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Regional Unemployment in the EU before and after the Global Crisis

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ABSTRACT

In this paper we empirically assess the evolution for the EU regions of both employment and unemployment before and after the Global Crisis. After a review of the literature on the theories and key determinants of regional unemployment, we shall overview the main findings concerning the labour market impact of the Global Crisis. The empirical analysis will initially be carried out at the national level including all EU countries; subsequently, we shall focus on the EU regions (at the NUTS-2 level), in order to detect possible changes in the dispersion of regional unemployment rates after the crisis. Our econometric investigations aim to assess the effect, on labour market performance, of previous developments in regional labour markets time series, as well as the importance of structural characteristics of the labour markets, in terms of the sectoral specialization of the regional economies. In fact, the local industry mix may have played a crucial role in shaping labour market performance in response to the crisis. In addition, we consider further characteristics of the regional labour markets, by including indicators of the level of precarization of labour and of the share of long-term unemployed, as indicators of the efficiency of the local labour markets. From a methodological viewpoint, we exploit eigenvector decomposition-based spatial filtering techniques, which allow us to greatly reduce unobserved variable bias – a significant problem in cross-sectional models – by including indicators of latent unobserved spatial patterns. Finally, we render a geographical description of the heterogeneity influence of past labour market performance over the crisis period, showing that the past performance has a differentiated impact on recent labour market developments.

Keywords: crisis, employment, unemployment, European Union, NUTS-2, spatial filtering, sectoral composition, spatially heterogeneous parameters

JEL codes: C21, R12

1. Introduction

The 2007–08 financial crisis and the subsequent Great Recession have had deep effects on labour markets, with employment cuts (delayed, in some European countries, by labour-hoarding practices and working hours adjustments) and consequent increases in unemployment, which are likely to become persistent over time, at least partially. Labour market impacts of the crisis have been heterogeneous between and within countries. They have been deeper in areas specialized in construction (which, in the previous decade, was one of the most dynamic sectors, at least in some countries) and also – during the general fall of production of 2009 – in many manufacturing activities.

Spatial linkages between regions have been shown to be important in the past in affecting the performance of regional economic systems and labour markets. Many studies have discussed the importance of such links, both from a theoretical viewpoint (e.g., in a neoclassical, factor-mobility perspective, or within a new economic geography framework) and from an empirical viewpoint, employing varying econometric techniques, such as (spatial) dynamic panel or spatial VAR models. In particular, the existence, persistence and evolution of the regional differences in the labour market performance have been largely studied, especially in recent literature (e.g., Perugini & Signorelli, 2010). However, the growing literature investigating the labour market impact of the last crisis regarded - until now - especially the national level (e.g., Arpaia & Curci, 2010), while the regional analyses have been extremely rare (e.g., Demidova & Signorelli, 2011).

In this paper we aim to assess the regional labour market impact of last crisis in the European context by taking into account of the potential effects of (i) the previous regional (un)employment dynamics, (ii) the sectoral composition and (iii) some structural characteristics of the labour markets.

First of all, we think it is interesting to investigate if the most penalized regions have been the weakest ones – i.e. where unemployment was high even before the crisis – or if there has been an 'inversion' causing a bigger impact on the previous best-performing regions. In addition, the local industry mix may have played a crucial role in shaping the labour market performance of regional economies before the crisis and in particular, likewise, in determining their response to the following (crisis) period. Finally, we also consider some characteristics of the regional labour markets, by including indicators of the diffusion of 'temporary contracts' and of the weight of long-term unemployment.

The empirical analyses have been carried out for both employment and unemployment dynamics in order to control for the behaviour of labour supply, potentially relevant in

explaining the unemployment changes over the business cycle (the 'discouraged worker effect' is particularly important in influencing the propensity to work of women and young people, especially after a deep macroeconomic shock).

As for the policy implications of our study, it should be noted that the regional level is particularly important both in terms of the EU's cohesion objectives, and also considering that, in the multilevel policy design of several European countries, key labour market policies have been decentralized at the sub-national level (e.g., Signorelli, 2008). On the other hand, labour market indicators – such as the employment rate – are still at the centre of the new 'Europe 2020' strategy.

The structure of the paper is as follow. Section 2 includes a review of the main literature on the theories and empirical evidence about unemployment dynamics at the regional level. The labour market impact of the recent Global crisis is discussed in Section 3. An introductory statistical evidence concerning unemployment in the EU countries and regions is presented in Section 4. Our econometric investigations are presented and commented in Section 5. Section 6 concludes.

2. Literature Review

Unemployment has been traditionally studied at the national level. The main national determinants have been found in active labor market policies, unemployment benefits, benefit duration, benefit replacement ratio, tax wedge, degree of coordination, degree of centralization, union density, and union coverage (see Garcilazo & Spiezia, 2007; Nickell, 1997). Blanchard & Wolfers (2000), among others, focus on the interaction between institutional arrangements and economic shocks (especially to explain differences in cross-sectional unemployment rates); on the other hand, Belot and van Ours (2004) investigate the evolution of unemployment over time by interacting institutions and changes in institutions.

The regional dimension of unemployment has been paid attention to since the work of Blanchard and Katz (1992). Regional unemployment differentials are wide and persistent, and low unemployment regions tend to cluster close to each other. Moreover, such differentials show a clear and persistent core-periphery pattern (European Commission, 2002), since high and persistent unemployment is concentrated in peripheral regions. Wage rigidities, low labour mobility and specific labour market institutional factors make the effects of the (otherwise temporary) aggregate demand shocks more persistent (see Bentolila & Bertola, 1990).

Empirical investigations on regional unemployment differentials employ a wide range of variables (for a survey, see Elhorst, 2003). Many explanatory variables are negatively correlated with regional unemployment, such as GDP per capita, industry concentration, participation rate, other variables are positively correlated with it, such as the weight of young people on the population or the presence of 'amenities' in the region. More recently Basile and De Benedectis (2008) stressed the importance of labour productivity.

Among the structural determinants, the sectoral specialization of regions received a special attention. Marelli (2006) emphasized its importance in explaining the evolution of employment in a large sample of (NUTS-2) EU regions[1]; national borders are not particularly significant in singling out clusters of regions with similar patterns of employment growth (in particular, manufacturing employment seems better correlated across regions than aggregate employment).

The effect of sectoral specialization has been analysed on regional unemployment rates as well. Izraeli and Murphy (2003), considering the US case, discovered that an increase in industrial diversification (i.e. a fall in sectoral specialization) reduces regional unemployment rates. However it seems that in Europe the institutional elements are likely to modify such relation: in fact, the relationship between regional specialization [2] and the regional unemployment rate is stronger in countries with intermediate collective bargaining institutions – only in these countries policies aiming at fostering regional diversification might be useful – in comparison to countries with centralized collective bargaining institutions (see Longhi et al., 2005).

A different strand of literature focuses – rather than on long-run structural determinants – on a business cycle perspective. For example, Belke and Hein (2006) examine the degree of correlation among EU regional employment cycles; their empirical result (derived from a dynamic panel data model estimated for pairs of regions by within groups) is that synchronicity between regions has declined; differently from national business cycles between countries that have become more synchronized. The main reason relates to differences in regional industry structure (they use a number of indices of specialization); in

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[1] Moreover, the results confirm the growing integration of European regions, extended to many EU countries (the alleged existence of a core of regions located in Northern Europe with more uniform employment dynamics is not corroborated).
[2] The question of whether specialization of European regions is increasing or decreasing over time is still debated. For example, Marelli (2007) found – by using different specialization indices – that for the aggregate economies structural convergence is a widespread phenomenon across European countries and regions, but within the industrial sector and within market services specialisation trends are more mixed (with concentration prevailing is some industrial activities).

fact, employment growth is more synchronized when regions are similar in their sectoral structure.

This outcome is more thoroughly explained in Belke (2007), where it is related to the theories – and empirical evidences – concerning the so-called 'endogenous' optimum currency areas. The existence of endogenous mechanisms leading to 'real' convergence of the economies is one of the factors underlying the success or failure of the European Monetary Union (see also Marelli & Signorelli, 2010a). On the other hand, the possibility that regional economies exhibit business cycles different from the national ones was originally stressed by Fatàs (1997).

More specific studies concern either particular sub-sets of European regions or certain elements causing unemployment or its persistence. As to the first line of research, the regional labour market performance evolutions in the 'old' EU countries and their determinants have been investigated in Perugini and Signorelli (2007). On the other hand, the evolution in New member states (NMS) of EU, former transition countries, has also been analysed and compared to 'old' EU countries (e.g. Perugini & Signorelli, 2010). A comprehensive survey on regional labour market developments in transition countries can by found in Huber (2007). A more specific research, by Tyrowicz and Wòjcik (2010), investigates (by means of beta, sigma and stochastic convergence methods) convergence in regional unemployment rates of three transition countries; regions exhibiting the higher persistence, together with low mobility in the national distributions, are those with relatively high or relatively low unemployment rates.

Bornhorst and Commander (2006) investigate the persistence of regional unemployment rates in six major transition countries; despite increasing wage flexibility, employment creation has suffered in regions of high unemployment and labour mobility remains limited; they also provide some policy suggestions (e.g. policies addressing housing market imperfections and information asymmetries). A similar feature common between NMS and old EU is that a substantial part of the adjustment to asymmetric shocks is carried by participation decisions, while migration plays a small role (see Gács & Huber, 2005). Regional variation in inherited human capital (within countries) is also relevant in explaining regional unemployment differentials: according to Jurajda and Terrell (2009), human capital explains the bulk of regional variation in unemployment of four post-communist countries; the dispersion of human capital across regions is largely explained by its distribution at the end of communism. Furthermore, the divergence of regional unemployment and wage rates is also influenced by the migration patterns of workers by skill and by the flow of foreign capital:

more educated workers and FDI flow to regions with a higher concentration of educated workers.

Some other variables, specifically considered for transition countries, are institutional in character. For instance, Marelli and Signorelli (2010b), in order to explain employment growth in a large sample (at the NUTS-3 level of disaggregation) of regions in eight transition countries, included an index of 'progress in transition' (computed from the EBRD statistics); the key finding was a negative effect of the 'transition index' on employment growth in a first period (1990-2000) that became positive in the years after 2000 (in fact the initial privatizations and market reforms were accompanied by rationalizations and restructuring processes causing negative effects on employment).[3]

For both NMS and 'old' EU countries some other institutional elements have been considered[4]: e.g. the wage bargaining system. A high regional employment differentiation may be the consequence of a centralized wage bargaining system that causes a low regional wage differentiation. Vamvakidis (2009) provides empirical evidence for the EU regions for the period 1980-2000. An interesting question is raised by Galbraith and Garcilazo (2010), i.e. whether there is a trade-off between pay inequality and unemployment rates, but their empirical analysis (referred to 187 European regions and 16 industrial sectors) shows no trade-off, since lower pay inequality is generally associated with a lower regional unemployment rate. The important policy implication is that cohesion is a useful and even a necessary condition for enhanced efficiency in Europe's labour markets, reducing both unemployment and economic migration.

Last but not least, many studies found that the regional distribution of unemployment rates is more dependent on spatial elements and geographic location (neighborhood effects) than on national factors (state effects) including labour market institutions. The underlying theories refer mainly to the New Economic Geography models. Garcilazo and Spiezia (2007), by considering not only the two types of effects but also some joint effects, came to the conclusion (through a methodology based on nonparametric stochastic kernels) that neighborhood effects are really stronger (than state effects) in Europe – as originally discovered in the oft-cited work by Overman and Puga (2002) – whereas in North America also joint effects are important. The policy implication is that in Europe labour market

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[3] Another major result of the paper is that regional divergence *within countries* co-exists with convergence *between countries*; but this evidence, although stronger for transition countries (in which the clustering of employment and economic activities in the regions where capital cities are located is especially clear), is shown also by Western EU regions (as already found in Marelli, 2007).

[4] The specific determinants of regional youth unemployment rates in the European context have been investigated by Perugini and Signorelli (2010).

policies alone are not able to reduce unemployment if not accompanied by measures to generate agglomeration economies.

3. The Labour Market Impact of the Last Crisis

The last crisis began as financial crisis at the end of 2007; its deepest impact on financial markets (with Lehman Brothers default) was in September 2008, when the real effects initially developed. The deepest fall in production was reached in the first half of 2009 and led to increasing unemployment rates during 2009. After US and 'old' EU countries, the second round of adverse effects of crisis appeared in transition and developing countries (although China and India were only slightly affected by the crisis).[5] The real effects (on output, income, etc.) of financial crises are always *lagged* and the labour market effects are even more lagged.

Moreover, not only such effects have been delayed, but they have been significantly heterogeneous, differing across countries and regions. The intensity of the reaction depends upon various factors: e.g. country reliance on international trade, dependence on natural resources, financial liberalization of banking system, fiscal resources at government disposal, and so on.

As for labour market impact, the different employment adjustments depend on institutional frameworks and labour hoarding phenomena. We can find two main types of adjustments[6]:

1) in the most 'flexible' countries, such as the United States, Ireland, the Baltic states and also Spain (in the latter case because of the huge number of temporary contracts), employment has been cut rapidly and deeply, helping to maintain labour productivity (that exhibited in some countries a counter-cyclical pattern), but at cost of the high increases in unemployment;

2) on the opposite side, some other countries (like Germany, Japan, the Netherlands, Denmark and Italy) experimented less remarkable employment effects, thanks to more significant labour hoarding practices, working hour adjustments and specific policy measures[7]; moreover, in some countries (especially in Italy) the fall in labour demand

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[5] In the world, the financial crisis harmed initially the US, the UK, Ireland, Spain and smaller countries (Iceland, Greece, the Baltic States). On the contrary, the largest output (real GDP) reductions in 2009 have been recorded – among the biggest countries – in Japan, Germany, and Italy (GDP fall was around or above 5% in all three countries); this is a consequence of world trade contractions, affecting more deeply industrial and export-oriented countries.

[6] A recent contribution (Arpaia & Curci, 2010) analyzes in depth the labour market impact of the crisis for the EU-27 countries. See also European Commission (2009).

[7] For instance, subsidies for part-time work in Germany, or extending income support for workers formally maintaining job contracts at reduced working-time or at 'zero-hours' in Italy.

has been accompanied by a reduction in labour supply (the 'discouraged worker effect'), thus dampening down the impact on unemployment rates.

IMF (2009) partly explains the mentioned heterogeneity by considering the multifaceted dimensions of labour market flexibility, including: employment protection legislation (EPL), the types of wage-bargaining arrangements, the level and duration of unemployment benefits, the diffusion of temporary contracts. The stronger employment response in low EPL economies, relative to medium/high EPL economies, is consistent with the literature suggesting that employment protection reduces both inflows to and outflows from employment. For medium/high EPL countries, the reduction in employment after the last crisis has been similar to that during previous cycles despite substantially bigger GDP declines, confirming the above mentioned higher degree of labour hoarding.

In the past, it was estimated that in normal recessions it takes three quarters – after output has started to recover – for employment to start increasing and an additional two quarters for the unemployment rate to peak.[8] But the responsiveness of the unemployment rate to changes in output has increased over time in many countries, due to less strict employment protection and greater use of temporary employment contracts (IMF, 2010, chapter 3). This responsiveness should help in raising employment rates (after the fall due to the recession) when the recovery will become stronger.

The crisis had heterogeneous and differentiated effects also within countries. Many researches agree that the labour market impact will result in extension of gender inequality and poverty: e.g. in developing economies, the initial decline in textile and agricultural exports has caused an increase in unemployment among women, together with a rise in female workers share in informal sectors and vulnerable (low paid) jobs. On the contrary, in the case of some developed economies (especially those directly affected by the crisis or more export oriented), the crisis mainly affected sectors with a higher presence of male employment, for instance constructions and manufacturing, producing a different gender impact with respect to past crises (European Commission, 2009).

Concerning current and future developments, unemployment rates reached top rates in 2010, but in some EU countries even in 2011. As for the next years, it is likely, similarly to past crises, a certain degree of persistence, due to 'hysteresis' effects (upward shift in the 'structural unemployment')[9]. Persistence and hysteresis largely depend on the robustness of

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[8] Moreover, these lags are longer if the recession comes together a financial crisis. It should also be noted that unemployment can still rise (for a period) even after employment growth has turned positive.

[9] The EC (Spring 2011) forecasts for the year 2012 largely confirm this expectation.

the recovery, also related to the adoption of macroeconomic policies; in the world as a whole recovery has been satisfactory, thanks to the pushing up of the emerging economies. In the EU, on the contrary, has been feeble – apart from the recent German 'miracle' – also because of the new uncertainty scenario caused by the 'sovereign debt' crisis.

Let us now focus on the EU countries. The employment rate – the key labour market performance indicator of the European Employment Strategy (EES) – declined in 2009 (at 64.6%) and 2010 (at 64.2%) in EU-27.[10] The unemployment rate in 2010 was 9.6% (2.5 points more than the 7.1% of 2008) and it is expected to persist at a very similar level in 2011 (9.5%) and still 2 point above the previous minimum (2008) in 2012 (9.1%). The smaller impact of the crisis on women in some regions or countries most likely reflects the sectoral and international specialization, but also a probable more intense 'discouragement effect' among women. Also young people have been remarkably affected by the employment crisis (they are workers with weaker work contracts and a lower qualification and experience); long term unemployment for young workers can be harmful and may result in 'discouraged workers' effects and social exclusion from labour market.[11]

With reference to individual countries, in Table 1 past, present and expected (for 2011 and 2012) national evidences on unemployment rates are shown for 'old' EU countries, new EU transition countries, US and Japan.

Table 1 – Unemployment rates

	1991–2000	2001–2010	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Belgium	8.5	7.8	8.4	8.5	8.3	7.5	7.0	7.9	8.3	7.9	7.8
Germany	7.8	8.8	9.8	11.2	10.3	8.7	7.5	7.8	7.1	6.4	6.0
Estonia	-	9.7	9.7	7.9	5.9	4.7	5.5	13.8	16.9	13.0	11.5
Ireland	11.1	6.3	4.5	4.4	4.5	4.6	6.3	11.9	13.7	14.6	14.0
Greece	9.5	9.8	10.5	9.9	8.9	8.3	7.7	9.5	12.6	15.2	15.3
Spain	15.7	11.9	10.6	9.2	8.5	8.3	11.3	18.0	20.1	20.6	20.2
France	10.6	8.9	9.3	9.3	9.2	8.4	7.8	9.5	9.7	9.5	9.2
Italy	10.4	7.8	8.0	7.7	6.8	6.1	6.7	7.8	8.4	8.4	8.2
Cyprus	-	4.6	4.7	5.3	4.6	4.0	3.6	5.3	6.5	6.3	5.6
Luxembourg	2.5	4.1	5.0	4.6	4.6	4.2	4.9	5.1	4.5	4.4	4.2
Malta	5.7	7.1	7.4	7.2	7.1	6.4	5.9	7.0	6.8	6.8	6.7
Netherlands	5.1	4.0	5.1	5.3	4.4	3.6	3.1	3.7	4.5	4.2	4.0
Austria	3.9	4.4	4.9	5.2	4.8	4.4	3.8	4.8	4.4	4.3	4.2
Portugal	5.5	7.4	6.7	7.7	7.8	8.1	7.7	9.6	11.0	12.3	13.0
Slovenia	-	6.1	6.3	6.5	6.0	4.9	4.4	5.9	7.3	8.2	8.0
Slovakia	-	15.1	18.2	16.3	13.4	11.1	9.5	12.0	14.4	14.0	13.3
Finland	12.5	8.2	8.8	8.4	7.7	6.9	6.4	6.2	8.4	7.9	7.4
Euro area (17)	-	8.7	9.0	9.1	8.5	7.6	7.6	9.6	10.1	10.0	9.7

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[10] Interrupting its previous continuous rise - toward the 'Lisbon objective' (70%) - started with the launch of the EES in 1997 (employment rate EU-27 at 60.7%) and culminated in 2008 (65.9%).

[11] According to Scarpetta et al. (2010) the size of the group of 'youth left behind' can be proxied by the number of young people who are *neither in employment, nor in education or training* (*NEET*), that has extensively increased after the crisis.

	1991–2000	2001–2010	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Bulgaria	-	11.2	12.1	10.1	9.0	6.9	5.6	6.8	10.2	9.4	8.5
Czech Rep.	-	7.0	8.3	7.9	7.2	5.3	4.4	6.7	7.3	6.8	6.4
Denmark	6.6	4.9	5.5	4.8	3.9	3.8	3.3	6.0	7.4	7.1	6.7
Latvia	12.7	11.1	10.4	8.9	6.8	6.0	7.5	17.1	18.7	17.2	15.8
Lithuania	7.5	10.9	11.4	8.3	5.6	4.3	5.8	13.7	17.8	15.5	12.7
Hungary	-	7.5	6.1	7.2	7.5	7.4	7.8	10.0	11.2	11.0	9.3
Poland	-	14.3	19.0	17.8	13.9	9.6	7.1	8.2	9.6	9.3	8.8
Romania	-	7.1	8.1	7.2	7.3	6.4	5.8	6.9	7.3	7.2	6.8
Sweden	7.6	7.0	7.4	7.7	7.1	6.1	6.2	8.3	8.4	7.6	7.2
U.K.	7.9	5.6	4.7	4.8	5.4	5.3	5.6	7.6	7.8	8.0	7.8
EU (27)	9.2 *	8.6	9.1	9.0	8.2	7.2	7.1	9.0	9.6	9.5	9.1
US	5.6	6.1	5.5	5.1	4.6	4.6	5.8	9.3	9.6	8.6	8.1
Japan	3.3	4.7	4.7	4.4	4.1	3.9	4.0	5.1	5.1	4.9	4.8

Source: European Commission - Spring Forecasts (May 2011). * EU-15.

4. Key facts about regional responses

The financial crisis and consequent Great Recession had profound effects on the European labour markets, both in terms of employment contraction and unemployment increase.

As for the country level, the next two figures (Figure 1) can be depicted: (i) the employment change in 2008-09 vs. the employment change in the period (average per annum values) 2000-08; (ii) the unemployment rate (UR) change in 2008-09 vs. the UR change in 2000-08. While employment change was positive in most EU countries in 2000-08 (except for Romania), in 2008-09 became negative in almost all countries (apart from Luxembourg and Malta), with huge falls in the Baltic states, Ireland and Spain (let us call them the 'worst five'). Similarly, the UR in 2008 was in the majority of countries lower than in 2000 (Portugal and Ireland are among the exceptions); opposite trends can be detected from 2008 to 2009, with generalized increases (but close to zero in Germany and Luxembourg) and the poorest performance in the 'worst five'.

The next two figures (depicted in Figure 2) are similar to the previous ones, but refer to the 271 NUTS-2 regions rather than to the 27 EU countries (the grouping of regions refer either to big countries or to group of countries if small). Although it is apparent that there are clusters of regions on a national base (e.g. the red points relate to the Spanish regions), some of these go beyond the national borders.

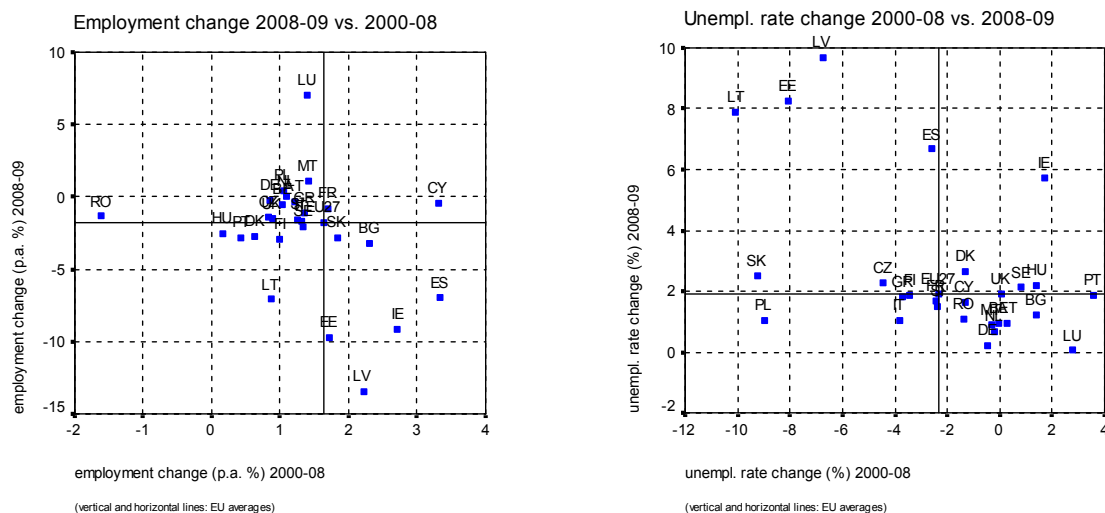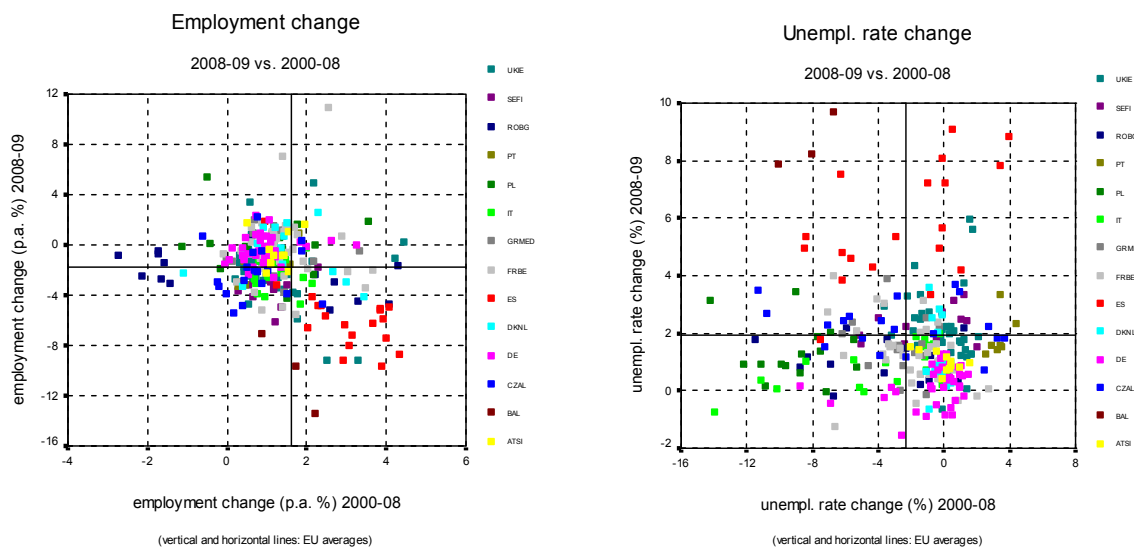*Figure 1 – Employment and unemployment change in 2000–08 and 2008–09 at the NUTS-1 level*

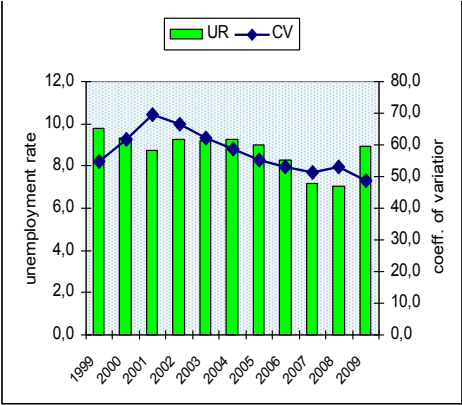*Figure 2 – Employment and unemployment change in 2000–08 and 2008–09 at the NUTS-2 level*

A possible question that arises now is whether the deteriorating performance of labour markets from 2008 to 2009 was accompanied also by an increase in the disparities between regions. If we focus now on unemployment rates (UR), Table 2 below shows the coefficient of variation (CV, in percentage points) computed for all 271 EU27 regions and for the regions in each country; we excluded the one-region countries (Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta), the two-regions countries (Ireland and Slovenia) and Denmark as well (it has five NUTS-2 regions but the data are incomplete). For all EU27 regions, the CV has

decreased both in the years (2004-08) preceding the crisis and in the crisis's year (2009). The series-long data are depicted for all years in the next Figure 3, together with the UR (mean value for all EU-27): the top value of CV was achieved in 2001, then there was a continuous decrease.

Table 2 – Coefficient of Variation (CV)

	1999-2003	2004-08	2009
Austria	36,0	38,5	29,7
Belgium	47,6	50,9	48,8
Bulgaria	23,0	28,1	28,0
Czech Rep.	42,4	47,5	37,0
Finland	52,9	42,0	27,2
France	46,6	57,8	50,3
Germany	52,1	43,0	37,6
Greece	21,0	21,8	17,7
Hungary	33,6	33,0	28,3
Italy	75,3	57,4	44,6
Netherlands	24,9	19,9	21,2
Poland	19,0	15,1	18,8
Portugal	36,8	29,3	20,7
Romania	14,7	23,9	29,1
Slovakia	39,0	50,6	45,4
Spain	38,8	40,4	29,1
Sweden	23,8	13,1	9,7
UK	30,9	27,4	24,9
EU27	*63.0*	*54.2*	*48.9*

Figure 3 – UR level and CV (EU-27)

The above trends are replicated in many EU countries, although the reduction from the first (1999-2003) to the second (2004-08) period is not so common; thus it is probably more triggered by the *between-country* reduction in disparities. In fact, we can detect a rise in CV values in numerous countries: Austria, Belgium, Bulgaria, Czech Rep., France, Greece, Romania, Slovakia, Spain. On the contrary, the fall of CV in the crisis's year (2009) is much more generalized: the only exceptions are the Netherlands, Poland, Romania. The reason, in the latter case, is that during the crisis all regions suffered, with (proportionally) greater increases of UR in the previous best-performing regions.
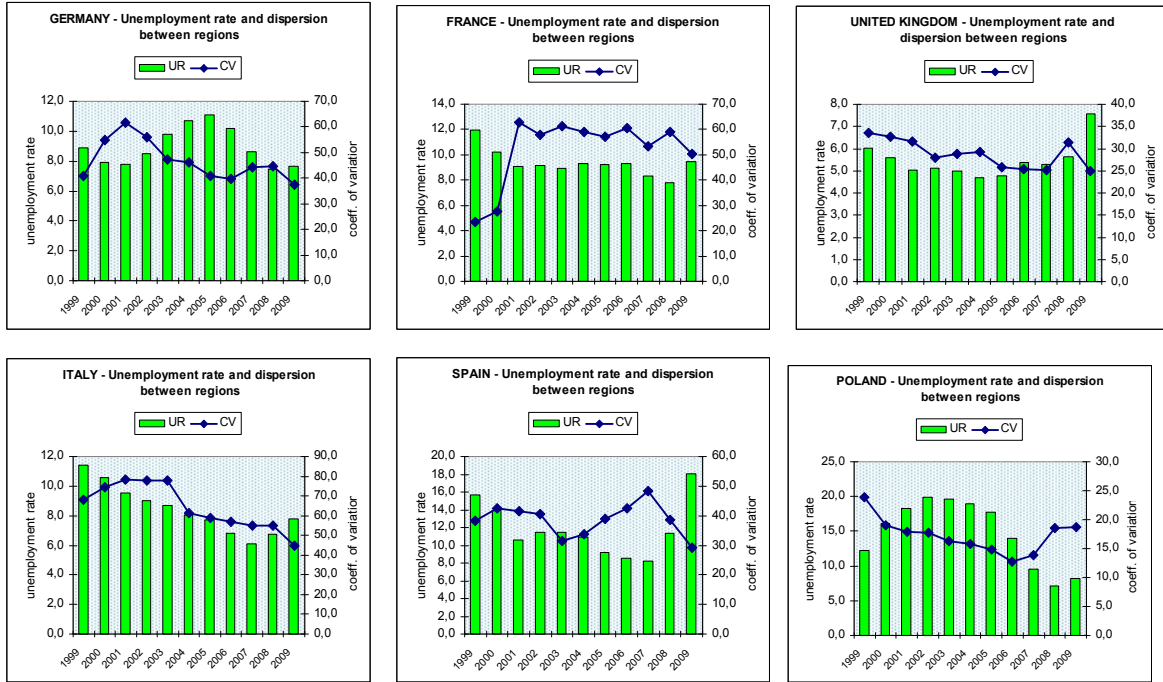
The following graphs (Figure 4) are similar to the previous one, but refer to the six greatest EU countries. It emerges again the recent negative correlation between UR change and CV variation.

5. Some Econometric Investigations

The preceding sections have outlined recent evidence on the effects of the economic crisis on labour markets, and descriptive statistics have been presented for the data currently available from Eurostat's Labour Force Survey (LFS), which are employed in this paper. This section aims to look deeper into the preliminary evidence given in Section 4 by means of standard and innovative econometric tools. In particular, we are interested in evaluating the impact of

the economic crisis on regional labour markets on the basis of the pre-crisis conditions, and of previous trends. In other words, our focus is on identifying structural weak points in regional labour markets (or factors of competitive advantage) with respect to a region's reaction to the crisis.

Figure 4 – Unemployment rate development and coefficient of variation for the six greatest EU countries

We set up two cross-sectional models, which employ, as dependent variables, the percentage change in employment (e_{07-10}) and unemployment (u_{07-10}), respectively, during the period 2007–10.[12] The models can be generically written, for region i,[13] as:

$$e_{i,07-10} = \beta_0 + \beta_1 e_{i,04-07} + \beta_2 spec_i^{agr} + \beta_3 spec_i^{con} + \beta_4 spec_i^{fin} + \beta_5 spec_i^{hot} + \beta_6 spec_i^{man} + \beta_7 udur_i + \beta_8 etemp_i + u_i,$$
(1)

$$u_{i,07-10} = \beta_0 + \beta_1 u_{i,04-07} + \beta_2 spec_i^{agr} + \beta_3 spec_i^{con} + \beta_4 spec_i^{fin} + \beta_5 spec_i^{hot} + \beta_6 spec_i^{man} + \beta_7 udur_i + \beta_8 etemp_i + u_i,$$
(2)

where: e_{04-07} (u_{04-07}) is the employment (unemployment) percentage change over the preceding three-year period (2004–07); *spec* are variables defining a region's specialization in
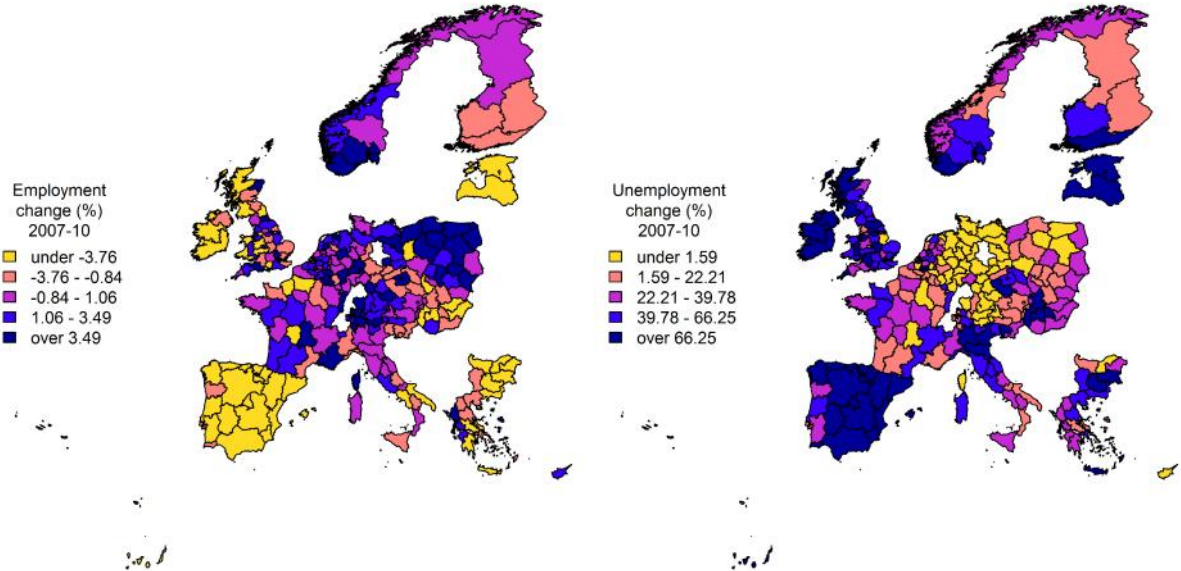
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[12] We use data from the second quarter (30 June) for both dependent and independent variables. Although LFS data were available for the third quarter of 2010, which would have allowed to observe some slightly later post-crisis developments, the high number of missing values makes it inconvenient to employ them, and suggests to use second quarter data.

[13] We considered NUTS-2 Europen regions.

a given (NACE) sector (agriculture, construction, finance and insurance, accommodation and food service, and manufacturing), computed as the percentage of workers employed in the sector on overall (all sectors) employment; *udur* is the percentage of long-term (12 months or more) unemployed individuals over total unemployment; and *etemp* is the percentage of precarious workers over total employment.

Figure 5 provides a graphical representation, at the NUTS-2 level of geographical aggregation, of our dependent variables. Although with some differences, the maps for employment and unemployment draw a similar picture, in which Spain, Ireland, the Baltic States, Scotland and the North of Greece appear to be the biggest losers in terms of employment, and the regions where the number of unemployed grew faster,[14] together with the North of Italy.

Figure 5 – Employment and unemployment change during 2007–10 at the NUTS-2 level

We include in the model the lagged labour market performance (between 2004 and 2007) in order to investigate trend inversion or prosecution phenomena. In particular, on the grounds of the estimated regression parameter(s) for this variable, we may speculate on the origins of a labour market improvement achieved in the previous years. If such improvement was due to change in economic structure or human capital, then we may expect it to spread its positive effects over the crisis (or at least smooth its local impact), conditional to other labour market

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[14] Here we refer here to the growth of unemployed people in relative terms (the increase appears huge also in regions where the initial number of unemployed was low).

characteristics. If instead labour market results were obtained by fragmenting jobs or by relying on volatile and low-human-capital sectors (such as constructions), we may expect the crisis to cancel out such results as investments fall, and to generate a trend inversion on the labour market.

Trend inversion or continuation should be conditioned to the structural characteristics of the labour market at the beginning of the crisis. The *spec* variables allow us to control for regional specialization in key sectors such as constructions, tourism or manufacturing, in order to provide an indicator of a region's exposure to demand volatility. We may expect regions highly specialized in these sectors – which suffered greatly from the crisis – to be more strongly hit by the crisis.

In addition to the above, the variable *udur* aims to capture the potentially different reaction of regions (to an exogenous shock such as the crisis) on the basis of the structural characteristics of their unemployed population. We expect regions with high shares of long-term unemployed to be differently affected by a labour demand shock, that is, that labour participation will fall more acutely in these regions because of discouraged workers, consequently moderating the effect of the crisis on unemployment. Finally, the *etemp* variable provides information on a region's reliance on temporary workers, who, because of weaker contractual power and union support (e.g., the insider/outsider effect), will be easier to lay off during the crisis. We could then expect regions with higher shares of temporary workers to be more severely hit by the crisis in terms of employment and unemployment. On the other hand, a higher share of temporary workers may also denote a 'fragmentation' of work, which provides firms with the ability to redistribute (the decreased) labour demand over the same pool of employees. The sign to be expected on this variable depends then on which one of the two above aspects is dominant, and is therefore ambiguous.

We start by estimating our models, for employment and unemployment change, by OLS, whose results are reported in Table 3.

Table 3 shows consistent results for the effect of the lagged labour market performance, with a significant negative sign, implying – on average – a trend reversal, though the size of the effect is not strong (e.g., an increase of 1 per cent in employment over 2004–07 corresponds to a decrease in 2007–10 of 0.21 per cent). Consistent signs between the two equations are found for *udur* as well, confirming the hypothesis that regions with higher shares of long-term unemployed (most likely already suffering from high unemployment and inefficient matching in labour markets) suffered apparently less because of the crisis (for in particular the unemployment attenuation may be caused by the discouraged worker effect).

Specialization in the finance sector seems to show a positive relation with employment change, possibly identifying more urbanized and advanced regions, specialized in the tertiary sector and therefore relying less on aggregate demand than construction or manufacturing (it is also well known that the cyclical sensitivity of the services is lower compared to the latter sectors). A further positive relation with employment change is found for the share of temporary workers over employed individuals, suggesting that the hypothesis of greater flexibility made above may dominant over the one of easier lay-offs.

Table 3 – OLS estimates, for employment change and unemployment change

	Employment change			Unemployment change		
	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Intercept	−0.431	2.386	0.857	7.121	25.247	0.778
$e_{i,04-07}$	−0.205	0.072	0.005	–	–	–
$u_{i,04-07}$	–	–	–	−0.501	0.169	0.003
$spec_i^{agr}$	0.084	0.063	0.187	0.156	0.559	0.781
$spec_i^{con}$	−0.516	0.162	0.002	10.429	2.315	0.000
$spec_i^{fin}$	1.044	0.233	0.000	−1.584	2.632	0.548
$spec_i^{hot}$	−0.300	0.230	0.194	1.645	2.128	0.440
$spec_i^{man}$	−0.039	0.050	0.441	−0.127	0.544	0.815
$udur_i$	0.065	0.022	0.003	−1.319	0.293	0.000
$etemp_i$	0.122	0.060	0.044	−0.768	0.819	0.349
Moran's I	5.870	–	0.000	6.950	–	0.000
Adj. R-squared	0.319	–	–	0.391	–	–
Residual dof	208	–	–	208		

Note: Robust standard errors.

Finally, we compute diagnostic tests (Moran's *I*; Moran, 1948) for the presence of residual spatial autocorrelation (i.e., correlation between the regression residuals that is due to geographical proximity), which reject in both cases the hypothesis of spatial randomness of residuals and suggest the presence of either unobserved and spatially correlated relevant explanatory variables or significant spatial spillovers/interaction. An econometric adjustment, in lack of proper model extensions, is then necessary in order to cope with such spatial autocorrelation, which violates the assumption of independence of observations.

A number of econometric approaches are available for modelling spatial autocorrelation in cross-sectional models. LeSage and Pace (2009) support the use of general model specifications such as the spatial Durbin model, where spatial lags at both the dependent and independent variables level are allowed for, encompassing all simpler typical spatial

regression models such as the spatial lag or the spatial error model. On the other hand, Anselin (1988, 1990) developed a series of (Lagrange multiplier) specification search tests, which start from the OLS residuals augmenting the model in a forward-search fashion. Other contributions, e.g., Florax et al. (2003), suggested further strategies.

An alternative approach, based on a non-parametric filtering of spatial autocorrelation, has been proposed by Griffith (2000, 2003) and widely employed in cross-sectional and – more recently – panel frameworks. Spatial filtering does not require a priori knowledge of the type of spatial data-generating process, and allows the researcher to estimate a model in whatever functional form – differently from the above methods which, with the exclusion of some Bayesian ones – are all based on linear models. The method is essentially based on eigenvector decomposition of a spatial weight matrix, defining neighbouring relations between regions, and is mathematically consistent with the numerator in the formula of Moran's *I*. By means of a stepwise regression approach, a set of candidate eigenvectors, representing orthogonal and uncorrelated spatial autocorrelation patterns, is evaluated and a subset, hereby called a spatial filter, is selected. This spatial filter maximizes model fit or minimizes residual spatial autocorrelation, depending on the objective function selected. The final model estimated is therefore (using the unemployment model as an illustration):

$$
\begin{aligned}
u_{i,07-10} = {} & \beta_0 + \beta_1 u_{i,04-07} + \beta_2 spec_i^{agr} + \beta_3 spec_i^{con} + \beta_4 spec_i^{fin} + \beta_5 spec_i^{hot} + \beta_6 spec_i^{man} + \\
& \beta_7 udur_i + \beta_8 etemp_i + \sum_j \gamma_j e_j + u_i,
\end{aligned}
\tag{3}
$$

where e_j is the *j*th selected eigenvector composing the spatial filter.

While we refer to Griffith (2000) and Patuelli et al. (2010) for further details on the application of the method, we present, in Table 4, the results obtained by incorporating a spatial filter in the otherwise spaceless models given above.

The results shown in Table 4 confirm the inverse relation between the pre- and mid-post-crisis labour market performance seen above, with highly significant parameters. Because of the inclusion of the spatial filters, which account for unobserved heterogeneity and omitted variables, the size of the effects slightly decreases. Differently from the OLS estimates, specialization in construction is not significant anymore in occupational terms, but only in terms of unemployment. The opposite happens for agriculture and the accommodation sector, which are significant only for the employment model. These opposite results may be justified by the different characteristics of the labour demand and supply involved. The agricultural and hotel sectors tend to employ seasonal and family workers, often from abroad, while the construction sector makes a wide use of black market workers. While the former appear in

labour statistics when demand calls for additional labour force – they are often otherwise inactive in the case of family workers or local population – the latter emerge in the statistics when labour demand in the sector is scarce, that is, when off-the-books employment is not available. The effect of specialization in the financial sector, as well as the one of the share of long-term unemployed, is confirmed, while the negative effect of specialization in manufacturing can be expected given the sector's dependence on demand, and given the strong regulation and unionization of the manufacturing sector. It is indeed surprising that this effect can be seen only for employment.

Table 4 – Spatial filtering estimates, for employment change and unemployment change

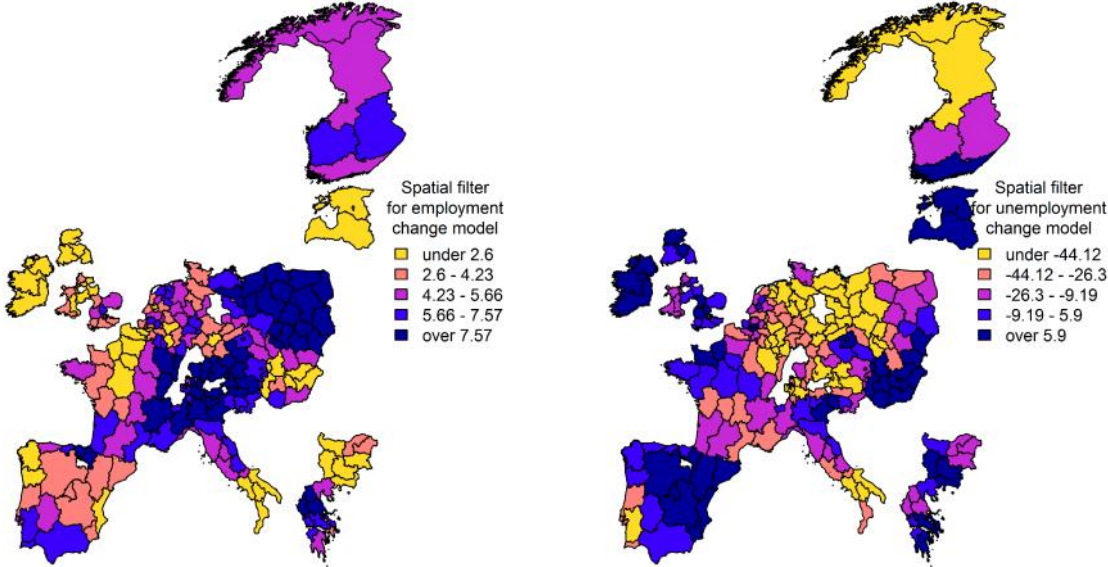|	Employment change			Unemployment change		
	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Intercept	5.158	2.121	0.016	−16.956	23.143	0.465
$e_{i,04-07}$	−0.178	0.050	0.000	–	–	–
$u_{i,04-07}$	–	–	–	−0.441	0.105	0.000
$spec_i^{agr}$	−0.167	0.054	0.002	−0.731	0.466	0.119
$spec_i^{con}$	−0.138	0.138	0.320	6.573	1.371	0.000
$spec_i^{fin}$	0.498	0.184	0.007	1.352	1.706	0.429
$spec_i^{hot}$	−0.741	0.186	0.000	2.598	1.756	0.141
$spec_i^{man}$	−0.195	0.049	0.000	0.107	0.382	0.779
$udur_i$	0.089	0.020	0.000	−0.680	0.246	0.006
$etemp_i$	−0.064	0.058	0.270	0.759	0.508	0.137
# of eigen.	23	–	–	21	–	–
Moran's I	−1.100	–	0.865	0.301	–	0.382
Adj. R-squared	0.652	–	–	0.735	–	–
Residual dof[*]	175	–	–	177	–	–

Note: Robust standard errors.
[*] Non-contiguous regions (islands) are omitted from the estimates since the spatial weight matrix needs to be non-singular in order to extract real eigenvectors.

From a statistical perspective, we can note that the adjusted R-squared for both models has grown significantly, and that spatial autocorrelation in the residuals is now absent. The spatial filters obtained for the two models are shown in Figure 6. Recognizable spatial patterns can be used to identify the distribution of unobserved effects that influenced (un)employment change over 2007–10. In the leftside map, pertaining to the employment change model, a contrast between problematic areas like Ireland, Scotland, the North of Greece, the South of Italy and the Baltic States – as seen in Figure 5 – and regions including most of Poland and the alpine arc may be identified. In the rightside map, the greatest contrast

can be seen between the area of Germany and Poland and the ones of Spain, Ireland, Scotland and the Baltic States.

Figure 6 – Spatial filter computed for the employment and unemployment model estimates

A further step ahead in our analysis of the labour market impact of the recent crisis can be given by inspecting more in-depth the regions' dependence on their previous performance. The results presented in Tables 3 and 4 appear to provide evidence for a trend reversal, conditional to sectoral specialization and labour market characteristics. However, because institutional factors (at the national level) cannot feasibly be implemented in a cross-sectional model, it is not possible to highlight how the aggregate trends affect our results of trend reversal. A more detailed look at the (possible) underlying heterogeneity of this effect could be achieved by employing statistical techniques such as quantile regression. However, this approach would again be 'spaceless', while spatial autocorrelation has been shown to be a relevant issue for our model. A 'spatial' alternative is represented by geographically weighted regression (GWR; see, e.g., Fotheringham et al., 2002), which allows for a spatial heterogeneity in regression parameters based on proximity. Within our estimation framework, an equivalent estimation strategy (Griffith, 2008) is given by a spatial filter representation of GWR. By interacting a given set of candidate eigenvectors with a numerical explanatory variable, it is indeed possible to obtain, by means of the same procedure described above, a spatial filter representation of the spatially heterogeneous regression parameter associated with the variable at hand. The GWR spatial filter represents heterogeneity that can be

attributed to spatial proximity. Residual idiosyncratic heterogeneity is left in the residuals. A further (standard) spatial filter (as discussed above) can still be estimated, leading to the following model (again shown for the unemployment model):

$$u_{i,07-10} = \beta_0 + \beta_1 u_{i,04-07} + \sum_k \alpha_k e_k u_{i,04-07} + \beta_2 spec_i^{agr} + \beta_3 spec_i^{con} + \beta_4 spec_i^{fin} + \beta_5 spec_i^{hot} +$$
$$\beta_6 spec_i^{man} + \beta_7 udur_i + \beta_8 etemp_i + \sum_j \gamma_j e_j + u_i. \tag{4}$$

Table 5 reports the results obtained for the GWR-spatial filtering estimation. While the findings of the standard spatial filtering estimation given in Table 4 are generally confirmed, one significant difference can be spotted. While the trend reversal effect found for the unemployment model is confirmed, the one for the employment model has disappeared and has become a trend continuation, with a positive parameter of 0.315.
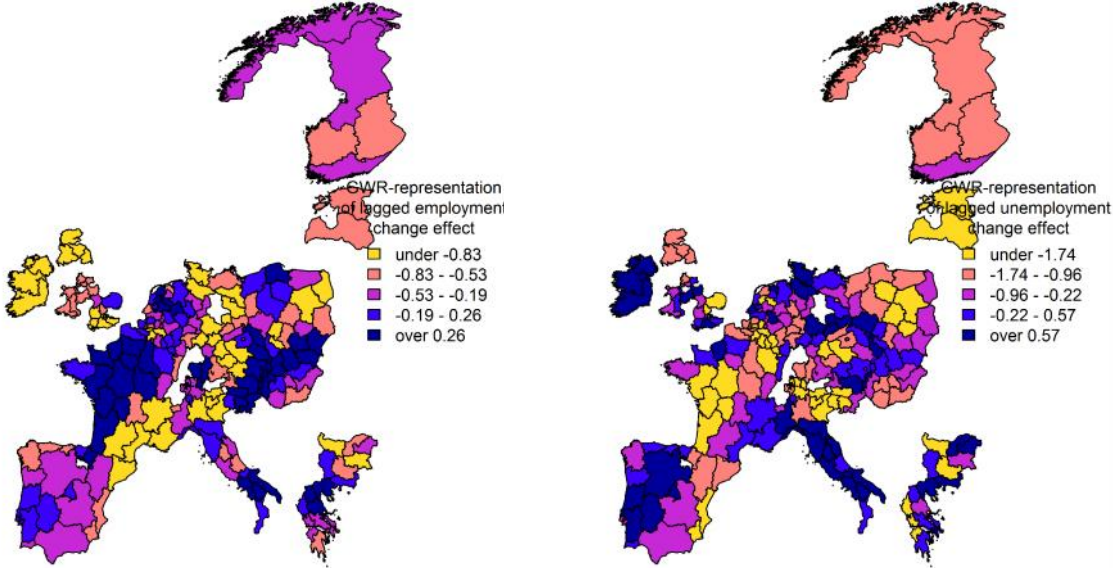
Table 5 – Spatial filtering estimates, for employment change and unemployment change

	Employment change			Unemployment change		
	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Intercept	5.192	2.281	0.024	0.276	20.476	0.989
$e_{i,04-07}$	0.315	0.064	0.000	–	–	–
$u_{i,04-07}$	–	–	–	−0.713	0.107	0.000
$spec_i^{agr}$	−0.079	0.045	0.085	−0.439	0.412	0.288
$spec_i^{con}$	0.204	0.134	0.131	4.124	1.134	0.000
$spec_i^{fin}$	0.518	0.216	0.018	2.137	2.039	0.296
$spec_i^{hot}$	−0.546	0.159	0.001	3.448	1.311	0.009
$spec_i^{man}$	−0.180	0.045	0.000	0.207	0.346	0.550
$udur_i$	−0.010	0.024	0.682	−0.782	0.187	0.000
$etemp_i$	0.000	0.060	0.996	−0.013	0.408	0.974
# of GWR eigen.	22	–	–	22	–	–
# of eigen.	21	–	–	29	–	–
Moran's I	0.144	–	0.443	−0.276	–	0.609
Adj. R-squared	0.777	–	–	0.878	–	–
Residual dof[*]	155	–	–	147	–	–

However, because a GWR-spatial filter has been applied to this variable, the parameters estimated for the (un)employment change over 2004–07 should be interpreted solely as the general effect mean around which a spatial pattern of heterogeneous effects is centred. Figure 7 provides a visualization of such patterns, for both models. It is now evident that the trend inversion or continuation effects found by punctual analyses are not geographically homogeneous. While the numerical findings given in Table 5 above provide the average effect size estimated, our maps show that specific geographical patterns exist made of regions

where either a strong trend inversion has happened (e.g., Ireland, with regard to employment, or the Baltic States, with regard to unemployment), or a positive effect of lagged labour market performance is estimated (e.g., the North of France, for employment, or Ireland and Italy, for unemployment). This evidence suggests that some European regions –even wide areas – were able, for example, to draw benefits from the growth experienced in the previous period or, in the negative case, regions with a negative trend were more severely hit by the crisis.

Figure 7 – GWR representation of the spatially heterogeneous lagged employment and unemployment change effect

6. Conclusions

The real effects of the 2007–08 financial crisis have been particularly severe in the European context and significant 'between countries' differences emerged also in the labour market responses; the impact has been exacerbated by the feeble recovery – that differentiates EU countries from other world regions – and further aggravated by the current (2010–11) sovereign debt crises. In addition, while in many countries (both in Europe and North America) the response was characterized by high flexibility, in some EU countries labour markets have been remarkably resilient during the 'great recession', with employment declining less than output, especially due to a reduction in hours worked per employee. While a growing literature investigating the above phenomena (at the national level) already exists, focusing especially on the different institutional settings, our contribution is one of the very

few – until now – that is trying to detect some determinants of the differentiated impact of the last crisis on the labour market performance at the regional level.

Some descriptive statistics for the 271 NUTS-2 regions of EU-27 highlighted that the recent regional changes in (un)employment tend to (partly) cluster on a national base, but many exceptions clearly emerged. In addition, while the disparity for all EU-27 regions has decreased both in the years preceding the crisis (2004–08) and in the crisis's year (2009), the coefficient of variation (CV) increased in many countries in the years preceding the crisis, showing the predominance of *between-country* reduction in disparities. On the contrary, the fall of CV in the real crisis year (2009) is much more generalized: the reason is that during the crisis all regions suffered, but in particular the previous best-performing regions. In other terms, a recent negative correlation between change in unemployment rate and CV emerged.

Our econometric investigations aimed at better evaluating the impact of the crisis on regional labour markets (in terms of both employment and unemployment) on the basis of the pre-crisis conditions, specializations and trends. Applying appropriate diagnostic tests to our basic OLS model we found the presence of either unobserved and spatially correlated relevant explanatory variables or significant spatial spillovers. By taking spatial autocorrelation into account, a 'trend reversal', that is, an inverse relation between the pre- and post-crisis labour market performance, clearly emerged, with highly significant parameters. In addition, sectoral specialization and some characteristics of the labour market (such as long-term unemployment or reliance on temporary workers) seem to have conditioned the regional reactions to the crisis. A further investigation – based on GWR-spatial filtering techniques – confirmed the 'trend reversal' for unemployment model, while a 'trend continuation' emerged (on average) for employment. As graphically evidenced, the trend inversion or continuation effects found by punctual analyses are not geographically homogeneous: in some regions a strong trend inversion has happened, while in others a positive effect of lagged labour market performance can be observed.

Our results confirm the need to appropriately investigate the complexity and heterogeneity of regional labour market dynamics and to take into account spatial linkages.

As for the policy implications, in addition to sound macroeconomic and structural policies that would allow to raise growth rates – particularly feeble in Europe – policymakers should pay more attention to the 'quality' of employment. In fact, a part of the generalized and considerable (quantitative) labour market improvements in the decade preceding the crisis was not 'fully sustainable' in a long run perspective, if we take into account either the

structural characteristics (sectoral specialization) or some institutional features of labour markets.

References

Anselin, L. (1988). Lagrange Multiplier Test Diagnostics for Spatial Dependence and Spatial Heterogeneity. *Geographical Analysis, 20*(1), 1-17.

Anselin, L. (1990). Some Robust Approaches to Testing and Estimation in Spatial Econometrics. *Regional Science and Urban Economics, 20*(2), 141-163.

Arpaia, A., & Curci, N. (2010). EU Labour Market Behaviour During the Great Recession. *European Economy, Economic Papers 405*.

Basile, R., & De Benedictis, L. (2008). Regional Unemployment and Productivity in Europe. *Papers in Regional Science, 87*(2), 173-192.

Belke, A. (2007). Endogenous Optimum Currency Areas and the Blend of Sectors - On the Determinants of Business Cycle Correlation across European Regions. *Journal of Economic Integration, 22*(1), 26-49.

Belke, A., & Heine, J. M. (2006). Specialisation Patterns and the Synchronicity of Regional Employment Cycles in Europe. *International Economics and Economic Policy, 3*(2), 91-104.

Belot, M., & van Ours, J. C. (2004). Does the Recent Success of Some OECD Countries in Lowering their Unemployment Rates Lie in the Clever Design of their Labor Market Reforms? *Oxford Economic Papers, 56*(4), 621-642.

Bentolila, S., & Bertola, G. (1990). Firing Costs and Labour Demand: How Bad is Eurosclerosis? *Review of Economic Studies, 57*(3), 381-402.

Blanchard, O., & Wolfers, J. (2000). The Role of Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence. *The Economic Journal, 110*(462), 1-33.

Blanchard, O. J., & Katz, L. F. (1992). Regional Evolutions. *Brookings Papers on Economic Activity, 1*, 1-75.

Bornhorst, F., & Commander, S. (2006). Regional Unemployment and its Persistence in Transition Countries. *Economics of Transition, 14*(2), 269-288.

Demidova, O., & Signorelli, M. (2011). The Impact of Crises on Youth Unemployment of Russian Regions: An Empirical Analysis. *China-USA Business Review, 10*, 7.

Elhorst, J. P. (2003). The Mystery of Regional Unemployment Differentials: Theoretical and Empirical Explanations. *Journal of Economic Surveys, 17*(5), 709-748.

European Commission. (2002). *Employment in Europe 2002: Technical Report*. Brussels/Luxembourg.

European Commission. (2009). *Employment in Europe 2009*. Brussels/Luxembourg.

Fatás, A. (1997). EMU: Countries or regions? Lessons from the EMS experience. *European Economic Review, 41*(3-5), 743-751.

Florax, R. J. G. M., Folmer, H., & Rey, S. J. (2003). Specification searches in spatial econometrics: the relevance of Hendry's methodology. *Regional Science and Urban Economics, 33*, 557-579.

Fotheringham, A. S., Brunsdon, C., & Charlton, M. (2002). *Geographically Weighted Regression: The Analysis of Spatially Varying Relationships*. Chicester: John Wiley & Sons Ltd.

Gács, V., & Huber, P. (2005). Quantity Adjustments in the Regional Labour Markets of EU Candidate Countries. *Papers in Regional Science, 84*(4), 553-574.

Garcilazo, J. E., & Spiezia, V. (2007). Regional Unemployment Clusters: Neighborhood and State Effects in Europe and North America. *The Review of Regional Studies, 37*(3), 282-302.

Griffith, D. A. (2000). A Linear Regression Solution to the Spatial Autocorrelation Problem. *Journal of Geographical Systems, 2*(2), 141-156.

Griffith, D. A. (2003). *Spatial Autocorrelation and Spatial Filtering: Gaining Understanding through Theory and Scientific Visualization*. Berlin New York: Springer.

Griffith, D. A. (2008). Spatial-Filtering-Based Contributions to a Critique of Geographically Weighted Regression (GWR). *Environment and Planning A, 40*(11), 2751-2769.

Huber, P. (2007). Regional Labour Market Developments in Transition: A Survey of the Empirical Literature. *The European Journal of Comparative Economics, 4*(2), 263-298.

IMF. (2010). *World Economic Outlook. Rebalancing Growth*. Washington, D.C.: IMF.

Izraeli, O., & Murphy, K. J. (2003). The Effect of Industrial Diversity on State Unemployment Rate and Per Capita Income. *The Annals of Regional Science, 37*(1), 1-14.

Jurajda, Š., & Terrell, K. (2009). Regional Unemployment and Human Capital in Transition Economies. *Economics of Transition, 17*(2), 241-274.

LeSage, J. P., & Pace, R. K. (2009). *Introduction to Spatial Econometrics*. Boca Raton: CRC Press.

Longhi, S., Nijkamp, P., & Traistaru, I. (2005). Is Sectoral Diversification a Solution to Unemployment? Evidence from EU Regions. *Kyklos, 58*(4), 591-610.

Marelli, E. (2006). Regional Employment Dynamics in the EU: Structural Outlook, Co-Movements, Clusters and Common Shocks. In F. E. Caroleo & S. Destefanis (Eds.), *The European Labour Market: Regional Dimensions* (pp. 89-121). Heidelberg: Physica-Verlag.

Marelli, E., & Signorelli, M. (2010a). Institutional, Nominal and Real Convergence in Europe. *Banks and Bank Systems, 5*(2), 140-155.

Marelli, E., & Signorelli, M. (2010b). Transition, Regional Features, Growth and Labour Market Dynamics. In F. E. Caroleo & F. Pastore (Eds.), *The Labour Market Impact of the EU Enlargement: A New Regional Geography of Europe?* (Vol. 99-147). Berlin Heidelberg: Springer-Verlag.

Moran, P. (1948). The Interpretation of Statistical Maps. *Journal of the Royal Statistical Society B, 10*, 243-251.

Nickell, S. (1997). Unemployment and Labor Market Rigidities: Europe versus North America. *The Journal of Economic Perspectives, 11*(3), 55-74.

Overman, H. G., & Puga, D. (2002). Unemployment Clusters across Europe's Regions and Countries. *Economic Policy, 17*(34), 115-148.

Patuelli, R., Schanne, N., Griffith, D. A., & Nijkamp, P. (2010). *Persistence of Regional Unemployment: Application of a Spatial Filtering Approach to Local Labour Markets in Germany* (Quaderno No. 10-01). Lugano: Faculty of Economics, University of Lugano.

Perugini, C., & Signorelli, M. (2007). Labour Market Performance Differentials and Dynamics in EU-15 Countries and Regions. *The European Journal of Comparative Economics, 4*(2), 209-262.

Perugini, C., & Signorelli, M. (2010). Youth Labour Market Performance in European Regions. *Economic Change and Restructuring, 43*(2), 151-185.

Scarpetta, S., Sonnet, A., & Manfredi, T. (2010). *Rising Youth Unemployment During The Crisis: How to Prevent Negative Long-term Consequences on a Generation?* Paris: OECD Publishing.

Signorelli, M. (2008). Employment and Unemployment in a Multilevel Regional Perspective. In M. Petricioli (Ed.), *L'Europe méditerranéenne - Mediterranean Europe* (pp. 175-200). Bruxelles: P.I.E. Peter Lang.

Tyrowicz, J., & Wójcik, P. (2010). Unemployment Convergence in Transition. In E. Marelli & M. Signorelli (Eds.), *Economic Growth and Structural Features of Transition* (pp. 236-259). London: Palgrave Macmillan.

Vamvakidis, A. (2009). Regional Wage Differentiation and Wage Bargaining Systems in the European Union. *Financial Theory and Practice, 33*(1), 73-87.

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