Centre of Full Employment and Equity

Working Paper No. 01-14

The changing patterns of labour underutilisation in Europe in the face of policy austerity

William Mitchell and Michael Flanagan[1]

November 2014

Centre of Full Employment and Equity
The University of Newcastle, Callaghan NSW 2308, Australia
Home Page: http://www.fullemployment.net
Email: coffee@newcastle.edu.au

1. Introduction

The aim of this article is to examine the impact of the Global Financial Crisis (GFC) and ensuing fiscal austerity on regional labour markets in Europe by analysing the changing spatial pattern of unemployment between 2008 and 2013 in Europe compared to the earlier growth period (2003-08). We concentrate on unemployment because data for broader forms of labour underutilisation, including underemployment and hidden unemployment, are only published at the national level. However, Mitchell and Muysken (2008: 202) show that "a reliable yet conservative rule of thumb is to double the official unemployment rate to get an indicator of the extent of labour wastage in the economy" or for that matter, region. Prior to the great recession, regional disparities in unemployment rates across Europe were narrowing although there were still pockets of entrenched long-term unemployment.

Traditionally, regional cross-sectional data are handled in the same way as cross-sectional data on individuals or businesses at a single location. However, increasingly regional researchers are aware that 'space' matters, in that it introduces a separate element to the analysis that erstwhile standard statistical tools fail to capture (Cliff and Ord, 1973, 1981; Anselin, 1988). Using a new suite of spatial modelling tools, previous research has found that unemployment hotspots (regional clusters of concentrated labour underutilisation which spill over administrative boundaries) span national boundaries in Europe (Niebuhr, 2002).

Since the release of the OECD Jobs Study (OECD, 1994), the dominant policy framework in Europe and elsewhere in response to persistently high unemployment rates has been focused on the notion of full employability, a supply-side conceptualisation of the problem. Accordingly, unemployment is constructed in terms of the skill and attitudinal deficiencies of individuals and/or the way the unemployed respond to disincentives built into income support systems and other alleged rigidities (for example, minimum wages, job protection laws). Past research would suggest that this approach ignores the fundamental determinant of high rates of labour underutilisation - a lack of jobs and the spatial spill-overs, which magnify the demand deficiency across regional space (Niebuhr, 2002; Mitchell and Bill, 2004; Mitchell and Muysken, 2008). A feature of this paper is that it focuses on the demand determinants of the evolution of unemployment at the regional level, while controlling for the typical supply-side influences. In doing so, the research outcomes provide an evidential basis for the development of a coherent policy framework designed to address the unemployment crisis in Europe.

There has been a plethora of analysis of the impacts of the crisis and policy response at the macroeconomic level, but the regional analysis has been limited. Martin (2011: 607) concluded that public sector cuts ''will almost certainly impact some cities and localities much more than others. The ramifications of the financial crisis have proved anything but spatially uniform.'' Similarly, Kitson *et al.* (2011) concluded that the local impact of policy austerity in the UK has been unequally distributed and disproportionately felt by traditionally disadvantaged areas (see also Rowthorn, 2010). Monastiriotis (2011) considered the regional impact of the Greek austerity measures in the context of pre-existing and multi-faceted inequalities and weak cross-regional equilibration mechanisms. He also noted that Greek economic activity is more concentrated than in other European nations. As a result, he predicted that regional inequalities would rise as the austerity regime was strengthened. Davies (2011) considered the concept of regional resilience in Europe, which allows a local area to rebound after a major external shock, in the context of response of unemployment rates to the crisis. She found that the capacity of the manufacturing sector to recover was crucial. She also found that government support for regions, particularly when used to support capital projects increased resilience compared to situation where funds earmarked for regional development were shifted to provide economy-wide support (see also Groot *et al.*, 2011 and Donald *et al.*, 2011).

This paper uses spatial statistics and spatial econometric techniques to reveal the nature of spatial dependence of regional unemployment rates in Europe spanning the decade from 2003 to 2013. The sample is constructed to allow a comparison between the period of growth before the GFC (2003-08) and the period of the crisis and subsequent imposition of fiscal austerity, which has seen the Eurozone, in particular, mired in deep recession and persistently high unemployment (2008-13). The results confirm the existence of unemployment 'hotspots' and shows how they have increased since the crisis and ensuing policy austerity.

The paper is laid out as follows: Section 2 briefly considers the socio-economic factors that have been identified in the literature as contributing to the existence of spatial dependencies in economic outcomes. Section 3 considers the spatial patterning of unemployment rates in Europe between 2003 and 2013, which suggest evidence of spatial concentration. Section 4 employs spatial statistics to confirm the presence of spatial dependence and the concentration of unemployment hotspots and coldspots. Section 5 presents a series of spatial econometric models to examine the factors that may be empirically significant in driving the observed patterns of spatial dependence. The existence of spatial dependence suggests that policy solutions to reduce unemployment must be supra-national rather than confined to specific regions. Concluding remarks and the policy relevance of our findings follow.

2. Socio-economic behaviour and spatial dependencies

Spatial autocorrelation refers to the formal measure of the extent near and distant things are related, either positively (when proximate regions are similar in attributes) or negatively (when proximate regions are dissimilar in attributes). There are several reasons why European regional unemployment might exhibit spatial dependence. First, Eurostat administrative boundaries for Nomenclature of Territorial Units for Statistics (NUTS)-2 data collection are unlikely to reflect the underlying processes that generate the sample data (Anselin, 1988). When socio-economic behaviour spans these boundaries we would expect to see very similar results amongst neighbouring regions. For example, mobile workers can cross boundaries to find employment in neighbouring areas.

Second, location and distance are important forces at work in human geography and market activity. Clustering of unemployment rates might occur because of the spatial pattern of employment growth (demand) including the distribution and concentration of industrial activity and the distribution of population characteristics such as job skills (supply), and some mismatch between them.

In this regard, there are several dimensions that underpin the importance of space. Neoclassical economists explain the poor rates of convergence in regional outcomes in terms of wage differentials, low labour mobility and related structural impediments. However, the disparity between unemployment rates in Europe declined between 2003 and 2008 as a result of generalised employment growth. With the onset of the GFC, regional unemployment rates in Europe have diverged again. The role of the persistence of demand constraints (not enough jobs being produced) across most regional labour markets and the fact that regional unemployment rates are highly related (inversely) to regional employment growth (see Mitchell and Carlson, 2005) suggests that employment growth dynamics will help to explain the spatial dynamics of unemployment rates.

Keynesian macroeconomics argues that regional employment variations are a function of variations in the distribution of industries across space and that the impact of aggregate factors is largely uniform within those industries. However, Mitchell and Carlson (2005) found that after decomposing national and industry-mix components from Australian employment growth, there were still significant regional effects left unexplained. Regional disparities received renewed emphasis in the 'new economic geography' and growth theory (Romer, 1986; Lucas, 1988; and Krugman, 1991). Spatially disaggregated analysis of the labour market appears to provide beneficial insights into internal forces and the ways external forces are transmitted via economic, social and political linkages (Maierhofer and Fischer, 2001). In this context, theoretical explanations of spill-overs also consider capital accumulation processes and knowledge externalities, which create agglomerations that influence firm locational decisions, and models of herds and information cascades (Banerjee, 1992; Audretsch and Feldman, 1996). Regional spill-overs are also most likely to exist in regions tightly linked by interregional migration, commuting and trade (Niehbuhr, 2001). Spill-over effects ensure the spread of local shocks to neighbouring regions (Molho, 1995; Topa, 2001).

Housing also may contribute to the clustering of unemployment rates as disadvantaged workers seek cheaper housing and/or cannot afford the costs of relocation as a local labour market deteriorates (Cameron and Muellbauer, 1998; OECD, 2005). Residential segregation, where people with similar educational backgrounds and socio-economic status locate in similar areas, intensifies over time (Suttles, 1970). Mobility then becomes an important factor in determining the extent of spatial dependence. European empirical evidence points to the strong effects of distance as an obstacle to migration. Intra- and extra-European Union (EU) mobility (migration) is "still a rather limited phenomenon … [restricted by] … language barriers, cultural differences, transferability of social security rights and recognition of educational degrees" (EuroFound, 2006: 15; see also Helliwell, 1998; Tassinopolous and Werner, 1999).

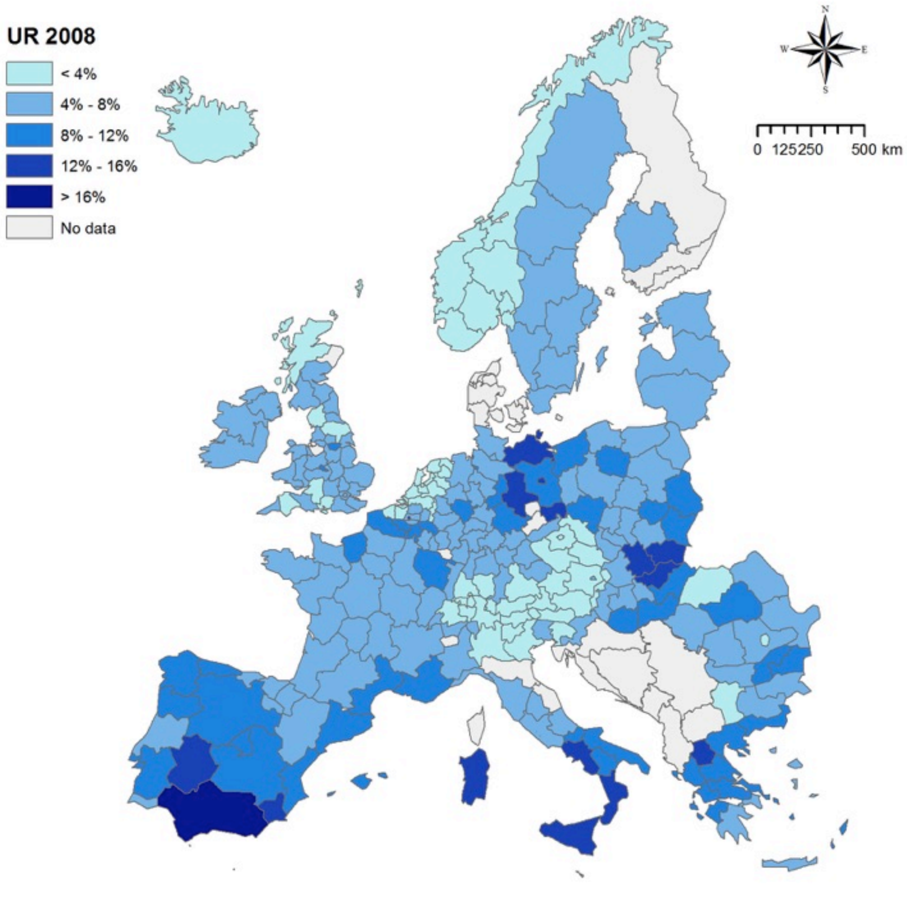
Local interactions need not be defined geographically, but can exist across a 'social distance', with a set of neighbours defined by an economic or social distance metric, such as occupation or ethnicity (Topa, 2001). The functioning of social networks and neighbourhood effects may be important determinants of the spatial patterning of economic outcomes (Massey *et al.*, 1994; Portes, 1998; Topa, 2001). For example, where social interactions are facilitated by spatial proximity, the quality and frequency of exchange of information may become dependent on the socio-economic composition of a person's suburb of residence. This may have significant implications for job-search, which in turn impacts on the overall suburb level of employment and the quality of job information available (Granovetter, 1973; Wilson, 1987; Portes, 1998). Peer group, role model and contagion effects may also mean that area composition matters; individual decisions and fortunes are transmitted across neighbourhoods, altering neighbourhood level outcomes (Durlauf, 2003). Wilson (1987) proposed that in areas of high long-term unemployment, isolation excludes residents from neighbouring job networks, which results in less effective job-search and ensuing welfare dependency increases and poverty traps. While the problem is in its source, a lack of job opportunities, the hysteretic effects on individual motivation entrench the problem and increase the costs (see Mitchell and Muysken, 2008).

While data availability limits the scope to which all these influences might be studied together, it remains that multivariate analysis is required to properly untangle the relative importance of these varying factors on the spatial patterning of unemployment in Europe. We need not only to control for labour demand and supply factors within a specific region, but also recognise that a region's fortunes may be dependent on those of its neighbours. This requires us to deploy the appropriate spatial modelling tools.

3. The spatial patterning of unemployment in Europe

Figures 1 and 2 plot official unemployment rates at the NUTS-2 level for Europe as at 2008 and 2013, respectively. They provide a visual snapshot of the changes that have occurred following the GFC. The early to mid part of the 2000s saw almost universal reductions in unemployment across Europe, as the relatively modest economic growth was still sufficient for employment growth to outstrip labour force growth. The average unemployment rate across the EU was 7.0 per cent in 2008, down from 9.1 per cent in 2003. Total employment grew by 7.5 per cent between 2003 and 2008 but was unevenly distributed across regions.

Figure 1 Regional unemployment rates, Europe, 2008



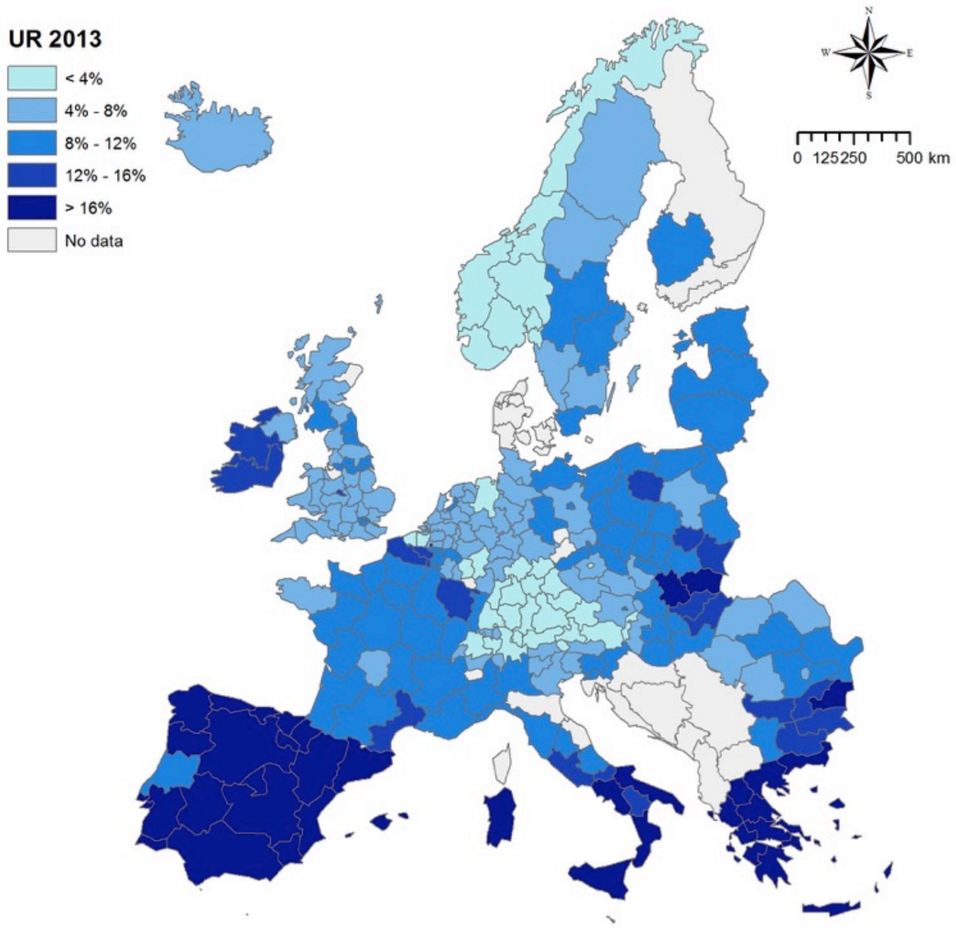
Source: see Data Appendix.

Note: UR is unemployment rate.

Significantly, Germany's unemployment fell during this period as it absorbed East Germany and introduced the Hartz reforms. Further, the persistently high unemployment in Southern Spain and Italy moderated. This period was also characterised by growing imbalances in trade between southern and northern Europe and housing booms in Ireland and Spain that drove unsustainable employment growth in construction and related sectors. The other notable feature of this period was the recovery of the Baltic States after the breakdown of the Soviet system. These states were also aided by housing booms. Figure 1 describes the situation in 2008.

The GFC began in earnest in the second half of 2008 with the collapse of the sub-prime mortgage market in the USA. The ensuing recession and the subsequent imposition of fiscal austerity under the Stability and Growth Pact (SGP) changed the European picture dramatically (see Figure 2). The first impacts in Europe manifested in Spain where the unemployment rate increased to 11.3 per cent in 2008 from 8.2 per cent in 2007; Ireland 6.0 from 4.6 per cent; and Italy 6.7 from 6.1 per cent. By 2009, all Member States recorded increased unemployment rates as employment growth turned sharply negative. In the period 2008 to 2013, total employment in the 261 NUTS-2 regions declined by 2.2 per cent and the variance across the sample increased relative to the 2003-08 period.

Figure 2 Regional unemployment rates 2013



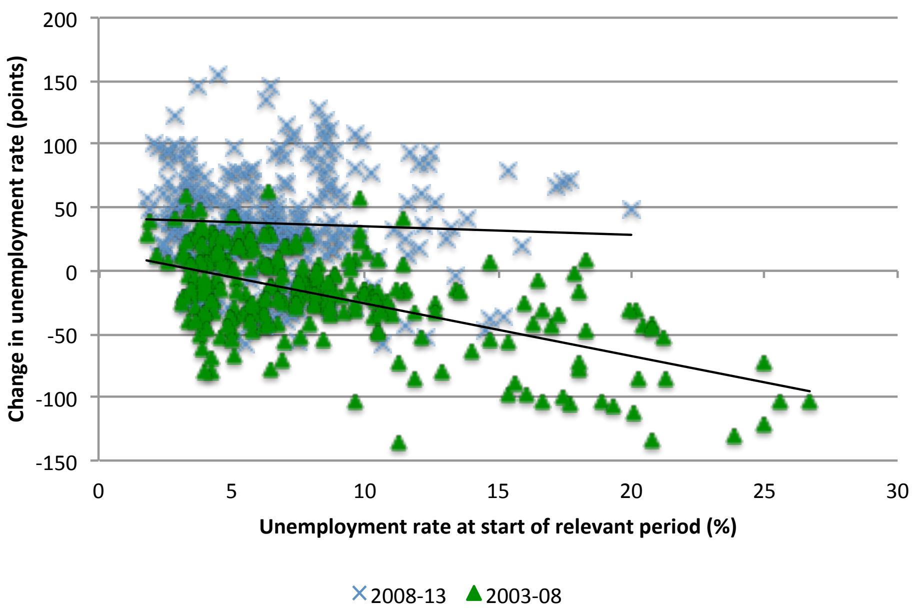
Source: see Figure 1.

Note: UR is unemployment rate.

The darkening of many parts of the European map by 2013 indicates that the level of unemployment had risen more or less uniformly throughout Europe through the crisis, with the main exceptions being most of Germany, Switzerland, and Norway. Relatively high unemployment rates persisted in Ireland (which had previously enjoyed low unemployment), all of Spain and most of Portugal, all of southern Italy, all of Greece, and parts of Hungary and Slovakia. Countries like Germany, Austria, Finland, Sweden and the UK peaked or plateaued in 2009 or 2010. Unemployment rates in Spain (26.1 per cent in 2013) and Greece (27.3 per cent in 2013) have been particularly severe as the policy austerity compounded the initial damage caused by the private spending collapse in 2008-09.

There was also some evidence of regression to the mean operating in the change in unemployment between 2003 and 2008, which vanished in the second period (2008-13) (see Figure 3). Regions with high unemployment did not have the largest changes in unemployment rates in the second period.

Figure 3 Persistence in regional unemployment rates, 2003-08, 2008-13



Source: see Figure 1 and authors' calculations. The lower straight line is a simple linear regression for the 2003-08 period and the upper line is the same for the 2008-13 period.

4. Exploratory Spatial Data Analysis of unemployment clustering

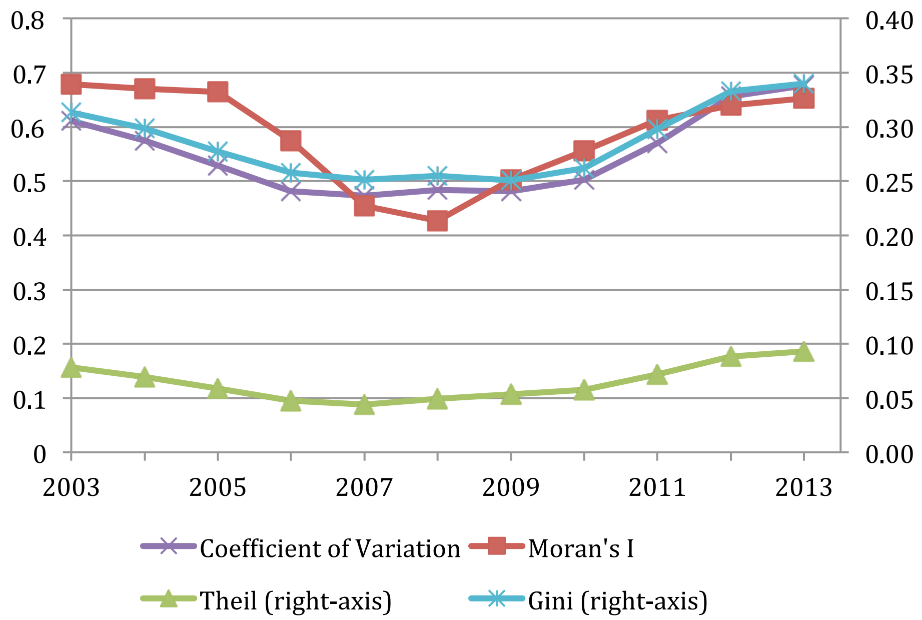
4.1 Introduction

Exploratory Spatial Data Analysis (ESDA) is a suite of statistical and mapping techniques aimed at visualising the spatial distribution of data, which helps us understand the economic phenomena portrayed in large and detailed maps. ESDA can identify 'atypical localisation' such as statistically significant patterns of spatial association - clusters or 'hot spots' and 'cold spots' (Anselin, 1995). We deploy these techniques to supplement standard measures of concentration (Theil Index, Gini Coefficient) and dispersion (Coefficient of Variation) to determine the degree of spatial dependence or concentration in regional European unemployment rates between 2003 and 2013.

The Theil Index and the Gini Coefficient both take the value of zero when there is perfect equality. A rising Index or Coefficient value indicates rising inequality. Figure 4 shows that while unemployment rate disparity in Europe declined between 2003 and 2007, all measures increased in the period 2009 to 2013. The increase in the concentration of unemployment was greatest from 2011 to 2012, well after the onset of the GFC, pointing to the damaging effect that policy austerity had on regional labour markets. By 2012, all measures of inequality had risen above their 2003 levels, erasing the convergence that had occurred in the growth period after 2003. Further, these patterns are dominated by changes between Member States, which all follow similar dynamic patterns. The within-country inequality is not as strong a factor in determining overall inequality in these statistical measures.

The spatial distribution of unemployment revealed in Figures 1 and 2 leads to the conjecture that unemployment rates in regions are heavily influenced by unemployment rates in neighbouring regions and that these associations have intensified between 2008 and 2013. To advance that conjecture we need to introduce spatial autocorrelation measures, which provide summary measures of the similarity or dissimilarity of spatially proximate values.

Figure 4 Concentration, dispersion and spatial autocorrelation of regional unemployment in Europe, 2003-2013



Source: Authors' calculations.

4.2 Global spatial autocorrelation

Global measures of spatial autocorrelation provide an index of comparison which helps us determine if the values of unemployment in our maps deviate from one which would exist if they were randomly assigned (Upton and Fingleton, 1985). Cliff and Ord (1973) extend the concept of spatial dependence beyond the non-random patterning of the data to embrace behavioural interactions between neighbouring regions. Thus, spatial dependence exists when a region has some quality or quantity that makes its presence more or less likely in neighbouring regions. The formal spatial econometric analysis in Section 5 examines the factors that might drive this dependence. Here, we focus on establishing the existence of spatial dependence in regional unemployment.

Spatial statistics employ a spatial weight matrix $\mathbf{W}$ to define the strength of connection between places, which Stetzer (1982: 571) notes represent "a priori knowledge of the strength of the relationship between all pairs of places in the spatial system." The weights are analogous to lag coefficients in autoregressive-distributed lag time series models. Unlike in time-series data where data points are ordered contemporaneously determining the order of observations in space is difficult as it is multidirectional. Various criteria are proposed in the literature to guide the specification of the weighting matrices, including "connectivity, contiguity, length of common boundary between political units, and various distance decay functions" (see Hordijk, 1979; Anselin, 1988). LeSage and Pace (2010) and LeSage (2014) advise researchers to use low-order contiguity structures and to avoid using multiple weight matrices to capture spatial effects in the equation and the error structures. Accordingly, we use a single, row-standardised matrix based on first-order contiguity to represent the connections between different regions, where $w_{ij} = 1$ if regions i and j touch and $w_{ij} = 0$ otherwise.

Moran's I statistic is a standard measure of global spatial autocorrelation (Moran, 1948), which provides an indication of the degree of linear association between the observation vector ($\mathbf{x}$) and a vector of spatially weighted averages of neighbouring values ($\mathbf{Wx}$). Moran's I statistic ranges from minus one to one, with zero indicating no spatial autocorrelation. Values above (below) zero reflect positive (negative) spatial autocorrelation. We reject the null of no spatial autocorrelation at the 5 per cent level of significance, if the standardised Moran I statistic is greater than 1.96.

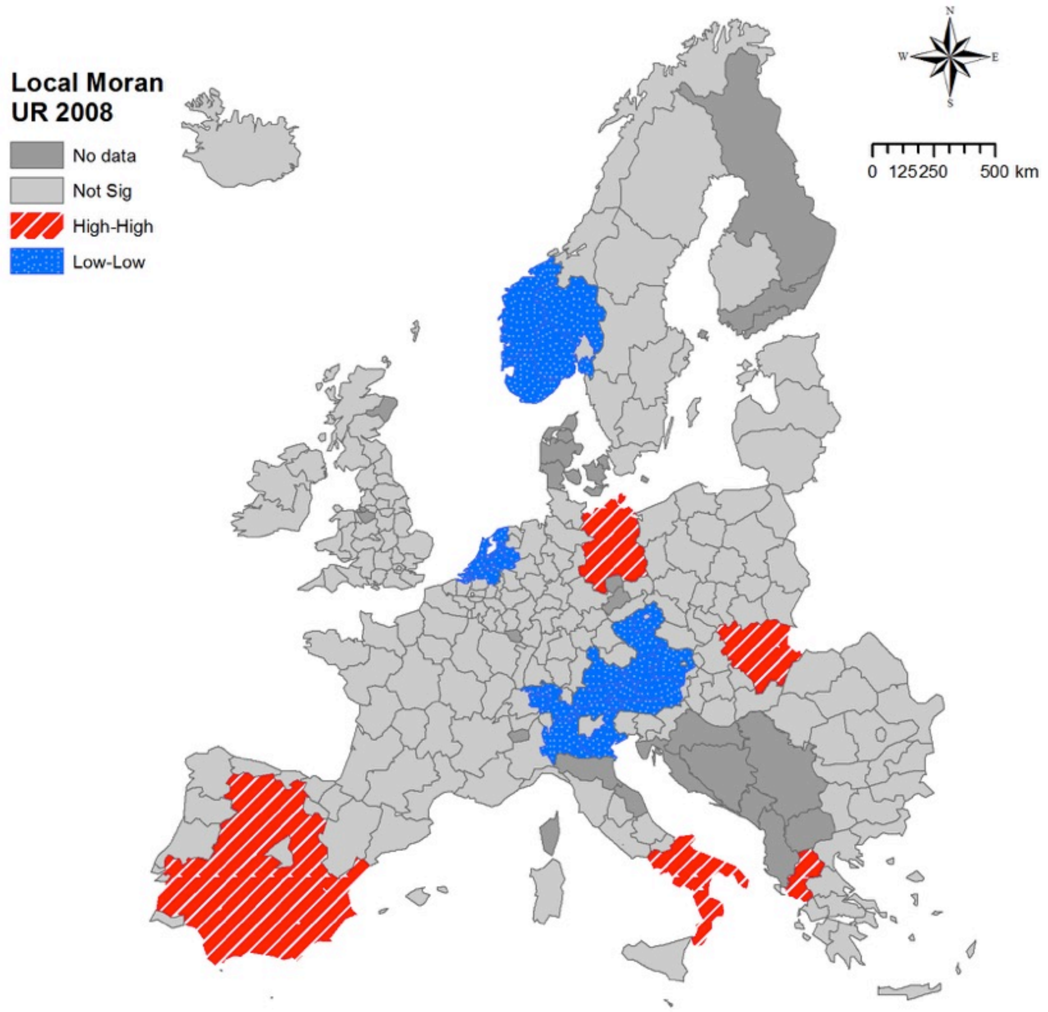
The Moran's I statistic for the unemployment rates across the 261 regions between 2003 and 2013 follows a similar trajectory to the standard dispersion measures (see Figure 4). The Moran's I statistics depicted in Figure 4 indicate the presence of statistically significant positive spatial autocorrelation for each year in the study period. Unlike the dispersion measures, Moran's I statistic reached its nadir in 2008 rather than 2007 and increased each year thereafter. Thus, spatial dependence in unemployment rates between contiguous regions was much stronger in 2013 than in 2008.

4.3 Local spatial autocorrelation – hot and cold spots

While our dataset reveals a globally significant trend towards clustering, global measures of spatial autocorrelation only offer 'averages', which may hide interesting micro-concentrations of spatial dependence. To overcome this limitation, local measures of spatial association (LISAs) are used to indicate if one or more local areas exhibit substantial deviation from spatial randomness (Anselin, 1995). Two measures, the local Moran's statistic (Anselin, 1995) and the Getis/Ord Local G_i statistic (Getis and Ord, 1992) detect significant spatial clusters of similar values. Both these local measures identify 'hot' and 'cold' spots where regions with high or low unemployment are adjacent. The local Moran's statistic also identifies areas where adjacent regions have significantly different data values. We concentrate on local Moran's statistic in the following discussion.

Figures 5 and 6 show the distribution of the local Moran statistics for the unemployment rates in 2008 and 2013, respectively. Figure 5 shows significant clusters of high unemployment throughout most of Spain and a region in Portugal, northern Germany, southern Italy, on the border of Slovakia and Hungary and northern Greece. Clusters of low unemployment rates occur throughout the Netherlands, in southern Norway, and in a wide region including northern Italy, Switzerland, Austria, the Czech Republic and a region in southern Germany.

Figure 5 Local Moran statistics for regional unemployment rates, 2008

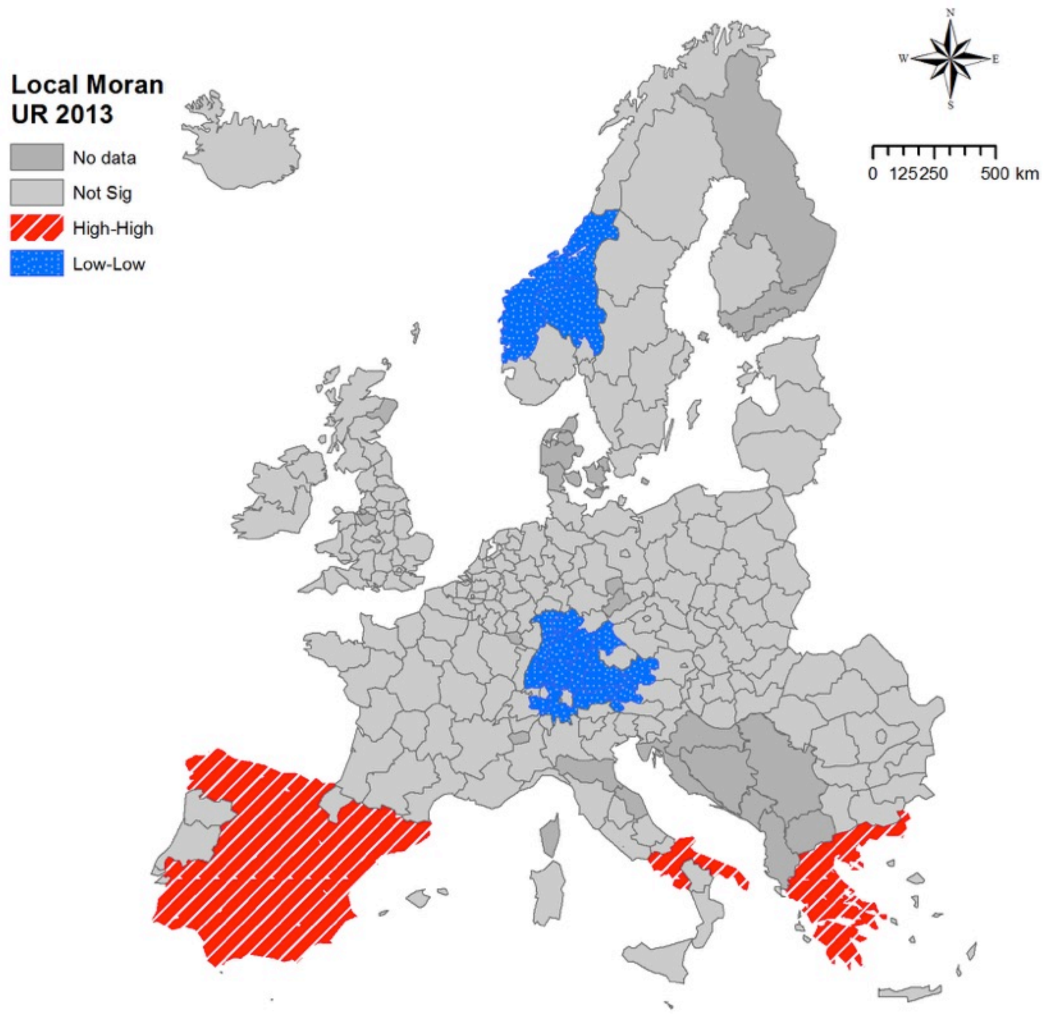


Source: See Figure 1 and Authors' calculations.

Note: UR is unemployment rate.

Figure 6 shows the result of the austerity measures, particularly in Spain, Portugal, Italy and Greece. By 2013, cold spots dominate the populated areas of Norway, while the Netherlands had lost its dominance among low unemployment regions. Finally, the cold spot in the middle of Europe shifted north, out of the Czech Republic and Italy, predominantly into Germany with some spill-over into Switzerland and Austria.

Figure 6 Local Moran statistics for regional unemployment rates, 2013

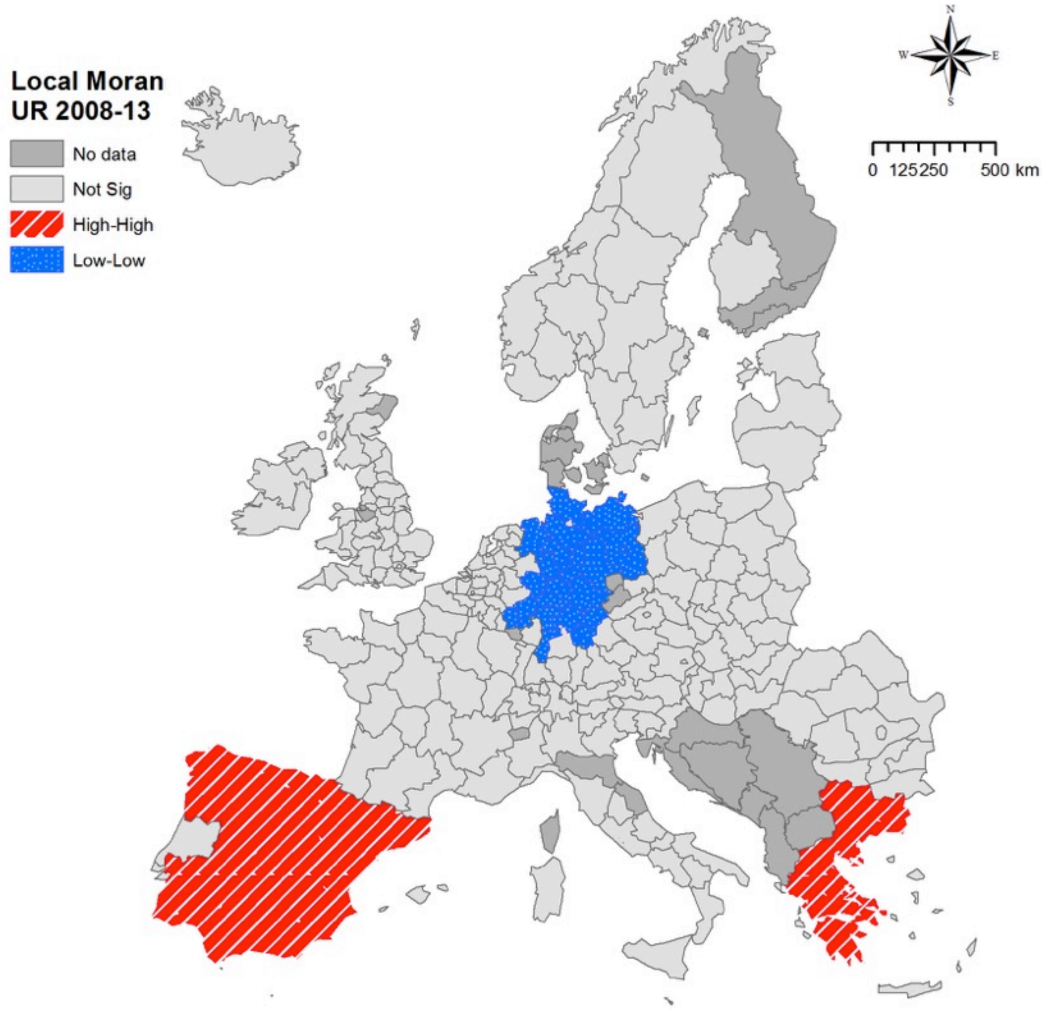


Source: See Figure 1 and Authors' calculations.

Note: UR is unemployment rate.

Figure 7 demonstrates the spatial distribution of the *change* in unemployment between 2008 and 2013. Only three large areas have statistically significant hot spots - Spain, Portugal and Greece, all of which have experienced high unemployment growth from 2008 to 2013. Conversely, most of Germany's regions cluster together in a 'cold' spot where they have experienced low, in most cases negative, unemployment growth.

Figure 7 Local Moran statistics for change in regional unemployment rates, 2008-2013



Source: See Figure 1 and Authors' calculations.

Note: UR is unemployment rate.

4.4 Cross-border clustering

Niebuhr (2002: 15) took into account cross-border effects in her spatial analysis of unemployment and observed that "cross border unemployment clusters like the area at the French-Belgian border indicate that unemployment clusters are not exclusively based on national differences". A detailed analysis of the existence of cross-border clustering in unemployment rates for 2013 shows the hot spots are largely confined within countries, specifically, Spain/Portugal, Italy and Greece. However, in the case of Spain and Greece, the cluster includes regions that share borders with other countries (France and Bulgaria, respectively). By definition, a region that is assigned a significant Local *I* value has surrounding regions that share similar values. Hence there is evidence of cross-border clustering in these border regions, despite the regions in the neighbouring countries not themselves becoming significant hot spots.

Local *I* analysis is generally more conservative than Local *G* in the regions included within a significant hot spot. Local *G* hot spots include a Bulgarian region, for example. Unfortunately there is no data for Macedonia or Albania, which also border Greece to the north or Turkey which shares a border to the west. Similarly, using the local *G* measure, we find more of Portugal is included in the Iberian hot spot, though it still doesn't extend into France.

The local *G* cold spot is also much wider than the Local *I* cold spot. Specifically it spreads through most of Germany and extends into the Netherlands and then into Belgium to the north-east; to a region in France and many in Switzerland to the south-east; through most of Austria and two regions in the north of Italy as well as a region in the Czech Republic. Similarly, the cold spot in Norway extends into a region in Sweden.

4.5 Summary

The results point to significant concentration and spatial dependence of unemployment in Europe, which has been exacerbated by the GFC and the subsequent austerity measures. Significant improvements that were made in reducing large areas of regional disparity through the mid part of the decade have been eradicated by the crisis and the subsequent policy choices. Further, the existence of some cross-border interaction suggests that the policy solution will involve European-wide measures.

5. Modelling the spatial dynamics of unemployment in Europe

5.1 The general spatial model

Anselin (2003) makes a distinction between 'global' and 'local range' spatial dependencies, which influences the choice and conceptual plausibility of various available spatial econometric specifications involving spatially lagged dependent variables (**Wy**), spatially lagged explanatory variables (**WX**) and spatially lagged error terms (**Wu**). LeSage (2014) refines the distinction and concludes that local spill-over specifications are appropriate when the impacts of one region on its neighbours "do not involve endogenous feedback effects" (LeSage, 2014: 3). However, if there is endogenous interaction, "changes in one region … set in motion a sequence of adjustments in (potentially) all regions … such that a new long-run steady state equilibrium arises" (LeSage, 2014: 4). We conjecture that the unemployment dynamics in Europe will exhibit both local and global influences, given the discussion in Section 2 and the central role that the European Commission plays in determining economic policy in the Member States.

Our general spatial model of the change in the unemployment rate $\Delta\mathbf{ur}$ over some specified time period is:

(1) $$\Delta\mathbf{ur} = \delta\mathbf{ur} + \rho\mathbf{W}\Delta\mathbf{ur} + \boldsymbol{\alpha}\Delta\mathbf{e} + \gamma\mathbf{W}\Delta\mathbf{e} + \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$$

This includes the unemployment rate level (**ur**) to capture persistence (mean regression) and the spatial lag term ($\mathbf{W}\Delta\mathbf{ur}$), where the coefficient ρ measures the average influence of the change in unemployment rates in neighbouring regions on the change in the unemployment rate in region *i*. The labour demand variable, $\Delta\mathbf{e}$ is the percentage employment growth in each region over the corresponding period and γ is the coefficient on the spatially lagged employment growth rate $\mathbf{W}\Delta\mathbf{e}$. This term captures the average-neighbour employment growth as an independent influence on each region's unemployment rate evolution. The coefficient on the spatially lagged regional employment growth, allows us to test whether the change in a region's unemployment rate is a function (expected to be negative) of its neighbour's employment growth. We could also generalise the right-hand side of Equation (1) to weight all explanatory variables, which would result in a fully specified spatial Durbin model. **X** is a matrix of variables to control for supply-side influences (see Niebuhr, 2002; Mitchell and Bill, 2004). The error term, $\boldsymbol{\varepsilon}$ takes different structures depending on the nature of the spatial dependence present (see below).

LeSage (2014: 10) concludes that the plethora of theoretical models identified by Anselin (1988) is "one obstacle confronting regional scientists" in their quest for knowledge. LeSage (2014: 5) argues that only two spatial versions of Equation (1) are plausible if local spatial effects are dominant: (a) "the spatial lag of X model (SLX)" such that $\rho = 0$ and the errors are well-behaved; or (b) the "spatial Durbin error model (SDEM)" such that $\rho = 0$ and $\boldsymbol{\varepsilon}$ contains a random term with finite variance and a spatially-lagged term (with coefficient λ), which suggests that the spatial spill-overs work through both channels. When global spill-overs dominate, LeSage (2014: 8) argues that the most plausible specification is the "spatial Durbin model (SDM)" which does not restrict ρ= zero. Endogenous spill-over effects thus also operate through the lagged dependent variable and the rest of the specification allows for "own-region characteristics **X**, and a matrix of characteristics of neighboring regions (**WX**) as additional explanatory variables" (LeSage, 2014: 8). In the context of Equation (1) a rise in the unemployment rate in one region and the commensurate income losses could impact negatively on aggregate spending in the neighbouring regions and drive their unemployment rates up. The multiplier spending effects would feedback through the spatial structure creating global effects. The SDM has well-behaved errors.

LeSage (2014: 10) also argues "only two model specifications" are "worth considering for applied work": the SDEM specification (for local spill-overs) and the SDM specification (for global spill-overs). This is because the SDEM model nests both the SLX model (if the errors are well-behaved) and the so-called spatial error model (SEM) if the spatial lags on the explanatory variables are insignificant and the errors are spatially correlated. In turn, the SDM specification nests the spatially-autoregressive model (SAR) if the coefficients on the weighted explanatory variables are uniformly zeros and the errors are well behaved.

It is clearly difficult to determine whether the local or global effects are driving the spatial dependence in data that is not finely grained. The best way forward is to estimate an array of spatial specifications and use diagnostic information to identify the most reasonable specification.

The data set also allows us to partition the decade between 2003 and 2013 into a growth sample (2003-08) and a crisis/austerity sample (2008-13) to test for differences between the two periods. This amounts to a test as to whether two separate equations are superior to a pooled model covering the entire decade. Further, we can also take advantage of the panel structure of the dataset with two time periods corresponding to our spatial cross-section. The use of the first-order contiguity spatial weight matrix will also allow for cross-border effects.

Employment growth is the primary indicator of the robustness in labour demand. However, employment growth may not necessarily reduce a specific region's unemployment rate. It is possible that an increasing dispersion in employment growth across regions contributes to higher unemployment rates. Further, if a region's industrial composition of employment is enjoying favourable circumstances, then its employment growth will be faster than the national average. However, this also may not necessarily reduce the region's unemployment rate. Blanchard and Katz (1992) show that it is possible that in-migration could absorb all the jobs created if the local workforce considered these jobs to be inferior or were unable to compete for the jobs as a result of skill mismatch/decay.

In addition to including the demand-side influence of employment growth (measured as the log ratio of employment between two years 2003-08 and 2008-13), we control for other, mostly supply-side, factors (computed at the start of the relevant sample period) including:

1. Economically active rate, which may measure supply (mobility) or demand (added or discouraged workers) factors.
2. Population Density to capture the density of local labour markets. Elhorst (2003a) argues that matching efficiency between labour demand and supply improves with increases in density and thus unemployment rates should be lower. The alternative is that dense markets may attract unemployed workers from other regions and the supply effects may increase the unemployment rate in that region (Niebuhr, 2002).
3. Skill variable proxied as the percentage of population 25-64 years of age with low secondary education levels. Higher levels of schooling reduce the odds of unemployment because education raises a person's productivity in the labour market, although it could equally be argued education is a screen for employers to determine a person's innate ability (Mitchell and Bill, 2004). Highly educated workers have better access to information about job opportunities and may be less reluctant to relocate to search for new employment (EuroFound, 2006). However, the human capital effect cannot be entirely interpreted in the context of ease of migration. In job-rationed regions, particularly those facing industrial retrenchment, lower skilled workers will be rationed out of employment first and unemployed workers display very low mobility rates (EuroFound, 2006).
4. Age variable proxied by the percentage of 15-24 year olds in region's population to capture the vulnerability of regions where higher proportions of the workforce have reduced workforce experience and higher intrinsic job turnover.
5. Industrial composition variables including proportion of manufacturing employment in a region's total employment and the proportion of services employment (embracing the statistical classification of economic activities in the European community (NACE Rev. 2) divisions Wholesale and Retail Trade, Transport, Accommodation and Food Services; Information and Communication; Finance and Insurance Activities; Real Estate Activities; Professional, Scientific and Technical Activities; Administrative and Support Service Activities; Public Administration; Defence; Education; Human Health and Social Work Activities Property and Business Services; Arts, Entertainment and Recreation; and Other Service Activities).
6. Industrial diversity index (RDI) – a modified Herfindahl index (Duranton and Puga, 1999). *RDI* is the inverse of the share of regional employment in industry *j* minus national share of employment in industry *j* summed over all industries present in a region at the start of the relevant sample period. The RDI for 2003 was based on the six industry breakdown for 2005 as this was complete for all 261 regions and for the eight industry breakdown for 2008.

7. Proportion of part-time employment in total employment to reflect increased vulnerability of job loss and increased incidence of underemployment, which we conjecture is positively related to unemployment (Mitchell and Bill, 2004)
8. Dummy variables for each of the countries (Germany the base case) to account for the unobserved heterogeneity in the sample arising from cultural similarities (Baltagi, 2001; Elhorst, 2003b).

5.2 Results and analysis

The first stage of the formal spatial econometric modelling involved estimating ordinary least squares (OLS) models for the change in unemployment rates between 2003-08 and 2008-13, then pooling the data and testing for stability using a conventional Chow Test. The results (not reported) overwhelmingly suggest that the restricted (pooled) regression is inferior to the two separate regressions. We also estimated a fixed effects panel model for the period 2003-13 with a time variable to test for time effects across the panels (see Elhorst, 2003b; Baltagi, 2001; Yesilyurt and Elhorst, 2014).[2] The results (not reported) concurred with the previous findings that the unemployment dynamics had changed significantly in the second period. But these results should be treated with care because in both the individual and pooled regressions, significant spatial autocorrelation was detected using the Moran's *I* test statistic and these results were generally supported using other spatial diagnostic test statistics. The Moran's *I* statistic for 2003-08 sample was 4.99, 3.54 for the 2008-13 sample, and 3.42 for the pooled 2003-13 sample.

Table 1 reports the various spatial regression models estimated for 2003-08, while Table 2 reports for 2008-13. We first estimated the SAR specification (1.1) and found the spatial lag (ρ) to be insignificant and the significant Moran's *I* test statistic indicates that spatial autocorrelation remains in the residuals. We thus eliminated that from our consideration. We then estimated the more general SDEM specification (1.2). The spatial coefficient on the error component, λ, is highly significant and there is no remaining spatial autocorrelation. The highly significant negative coefficient on the unemployment rate level term (UR2003) confirms that unemployment rates are persistent and regression to the mean is weak. The substantive finding is that employment growth is a dominant factor in explaining unemployment rate dynamics. The demand side is often ignored in studies that focus only on supply side determinants. Indeed, the major emphasis of the employability agenda underpinning labour market activism (post OECD, 1994) ignores the necessity for there to be sufficient job creation before job search can be effective.

The statistically significant negative economically activity effect (EA03) may be capturing a combination of mobile labour supply and/or added worker effects both of which would be consistent with that region having decreases or relatively small increases in its unemployment rates.

The significant negative coefficients on the proportion of workers in the region employed in manufacturing (Manu03) and services (Services03) indicate that the composition of industry helps to explain the dynamics of unemployment in each region. The results show that regions with a higher proportion of workers engaged in manufacturing have larger declines (or smaller increases) in their unemployment rate, other things equal. Similarly, regions with a higher proportion of workers in the services sector also enjoy greater reductions in the unemployment rate when it is falling and vice versa.

Population density (PopDensity03) is also highly significant. The positive sign means that the denser is the local population the larger are the changes in the unemployment rate. The other significant effect detected relates to low skills (LowEd03), which has the expected positive sign. None of the weighted explanatory variables were significant and are not reported. The signs on the country dummies are to be interpreted relative to the base case of Germany.

We then estimated special cases of the SDEM: the SEM (1.3) and the SDM (1.4). The magnitude and signs of the coefficient estimates are highly stable across all three specifications. The major difference being that the SDM specification finds some evidence of significant spatial interactions in the weighted terms WUR03 and WLowEd03. However, comparing the information loss using the AIC outcome and the elevated Moran's *I* statistic would suggest that the SDM specification is inferior to the SEM equation. The Likelihood Ratio test between the SEM and SDEM also pointed to the superiority of the SEM specification.

The results for the second period (2008-13) are quite different (Table 2). The spatial spill-over effects are more pronounced and the heterogeneity of the Member States is more diverse than in the earlier period. All four models are free of residual spatial autocorrelation. The SAR specification (2.1) can no longer be rejected. The spatial lag (ρ) is highly significant in (2.1) as it is in (2.3) and positive, which indicates that there is significant spatial dependence between the change in closely proximate regional unemployment rates such that an increase in rate in region *i* will tend to push up the rate in neighbouring regions. This result is consistent with the increased clustering of unemployment shown in Figure 2.

The increased strength of the employment growth effect across all four specifications relative to the earlier period is also notable. When economies experience a rise in job rationing as a result of deficient employment growth, the supply side variables can be best interpreted as shuffling people within the unemployment queue (Mitchell and Muysken, 2008). In this vein, the vulnerability of younger workers (FirstVote08) and low skill workers (LowEd08) is shown by their significant, positive coefficients. Interestingly, the significant coefficient on the proportion of part-time workers (PTEmp08) is negative, indicating, contrary to our surmise, that regions with higher proportions of workers engaged in part-time employment have smaller increases in their unemployment rate.

The other notable result is that the heterogeneity (fixed effects) captured by the country dummies are now more pervasive, and, mostly more severe than in the earlier period. Of particular note are the results for Greece (-0.34 to 0.71 for the corresponding SEMs), Spain (0.12 to 0.74), Italy (-0.26 to 0.49), and Portugal (-0.73 to 0.17), among the major European nations affected by the austerity period.

The signs and significance of these control variables are relatively robust across the various specifications. In determining the preferred specification, we note the AIC is smallest for the SDM and the original and robust Lagrange Multiplier tests indicate spatial lag being present in the dependent variable. Further, the Likelihood Ratio test between the SDM and SAR model pointed to the superiority of the SDM.

The SDM then points to three lagged explanatory variables also having a significant effect on unemployment. The positive sign of the lagged unemployment rate (WUR08) indicates that regions with neighbours with high unemployment rates in 2008 were more likely to have a higher increase in their unemployment rate through the period to 2013. Similarly, regions with neighbours with a high proportion of workers in the services industry (WServ08) were also more likely to see their unemployment rate increase. While higher population density in a region's neighbours saw a lower increase in that region's unemployment rate.

Table 1 Regression results, change in unemployment rate, 2003 to 2008, 261 regions

Variable	1.1 SAR	1.2 SDEM	1.3 SDM	1.4 SEM
UR2003	-0.30 ***	-0.39 ***	-0.39 ***	-0.34 ***
EMPG0308	-1.12 ***	-0.96 ***	-0.98 ***	-1.02 ***
EA03	-0.75 ***	-1.06 ***	-0.95 ***	-0.99 ***
RDI03	-0.01	-0.02	-0.02	-0.02
Manu03	-0.16 ***	-0.17 ***	-0.19 ***	-0.15 ***
Services03	-0.57 ***	-0.57 ***	-0.58 ***	-0.57 ***
PopDensity03	0.04 **	0.05 ***	0.05 **	0.05 ***
PTEmp03	-0.01	-0.02	-0.02	-0.02
FirstVote03	0.18	0.30	0.24	0.29 *
LowEd03	-0.09	0.17 **	0.15 *	0.13 *
WUR03		0.13	0.20 *	
WLowEd03		-0.13	-0.16 *	
Country Dummies				
Austria	-0.18 *	-0.13	-0.12	-0.16
Bulgaria	-0.60 ***	-0.69 ***	-0.50 ***	-0.74 ***
Czech Republic	-0.41 ***	-0.45 ***	-0.41 ***	-0.41 ***
Estonia	-0.30	-0.33	-0.32	-0.27
Greece	-0.29 *	-0.26	-0.19	-0.34 **
Spain	0.14	0.22	0.24 *	0.12
Ireland	0.31 *	0.53 **	0.37 *	0.46 **
Italy	-0.21 *	-0.15	-0.08	-0.26 *
Lithuania	-0.57 **	-0.57 **	-0.54 **	-0.53 **
Malta	-0.40	-0.40	-0.32	-0.50 *
Netherlands	-0.20 *	-0.09	-0.13	-0.15
Poland	-0.63 ***	-0.81 ***	-0.68 ***	-0.73 ***
Romania	-0.63 ***	-0.77 ***	-0.63 ***	-0.75 ***
Sweden	0.40 ***	0.37 **	0.35 **	0.45 ***
Slovenia	-0.32 *	-0.26	-0.22	-0.32 *
United Kingdom	0.12	0.21 *	0.18 *	0.12
ρ	0.079		0.170 *	
λ		0.400 ***		0.423 ***
LLR	92.20	104.42	99.82	99.17
AIC	-104.41	-108.83	-99.63	-118.34
LM error test	14.09 ***		7.07 **	
Moran *I* statistic	2.33 *	0.049	1.43	0.004

Source: Authors' calculations

Note: All variables in logs. Intercept not reported. Country dummies not reported if insignificant in all four models. All results are available on request from the authors. Significance codes: *** 0.001, ** 0.01, * 0.05. ML sigma is the Maximum Likelihood variance unsquared, LLR is the Log Likelihood and AIC is the Akaike Information Criteria. Germany is the benchmark nation.

Table 2 Regression results, change in unemployment rate, 2008 to 2013, 261 regions

Variable	2.1 SAR	2.2 SDEM	2.3 SDM	2.4 SEM
UR08	-0.37 ***	-0.39 ***	-0.37 ***	-0.42 ***
EG0813	-1.24 ***	-1.18 ***	-1.12 ***	-1.37 ***
PopDensity08	0.04 **	0.05 ***	0.06 ***	0.04 ***
PTEmp08	-0.20 ***	-0.18 ***	-0.17 ***	-0.20 ***
FirstVote08	0.50 ***	0.40 **	0.37 **	0.58 ***
LowEd08	0.12 *	0.08	0.07	0.10 *
WUR08		0.04	0.13 *	
WEG0813		-0.92 *	-0.40	
WServ08		0.34	0.41 *	
WPopDens08		-0.04	-0.05 *	
WPTEmp08		-0.10 *	-0.05	
WLowEd08		0.16 *	0.12	
Country Dummies				
Austria	0.07	0.11	0.13 *	0.11
Belgium	0.18 **	0.20 **	0.19 **	0.24 ***
Switzerland	0.29 ***	0.35 ***	0.31 ***	0.36 ***
Czech Republic	0.14	0.20	0.22 *	0.13
Greece	0.63 ***	0.46 ***	0.50 ***	0.71 ***
Spain	0.63 ***	0.41 ***	0.41 ***	0.74 ***
Finland	0.32 *	-0.01	-0.01	0.32 *
France	0.28 ***	0.23 ***	0.23 ***	0.34 ***
Ireland	0.45 ***	0.42 **	0.39 **	0.52 ***
Iceland	0.39 *	0.19	0.21	0.44 *
Italy	0.44 ***	0.35 ***	0.38 ***	0.49 ***
Lithuania	0.38 *	0.38 *	0.40 **	0.44 **
Malta	-0.18	-0.50 **	-0.48 **	-0.19
Netherlands	0.57 ***	0.65 ***	0.60 ***	0.66 ***
Poland	0.20 *	0.30 **	0.32 **	0.17
Portugal	0.40 **	0.13	0.17	0.53 ***
Sweden	0.38 ***	0.29 **	0.23 *	0.47 ***
Slovenia	0.51 ***	0.48 ***	0.52 ***	0.51 ***
United Kingdom	0.20 ***	0.19 **	0.19 **	0.26 ***
ρ	0.161 ***		0.197 **	
λ		0.247 **		0.298 ***
LLR	152.77	166.5	167.20	148.59
AIC	-225.54	-233.0	-234.41	-217.18
LM error test	0.75		0.10	
Moran *I* statistic	0.818	0.408	0.242	0.416

Source: Authors' calculations

Note: see Table 2. The variables EA08, RDI08, Manu08 and Serv08 were never statistically significant and are not reported for brevity.

6. Conclusion and policy implications

Traditional measures of concentration and dispersion (Theil Index, Gini Coefficient and Coefficient of Variation) indicate that regional inequality fell across the 261 regions between 2003 and 2008 but rose sharply from 2009 such that the gains from convergence in the earlier growth period were wiped out by 2013. Further there is strong evidence of significant clustering of regional unemployment in Europe. The non-random patterning of unemployment intensified between 2008-13 (Figure 4).

The formal spatial econometric modelling reveals that OLS regressions of the change in the unemployment rate in either period (2003-08, 2008-13, 2003-13), with controls for demand and supply side variables, suffered significant spatial autocorrelation in the residuals. Various spatial econometric specifications were estimated, controlling for demand and supply characteristics but incorporating spatially lagged unemployment rates and employment growth. The results confirm that significant spatial effects exist, that is, a change in one region's unemployment or employment growth rate impacts positively on proximate regions' unemployment rates. This dependence endures even after controlling for the underlying similarities in population composition, rates of economic growth and labour force participation between nearby regions. As a result, we conclude that the presence of significant spill-overs between regions magnify local responses to national economic phenomena.

The different elements of the analysis demonstrate that the spatial pattern of unemployment in Europe changed significantly between 2008 and 2013, when compared to the period 2003 to 2008. While the GFC was clearly a very damaging event, the results suggest that the imposition of policy austerity intensified the spatial dependence in regional unemployment rates.

With policy austerity paramount, labour market policy has concentrated on supply-side measures aimed to increase skills and participation. Past research would suggest that this approach ignores the fundamental determinant of high rates of labour underutilisation - a lack of jobs and the spatial spill-overs, which magnify the demand deficiency. A unique characteristic of our approach has been to include both demand- and supply-side influences in the formal models.

Direct intervention in the form of job creation programs in regions with strong spill-overs or interactions will promote higher overall employment growth, as effects ripple out to neighbours magnifying the initial growth stimulus. The development of economies of agglomeration, improvement in the size and efficiency of information flows (including technology and job-networks), increased market efficiency and associated higher levels of capital investment will lead to greater resilience against economic shocks for the region and its neighbours.

Further, previous research has found that unemployment hotspots span national boundaries. We find some supporting evidence of cross-border dependence. This suggests that policy solutions to reduce unemployment must be supra-national rather than confined to specific regions and should include demand measures, preferably those that immediately stimulate employment growth, given the persistence of the unemployment rates (Figure 3).

Data Appendix

All data was sourced from Eurostat, September 3, 2014.

Variable	Eurostat table
UR	Unemployment rates by sex, age and NUTS 2 regions [lfst_r_lfu3rt]
Employment Growth	Employment by sex, age and NUTS 2 regions (1 000) [lfst_r_lfe2emp]
Economically Active	Economic activity rates by sex, age and NUTS 2 regions (%) [lfst_r_lfp2actrt]
RDI, Manufacturing, Services	Employment by economic activity and NUTS 2 regions (NACE Rev. 2) - 1 000 [lfst_r_lfe2en2] and Employment by economic activity and NUTS 2 regions (1999-2008, NACE Rev. 1.1) - 1 000 [lfst_r_lfe2en1]
Population Density	Population density - NUTS 3 regions [demo_r_d3dens]
Part-time Employment	Employment by full-time/part-time, sex and NUTS 2 regions (1 000) [lfst_r_lfe2eftpt]
First Voters	Population on 1 January by five years age groups and sex – NUTS 2 regions [demo_r_pjangroup]
Low Education	Population aged 25-64 with lower secondary education attainment by sex and NUTS 2 regions [edat_lfse_09]

References

Anselin, L. (1988) *Spatial Econometrics: Methods and Models*, Kluwer Academic, Dordrecht.

Anselin, L. (1995) 'Local Indicators of Spatial Association – LISA', *Geographical Analysis*, 27, 92-115.

Anselin, L. (2003) 'Spatial externalities, spatial multipliers and spatial econometrics', *International Regional Science Review*, 26(2), 153-166.

Audretsch, B. and Feldman, M.P. (1996) 'R&D spillovers and the geography of innovation and production', *American Economic Review*, 86, 630-39.

Baltagi, B.H. (2001) *Econometric Analysis of Panel Data*, John Wiley and Sons, Chichester.

Banerjee, A.V. (1992) 'A simple model of herd behavior', *Quarterly Journal of Economics*, 107(3), 797-818.

Blanchard, O.J. and Katz, L.F. (1992) 'Regional evolutions', *Brookings Papers on Economic Activity*, 1, 1-73.

Cameron, G. and Muellbauer, J. (1998) 'The housing market and regional commuting and migration choices', *Scottish Journal of Political Economy*, 45(4), 420–46.

Cliff, A.D. and Ord, J.K. (1973) *Spatial Autocorrelation*, Pion, London.

Cliff, A.D. and Ord, J.K. (1981) *Spatial Processes*, Pion, London.

Davies, S. (2011) 'Regional resilience in the 2008-2010 downturn: comparative evidence from European countries', *Cambridge Journal of Regions, Economy and Society*, 4, 369-382.

Donald, B., Glasmeier, A., Gray, M. and Lobao, L. (2011) 'Austerity in the city: economic crisis and urban service decline?', *Cambridge Journal of Regions, Economy and Society*, 7, 3-15.

Duranton, G. and Puga, D. (1999) 'Diversity and specialisation in cities: why, where and when does it matter?', *Centre for Economic Performance,* Discussion Paper No. 433.

Durlauf, S. (2003) *Neighborhood Effects*, mimeo, Department of Economics, University of Wisconsin.

Elhorst, J.P. (2003a) 'The mystery of regional unemployment differentials: theoretical and empirical explanations', *Journal of Economic Surveys*, 17(5), 709-748.

Elhorst, J.P. (2003b) 'Specification and estimation of spatial panel data models', *International Regional Sciences Review*, 26(3), 244-268.

EuroFound (2006) *Mobility in Europe,* European Foundation for the Improvement of Living and Working Conditions, Dublin.

Getis, A. and Ord, K. (1992) 'The analysis of spatial association by use of distance statistics', *Geographical Analysis*, 24, 189-206.

Granovetter, M. (1973) 'The strength of weak ties', *The American Journal of Sociology*, 78(6), 1360-1380.

Groot, S.P.T., Mohlmann, J.L., Garretsen, J.H. and de Groot, H.L.F. (2011) 'The crisis sensitivity of European countries and regions: stylized facts and spatial heterogeneity', *Cambridge Journal of Regions, Economy and Society*, 4, 437-456.

Helliwell, J.F. (1998) *How Much Do National Borders Matter?,* Brookings, Washington DC.

Hordijk, L. (1979) 'Problems in estimating econometric relations in space', *Papers of the Regional Science Association*, 42, 99-115.

Kitson, M., Martin, R. and Tyler, P. (2011) 'The geographies of austerity', *Cambridge Journal of Regions, Economy and Society*, 4, 289-302.

Krugman, P. (1991) *Geography and Trade*, MIT Press, Cambridge.

LeSage, J.P. (2014) 'What regional scientists need to know about spatial econometrics', *mimeo*, Department of Finance and Economics, Texas State University-San Marcos.

LeSage, J.P. and Pace, R.K. (2010) *The Biggest Myth in Spatial Econometrics*, Available at http://dx.doi.org/10.2139/ssrn.1725503.

Lucas, R. (1988) 'On the mechanics of economic development', *Journal of Monetary Economics*, 22, 3-42.

Maierhofer, E. and Fischer, M. (2001) 'The tyranny of regional unemployment rates – conceptual, measurement and data quality problems', Paper presented to the *41st Congress of the European Regional Science Association*, Zagreb.

Martin, R. (2011) 'The local geographies of the financial crisis: from the housing bubble to economic recession and beyond', *Journal of Economic Geography*, 11, 587–618.

Massey, D.S., Arango, J., Hugo, G., Kouaouci, A., Pellegrino, A. and Taylor, J.E. (1994) 'An evaluation of international migration theory: The North American case', *Population and Development Review*, 20(4), 699–749.

Mitchell, W.F. and Carlson, E. (2005) 'Exploring employment growth disparities across Metropolitan and Regional Australia', *Australasian Journal of Regional Studies*, 11(1), 25-40.

Mitchell, W.F. and Bill, A. (2004) 'Spatial dependence in regional unemployment in Australia', in Carlson E. (ed) *A Future that works: economics, employment and the environment*, Proceedings of the 6th Path to Full Employment Conference and the 11th National Conference on Unemployment, 312-326.

Mitchell, W.F. and Muysken, J. (2008) *Full Employment Abandoned: Shifting Sands and Policy Failure*, Edward Elgar, Aldershot.

Molho, I. (1995) 'Spatial autocorrelation in British unemployment', *Journal of Regional Science*, 35(4), 641-658.

Monastiriotis, V. (2011) 'Making geographical sense of the Greek austerity measures: compositional effects and long-run implications', *Cambridge Journal of Regions, Economy and Society*, 4, 323-337.

Moran, P. (1948) 'The interpretation of statistical maps', *Journal of the Royal Statistical Society, Series B*, 10(2), 243-251.

Niebuhr, A. (2001) 'Convergence and the effects of spatial interaction', *HWWA Discussion Paper 110*, Hamburg Institute of International Economics, Hamburg.

Niebuhr, A. (2002) 'Spatial dependence of regional unemployment in the European Union', *HWWA Discussion Paper 186*, Hamburg Institute of International Economics, Hamburg.

OECD (1994) *The Jobs Study, Facts, Analysis, Strategies*, OECD, Paris.

OECD (2005) *Employment outlook*, OECD, Paris.

Portes, A. (1998) 'Social capital: origins and applications', *Annual Review Sociology*, 24, 1–24.

Romer, P.M. (1986) 'Increasing Returns and Long-Run Growth', *Journal of Political Economy*, 94, 1002-1037.

Rowthorn, R. (2010) 'Combined and uneven development: reflections on the North-South divide', *Spatial Economic Analysis*, 5(4), 363-388.

Stetzer, F. (1982) 'Specifying weights in spatial forecasting models: the results of some experiments', *Environment and Planning A*, 14(5), 571-584.

Suttles, G. (1970) *The Social Construction of Communities,* University of Chicago Press, Chicago.

Tassinopoulos, A. and Werner, H. (1999) 'To Move or Not to Move. Migration in the European Union', *IAB Labour Market Research Topics 35*, IAB, Nurenberg.

Upton, G.J. and Fingleton, B. (1985) *Spatial Data Analysis by Example, Volume 1: Point Pattern and Quantitative Data*, Wiley, Toronto.

Topa, G. (2001) 'Social interactions, local spillovers and unemployment', *Review of Economic Studies*, 68, 261-295.

Wilson, W.J. (1987) *The Truly Disadvantaged*, University of Chicago Press, Chicago.

Yesilyurt, F. and Elhorst, J.P. (2014) 'A regional analysis of inflation dynamics in Turkey', *Annals of Regional Science*, 52, 1-17.

---

1 The authors are Director of Centre of Full Employment and Equity and Professor of Economics, at the University of Newcastle, Australia (Mitchell) and Research Officer, Centre of Full Employment and Equity (Flanagan). Administrative assistance was received from Melinda Hannan (CofFEE).

2 The R package SPDEP was used for all spatial econometric work other than the panel estimation, which deployed the Stata XSMLE package.