UNIVERSITAT DE BARCELONA

Essays on Regional Labour Markets in Spain

Celia Melguizo Cháfer

PhD in Economics

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A mis padres.

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Introduction

The global financial crisis, which started as a result of the subprime mortgage crisis and the bankruptcy of Lehman Brothers US bank on September 15th of 2008, triggered the worst economic recession ever experienced since the economic downturn of the 1930s. The excessive risk-taking behaviour of the financial institutions resulted in a crisis spreading globally. In order to avoid financial collapse, several bail-out packages and monetary and fiscal policies were carried out by public institutions. However, these measures could not ward off the subsequent downturn that affected world economies. In Europe, especially in the southern countries, recession had a strong impact on unemployment and it led to a sovereign debt crisis that was managed by resorting to austerity measures and cuts that resulted in higher unemployment and made more difficult the entry of youths into the labour market.

Spain is amongst the European countries that suffered severely and was most affected by the "Great Recession". Its economy, which was highly dependent on the services and housing sectors, experienced a great shock that implied a decrease of 15.5 percentage points (p.p.) in GDP. The bursting of the housing bubble also dragged other sectors. The unemployment rate resulted to an increase of 18 p.p. in just six years. The highest figure was reached in 2013, when it accounted for 26% of the working population. Also, in 2013 youth unemployment rate reached its peak, standing at 42.4%. This recessive context also affected real wages, which declined from 2009 to 2013 by 7.2 p.p. The youth suffered this decline to a high extent and the variation in their wages accounted for -22.6 p.p. The severe effect of the economic recession on the labour market in Spain has occurred as a consequence of different factors. Boeri and Jimeno (2015) point out that unemployment rate has been affected by the exposure to economic shocks or, in other words, to high economic variations given by the bursting of the pre-crisis housing bubble, the sinking financial markets and the lack of automatic economic stabilisers at country level. This relationship between GDP variations and unemployment rate, commonly known as Okun's law, acknowledges higher unemployment sensitivity in Spain than in most OECD countries (Ball et al., 2017; Dixon et al., 2017). In addition, Sala and Silva (2009), Jimeno (2015), Boeri and Jimeno (2015) and Ghoshray et al. (2016) establish that the great effect of the recession on the labour market is also a result of the poor functioning of the labour market institutions and deficient employment policies.

The Spanish labour market has what economists have traditionally called strongly unemployment generating institutions. Despite the reforms, these institutions still have an amplifying effect of the economic shocks on unemployment (Bentolila and Jimeno, 2006). Among them, authors obtain that employment protection legislation has favoured a dual labour market, in which fixed-term and permanent contracts coexist and yield different rights, wages and productivity levels for workers. Since the reform in 1984, which eliminated the limitations imposed on temporary contracts, the use of fixed-term contracts was generalized in private companies until constituting 33% of registered employment in the mid-1990s (Dolado et al., 2002). The 1984 reform had a scarce effect on reducing long-term unemployment and the low rate of conversion of fixed-term on permanent contracts did not compensate for the higher unemployment sensitivity, lower human capital investment and inequality among permanent and temporary workers in terms of protection and wages. As a consequence, counter-reforms were carried out in 1994, 1997 and 2001 to reduce the employment temporality. They led a slight decrease in the use of fixed-term contracts but failed in their aim of putting an end to the dual labour market.

Another labour institution considered as an unemployment-prone institution is unemployment benefits (Sanchis, 2000). Unemployment benefits include the replacement rate but also the length of these benefits. The macroeconomic literature for Spain obtains that replacement rate raises wages and, through this channel, equilibrium unemployment, whereas microeconomic studies establish that a longer length of the unemployment benefits reduces the exit rate from unemployment but does not lead to better matches (Bentolila and Jimeno, 2006). Obtaining these benefits has become more tightened over time. Since 1992, these benefits are received by an unemployed person who had worked for more than a year, while previously, it was only required to have worked for six months. In addition, the 1992 reform also reduced the unemployment benefits length to one-third of tenure (previously it was one-half) and the coverage rate, which remains steadily declining over the unemployment period.

Bentolila and Jimeno (2006) obtained that unemployment benefits and employment protection jointly accounted for more than three-quarters of the unemployment institutions-induced increase. However, the favouring unemployment effect that is attributed to other institutions cannot be ignored. Among them, wage tax in Spain is slightly above the European average and active labour market policies are still quite deficient. With respect to the role of unions, coordination is low whereas coverage is high. The only one institution whose influence on Spanish labour market is quite low compared to that observed in other European countries is union density.

Minimum wage is another relevant institution, but the effect generated on the labour market is not clear. Time - series analyses frequently recognize a negative impact of minimum wages on employment, especially for youths (Card, 1992; Neumark and Washer, 2004). Meanwhile, the works based on natural experiments generally find no or very small disemployment effects (Card and Krueger, 1994, 1995; Doucouliagos and Stanley 2009; Leonard et al., 2014; Neumark et al., 2014; Belman and Wolfson, 2014). For the Spanish case, it is generally accepted a negative effect of minimum wages on youth employment, however, it is not always found a negative significant influence for adults (Dolado et al., 1997; Dolado and Felgueroso, 1997; Cebrián et al. 2010). Therefore, it is commonly considered that minimum wage is clearly an unemployment favouring institution for youth population but not for adults.

Despite the former arguments, the analysis of the effect of the Spanish exposure to shocks and the influence of the labour market institutions on the labour market may provide us a myopic perspective whether we do not consider the economic, social and labour market differences among Spanish regions.

Spain is a national state composed by seventeen autonomous communities (NUTS 2) and two autonomous cities in the North of Africa that present certain political, social and economic particularities. Figure 1.1. represents the Spanish NUTS 2 regions. The seventeen autonomous communities are integrated by fifty provinces (NUTS 3), which are the administrative units that better represent the concept of integrated labour markets. These territorial areas present marked differences that are spatially correlated but have remained quite stuck to each other over decades.

Figure 1.1. Spanish NUTS 2 regions

The level of GDP per capita is one of the variables that shows how regional differences have remained quite constant over time. Actually, the relative position of regions in terms of income per capita has barely varied over decades (Maza, 2006; Marchante and Ortega, 2006; and Puente, 2017). Similarly, productivity per worker differences between regions have led to a region's ordering that has kept almost unchanged: geographical areas with higher values are the provinces on the peninsular North – East and Madrid, whereas the southern Spanish regions are in the latest positions. Raymond and García (1994) attribute the modest internal convergence results to the low migration registered after seventies. In fact, most authors, who disaggregate per capita GDP in productivity of work and employment rate, assume that convergence has had more to do with the former factor. Studies such as De la Fuente (2002), Tortosa-Ausina et al. (2005) and Puente (2017) consider that capital accumulation has a relevant role. Mas et al. (1998) show specifically the important influence of public capital. Besides, knowledge and human capital are also considered significant determinants (Pérez and Serrano, 2000; De la Fuente, 2002 and Ramos et al., 2010). Finally, sectoral changes in employment have also been found a leading factor of convergence (Carnicero, 2001 and De la Fuente, 2002).

Provincial unemployment rates also present a spatial distribution. Northern territories show low unemployment rates whereas the southern provinces from Andalusia, Extremadura and Canary Islands persistently present the highest figures. López-Bazo et al. (2002, 2005) acknowledge the important role that spatial spillovers play on regional unemployment rates. But also, economic and demographic factors add as determinants of regional differences in unemployment rates. López-Bazo et al. (2005) find that industrial composition and real wages were disequilibrium factors significant to explain unemployment disparities in eighties, whereas in the nineties, amenities differentials were the more relevant factors. Bande et al. (2008) establish that unemployment rate disparities together with their positive relationship with the business cycle are largely explained by the territorial wage imitation effect. Bande and Karanassou (2009, 2014) obtain that capital stock growth is also a relevant determinant of unemployment disparities. Finally, López-Bazo and Motellón (2013) resort to micro-data on personal characteristics and establish that individual's education, in addition to other regional factors allow us to understand the territorial differences in unemployment rates.

In this context of persistent economic differences, it can be stated that internal migration has played a limited role in terms of regional convergence (Raymond and García, 1994; Ródenas 1994). This is mainly due to the fact that the number of migratory flows between regions has been quite small compared to the one that took place in the sixties and seventies (Bover and Velilla, 2005), when convergence did effectively occurred. Several works have stressed the role of economic and labour market factors as drivers of migration flows during the economic expansive years (Maza and Villaverde, 2004; Maza, 2006; Juárez, 2000; Mulhern and Watson, 2009, 2010). However, it was not the case in recession periods: during the transition to democracy, a period with strong social and economic instability, richer regions experienced negative net migration flows. This strange phenomenon, labelled as an "enigma", deterred convergence and led us to wonder about the leading migration motivations during the recent economic downturn.

In this work, we address different aspects currently affecting the regional labour markets in Spain. In Chapter 2 entitled "An analysis of Okun's law for the Spanish provinces", we evaluate for the Spanish provinces the relationship between unemployment and GDP, commonly known as Okun's law. The application of this relationship to Spain is particularly interesting due to the sharp effect that economic shocks have on unemployment. After testing the time series properties of provincial GDP and unemployment, we specify and estimate the difference version of Okun's law using VAR techniques. The obtained results point out that Spain's provinces show large differences in their unemployment sensitivity to economic variations. An analysis of the underlying causes of this heterogeneous behaviour finds that provinces showing less diversified industries, a more developed services sector and higher rates of labour participation suffer from higher variations in unemployment rates.

One of the main contributions of Chapter 2 regards to the use of provinces as territorial unit of analysis. Less disaggregated territorial units had been considered in Okun's law analyses for Spain and the results pointing towards different unemployment sensitivity in provinces within the same autonomous community show the importance of using this spatial division, which in addition represents integrated labour markets. Another contribution is the use of VAR techniques, which had not yet been applied to the Okun's law analysis for the Spain's provinces. Finally, the analysis of the factors affecting unemployment sensitivity elucidates that provinces that show less diversified industries, a more developed services sector and higher rates of labour participation suffer from higher unemployment sensitivity. The effect of these variables on unemployment response to economic variations had not been analysed before for the case of Spain and it provides some useful information from the policy perspective.

Chapter 3 of this work "Minimum wages and youth employment: a spatial analysis" focuses on the effect on employment of one of the most analysed labour market institutions: the minimum wage. The debate on the effect of this institution has been recently reopened since the recent recession has strongly affected the labour market. Due to the internal devaluation policies adopted since 2011, minimum wages compared to average wages have substantially increased in Spain during the last years. In this paper, we exploit the differences in the evolution and level of minimum wages in real terms across Spanish provinces in order to measure its impact on youth employment rates. In order to do so, we consider a panel composed by the Spanish provinces and exploit the common nominal minimum wage at national level and the territorial differences in prices as empirical strategy. Our results, in line with previous studies for Spain, show a negative impact of minimum wages on youth employment rate, although the impact is very modest, particularly when spatial spillovers are controlled for.

The analysis carried out in Chapter 3 contributes to the literature by focusing mainly on a recessionary period, in which employment is more likely to be affected by minimum wages. Additionally, in the study performed in this chapter, spatial effects are included in order to capture the interactions between regional labour markets. This constitutes an innovative line of this work as spatial spillovers had not been previously taken into account in this kind of analyses for the Spanish case.

The spatial effects included in the analysis in Chapter 3 consider specifically dependencies such as those that could be linked to trade flows, commuting and migration. The significant and positive sign of these spatial effects lead us to wonder whether migration is effectively affected by labour market factors and, specifically, employment and income differentials across regions. Therefore, in Chapter 4 "What drives migration moves across urban areas in Spain? Evidence from the Great Recession", we shed light on the role that labour market variables play on internal migration during the recent economic downturn and pay special attention to the migration response of the different collectives that may have heterogeneous motivations. In order to carry out the analysis, we resort to an extended gravity model and we consider as a territorial unit the 45 Spanish Functional Urban Areas (FUAs) defined by the Urban Audit project[1]. Our results point to a high influence of wages on migration. Real wages significantly influence migration flows between urban areas, especially in the case of foreigners, for which wages

[1] Information on the Urban Audit project is available in http://ec.europa.eu/eurostat/web/cities.

are also a retention factor. Wages are also relevant in the migration decision and act in the expected way for all the working age groups. Besides, the influence of employment rate is only observed on nationals' moves.

The research carried out in Chapter 4 contributes to the existing literature in several ways. We perform the analysis for the recent recessive period, which has implied the worst economic downturn suffered in Spain during the democracy. The results of the study clarify whether during the recessive period migration flows can be still considered as an "enigma". Secondly, Functional Urban Areas have been considered as territorial unit. They constitute labour markets perfectly integrated and the availability of data has allowed us to consider this unit, which had not been previously used to determine the migration motivations in Spain. Additionally, this study considers separately different population groups that may have heterogeneous migration motivations. Finally, a count data model has been applied and a wide set of fixed effects structures have been considered to control for multilateral resistance to migration, which specifically takes into account migration motivations not considered by the exogenous variables.

The rest of the work is organized as follows. Chapters 2, 3 and 4 present an extensive discussion of the topics above mentioned along with the empirical exercises, whose results contribute to the literature in the ways previously commented. Finally, Chapter 5 concludes with a summary on the main results obtained and the policy recommendations that emerge from them. It also presents the lines of research that could be carried out in the future to shed light on some related questions still unsolved.

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Chapter 2:

An analysis of Okun's law for the Spanish provinces†

2.1. Introduction

The strong impact of business cycles on unemployment is a particular feature of the Spanish economy. The high increase in unemployment during the recent economic downturn is a clear example of the great variability of the unemployment rate. Since 2008, in just six years the unemployment rate has more than tripled, accounting in 2013 for 26 percent of the active population. However, this phenomenon is not confined to recession periods. Before this economic crisis, the Spanish economy experienced a continuous growth from middle nineties, reducing unemployment rates from 20% of the labour force to levels slightly above the European average, which was around 7% of the active population.

Thus, as Figure 2.1 shows, the economic cycles in Spain have their counterpart in the unemployment rate. In the graph that shows the variables in differences, it is clearly observed the opposite pattern for GDP and unemployment rate whereas labour force participation remains much more

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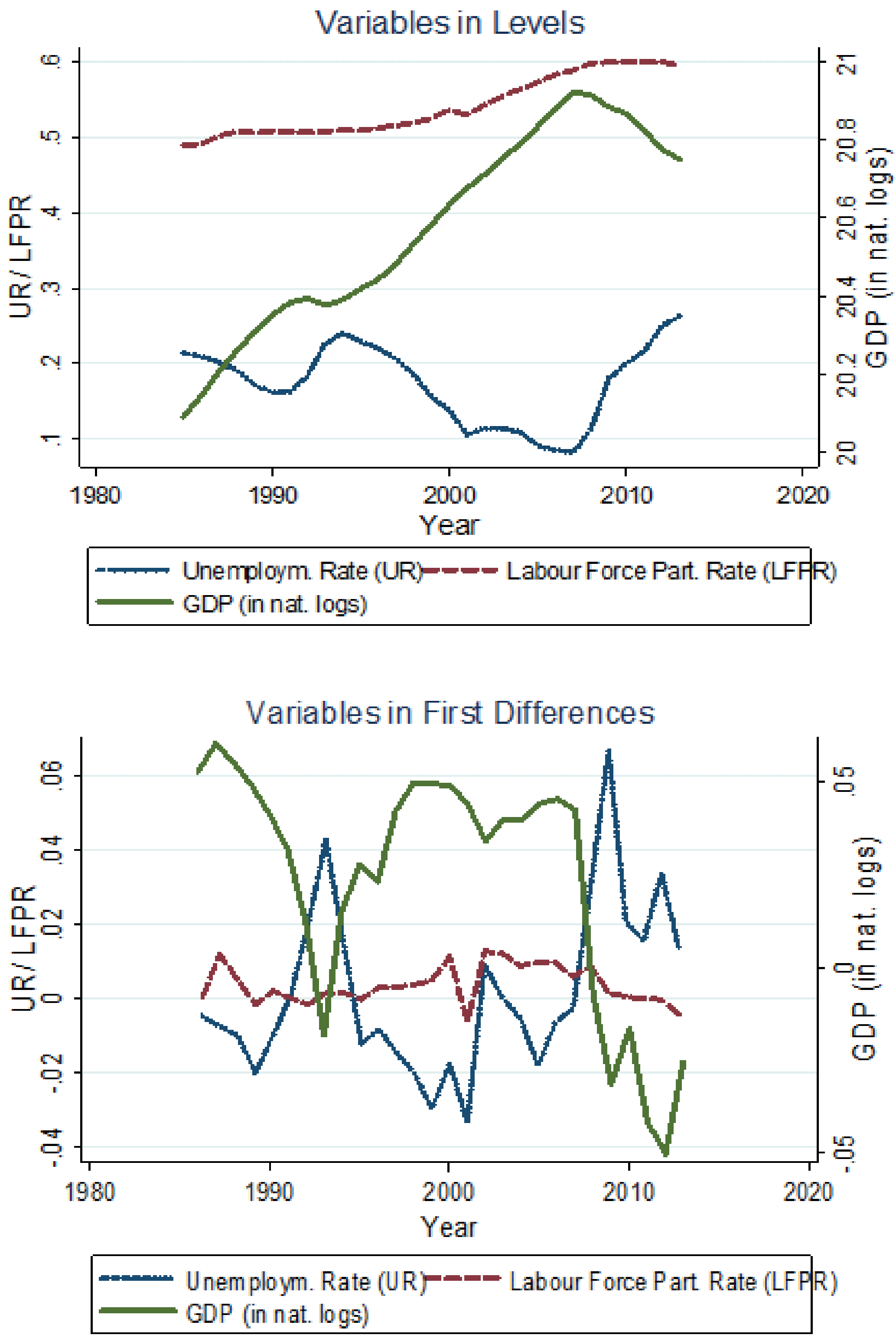
stable to economic fluctuations. This indicates that unemployment rate mostly absorbs the effect of GDP variations.

Nevertheless, the sensitivity of unemployment rate to Gross Domestic Product (GDP) shifts is not the same for all regions. Villaverde and Maza (2009) found that while a great unemployment response to changes in the economic cycle is observed in some autonomous communities (NUTS 2), in others unemployment rate varies to a much lesser extent. However, the analysis for autonomous communities could be hiding certain patterns due to the great internal heterogeneity they show. Autonomous communities internally differ in their levels of economic activity, labour force participation and industrial structure, which may result in unemployment response disparities. In this regard, the provincial approach (NUTS 3) implies a more thorough and spatially detailed analysis that clarifies the patterns and differences in unemployment sensitivity to economic variations. Besides, it is important to consider provinces because they prove to be the regional units that are closer to the concept of local labour markets and this is the territorial dimension that really matters to firms and workers.

The aim of this chapter is to analyse the provincial differences in the response of unemployment rates to economic variations. To do so, we resort to the commonly known Okun's law, which is an empirical relationship relating unemployment to GDP. The initial statement of this law (Okun, 1962) supposes that a 3 percent of increase in output corresponds to a 1 percent of decline in the rate of unemployment. However, a more recent literature review shows that authors agree to accept the negative sign of the Okun's coefficient but it is generally obtained that the value of this coefficient varies over time and among countries. In our analysis, we aim to observe the effect of economic growth on unemployment for all Spanish provinces. In order to do so, we consider the difference version of Okun's law and then, the analysis is complemented with the use of VAR and panel VAR models to check the robustness of the results obtained from the difference specification in a framework that takes into account the potential endogeneity of GDP and unemployment.

Figure 2.1. Evolution of GDP and the main labour market variables



Our results show that there are great differences among provinces in the sensitivity of unemployment to variations in economic conditions. The analysis of the underlying causes behind the provincial heterogeneity points towards a higher unemployment response in the provinces that show less diversified economies, a more developed services sector and higher rates of labour participation.

One of the contributions of this work concerns the consideration of a provincial approach. To the best of our knowledge, provincial analyses have not been carried out previously in studies examining Okun’s law for Spain. We find that Spanish autonomous communities are internally heterogeneous in the unemployment response to economic variations. The second contribution is to analyse the relationship between GDP and unemployment through VAR and panel VAR techniques, which have not yet been applied at the Spanish provincial level.

The rest of the paper is organized as follows. In Section 2.2, we briefly gather the contributions to Okun's law, including specific analysis for Spain. In Section 2.3, we describe our methodology and in Section 2.4, we present our main results. Finally, Section 2.5 concludes.

2.2. Literature review

2.2.1. General overview

The relationship between economic activity and unemployment has been traditionally analysed by using the specifications of Okun’s law. Okun (1962) formulated the well-known rule of a thumb that assigns approximately a 3 percentage points of GDP decrease to a 1 percentage point of unemployment rate increase. Since then, Okun’s law has been the focus of discussion and analysis. Many authors have submitted it to transformations in order to modify certain theoretical foundations and to achieve a more accurate statistical fit. Furthermore, it has been analysed in different economic contexts. It is worth noting the work of Gordon (1984), Evans (1989), Prachowny (1993), Weber (1995), Attfield and Silverstone (1997), Moosa (1997, 1999), Knotek (2007), Owyang and Sekhposyan (2012), Perman et al. (2015), Ball et al. (2017) and Canarella and Miller (2017), among others.

The literature has suggested both static and dynamic specifications of the aforementioned empirical relationship. Evans (1989) considered three lagged periods to observe how past variations in Gross National Product (GNP) and unemployment influenced quarterly values of these variables. Moosa (1999) considered a dynamic version with different lag lengths to check the results obtained for the U.S. economy.

Economists have also analysed the relationship between GDP and unemployment rate in three additional directions. First, whereas Okun's seminal study considered unemployment as the exogenous variable, other relevant analyses have placed it endogenously. Second, other studies have introduced new variables to the original formula. For instance, Gordon (1984) introduced as explanatory variables the changes in capital and technology regarding their potential level, in addition to unemployment variations. Prachowny (1993) also considered labour supply, workers' weekly hours and capacity utilization deviations from the equilibrium. Oberst and Oelgemöller (2013) and Palombi et al. (2015a) introduced spatial effects. And finally, a third set of studies, among we find Silvapulle et al. (2004), Palombi et al. (2015b), Clar-López et al. (2014) and Wang and Huang (2017), distinguished among expansive and recessive periods to account for the effect of economic variations on unemployment. Authors generally found that unemployment is more affected by GDP variations in recessions than in expansions. Buendía-Azorín and Sánchez de la Vega (2017) went further and obtained that after the recent recession output growth required to reduce unemployment is much higher than the necessary to increase employment.

All these transformations have contributed to the fact that there is no consensus about the value of Okun's coefficient. Some authors have confirmed the value initially presented by Okun. Others obtain that the magnitude of the impact of business cycle on unemployment is closer to two instead of three. Other analyses show that Okun's coefficient varies over the period selected and among the countries considered. Weber (1995) analysed the U.S. economy during the period of 1948 to 1988 and obtained that the long-term coefficient was close to three. However, he acknowledged there was a breakdown in the third quarter of 1973. In the same line, more recent studies, such as Knotek (2007) and Owyang and Sekhposyan (2012), consider this empirical relationship to be a good approximation in the long term. Galí et al. (2012) ensured that Okun's law holds for the U.S. economy and he attributed the low job creation in recent economic recoveries to the slowness at which these recoveries occurred.

In this regard, Perman et al. (2015) conducted a meta-analysis to obtain the “true value” of the Okun’s law coefficient. They used a sample of 269 estimates, among which they discarded those that did not fulfil the pre-established requirements and distinguished between analyses that considered changes in GDP as the independent variable and those that considered unemployment variations exogenously. They quantified the impact of unemployment rate on GDP at -1.02 points. This value is far from the three-point coefficient and clearly demonstrates that the period and countries selected matters. In the same vein, Lee (2000) acknowledged that Okun's law could be considered valid qualitatively but not quantitatively. He selected 16 OECD countries to observe in an effort to determine if the so called rule of thumb holds. Lee obtained that, although all countries present a negative relationship between GDP and unemployment, the coefficient that relates these variables varies significantly across countries. Moosa (1997), who considered the G7 countries, obtained the same result. Finally, Ball et al. (2017) overcame these discrepancies and showed that Okun coefficient has remained relatively stable for the U.S. but it has experimented variations over time in some other OECD countries, including Spain.

2.2.2. From the national to the regional perspective

The main criticism of Okun's law, based on the divergence in its coefficient, has become a tool to compare the labour market performance in different countries and regions. The regional analysis further allows for the isolation of the impact of labour market institutions. For this reason, many authors have determined the patterns of unemployment and business cycle by region and their relationship to recommend appropriate economic policies.

Freeman (2000) was one of the first authors to apply Okun’s law at the regional level. He applied it to eight U.S. areas and obtained, unlike the studies mentioned below, a similar and stable coefficient for all regions. This result shows high flexibility in the U.S. labour market, which favours regional convergence in unemployment rates. However, Adanu (2005) did not observe this level of convergence among Canadian provinces. He obtained that the law did not hold for three of the ten analysed provinces. Adanu observed that GDP varies considerably in the most industrialized provinces when changes in labour occur, mainly because productive jobs are concentrated to a greater extent in industrialized provinces.

In European countries, Okun's law holds at the national level, but when regions are analysed, some authors obtain that variations in the business cycle do not always explain changes in the unemployment rate. Binet and Facchini (2013) applied the relationship to the twenty-two French regions and obtained that it is significant for only fourteen of them. They concluded that this finding is due to high unemployment rates coexisting in some regions with above average per capita GDP levels. A lack of significance of Okun's law is even more evident in the Greek regions. Christopoulos (2004) applied a similar analysis to Greek regions and found that only six of thirteen have a significant relationship between unemployment and the business cycle. Apergis and Rezitis (2003) also analysed the case of Greece and obtained that unemployment has become more responsive to output changes for most regions right after 1981, period when Okun's relationship underwent a structural change, probably due to hysteresis phenomena.

2.2.3. The case of Spain

The Spanish economy has been characterized by a strong impact of business cycles on unemployment since 1975. In fact, the unemployment rate has experienced an upward trend that has only undergone two breakdowns during the 1986 to 1991 and 1995 to 2007 expansion periods. This unemployment uptrend cannot be justified by the moderate increase in labour force participation at the national level (Jimeno and Bentolila, 1998).

The economic depression, which affected Spanish economy in 1975, was mainly attributable to the great instability that accompanied the transition to democracy, the shocks to industry as a result of the delayed effect of the oil price increase, and the social measures partly geared to augment wages (Bentolila and Jimeno, 2006). As a consequence, in 1985 the unemployment rate reached 21.4% and only 47% of the working age population was occupied. In 1986, Spain's entry into the European Union caused widespread optimism that affected the economy and led to a decrease in the unemployment rate. This lasted until 1991, when a generalised recession affected again the Spanish economy. The cycle change came in 1995 when labour law reforms favoured wage moderation and boosted temporary jobs. Low interest rates following the adoption of the Euro fuelled housing and promoted economic growth; and convergence with European levels of unemployment occurred. In 2007, whereas the average unemployment rate was around 7% in Europe, in Spain it was at 8%. This degree of unemployment rate variation illustrates the strong impact of GDP on unemployment in Spain, resulting in a greater Okun's coefficient for this country than for most OECD countries (Ball et al., 2017; Dixon et al., 2017). Since 2007, the bursting of the housing bubble triggered an unprecedented recession, and in three years, an increase in the unemployment rate of nearly 12 p.p. occurred. This unemployment increase was accompanied by only a 7.8 p.p. GDP drop, which reinforces the stylised fact of high unemployment variability in Spain.

On the other hand, labour force participation seems to be alien to these cycles, maintaining a growing trend that just stalled during the 1991 to 1996 and the recent recessive periods. This is illustrated by Jimeno and Bentolila (1998), who acknowledge that changes in the Spanish economy have been reflected in the unemployment rate. They argue that this Spanish feature is neither commonly observed in the U.S. nor in most European countries, where shocks have a greater impact on migration flows and participation respectively.

However, this is not the whole story. National data fail to reflect the great diversity of the Spanish regions. There are large disparities between regions in terms of unemployment rates[1] (López-Bazo et al., 2002, 2005; Bande and Karanassou, 2008, 2009, 2014; López Bazo and Motellón, 2013), but also in the unemployment elasticity to business cycles. Pérez et al. (2003) and Amarelo (2013) analysed unemployment sensitivity for Andalusia and Catalonia respectively and compared their results to the Spanish ones. Pérez et al. (2003) obtained for Andalusia a lower unemployment variability to business cycles during the 1984 to 2000 period than that they obtained for Spain. Amarelo (2013) observed the opposite for Catalonia; unemployment variability was found higher than that obtained for Spain. Villaverde and Maza (2007, 2009), who analysed Okun's law for all Spanish regions (NUTS 2), confirm the great heterogeneity among regions in the unemployment

[1] In Section A2.1 of the Appendix A2, we highlight the differences in regional unemployment rates for Spain over the period. Maps show that unemployment rate differences among provinces are large and persistent.

response to business cycles. Regarding the underpinning causes behind the unemployment sensitivity disparities among regions, little has been said until now for the Spanish case. Only the work of Villaverde and Maza (2009) relates unemployment sensitivity to other factors and find a strong correlation between productivity growth and unemployment response to economic cycles. However, the descriptive way in which the analysis is performed limits the credibility of the results.

2.3. Data sources and methodology

2.3.1. Data sources and variable definition

The analysis of the effect of the output variation on the unemployment rate requires three macroeconomic datasets: real GDP, unemployment and labour force participation data. The analysis is carried out annually at the provincial level, and we focus on the period spanning 1985 and 2013. The selected period allows us to consider the entry of Spain into the European Union and the subsequent industrial reconversion, the creation of the welfare state, the economic expansion, and the recent crisis that began in 2008. Using provinces as the unit of analysis allows for a thorough study that specifically takes into account each area's weaknesses and strengths and the impact of individual policies. We selected 50 Spanish provinces for analysis, excluding Ceuta and Melilla. The information has been taken out from the Spanish National Institute of Statistics (*Instituto Nacional de Estadística*, INE). We resort to the Spanish Regional Accounts (*Contabilidad Regional de España*, CRE) to obtain nominal GDP by province and the Consumer Price Index CPI (*Índice de Precios al Consumo*[3], IPC) dataset to deflate nominal output and obtain a proxied measure of real GDP. Besides, unemployment and labour force participation information[4] is provided by the Labour Force Survey (*Encuesta de Población Activa*, EPA).

[3] Using CPI as a GDP deflator is a consequence of the lack of data on GDP deflation at the provincial level for part of the considered period. Hence, provincial CPIs become the most suitable indicator to remove the effect of prices from the output. As CPI is only available for provinces after 1993, we use the index for the provincial capitals for the previous years.
[4] The EPA provides non-homogeneous panel datasets. Occupation and participation data are furnished according to different criteria based on the time the information was collected. In this case, we follow De la Fuente (2012), who makes the required adjustments to link the 1976 to 1995 and 1996 to 2004 occupation and participation series to the 2005 to 2013

Furthermore, the data to obtain the determinants of unemployment sensitivity is also provided by the EPA, from which we get the information on working age population and the percentage distribution of employment by industry.

2.3.2. Methodology

In order to quantify the differences in the degree of sensitivity of unemployment to GDP fluctuations among Spain's provinces, we use the difference version[5] of Okun's law and then we conduct VAR and panel VAR analyses[6].

The difference version of Okun's law provides information on the relationship between GDP and unemployment rate variations. It is specified as:

$$(u_t - u_{t-1}) = c + \beta_1(y_t - y_{t-1}) + \varepsilon_t \quad (2.1)$$

where $u_t - u_{t-1}$ represents the difference between unemployment rates in periods t and t-1, $y_t - y_{t-1}$ is the variation of the GDP natural logarithms that takes place between t and t-1 periods, c is the constant and ε_t represents the idiosyncratic error term. The large variability in the unemployment rate

series. Differences are mainly due to sample replacement and methodological changes, such as questionnaire modifications and adjustments in the definition of occupation and unemployment. Annual and state adjustments are distributed among the provinces considering their weighting in the state occupation and labour force participation data.

[5] Okun's seminal work defined three different versions of the empirical relationship: the gap version, the specification in first differences and the dynamic one. In our analysis, we select the version in first differences. Literature has frequently resorted to the gap version; however, it requires making strong assumptions on the unobserved macroeconomic variables (potential output and NAIRU). In addition, there is no agreement on the proper procedure to extract the trend component from the series and observe the effect of the cycle. These problems lead us to resort to the difference specification. In addition, it is easier to reach stationary series when this version is used. Many analyses have resorted to this version. Among them, we find Mankiw (1994), Sögner and Stiassny (2002), Perman and Tavera (2005), Kosfeld and Dreger (2006), Knotek (2007), Galí et al. (2012) and Palombi et al. (2015a, 2015b).

[6] Before estimating we need to perform unit root tests to know whether the series and panels with which we work are stationary. Stationarity ensures that the obtained results are not spurious. We obtain the panels and most series are generated by I(1) processes. Section A2.3 of Appendix A2 shows further information about the methodology and results obtained.

observed for Spain and many of its provinces over the selected period makes the difference specification more accurate than the gap approach. The estimation of the coefficient of the provincial series is performed using the ordinary least squares (OLS) method, while the panel that integrates all provinces requires estimating by fixed effects (FE).

However, estimating the relationship between the aforementioned variables does not allow us to take into account the potential endogeneity of GDP and the unemployment rate. In order to consider this, we resort to the VAR and panel VAR techniques and the Impulse Response Functions (IRFs) associated. VAR and panel VAR techniques allow us to determine the effect of an output or unemployment innovation regarding past values of these variables. We write the VAR representation as follows:

$$\Delta u_t = c + \alpha(L)\, \Delta u_t + \beta(L)\, \Delta y_t + v_t^u$$
$$\Delta y_t = c + \gamma(L)\, \Delta y_t + \eta(L)\, \Delta u_t + v_t^u \quad (2.2)$$

where Δu_t and Δy_t represent respectively unemployment rate and GDP natural logarithm variations between periods t and t-1; $\alpha(L)$, $\beta(L)$, $\gamma(L)$ and $\eta(L)$ are respectively the vectors of the coefficients relating past changes in the variables associated with current values; c is the constant and v_t^u and v_t^y are vectors of the idiosyncratic terms.

VAR models treat GDP and unemployment variables as endogenous and interdependent and analyse the transmission of idiosyncratic shocks across time. Meanwhile, the panel that includes all provincial series requires the PVAR technique[7]. The lag order selected in these analyses is one, because we work with annual data and we expect that the variables considered will keep some correlation with the same variable lagged one period. The AIC, HQIC and SBIC criteria[8] also obtain that considering one lag in the VAR analysis is optimal for most series[9]. After performing the estimation,

[7] In order to apply PVAR technique, we resort to the Ryan Decker program, which is an update version of the Inessa Love original package, used in Love and Zicchino (2006), among others.

[8] AIC, HQIC and SBIC are, respectively, the Akaike, Hannan-Quinn and Schwarz information criteria.

[9] More lags have also been included in the specification and results are mostly the same.

associated Impulse Response Functions (IRFs) show the response of both variables to shocks. We obtain IRFs for all provinces by orthogonalising[10] the variables as Sims (1980) proposes.

2.4. Empirical results

2.4.1. Okun's law difference version

In this section, we estimate the relationship between GDP and unemployment. We construct a first difference specification[11] for every province and the panel that integrates all of them. The results of the estimation of the Okun's relationship for the Spanish provinces and the panel are shown in Table 2.1. Coefficients point out the unemployment rate variation when GDP changes by one percentage point. We have ordered the provinces attending the value of this coefficient and we can observe large differences between them. Whereas for some provinces, such as Barcelona and Cádiz, one percentage point of GDP variation is accompanied by a change in the opposite direction of unemployment rates with values higher than 0.5; for Guadalajara, Salamanca and Soria, GDP shifts barely affect unemployment: the absolute value of the relationship coefficient does not reach 0.2 percentage points. This is a clear example of heterogeneity in the Spanish labour market. In some provinces, unemployment varies largely when shifts in economic activity occur, whereas other provinces show low variability or even do not present any relationship.

[10] As we orthogonalise the variables as Sims (1980) proposes and, thus, we assume that a GDP shock affect unemployment in the same period, we should express the VAR in the following way: $\Delta u_t = c + \lambda \Delta y_t + \alpha(L)\, \Delta u_t + \beta(L)\, \Delta y_t + v_t^u$; $\Delta y_t = c + \gamma(L)\, \Delta y_t + \eta(L)\, \Delta u_t + v_t^u$

[11] We have estimated the gap version of Okun's law using the Hodrick Prescott filter in order to check our specification. We aim to know if the results obtained are comparable with those obtained by the authors that consider the gap version. Section A2.4 of Appendix A2 shows that both versions provides us a similar province ordering regarding the value of the coefficient.

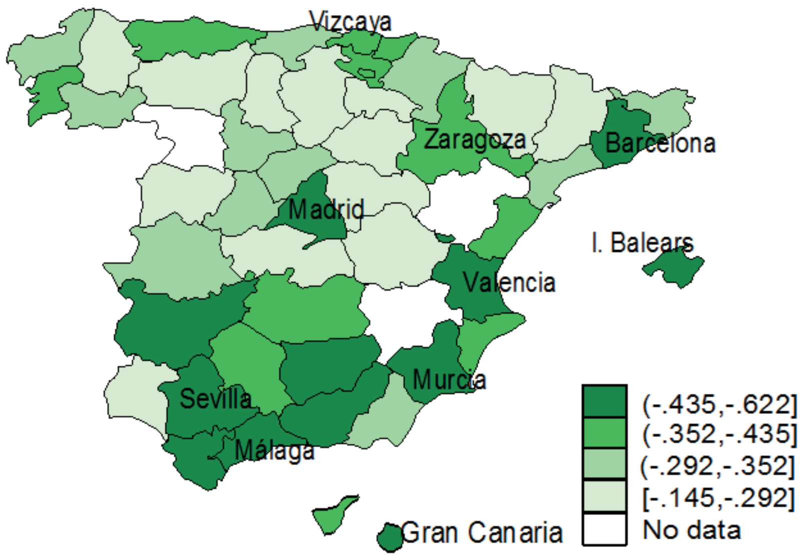
Table 2.1. Okun's law estimation for the Spanish provinces

Province	($\ln GDP_t$ - $\ln GDP_{t-1}$)			
	Coeff.	St. Error	Obs.	R-squared
Cádiz	-0.622***	(0.0809)	28	0.604
Barcelona	-0.548***	(0.115)	28	0.590
Palmas, Las	-0.535***	(0.145)	28	0.478
Valencia/València	-0.530***	(0.129)	28	0.545
Granada	-0.515***	(0.127)	28	0.457
Murcia	-0.514***	(0.124)	28	0.399
Sevilla	-0.494***	(0.0993)	28	0.546
Málaga	-0.481***	(0.118)	28	0.536
Jaén	-0.458***	(0.0815)	28	0.430
Badajoz	-0.453***	(0.0704)	28	0.532
Balears, Illes	-0.439***	(0.131)	28	0.435
Madrid	-0.436***	(0.0823)	28	0.605
Álava/Áraba	-0.424***	(0.0970)	28	0.559
Zaragoza	-0.423***	(0.106)	28	0.487
Ciudad Real	-0.420***	(0.109)	28	0.486
Asturias	-0.407***	(0.0737)	28	0.476
Córdoba	-0.405***	(0.0750)	28	0.442
Sta. Cruz de Tenerife	-0.399***	(0.133)	28	0.350
Castellón/Castelló	-0.390***	(0.128)	28	0.403
Pontevedra	-0.382***	(0.0672)	28	0.554
Alicante/Alacant	-0.367**	(0.140)	28	0.339
Guipuzcoa/ Gipuzkoa	-0.366***	(0.0697)	28	0.518
Vizcaya/ Bizkaia	-0.353***	(0.0889)	28	0.411
Ourense	-0.351**	(0.128)	28	0.181
Almería	-0.336***	(0.0818)	28	0.389
Ávila	-0.333***	(0.102)	28	0.266
Navarra	-0.332***	(0.0499)	28	0.621
Cantabria	-0.323***	(0.0984)	28	0.413
Tarragona	-0.322***	(0.0819)	28	0.354
Segovia	-0.316***	(0.0875)	28	0.447
Valladolid	-0.310***	(0.0652)	28	0.371
Gerona/ Girona	-0.309***	(0.0843)	28	0.353
Coruña, A	-0.302***	(0.0866)	28	0.313
Cáceres	-0.294**	(0.135)	28	0.125
Burgos	-0.291***	(0.0869)	28	0.285
Toledo	-0.291***	(0.0715)	28	0.367
Lugo	-0.290***	(0.0596)	28	0.516
Rioja, La	-0.281**	(0.117)	28	0.211
León	-0.276***	(0.0886)	28	0.276
Cuenca	-0.264**	(0.107)	28	0.217
Huelva	-0.261**	(0.114)	28	0.101
Huesca	-0.253***	(0.0730)	28	0.282
Lérida/ Lleida	-0.243**	(0.108)	28	0.205
Palencia	-0.201***	(0.0579)	28	0.183
Guadalajara	-0.192***	(0.0506)	28	0.289
Salamanca	-0.169*	(0.0892)	28	0.070
Soria	-0.145**	(0.0704)	28	0.157
Albacete	-0.226	(0.137)	28	0.102
Zamora	-0.157	(0.105)	28	0.064
Teruel	-0.131	(0.0881)	28	0.101
Spain	-0.530***	(0.0990)	28	0.711
Panel Spain	-0.346***	(0.0168)	1,400	0.315

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

Figure 2.2 clearly shows a different unemployment response among provinces between and within autonomous communities. Provinces such as Madrid, Barcelona, Valencia, Sevilla, Málaga, Murcia, Cádiz, Las Palmas and Illes Balears show the highest levels of unemployment sensitivity to economic variations. These provinces present high levels of economic activity and labour force participation. In contrast, the peninsular centre, excepting Madrid, remains the geographical area where lower effects of GDP shocks on unemployment are observed. This area shows a very ageing population and lower levels of economic activity. Figure 2.2 also highlights a north-south distinction. The south of Spain is a traditionally depressed area with high unemployment rates whereas peninsular north performs relatively better. The industrial structure in these areas also differs to a great extent. Northern provinces show higher shares of employment in manufacturing while in southern economies, service sector plays a more relevant role.

Figure 2.2. Unemployment sensitivity to economic variations for the Spanish provinces



Furthermore, panel estimation indicates that one percentage point of GDP variation is accompanied by an unemployment rate change in the opposite direction that is quantified by 0.34 p.p. This value is not comparable to that obtained from the national data of Spain, which is significantly higher.

Such difference is due to the fact that panel estimates gives equal weight to all regions, yielding a downward biased value of Okun's coefficient. This is because very populous provinces that present higher unemployment and economic activity in absolute terms are among those with greater unemployment sensitivity to GDP variations. The great difference between the national and panel estimations also highlights the great heterogeneity that Spanish provinces show in terms of unemployment sensitivity.

2.4.2. VAR and panel VAR analysis

The VAR and panel VAR methodology provides us additional information regarding the relationship between GDP and unemployment. The simple OLS estimation reports basically the correlation between the two variables considered. It does not allow to take into account the potential endogeneity of GDP and unemployment. IRFs associated to the VAR and PVAR methodology respond to this question.

This methodology shows the effect of shocks over time. In this analysis, we resort to the VAR technique to identify the impact of GDP growth innovations on unemployment rate regarding past values of both variables. The associated Impulse Response Functions (IRFs) show the effect of these shocks over time. IRFs isolate the effect of a GDP growth specific shock and allow us to observe this effect on unemployment.

Thus, we estimate a bivariate VAR for all provinces and we obtain their orthogonal IRFs[12]. The orthogonal IRF representations for all Spanish provinces are reported in Figure 2.3. The effect of GDP growth shocks is presented for 10 periods. 95% Confidence intervals are defined by the grey shaded area around the line that points out the effect of GDP growth shocks on unemployment. We can observe that for all provinces the effect of shocks on unemployment are negative, but the magnitude of these shocks and the persistence vary across provinces. In provinces such as Illes Balears, Jaén and Málaga, the initial effect of shocks is very sharp, whereas in Asturias, Barcelona and Cantabria, the initial effect is not so steep, but the shock is more persistent. There are also provinces for which we cannot observe any

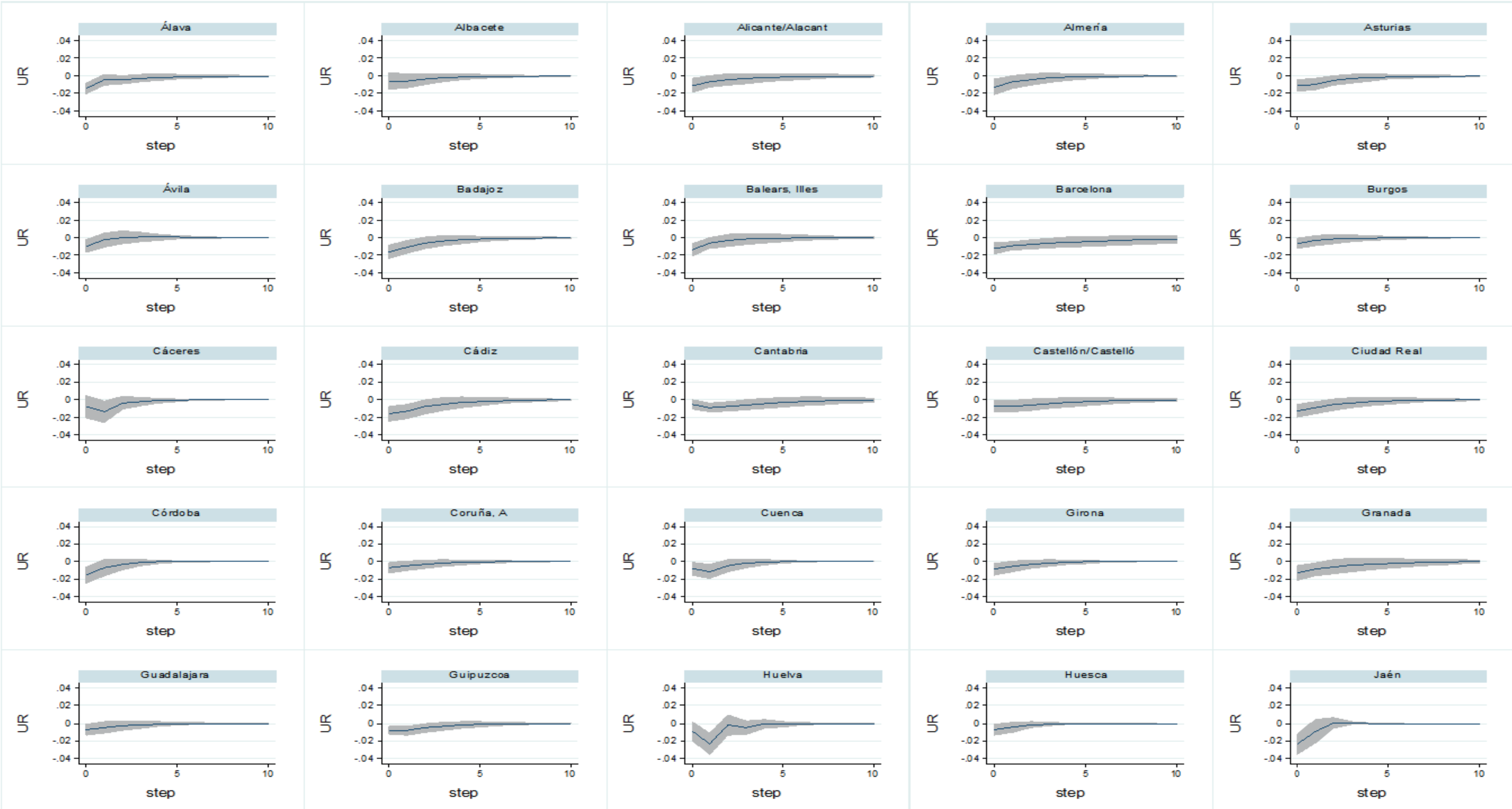
[12] The ordering of the variables in the VAR model could determine the results obtained. For this reason, and in order to check GDP growth causes unemployment rate variations for most provinces, we show the results obtained when we change the ordering of the variables in the Section A2.5 of the Appendix A2.

impact on unemployment. This is the case for Palencia, Soria and Zamora, among others. As in the contemporary analysis, we observe that provinces greatly differ in their unemployment response to economic shifts.

Table 2.2 shows the impact for the Spanish provinces of these shocks in the period in which they occur, as well as the cumulative effect after 2, 4, 6 and 10 periods. We have ordered the provinces according to the magnitude of the impact of the shock. At the top of the table are displayed the provinces for which the cumulative effect of the shock is higher at period 10. We get results comparable to those obtained in the estimation of the Okun's law difference version. We can see in the first positions of the table the provinces for which the Okun's difference version acknowledged a higher impact of GDP on unemployment. The bottom part is composed by provinces for which the Okun's coefficient was relatively low or not significant.

Figure 2.4 gathers, in a clearer way, the cumulative effect of GDP growth shocks on unemployment. In this case, Illes Balears and Málaga do not fall among the provinces with higher sensitivity to GDP shifts. Contrarily, Asturias, Cantabria, Castellón and some southern provinces join this group. The peninsular centre remains the geographical area where lower effects of GDP shocks on unemployment are observed.

Figure 2.3. Provincial OIRF representation



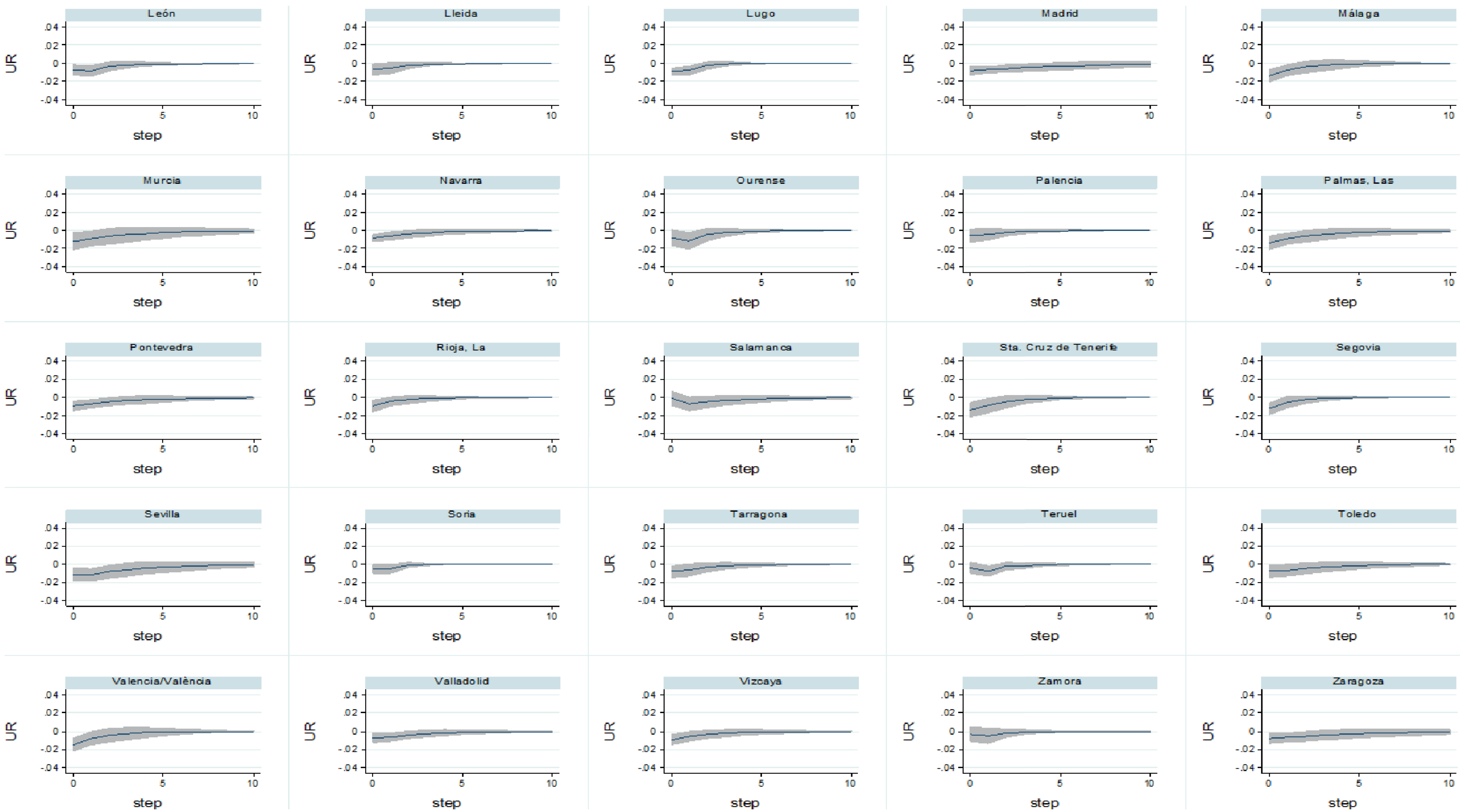
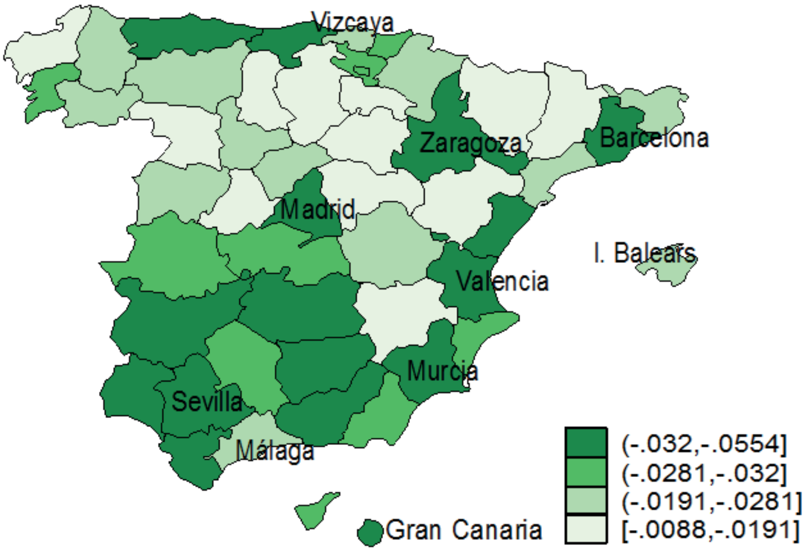

León
Lleida
Lugo
Madrid
Málaga
Murcia
Navarra
Ourense
Palencia
Palmas, Las
Pontevedra
Rioja, La
Salamanca
Sta. Cruz de Tenerife
Segovia
Sevilla
Soria
Tarragona
Teruel
Toledo
Valencia/València
Valladolid
Vizcaya
Zamora
Zaragoza
UR
step

Table 2.2. Cumulative effect of GDP shocks on unemployment

Unemployment rate (First Difference)					
Provinces	0	2	4	6	10
Barcelona	-0.01174	-0.02836	-0.03943	-0.04691	-0.05539
Sevilla	-0.01140	-0.03120	-0.04143	-0.04682	-0.05116
Cádiz	-0.01613	-0.03727	-0.04552	-0.04880	-0.05063
Palmas, Las	-0.01382	-0.02903	-0.03658	-0.04055	-0.04377
Murcia	-0.01207	-0.02706	-0.03499	-0.03919	-0.04260
Granada	-0.01302	-0.02810	-0.03548	-0.03912	-0.04181
Huelva	-0.00896	-0.03433	-0.03995	-0.04120	-0.04154
Cantabria	-0.00515	-0.02196	-0.03205	-0.03735	-0.04152
Badajoz	-0.01568	-0.03169	-0.03725	-0.03920	-0.04012
Madrid	-0.00812	-0.02042	-0.02859	-0.03401	-0.03998
Zaragoza	-0.00761	-0.01984	-0.02770	-0.03262	-0.03760
Ciudad Real	-0.01276	-0.02772	-0.03370	-0.03612	-0.03750
Castellón/Castelló	-0.00741	-0.02070	-0.02804	-0.03180	-0.03468
Jaén	-0.02407	-0.03293	-0.03260	-0.03261	-0.03261
Asturias	-0.01084	-0.02520	-0.03005	-0.03175	-0.03254
Valencia/València	-0.01454	-0.02673	-0.03042	-0.03156	-0.03203
Santa Cruz de Tenerife	-0.01341	-0.02638	-0.02996	-0.03092	-0.03125
Pontevedra	-0.00889	-0.02017	-0.02581	-0.02863	-0.03075
Álava/ Áraba	-0.01452	-0.02327	-0.02736	-0.02912	-0.03018
Alicante/Alacant	-0.01104	-0.02149	-0.02630	-0.02858	-0.03017
Toledo	-0.00785	-0.01958	-0.02508	-0.02766	-0.02944
Cáceres	-0.00802	-0.02534	-0.02848	-0.02909	-0.02924
Almería	-0.01253	-0.02347	-0.02711	-0.02832	-0.02886
Guipuzcoa/ Gipuzkoa	-0.00771	-0.02123	-0.02623	-0.02795	-0.02874
Córdoba	-0.01565	-0.02594	-0.02776	-0.02808	-0.02815
Ourense	-0.00810	-0.02389	-0.02716	-0.02788	-0.02807
Cuenca	-0.00807	-0.02422	-0.02712	-0.02763	-0.02774
Málaga	-0.01350	-0.02475	-0.02733	-0.02764	-0.02748
Navarra	-0.00819	-0.01830	-0.02246	-0.02417	-0.02515
Balears, Illes	-0.01354	-0.02238	-0.02421	-0.02461	-0.02474
Valladolid	-0.00725	-0.01766	-0.02188	-0.02364	-0.02469
Vizcaya/ Bizkaia	-0.00926	-0.01815	-0.02160	-0.02294	-0.02366
Salamanca	-0.00114	-0.01291	-0.01872	-0.02147	-0.02339
Tarragona	-0.00820	-0.01784	-0.02080	-0.02171	-0.02208
Segovia	-0.01249	-0.02009	-0.02162	-0.02192	-0.02199
León	-0.00720	-0.01837	-0.02088	-0.02148	-0.02166
Gerona/ Girona	-0.00881	-0.01766	-0.02029	-0.02107	-0.02138
Lugo	-0.00887	-0.01889	-0.01917	-0.01911	-0.01911
Albacete	-0.00591	-0.01486	-0.01778	-0.01869	-0.01907
Coruña, A	-0.00720	-0.01499	-0.01768	-0.01860	-0.01903
Guadalajara	-0.00738	-0.01479	-0.01719	-0.01792	-0.01820
Rioja, La	-0.00935	-0.01538	-0.01704	-0.01751	-0.01769
Teruel	-0.00404	-0.01363	-0.01614	-0.01683	-0.01707
Lérida/ Lleida	-0.00656	-0.01386	-0.01518	-0.01544	-0.01549
Huesca	-0.00725	-0.01324	-0.01427	-0.01445	-0.01449
Palencia	-0.00552	-0.01171	-0.01318	-0.01355	-0.01366
Burgos	-0.00643	-0.01135	-0.01264	-0.01298	-0.01310
Zamora	-0.00300	-0.01010	-0.01154	-0.01184	-0.01192
Soria	-0.00509	-0.01069	-0.01114	-0.01117	-0.01118
Ávila	-0.00958	-0.01163	-0.00993	-0.00908	-0.00881
Spain	-0.01258	-0.02647	-0.03497	-0.04125	-0.05001

Figure 2.4. Unemployment sensitivity to economic shocks: cumulative effect after 10 periods.



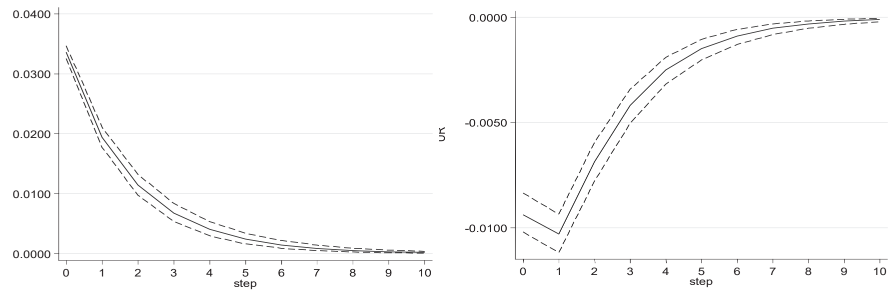
After observing for all provinces the effect of economic growth shocks, we apply the PVAR technique to observe the effect of shocks for the panel that integrates all provinces. It should be mentioned that variables have been orthogonalised such that an economic growth shock affects unemployment rate contemporaneously, but the effect of an unemployment rate growth shock on economic growth takes place after one period. Results from the PVAR analysis can be observed in Table 2.3 and Figure 2.5. They show the IRFs representations when a shock in economic growth and a shock in unemployment rate variation are respectively produced. Standard errors are calculated using Monte Carlo simulations with 500 replications. In this figure, we observe that the effect of a GDP growth shock on unemployment peak after one period and then the effect decreases to zero.

Table 2.3. Cumulative effect of shocks for the panel of provinces

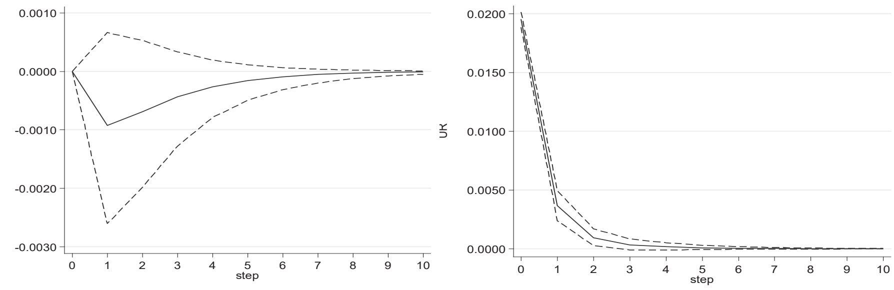
	Unemployment rate (First Difference)				
	0	2	4	6	10
UR response to a UR Shock	0.0195	0.0241	0.0247	0.0249	0.0249
GDP response to a UR Shock	0	-0.0016	-0.0023	-0.0026	-0.0027
UR response to a GDP Shock	-0.0094	-0.0266	-0.0333	-0.0357	-0.0368
GDP response to a GDP Shock	0.0336	0.0644	0.0752	0.079	0.0808

Figure 2.5. Unemployment response to shocks for the panel of provinces

Response to GDP growth shocks



Response to shocks in economic variation



2.4.3. Factors determining unemployment sensitivity

Once we have checked the heterogeneity among provinces regarding the effect of growth in unemployment, it is also interesting to determine the underlying causes behind this different degree of unemployment response to economic variations. In this regard, only a few studies have analysed the factors affecting unemployment sensitivity at regional level. Guisinger et al. (2018) considers 47 US states and obtain that a lower Okun's coefficient is obtained where higher levels of education, lower rate of unionization and a higher share of non-industrial employment is registered. Herwartz and Niebuhr (2011), in an analysis for EU15 regions, obtain that regional factors such as industrial composition, employment density, regional age structure and the role of trade unions influence unemployment responsiveness. Authors such as Robson (2009), Galí et al. (2012), and Dixon and Shepherd (2013) also find evidence on the influencing role of industrial structure, whereas Congregado et al. (2011) focuses on the effect that labour market participation exerts on unemployment over the cycle.

In our analysis, several variables[13] are taken into account to analyse the differences between Spanish provinces on unemployment sensitivity. Disparities on labour force participation and regional industry composition in terms of employment, together with urban and geographical variables[14], are included in the analysis as potential determinants of unemployment sensitivity[15].

The estimation is performed using the weighted least squares methodology (WLS). This methodology allows us to consider the standard errors of the unemployment sensitivity estimation by OLS as weights to perform a more efficient estimation of the influencing factors. Thereby, we give more influence to the provinces for which unemployment sensitivity has been measured more precisely. Table 2.4 shows the estimation results. Several combinations of variables have been considered in order to avoid the multicollinearity problem, which arises when certain correlated variables are considered at the same time. As it is shown in Table 2.4, levels of industrial diversification [16] as well as variables related to industry composition significantly affect unemployment sensitivity to economic growth. Labour activity and the urban dummy have also been found influencing factors. Besides, geographical controls are also significant.

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[13] Detailed information about the required data sets, the components and the sources of information are compiled in table A2.1 in the Section A2.1 of Appendix A2.

[14] Urban, south and coast are dummy variables. Urban variable takes the value 1 if one of the ten biggest Spanish municipalities is located in the province; and 0 otherwise. South variable takes the value 1 for provinces belonging to Extremadura, Castile-La Mancha and Canary Islands NUTS 2 regions; and 0 otherwise. These regions are located in the south of Spain and are those that have traditionally had higher rates of unemployment over the years. Finally, coast takes the value 1 if the province is located in the coast; and 0 otherwise.

[15] In addition to these variables, we consider wages, levels of education, trade unions and the employment share in the public sector as independent variables in the analysis. Results point out that these variables do not significantly affect unemployment sensitivity.

[16] Diversification index is expressed as: $D_i = -\sum_{j=1}^{J}\left[\frac{X_{ij}}{X_i} ln(\frac{X_{ij}}{X_i})\right]$, where X_{ij} represents the total employment in industry j and province i, whereas X_i is the total employment in province i.

Table 2.4. Weighted Least Square Regression Model

Variables	Dep variable: Unemployment Sensitivity to GDP Shocks				
	(1)	(2)	(3)	(4)	(5)
Divers. Index	-0.250*				
	(0.134)				
LFP		0.727**			
		(0.329)			
Agric.			-0.558**		
			(0.241)		
Manuf.				0.273*	
				(0.143)	
Serv.					0.611***
					(0.191)
Urban	0.0835**	0.122***			
	(0.0400)	(0.0253)			
South		0.0964***	0.0876***	0.0996***	0.0389**
		(0.0140)	(0.0207)	(0.0224)	(0.0162)
Coast	0.0565**		0.0589*	0.0758**	0.0579*
	(0.0230)		(0.0284)	(0.0289)	(0.0319)
Constant	0.574***	-0.0810	0.370***	0.237***	-0.0460
	(0.153)	(0.173)	(0.0342)	(0.0388)	(0.107)
Observations	50	50	50	50	50
R-squared	0.438	0.488	0.402	0.282	0.392

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results point out that the provinces with lower levels of diversification in its industry structure suffer to a higher extent from the effect of shocks on unemployment. In other words: diversified industries keep unemployment more stable to economic shocks. Regarding the industry mix composition, a higher share of employment in services and manufacturing is positively related to unemployment sensitivity. The opposite occurs when we consider the share of employment in agriculture. The high magnitude of the services coefficient points towards a higher response of unemployment in provinces such as Madrid, Barcelona, Valencia, Sevilla and Illes Balears, among others, which show a high share of employment in services. As opposed, provinces in the peninsular centre of Spain, which show the lowest levels of unemployment sensitivity, have a relatively high share of employment in agriculture and lower levels of employment in services and industry.

As for labour market variables, we find that labour force participation plays a significant role as determinant of unemployment sensitivity. The positive sign of the estimated coefficient and its high magnitude show that those provinces with a higher active population rate suffer to a greater extent from the effects of economic variations on unemployment. Besides, the urban dummy has been also found significant and its positive sign indicates that unemployment sensitivity is higher in provinces with bigger cities, although the magnitude of the coefficient implies that the effect is not very high. Geographical controls also point out to higher unemployment sensitivity in the southern and coastal provinces.

2.5. Final remarks

This chapter has examined the relationship between economic activity and unemployment rates for the Spain's provinces during the period of 1985 to 2013. This analysis has been carried out considering the Okun's law difference version and the VAR and panel VAR methodology.

The results obtained in this study stress the importance of analysing unemployment sensitivity at provincial level. We find that provinces within regions show a different response in unemployment rate with respect to GDP variations. Our analysis provides more information than previous studies for Spain, which considered the region (NUTS 2) as its geographical scope of analysis. Moreover, we obtain that provinces like Madrid, Barcelona, Valencia and Sevilla are among those which suffer to a higher extent from the effect of economic shocks on unemployment. In contrast, the peninsular centre, excepting Madrid, is the geographical area where unemployment is the least affected by economic shifts. In this regard, the comparison of the provincial coefficients of Okun's law first difference estimation and the results from the IRFs show the great differences within Spanish territory in the unemployment sensitivity to output variations.

The analysis of the underlying causes behind this different degree of unemployment response to economic variations highlights that industry composition as well as labour force participation are the main determinants of this different unemployment response to economic variations. Provinces showing higher shares of employment in services and manufacturing suffer to a greater extent from the effect of economic shocks. Besides, higher levels of labour force participation also boost unemployment sensitivity, whereas industrial diversification reduces the effect of economic shocks on unemployment.

These results are interesting from the economic policy perspective as in some provinces active population is suffering to a higher extent from the effects of the business cycle, whereas other provinces are less affected by the economic contingencies. In addition, provinces within the same autonomous communities are heterogeneous in their unemployment sensitivity, which is also relevant from the policy perspective as the main decisions about employment are taken at the national and autonomous community levels. Our results suggest that policy makers should consider the local labour markets peculiarities and apply differentiated policies.

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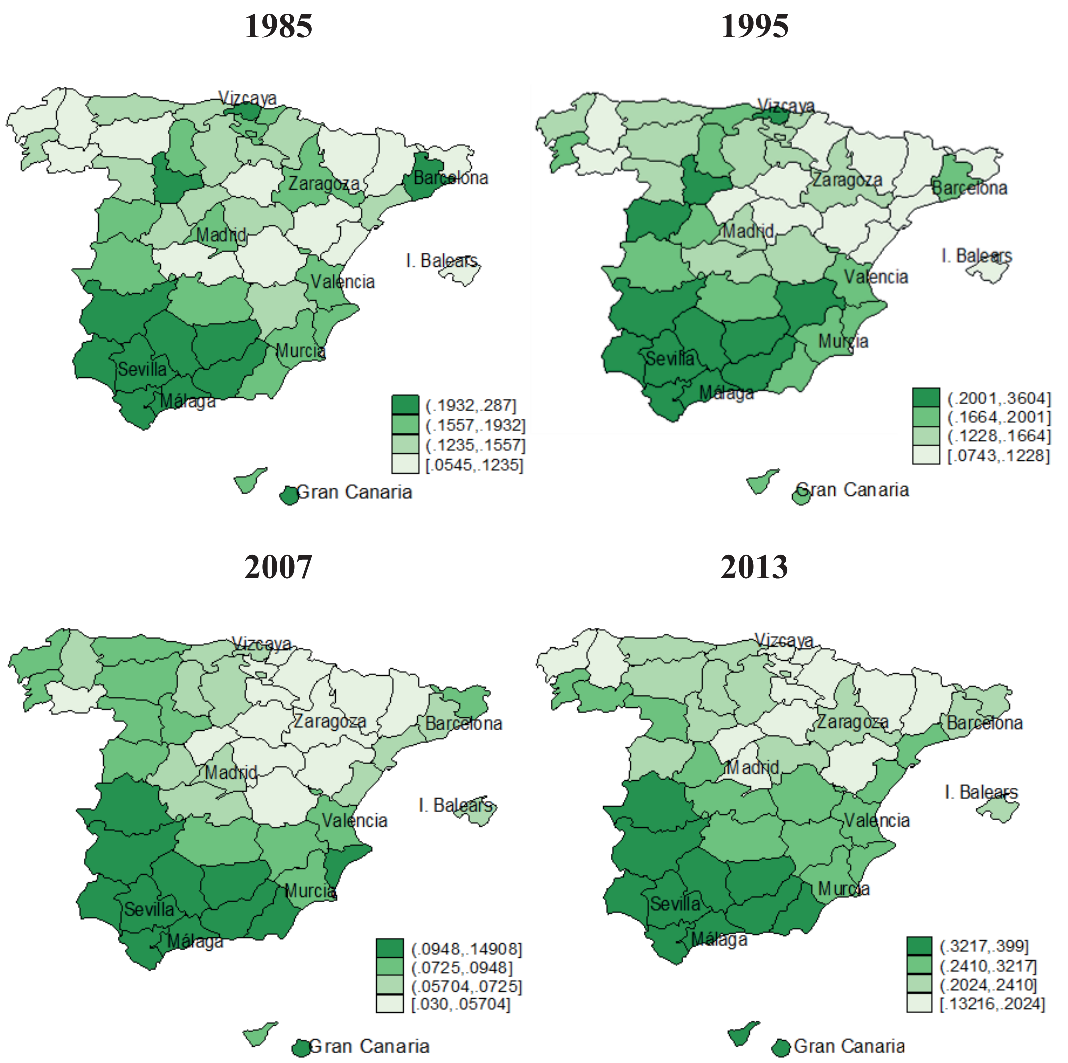
A2. Appendix

A2.1. Regional unemployment rates

Figure A2.1.1. Regional unemployment Rates in 1985, 1995, 2007 and 2013



A2.2. Sources of information

Table A2.2.1. Sources of information

Data	Information	Detailed Components	Source
Real GDP	Real GDP is obtained from the nominal GDP deflated by CPI. We construct a homogeneous series for the aforementioned data sets for the period spanning 1985-2010.	Nominal GDP (CRE 86, CRE 00, CRE 08) IPC (IPC 83, 92, 11)	CRE IPC
Unemployment	Unemployment is the overall number of people aged 16 and older who have not worked for at least one hour during the reference week for money or other remuneration. Unemployment does not include people who are temporarily absent from work due to illness, vacation, etc.	-	EPA
Labour Force	Labour force is the overall number of people aged 16 and older, who supply labour for the production of goods and services or are available and able to work.	-	EPA
Working Age Population	Working age population is the overall number of people aged 16 and older.	-	EPA
Industry Structure	The industrial structure is a measure of the relative importance of each economic sector in the economy. It is calculated by dividing the number of people employed in each economic sector by total employment.	-	EPA

A2.3. Unit root tests

A2.3.1. Unit root testing methodology

Unit root testing allows us to know whether the processes generated are stationary and guarantees that the obtained results have economic sense. The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests are two of the most often applied. However, these traditional unit root tests do not consider the existence of structural breaks in the series. In the presence of structural breaks, the ADF and PP tests tend to have low power. Glynn et al. (2007) establish that structural breaks generate a bias in the ADF and PP tests that reduces their ability to reject a false unit root hypothesis. Perron (1989) was the first author to mention this, and he developed a procedure based on the ADF test that accounted for only one exogenous break. However, the Perron procedure is severely criticised by many economists. Among the critics, Christiano (1992) established that a pre-test analysis of the data could lead to bias in the unit root test. Zivot and Andrews (1992) proposed an endogenous determination of the break to reduce this bias. The Zivot-Andrews test allows for an endogenous structural break, which is registered the time period in which the ADF t-statistic is the minimum. Later versions, such as Perron and Vogelsang (1992), distinguish between additive and innovative outliers. Clemente et al. (1998) contemplate this break distinction, but go further to consider the existence of two breaks. In our study, we conduct the ADF and PP traditional tests, but we also apply the Zivot-Andrews and Clemente-Montañés-Reyes tests. Applying both sets of tests guarantees robustness in determining if the series are stationary. The lag length selection criterion differs for each test. For the ADF test, we check that for every province the lags are significant at the 90% level, and we chose the maximum number of significant lags. Meanwhile, we resort to the default number of Newey-West lags to calculate the standard error for the PP test.[17]

After conducting individual unit root tests, panel-data unit root tests are applied to complete our analysis and obtain an overall view of the GDP and the unemployment rate of the Spanish provinces. The test results provide additional information and increase the value of unit root tests based on single series.

[17] This number of lags is given by the following formula: $int\{4(T/100)^{2/9}\}$.

There is some literature about panel-data unit root tests and many attempts to remove cross-sectional dependence such as Pesaran (2007), Moon and Perron (2004), Maddala and Wu (1999), Levin and Lin (2002), and Im et al. (2003). In our work we apply the Fisher-type, Levin Lin Chu, Im Pesaran Shin, and Hadri LM tests. In the first three tests, the null hypothesis considers the presence of unit roots in, at least, one of the series that form the panel and stationarity is assumed under the alternative hypothesis. The Hadri LM test considers in its null hypothesis that the series are generated by stationary processes.

In all the tests the lag length[18] is chosen according to Österholm (2004), who selects the maximum number of lags from individual tests. The maximum significant number of lags obtained in the individual ADF test is that which we use to determine the lag length for the panel unit root tests.

A2.3.2. Results of unit root tests

We conduct two types of tests over the variables in levels[19] and first differences in order to check that the series with which we are working are stationary. The traditional ADF and PP tests are applied, as are the Zivot-Andrews and Clemente-Montañés-Reyes tests, which consider structural breaks.

Results from the ADF and PP tests over variables in first differences are shown in Table A2.3.2.1. In this table, we can observe the model that we consider, which is individually chosen, and the statistical value of the test, which allows us to accept or reject the null hypothesis. In light of the results, both tests lead us to reject the null hypothesis of the presence of unit roots for most provincial series in first differences at the conventional levels of significance. When we test the first differenced unemployment rate variable, we find that none of tests can reject the null hypothesis of the presence of unit roots for any province. In the case of GDP, in 18 of the 50 provinces both tests find problems in rejecting the null hypothesis. These exceptions may be due to the presence of structural breaks in the series that are not detected by the ADF and PP tests. We apply the Zivot-Andrews and Clemente-Montañés-Reyes tests in order to check whether the results remain the same or change when structural breaks are taken into account. Tables

[18] Other criteria are also used in order to obtain robust results. We consider the AIC criterion in the Levin Lin Chu and Im Pesaran Shin tests to select the lag length.
[19] Unit root tests of the variables in levels are available from the author on request.

A2.3.2.2 and A2.3.2.3 show the results of the Zivot-Andrews and Clemente-Montañés-Reyes tests for the variables in the first differences. According to these results, the unemployment rate and GDP provincial series are mostly stationary in first differences. The same occurs for the national data series. After performing Clemente-Montañés-Reyes tests, we observe that both GDP and unemployment rate series can be considered stationary if we take into account an innovative break in 2006, This allows us to estimate the relationship between the variables considered, as seen in most of the literature.

We also carry out panel unit root tests. Results are shown in Table A2.3.2.4. They confirm the results obtained for provincial series: unit root processes are found in the levels of the variables, but we cannot reject stationarity in first differences. In particular, the Levin Lin Chu, Im Pesaran Shin, and Fisher Type (conducted as an ADF test) tests reject the null hypothesis of unit root processes in the first differenced variables at a 99 percent confidence level. Meanwhile, the Hadri LM test cannot reject stationarity at any of the conventional confidence levels.

Table A2.3.2.1. ADF and PP unit root tests on variables in FD.

Province	Unemployment Rate				GDP (Natural logarithm)			
	ADF-t		*PP-t*		*ADF-t*		*PP-t*	
	Model	t-Stat.	Model	*t-Stat.*	Model	t-Stat.	Model	*t-Stat.*
Álava/ Araba	NT,C,0L	-4.605***	NT,C	-4.583***	NT,C,0L	-2.331	NT,C	-2.308
Albacete	NT,C,0L	-3.469***	NT,C	-3.474***	T,C,0L	-4.649***	T,C	-4.638***
Alicante/Alacant	NT,C,0L	-3.374**	NT,C	-3.312**	T,C,0L	-2.786	T,C	-2.838
Almería	NT,C,0L	-3.371**	NT,C	-3.322***	T,C,0L	-3.368*	T,C	-3.397**
Asturias	NT,C,0L	-3.751**	NT,C	-3.722***	NT,C,0L	-2.477	NT,C	-2.368
Ávila	NT,C,0L	-2.715*	NT,C	-2.809*	T,C,0L	-3.613**	T,C	-3.653**
Badajoz	NT,C,0L	-3.713***	NT,C	-3.728***	T,C,0L	-3.366*	T,C	-3.474**
Balears, Illes	NT,C,0L	-3.065*	NT,C	-3.088**	T,C,0L	-2.922	T,C	-3.021
Barcelona	NT,C,0L	-2.897**	NT,C	-2.914**	NT,C,0L	-1.522	NT,C	-1.545
Burgos	T,C,1L	-4.057**	NT,C	-3.065**	T,C,0L	-3.136*	T,C	-3.120*
Cáceres	NT,C,0L	-5.432***	NT,C	-5.432***	NT,C,0L	-3.084**	NT,C	-3.113**
Cádiz	NT,C,0L	-2.978*	NT,C	-2.994**	NT,C,0L	-2.585*	NT,C	-2.574*
Cantabria	NT,C,0L	-2.806*	NT,C	-2.868**	T,C,0L	-2.782	T,C	-2.909
Castellón/Castelló	T,C,1L	-3.328*	T,C	-2.384	NT,C,0L	-2.772*	NT,C	-2.864**
Ciudad Real	NT,C,0L	-3.382**	NT,C	-3.314**	NT,C,0L	-2.145	NT,C	-1.927
Córdoba	NT,C,0L	-3.547***	NT,C	-3.592***	T,C,0L	-4.357***	T,C	-4.414***
Coruña, A	NT,C,0L	-3.421**	NT,C	-3.436***	NT,C,0L	-2.566*	NT,C	-2.444
Cuenca	T,C,0L	-3.404*	T,C	-3.307*	T,C,0L	-4.342***	T,C	-4.339***
Gerona/ Girona	NT,C,0L	-3.503***	NT,C	-3.511***	NT,C,0L	-2.757*	NT,C	-2.689*
Granada	NT,C,0L	-2.744*	NT,C	-2.742*	NT,C,0L	-1.943	NT,C	-1.892
Guadalajara	NT,C,0L	-2.869**	NT,C	-2.869**	NT,C,0L	-2.937**	NT,C	-2.980*
Guipúzcoa/ Gipuzkoa	NT,C,0L	-3.297**	NT,C	-3.335**	T,C,0L	-2.757	T,C	-2.785
Huelva	NT,C,0L	-4.890***	NT,C	-4.894***	NT,C,0L	-3.430***	NT,C	-3.491***
Huesca	T,C,1L	-4.617*	T,C	-4.308***	NT,C,0L	-3.836***	NT,C	-3.886***
Jaén	NT,C,0L	-4.230***	NT,C	-4.250***	T,C,0L	-5.738***	T,C	-5.763***
León	NT,C,0L	-3.398**	NT,C	-3.348**	T,C,0L	-4.162***	T,C	-4.239***
Lérida/ Lleida	NT,C,0L	-4.297***	NT,C	-4.270***	T,C,0L	-3.833**	T,C	-3.832**
Lugo	NT,C,0L	-3.087**	NT,C	-3.041**	T,C,0L	-4.174***	T,C	-4.226***
Madrid	NT,C,0L	-2.567*	NT,C	-2.55	NT,C,0L	-1.709	NT,C	-1.84
Málaga	NT,C,0L	-2.545	NT,C	-2.603*	NT,C,0L	-2.414	NT,C	-2.467
Murcia	NT,C,0L	-2.781*	NT,C	-2.866**	NT,C,0L	-1.777	NT,C	-1.768
Navarra	T,C,0L	-3.423**	T,C	-3.368*	NT,C,0L	-2.705*	NT,C	-2.632*
Ourense	NT,C,0L	-3.738***	NT,C	-3.775***	T,C,0L	-4.029***	T,C	-4.084***
Palencia	NT,C,0L	-3.356**	NT,C	-3.361**	T,C,0L	-4.504***	T,C	-4.593***
Palmas, Las	NT,C,0L	-2.773*	NT,C	-2.729*	NT,C,0L	-2.282	NT,C	-2.297
Pontevedra	NT,C,0L	-2.662*	NT,C	-2.751*	NT,C,0L	-2.072	NT,C	-2.164
Rioja, La	NT,C,0L	-3.543***	NT,C	-3.536***	T,C,0L	-3.530**	T,C	-3.538**
Salamanca	NT,C,0L	-3.976***	NT,C	-3.962***	T,C,0L	-3.489**	T,C	-3.540**
Sta. Cruz deTenerife	NT,C,0L	-3.285**	NT,C	-3.259**	T,C,0L	-3.952**	T,C	-3.999***
Segovia	NT,C,0L	-4.109***	NT,C	-4.073***	T,C,0L	-3.769**	T,C	-3.789**
Sevilla	NT,C,0L	-2.519	NT,C	-2.586*	T,C,0L	-2.849	T,C	-2.881
Soria	T,C,0L	-4.722***	T,C	-4.711***	T,C,0L	-5.764***	T,C	-5.758***
Tarragona	T,C,0L	-3.425***	T,C	-3.387*	NT,C,0L	-3.515***	NT,C	-3.535***
Teruel	NT,C,0L	-3.737***	NT,C	-3.878***	T,C,0L	-4.581***	T,C	-4.577***
Toledo	NT,C,0L	-2.598*	NT,C	-2.564	T,C,0L	-3.250*	T,C	-3.417**
Valencia/València	NT,C,0L	-2.788*	NT,C	-2.813*	NT,C,0L	-2.007	NT,C	-1.922
Valladolid	NT,C,0L	-3.156**	NT,C	-3.171**	T,C,0L	-3.580**	T,C	-3.513**
Vizcaya/ Bizkaia	NT,C,0L	-3.557***	NT,C	-3.548***	NT,C,0L	-2.203	NT,C	-2.241
Zamora	NT,C,0L	-3.708***	NT,C	-3.659***	T,C,0L	-4.519***	T,C	-4.521***
Zaragoza	NT,C,0L	-2.636*	NT,C	-2.621*	NT,C,0L	-1.694	NT,C	-1.655
Spain	NT,C, 0L	-2.347	NT,C	-2.396	NT,C,0L	-1.124	NT,C	-1.208

NT: No trend; T: Trend; NC: No Intercept; C: Intercept; 0L: 0 lags included; 1L: 1 lag included; 2L: 2 lags included.
*** p<0.01, ** p<0.05, * p<0.

Table A2.3.2.2. Unit root tests with structural breaks on first dif. UR

Province	Zivot- Andrews			Clemente-Montañés-Reyes						
	t-statistic	Year	Outlier	t-statistic	Year 1	Year 2	Outlier	t-statistic	Year 1	Year 2
Álava/ Araba	-6.476***	1995	1 AO	-2.508	2005		2 IO	-7.412**	1993	2007
Albacete	-5.113**	1994	1 AO	-4.703**	2005		2 IO	-5.679**	1992	2007
Alicante/Alacant	-4.702*	1995	1 AO	-3.199	2007		1 IO	-4.175	2006	
Almería	-5.153**	2007	1 AO	-2.734	2005		1 IO	-4.448**	2006	
Asturias	-5.748***	2009	1 AO	-5.162**	2006		2 IO	-4.626	2000	2007
Ávila	-3.707	2008	1 AO	-3.565**	2004		1 IO	-3.544	2006	
Badajoz	-5.648***	2008	1 AO	-4.890**	2005		1 IO	-5.656**	2007	
Balears, Illes	-3.641	1994	1 AO	-6.197**	2007		1 IO	-3.562	2006	
Barcelona	-3.767	1995	0 AO				1 IO	-4.155	2006	
Burgos	-5.989***	2008	1 AO	-6.001**	2005		1 IO	-4.086	2006	
Cáceres	-6.872***	2008	1 AO	-7.032**	2007		1 IO	-6.762**	2007	
Cádiz	-5.196**	2008	2 AO	-5.788**	1995	2007	2 IO	-5.859**	1993	2006
Cantabria	-4.573*	1997	1 AO	-3.324	2010		2 IO	-6.221**	1995	2007
Castellón/Castelló	-4.615*	2008	1 AO	-1.925	2007		1 IO	-4.570**	2006	
Ciudad Real	-5.037**	2008	1 AO	-4.346**	2005		1 IO	-6.733**	2006	
Córdoba	-5.323**	2008	1 AO	-3.681**	2007		2 IO	-3.026	1998	2007
Coruña, A	-4.646*	1995	1 AO	-4.280**	2008		2 IO	-5.124	2003	2007
Cuenca	-5.379***	2009	1 AO	-6.002**	2005		1 IO	-16.499**	2007	
Gerona/ Girona	-4.421	1995	1 AO	-3.162	2007		1 IO	-4.351**	2006	
Granada	-4.489	2007	1 AO	-3.751**	2004		2 IO	-4.815	1996	2006
Guadalajara	-5.252**	2008	1 AO	-2.481	2005		1 IO	-5.145**	2006	
Guipuzcoa/ Gipuzkoa	-4.933**	1995	1 AO	-4.065**	2005		1 IO	-4.081	2007	
Huelva	-6.066***	2008	1 AO	-6.128**	2007		1 IO	-5.955**	2006	
Huesca	-6.542***	1997	0 AO				1 IO	-4.832**	2006	
Jaén	-6.248***	1997	2 AO	-5.198	1996	2007	1 IO	-5.678**	2007	
León	-5.575***	2008	1 AO	-4.282**	2006		2 IO	-5.571**	1998	2007
Lérida/ Lleida	-5.702***	2008	1 AO	-4.495**	2005		1 IO	-6.537**	2006	
Lugo	-2.866	2009	2 AO	-6.071**	1996	2008	1 IO	-2.043	2007	
Madrid	-3.914	1997	1 AO	-3.379	2005		1 IO	-3.397	2006	
Málaga	-4.052	2008	1 AO	-3.413	2005		1 IO	-29.904**	2006	
Murcia	-4.116	2008	1 AO	-3.376	2005		1 IO	-3.961	2006	
Navarra	-3.338	1996	1 AO	-4.938**	2005		1 IO	-4.977**	2006	
Ourense	-5.852***	2000	0 AO				2 IO	-3.080	2000	2006
Palencia	-5.319**	1997	1 AO	-4.650**	2005		1 IO	-4.696**	2006	
Palmas, Las	-4.234	2008	1 AO	-3.895**	2005		1 IO	-6.479**	2006	
Pontevedra	-4.351	2008	1 AO	-3.332	2009		1 IO	-3.919	2006	
Rioja, La	-5.29**	1996	1 AO	-4.812**	2005		1 IO	-5.452**	2006	
Salamanca	-5.001**	1995	1 AO	-4.354**	2005		2 IO	-5.415	1993	2006
Sta. Cruz de Tenerife	-5.429***	2008	1 AO	-5.280**	2005		1 IO	-5.290**	2006	
Segovia	-5.282**	2008	2 AO	-5.563**	1990	2005	2 IO	-5.899**	1989	2006
Sevilla	-3.688	2008	1 AO	-4.126**	2007		1 IO	-3.639	2006	
Soria	-6.655***	2009	1 AO	-6.197**	2006		1 IO	-6.680**	2007	
Tarragona	-4.838**	2008	1 AO	-4.199**	2005		1 IO	-4.463**	2006	
Teruel	-4.222	1997	1 AO	-5.266**	2005		1 IO	-5.462**	2006	
Toledo	-5.103**	2008	1 AO	-4.725**	2009		1 IO	-5.480**	2006	
Valencia/València	-3.707	1995	1 AO	-2.774	2007		1 IO	-3.622	2006	
Valladolid	-4.911**	2008	1 AO	-0.063	2005		1 IO	-4.768**	2006	
Vizcaya/ Bizkaia	-5.469***	1996	1 AO	-4.253**	2005		1 IO	-4.633**	2007	
Zamora	-5.446***	2009	1 AO	-5.203**	2008		2 IO	-7.234**	1996	2007
Zaragoza	-4.471	1995	1 AO	-3.5732	2006		1 IO	-4.331**	2006	
Spain	-3.812	2008	1 AO	-3.001	2005		1 IO	-4.564**	2006	

NT: No trend; T: Trend; NC: No Intercept; C: Intercept; 0L: 0 lags included; 1L: 1 lag included; 2L: 2 lags included.
Zivot - Andrews Test: *** p<0.01, ** p<0.05, * p<0.1
Clemente -Montañés-Reyes Test: ** p<0.05

Table A2.3.2.3. Unit root tests with structural breaks on first dif.GDP(NL)

Province	Zivot- Andrews			Clemente-Montañés-Reyes						
	t-statistic	Year	Outlier	t-statistic	Year 1	Year 2	Outlier	t-statistic	Year 1	Year 2
Álava/ Araba	-4.913**	2008	2 AO	-4.011	1996	2008	1 IO	-98.001**	2007	
Albacete	-6.456***	1998	1 AO	-5.347**	2007		1 IO	-2.718	2008	
Alicante/Alacant	-4.85**	2008	2 AO	-4.353	2005	2009	1 IO	-4.905**	2006	
Almería	-5.366***	1996	1 AO	-4.425**	2005		1 IO	-5.469**	2006	
Asturias	-3.305	2009	1 AO	-4.960**	2009		2 IO	-4.022	1996	2007
Ávila	-5.076**	1998	1 AO	-4.640**	2009		2 IO	-6.031**	1988	2006
Badajoz	-4.973**	1996	1 AO	-3.710**	2005		1 IO	-4.138	2007	
Balears, Illes	-4.916**	1997	1 AO	-3.450	2009		1 IO	-4.281**	2006	
Barcelona	-3.549	2008	2 AO	-4.499	1990	2009	2 IO	-4.715	1988	2006
Burgos	-5.027**	2009	1 AO	-2.499	2008		1 IO	0.725	2007	
Cáceres	-5.812***	1999	1 AO	-3.601**	2009		0 IO			
Cádiz	-5.078**	2008	1 AO	-3.524	2009		1 IO	-4.176	2006	
Cantabria	-4.422	1997	1 AO	-3.726**	2009		1 IO	1.821	2006	
Castellón/Castelló	-4.802**	2007	1 AO	-4.356**	2008		1 IO	-4.280**	2007	
Ciudad Real	-4.76*	1997	1 AO	-3.885**	2009		1 IO	-3.704	2006	
Córdoba	-5.762***	1998	1 AO	-17.427**	2009		1 IO	-4.953**	2006	
Coruña, A	-4.611*	2008	1 AO	-4.834**	2009		0 IO			
Cuenca	-5.295**	2008	1 AO	-4.933**	2009		1 IO	-5.493**	2006	
Gerona/ Girona	-4.58*	2008	1 AO	-5.482**	2008		1 IO	-5.285**	2006	
Granada	-3.858	1997	1 AO	-3.525	2004		1 IO	-3.434	2005	
Guadalajara	-4.59*	1990	1 AO	-3.742**	2009		2 IO	-5.061	1988	2006
Guipuzcoa/ Gipuzkoa	-4.787*	2008	1 AO	-3.714**	2009		1 IO	-4.503**	2006	
Huelva	-4.776*	2008	1 AO	-4.926**	2007		1 IO	-3.575	2007	
Huesca	-6.185***	2009	1 AO	-5.604**	2009		2 IO	-6.740**	1997	2007
Jaén	-6.498***	1997	1 AO	-6.739**	2008		1 IO	-6.323**	2008	
León	-3.456	2008	1 AO	-7.473**	2008		1 IO	-6.515**	2008	
Lérida/ Lleida	-4.969**	2009	1 AO	-5.428**	2008		1 IO	-4.998**	2008	
Lugo	-6.148***	2000	1 AO	-4.714**	2009		2 IO	-5.493**	1998	2007
Madrid	-4.14	2008	2 AO	-2.384	1991	2007	1 IO	-3.879	2006	
Málaga	-4.757*	2008	1 AO	-4.095**	2009		2 IO	-5.103	1995	2007
Murcia	-4.155	1997	2 AO	-4.476	1996	2007	1 IO	-3.540	2006	
Navarra	-3.002	2009	2 AO	-5.126	1987	2009	1 IO	-4.217	2007	
Ourense	-6.386***	1999	2 AO	-5.365	1998	2006	1 IO	-5.337**	2007	
Palencia	-5.82***	1998	1 AO	-2.518	2009		1 IO	-2.283	2006	
Palmas, Las	-3.765	1997	1 AO	-3.449	2005		1 IO	-4.060	2006	
Pontevedra	-4.197	2008	1 AO	-3.727**	2009		1 IO	-5.069**	2006	
Rioja, La	-5.829***	2008	1 AO	-5.059**	2009		1 IO	-0.708	2006	
Salamanca	-6.022***	2000	1 AO	-3.208	2007		2 IO	-5.485**	1989	2008
Sta. Cruz de Tenerife	-6***	2008	1 AO	-5.491**	2005		1 IO	-6.101**	2006	
Segovia	-6.018***	1997	1 AO	-4.986**	2005		1 IO	-5.738**	2006	
Sevilla	-4.099	1997	2 AO	-4.540	1991	2007	1 IO	-8.121**	2006	
Soria	-6.792***	2009	1 AO	-3.282	2009		2 IO	-7.344**	1988	2007
Tarragona	-2.101	1996	1 AO	-5.370**	2009		1 IO	-5.233	2007	
Teruel	-5.289***	2009	1 AO	-1.391	1989		1 IO	-5.254**	2007	
Toledo	-4.328	2008	1 AO	-4.204**	2009		1 IO	-4.397**	2006	
Valencia/València	-5.222**	1997	1 AO	-3.834**	2009		2 IO	-5.071	1995	2007
Valladolid	-5.106**	2008	2 AO	-4.601**	2005	2009	1 IO	-3.898	2006	
Vizcaya/ Bizcaia	-4.226	1997	1 AO	-3.975**	2008		2 IO	-4.613	1995	2007
Zamora	-7.625***	1999	1 AO	-5.155**	2009		1 IO	-5.294**	2006	
Zaragoza	-3.828	2008	2 AO	-4.607	1991	2009	1 IO	-5.291**	2006	
Spain	-3.890	2008	1 AO	-3.029	2009		1 IO	-18.462**	2006	

NT: No trend; T: Trend; NC: No Intercept; C: Intercept; 0L: 0 lags included; 1L: 1 lag included; 2L: 2 lags included.
Zivot - Andrews Test: *** p<0.01, ** p<0.05, * p<0.1 Clemente -Montañés-Reyes Test: ** p<0.05

Table A2.3.2.4. Panel unit root tests over first differenced variables

Test	Unemployment Rate		GDP NL	
	Model	First Diff.	Model	First Diff.
Hadri LM	c, 1lag	-0.8074	c, 0 lag	-1.0089
Levin Lin Chu	c, 1lag	-14.32***	c, 0 lag	-32.5249***
Im Pesaran Shin	c, 1lag	-17.7655***	c, 0 lag	-33.2857***
Fisher Type (conducted as a ADF)	c, 1lag	-19.5317***	c, 0 lag	-33.6617***

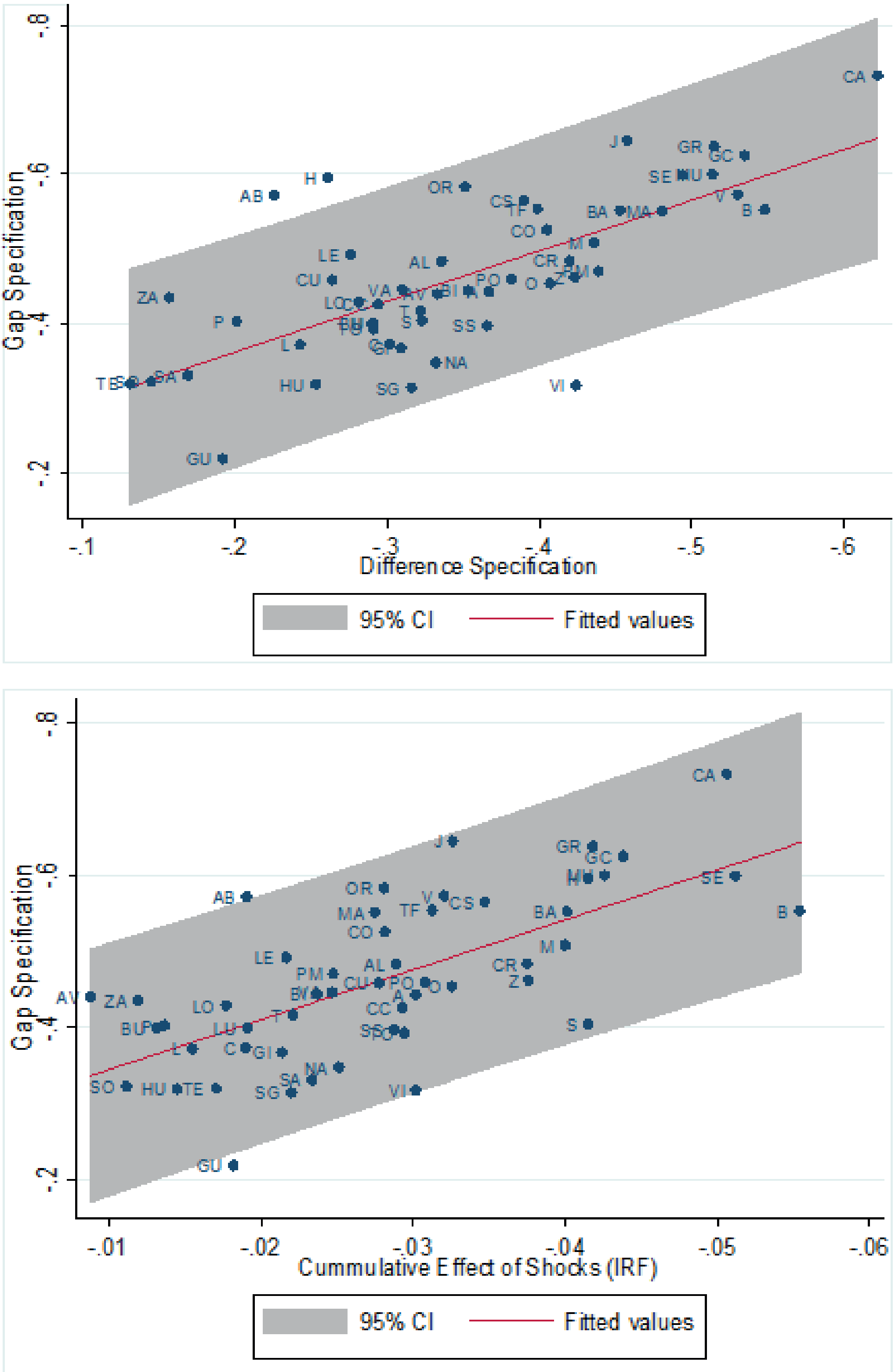
C: intercept included; 1lag: 1 lag included.
*** p<0.01, ** p<0.05, * p<0.1

A2.4. Gap specification

As can be observed in Figure A2.4.1 Okun's law gap version provides us a similar ordering of provinces[20] to the version in first differences and the VAR model estimated with the first differenced data. When we compare gap and first differences specifications, we can only observe sizable differences for the Álava (VI), Albacete (AB) and Huelva (H) provinces. Gap version estimates for Albacete and Huelva a higher coefficient. The opposite occurs for Álava. With respect to the differences between the gap specification results and the results of the IRF obtained using a VAR model, we can observe only notable differences for the Albacete (AB) and Guadalajara (GU). For the first province, the coefficient estimated by Okun's law gap version points out to a higher unemployment response than the results of IRFs whereas the opposite is obtained for Guadalajara.

[20] The Spanish provinces are labelled as follows: Álava (VI), Albacete (ALB), Alicante (A), Almería (AL), Asturias (O), Ávila (AV), Badajoz (BA), Barcelona (B), Burgos (BU), Cáceres (CAC), Cádiz (CA), Castellón (CS), Ciudad Real (CR), Córdoba (CO), Cuenca (CU), Gerona (GI), Granada (GR), Guadalajara (GU), Guipúzcoa (SS), Huelva (H), Huesca (HU), Islas Baleares (PM), Jaén (J), La Coruña (C), La Rioja (LO), Las Palmas (GC), León (LE), Lérida (L), Lugo (LU), Madrid (M), Málaga (MA), Murcia (MU), Navarra (NA), Orense (OR), Palencia (P), Pontevedra (PO), Salamanca (SA), Santa Cruz (TF), Santander (S), Segovia (SG), Sevilla (SE), Soria (SO), Tarragona (T),. Teruel (TE), Toledo (TO), Valencia (V), Valladolid (VA), Vizcaya (BI), Zamora (ZA), Zaragoza (Z).

Figure A2.4.1. Comparing the estimation results to gap specification results

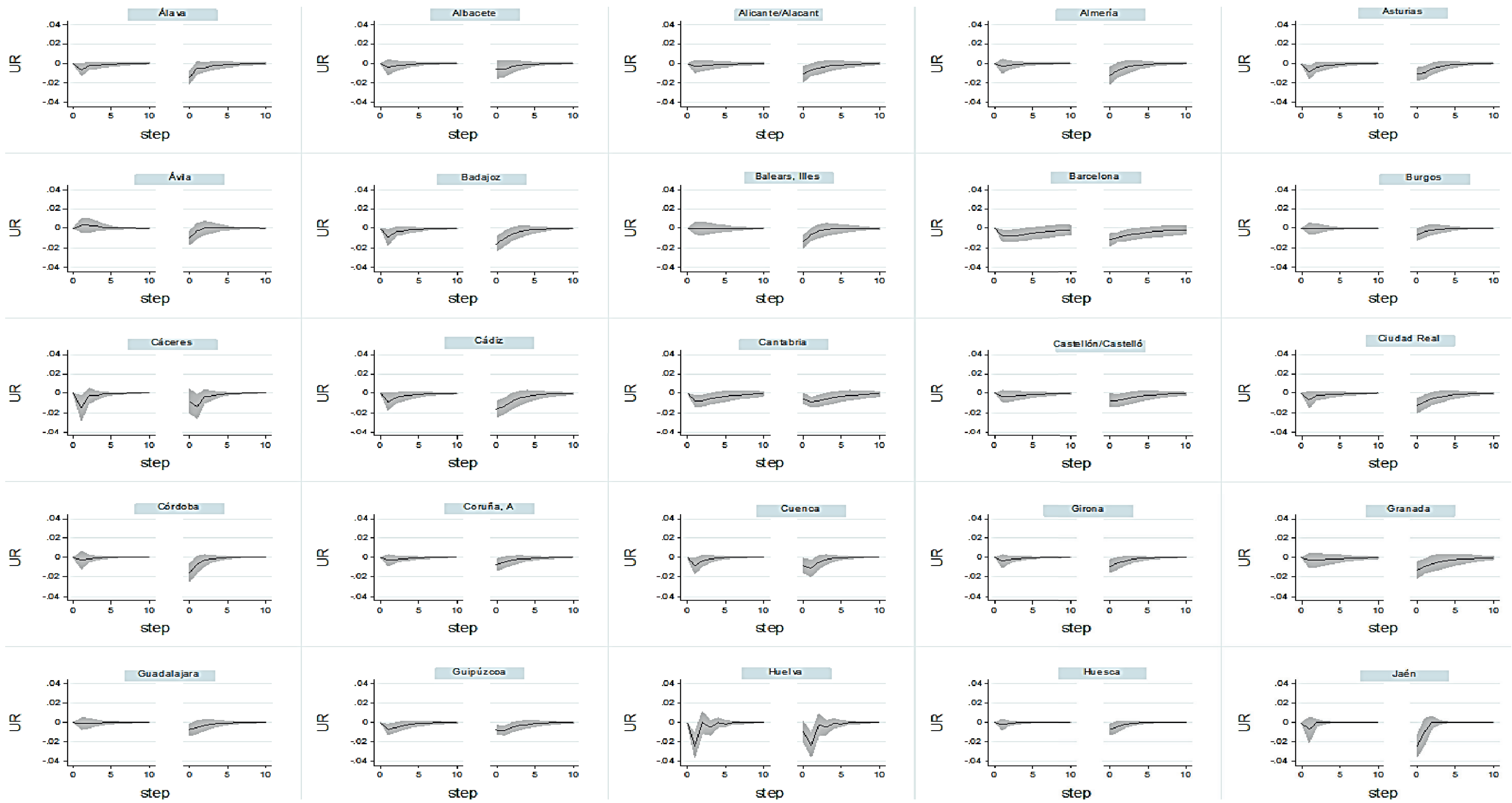


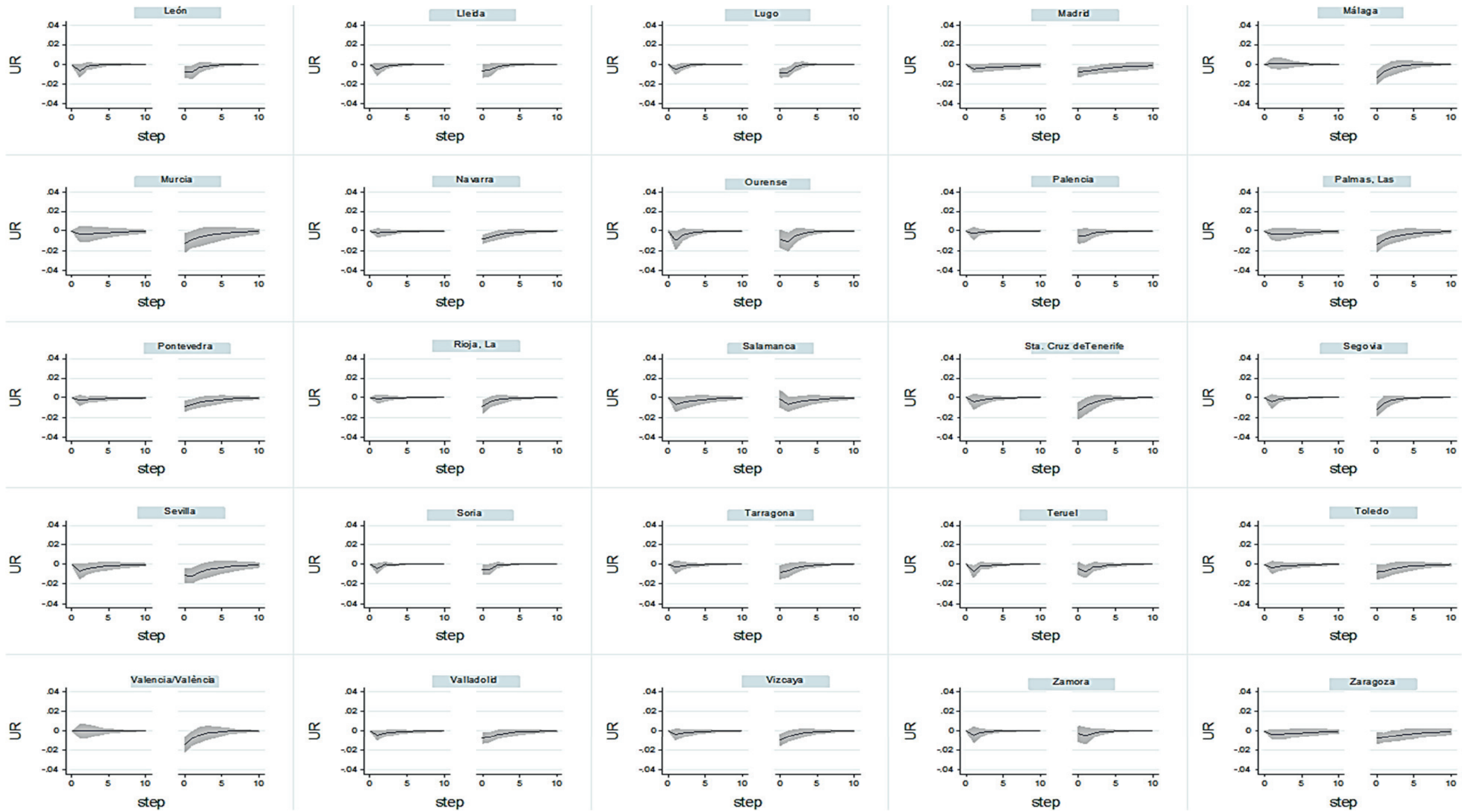
A2.5. Orthogonalising the variables in two directions.

We aim to know if the results obtained in Figure 2.3 differ from those obtained when we consider that economic growth shocks affect unemployment rate variation with a lag. We compare these results[21] in Figure A2.5.1 The orthogonalisation of variables in the opposite direction than previously assumed implies that shocks similarly affect unemployment rate variation for most provinces, but after one period. There are clear exceptions such as: Illes Balears, Málaga, Murcia and Valencia. They are unaffected by the GDP shocks when the order of the variables is changed. In these provinces, GDP shocks do not cause unemployment variations. Thus, we do not observe for these provinces a causality relationship in this way in the sense of Granger.

[21] In Figure A2.5, for each province we show two graphs. The second graph is the graph that was represented in Figure 2.3. Meanwhile, the first graph represents the Impulse Response Functions when variables are orthogonalised in the opposite direction. Thus, the first graph represent the effect that an economic growth shock has on unemployment rate variation after one period as it is indicated in the following equation: $\Delta u_t = c + \alpha(L)\,\Delta u_t + \beta(L)\,\Delta y_t + v_t^u$; $\Delta y_t = c + \lambda\Delta u_t + \gamma(L)\,\Delta y_t + \eta(L)\,\Delta u_t + v_t^u$

Figure A2.5.1. Orthogonalising the variables in two directions. Effects on unemployment rate to GDP growth shocks




León
Lleida
Lugo
Madrid
Málaga
Murcia
Navarra
Ourense
Palencia
Palmas, Las
Pontevedra
Rioja, La
Salamanca
Sta. Cruz deTenerife
Segovia
Sevilla
Soria
Tarragona
Teruel
Toledo
Valencia/València
Valladolid
Vizcaya
Zamora
Zaragoza
UR
step

Chapter 3:

Minimum wages and youth employment: a spatial analysis+

3.1. Introduction

The social and economic impact of the Great Recession has been particularly strong in Spain. Job creation has stagnated since the beginning of the global financial crisis and young people, particularly those entering the labour market for the first time, find much more difficulties to find stable jobs. Despite the gap in experience of youth workers explains part of the differences in their labour market outcomes with respect to those for adults, labour market institutions, such as the minimum wage, can also play an important role.

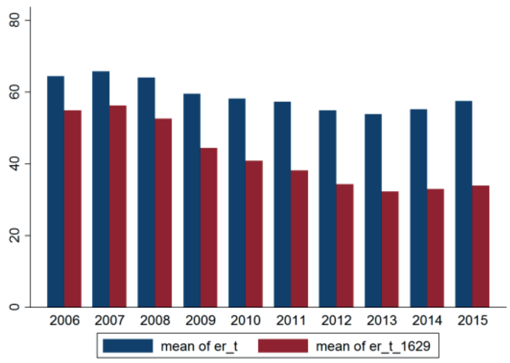
Due to the internal wage devaluation promoted by the Spanish government between 2010 and 2016, the relative value of minimum wages has substantially increased. In particular, the Kaitz Index, the ratio of the minimum wage to average wages (Kaitz, 1970), has risen during the recession (see figure 3.1). As in Spain the minimum wage is not differentiated across groups of workers, this upward trend can have had negative effects on the possibilities of youth workers to find jobs. In fact, although minimum wages are usually proposed as a way of raising workers' income, there is a substantial body of research that shows negative effects of minimum wages

+ The work in this chapter has been carried out jointly with Jordi López-Tamayo and Raúl Ramos from the University of Barcelona. Previous versions of the work were presented in the Spanish meeting of Labour Economics (Valladolid Spain; 2017), 57th ERSA Congress, XII (Groningen, The Netherlands; 2017) and XLIII Spanish meeting of Regional Science (Sevilla, Spain; 2017).

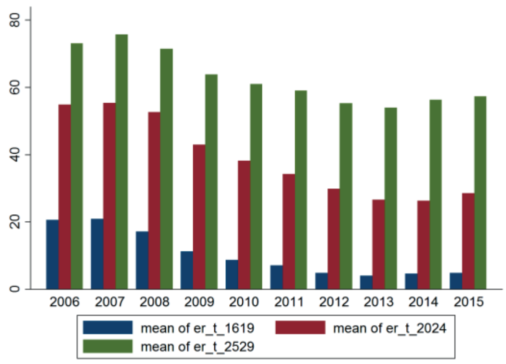
on employment (Kalenkoski, 2016). According to standard neoclassical theory, when the minimum wage is raised, labour demand reduces while at the same time, labour supply increases. The result is a reduction in the number of available jobs and an increase in unemployment.

Figure 3.1. Evolution of the Employment Rate and the Kaitz Index

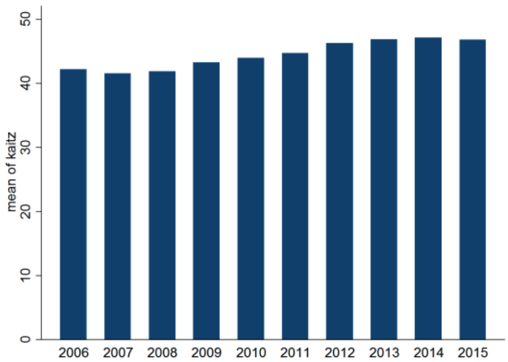
3.1a. Total and Youth Employment Rate



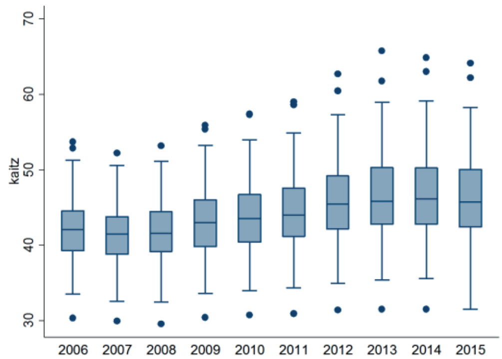
3.1b. Youth Employment. Groups



3.1c. Kaitz Index



3.1d. Kaitz Index. Regional



Our work contributes to this literature. Although in Spain there is no territorial differentiation of the minimum wage in nominal terms, the existence of different regional price levels and inflation rates (Costa et al., 2015) makes the real magnitude territorially heterogeneous. As shown in Figure 3.1, the Kaitz index exhibits significant variations at the provincial level (between 30 and almost 70%). Therefore, in our work, we evaluate the impact of this differential on total employment and youth employment in the recent period of recession, in which the minimum wage has grown significantly in relative terms (the Kaitz index varied from 41 to 47%) due to fact that the nominal wage has remained nearly constant but the average wage has decreased in more than 7 p.p.

There are only a few studies that try to estimate how minimum wage affects youth employment using panel data and exploiting the time and the territorial variation in labour market outcomes and minimum wages. In fact, previous literature has mainly focused on cross-country analyses. For instance, Neumark and Wascher (2004) considered the potential impact on youth employment of minimum wage variation between 17 OECD countries from 1975 to 2000 finding negative employment effects. Dolton and Rosazza-Bondibene (2012) performed a similar analysis considering a panel of 33 OECD countries from 1976 to 2008 and they found negative employment effects, particularly during recessionary periods, a result also confirmed by Laporsek (2013) when looking at 18 EU member states between 1996 and 2011. These works have also highlighted the relevant role of institutions to explain part of this effect. Taking this into account, looking at regional differences within a single country, with a common regulatory framework and institutions, will provide a more accurate picture of the effects of minimum wages on youth labour market outcomes.

The work also contributes to the literature by considering spatial effects in the relationship between minimum wage and employment in a country with relatively low mobility of workers, in spite of the recent crisis has clearly stimulated the geographical mobility of youth workers (Ramos and Royuela, 2017). In fact, to the best of our knowledge, the only studies that account for the fact that minimum wages and youth employment could be correlated across political boundaries are Kalenkoski and Lacombe (2008, 2013). These authors argue that "this correlation may exist whether a change in the effective minimum wage in a state (i.e., the maximum of the state and federal minimum wages) affects employment not only in its own state but also in other neighbouring states". In case the minimum wage is increased in one state, workers in a neighbouring state without an increase may decide to cross the border to benefit from this increase. If this happens, the overall effect of the minimum wage increase should also consider the reduction in employment in the neighbouring state in addition to the potential reduction in the state that increased its minimum wage. This indirect effect can be captured by applying spatial econometric techniques. The results by

Kalenkoski and Lacombe (2008, 2013) for the US states applying these techniques allows them to conclude that ignoring spatial correlation biases the estimates of the effect of minimum wages on youth employment (both in cross-sectional or panel data settings).

The rest of the paper is organised as follows. First, in Section 3.2 we briefly review previous literature. Then, we present the data and the methodology used in Section 3.3. Later on, in Section 3.4, we present and discuss the obtained results and, finally, we conclude in Section 3.5.

3.2. Literature review

There is a substantial body of empirical evidence on the effects of the minimum wage on youth employment, although there is no clear agreement on the causal mechanisms that can drive different results.

Schmitt (2013) summarizes the three fundamental approaches to explain the causal relation between the two considered variables. The first approach is the competitive model that establishes that increases in the minimum wage reduce the level of employment (or hours worked). However, in the work it is recognized that the effect of this adjustment generated by the minimum wage can also be carried out through other channels such as: increases in the prices of products or reduction of social benefits that can reduce the negative effects on employment. Second, the institutional model establishes that the increase of the minimum wage can give rise to the managers' greater concern to improve the productivity of the company, which through different managerial practices could counteract this wage effect. In addition, the increase in the wage of those workers with lower purchasing power can favour consumption and demand for companies. The institutional model justifies the positive or zero results in employment after an increase in the minimum wage. Lastly, the dynamic monopsony model states that frictions in the labour market, such as those related to hiring new workers and the difficulties associated to find a job, especially for some groups, suppose that the labour market operates with vacant positions. An increase in the minimum wage could increase supply and may lead to positive effects on employment at macroeconomic level as it improves the quality of matching and reduces unfilled vacancies.

Although most empirical evidence is consistent with competitive labour market theory, meta-analyses do not show the existence of a clear negative response of employment to variations in the minimum wage[1]. In fact, there are studies that show no employment effects of minimum wages or even small positive effect. Findings of no effect would be consistent with very low minimum wages, and so ineffective while studies showing positive effects would be in line with the monopsonistic view. A first wave of meta-analysis studies are Card (1992), Neumark and Wascher (1992) and Card and Krueger (1994). Card and Krueger (1995) were the first authors that resort to a meta-analysis to study the employment effect of the minimum wage. In this paper authors obtain information from 30 studies carried out mostly in the 1980s. When published and unpublished papers are included in the analysis, the authors find that there is no evidence that the minimum wage affects the level of employment. Likewise, the work of Doucouliagos and Stanley (2009) considers the information of 64 studies carried out between 1972 and 2007. These authors analyse the effect of the minimum wage on youth employment in the United States. The study specifically considers the accuracy of the estimates and it is obtained that those more precise resulted in a null or almost null effect of the variations in the minimum wage. O'Higgins and Moscariello (2017) also analyse the effect of minimum wage on youth unemployment. They include in the regression other labour market institutions as in Boockmann (2010) and consider 328 estimates from 15 countries from 1990 to 2015. They confirm the results obtained by previous studies that find a very small or not significant effect of minimum wage on unemployment but they make a contribution by finding that in countries with a strong employment protection legislation (EPL), minimum wage is less likely to affect employment. Besides, Belman and Wolfson (2014) carried out the study with the results of papers published since 2000. The authors controlled according to the type of worker and showed that there was no statistically significant negative relation. Finally, Leonard et al. (2014)

[1] This type of studies clusters by using well-defined statistical techniques the results of the different analyses. Therefore, they are considered studies of studies that provide a clearer vision of the statistical relation between the minimum wage and the variables of the labour market.

carried out a meta-analysis with studies conducted for the UK and obtained similar results to those of previous works.

But, apart from the meta-analyses, the studies performed have been based on different methodologies. Firstly, we find studies based on time series at national level (Neumark and Wascher, 2004; Dolton and Rosazza - Bondibene, 2012; Arpaia et al., 2017). Neumark and Wascher (2004) support this type of analyses and establish that the greatest contribution made in the field has been carried out by this kind of studies, which they consider pretty reliable. On the opposite, from the pioneering work of Card and Krueger (1994), numerous studies have been based on natural experiments. These works analyse the effect of a concrete policy carried out on the minimum wage and that compares affected workers with workers who have not been subject to the policy measure (either because they are in another age range or belong to another state). Among these studies, we find Dube et al. (2010), Allegretto et al. (2011) and Hirsch et al. (2015).

The analysis of the effect of the minimum wage on youth employment is interesting since, in the developed economies, they are generally those with lower wages and higher levels of unemployment. Authors such as Neumark and Wascher (2004) or Dolton and Rosazza-Bondibene (2012), among others, have found a negative relation between employment and minimum wages for young people between 15 and 24 years. In particular, Neumark and Wascher (2004) carry out the analysis for 17 OECD countries between 1975 and 2000. They consider specifically country-individualized time trends and take into account the potential endogeneity by considering a dynamic model. The authors obtain that the elasticity of employment to minimum wage ratio is -0.13 for youth aged between 15 and 24 years old and -0.18, when the 15 to 19 population aged group was considered. Dolton and Rosazza-Bondibene (2012), in their analysis for 33 OECD countries for the 1971-2009 period, obtain a minimum wage coefficient of -0.2 for youths between 15 and 24 years old. Rybczynski and Sen (2018) apply the analysis for the Canadian provinces and obtain that 10% increase in minimum wage is associated to a 1-4% of decrease of employment for youth aged 18-19 years old. Arpaia et al. (2017), who consider in their analysis the UE members, obtain a negative elasticity for those between 20 and 24 years that range between -0.13 and -0.2, while Christl et al. (2017), who analyse this relationship taking information from 14 European countries, obtain a non-linear effect of the minimum wage in youth employment. This relationship is, from a certain level of minimum wage, negative. Therefore, results obtained by authors for youth population are quite clear. Youth employment rate is generally negatively affected by minimum wages.

3.2.1. The Spanish case

In Spain, there is a bulk of literature that has focused on the relationship between minimum wages and aggregate employment. Pérez-Domínguez et al. (1995) Dolado et al. (1997), Dolado and Felgueroso (1997), González-Güemes (1997), Pérez-Domínguez et al. (2002) and González-Güemes et al. (2003) are some of most relevant studies. These works do not obtain a significant impact of the minimum wage on total employment, however, a significant but slightly negative influence was found by many authors when youth unemployment was taken into account. The disaggregation of youth population by sex and age led the authors to obtain that youth between 16 and 19 years old was the collective most affected whereas for youth between 20 and 24 years old, it was generally not found a significant relationship (Dolado et al.,1997; and González-Güemes, 1997), probably due to the great heterogeneity in terms of individual qualification and experience.

Most of these aggregate analyses have based their findings in an extended equation relating employment and a minimum wage indicator that also included other exogenous variables as controls. Others rely on a system of inter-related equations in which it is not only observed the effect of minimum wage on employment, but also the minimum wage effect on other labour market variables such as participation (Pérez-Domínguez et al., 2002). More recent works such as Cebrián et al. (2010), Blázquez-Cuesta et al. (2011), and Galán, and Puente (2015) introduce some innovations with respect to previous literature both methodologically and in the datasets used. In particular, Galan and Puente (2015) resort to micro-data to carry out a diff-in-diff specification to determine the impact of minimum wage increases between 2004 and 2010 in the probability of losing the job. After focusing on workers that may be potentially affected by increases in minimum wages, they obtained a higher effect for older workers. Cebrián et al. (2010), who focus on the 2000-2008 period, resort to the *Encuesta de Coyuntura Laboral* (ECL) micro-dataset and to the EPA data. The significant coefficient of -0.73 obtained from their micro-analysis that negatively relates minimum wage and employment in private companies strongly contrast with the null effect obtained from the macro-analysis. Finally, Blázquez-Cuesta et al. (2011), who also cover the 2000-2008 period in a dynamic analysis that specifically consider the regional specifities, obtains no evidence of a negative effect of minimum wage on total and youth employment.

3.3. Methodology and data

3.3.1. Empirical Strategy

In order to assess whether the minimum wage has any impact on the employment rate for the period 2006-2015, we specify the following model:

$$\ln(ER_{it}) = \alpha + \tau \ln(ER_{it-1}) + \rho W \ln(ER_{it}) + \delta_1 Kaitz_{it} + \beta X_{it} + \gamma_1 W Kaitz_{it} + \theta W X_{it} + \mu_i + trend_t + u_{it} \quad (3.1)$$

Where:

- $\ln(ER_{it})$ is the natural logarithm of the employment rate in period t corresponding to the region i differentiated by age [$\ln(ER)$, $\ln(ER\_1629)$, $\ln(ER\_1619)$, $\ln(ER\_2024)$, $\ln(ER\_2529)$]
- $Kaitz_{it}$ is Kaitz index, which is the relation between the minimum wage and the average nominal wage in each region
- X_{it} is a set of additional controls related to the evolution of employment rates.
- W represents the matrix of spatial weights based on spatial contiguity between provinces. Similar results have been obtained by using the inverse of the distance and the inverse of the squared distance. In particular, the haversine distance has been used, which is the one recommended when the spatial units are located on the surface of the earth and the variables represent these spatial locations (Drukker et al., 2013).[2]

[2] The values of the Moran's I statistics for each year of the considered period do not reject the existence of autocorrelation in the considered relationship. Detailed results are available from the authors on request.

- μ_i captures regional fixed effects.
- $trend_t$ is a homogenous trend for all regions that captures the temporary shocks common to all these regions.
- u_{it} is the random error term that is normally distributed.

Equation (3.1) also introduces the employment rate lagged one period[3] in order to capture the existence of hysteresis in the dynamics of employment (see, for instance, Mota et al., 2012).

This relationship has been estimated for the employment rate, for the youth employment rate (between 16 and 29 years old), and distinguishing by age groups (16-19, 20-24, and 25-29). Different variables that are likely to affect employment rates have been considered as additional controls. In particular, these controls are the growth rate of the regional gross domestic product (GDP) lagged one period, the Theil index of sectoral specialisation[4], the population density, the part-time employment rate, the temporary employment rate and a human capital indicator[5]. A common time trend has also been introduced in order to capture the common shocks that all provinces have suffered during the considered period. Last, regional fixed effects are also introduced to take into account regional specificities not captured by the rest of variables.

3.3.2. Data

The analysis of the influence of minimum wages on employment rate taking into account the spatial dynamics requires information disaggregated at provincial level (NUTS 3). Province is the most disaggregated territorial unit that can be found in labour statistics in Spain considering the information restrictions. It is for this reason that this territorial unit is generally considered the one closest to the concept of local labour markets. In our analysis, we take into account 46 of the 50 Spanish provinces[6].

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[3] Employment rate lagged one period has been introduced in the equation to avoid endogeneity problems.

[4] The industry classification has considered agriculture, industry, construction, public and private sectors separately.

[5] In particular, we have calculated the average number of years of schooling by province following the methodology by IVIE using microdata from the Spanish Labour Force Survey.

[6] Ceuta and Melilla provinces have been removed from sample given the small sample size of the Labour Force Survey and, therefore, the low statistical representativeness of the

We have exploited several sources of information to carry out the analysis[7]. The employment data has been drawn from the Labour Force Survey (*Encuesta de Población Activa*, EPA). We resort to the microdata of this survey because we need the information disaggregated at provincial level and for heterogeneous groups in terms of age and gender. We also use the EPA microdata to obtain information about the level of temporality and also part-time employment, which are control variables in our analysis. EPA also reports information on the industry composition of employment to construct the Theil Index and also the data to obtain the regional human capital indicator, which is calculated taking into account the *Instituto Valenciano de Investigaciones Económicas* (IVIE) methodology. With regards to the information on wages, the Spanish Agency of Tax Administration (*Agencia Española de Administración Tributaria*, AEAT) provides the annual wage of the average employee. Provincial GDP is obtained from the Spanish Regional Accounts (*Contabilidad Regional de España*, CRE). The data of total population and population by age groups is obtained from the Municipal Register, meanwhile data on provincial surface, which will be used to obtain the population density, is obtained from the Statistical Yearbook of the National Institute of Statistics (*Instituto Nacional de Estadística*, INE).

3.4. Empirical results

Figure 3.2 relates Kaitz index and employment rate for the different groups of workers considered in our analysis. As expected, it is shown a clear negative relationship in all cases, although at this stage we cannot conclude anything, as there are other factors that can also affect the employment rate.

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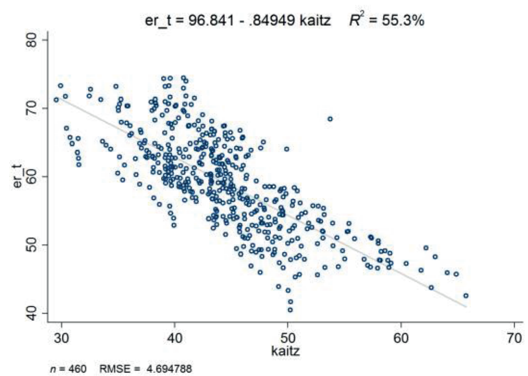
calculated indicators for these provinces. Besides, Navarra, Álava, Guipúzcoa and Vizcaya provinces are also removed since they are not included in the statistics of the Tax Agency used to approximate average wage levels at the regional level.

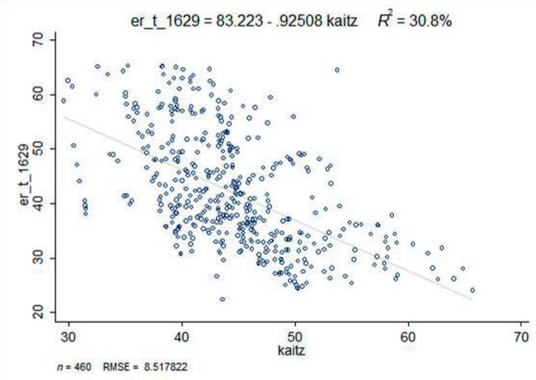
[7] Table A3.1 in Annex 3 shows the description of the datasets used and also the sources of information while Table A3.2 shows basic descriptive statistics.

Figure 3.2. Relationship between the Employment Rate and the Kaitz Index

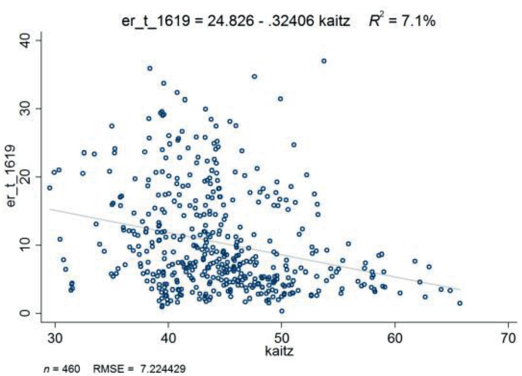
3.2a. Total Population



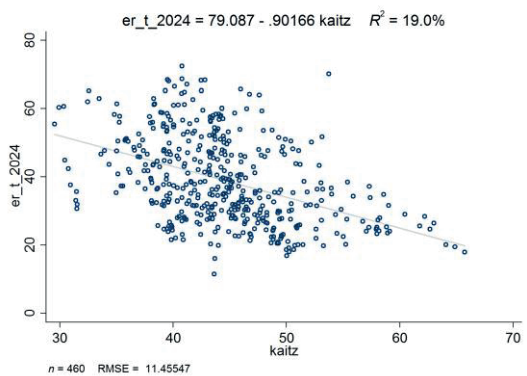
3.2b. Youth 16-29



3.2c. Youth 16-19



3.2d. Youth 20-24



3.2e. Youth 25-29

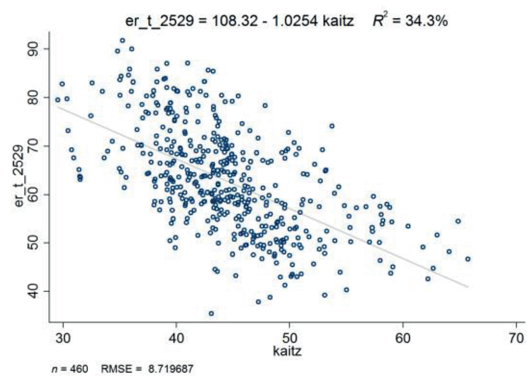


Table 3.1 shows the results of estimating equation (3.1) for the employment rate under different assumptions. First, column 1 shows the results of estimating a model assuming a linear relationship between the Kaitz Index and the employment rate without controls and without spatial effects. This implies restricting the model of Equation (3.1) in the following sense:

$$\tau = \rho = \delta_2 = \Upsilon_1 = \Upsilon_2 = \theta = 0 \tag{3.2}$$

In column 2, control variables are added while spatial effects are considered in columns 3 and 4. First, we consider a Spatial Autorregresive Model (SAR) with the endogenous variable spatially lagged but with non-spatial effects in the Kaitz index and the controls. This implies that the spatial effect is restricted to the endogenous variable only allowing employment in the rest of the territory to affect regional employment. Therefore, the restriction applied to equation (3.1) is:

$$\Upsilon_1 = \Upsilon_2 = \theta = 0 \tag{3.3}$$

Next, besides the spatial influence of employment rate of the other regions, a spatial effect of the Kaitz index and the additional controls (i.e., a Spatial Durbin Model – SDM) is also considered in the results shown in column 4. Columns 5 to 8 in table 3.1 present the results obtained following the same specification strategy but for the youth employment rate instead of the total one. In all specifications, the coefficient associated to the lagged value of the employment rate is positive and statistically significant at the usual levels with values between 0.20 and 0.47. These values are below the ones observed in the literature, probably due to the fact that we are considering a period with very intense cyclical fluctuations (double-dip recession). The coefficient associated to the Kaitz index is negative in nearly all models, although it is not always statistically significant at the usual levels. In those models for the total employment rate where the effect is statistically significant, the value of the elasticity is very modest (-0.008). The effect is higher for youth than for total employment with an elasticity of

-0.014 in the model when additional controls are considered. This result is in line with the recent literature for the Spanish case pointing to a modest effect of the minimum wage on labour market outcomes. In fact, even after the internal devaluation that has taken place in Spain and the increase in the Kaitz index, minimum wages in Spain seem to be at a level that is not damaging employment creation

Table 3.1. Minimum wage effect on the employment rate and youth employment rate

	Dep. Variable: Employment Rate							
	Total Population				Total Youth (16-29)			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	DPM	DPM	SAR (L1W1)	SDM (L1W1)	DPM	DPM	SAR(L1W1)	SDM (L1W1)
L.ER (nl)	0.207*	0.227***	0.399***	0.469***	0.217*	0.382***	0.389***	0.454***
	(0.087)	(0.042)	(0.049)	(0.051)	(0.092)	(0.043)	(0.040)	(0.041)
Kaitz I.	-0.006	-0.008***	-0.003*	-0,002	-0.018*	-0.014**	-0,004	0,000
	(0.004	(0.002	(0.001	(0.002	(0.008	(0.004	(0.003	(0.004
trend	0.003*	0.006***	0.004***	0.003**	0.005	0.009***	0.008***	0.005**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)
Wx								
Kaitz I.				0.002				0.004
				(0.004)				(0.008)
Spatial r			0.333***	0.194***			0.152***	0.016
			(0.057)	(0.051)			(0.034)	(0.056)
s^2_e			0.001***	0.001***			0.004***	0.004***
			(0.000)	(0.000)			(0.000)	(0.000)
Controls	no	yes	yes	yes	no	yes	yes	yes
N	414	414	414	414	414	414	414	414
n	46	46	46	46	46	46	46	46
Wx=0				33.70***				186.64***
q - br = 0				40.54***				60.10***
controls=0		468.05***		13.39**		353.99***		14..67**
AIC			-1836.385	-1846.518			-1091.224	-1097.715
BIC			-1663.273	-1645.225			-918.112	-896.421
Spillovers								
SR_Direct			-0.003**	-0.002			-0.004	0.000
SR_Indirect			-0.002*	0.002			-0.001	0.004
SR_Total			-0.005**	0.000			-0.004	0.004
LR_Direct			-0.006**	-0.004			-0.006	-0.001
LR_Indirect			-0.007	0.005			-0.002	0.008
LR_Total			-0.013*	0.001			-0.008	0.007

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

Notes: (i) DPM: Dynamic Panel Model (constant omitted), SAR: Spatial Autorregresive Model and SDM: Spatial Durbin Model. (L1W1): 1-Lag in endogenous variable and a spatial lag.
(ii) All models include regional fixed effects.
(iii) Controls included: GDP growth rate (t-1), sectoral employment Theil index, population density, partial ER, temporary ER and human capital.

Regarding spatial spillovers, the coefficient associated to the spatial lag of the employment rate is significant and presents the expected sign. That is, an increase in the employment rate in the other provinces has a positive influence on the increase in the employment rate in the province of reference. It should be noted that the introduction of spatial lags of the controls reduces the effect of the minimum wage in the province of reference. After including spatial spillovers, only in the SAR model for the total employment rate, the effect is different from zero. However, according to the tests shown in table 3.1, the SDM, where no effect is observed, would be preferred to the SAR model.

Table 3.2 provides similar results but considering different age groups. In particular, the results are shown for workers between 16 and 19 years old, 20 and 24 years old and 25 to 29 years old. As we can see in the different columns of this table, the group that seems to be more affected by the increase in minimum wages is that formed by youth between 20 and 24 years old. In fact, this is the most common age group when workers face their school-to-work transition and it seems to be the one that has been more damaged by the relative increase of minimum wages during the recession.

Table 3.2. Minimum wage effect on youth employment rate by age groups

Variables	Dep. Variable: Employment Rate											
	Youth (16-19)				Youth (20-24)				Youth (25-29)			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	DPM	DPM	SAR(L1W1)	SDM(L1W1)	DPM	DPM	SAR(L1W1)	SDM(L1W1)	DPM	DPM	SAR(L1W1)	SDM(L1W1)
L.ER (nl)	0.08	0.224***	0.322***	0.311***	0.177	0.259***	0.305***	0.317***	0.097	0.241***	0.407***	0.449***
	(0.131)	(0.053)	(0.055)	(0.054)	(0.143)	(0.052)	(0.062)	(0.057)	(0.133)	(0.053)	(0.052)	(0.053)
Kaitz I.	-0.03	-0.059**	-0.025	-0.008	-0.033	-0.036***	-0.019**	-0.012	-0.018	-0.011*	0.000	0.005
	(0.036)	(0.02)	(0.017)	(0.026)	(0.017)	(0.008)	(0.007)	(0.009)	(0.01)	(0.005)	(0.004)	(0.006)
trend	0.022	0.032***	0.027**	0.020	0.011	0.012***	0.013***	0.008*	0.003	0.006***	0.007**	0.004
	(0.014)	(0.007)	(0.009)	(0.012)	(0.006)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)
Wx												
Kaitz I.				-0.022				-0.012				0.004
				(0.039)				(0.014)				(0.009)
Spatial r			0.071	0.018			0.044	0.128*			0.012	0.128**
			(0.047)	(0.061)			(0.043)	(0.050)			(0.037)	(0.048)
s^2_e			0.103***	0.098***			0.015***	0.014***			0.007***	0.006***
			(0.014)	(0.012)			(0.002)	(0.002)			(0.001)	(0.001)
Controls	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
N	414	414	414	414	414	414	414	414	414	414	414	414
P	46	46	46	46	46	46	46	46	46	46	46	46
Wx=0				9.22				38.79***				19.16***
q - br = 0				24.74***				26.24***				121.72***
Controls=0		8.97		15.31**		243.16***		29.96***		248.12***		79.10***
AIC			275.446	268.878			-528.785	-528.089			-857.138	-861.102
BIC			448.558	470.171			-355.673	-326.796			-684.026	-659.808
Spillovers												
SR_Direct			-0.026	-0.009			-0.019**	-0.012			-0.001	0.005
SR_Indirect			-0.002	-0.018			-0.001	-0.009			0.000	0.003
SR_Total			-0.028	-0.027			-0.020**	-0.021*			0.000	0.008
LR_Direct			-0.039	-0.013			-0.027**	-0.018			-0.001	0.009
LR_Indirect			-0.005	-0.026			-0.002	-0.011			0.000	0.004
LR_Total			-0.043	-0.039			-0.029**	-0.029*			-0.001	0.014

*** p<0.01. ** p<0.05. * p<0.1

Notes: (i) DPM: Dynamic Panel Model (constant omitted). SAR: Spatial Autorregresive Model and SDM: Spatial Durbin Model. (L1W1): 1-Lag in endogeous variable and a spatial lag

(ii) All models include regional fixed effects

(iii) Controls included: GDP growth rate (t-1), sectoral employment Theil index, population density, partial ER, temporary ER and human capital.

(iv) All controls have been used as instruments in dpm models and have been spatially lagged in sar and sdm models.

3.5. Final remarks

In this chapter, we have evaluated the effect of minimum wages on total and youth employment in Spain in the context of the recent economic downturn. The economic recession has had a sharp effect on unemployment rates but also on wages, especially for certain collectives such as youth. In this context, the extensive discussion on the role of minimum wages on labour market variables has been reopened. This analysis contributes to the debate by analysing the relationship between minimum wages, measured as the Kaitz index, and the employment rate in Spain by taking into account the effect of spatial spillovers, an aspect not considered in previous studies.

Our results show a negative relationship between the Kaitz index and the employment rate, but with a very modest effect except for youth between 20 and 24 years old. Our analysis also highlights the need to take into account spatial interactions between regional labour markets. From a policy perspective, the obtained evidence supports a differentiation of statutory minimum wages for youth workers in order to improve their situation in the labour market, although even after the internal devaluation that has taken place in Spain and the increase in the Kaitz index, minimum wages in Spain seem to be at a level that are not damaging employment creation. It is worth mentioning, however, that our analysis do not consider the potential impact of policy changes on participation decisions, an issue that deserves future analysis.

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A3. Appendix

Table A3.1. Variable definition and data sources

Variable	Description	Source
Minimum wage	Minimum remuneration amount that a worker receive for a working journey. The value is fixed every year by the government.	http://www.salariominimo.es
Average Wage	Average provincial minimum wage	Spanish Agency of Tax Administration
Employment Rate	Percentage of persons of working age who are employed.	Labour Force Survey. Spanish National Institute of Statistics.
Population	Registered Population	Registered Population. Spanish National Institute of Statistics
Territorial Surface	Provincial Territorial Surface in squared km	Statistical Year Book of Spain. Spanish National Institute of Statistics.
Real GDP	Nominal GDP deflated by provincial CPI (NUTS 3)	Spanish Regional Accounts. Spanish National Institute of Statistics.
Human capital	Average number of schooling years, by province	Own calculation using microdata from the LFS applying the methodology by IVIE
Distance	Haversine distance in Km	Haversine distance calculation between the provincial centroids. Module SPMAT. Stata.

Table A3.2. Descriptive statistics

	Employment Rate	Youth Employment Rate (16-29)	Youth Employment Rate (16-19)	Youth Employment Rate (20-24)	Youth Employment Rate (25-29)	Kaitz Index
			2006			
Mean	64.38	54.97	20.58	54.87	73.16	42.21
St. Dev.	5.55	5.74	6.78	7.09	7.03	5.09
CV	0.09	0.10	0.33	0.13	0.10	0.12
Min	53.46	45.67	9.01	43.32	59.26	30.33
Max	74.43	65.16	36.97	70.08	85.85	53.74
Range	20.97	19.49	27.96	26.76	26.59	23.41
p25	59.39	50.05	15.89	49.14	67.06	39.25
p50	63.84	54.68	20.10	54.65	71.91	42.07
p75	69.68	59.55	24.96	60.64	79.73	44.53
			2015			
Mean	57.54	33.98	4.87	28.54	57.34	46.82
St. Dev.	6.18	4.51	2.12	5.93	8.61	6.65
CV	0.11	0.13	0.44	0.21	0.15	0.14
Min	43.33	26.16	0.36	16.08	35.41	31.47
Max	67.46	44.03	9.71	40.87	80.48	64.11
Range	24.13	17.87	9.35	24.79	45.07	32.64
p25	52.86	31.01	3.24	24.66	51.25	42.45
p50	56.63	33.50	4.70	28.73	55.70	45.77
p75	62.94	37.14	6.42	31.50	63.00	50.01

Chapter 4:

What drives migration moves across urban areas in Spain? Evidence from the Great Recession‡

4.1. Introduction

Migration flows have traditionally occurred as a result of the pursuit of personal improvement. Achieving better personal and environmental conditions has motivated individuals to move from one place to another over short and long distances. For developed economies, literature has generally acknowledged the influence of economic and labour market differentials to explain migratory flows. In Spain, internal migratory flows respond to similar patterns as those observed for most countries of the European Union. During decades of economic prosperity, regional disparities in economies and employment opportunities have motivated migration flows. However, regional disparities in Spain were not the drivers of population flows in the 1980s and early 1990s, when several periods of economic instability took place. Inconclusive results were obtained: Bentolila and Blanchard (1990), Bentolila and Dolado (1991), Antolín and Bover (1997), Bentolila (1997),

‡ The work in this chapter has been carried out jointly with Vicente Royuela from the University of Barcelona. It was presented in the 56th ERSA Congress, XII (Vienna, Austria; 2016), Spanish meeting of Labour Economics (Valladolid Spain; 2017), XLII Spanish meeting of Regional Science (Santiago, Spain; 2016), 28th ERSA & ERES Summer School (Vienna, Austria; 2016) and invited seminars (University of Illinois at Urbana Champaign – USA; Universidad del Norte, Colombia; 2016 Universitat de Vic, Spain; 2017; and University College Cork, Ireland, 2018). The work in this chapter is currently being considered for potential publication in *Regional Studies* (second round of revision).

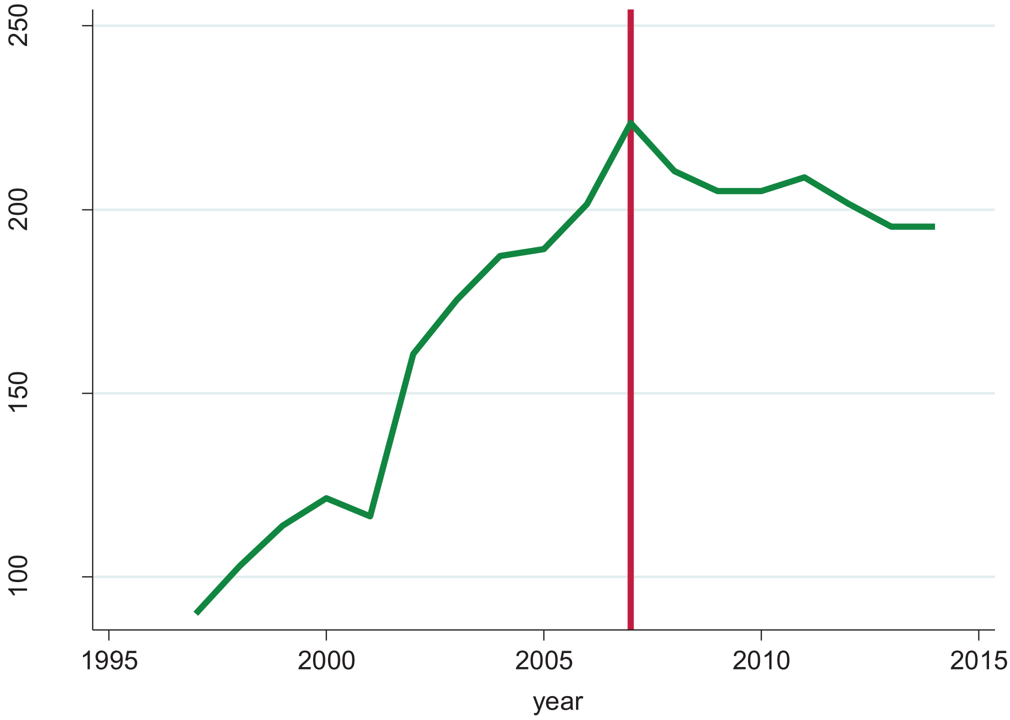
Ródenas (1994), and De La Fuente (1999) found small or insignificant responses to labour market variables (several times even with the wrong sign). De La Fuente (1999) acknowledges that a decline in migration occurred due to the reduction of interregional income disparities and the adverse effect of a generalized increase in unemployment combined with the growth of unemployment benefits. Economists debated the underlying causes of the unresponsiveness to traditional explanatory variables, with Mulhern and Watson (2010) labelling it an enigma.

The Great Recession had a severe impact in Spain. Economic activity shrank by 15.5 p.p. in just six years, unemployment rate increased by 18 p.p., and real wages declined by 7.2 p.p. In this context, international emigration skyrocketed, resulting in a net loss of population.[1] Although in 2013 it reached the highest volume of outflows registered for decades, it accounted for just 1.1% of the population. Internal movements have declined since the start of the crisis, as Figure 4.1 shows, despite the persistence of internal differences in economic and labour market terms (Cuadrado-Roura and Maroto, 2016). As in the past, the generalized recession in the country affected all cities and regions, constraining migration decisions.

This paper investigates the causes of migration flows in Spain during the Great Recession to determine if the Spanish migration enigma during crisis periods remains. We perform the analysis by considering an extended gravity model of migration. Our work is innovative in several ways: we investigate the factors driving migration flows in the 2008 to 2014 period in Spain, one of the countries more severely affected by the Great Recession; we consider economically consistent spatial units of analysis, 45 Spanish Functional Urban Areas, improving upon previous works that use provincial or regional data; we perform our estimates considering consistent estimation methods for count data; we take advantage of the panel dimension of our data set to control for multilateral resistance to migration by means of wide structures of fixed effects; and, we develop our analysis for different population groups, including nationals and foreigners, returned migrants and different age cohorts.

[1] Section A4.1 in Appendix A4 displays the evolution of international net migration and emigration for recent years.

Figure 4.1. Evolution of migration among Spain's Functional Urban Areas



Our results point to a high influence of wages on migration. Real wages are significantly associated with migration flows between urban areas, especially in the case of foreigners, for which wages are also a retention factor. Our results for this recessive period only show the influence of employment rate on nationals' moves. In addition, the age disaggregation allows us to know that wages affect migration of working age population in the expected way. However, no effect is observed with respect to employment opportunities.

The rest of the paper is organized as follows. Section 4.2 reviews the migration literature and the theories explaining these moves. Sections 4.3 and 4.4 describe the methodology and data, respectively. In Section 4.5 we present our main results, and Section 4.6 concludes.

4.2. Literature Review

4.2.1. A general overview of migration theories

Migration and its main motivations have been the focus of extensive discussions in the economics literature. Authors have frequently resorted to economic differentials to explain migratory flows: Ravenstein's pioneering works (1885, 1889) acknowledge the importance of economic disparities in understanding people movements; Hicks (1932) and Bartel (1979) point out that wage differentials motivate people to move to areas with higher salaries; Greenwood (1975, 1985) argues that migration is mainly due to the job seeking process; and Jackman and Savouri (1992) consider migration as a mechanism to improve job-matching between employers and workers. These analyses fall within the disequilibrium theories, which assume that economic differentials among territories tend to level off in the long run. Migration flows and other mobility factors foster the equilibrium among areas although, rigidities in the labour and housing markets may complicate the adjustment process and determine the speed at which the equilibrium is reached.

Nevertheless, this disequilibrium approach is called into question as a consequence of a number of studies reporting un-hypothesized signs for unemployment and real wages. The studies of Graves (1976, 1979, 1980, 1983), Marston (1985), and Knapp and Graves (1989) highlight the importance of spatial equilibrium. The equilibrium approach establishes that economic differentials among territories may occur in the long term due to other kind of factors, such as climatic conditions and natural and social endowments, encourage people to stay in areas where economic and labour market conditions are relatively worse. Thus, economic disparities in equilibrium are a result of constant utility across areas, where amenities and non-economic factors play a relevant role in individual preferences.

Equilibrium and disequilibrium approaches were seen as competitors throughout the 1980s and most of the 1990s. However, recent economic literature has been able to reconcile both views around the utility maximization principle, which assumes that migration flows are not only due to the specific attributes of the areas, but also to the value that individuals give to these attributes, which in turn depends on the needs and preferences of individuals and households.

4.2.2. Recent evidence on migration processes and the case of Spain

The utility maximization principle justifies the heterogeneity in results obtained for Europe and the US regarding their internal migration processes. In the US, people tend to be much more mobile than in Europe (Rupansigha et al., 2015). Economic disparities between these territories add to significant cultural and social heterogeneity among regions in Europe. Besides, the main motivations driving migration in the US also differ from those observed in Europe. American works like Partridge et al. (2008), Partridge (2010), and Faggian et al. (2012) find that natural amenities highly influence people movements and attribute to employment opportunities a secondary role. In Europe, economic and labour market differences among regions are key determinants of migration. Biagi et al. (2011) and Etzo (2011) find evidence for Italy: unemployment rate and per capita GDP differentials are relevant factors to explain migration from poorer southern regions to richer regions in the North. For Germany, Hunt (2006) highlights the influence of wage differentials in attracting young skilled workers from eastern to western regions. Détang-Dessendre et al. (2016) analyse 88 French labour market areas and find evidence of a significant influence of employment opportunities on people moves and commuting flows.

In Spain, internal migration shows similar patterns to those observed for Europe. Economic disparities between regions have led to disequilibrium factors have traditionally played a relevant role as determinants of population movements throughout the territory. During the 1960s and 1970s, massive movements took place from the poorer regions to Madrid, Catalonia, and Basque Country, the most developed regions (Bover and Velilla, 2005), because wages and employment opportunities (Santillana del Barrio, 1981). During the period of high economic instability that took place in Spain in the 1980s and early 1990s, migratory flows declined while poorer regions that had previously been net outmigration areas became net immigration regions, and the opposite occurred for richer regions. In these years, the more important flows were those observed within regions due to the increase of employment in services, which prompted moves towards larger towns. In addition, foreign immigration became an important phenomenon in those years, resulting in an important change in internal migration patterns. As Recaño and Roig (2006) explain, migration patterns of foreigners are significantly different from those of the native population—foreigners are about three times more mobile. The first consequence is an increase in aggregate internal flows: about 3.4 p.p. in 2012 are foreigners' flows, which contrasts to the 0.7% in 1960 (Minondo et al., 2013) and about 80% of recent foreigners flows had urban areas as a destination. But still, recent interregional migration flows (0.43% in 2002-11) were below the 1960s figures (0.77%) (Recaño et al., 2014).

Therefore, territorial disparities generated large interregional flows in the 1960s and 1970s whereas in eighties, internal migrations intensified but there was a reduction in interregional moves. According to Ródenas (1994), the increase in unemployment due to the economic crisis in the 1980s resulted in the decrease in interregional migration flows. De la Fuente (1999) notes that the reduction of regional disparities as well as factors related to quality of life caused this decline. In addition, researchers find un-hypothesized signs and, in some cases, lack of significance for both economic and labour market variables, which has attracted the attention of many economists. Works analysing more recent flows, such as Maza and Villaverde (2004) and Maza (2006) acknowledge the influence of regional income in the decision to move. In addition, Juárez (2000) and Mulhern and Watson (2009, 2010) obtain that unemployment differentials are also relevant factors, whereas Clemente et al. (2016) observe that labour market factors play a substantial role if the economic situation in the origin region is relatively unfavourable. And finally, works based on micro data, such as Maza et al. (2013) and Clemente et al. (2016), include a variety of personal characteristics in the analysis, as Antolín and Bover (1997) did for lately eighties. Overall, the selectivity of migrants and the heterogeneity of flows have been considered a key factor in explaining population flows.

Regarding the technical approach, most academic literature focused on Spain has analysed aggregate migration flows at the regional level. Some of these works consider a panel structure, and only few of them use origin and destination fixed effects to control for unobserved heterogeneity (such as Martínez-Torres, 2007). Although some articles consider count models using the number of migrants between origin and destination (Devillanova and García Fontés, 2004; Reher and Silvestre, 2009; Faggian and Royuela, 2010), most of the literature considers linear models in which the dependent variable is the migration rate or the log of migrants (recently, Clemente et al., 2016). Other works use micro data, analysing the propensity to migrate (Bover and Arellano, 2002; Reher and Silvestre, 2009).

Despite the large body of literature on the topic, there is a need to study migration flows during the Great Recession, the most significant crisis experienced in the country since the Civil War in 1936. Besides, there is space for a better analysis of population flows considering economically consistent spatial units, such as FUAs, rather than administrative definitions like province and autonomous community, together with differentiated flows, considering Spanish born versus foreigners, returned migrants and different age cohorts. Finally, the literature lacks studies using count data models together with wide structures of fixed effects controlling for multilateral resistance to migration effects.

4.3. Methodology

4.3.1. Theoretical approach

Based on the maximization utility principle, migrants decide where to go based on the relative area factor endowments and their individual preferences for these factors. The utility *(U)* that the i-th area reports to the k-th individual is a function of economic and amenity endowments of the area (Z_i) and individual idiosyncratic tastes (ε_i^k):

$$U_i^k = u(Z_i) + \varepsilon_{i-k.} \tag{4.1}$$

The deterministic part is "common" to all individuals and is a function of a vector of economic factors and amenities. Given this utility function and following Faggian and Royuela (2010), k-th individual decides to move if the expected utility of a destination area j is higher than the expected reported utility of the origin area i plus the costs of moving, frequently proxied in the literature by the distance between i and j locations:

$$E(U^k_j) - c(D_{ij}) > E(U^k_i) \tag{4.2}$$

We aggregate individual decisions at a macro level following the works of Santos Silva and Tenreyro (2006) and Miguélez and Moreno (2014), and we define a dummy variable y_{ijt}^k that takes the value 1 when equation (4.2) is met at period t and 0, otherwise. The sum of all individual decisions is represented by y_{ijt}, which captures the number of flows registered between every pair of spatial units i and j at period t. Thereby, we can write an extensive form of the gravity model including y_{ijt} as the endogenous variable and migration potential motivations as independent variables in addition to the origin and destination population size and the distance between the aforementioned origin and destination areas. The gravity equation of our baseline specification is as follows:

$$y_{ijt} = e^{\beta_0}(D_{ij})^{\beta_k} \prod_{l=1}^{L} F_{it-1l}^{\lambda_{il}} \prod_{l=1}^{L} F_{jt-1l}^{\lambda_{jl}} \prod_{t=1}^{T} e^{\theta_t d_t} \prod_{s=1}^{S} e^{\theta_{is} d_{is}} \prod_{s=1}^{S} e^{\theta_{js} d_{js}} \varepsilon_{ijt} \tag{4.3}$$

where y_{ijt} depends multiplicatively on L push (F_i) and pull (F_j) factors. An endogeneity problem may arise due to the reverse causality problem, as migration may affect labour market variables. However, in the Spanish case gross internal migration flows represent a small percentage of the national population, casting doubts on such impact. In Section A4.5 in Appendix A4, we show for all FUAs the percentages that net migration flows of people older than 18 represent on total and working age population for 2009 and 2014 respectively. To avoid such potential impact, we lag all right hand variables in equation (4.3) by one year. Our empirical model also incorporates S dummy variables d_s for every origin and destination and one fixed effect for every time period d_t. D_{ij} represents the travel distance between every pair of locations, e^{β_0} is the constant term, and ε_{ijt} is the idiosyncratic error.

4.3.2. Estimation strategy

The most common practice in empirical migration analyses has been to transform the multiplicative gravity equation by taking natural logarithms and estimating the model using Ordinary Least Squares. However, the log-linear transformation of the model entails several problems. The first problem relates to the presence of zero migration flows between pairs of areas, which becomes particularly relevant when we focus on specific population groups. Since the logarithm of zero is not defined, truncating and censuring these zero migration flows or transforming the data are two common procedures that may be accompanied by efficiency reductions due to the loss of information and estimation and sample selection bias (Westerlund and Wilhelmsson, 2009). Another problem emerges in the presence of heteroscedasticity, which frequently occurs with migration data. The OLS estimation is based on the homoscedasticity assumption. This implies that the expected value of the error term is a function of the regressors and the estimation variance is biased, affecting the model's inference. These failures have led to the use of mixed models and nonlinear methods to estimate the gravity equation. Among them, the Poisson Pseudo Maximum Likelihood (PPML) technique proposed by Santos Silva and Tenreyro (2006) has become the workhorse in gravity analyses. PPML, as a count data model, deals in a natural way with the presence of zero migration flows. In addition, it does not make any assumption about the form of heteroscedasticity, thus it is applicable under different heteroscedasticity patterns. These characteristics make PPML the appropriate method for our analysis. In order to carry out the PPML estimation, we resort to the property establishing the conditional expectation of y_{ijt} given the set of regressors $x_{ijt} = (1, D_{ij}, F_{it-1l}, F_{jt-1l}, d_t, d_i, d_j)$ as in the following exponential function:

$$E(y_{ijt}|x_{ijt}) = exp\left[\beta_0 + \beta_k\, ln(D_{ij}) + \sum_{l=1}^{L} \lambda_{il}\, lnF_{it-1l} + \sum_{l=1}^{L} \lambda_{jl}\, lnF_{jt-1l} + \sum_{t=1}^{T} \theta_t d_t + \sum_{s=1}^{S} \theta_{is} d_{is} + \sum_{s=1}^{S} \theta_{js} d_{js}\right] \quad (4.4)$$

4.4. Data

4.4.1. Urban areas

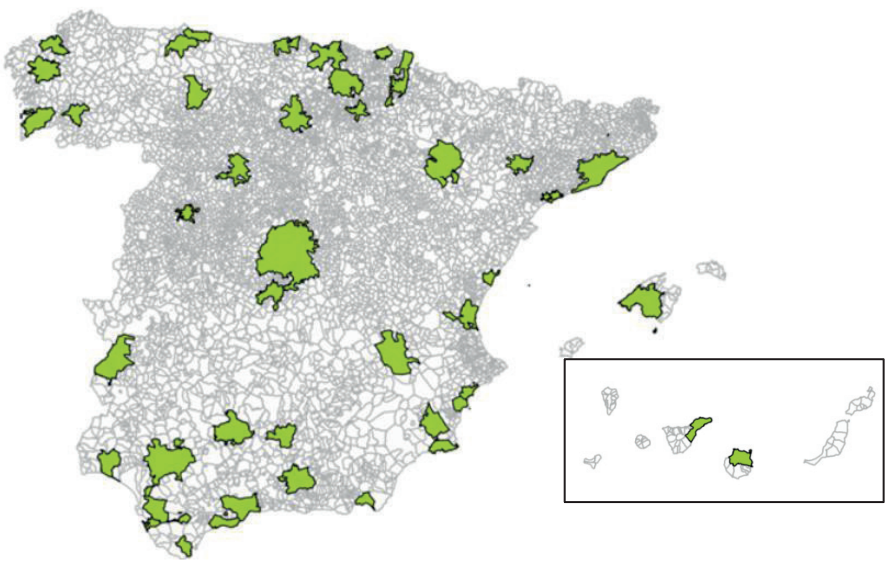
As reported above, we focus our analysis on migration between urban areas. We consider areas to be urban if they meet the definition of Functional Urban Areas (FUA) developed by the European Commission and the OECD in 2011 in the Urban Audit project. A FUA is the closest definition of a city, based on population and density criteria, and its commuting zone. In Spain, the 45 FUAs included 951 municipalities in 2013, although this number of municipalities has varied over the period of analysis. In this sense, we follow the work of Ruiz and Goerlich (2015) to identify municipality changes in FUAs.[2] Figure 4.2 maps Spain's FUAs, which represent about 10% of the

[2] We consider specifically the cases that affect the number of municipalities in the FUAs. These are the cases of "Villanueva de la Concepción" and "La Canonja" municipalities, which emerged during the considered period due to the disaggregation from "Antequera" and "Tarragona" respectively. We also take into account the case of "Oza-Cesuras," which emerged from the aggregation of "Oza

national territory and, in 2013, accounted for over 61% of the population and about 68% of employment.

Spain's FUAs have large differences in population size and density, and in economic aspects and labour market performance. Madrid and Barcelona are the biggest urban areas: 137 and 127 municipalities and 6.5 and almost 5 million inhabitants respectively. Nevertheless, the median FUA is quite far from these values, accounting for 13 municipalities and about 300,000 inhabitants. From an economic perspective, we also observe considerable heterogeneity among urban areas. In 2013, the average household income in Madrid, the urban area with the highest value was 89.7 p.p. higher than that of Marbella, the city with the lowest average level. We can also observe large differences in unemployment rates: in 2013, Donostia, a northern urban area, registered the lowest unemployment rate (13.7%), which contrasts with Almeria, a southern province, differing by more than 30 p.p.

Figure 4.2. Map representation of Spain's Functional Urban Areas.



Dos Rios" and "Cesuras," which no longer exist. Therefore, the number of municipalities in the considered FUAs has varied over the period.

Selecting FUAs as the territorial unit of analysis has a number of advantages. They are not mere geographical areas, but territories that are economically and socially integrated and prove to be the best approximation to the concept of local labour markets. These urban areas differ not only in economic and labour factors, but also in amenities and infrastructures, which may affect their attractiveness. Therefore, determining the influencing factors of migration between them implies performing a precise analysis of long distance moves rather than analysing short distance moves and regional or provincial data. Finally, analysing FUAs overcomes the limitations of analyses that just take into account cities and do not consider the suburbanization processes. In our analysis, we remove from our observations the migration moves between FUAs whose travel distance in both directions is less than 120 kilometres. We follow the work of De la Roca (2015) in order to establish the 120 km threshold, which aims to remove from our observations those residential variations that may not imply a migration move, i.e., municipality changes that do not imply a social or a workplace change for the migrant.[3]

4.4.2. Data sources

The analysis of the determinants of migration between the 45 Spanish FUAs for the 2008 to 2014 period requires the use of disaggregated data at municipality level. The final data involves a list of sources.[4] Migration flows are obtained from the Residential Variation Statistics (*Estadística de Variaciones Residenciales*, EVR). This micro dataset contains information on individual moves that imply a municipality change, and it is compiled on the basis of municipality registration data. EVR exploits information such as the date of the residential variation and the municipalities of departure and arrival. It also accounts for nationality, birth place (either municipality or country of origin), birth date, and gender, which allows us to identify some characteristics of migrants and makes it possible to determine the migration motivations for specific groups that may present heterogeneous behaviour. EVR provides high-quality information due to the application of advanced

[3] The number of origin-destination pairs is not 1,980 but 1,910, as we remove moves between the FUAs with travel distances of less than 120 km.

[4] Detailed information about the datasets and the components and sources of information are compiled in Section A4.2 in Appendix A4, while descriptive statistics are displayed in Section A4.3.

control and data collection procedures, but also because of the Continuous Register implementation, which updates residential variation information immediately. The potential criticism of use of this data is that it represents only registered moves. However, in Spain, a registration certificate is mandatory to have access to basic social and municipal services and the right to vote, which serves as an incentive for movers to register. The alternative source, the Population Census, may not allow for tracing of the Great Recession and has been criticised in the past for erroneous input methods for nonresponse questions, making the information unreliable (Ródenas and Martí, 2009). Other sources, such as the Labour Force Survey or Social Security Records, are alternatives that are suitable for investigating either aggregate flows or personal characteristics of working people.

As for the explanatory variables of our empirical model, we had to work with municipal data to build FUA consistent variables. Data for population comes from Spain's Continuous Register, and we measure distance in minutes.[5] We resort to Spain's Social Security records for information on employment. The workers' affiliation records with Social Security provide data on registered employment at the municipality level, and we obtain municipal working age population data from Spain's Continuous Register. We use the average provincial wage provided by the Spanish Tax Agency (AEAT), and we use information on local housing costs collected by *Idealista*, a web-based real estate firm that works at the national level. We deflate nominal variables using provincial (NUTS 3) Consumer Price Indexes (CPI). Finally, we resort to the Spanish Meteorological Agency (AEMET) to obtain information on natural amenities such as temperature and rainfall.

[5] The driving distance indicated on Google Maps is considered for FUAs located in peninsular Spain. For FUAs located on islands, we consider the flight time (minutes) provided by AENA on regular flights between Spanish airports, which we add to the distance to the closest airport, the driving distance between the island airport and the island FUA, and an extra hour to take into account the minimum lapse of time to remain at the airport.

4.5. Results

We estimate the effect that labour market factors exert on migration for people older than 18 years of age to remove the bias that family responsibilities may generate in our results. Later, we disaggregate adult migrants by citizenship and their link with the destination (return/non-return migration). The distinction of the groups[6] allows us to determine the heterogeneity related to the preferences of internal migrants, which makes it possible to ascertain the role of labour market factors as determinants of internal migration in Spain.

As mentioned, Table 4.1 presents the results of the estimation of internal migration motivations during the recent economic downturn. We consider several fixed effect structures. In column (1) we include time fixed effects, which allows to control for global time-specific events. Column (2) reports our baseline specification, including time and origin and destination fixed effects, controlling for time-invariant characteristics of every FUA. Column (3) considers a dyadic origin-destination fixed effect to control for specific permanent dyadic characteristics, such as common co-official languages that may favour migration, and social networks, as past migration episodes between pairs of FUAs may generate a stock of migrants with strong personal links, which are usually difficult to capture. Finally, we consider two additional structures of fixed effects: a model with dyadic destination-time and monodic origin fixed effects in column (4), and a model with dyadic origin-time and monodic destination fixed effects in column (5). These specifications allow us to proxy different sources of multilateral resistance to migration[7] and, therefore, help us to deal with another potential source of endogeneity. Destination-time fixed effects take into account any shock that may occur and modify the preferences for the different destinations, whereas

[6] Section A4.4 in Appendix A4 displays the total number of migrants in each group and the percentage of adult migrants that each group represents.

[7] Multilateral resistance to migration refers to the influence that third area characteristics may exert on the migration flows between two given areas. Not considering the potential sources of multilateral resistance to migration may bias the results and lead to endogeneity (Hanson, 2010), as the omission of relevant information generates regressors correlated with the error term, which is in turn also spatially and serially correlated. The Common Correlated Estimator (CCE) (Pesaran, 2006) performs correctly when the longitudinal and cross-sectional dimensions of the panel are large enough, which is not our case. In addition, this estimator exhibits the same problems as the OLS estimator in the presence of zero flows and heteroscedasticity. For all these reasons, we opt for the fixed effects structures.

origin-time fixed effects consider the changes that modify migration preferences by origin.

Our estimates use the PPML method, avoiding problem of omitting variables by considering different structures of fixed effects. Column (1) includes time fixed effects plus fixed amenities variables for origin and destination, which is clearly insufficient but allows us to find the basic estimates of a gravity equation, where the parameters for population are close to one: larger flows come from and to larger cities. In our case, there are considerable differences in the size of the FUAs, thus between differences are significant.

Table 4.1. PPML Estimation results for total migrants (≥18)

	Dep Variable Migration flows				
Indep. Variables	(1)	(2)	(3)	(4)	(5)
log Population O	0.972***	0.488	0.475	0.564	
	(0.0197)	(0.393)	(0.392)	(0.353)	
log Population D	0.992***	1.341***	1.319***		1.198***
	(0.0186)	(0.355)	(0.353)		(0.258)
log Distance (time)	-0.985***	-1.056***		-1.056***	-1.056***
	(0.0352)	(0.0268)		(0.0268)	(0.0268)
Emp. Rate O	-0.0328	0.233	0.225	0.226*	
	(0.280)	(0.155)	(0.153)	(0.131)	
Emp. Rate D	-0.315	0.291**	0.287**		0.285**
	(0.325)	(0.142)	(0.141)		(0.130)
log Real Wage O	-0.612***	-0.680***	-0.689***	-0.603***	
	(0.202)	(0.202)	(0.199)	(0.158)	
log Real Wage D	-0.0844	0.638***	0.643***		0.665***
	(0.200)	(0.240)	(0.240)		(0.171)
log Housing Costs O	0.0935	0.0887**	0.0851*	0.114***	
	(0.113)	(0.0451)	(0.0446)	(0.0413)	
log Housing Costs D	0.194	0.0807*	0.0809*		0.0506
	(0.122)	(0.0481)	(0.0481)		(0.0458)
Amenities O	yes	no	no	no	no
Amenities D	yes	no	no	no	no
T FE	yes	yes	yes	no	no
O FE	no	yes	no	yes	no
D FE	no	yes	no	no	yes
OD FE	no	no	yes	no	no
OT FE	no	no	no	no	yes
DT FE	no	no	no	yes	no
R-squared	0.949	0.978	0.995	0.980	0.979

Notes: 11,460 observations. Robust standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1

Column (2) introduces origin and destination fixed effects in line with most of the empirical literature applied to the Spanish case. This model captures permanent elements of every FUA by means of a list of dummies; consequently, the parameters of the control variables exploit only within information, which is a small portion of the overall variation. Still, with this strategy we are able to capture fixed non-observables that can bias the estimation. In this specification, FUAs with more population attract large flows of migrants. The estimates of the parameters for employment opportunities and wages behave as expected, while high housing costs allow for emigration and at the same time act as a pull factor, potentially signalling a higher quality of life. Distance is significant and negatively affecting migration flows, as expected. Column (3) introduces dyadic origin-destination fixed effects. The result is an increase in the adjustment of the model, which calls for specificities in migration costs between pairs of origins and destinations.[8] Still, the parameters for the variables hardly change, and consequently these specificities are not correlated with our covariates.

The last two specifications widen the fixed effects structure and allow for a similar interpretation as column (2), but controlling for all time varying effects at the destination -column (4)- and origin -column (5). Most parameters in these new and preferred specifications experience a decrease in the magnitude and in the standard errors. The latter effect is responsible for having significant and positive parameters for employment opportunities in the origin, an unexpected result. On the contrary, the positive parameter for housing costs in the destination stops being significant, casting doubt on the role of housing prices as quality of life signal.

The literature analysing migration in Spain reports that some of the conflicting results of aggregate models are due to specificities of individuals, as heterogeneous groups respond differently to push and pull factors. We first perform separate analyses depending on the nationality of movers, considering also those who move back to their origin areas. Table 4.2 reports the estimates of our preferred specification for all nationals, returned

[8] Section A4.6 in the Appendix A4 shows the basic results considering alternative measures of distance, such as physical distance (km) and straight line distance. As in Poot et al. (2016), straight-line distance reports the lower parameter, while in our case time distances yield lower parameters than distance in km.

nationals, and foreigners. Our preferred specifications include controls for all destination-time or origin-time specific events, allowing for concentration on the parameters in the origin and destination respectively.

With respect to the effect of the traditional gravity variables, for Spanish national migrants, population in origin and destination display significant and positive parameters. Besides, returned nationals leave areas with higher populations, whereas foreigners behave in the opposite way, as they are attracted by FUAs with higher populations. Distance reports the expected negative and significant parameter for all groups. Its magnitude is lower for foreigners: previous moving experiences decrease the negative impact of distance in migration decisions.

Table 4.2. Results by nationality and linkage with destination

	Nationals		Returned Nationals		Foreigners	
	(1)	(2)	(3)	(4)	(5)	(6)
log Population O	1.706***		2.162***		0.417	
	(0.362)		(0.677)		(0.634)	
log Population D		1.662***		0.831		1.501***
		(0.305)		(0.664)		(0.488)
log Distance (time)	-1.116***	-1.116***	-1.119***	-1.119***	-0.853***	-0.853***
	(0.0321)	(0.0321)	(0.0437)	(0.0437)	(0.0224)	(0.0224)
Emp. Rate O	0.0869		0.960**		0.902**	
	(0.0945)		(0.433)		(0.378)	
Emp. Rate D		0.304***		0.0102		0.399
		(0.109)		(0.197)		(0.34)
log Real Wage O	0.469***		0.48		-2.635***	
	(0.18)		(0.319)		(0.313)	
log Real Wage D		0.450**		0.603*		0.515*
		(0.197)		(0.316)		(0.303)
log Housing Costs O	-0.0146		0.072		0.0591	
	(0.0394)		(0.0644)		(0.0768)	
log Housing Costs D		0.0306		-0.274***		-0.139*
		(0.0442)		(0.0785)		(0.0836)
O FE	yes	no	yes	no	yes	no
D FE	no	yes	no	yes	no	yes
OT FE	no	yes	no	yes	no	yes
DT FE	yes	no	yes	no	yes	no
R-squared	0.962	0.961	0.921	0.915	0.988	0.986

Notes: 11,460 observations. Robust standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1

As for the economic variables, we see that wages have a greater effect on the foreigners group, whereas employment has a counterintuitive positive effect at origin. For Spanish national migrants, employment at destination exerts the expected influence. On the contrary, for returned national migrants, we observe a positive sign of employment at origin. This significant parameter is close to that observed for foreigners and is far from what one would expect. Finally, housing costs at destination have a negative influence on the moves of foreigners and returned migrants, which clearly shows the preference of these groups for cheaper housing.

We finally analyse migration by age cohort. As in Clemente et al. (2016), we differentiate three cohorts: 18 to 30, 30 to 60, and above 60. Table 4.3 displays the results of these new estimates. As above with national returned migrants, we see that the above 60 group is least affected by push and pull economic factors, as it is by far the group with the lowest adjustment models. On the contrary, younger migrants are the ones with models reporting higher R^2 statistics. Younger migrants are more affected by wage differentials, followed by migrants between 30 and 60. For younger migrants, high real wages in the origin discourage leaving their city, while better wage prospects in the destination encourage them to move.

Table 4.3. Results by age cohort

	[18-30)		[30-60)		≥ 60	
	(1)	(2)	(3)	(4)	(5)	(6)
log Population O	1.067*		0.142		0.488	
	(0.566)		(0.354)		(0.559)	
log Population D		1.686***		0.740***		1.522***
		(0.449)		(0.285)		(0.541)
log Distance (time)	-0.991***	-0.991***	-1.083***	-1.083***	-1.118***	-1.118***
	(0.0261)	(0.0261)	(0.0262)	(0.0262)	(0.0475)	(0.0476)
Emp. Rate O	0.305		0.203		-0.106	
	(0.227)		(0.130)		(0.254)	
Emp. Rate D		0.385		0.189		0.483
		(0.265)		(0.124)		(0.330)
log Real Wage O	-0.930***		-0.703***		0.655**	
	(0.252)		(0.176)		(0.331)	
log Real Wage D		0.859***		0.480***		1.687***
		(0.258)		(0.182)		(0.387)
log Housing Costs O	0.174***		0.0829*		0.0532	
	(0.0676)		(0.0466)		(0.0762)	
log Housing Costs D		0.153**		0.0161		-0.0367
		(0.0660)		(0.0522)		(0.0733)
O FE	yes	no	yes	no	yes	no
D FE	no	yes	no	yes	no	yes
OT FE	no	yes	no	yes	no	yes
DT FE	yes	no	yes	no	yes	no
R-squared	0.978	0.978	0.980	0.980	0.870	0.869

Notes: 11,460 observations. Robust standard errors in parentheses.
*** p<0.01. ** p<0.05. * p<0.1

Employment rates do not display any significant parameters in the origin or destination. As in the previous crisis in Spain, we interpret this result as related to the almost non-existent employment opportunities in Spain during the Great Recession. Moving from an urban area with 25% unemployment to another city with about 20% unemployment presents the potential migrant with a low margin for improvement.

It is difficult to interpret the parameters associated with housing costs, as they arise as positively related with migration flows both in the origin and destination. In this case, we relate the negative side of the story: urban areas with a greater decrease in housing prices leave residents with fewer opportunities to sell their property and subsequently to leave their city. As other works indicate, housing ownership (particularly high in Spain) acts as a brake on population moves.

Finally, we comment on the factors influencing flows of older people. In this case, we see a positive and significant parameter for real wages at the origin, an aspect that is difficult to explain in more aggregate models or in the analysis of flows not considering the life cycle (non-returned nationals). Interestingly this group is the one more seriously affected by migration costs (distance), reporting a strong role of social networks achieved over the years.

4.6. Concluding remarks

The analysis on the role of labour market factors in internal migration decisions during the Great Recession in Spain is interesting for several reasons. First, this recent economic downturn has had a strong effect on wages and, more importantly, on unemployment rates, which have greatly absorbed the economic shock. In this context, we observe a decline in internal migration, which led us to wonder about the extent to which migration has been motivated by economic and labour market factors. Secondly, the results for migration determinants obtained in a previous period of instability in Spain—the 1980s and early 1990s—cast doubt on the influence of labour market factors on migration during the current economic crisis.

This work aims to determine the role of economic and labour market factors in migration flows between Spain's FUAs during the recent economic crisis. The results highlight that labour market factors exert a significant influence on internal migration decisions. The influence of real average wages is relevant, especially for foreigners and returned nationals. On the contrary, the effect of employment rate on migration flows is less clear, as we only observe a significant positive effect of employment rate at the destination for nationals. An unexpected positive effect of employment rate at the origin is found for returned nationals and foreigners. Conflicting results are also reported for housing costs. These results are in line with the previous literature, which considers the phenomenon of migration in Spain an enigma.

Still, when disaggregating migration flows by age cohort, most results are in line with the theory: real wages report significant parameters in line with the theory (negative in the origin and positive in the destination) for working age groups, while employment rates are not relevant, as unemployment rates are so high in this period that they discourage moves for finding a job. Our results can be seen as a proof of the role of the life cycle in explaining migration decisions.

The obtained results show a strong role of population flows in driving spatial equilibrium on wages if neoclassical approach applies. Consequently, any policy aimed at fostering economic convergence in the country needs to account for the role of migration. Heterogeneous patterns for different population groups also calls for defining tailored policies promoting migration. We believe that further research can be devoted to the interaction between urban and rural flows, and also to internal and foreign migration flows, although these aspects are neither straightforward nor feasible in a gravitational framework like the one developed here due to data availability.

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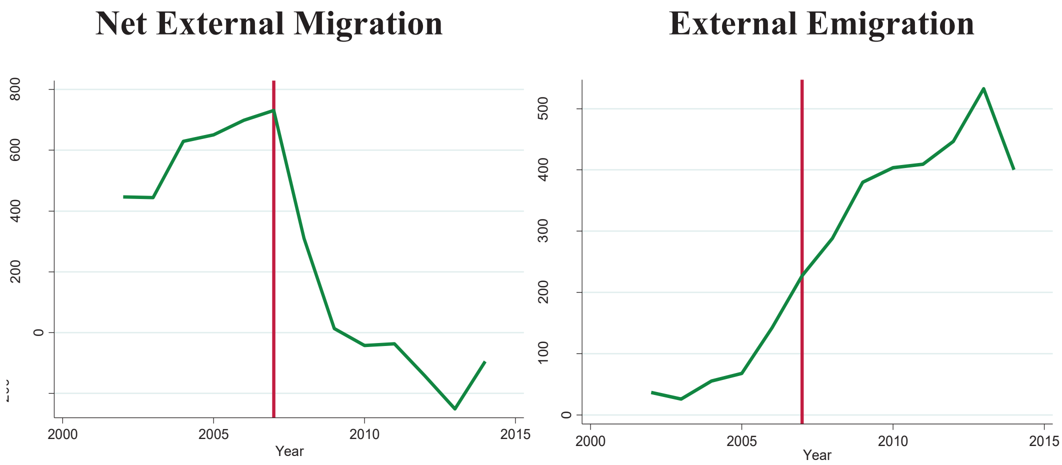
A4. Appendix

A4.1. External migration evolution

Figure A4.1.1. Evolution of external migration flows



A4.2. Sources of information

Table A4.2.1. Variables definition and information sources

Variable	Proxy	Source
Migration flows	Counts of people flows over 18 years old flows that take place between FUAs which are located at a minimum distance of 120 km.	EVR
Population	Total population	Continuous Register (INE)
Geographical distance	Driving distance in time (minutes) Flight distance in time (minutes) if origin and/or destination FUAs are located in an island	Google maps and own calculations
Employment Rate	Registered employment in the municipalities that integer the FUAs divided by the FUAs working age population	Public State Employment (Social Security Database)
Real Wage	Nominal Wage deflated by CPI (NUTS 3 level). For the Basque country and Navarra the data is obtained from the Wage Structure Survey. The final average income of these FUAs takes into account the relationship between NUTS 2 regional average income provided by the Tax Agency and the EES wage.	AEAT
Housing costs	Average cost of housing per sq-m in municipalities within every FUAs with at least 50 sale advertisements on the webpage. We calculate the average housing costs for every FUAs as a by weighted average in terms of local population.	Idealista
Temperature	January average temperature	AEMET. *Guía resumida del clima en España 1981-2010*
Raining	Yearly average precipitation	AEMET. *Guía resumida del clima en España 1981-2010*
Coast	1: if the FUA has a coast; 0: otherwise	Google maps

A4.3. Descriptive Statistics

Table A4.3.1. Descriptive statistics

Variable	Mean	Std. Dev. Overall	between	within	Min	Max	Perc. of zero mig. flows (over 1)
Total migration flows[a]	77.1162	240.2902	239.5970	18.9134	0	5182	0.0093
National mig. flows[a]	52.8901	150.1369	149.4347	14.8360	0	2815	0.0255
Foreigners mig. flows[a]	24.2261	98.1661	96.5341	17.9392	0	2881	0.1051
Non-returned mig. flows[a]	64.8492	208.2827	207.5543	17.9364	0	4633	0.0140
Returned mig. flows[a]	12.2670	35.7970	35.3904	5.4304	0	612	0.2178
log Population	12.8089	0.8462	0.8463	0.0126	11.7091	15.6980	-
log Distance (time) [b1]	5.7434	0.4532	0.4533	0	4.3137	6.4516	-
log Distance (km) [b2]	6.4424	0.6149	0.6151	0	4.7889	7.8261	-
Euclidean distance	6.2067	0 .6376	0 .6377	0	4.4760	7.6972	-
Employment Rate	0.4709	0.0823	0.0739	0.0362	0.0614	0.7115	-
log Real Wages	9.8243	0.1649	0.1560	0.0536	9.3741	10.2144	-
log Housing Costs	7.6649	0.2936	0.2390	0.1706	6.9030	8.4962	-
log Temperature	2.1388	0.4020	0.4021	0	1.1314	2.9014	-
log Raining	6.2457	0.5312	0.5313	0	5.0193	7.4904	
Coast	0.4880	0.4999	0.5000	0	0	1	-

Notes: (i) N = 11,460; n = 1,910; T = 6
(ii) [a] We consider migration flows of people equal or older than 18 years
(iii) [b1] Travel distance in time considering flight travel time in the case of islands
[b2] Travel distance in km

A4.4. Percentage of adult migrants represented by the different collectives

Table A4.4.1. Percentage of adult migrants that each group represents

Migration groups	Total Number of Migrants	Percentage (%)
Older than 18	883.752	100.00%
Nationals	606.121	68.58%
Returned nationals	140.580	23.19%
Foreigners	277.631	31.42%
Aged 18-30	294.511	33.32%
Aged 30-60	512.779	58.02%
Aged older than 60	76.200	8.62%

A4.5. Percentage of net flows on total and working age population for FUAs

Table A4.5.1. Percentage of net flows on total and working age population

FUAs	Percentage of net flows (%)			
	2009		2014	
	Total Population	Working age Pop[a]	Total Population	Working age Pop[a]
Albacete	-0.054	-0.066	-0.257	-0.310
Algeciras	-0.145	-0.178	-0.007	-0.008
Alacant/Alicante	-0.103	-0.123	-0.042	-0.050
Almería	-0.044	-0.053	-0.016	-0.020
Badajoz	-0.052	-0.063	-0.209	-0.253
Barcelona	0.031	0.037	0.065	0.077
Bilbao	0.063	0.072	0.005	0.006
Burgos	-0.170	-0.199	-0.220	-0.260
Cádiz	-0.114	-0.135	-0.223	-0.265
Cartagena	-0.018	-0.022	-0.071	-0.088
Castellón	-0.164	-0.196	-0.093	-0.111
Córdoba	-0.191	-0.230	-0.189	-0.227
A Coruña	0.020	0.023	-0.100	-0.116
Donostia	-0.009	-0.011	0.098	0.115
Elche/Elx	-0.044	-0.053	-0.020	-0.024
Gijon	-0.063	-0.071	-0.090	-0.102
Granada	-0.070	-0.084	-0.136	-0.165
Huelva	-0.011	-0.013	-0.105	-0.128
Jaén	-0.184	-0.224	-0.282	-0.340
Jérez de la Frontera	-0.009	-0.011	-0.139	-0.171
Palmas Gran Canaria	-0.063	-0.076	-0.068	-0.081
León	-0.149	-0.171	-0.285	-0.329
Lleida	-0.106	-0.126	-0.133	-0.160
Logroño	-0.103	-0.122	-0.020	-0.024
Madrid	0.065	0.077	0.118	0.141
Málaga	0.084	0.101	0.097	0.118
Marbella	0.092	0.111	0.167	0.202
Murcia	-0.014	-0.017	-0.080	-0.099
Ourense	0.038	0.043	-0.148	-0.169
Oviedo	-0.072	-0.082	-0.216	-0.247
Palma de Mallorca	-0.023	-0.027	0.087	0.105
Pamplona/Iruña	0.111	0.133	-0.022	-0.027
Reus	-0.083	-0.101	-0.039	-0.048
Salamanca	-0.273	-0.319	-0.349	-0.410
Santander	-0.061	-0.071	-0.070	-0.081
S. Compostela	0.075	0.086	-0.097	-0.112
Sevilla	0.063	0.077	-0.097	-0.118
Sta. Cruz de Tenerife	-0.070	-0.082	-0.045	-0.053
Tarragona	-0.087	-0.104	-0.045	-0.055
Toledo	-0.010	-0.012	-0.064	-0.079
Valencia	-0.041	-0.048	-0.041	-0.049
Valladolid	-0.103	-0.119	-0.169	-0.198
Vigo	-0.015	-0.017	-0.066	-0.077
Vitoria-Gasteiz	0.053	0.061	0.139	0.164
Zaragoza	-0.133	-0.156	-0.044	-0.052

Notes: [a] Working age population refers to population older than 16

A4.6. Robustness checks

Table A4.6.1. Sensitivity analysis by considering alternative distance measures

Variables	Dependent Variable: Counts of migration moves							
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Population O (nl)	0.892***	0.488	0.608*		0.897***	0.489	0.621*	
	(0.0231)	(0.393)	(0.357)		(0.0234)	(0.393)	(0.358)	
Population D (nl)	0.907***	1.350***		1.201***	0.912***	1.347***		1.160***
	(0.0220)	(0.356)		(0.255)	(0.0221)	(0.355)		(0.254)
Travel Distance Km (nl)	-0.624***	-0.912***	-0.912***	-0.912***				
	(0.0388)	(0.0302)	(0.0302)	(0.0302)				
Euclidean Distance Km (nl)					-0.604***	-0.902***	-0.902***	-0.902***
					(0.0387)	(0.0306)	(0.0306)	(0.0306)
Emp. Rate O	-0.0473	0.232	0.234*		-0.0306	0.232	0.237*	
	(0.290)	(0.155)	(0.134)		(0.291)	(0.155)	(0.134)	
Emp. Rate D	-0.350	0.291**		0.280**	-0.336	0.291**		0.281**
	(0.318)	(0.142)		(0.129)	(0.316)	(0.142)		(0.129)
Real Wage O (nl)	0.122	-0.680***	-0.611***		0.167	-0.679***	-0.604***	
	(0.237)	(0.203)	(0.160)		(0.239)	(0.203)	(0.160)	
Real Wage D (nl)	0.668***	0.631***		0.659***	0.723***	0.632***		0.646***
	(0.224)	(0.240)		(0.170)	(0.224)	(0.240)		(0.169)
Housing Costs O(nl)	0.0616	0.0900**	0.118***		0.0242	0.0900**	0.120***	
	(0.116)	(0.0450)	(0.0412)		(0.118)	(0.0451)	(0.0413)	
Housing Costs D(nl)	0.165	0.0820*		0.0512	0.130	0.0820*		0.0518
	(0.122)	(0.0482)		(0.0464)	(0.122)	(0.0483)		(0.0465)
Constant	-21.67***	-13.85	8.023	-13.12***	-22.23***	-14.08	7.502	-12.70***
	(2.779)	(9.526)	(6.083)	(3.751)	(2.763)	(9.522)	(6.106)	(3.717)
Amenities O	yes	no	no	no	yes	no	no	no
Amenities D	yes	no	no	no	yes	no	no	no
T FE	yes	yes	no	no	yes	yes	no	no
O FE	no	yes	yes	no	no	yes	yes	no
D FE	no	yes	no	yes	no	yes	no	yes
OD FE	no	no	no	no	no	no	no	no
OT FE	no	no	no	yes	no	no	no	yes
DT FE	no	no	yes	no	no	no	yes	no
Observations [a]	11.460	11.460	11.460	11.460	11.460	11.460	11.460	11.460
R-squared	0.935	0.976	0.977	0.977	0.935	0.975	0.977	0.977

Robust standard errors in parentheses
*** p<0.01. ** p<0.05. * p<0.1

Chapter 5:

Conclusions and Future Research

In this thesis, we have analysed the impact of the recession on the regional labour markets in Spain by considering three different aspects: the regional unemployment sensitivity to economic variations, the minimum wage effect on youth employment rate and finally, the role of the labour market determinants on internal migration. To carry out these analyses, we have exploited the territorial dimension of the information by distinguishing among provinces in the analyses in Chapters 2 and 3, and among urban areas in Chapter 4. This territorial consideration has allowed us to highlight the heterogeneous effect of the recession on the different areas of the country.

Chapter 2 has explored the inverse relationship between unemployment and GDP for the Spanish provinces and the period ranging 1985-2013. In order to perform the analysis, we have resorted to the difference version of the Okun's law and then to the VAR techniques and the associated impulse-response functions (IRF), which have allowed us to determine the effect of economic shocks on unemployment over the period and thereby, have made our results robust to endogeneity. However, before analysing the Okun's relationship, we have checked the stationarity of the variables for provinces in levels and first differences by applying the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests but also tests such as Zivot-Andrews and Clemente-Montañés-Reyes, which specifically consider the existence of structural breaks. Panel unit root tests have also been applied to check the stationarity of the variables for the panel of provinces.

Results from individual unit root tests have shown that most series are stationary in first differences. Stationarity of the first differenced variables has also been confirmed for the panel of provinces by the panel unit root tests. These results have allowed us to estimate the relationship between the first differenced GDP and unemployment rate. Estimations by using ordinary least squares (OLS) of the specification in differences and the use of VAR techniques have resulted in a very similar ordering of provinces. Results have shown that Spain's provinces show large differences in their unemployment sensitivity to economic variations. Provinces such as Madrid, Barcelona, Valencia, Sevilla, Málaga, Murcia, Cádiz, Las Palmas and Illes Balears show the highest levels of unemployment sensitivity to economic variations whereas the peninsular centre, except Madrid, is the geographical area where a lower unemployment sensitivity to GDP shocks is observed. An analysis of the underlying causes of this heterogeneity in terms of unemployment sensitivity has elucidated the main factors that are behind these differences. A weighted least squares (WLS) regression model has been conducted and sectoral composition, labour force participation, wages, levels of education, trade unions role and the employment share in the public sector variables were among the potential determinants besides urban, south and coast dummies. Results have pointed out that provinces that show less diversified industries, a more developed services sector and higher rates of labour participation suffer from higher variations in unemployment rates.

These results have important policy implications. Provinces (NUTS 3 regions) within autonomous communities (NUTS 2) show a very different degree of unemployment sensitivity. This finding that constitutes a contribution of the work has relevant implications. Political decisions that affect labour markets are generally adopted by the state and the autonomous communities and usually have application for the entire territory. However, the results of this work show that political authorities should not apply one size fits all policies as territorial unemployment has different sensitivities to the business cycle.

Nevertheless, this work keeps some research lines open that could be interesting to tackle in the future. One of the most relevant regards to the analysis of the linkages between provincial labour markets. Commercial flows and, to a lesser extent, migratory moves, favour the connection between provincial labour markets. Therefore, not only regional GDP growth affects the evolution of the unemployment rate, but also the economic situation of closer provinces does. This future research could be addressed by including spatial lags of the considered variables in the Okun's curve specification as Kosfeld and Dreger (2018), Oberst and Oelgemöller (2013), Palombi et al. (2015), Pereira (2014), Montero (2014) and Basistha and Montero (2017) recent analyses do.

Chapter 3 has focused on a different topic. It has analysed the effect of minimum wages on regional employment rates, taking especially into consideration its influence on youth employment. The analysis has included spatial effects that involve economic, social, employment and wage variables from closer provinces that affect, through trade and workers' mobility, the employment level of the province considered. This is the main contribution of this work as the inclusion of spatial effects on the minimum wage and youth employment relationship had not been previously analysed for the Spanish case.

In Spain there is no territorial differentiation of the minimum wage in nominal terms but, the existence of differences in regional price levels and inflation rates implies that the real magnitude differs across provinces. Thus, in Chapter 3, we have evaluated the impact of this differential on total and youth employment in the period comprised between 2006 and 2015, in which the minimum wage has grown in relative terms as a consequence of the decrease of the average wage in more than 7 p.p.

The strategy to conduct this analysis has been the following. We have estimated a dynamic panel data model for employment rates at the provincial level. The considered explanatory variables included the employment rate lagged one period and also spatially lagged, the Kaitz index of the considered and the contiguous provinces, and different additional controls. The obtained results have shown a negative but quite small effect of the Kaitz index on the employment rate. The disaggregation of youth population into different age groups has allowed us to identify that the youth group most affected by minimum wages is the one between 20 and 24 years old, which is the most common age group of workers that face the school-to-work transition. The obtained results have important policy implications, as the higher effect of Kaitz index on employment for young workers could justify a differentiation on the minimum wage according to the worker's age. However, the modest influence that it exerts in this crisis scenario supports the idea that there is still room for increasing the minimum wage for all population groups.

Lines of research that we could carry out in the future related to the analysis in Chapter 3 include the consideration of the minimum wage effect on other labour market variables such as the participation rate, a particularly relevant issue for youth. Additionally, it could be interesting to assess whether there are interactions between minimum wage and active labour market policies, or with other labour market institutions that are regionally different. In this sense, the recent works of Caliendo and Schmidl (2016), Hardoy (2018) and Kilhoffer et al. (2018) may guide us in our future analysis.

Chapter 4 has analysed the main determinants of migration between 45 Spanish Functional Urban Areas during the period of the recent economic downturn, in which factors traditionally related to internal migration such as real wages and employment have greatly declined. This work aims to determine whether labour market variables exert a relevant influence as in the previous expansive period or contrarily to this, the effect is not significant or counterintuitive as in the previous high instability period took place in eighties and early nineties, which led to migration phenomena was labelled an “enigma”.

In order to perform the analysis, we have resorted to a gravity model for bilateral migration flows where several controls and different complex structures of fixed effects have been included in order to avoid potential endogeneity problems as a consequence of variables omission. The estimation has been performed by using the Pseudo Poisson Maximum Likelihood (PPML) methodology. As a count data model, PPML deals in a natural way with the presence of zero migration flows and, moreover, as it does not make assumptions about the form of heteroscedasticity, it is robust to different sources of heteroscedasticity. Estimations have been conducted for all migrants, but we have also exploited the available information and have distinguished migrants attending the age, nationality and linkage with the destination. Results show that real average wages are relevant migration determinants. They exert a strong influence, especially in foreigners and returned nationals and also, they behave as expected for the working age groups. However, the effect of employment rate on migration flows is less clear. For nationals, a significant positive effect at destination has been found; but, for nationals and foreigners, an unexpected positive effect of employment rate at the origin has been obtained. Additionally, we have not found a significant influence of employment rates for the different age groups. The inconclusive results on the role of employment rate on migration are in line with results obtained in eighties and early nineties, which considered migration phenomenon an enigma.

Therefore, at the light of our results, neoclassical approach predicts that population flows foster spatial equilibrium on wages. However, a bulk of literature considers that migration, when mostly driven by highly qualified individuals, can lead to an increase in regional labour market differentials (Rauch, 1993; Borjas, 2003; Moretti, 2004; Suedekum, 2004; Kanbur and Rapoport, 2005; Schlitte, 2010; Behrens and Sato, 2011). In this sense, future research[1] may analyse the effect of migration in income convergence, not only for the case of migration between urban areas or provinces but also taking into account rural-urban migration. This is important from a policy perspective, as policies aimed at fostering economic convergence in the country necessarily have to take into account the role of migration. Additionally, it would be interesting to determine the consequences of migration for the individuals as in Abreu et al. (2011). In the case of returned migrants, we could determine whether acquiring certain experience in another region or in another country has a wage premium.

The main conclusion of this thesis dissertation is that labour markets in Spain are sensitive to local economic conditions and that spatially tailored policies can benefit employment creation. Such policies, though, have to be developed by assuming that they will generate endogenous results in labour markets, such as population flows aiming at adjusting spatial equilibrium. The search of efficient and equitable policies has been and will be the aim in future research.

[1] To carry out the two analyses proposed as an extension of Chapter 4 of this dissertation, we would need to know who the migrants are in terms of their educational and qualification level, and also their specific migration preferences. This information is not available but it could be obtained by merging the datasets from Longitudinal Sample of Working Lives (*Muestra Continua de Vidas Laborales* MCVL) and Residential Variation Statistics, as in De la Roca (2017). The Longitudinal Sample of Working Lives is a wide a complex dataset that follow individuals that have had any relationship with Spain's Social Security on a given year.

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