen as a proxy for migration costs, has had a deterrent effect on migration, this effect being higher among adult natives. Finally, due to the spatial econometric approach employed the paper finds evidence of positive spatial spillovers in per capita GDP and health expenditure, as well as negative spillovers in the case of the herd effect. Regarding spillover effects, differences between young and adult natives are not remarkable.

The findings of this piece of work may contribute to the wide debate on migratory flows that has recently revived in Spain. The paper stresses here the importance that out-migration of natives from Spain to Europe is having during the crisis, as well as the fact that it is largely composed of youth people between 16 and 34 years. This process, if it goes on, might aggravate some of the problems that Spain will have to cope with in the near future: shortages of population, aging population, pension system sustainability, and so on (Vázquez-Grenno, 2010; Díaz-Giménez and Díaz-Saavedra, 2017). Unfortunately, our findings point in that direction. People move looking for better job conditions and, needless to say, Spain is not going to be able to catch up with other countries. Social networks, by way of reducing the cost of migration, are already important. Therefore, a continuous and potentially more intense flow of natives migrating to European countries will no doubt contribute to the consolidation of large networks of Spaniards abroad and, in consequence, to increase the attractiveness of some European countries. As a whole, this study reveals that out-migration has become a real problem for Spain, with a trend toward aggravation as time passes. At present, with the Spanish labor market going through a gradual recovery, this poses an extra challenge Spain had better face.

Finally, it should be mentioned that the lack of information on the qualification of the natives migrating from Spain toward European countries prevents us from determining whether these natives' outflows during the crisis corresponded mainly to highly qualified people in search of labor opportunities. If this were the case, we might be facing a brain drain from Spain toward Europe. This is a topic for future research, providing that data are available.[11]

[11] Although employing alternative migration data (from the Spanish Survey of Economically Active Population published by the INE), which do not imply permanent movements (changes of residence) but only short-run migration (people working temporarily abroad), Izquierdo et al. (2014) show that those natives who migrated during the crisis (over the period 2008-2013) tend to be more skilled than those who remained in Spain. Unfortunately the same analysis, as these authors acknowledge, cannot be done for permanent migrations.

Conclusiones

Conclusiones

Esta última sección concluye la Tesis presentando los principales resultados obtenidos en cada uno de los capítulos, así como varias recomendaciones de política económica que se derivan de los mismos. También se exponen las posibles líneas futuras de investigación, las cuales estarán sujetas a la disponibilidad de datos y a la calidad de los mismos.

En el Capítulo 1 se lleva a cabo un análisis de los patrones de migración interna de extranjeros y nativos. Se estima un modelo de gravedad ampliado adoptando una perspectiva bilateral origen-destino. Éste se combina con una metodología que permite identificar comportamientos no lineales a través de thresholds de carácter endógeno. El análisis arroja resultados relevantes. En primer lugar, el papel desempeñado por los factores laborales es más importante entre los extranjeros que entre los nativos, especialmente antes del estallido de la crisis. Por otro lado, la evidencia empírica corrobora que el ciclo económico modifica la influencia de los factores determinantes de la migración; en concreto, el peso relativo del sector servicios y, en menor medida, las condiciones climáticas han ganado atractivo entre los nativos durante la crisis, mientras que se observa lo contrario en el caso de los extranjeros. Asimismo, el estudio revela la existencia de no linealidades sobre el efecto de los salarios esperados en la migración, con independencia del grupo (extranjeros y nativos) y el periodo (pre-crisis y crisis) considerados.

Para completar el estudio anterior, el Capítulo 2 se ocupa también de los factores explicativos de la movilidad interna entre las provincias españolas de ambos grupos de población. Este trabajo aborda lo que se conoce como 'multilateral resistance to migration', un concepto ampliamente descuidado en los estudios sobre migración. Nuestros resultados ponen de manifiesto que el efecto de los salarios y el desempleo sobre la migración interna es no lineal en el grupo de nativos, mientras que este comportamiento sólo se observa entre la población extranjera cuando se consideran efectos fijos diádicos origen-destino. Por otra parte, merece la pena destacar los resultados relativos a la hipótesis sobre si las preferencias de los nativos están más basadas en amenities y menos orientadas hacia factores económicos que las de los extranjeros. La evidencia lo confirma: el impacto de los determinantes de carácter económico sobre la migración interna es mayor para los extranjeros que para los nativos. Además, los resultados apuntan hacia una distinta naturaleza de las amenities más atractivas entre ambos grupos de población: mientras que los extranjeros buscan servicios sociales y amenities de tipo cultural, los nativos prefieren mejores condiciones climáticas. Para finalizar, se puede concluir que los modelos de equilibrio y desequilibrio de migración no son totalmente independientes a la hora de explicar la migración interna de nativos y extranjeros en España.

En el Capítulo 3 se adopta un enfoque espacial para evaluar el impacto de la inmigración sobre los salarios en las provincias españolas. Este análisis proporciona resultados interesantes. Un incremento en el stock de extranjeros en términos relativos sobre la población total tiene un impacto negativo pequeño en los salarios provinciales. Dicho impacto está determinado, en su mayor parte, por la presencia de efectos spillover procedentes del resto de provincias. Adicionalmente, se confirma que el salario medio de una determinada provincia depende de forma positiva de su nivel de productividad y de la participación de la industria manufacturera, y de forma negativa de la tasa de desempleo y de la participación del sector servicios. Por consiguiente, podemos afirmar que la reducción de los salarios durante la crisis no ha estado motivada por la inmigración, sino por el fuerte incremento en las tasas de desempleo y la desaceleración de la productividad.

El último capítulo presenta un análisis de los determinantes del proceso de emigración de la población nativa desde España hacia países europeos durante la Gran Recesión y el período inmediatamente siguiente. La estimación de un modelo de datos de panel Durbin espacial para la población nativa en edad de trabajar y para cada submuestra de población nativa joven y adulta, revela que la emigración de los nativos durante la crisis se debió principalmente a incentivos laborales, aunque la presencia de amenities también influyó a la hora de tomar la decisión de dónde emigrar. Asimismo, los resultados apuntan hacia la importancia de las redes de emigrantes españoles residentes en Europa como factor de atracción de los nativos residentes en España, mayor entre el colectivo de menor edad, así como un efecto disuasorio de la distancia, especialmente entre los adultos. Finalmente, se ha demostrado la existencia de efectos spillover espaciales positivos en el PIB per cápita y el gasto en sanidad y negativos en el caso del efecto red, con independencia de la edad de la población nativa.

En base a los resultados obtenidos a lo largo de esta Tesis, podemos extraer las siguientes recomendaciones de política económica. 1) Dado que la población extranjera muestra una mayor capacidad de respuesta a los determinantes de naturaleza económica que la población nativa cuando se mueven de una provincia española a otra, se deberían promover iniciativas encaminadas a mejorar los canales de información entre la población extranjera para facilitar su integración en el mercado de trabajo. Esto contribuiría a la equiparación de oportunidades entre ambos grupos de población y, a largo plazo, la movilidad interna de los extranjeros actuaría como mecanismo de equilibrio, reduciendo las disparidades y reforzando la cohesión social. 2) Sería recomendable que los gobiernos locales de aquellas provincias que se enfrentan a problemas de escasez de población combinen las iniciativas anteriormente expuestas con la estimulación de ciertas amenities, en particular de tipo social y cultural, ya que se ha comprobado su gran atractivo entre la población extranjera, junto con los factores económicos. 3) El efecto de la inmigración sobre los salarios no debería ser usado, por los gobiernos nacionales, como un argumento en contra a la hora de diseñar políticas de inmigración, y mucho menos, para aplicar políticas que intensifiquen los controles a la inmigración. 4) La puesta en marcha de políticas de inmigración orientadas a seleccionar a los inmigrantes en función de su cualificación, favoreciendo a aquellos con un mayor nivel de conocimientos, sería beneficiosa. Asimismo, se debería trabajar para que los inmigrantes sean integrados en el mercado de trabajo de acuerdo con los requerimientos específicos de cada sector de actividad en cada provincia.

Las futuras líneas de investigación incluyen la extensión de la primera parte de la Tesis con el uso de técnicas de econometría espacial, lo cual nos permitiría tratar la posible dependencia espacial existente en los datos. De este modo, se testaría la presencia de efectos spillover en los factores de ‘atracción’ y de ‘empuje’ de la migración interna entre las provincias españolas de nativos y extranjeros utilizando un enfoque origen-destino. También resultaría interesante estudiar los factores explicativos de la migración utilizando microdatos, lo que aportaría información relevante a nivel del individuo, de otra forma no disponible. Por lo que respecta al impacto de la inmigración en los salarios, el hecho de adoptar un enfoque más microeconómico recurriendo, por ejemplo, a datos de encuestas nos permitiría enriquecer nuestro análisis con características como la situación laboral o el género de la población inmigrante, o incluso llevar a cabo un estudio similar para tramos de salarios específicos y/o por ramas de actividad. Además, siempre y cuando dispongamos de datos, sería clave extender alguno de los análisis de migración presentados a lo largo de esta Tesis considerando una muestra más grande de países europeos o de la OCDE. Sin duda, esto nos proporcionaría información relevante sobre los patrones y determinantes de la migración desde una escala más global. Para terminar, la escasez de información relativa al nivel de cualificación de la población nativa que emigra desde España hacia países europeos nos impide determinar si los flujos de salida de nativos durante la crisis correspondieron a españoles con alta cualificación en busca de oportunidades laborales. Esto constituye una posible línea de investigación futura, siempre y cuando existan datos para llevar a cabo el análisis.

Conclusions

Conclusions

This final section concludes the Thesis by presenting the main findings obtained in each chapter and some recommendations for policy-making derived from them. In addition, this section outlines the possible future research lines, some of which will be restricted to the quality and availability of data.

In Chapter 1, internal migration patterns of foreigners and natives are analyzed. The extended gravity model, estimated by using a bilateral origin-destination perspective combined with a methodology that allows to identify endogenous thresholds to nonlinear effects, provides interesting results. To begin with, the role played by labor factors is more important for foreigners than natives, especially before the outbreak of the economic crisis. Besides, evidence supports the fact that the business cycle modifies the decision-making of migrants; to be more precise, the relative size of the service sector and, to a lesser extent, climate conditions have gained importance as attraction factors for natives over the crisis, while the opposite happens for foreigners. Moreover, some nonlinearities in the effect of expected wages on migration are found regardless of the group (foreigners and natives) and/or time frame (pre-crisis and crisis) considered.

To complete the previous study, Chapter 2 focuses as well on the driving factors of internal migration across Spanish provinces of both groups of population. It addresses the so-called 'multilateral resistance to migration', largely overlooked in migration studies. This chapter reveals that the effect of wages and unemployment on internal migration is clearly nonlinear for the group of natives, while this only happens for foreigners when dyadic fixed effects of origin-destination are considered. Furthermore, another relevant hypothesis that has been tested in this chapter is whether natives' preferences are more amenity-based/less economic-oriented than those of foreigners. Results in this regard tend to reinforce previous evidence that the impact of economic factors on internal migration is higher for foreigners than for natives. Besides, they disclose that the nature of amenities with the greatest impact on internal movements differs between both groups of population: while foreigners look for social services and cultural amenities, natives are more attracted by good climate conditions. In conclusion, it can be confirmed that disequilibrium and equilibrium models of migration cannot be totally separated to explain the internal migration of foreigners and natives in Spain.

On the other hand, a spatial approach is adopted in Chapter 3 to assess the impact of immigration on wages across Spanish provinces. The analysis yields some valuable insights. An increase in the stock of foreigners relative to the total population has a small negative impact on provincial wages, which is mainly determined by the presence of spillover effects coming from the rest of provinces. Additionally, it has been proven that the average wage of a particular province depends positively on its productivity level and the share of the manufacturing industry, and negatively on the rate of unemployment and the share of the service sector. So, a further conclusion can be drawn: the reduction of wages in Spain during the crisis period has not been triggered by immigration, but rather by the sharp increase in unemployment rates and the slowdown in productivity.

To conclude, the determinants of the process of out-migration of native population from Spain to European countries during the Great Recession and its aftermath are analyzed in the last Chapter. The estimation of a spatial panel Durbin model for the group of working-age natives, as well as for each subsample of young and adult natives, reveals that out-migration of natives during the crisis responded mainly to labor incentives, although the presence of amenities also mattered in the decision of where to migrate. Besides, results point to the relevance of social networks of Spanish emigrants residing in Europe as a pull factor for natives residing in Spain, higher in the case of young migrants, and the deterrent effect of distance, especially among adults. Finally, results disclose the existence of positive spatial spillovers in per capita GDP and health expenditure while negative in the case of social networks, irrespective of the age of natives.

Based on the results obtained throughout this Thesis, the following lessons or policy recommendations can be outlined. 1) As foreigners show more responsiveness to economic determinants than natives when moving across Spanish provinces, information channels among the foreign population should be improved to facilitate their integration into the labor market. This would lead to equal opportunities between both groups and in the long run, the internal mobility of foreigners could act as a mechanism of equilibrium helping reduce economic disparities and strengthen social cohesion. 2) Local governments in provinces facing shortages in population should combine the aforementioned policies with the enhancement of quality of life factors, specifically cultural and social amenities, as they have been proven to be, along with economic factors, particularly effective in the case of foreigners. 3) The effect of immigration on wages should not be used by national governments as an argument in the design of immigration policy, let alone to pursue policy measures to strengthen controls over immigration flows. 4) It would be advisable to conduct immigration policies aimed at selecting immigrants depending on their skill trying to favor the high-skilled group and at the same time, work toward the objective of immigrants being integrated into the labor market according to the specific requirements of the sectors of activity in each province.

Future lines of research would include the extension of the first part of the Thesis using spatial econometrics techniques to address the presence of potential spatial dependence in the data. By doing so, we would test for the existence of spillover effects in the push and pull factors shaping internal migration of natives and foreigners across Spanish provinces by using an origin-destination perspective. It would also be interesting to study the migration determinants by using microdata, which would add relevant information at the individual level, otherwise not accessible. With respect to the impact of immigration on wages, the fact of adopting a microeconomic approach by resorting to survey data would enable us to enrich the analysis with characteristics such as the employment situation or gender of the immigrant population, or even develop a similar study for specific wage ranges and/or branches of activity. Additionally, if data available, it would be valuable to extend some of the migration studies presented throughout this Thesis by considering a broader sample of European or OECD countries, which would provide additional insights into the patterns and determinants of migration from a more global scale. Finally, it should be mentioned that the lack of information on the qualification of the natives migrating from Spain toward European countries prevents us from determining whether these natives' outflows during the crisis corresponded mainly to highly qualified people in search of labor opportunities. This is a potential topic for future research, providing that data are available.

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Appendix

Appendix 1.

The Threshold Regression Model.

The method of threshold selection (Hansen, 1999) provides us with the threshold value(s) that detects nonlinearities in a target variable. The general model proposed by Hansen (1999) would be as follows:

$$y_{ij,t} = \begin{cases} \beta_1 \, x_{ji,t} + \varepsilon_{ij,t} \, , & q_{ji,t} \leq \gamma \\ \beta_2 \, x_{ji,t} + \varepsilon_{ij,t} \, , & q_{ji,t} > \gamma \end{cases} \qquad \text{(A1.1)}$$

where $q_{ji,t}$ is the threshold variable and γ is the threshold parameter.

In our case, $q_{ji,t} = w^{e}_{ji,t-1}$, $y_{ij,t} = m_{ij,t}$ and $x_{ji,t} = [w^{e}_{ji,t-1}, hc_{ji,t-1}, hp_{ji,t-1}, agr_{ji,t-1}, const_{ji,t-1}, ser_{ji,t-1}, clim_{ji,t-1}, d_{ij}]$. As can be seen, the two "regimes" are characterized by different slope coefficients β_1 and β_2.

The threshold parameter is unknown, so we should carry out an estimate. To do so and avoid the possibility that the potential threshold ($\hat{\gamma}$) sorts too few observations into each "regime", first of all, a grid search over the potential values of the threshold variable choosing, in our case, a 5% trimming is performed to exclude extreme values.

Then, by considering the remaining observations, this method takes different partitions which constitute the potential threshold values ($\hat{\gamma}$). If we denote $\hat{\beta}_1(\gamma)$ and $\hat{\beta}_2(\gamma)$ the corresponding estimates in each partition, it is possible to compute the sum of squared errors $S_1(\gamma)$ conditionally to a value of γ as follows:

$$S_1(\gamma) = \sum_{i=1}^{N} \sum_{j=1}^{N} \sum_{t=1}^{T} \hat{\varepsilon}^2_{ij,t} \, (\gamma) \qquad \text{(A1.2)}$$

The threshold estimate ($\hat{\gamma}$) is obtained by minimizing the concentrated sum of squared errors:

$$\hat{\gamma} = \underset{\gamma}{ArgMin}\ S_1(\gamma) \tag{A1.3}$$

Departing from the single-threshold model reported in (A1.1), the null hypothesis of no threshold effect (H_0: $\beta_1 = \beta_2$) could be tested with a standard test. Denoting the sum of squares of the linear model as S_0, the approximate likelihood ratio test of H_0 can be expressed as:

$$F_1 = \frac{S_0 - S_1(\hat{\gamma})}{\hat{\sigma}^2} \tag{A1.4}$$

where $\hat{\sigma}^2$ denotes a convergent estimate of σ^2. The difficulty here is that the threshold parameter γ is not identified under the null hypothesis. Thus, the asymptotic distribution of F_1 is not standard and, in particular, it does not correspond to a chi-squared distribution. To test for the nonlinearity hypothesis, we use bootstrap simulations to compute the p-value of the distribution (Hansen, 1999).

Then, if the p-value associated to F_1 led to rejecting the linear hypothesis, we would have to discriminate between one and two thresholds. The corresponding likelihood ratio statistic is the following:

$$F_2 = \frac{S_1(\hat{\gamma}) - S_2(\hat{\gamma}_1, \hat{\gamma}_2)}{\hat{\sigma}^2} \tag{A1.5}$$

where $\hat{\gamma}_1$ and $\hat{\gamma}_2$ refer to the threshold estimates of a double-threshold model and $S_2(\hat{\gamma}_1, \hat{\gamma}_2)$ denotes the corresponding residual sum of squares. Similarly, if the bootstrap p-value associated to F_2 led to rejecting the null hypothesis of one threshold, we then would have to discriminate between two and three thresholds, and so forth.

As it is shown in the paper, in our case, F_1 statistic seems to confirm the existence of nonlinearities in wages, while F_2 statistic does not support the existence of a double threshold. So our final model is that of one threshold.

Appendix 2. Overview of empirical literature analyzing the effect of immigration on wages.

Table A2.1 Overview of empirical literature analyzing the effect of immigration on wages.

Study	Country and time period	Methodology	Effect of immigration on wages
Grossman (1982)	US. Year 1970	Estimation of a translog production function	A 10% increase in the number of employed immigrants reduces native wages by 1%
Butcher and Card (1991)	US. Period 1979-1989	Analysis of changes in the distribution of wages in 24 major cities	Little indication of an adverse wage effect of immigration
Altonji and Card (1991)	US. Years 1970 and 1980	Instrumental variables (IV) estimation on different groups of "less-skilled" natives	A 1% increase in the foreign share of population in a city reduces the wages of unskilled natives by at most 1.2%
Card (2001)	US. Period 1985-1990	IV estimation on different occupation groups	A 10% increase in the immigrant inflows reduces wages of low-skilled service native workers in traditional gateway cities like Miami and Los Angeles by 1-3%
Camarota (1997)	US. Year 1991	Comparison of the relationship between the concentration of immigrants in occupations and the earnings of natives	A 1% increase in immigration reduces the weekly earnings of low-skilled native workers by 0.8%
Borjas (2003)	US. Period 1980-2000	IV estimation across education-experience groups	A 10% increase in immigration lowers average native wages by about 3% and the wages of the least-educated natives by 9%

Appendix 2 *(Continued)*

Study	Country and time period	Methodology	Effect of immigration on wages
Orrenious and Zavodny (2007)	US. Period 1994-2000	IV estimation using occupation as a proxy for skill	Larger immigrant inflows reduce average wages among natives working in manual labour occupations (the least skilled group). No effect among natives in professional and service occupations (more skilled workers)
Ottaviano and Peri (2012)	US. Period 1990-2006	Estimation of elasticities of substitution across groups of workers with different skills	A 10% increase in immigration has a small positive effect on both the wages of native workers with no high school degree (between 0.6% and 1.7%) and on average native wages (0.6%)
Dustmann et al. (2005)	UK. Period 1983-2000	OLS, IV as well as GMM estimation across skill groups	Little evidence of an adverse effect of immigration on wages
Dustmann et al. (2013)	UK. Period 1997-2005	OLS and IV estimation of wage effects along the distribution of native wages	Immigration depresses wages below the 20^{th} percentile of the wage distribution but leads to slight wage increases in the upper part of it. Average effects of immigration on wages are slightly positive
Nickell and Saleheen (2009)	UK. Period 1992-2006	OLS and GLS estimation using occupation as a proxy for skill	The immigrant-native ratio has a small negative impact on average wages, with the biggest impact registered in the semi-skilled and unskilled services sector (a 10% rise in the proportion of immigrants is associated with a 5% reduction in pay)

Appendix 2 *(Continued)*

Study	Country and time period	Methodology	Effect of immigration on wages
Manacorda et al. (2012)	UK. Period 1975-2005	Estimation of a multi-level Constant Elasticity of Substitution (CES) production function	Little discernible effect on natives' wages
De New and Zimmermann (1994)	Germany. Period 1984-1989	2-stage GLS estimation of wage functions of white and blue collar natives	Foreigners negatively affect the wages of Germans (a 1% point increase in the share of foreign labor implies a reduction of 4.1% in the hourly wage). Relatively small gains are made by white-collar employees with less than 20 years of experience (3.5%), while the wages of blue-collar employees decline by 5.9%
Pischke and Velling (1994)	Germany. Period 1985-1989	IV estimation	No significant adverse effect of immigration on wages
Brücker and Jahn (2008)	Germany. Period 1980-2004	2SLS and GMM estimation	A 1% increase in the German labour force through immigration reduces average wages by less than 0.1%
D´Amuri et al. (2010)	Germany. Period 1992-2001	IV estimation	Very little adverse impact of immigration on native wages: negative on highly educated and positive on the less educated

Appendix 2 *(Continued)*

Study	Country and time period	Methodology	Effect of immigration on wages
Winter-Ebmer and Zimmermann (1999)	Austria and Germany. Period 1986-1994	IV and weighted regression techniques with the sectoral employment shares as weights	In Austria, small negative impact of immigration on native wages (a 1% increase in immigration reduces native wages by 0.16%). No negative effect, however, is found for Germany
Carrasco et al. (2008)	Spain. Years 1991 and 2001	OLS and IV estimation	No significant negative impact of immigration on the wages of native workers
González and Ortega (2011)	Spain. Period 2001-2006	IV estimation	Relatively unskilled migration inflows do not affect the wages of unskilled workers

Appendix 3. $S(W)$ matrix of effect estimates for the $IMMIGR_{it-1}$ variable.

Table A3.1 $S(W)$ matrix of effect estimates for the $IMMIGR_{it-1}$ variable.

	Albacete	Alicante	Almería	Ávila	Badajoz	Baleares	Barcelona	Burgos	Cáceres	Cádiz	Castellón	Ciudad Real	Córdoba	La Coruña	Cuenca	Girona	Granada
Albacete	-0.0526	-0.0107	-0.0090	-0.0028	-0.0017	-0.0006	-0.0011	-0.0022	-0.0015	-0.0015	-0.0061	-0.0080	-0.0039	-0.0002	-0.0140	-0.0006	-0.0075
Alicante	-0.0155	-0.0526	-0.0082	-0.0017	-0.0010	-0.0018	-0.0023	-0.0016	-0.0009	-0.0009	-0.0113	-0.0043	-0.0023	-0.0001	-0.0094	-0.0013	-0.0053
Almería	-0.0131	-0.0083	-0.0525	-0.0024	-0.0026	-0.0004	-0.0006	-0.0013	-0.0018	-0.0034	-0.0031	-0.0087	-0.0070	-0.0002	-0.0064	-0.0003	-0.0221
Ávila	-0.0023	-0.0009	-0.0013	-0.0521	-0.0049	-0.0001	-0.0003	-0.0057	-0.0083	-0.0015	-0.0010	-0.0062	-0.0040	-0.0013	-0.0035	-0.0001	-0.0020
Badajoz	-0.0022	-0.0009	-0.0023	-0.0078	-0.0527	-0.0001	-0.0001	-0.0019	-0.0180	-0.0084	-0.0006	-0.0073	-0.0134	-0.0010	-0.0022	-0.0001	-0.0043
Baleares	-0.0037	-0.0074	-0.0017	-0.0007	-0.0003	-0.0501	-0.0261	-0.0011	-0.0003	-0.0002	-0.0134	-0.0012	-0.0006	-0.0001	-0.0036	-0.0201	-0.0011
Barcelona	-0.0021	-0.0029	-0.0007	-0.0006	-0.0002	-0.0079	-0.0595	-0.0012	-0.0002	-0.0001	-0.0095	-0.0008	-0.0004	-0.0001	-0.0026	-0.0308	-0.0006
Burgos	-0.0020	-0.0010	-0.0008	-0.0064	-0.0014	-0.0002	-0.0006	-0.0527	-0.0023	-0.0005	-0.0018	-0.0027	-0.0013	-0.0010	-0.0040	-0.0003	-0.0010
Cáceres	-0.0019	-0.0007	-0.0015	-0.0124	-0.0168	-0.0001	-0.0002	-0.0030	-0.0517	-0.0038	-0.0006	-0.0061	-0.0075	-0.0018	-0.0023	-0.0001	-0.0027
Cádiz	-0.0025	-0.0011	-0.0041	-0.0032	-0.0112	-0.0001	-0.0001	-0.0009	-0.0055	-0.0543	-0.0006	-0.0064	-0.0162	-0.0003	-0.0019	-0.0001	-0.0080
Castellón	-0.0071	-0.0091	-0.0025	-0.0014	-0.0006	-0.0026	-0.0060	-0.0022	-0.0006	-0.0004	-0.0533	-0.0024	-0.0011	-0.0001	-0.0082	-0.0034	-0.0019
Ciudad Real	-0.0073	-0.0027	-0.0054	-0.0068	-0.0051	-0.0002	-0.0004	-0.0027	-0.0046	-0.0034	-0.0019	-0.0519	-0.0106	-0.0004	-0.0070	-0.0002	-0.0085
Córdoba	-0.0041	-0.0017	-0.0051	-0.0051	-0.0109	-0.0001	-0.0002	-0.0015	-0.0065	-0.0099	-0.0010	-0.0123	-0.0532	-0.0004	-0.0033	-0.0001	-0.0099
La Coruña	-0.0004	-0.0002	-0.0002	-0.0032	-0.0015	0.0000	-0.0001	-0.0021	-0.0029	-0.0004	-0.0002	-0.0009	-0.0007	-0.0575	-0.0006	0.0000	-0.0003
Cuenca	-0.0127	-0.0059	-0.0040	-0.0039	-0.0015	-0.0005	-0.0013	-0.0039	-0.0017	-0.0010	-0.0064	-0.0070	-0.0029	-0.0003	-0.0517	-0.0007	-0.0039
Girona	-0.0018	-0.0025	-0.0007	-0.0005	-0.0002	-0.0093	-0.0472	-0.0011	-0.0002	-0.0001	-0.0081	-0.0007	-0.0003	0.0000	-0.0023	-0.0568	-0.0005
Granada	-0.0090	-0.0044	-0.0181	-0.0030	-0.0039	-0.0002	-0.0004	-0.0013	-0.0026	-0.0055	-0.0019	-0.0111	-0.0112	-0.0002	-0.0051	-0.0002	-0.0534
Guadalajara	-0.0058	-0.0029	-0.0020	-0.0053	-0.0015	-0.0004	-0.0011	-0.0073	-0.0020	-0.0007	-0.0044	-0.0052	-0.0022	-0.0004	-0.0125	-0.0006	-0.0022
Huelva	-0.0019	-0.0008	-0.0025	-0.0046	-0.0210	0.0000	-0.0001	-0.0012	-0.0104	-0.0189	-0.0005	-0.0058	-0.0139	-0.0007	-0.0017	-0.0001	-0.0049
Huesca	-0.0032	-0.0033	-0.0011	-0.0014	-0.0004	-0.0022	-0.0109	-0.0034	-0.0005	-0.0002	-0.0116	-0.0015	-0.0007	-0.0001	-0.0050	-0.0065	-0.0009
Jaén	-0.0093	-0.0039	-0.0114	-0.0039	-0.0043	-0.0002	-0.0004	-0.0017	-0.0031	-0.0045	-0.0020	-0.0154	-0.0118	-0.0003	-0.0061	-0.0002	-0.0189
León	-0.0009	-0.0004	-0.0004	-0.0070	-0.0020	0.0000	-0.0002	-0.0067	-0.0039	-0.0005	-0.0005	-0.0019	-0.0013	-0.0051	-0.0015	-0.0001	-0.0006
Lleida	-0.0025	-0.0031	-0.0009	-0.0008	-0.0003	-0.0043	-0.0253	-0.0018	-0.0003	-0.0002	-0.0110	-0.0010	-0.0004	-0.0001	-0.0034	-0.0150	-0.0007
La Rioja	-0.0029	-0.0017	-0.0010	-0.0044	-0.0010	-0.0004	-0.0014	-0.0152	-0.0016	-0.0004	-0.0036	-0.0027	-0.0012	-0.0006	-0.0059	-0.0008	-0.0011
Lugo	-0.0005	-0.0002	-0.0003	-0.0041	-0.0017	0.0000	-0.0001	-0.0030	-0.0034	-0.0004	-0.0003	-0.0011	-0.0009	-0.0221	-0.0008	0.0000	-0.0004
Madrid	-0.0043	-0.0018	-0.0019	-0.0104	-0.0028	-0.0002	-0.0005	-0.0067	-0.0038	-0.0012	-0.0020	-0.0078	-0.0035	-0.0007	-0.0073	-0.0003	-0.0026
Málaga	-0.0039	-0.0018	-0.0069	-0.0032	-0.0083	-0.0001	-0.0002	-0.0010	-0.0044	-0.0194	-0.0009	-0.0086	-0.0190	-0.0003	-0.0027	-0.0001	-0.0135
Murcia	-0.0197	-0.0175	-0.0154	-0.0021	-0.0015	-0.0008	-0.0011	-0.0015	-0.0012	-0.0016	-0.0061	-0.0065	-0.0038	-0.0001	-0.0092	-0.0007	-0.0097
Ourense	-0.0005	-0.0002	-0.0003	-0.0048	-0.0023	0.0000	-0.0001	-0.0028	-0.0046	-0.0006	-0.0003	-0.0013	-0.0012	-0.0186	-0.0008	0.0000	-0.0005
Asturias	-0.0008	-0.0003	-0.0004	-0.0057	-0.0016	0.0000	-0.0002	-0.0066	-0.0032	-0.0004	-0.0005	-0.0015	-0.0010	-0.0070	-0.0013	-0.0001	-0.0005
Palencia	-0.0014	-0.0007	-0.0006	-0.0080	-0.0017	-0.0001	-0.0003	-0.0146	-0.0031	-0.0005	-0.0010	-0.0025	-0.0014	-0.0018	-0.0027	-0.0002	-0.0009
Las Palmas	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pontevedra	-0.0004	-0.0002	-0.0002	-0.0035	-0.0019	0.0000	-0.0001	-0.0021	-0.0036	-0.0005	-0.0002	-0.0010	-0.0009	-0.0337	-0.0006	0.0000	-0.0004
Salamanca	-0.0014	-0.0006	-0.0009	-0.0141	-0.0064	-0.0001	-0.0002	-0.0044	-0.0134	-0.0016	-0.0006	-0.0039	-0.0035	-0.0030	-0.0021	-0.0001	-0.0015
Tenerife	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cantabria	-0.0014	-0.0007	-0.0006	-0.0059	-0.0013	-0.0001	-0.0005	-0.0199	-0.0023	-0.0004	-0.0013	-0.0021	-0.0011	-0.0017	-0.0028	-0.0003	-0.0008
Segovia	-0.0027	-0.0012	-0.0012	-0.0116	-0.0024	-0.0001	-0.0004	-0.0099	-0.0038	-0.0009	-0.0015	-0.0049	-0.0024	-0.0010	-0.0048	-0.0002	-0.0016
Sevilla	-0.0026	-0.0011	-0.0036	-0.0040	-0.0145	-0.0001	-0.0001	-0.0011	-0.0071	-0.0204	-0.0006	-0.0074	-0.0192	-0.0004	-0.0021	-0.0001	-0.0071
Soria	-0.0037	-0.0020	-0.0013	-0.0048	-0.0012	-0.0004	-0.0012	-0.0115	-0.0017	-0.0005	-0.0038	-0.0035	-0.0015	-0.0005	-0.0077	-0.0007	-0.0014
Tarragona	-0.0036	-0.0048	-0.0013	-0.0009	-0.0003	-0.0049	-0.0177	-0.0018	-0.0004	-0.0002	-0.0171	-0.0013	-0.0006	-0.0001	-0.0045	-0.0098	-0.0010
Teruel	-0.0068	-0.0064	-0.0022	-0.0019	-0.0007	-0.0015	-0.0042	-0.0032	-0.0008	-0.0004	-0.0183	-0.0028	-0.0012	-0.0002	-0.0101	-0.0024	-0.0018
Toledo	-0.0047	-0.0018	-0.0027	-0.0119	-0.0048	-0.0001	-0.0004	-0.0043	-0.0057	-0.0021	-0.0016	-0.0132	-0.0064	-0.0007	-0.0062	-0.0002	-0.0041
Valencia	-0.0136	-0.0169	-0.0049	-0.0018	-0.0009	-0.0015	-0.0027	-0.0021	-0.0009	-0.0007	-0.0154	-0.0039	-0.0019	-0.0001	-0.0116	-0.0015	-0.0036
Valladolid	-0.0016	-0.0007	-0.0008	-0.0122	-0.0025	-0.0001	-0.0003	-0.0094	-0.0047	-0.0008	-0.0009	-0.0034	-0.0020	-0.0018	-0.0028	-0.0002	-0.0011
Zamora	-0.0011	-0.0005	-0.0006	-0.0102	-0.0032	-0.0001	-0.0002	-0.0056	-0.0065	-0.0008	-0.0006	-0.0026	-0.0019	-0.0042	-0.0017	-0.0001	-0.0009
Zaragoza	-0.0045	-0.0037	-0.0014	-0.0023	-0.0007	-0.0012	-0.0044	-0.0052	-0.0008	-0.0004	-0.0109	-0.0024	-0.0010	-0.0002	-0.0079	-0.0025	-0.0013

Appendix 3 *(Continued)*

	Guadalajara	Huelva	Huesca	Jaén	León	Lleida	La Rioja	Lugo	Madrid	Málaga	Murcia	Ourense	Asturias	Palencia	Las Palmas	Pontevedra	Salamanca
Albacete	-0.0069	-0.0010	-0.0021	-0.0094	-0.0009	-0.0016	-0.0027	-0.0003	-0.0056	-0.0028	-0.0155	-0.0004	-0.0006	-0.0017	0.0000	-0.0002	-0.0014
Alicante	-0.0050	-0.0006	-0.0031	-0.0056	-0.0005	-0.0028	-0.0023	-0.0002	-0.0033	-0.0018	-0.0200	-0.0002	-0.0004	-0.0011	0.0000	-0.0001	-0.0008
Almería	-0.0035	-0.0019	-0.0010	-0.0167	-0.0006	-0.0008	-0.0014	-0.0003	-0.0037	-0.0071	-0.0178	-0.0003	-0.0004	-0.0011	0.0000	-0.0002	-0.0013
Ávila	-0.0052	-0.0019	-0.0007	-0.0032	-0.0057	-0.0004	-0.0034	-0.0024	-0.0112	-0.0019	-0.0013	-0.0029	-0.0034	-0.0075	0.0000	-0.0016	-0.0113
Badajoz	-0.0023	-0.0138	-0.0003	-0.0056	-0.0025	-0.0002	-0.0013	-0.0015	-0.0047	-0.0076	-0.0016	-0.0022	-0.0016	-0.0026	0.0000	-0.0014	-0.0081
Baleares	-0.0027	-0.0002	-0.0088	-0.0013	-0.0003	-0.0166	-0.0021	-0.0001	-0.0014	-0.0004	-0.0038	-0.0001	-0.0002	-0.0007	0.0000	-0.0001	-0.0003
Barcelona	-0.0024	-0.0001	-0.0132	-0.0007	-0.0003	-0.0296	-0.0024	-0.0001	-0.0012	-0.0002	-0.0017	-0.0001	-0.0002	-0.0007	0.0000	-0.0001	-0.0003
Burgos	-0.0081	-0.0005	-0.0020	-0.0015	-0.0061	-0.0010	-0.0132	-0.0020	-0.0081	-0.0007	-0.0011	-0.0019	-0.0045	-0.0154	0.0000	-0.0011	-0.0040
Cáceres	-0.0029	-0.0064	-0.0004	-0.0038	-0.0047	-0.0002	-0.0018	-0.0029	-0.0061	-0.0038	-0.0012	-0.0041	-0.0029	-0.0044	0.0000	-0.0025	-0.0159
Cádiz	-0.0015	-0.0166	-0.0003	-0.0079	-0.0009	-0.0002	-0.0007	-0.0005	-0.0027	-0.0239	-0.0022	-0.0007	-0.0006	-0.0011	0.0000	-0.0005	-0.0026
Castellón	-0.0061	-0.0003	-0.0088	-0.0023	-0.0006	-0.0081	-0.0039	-0.0002	-0.0031	-0.0007	-0.0056	-0.0002	-0.0004	-0.0014	0.0000	-0.0001	-0.0007
Ciudad Real	-0.0057	-0.0027	-0.0009	-0.0141	-0.0017	-0.0006	-0.0023	-0.0007	-0.0093	-0.0055	-0.0047	-0.0009	-0.0010	-0.0027	0.0000	-0.0005	-0.0035
Córdoba	-0.0028	-0.0074	-0.0005	-0.0126	-0.0013	-0.0003	-0.0012	-0.0007	-0.0048	-0.0142	-0.0032	-0.0009	-0.0008	-0.0017	0.0000	-0.0005	-0.0036
La Coruña	-0.0010	-0.0007	-0.0002	-0.0005	-0.0097	-0.0001	-0.0010	-0.0300	-0.0017	-0.0004	-0.0002	-0.0262	-0.0100	-0.0040	0.0000	-0.0372	-0.0057
Cuenca	-0.0136	-0.0008	-0.0030	-0.0056	-0.0014	-0.0020	-0.0051	-0.0005	-0.0088	-0.0017	-0.0066	-0.0005	-0.0009	-0.0028	0.0000	-0.0003	-0.0018
Girona	-0.0021	-0.0001	-0.0119	-0.0006	-0.0003	-0.0269	-0.0021	-0.0001	-0.0010	-0.0002	-0.0015	-0.0001	-0.0002	-0.0006	0.0000	-0.0001	-0.0002
Granada	-0.0032	-0.0030	-0.0007	-0.0227	-0.0008	-0.0005	-0.0013	-0.0003	-0.0040	-0.0114	-0.0092	-0.0004	-0.0005	-0.0012	0.0000	-0.0003	-0.0017
Guadalajara	-0.0520	-0.0007	-0.0031	-0.0033	-0.0022	-0.0018	-0.0092	-0.0008	-0.0119	-0.0012	-0.0031	-0.0008	-0.0015	-0.0049	0.0000	-0.0005	-0.0025
Huelva	-0.0016	-0.0527	-0.0003	-0.0056	-0.0015	-0.0002	-0.0008	-0.0010	-0.0031	-0.0121	-0.0015	-0.0015	-0.0010	-0.0015	0.0000	-0.0010	-0.0048
Huesca	-0.0057	-0.0002	-0.0531	-0.0012	-0.0008	-0.0203	-0.0068	-0.0003	-0.0028	-0.0004	-0.0022	-0.0003	-0.0006	-0.0019	0.0000	-0.0002	-0.0007
Jaén	-0.0040	-0.0028	-0.0008	-0.0532	-0.0010	-0.0006	-0.0016	-0.0004	-0.0054	-0.0087	-0.0076	-0.0005	-0.0006	-0.0016	0.0000	-0.0003	-0.0021
León	-0.0027	-0.0008	-0.0005	-0.0010	-0.0537	-0.0003	-0.0031	-0.0101	-0.0044	-0.0006	-0.0005	-0.0092	-0.0194	-0.0129	0.0000	-0.0055	-0.0089
Lleida	-0.0034	-0.0001	-0.0209	-0.0009	-0.0004	-0.0565	-0.0035	-0.0001	-0.0016	-0.0003	-0.0019	-0.0001	-0.0003	-0.0010	0.0000	-0.0001	-0.0004
La Rioja	-0.0118	-0.0004	-0.0048	-0.0017	-0.0033	-0.0024	-0.0521	-0.0011	-0.0075	-0.0006	-0.0016	-0.0011	-0.0024	-0.0080	0.0000	-0.0006	-0.0024
Lugo	-0.0013	-0.0007	-0.0002	-0.0006	-0.0141	-0.0001	-0.0014	-0.0562	-0.0022	-0.0004	-0.0003	-0.0264	-0.0146	-0.0057	0.0000	-0.0211	-0.0070
Madrid	-0.0109	-0.0012	-0.0014	-0.0041	-0.0033	-0.0008	-0.0054	-0.0012	-0.0522	-0.0017	-0.0023	-0.0014	-0.0021	-0.0062	0.0000	-0.0008	-0.0046
Málaga	-0.0020	-0.0086	-0.0004	-0.0123	-0.0009	-0.0003	-0.0009	-0.0004	-0.0032	-0.0536	-0.0036	-0.0006	-0.0005	-0.0011	0.0000	-0.0004	-0.0023
Murcia	-0.0047	-0.0010	-0.0018	-0.0097	-0.0006	-0.0015	-0.0019	-0.0002	-0.0038	-0.0032	-0.0531	-0.0003	-0.0004	-0.0012	0.0000	-0.0002	-0.0010
Ourense	-0.0014	-0.0010	-0.0002	-0.0007	-0.0124	-0.0001	-0.0014	-0.0254	-0.0025	-0.0006	-0.0003	-0.0560	-0.0108	-0.0053	0.0000	-0.0237	-0.0091
Asturias	-0.0024	-0.0007	-0.0005	-0.0008	-0.0259	-0.0003	-0.0031	-0.0139	-0.0037	-0.0005	-0.0004	-0.0107	-0.0528	-0.0121	0.0000	-0.0069	-0.0072
Palencia	-0.0052	-0.0007	-0.0011	-0.0014	-0.0111	-0.0006	-0.0066	-0.0035	-0.0071	-0.0007	-0.0008	-0.0034	-0.0078	-0.0530	0.0000	-0.0020	-0.0061
Las Palmas	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.1031	0.0000	0.0000
Pontevedra	-0.0010	-0.0009	-0.0002	-0.0006	-0.0094	-0.0001	-0.0010	-0.0259	-0.0018	-0.0005	-0.0002	-0.0303	-0.0089	-0.0040	0.0000	-0.0580	-0.0066
Salamanca	-0.0031	-0.0025	-0.0005	-0.0022	-0.0089	-0.0003	-0.0024	-0.0050	-0.0063	-0.0017	-0.0008	-0.0068	-0.0055	-0.0072	0.0000	-0.0039	-0.0521
Tenerife	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.1189	0.0000	0.0000
Cantabria	-0.0057	-0.0005	-0.0016	-0.0012	-0.0098	-0.0008	-0.0101	-0.0033	-0.0061	-0.0006	-0.0008	-0.0029	-0.0084	-0.0198	0.0000	-0.0018	-0.0045
Segovia	-0.0086	-0.0010	-0.0013	-0.0026	-0.0051	-0.0007	-0.0063	-0.0018	-0.0147	-0.0012	-0.0015	-0.0019	-0.0033	-0.0101	0.0000	-0.0011	-0.0058
Sevilla	-0.0018	-0.0160	-0.0003	-0.0079	-0.0011	-0.0002	-0.0008	-0.0006	-0.0032	-0.0175	-0.0021	-0.0009	-0.0007	-0.0013	0.0000	-0.0006	-0.0034
Soria	-0.0159	-0.0005	-0.0039	-0.0021	-0.0028	-0.0021	-0.0173	-0.0009	-0.0092	-0.0008	-0.0020	-0.0009	-0.0019	-0.0067	0.0000	-0.0005	-0.0025
Tarragona	-0.0040	-0.0002	-0.0156	-0.0012	-0.0004	-0.0225	-0.0035	-0.0002	-0.0020	-0.0004	-0.0028	-0.0002	-0.0003	-0.0010	0.0000	-0.0001	-0.0005
Teruel	-0.0086	-0.0003	-0.0091	-0.0024	-0.0009	-0.0064	-0.0057	-0.0003	-0.0042	-0.0008	-0.0046	-0.0003	-0.0006	-0.0019	0.0000	-0.0002	-0.0009
Toledo	-0.0071	-0.0021	-0.0010	-0.0066	-0.0028	-0.0006	-0.0033	-0.0011	-0.0149	-0.0030	-0.0027	-0.0014	-0.0018	-0.0045	0.0000	-0.0008	-0.0055
Valencia	-0.0066	-0.0005	-0.0043	-0.0043	-0.0007	-0.0036	-0.0032	-0.0002	-0.0039	-0.0013	-0.0113	-0.0003	-0.0004	-0.0014	0.0000	-0.0002	-0.0009
Valladolid	-0.0050	-0.0010	-0.0008	-0.0018	-0.0097	-0.0004	-0.0047	-0.0034	-0.0086	-0.0010	-0.0009	-0.0036	-0.0060	-0.0150	0.0000	-0.0020	-0.0089
Zamora	-0.0029	-0.0013	-0.0005	-0.0014	-0.0163	-0.0003	-0.0027	-0.0077	-0.0053	-0.0009	-0.0006	-0.0089	-0.0098	-0.0103	0.0000	-0.0050	-0.0152
Zaragoza	-0.0098	-0.0003	-0.0144	-0.0018	-0.0012	-0.0077	-0.0103	-0.0004	-0.0047	-0.0006	-0.0028	-0.0004	-0.0009	-0.0029	0.0000	-0.0002	-0.0011

Appendix 3 *(Continued)*

	Tenerife	Cantabria	Segovia	Sevilla	Soria	Tarragona	Teruel	Toledo	Valencia	Valladolid	Zamora	Zaragoza
Albacete	0.0000	-0.0011	-0.0036	-0.0021	-0.0042	-0.0025	-0.0067	-0.0056	-0.0124	-0.0021	-0.0011	-0.0039
Alicante	0.0000	-0.0008	-0.0023	-0.0013	-0.0033	-0.0049	-0.0092	-0.0031	-0.0223	-0.0013	-0.0007	-0.0047
Almería	0.0000	-0.0007	-0.0024	-0.0043	-0.0022	-0.0013	-0.0032	-0.0048	-0.0066	-0.0015	-0.0009	-0.0018
Ávila	0.0000	-0.0038	-0.0128	-0.0027	-0.0045	-0.0005	-0.0016	-0.0118	-0.0014	-0.0128	-0.0088	-0.0015
Badajoz	0.0000	-0.0013	-0.0042	-0.0154	-0.0017	-0.0003	-0.0009	-0.0075	-0.0010	-0.0042	-0.0044	-0.0007
Baleares	0.0000	-0.0006	-0.0011	-0.0003	-0.0025	-0.0213	-0.0088	-0.0011	-0.0084	-0.0007	-0.0003	-0.0062
Barcelona	0.0000	-0.0007	-0.0010	-0.0002	-0.0026	-0.0231	-0.0077	-0.0008	-0.0046	-0.0006	-0.0003	-0.0072
Burgos	0.0000	-0.0142	-0.0123	-0.0008	-0.0122	-0.0012	-0.0029	-0.0048	-0.0018	-0.0110	-0.0054	-0.0041
Cáceres	0.0000	-0.0022	-0.0062	-0.0070	-0.0024	-0.0003	-0.0009	-0.0084	-0.0010	-0.0072	-0.0084	-0.0008
Cádiz	0.0000	-0.0006	-0.0020	-0.0290	-0.0010	-0.0003	-0.0007	-0.0044	-0.0011	-0.0017	-0.0015	-0.0005
Castellón	0.0000	-0.0012	-0.0024	-0.0006	-0.0051	-0.0141	-0.0211	-0.0023	-0.0164	-0.0014	-0.0007	-0.0111
Ciudad Real	0.0000	-0.0015	-0.0060	-0.0055	-0.0036	-0.0009	-0.0025	-0.0146	-0.0033	-0.0039	-0.0025	-0.0019
Córdoba	0.0000	-0.0009	-0.0035	-0.0165	-0.0018	-0.0004	-0.0013	-0.0082	-0.0018	-0.0027	-0.0021	-0.0009
La Coruña	0.0000	-0.0025	-0.0025	-0.0007	-0.0011	-0.0001	-0.0003	-0.0015	-0.0002	-0.0044	-0.0086	-0.0003
Cuenca	0.0000	-0.0020	-0.0059	-0.0015	-0.0081	-0.0029	-0.0091	-0.0069	-0.0096	-0.0033	-0.0017	-0.0063
Girona	0.0000	-0.0006	-0.0009	-0.0002	-0.0022	-0.0195	-0.0066	-0.0007	-0.0040	-0.0006	-0.0003	-0.0063
Granada	0.0000	-0.0007	-0.0026	-0.0070	-0.0019	-0.0008	-0.0022	-0.0059	-0.0040	-0.0017	-0.0011	-0.0014
Guadalajara	0.0000	-0.0036	-0.0096	-0.0012	-0.0152	-0.0024	-0.0071	-0.0072	-0.0050	-0.0053	-0.0025	-0.0071
Huelva	0.0000	-0.0008	-0.0026	-0.0259	-0.0012	-0.0002	-0.0007	-0.0050	-0.0009	-0.0025	-0.0026	-0.0005
Huesca	0.0000	-0.0019	-0.0026	-0.0004	-0.0069	-0.0169	-0.0138	-0.0018	-0.0060	-0.0016	-0.0008	-0.0193
Jaén	0.0000	-0.0009	-0.0034	-0.0064	-0.0024	-0.0009	-0.0024	-0.0079	-0.0039	-0.0023	-0.0015	-0.0016
León	0.0000	-0.0078	-0.0070	-0.0009	-0.0032	-0.0003	-0.0009	-0.0035	-0.0006	-0.0126	-0.0175	-0.0009
Lleida	0.0000	-0.0010	-0.0015	-0.0002	-0.0037	-0.0250	-0.0100	-0.0011	-0.0052	-0.0009	-0.0004	-0.0105
La Rioja	0.0000	-0.0084	-0.0090	-0.0007	-0.0211	-0.0026	-0.0060	-0.0043	-0.0031	-0.0064	-0.0031	-0.0096
Lugo	0.0000	-0.0036	-0.0034	-0.0008	-0.0015	-0.0002	-0.0004	-0.0020	-0.0003	-0.0061	-0.0115	-0.0004
Madrid	0.0000	-0.0036	-0.0150	-0.0020	-0.0081	-0.0011	-0.0032	-0.0137	-0.0027	-0.0084	-0.0042	-0.0031
Málaga	0.0000	-0.0006	-0.0022	-0.0202	-0.0013	-0.0004	-0.0011	-0.0052	-0.0017	-0.0017	-0.0014	-0.0007
Murcia	0.0000	-0.0008	-0.0025	-0.0022	-0.0029	-0.0025	-0.0058	-0.0041	-0.0131	-0.0015	-0.0008	-0.0031
Ourense	0.0000	-0.0031	-0.0036	-0.0010	-0.0015	-0.0002	-0.0004	-0.0023	-0.0003	-0.0063	-0.0129	-0.0004
Asturias	0.0000	-0.0089	-0.0060	-0.0008	-0.0030	-0.0003	-0.0008	-0.0029	-0.0005	-0.0105	-0.0140	-0.0009
Palencia	0.0000	-0.0134	-0.0119	-0.0009	-0.0067	-0.0006	-0.0017	-0.0048	-0.0011	-0.0167	-0.0094	-0.0021
Las Palmas	-0.1188	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pontevedra	0.0000	-0.0024	-0.0026	-0.0008	-0.0011	-0.0001	-0.0003	-0.0017	-0.0002	-0.0046	-0.0092	-0.0003
Salamanca	0.0000	-0.0036	-0.0080	-0.0029	-0.0029	-0.0003	-0.0009	-0.0068	-0.0008	-0.0117	-0.0165	-0.0008
Tenerife	-0.1031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cantabria	0.0000	-0.0517	-0.0098	-0.0007	-0.0085	-0.0009	-0.0021	-0.0039	-0.0013	-0.0117	-0.0071	-0.0031
Segovia	0.0000	-0.0057	-0.0525	-0.0015	-0.0083	-0.0009	-0.0025	-0.0092	-0.0019	-0.0133	-0.0062	-0.0027
Sevilla	0.0000	-0.0007	-0.0025	-0.0555	-0.0012	-0.0003	-0.0008	-0.0054	-0.0011	-0.0021	-0.0019	-0.0006
Soria	0.0000	-0.0057	-0.0098	-0.0009	-0.0527	-0.0025	-0.0065	-0.0052	-0.0037	-0.0061	-0.0028	-0.0087
Tarragona	0.0000	-0.0010	-0.0016	-0.0003	-0.0040	-0.0549	-0.0134	-0.0014	-0.0080	-0.0010	-0.0005	-0.0109
Teruel	0.0000	-0.0017	-0.0033	-0.0007	-0.0075	-0.0096	-0.0532	-0.0029	-0.0127	-0.0020	-0.0009	-0.0154
Toledo	0.0000	-0.0025	-0.0102	-0.0036	-0.0050	-0.0008	-0.0024	-0.0518	-0.0025	-0.0069	-0.0041	-0.0021
Valencia	0.0000	-0.0011	-0.0027	-0.0010	-0.0046	-0.0062	-0.0137	-0.0032	-0.0531	-0.0016	-0.0008	-0.0068
Valladolid	0.0000	-0.0071	-0.0140	-0.0014	-0.0055	-0.0006	-0.0015	-0.0065	-0.0011	-0.0528	-0.0116	-0.0017
Zamora	0.0000	-0.0052	-0.0078	-0.0015	-0.0031	-0.0003	-0.0009	-0.0047	-0.0007	-0.0141	-0.0529	0.0013
Zaragoza	0.0000	-0.0028	-0.0043	-0.0006	-0.0115	-0.0088	-0.0175	-0.0029	-0.0071	-0.0026	-0.0013	-0.0524

Notes: The results have been obtained using the exponential distance matrix. The cells of the main diagonal are shaded.