R | E | A | L
Regional Economics Applications Laboratory
www.real.illinois.edu

Economic crisis and youth unemployment in Europe: the role of regional specialization through a spatial quantile approach

André Carrascal Incera and Diana Gutiérrez Posada

REAL 18-T-5

July, 2018

Regional Economics Applications Laboratory
65-67 Mumford Hall
1301 West Gregory Drive
Urbana, IL, 61801
Phone: (217) 333- 4740

ILLINOIS

Economic crisis and youth unemployment in Europe: the role of regional specialization through a spatial quantile approach

André Carrascal Incera[1]*
University of Birmingham, City-REDI

Diana Gutiérrez Posada[2]
Aberystwyth University, Aberystwyth Business School

Abstract:

European youth unemployment exhibits a contrasting image between the Northern and the Southern regions, which leads the analysis towards the drivers behind the spatial clustering of areas with low or high unemployment rates. The aim of this article is to provide some hints about the structural causes of the spatial distribution of youth unemployment growth during the recent crisis, using a Spatial Quantile approach at NUTS2 level. Results suggest that the similarity in the productive structure, the specialization in sectors with a higher concentration of young workers, or the working time flexibility had a different effect in those regions at the top or the bottom of the youth unemployment growth distribution, being this effect significantly different from the result of the global spatial estimation.

Keywords: *Youth Unemployment, Spatial Quantile, Regional Economics*

JEL codes: R23, J13, J64

Funding:

This work was supported by the Consellería de Cultura, Educación e Ordenación Universitaria, Xunta de Galicia [Grant Plan I2C/2014].

[1]*Corresponding Author.
University of Birmingham, City-REDI Birmingham Business School, Ash House, B15 2TT, Birmingham (UK). E-mail: A.CarrascalIncera@bham.ac.uk. Phone: +44 (0) 121 414 9673. ORCID ID: orcid.org/0000-0001-9762-1636.
[2] *Aberystwyth University*, Aberystwyth Business School, Rheidol Building, SY23 3AL, Aberystwyth (UK). E-mail: dig11@aber.ac.uk. Phone: +44 (0) 1970 622012. ORCID ID: orcid.org/0000-0002-0435-8056.

1. Introduction

The outbreak of the recent crisis boosted the level of the youth unemployment in Europe to unprecedented figures. In fact, according to the European Labour Force Survey (LFS) the youth unemployment rate increased 8.1 percentage points during the period 2008-2013 (while the one for adults[1] did it by 3.6). This specific period comprises the time between the beginning of the crisis, with the lowest point registered for youth unemployment at 15.6%, and the moment where it reached its maximum at 23.7%. A high youth unemployment rate implies that many people between 15 and 24 years cannot find a job. During the crisis this problem worsened, given that only 29.7% of the young unemployed population in 2010 found a job in 2011. Additionally, the positions they got were subject to several job insecurity issues: in 2013, 43.1% of young employees worked under a fixed-term contract (four times the rate for adults); 35.1% of the contracts were part-time (twice the rate for adults) and, among them, 29.2% were involuntary.

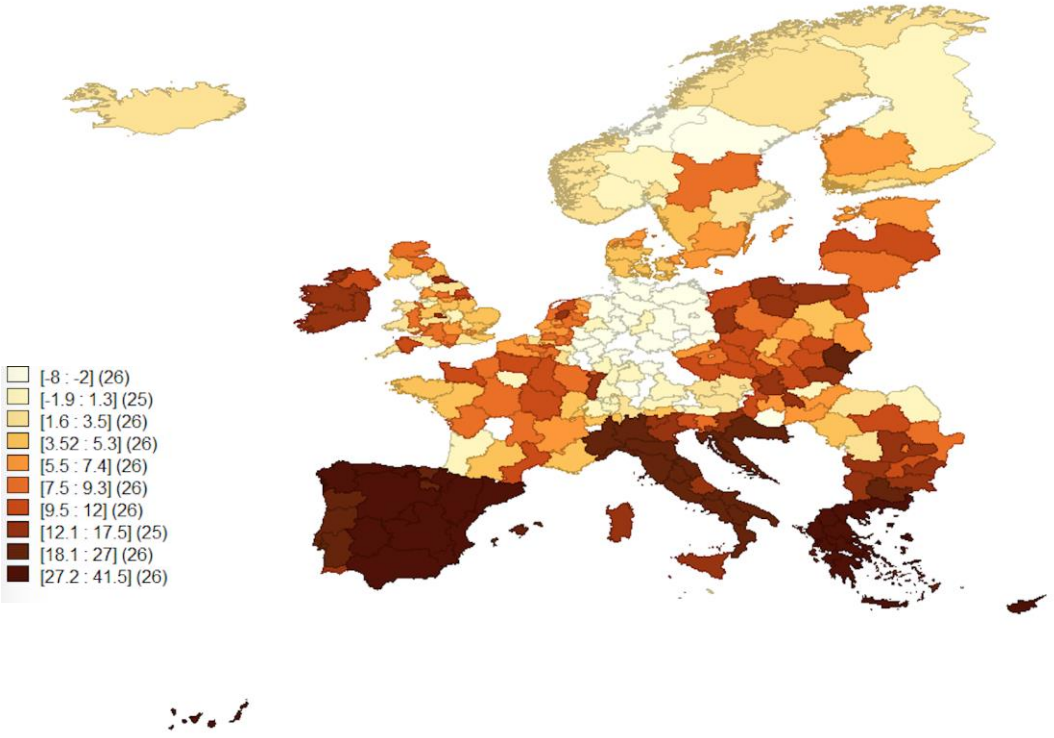
All these figures led to the increase in the number of young discouraged workers — i.e. people that give up searching for a job— and, what is even worse, the rise of the so-called NEET's (Not in Education, Employment, or Training), which is normally considered a risk factor for social exclusion. Linked with this, it is well documented by the related literature that unemployment in early stages of the working life could reduce individual's productive potential and long-term employment prospects (Narendranathan and Elias, 1993; Ryan, 2001; Caroleo et al., 2017). Gregg and Tominey (2005) obtained a wage scar penalty of 13-21% at the age of 41 that reduces to 9-11% if individuals avoid repeated exposure. Mroz and Savage (2006) found a catch-up response by those who suffer unemployment at the young age, but an overall negative effect persists on life-cycle earnings. The mentioned evidence points out that unemployment doesn't have the same effect depending on when it happens. As Bell and Blanchflower (2011) demonstrate, early unemployment creates longer lasting scars than recent unemployment experiences (happening at the age of 50). Other authors, such as Jimeno and Rodríguez (2002), found that youth unemployment can also have a negative effect on human capital accumulation or, even, on fertility rates. This suggests that a long crisis (at least 5 years) can seriously

[1] We consider young those between 15 and 24 years old, and adults those aged 25 or more.

affect the future of the younger generation with respect to their counterparts of other age cohorts.

However, the difficulties of the young population for finding a job were not spread homogenously among the European regions, and there appear important regional differences between the Northern and the Southern regions of Europe. As can be seen in Figure 1 (NUTS 2 level), the region of Dresden in Germany and the region of Cumbria in the UK were the ones showing a better evolution during the period considered, with a reduction in youth unemployment of 8.0 and 7.0 percentage points, respectively. On the other hand, regarding those regions with a higher increase in youth unemployment, we found that, out of the top 25, 10 are Greek regions, 14 correspond to Spanish regions, being the remaining one the isle of Cyprus, all of them Southern regions. Therefore, there is a clear disparity in terms of outcomes between the periphery and the core of Europe, which calls for an analysis towards the drivers behind the spatial clustering of areas with low or high youth unemployment rates.

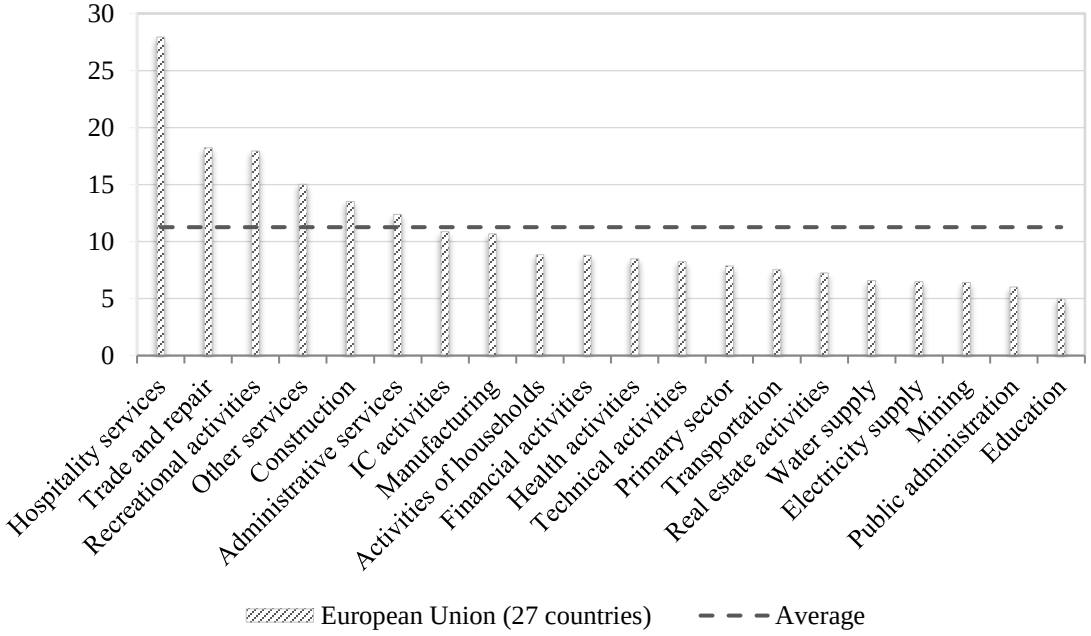
FIGURE 1 - Youth unemployment growth rate by NUTS 2 between 2008 and 2013.



Source: European Labour Force Survey.

Theoretically, the demand for labour is a derived demand from the one of goods and services (Brue et al., 2016) and so, any shock that reduces the aggregate demand, like the recent economic crisis, would cause a decrease in the number of workers needed by the productive sectors affected, independently if those workers are young or adults. However, the transmission of the impact from the aggregate demand to the labour demand is going to be different for each region and production factor depending on the economic structure of the region (i.e. productive specialization) and on its institutional framework, especially with regards to the labour market. This goes in line with the findings of Bell and Blanchflower (2011), concluding that youth unemployment in some countries like Spain, Latvia, Lithuania and Ireland rises when housing prices fall as a result of the reduction in the construction demand. Previous literature also found that young workers tend to absorb the macroeconomic shocks because of the higher flexibility of their contracts (Blanchard and Wolfers, 2000; and O'Higgins, 2014), and that their situation is more sensitive to business cycle oscillations than adult employment (Ghoshray et al., 2016). Carrascal (2017) identified the main structural factors affecting the higher decline in youth employment in the EU15 countries. Among other results, this study found that the construction sector reduced the number of youth workers during the period 2008-2011 in 527,100 individuals through changes in the investment (as part of the final demand) and in the age mix. Following this line, it is reasonable to believe that the sectoral specialization plays an important role at explaining the regional differences in youth labour outcomes.

FIGURE 2 – Youth employment ratio by sectors in 2008.



Source: European Labour Force Survey.

One of the main factors to explain the difference between the causes of youth and adult unemployment is, precisely, that youth employment is highly concentrated in few activities. According to the European Labour Force Survey (LFS) at a 20-sectoral level of aggregation, Figure 2 shows the youth employment ratio by sectors in 2008 for the EU-27 countries. This ratio represents the amount of young workers per 100 adults, considering young those between 15 and 24 years old, and adults those who are 25 or older. Therefore, the sectors with a higher presence of young employees are hospitality services (hotels and restaurants) —close to 30 young workers per 100 adults—, trade and repair, recreational activities, other personal services, construction and administrative services. Those six sectors are the ones with a significant share of young workers in their total workforces, being all of them above the average. We can say then that, in general, the youth employment in EU27 is segregated, and consequently it is more exposed to shocks that affect the particular sectors where the young population tend to find jobs.

In the light of the evidence presented, the aim of this article is to provide an assessment of the importance of the way in which each regional economy entered the crisis in 2008 and how it affected its performance during the period that goes until 2013. Following the idea of path dependence, we estimate how much of the observed youth

unemployment growth can be explained by the initial conditions regarding productive specialization, labour market characteristics and geographical situation, using a Spatial Quantile approach at NUTS2 level. This methodology, proposed in the empirical applications of Zietz et al. (2008) and Kostov (2009), gives us estimations of the effect of each independent variable considered along the quantile distribution of the dependent variable, taking into account the spillover effects coming from the spatial nature of the phenomenon studied. Other studies that take into account the spatial effects when analysing youth unemployment typically include the industrial structure, the relative specialization, the share of part-time and temporary contracts, and the youth/adult population ratio (Perugini and Signorelli, 2010). In Bruno et al. (2014), the structural factors included are the demographic structure, the educational system and the sectoral specialization of the different countries. In general, this strand of the literature shows the impacts of these factors at the country level (Choudhry et al., 2012; Caporale and Gil-Alana, 2014; and Pastore and Guiliani, 2015), focusing primarily on the territorial differences. Alternatively, in our study we try to channel those disparities through the analysis of the different effects that the explanatory factors have depending on the level of youth unemployment growth of the region, provided that it shows a clear spatial pattern.

The rest of the paper is divided into four additional sections. In the first one we describe the methodological approach considered for the analysis. In the following section we explain the principal databases and variables used, and after that, we present the results obtained for the global assessment and the Spatial Quantile regressions at NUTS 2 level. Finally, the last section explains the main conclusions reached through the paper.

2. Methodology

Classical linear regressions, as Ordinary Least Squares (OLS), traditionally estimate a conditional mean function. This handy procedure is widely accepted as a benchmark to build up more complex and accurate formulations, and as such it should be taken into account that this method represents one of the many possible approximations to the conditional distribution of a variable (Mosteller and Tukey, 1977). In an effort to complete the picture and provide more information on the possible disparities at different points of the distribution, Koenker and Bassett (1978) introduced the idea of Quantile Regression.

The mechanism to perform a Quantile Regression is analogous to the one followed in OLS regression, being the main distinction that instead of pursuing the minimization of the sums of the squared (symmetrical) deviations with respect to the mean μ, expressed as a function of x and β (Eq. 1), Quantile Regression looks for the minimization of the weighted sums of the absolute (asymmetrical) residuals, where the weights depend on the quantiles regarded (τ) (Eq. 2). For an extensive review of this methodology and a number of applications in several fields, see Koenker and Hallock (2001) and Koenker (2005).

$$\min_{\beta \in R} \sum_{i=1}^{n} \left(y_i - \mu(x_i, \beta)\right)^2 \quad (1)$$

$$\min_{\beta \in R} \sum_{i=1}^{n} \rho_\tau \left(y_i - \xi(x_i, \beta)\right) \quad (2)$$

Apart from the interest on the effects at work in the lower and higher parts of the quantile distribution, especially in the presence of marked differences, when the phenomenon under study shows a clear spatial pattern (as in the case of youth unemployment) one should be aware of the inefficiency and bias of the estimators if spatial dependence is not taken into consideration, and try to overcome this issues using the appropriate techniques. A common approach is to resort to Spatial Econometrics, modelling spatial dependence through a weighting matrix that reflects the spatial structure of the response variable. Reviews of the various methods at hand to address spatial dependence can be found in Anselin et al. (2004) and in LeSage and Pace (2009).

The integration of Quantile Regression and Spatial Econometrics comes from the contribution of Kim and Muller (2004) and Chernozhukov and Hansen (2006) in dealing with the inconsistency problems of estimators arising from the endogeneity of the explanatory variables, commonly present in socio-economic analysis. Although these works were not concerned with the spatial character of the data in principle, they served as methodological foundations for the applied studies of Ziets et al. (2008) and Kostov (2009), both with an emphasis on spatial autocorrelation.

The spatial approaches based on Kim and Muller (2004) and Chernozhukov and Hansen (2006) are analogous to the estimation of the standard spatial autoregressive model through an instrumental variables procedure in which the spatially lagged values of the explanatory factors (x) serve as instruments for the spatially lagged dependent variable (Wy). In contrast to the traditional spatial lag model, here the spatial lag parameter and the vector of regression parameters are τ-dependent, where τ is the corresponding quantile of the dependent variable, which allows for a different degree of spatial dependence at different points of the response distribution. Starting from a specification of the form:

$$y = \lambda(\tau)W_y + X\beta(\tau) + u \qquad (3)$$

In the case of the Two Stage Quantile Regression (2SQR) by Kim and Muller (2004), in the first stage an instrumental variable is constructed for *Wy* using the predicted values from a quantile regression of *Wy* on a set of instruments. The second stage is a quantile regression of y on *X* and the predicted values of *Wy*. The same quantile is used in both stages. This approach goes in line with a Two Stages Least Square estimation. We follow this procedure to obtain the results presented in this paper.

As an alternative approach, in the Instrumental Quantile Regression (IVQR) by Chernozhukov and Hansen, (2006) a vector of possible values for λ is specified. The explanatory variable *Wy* is replaced by the predicted values of *Wy* on the instruments. This instrumental variable is then used along *X* as an explanatory variable for a series of quantile regressions of $(y - \lambda Wy)$ (one regression for each value of λ listed). The estimated values of β are finally calculated via a quantile regression of $(y - \lambda Wy)$ on *X*. This alternative would be asymptotically equivalent to a Generalized Method of Moments estimation.

3. Database and variables used in the analysis

In this section we present the variables used in the model aforementioned in order to see how the initial structural factors affect the growth in youth unemployment during the period 2008-2013. We also show the main databases and some of the limitations and constraints we found on the process of the analysis. Table 1 offers a summary of some basic information on these aspects.

The empirical model proposed includes indicators of the productive specialization of the region and labour market related variables, along with institutional, demographic and geographical factors as determinants of the youth unemployment growth. In the first group of variables we incorporate location quotients of six sectors (agriculture, industry, construction, wholesale and hospitality services, public activities and real estate services) in order to capture the regional specialization, and also a Le Masne Index (Le Masne, 1988; Pulido et al., 1993) of productive similarity to account for the possible complementarities or substitutions between neighbouring regions. The share of part-time reflects the time flexibility of the market and the long-term unemployment indicates the functioning of the labour market regarding the prospects of finding a job. Both of them are included as labour-market variables. The proportion of people between 15 and 24 years old determines the supply of young population, as well as, the demographic dynamism of the region. As an institutional factor, the model includes the share of early leavers from education, which accounts for regional differences with respect to the level of training and the importance of schooling. Additionally, the specification also contains the expenditure in Active Labour Market Policies (ALMP) as a percentage of the GDP in the country where the region is located. Geographical indicators are incorporated into the model to reflect the importance of the location of each region. This set of variables comprises the distance to the coast and the distance to a large city (more than one million inhabitants), as they may be associated with a better or worse economic performance. Finally, the model also takes into account the initial level of youth unemployment in order to test for regional convergence or divergence, following the traditional fashion of economic growth models.

As a remark on the estimation, the explanatory variables were taken at the beginning of the period (2008) to avoid the simultaneity problem that occurs when the independent factors can be affected by changes in the dependent variable when both terms are measured in the same period, causing inconsistency in the estimated parameters due to endogeneity.

TABLE 1 – Variables and databases considered in the analysis

Variable name	Variable description	Source
Gr. YU 08-13 Gr. AU 08-13	Percentage growth of youth (15-24) or adult (25 or more) unemployment rate between 2008 and 2013	European Labour Force Survey (EU-LFS) from Eurostat
Youth Unemp. 08 Adult Unemp. 08	Initial youth or adult unemployment rate	
LQ agriculture 08 LQ industry 08 LQ construction 08 LQ wholesale trade 08 LQ real estate 08 LQ public act. 08	Initial Location Quotient of the share of workers in each sector over the European share.	
Le Masne Index	Similarity index for measuring the productive specialization of the regions with respect to their neighbours, in terms of workers.	
15-24 years old 08	Initial share of population aged between 15 and 24 years old	Unified Demography (UNIDEMO) project from Eurostat
Early leavers 08	Initial share of early leavers from the educational system (18 to 24 years old)	European Labour Force Survey (EU-LFS) from Eurostat
Part-time 08	Initial share of employees not working full time	
Long-term Unemp. 08	Initial share of unemployed looking for a job for longer than one year	
ALMP expenditure 08	Initial expenditure in ALMP (2-7 categories) as a percentage of the GDP in the country where the region is located	European Commission, Directorate General for Employment, Social Affairs and Inclusion
Distance to nearest city	Logarithm of the distance between the regional centroid and the nearest city of more than one million inhabitants	EuroGeographics for the administrative boundaries from Eurostat
Distance to coast	Logarithm of the distance between the regional centroid and the nearest coastline	

Given the spatial distribution of youth unemployment growth (shown in Figure 1), in this analysis we used a contiguity matrix that includes the 6 nearest neighbours, bearing a Moran's I of 0.7484. This neighbouring structure is also used for calculating the Le Masne Index, which means that the industrial composition of a region is compared to the one of its 6 nearest neighbours to determine the level of similarity between them.

The European Labour Force Survey (EU-LFS) is the main source of information about the regional labour markets in this research, along with data from the Unified Demography (UNIDEMO) project. The ALMP factor was taken from the Labour Market Policy Database (LMP). Additionally, the information required to calculate the distances from each region to the nearest city and to the coastline was obtained from EuroGeographics for the administrative boundaries. Therefore, all the data for the 258 NUTS 2 regions considered was obtained from Eurostat.

4. Results

This forth section shows first the Ordinary Least Squares (OLS) model, which will serve as a first approximation to the relationship between youth unemployment growth and the factors presented in the introduction (productive structure, labour market and institutional aspects and geographic situation of the region). Then, the results of the Spatial Quantile Regression will be reviewed, focusing the discussion on the impact of the determinants included along the distribution of the response variable, providing also the results of the global spatial estimation (on the conditional mean).

As can be seen in Table 2, the OLS specification shows a significant divergence in the case of the youth unemployment, meaning that the economies with a high initial youth unemployment rate were the ones that suffered a larger increase in the growth rate of that same variable during the crisis. Attending first to the factors that would imply a higher growth in youth unemployment (*ceteris paribus)*, the specialization in wholesale trade and hospitality, in construction, and in primary sectors, as well as being similar to your neighbours (in terms of the Le Masne Index) have significant negative effects on the performance of the regions. On the other hand, a well-established part-time scheme, a higher share of population between 15 and 24 years old, and the specialization in public

activities were initial characteristics depicting those regions that presented a lesser growth in youth unemployment during the crisis. The effect of the expenditure in ALMP could be explaining the divergence pattern again, similarly to the conclusion that was drawn from the initial youth unemployment rate, i.e. the regions that were already expending more in ALMP at beginning of the crisis (a possible sign of a malfunctioning labour market) are those with a higher unemployment growth rate.

Comparing the results of the OLS estimation for young and adult unemployment growth, not many differences appear, but the coefficients tend to be higher for the case of the young unemployment overall, revealing a greater volatility and dependence of the regional economic structure, in line with the previous literature on the subject. In any case, the Moran's I test confirms the existence of spatial autocorrelation, which means that a spatial specification is necessary in order to evaluate the phenomenon of youth unemployment more accurately.

TABLE 2 – Ordinary Least Squares results

	Growth Youth Unemployment	**Growth Adult Unemployment**
Constant	0.5276	-8.1454
Youth unemp. 08	0.1954 **	--
Adult unemp. 08	--	-0.1699
Le Masne ind. 08	0.2619 *	0.1386 **
LQ agriculture 08	1.3953 **	0.7456 ***
LQ industry 08	-2.3047	-3.1353 ***
LQ construction 08	5.2817 **	3.0309 **
LQ wholesale 08	7.7475 *	5.2251 ***
LQ public act. 08	-8.2272 **	-2.2331
LQ real estate 08	-1.7309	-1.2221 **
Distance to nearest city	0.0009	0.0002
Distance to the coast	-0.0146 ***	-0.0044 **
Part-time 08	-0.3276 ***	-0.1832 ***
Long-term unemp. 08	-0.0348	0.0019
15-24 years old 08	-1.0059 ***	-0.1243
Early leave 08	0.0592	0.1102 ***
ALMP expend. 08	5.0976 **	4.6864 ***
Adjusted R^2	*0.54*	*0.55*
F-Statistic	*21.34 ****	*22.05 ****
Jarque-Bera test	*3.63*	*98.40 ****
Moran's I	*0.13 ****	*0.19 ****

In Table 3, we present both the Global Spatial estimation and the Spatial Quantile Regression. As expected, the signs of the coefficients in the Global estimation are the same as the ones obtained in the OLS estimation. However, the Quantile results show that the intensity of the effect varies along the distribution of the growth of youth unemployment. This variation can also be seen in Figure 3, where the red line represents the values of the Global Spatial estimation and the dotted black line shows the results for each decile.

Focusing first on the Global estimation output, results corroborate the existence of divergence during the period 2008-2013, which implies an overall increase in the gap between regions with low and high youth unemployment growth rates, and a widening on the inequality of opportunities between the north-south and the core-periphery divides observed in the introduction.

Moreover, the youth unemployment growth of the neighbouring regions (W Youth unemp. 08) has a positive impact on the own youth unemployment growth, meaning that the pernicious effects of this phenomenon are generally transmitted between regions. An analogous reasoning can be derived from the case of the OLS results for the Le Masne index: the structural similarity has worked as a diffusion mechanism, spreading the shocks from one region to its neighbours (although its effect is not significant from a global spatial perspective).

Looking further into the specific industrial specialization, the overall coefficient for the construction location quotient shows the importance of this factor in the skyrocketing of youth unemployment during the period studied, not only for being one of the sectors more severely hit by the economic crisis, but also because of the concentration of young employees in this activity. Conversely, a higher specialization in public activities is related to a lower growth of youth unemployment, which makes sense given the stability associated to the jobs in this type of sectors.

Additionally, it can be seen that inland locations (longer distance to the coast) are associated with a lower growth of youth unemployment during this particular period. Regions with a younger demographic profile and a higher share of part-time contracts also performed better regarding youth unemployment growth. These characteristics reflect a dynamic and flexible economy that proved to be more resilient to the negative shocks of the crisis.

The evaluation of the results of the Spatial Quantile Regression by deciles (Figure 3) shows that there are two groups of determinants: some have a relatively even impact along the distribution of youth unemployment growth, while others have a differentiated effect depending on whether lower or higher quantiles are considered.

An interesting finding is that the Le Masne index and the construction location quotient are in the latter set, which means that these factors, linked to the relative productive specialization of a region from the spatial and labour perspectives respectively, had different implications for regions on the right or the left side of the distribution of the dependent variable. The quantile estimation for the Le Masne index deviates considerably from the global coefficient in the first decile, indicating that a higher industrial similarity with the neighbours translates into a higher growth of youth unemployment for regions in the lower part of the distribution. On the contrary, the coefficients for the eighth and ninth growth rate deciles lie below the variation range of the global estimation, reaching even negative values, although its impact is not significant. This result means that the effect of industrial similarity dilutes for regions with a very high growth of youth unemployment. The behaviour displayed by this factor might be a signal of the stronger transmission of negative impacts in more closely related economies, especially in the case of low youth unemployment growth areas, providing support for the notion of more intense intra-industrial exchange and its power as an outlet for spatial spillovers (Percoco et al., 2007). In the case of the specialization in construction, the higher effects are found for regions with an acute growth of youth unemployment. According to the corresponding graph in Figure 3, the concentration of employment in this activity deepened greatly the issue of youth unemployment in the crisis context, particularly in Southern Europe as shown in Figure 1. This fact is consistent with the studies linking the specialization in construction with unemployment volatility, given the cyclical nature of the sector (Ezcurra, 2011). The substantial proportion of young workers in this activity further amplifies the severity of the effect.

Other variables with different impacts along the distribution of youth unemployment growth are the shares of part-time workers and early-leavers from the educational system. As happened with the industrial similarity index, the initial share of part-time had a distinct impact for the lower and higher parts of the distribution,

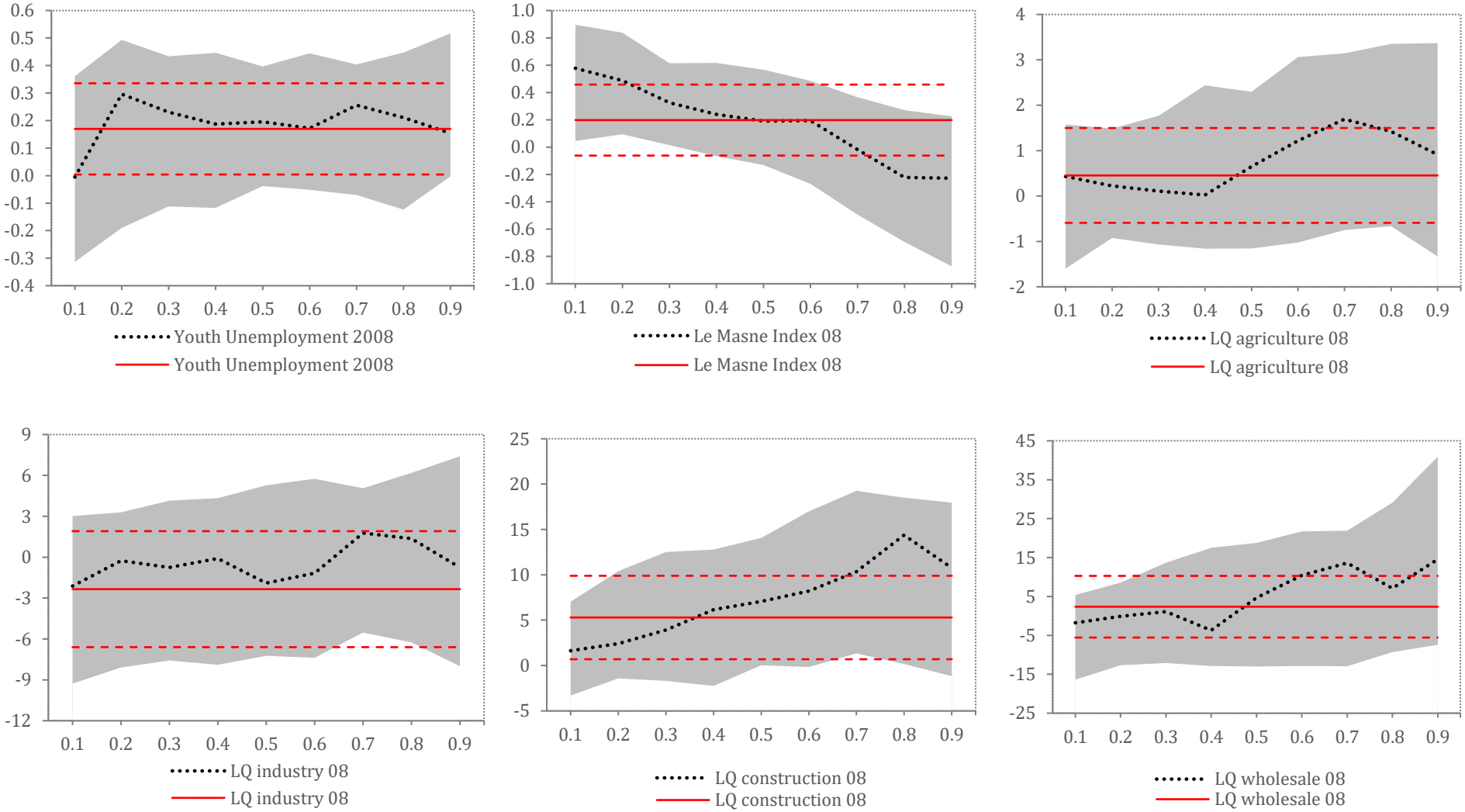
contributing more markedly to the reduction of youth unemployment growth in the first deciles, an impact that vanishes for the regions with higher scores. The differences observed might be the result of the specific schemes and particular orientation towards flexibility in the regions: either using the part-time contracts for providing more employment opportunities to those willing to conciliate several occupations (something specific to certain groups like young population or women), or as a forced choice due to the lack of full-time alternatives in the labour market. The coefficient for the share of youngsters leaving education before completion shows that this factor boosts the growth of young unemployment in the lowest part of the distribution, i.e. regions with better labour market outcomes are the ones affected by the premature disconnection of the population with formal education.

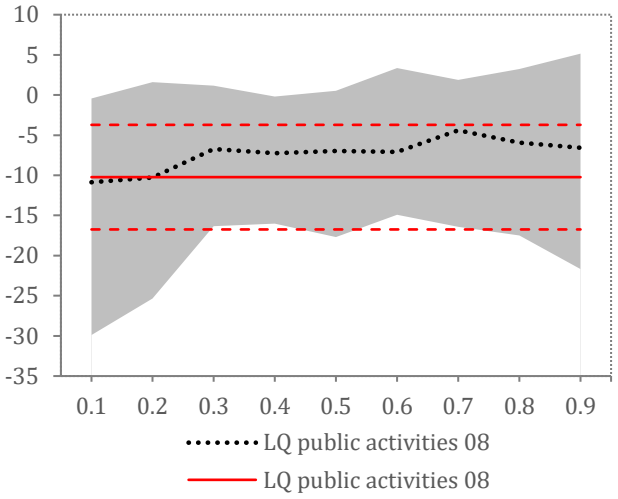
In the group of factors that comply with the global spatial estimation are the initial youth unemployment rate, the location quotient for the public sector, the share of young population and the youth unemployment growth of the neighbours. These determinants affect all the regions in a similar way independently of their situation regarding the distribution of the dependent variable.

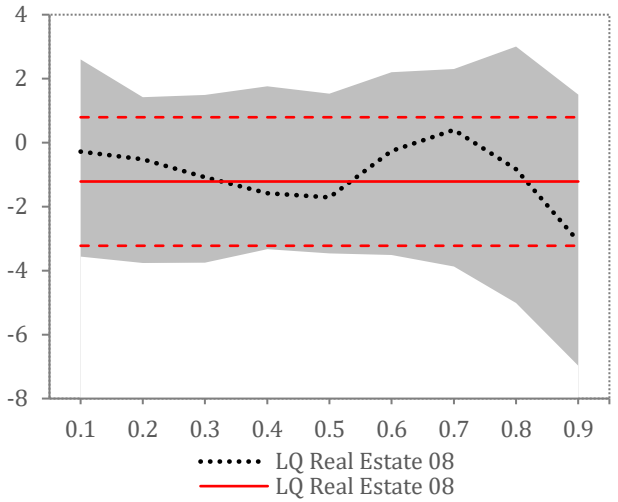
TABLE 3 - Spatial Quantile regressions for the decile distribution of the growth of youth unemployment between 2008 and 2013 and global spatial estimation

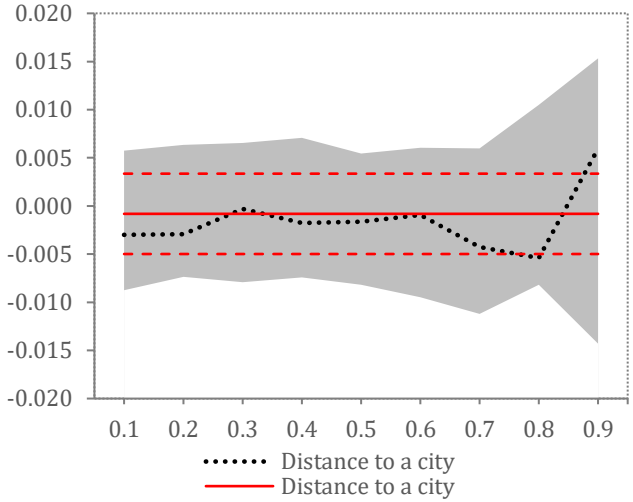
	Global Estimation	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Constant	3.2029	-21.5331	-23.7765	-11.5026	5.4936	3.1593	-3.3297	0.6641	21.6889	19.6138
Youth unemp. 08	0.1697 **	-0.0052	0.2962 *	0.2303 *	0.1869	0.1956 *	0.1719	0.2555 *	0.2104	0.1542
Le Masne ind. 08	0.1978	0.5772 ***	0.4861 ***	0.3258 **	0.2387	0.1911	0.1947	-0.0192	-0.2213	-0.2280
LQ agriculture 08	0.4538	0.4305	0.2222	0.1101	0.0221	0.6488	1.2211	1.6924	1.4228	0.9127
LQ industry 08	-2.3474	-2.1168	-0.2631	-0.7506	-0.0985	-1.8940	-1.1697	1.7717	1.3653	-0.7492
LQ construction 08	5.2956 **	1.6337	2.4045	3.9107	6.1611	7.0532 *	8.2126 *	10.3433 **	14.3779 ***	10.7518 *
LQ wholesale 08	2.3643	-1.7894	-0.1402	1.0749	-3.7079	4.7026	10.3885	13.6035	7.1149	14.5514
LQ public act. 08	-10.2307 ***	-10.8673	-10.2987	-6.7467	-7.2608 *	-6.9803	-7.0948 *	-4.3986	-5.9446	-6.5802
LQ real estate 08	-1.2151	-0.2797	-0.5184	-1.0783	-1.5844	-1.7141	-0.2642	0.3994	-0.8343	-3.0839
Distance to nearest city	-0.0008	-0.0030	-0.0029	-0.0003	-0.0018	-0.0016	-0.0009	-0.0042	-0.0054	0.0060
Distance to the coast	-0.0110 ***	-0.0045	-0.0072	-0.0073	-0.0094 *	-0.0083	-0.0095	-0.0123 **	-0.0154 *	-0.0093
Part-time 08	-0.2088 ***	-0.4433 ***	-0.3195 *	-0.3078 **	-0.2933 **	-0.2537	-0.2369	-0.0667	0.0172	-0.0515
Long-term unemp. 08	0.0006	-0.0830	-0.1013 *	-0.0420	-0.0397	-0.0282	0.0081	0.0144	0.0346	0.0794
15-24 years old 08	-0.6356 **	-0.7093	-0.3838	-0.5048	-0.8729 *	-1.0042 **	-1.2853 ***	-1.1778 **	-0.9268 *	-0.7134
Early leave 08	0.0447	0.3127 *	0.1459	-0.0163	-0.0112	-0.0146	0.0638	-0.0306	-0.0030	0.2011
ALMP expend. 08	3.1875	3.6225	1.9916	0.3774	0.6387	2.8832	3.9204	2.6203	4.2522	4.9786
W Youth unemp. 08	0.4374 ***	0.2389	0.3214 **	0.3875 ***	0.4807 **	0.3777 **	0.2762	0.4459 **	0.3550 **	0.2400

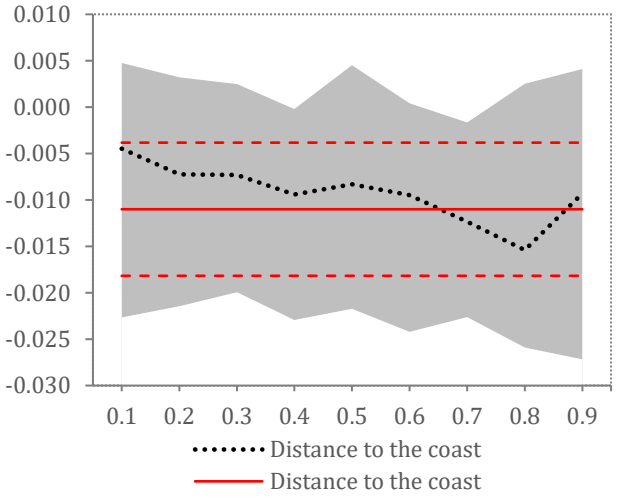
FIGURE 3 – Results obtained with the Spatial Quantile regressions for the growth of youth unemployment between 2008 and 2013 and the global spatial estimation

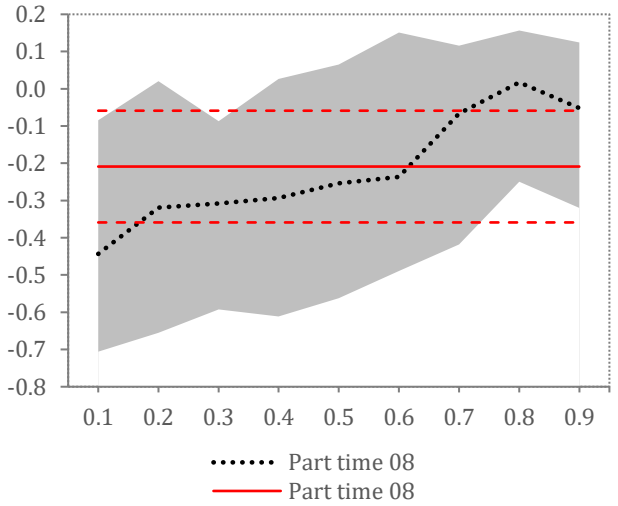



10
5
0
-5
-10
-15
-20
-25
-30
-35
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
LQ public activities 08
LQ public activities 08

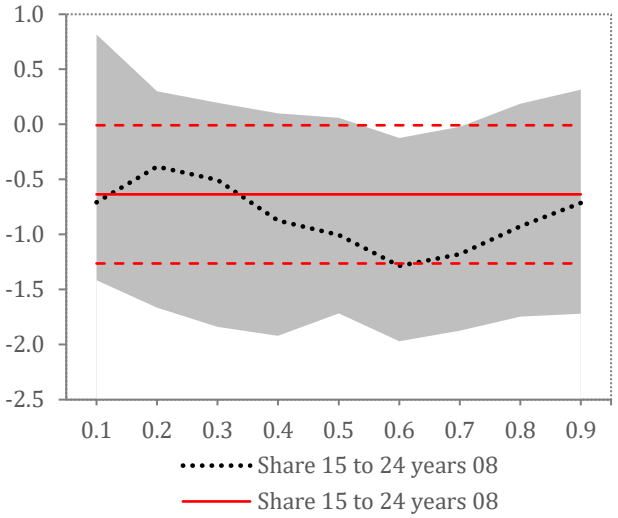

4
2
0
-2
-4
-6
-8
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
LQ Real Estate 08
LQ Real Estate 08

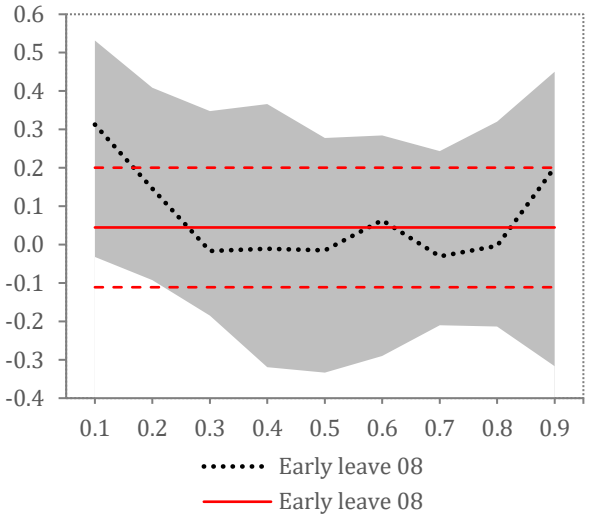

0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Distance to a city
Distance to a city

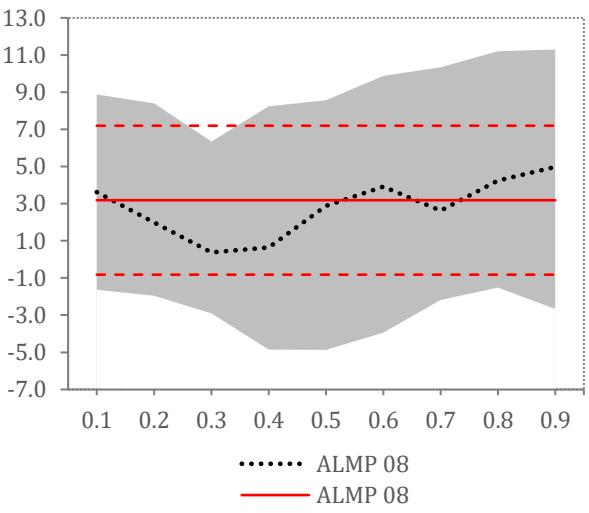

0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Distance to the coast
Distance to the coast

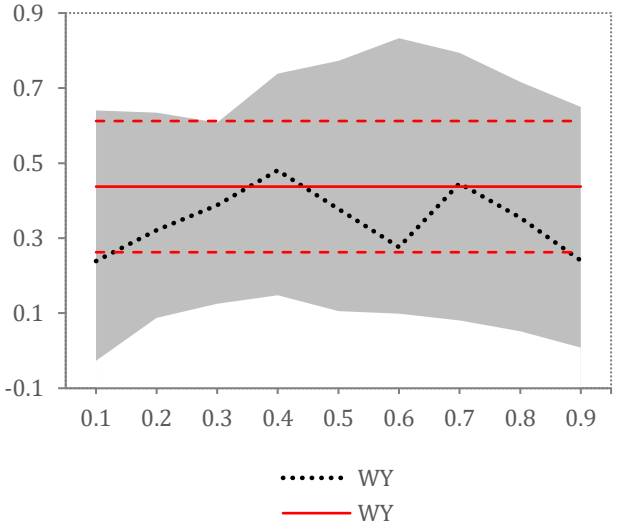

0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Part time 08
Part time 08


0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Long-term unemployment 08
Long-term unemployment 08


1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Share 15 to 24 years 08
Share 15 to 24 years 08


0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Early leave 08
Early leave 08


13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
-5.0
-7.0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
ALMP 08
ALMP 08


0.9
0.7
0.5
0.3
0.1
-0.1
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
WY
WY

5. Summary and conclusions

The recent economic crisis caused, among other economic and social negative effects, the increase of youth unemployment rates to extraordinarily high levels. Following the literature on the individual consequences of unemployment experiences, it seems to be problematic, not just in terms of individual's productive potential and long-term employment prospects, but also for fertility rates and for the rise in the number of NEETs. The combination of these outcomes is starting to show significant demographic and social exclusion consequences. It is important to notice that the young cohorts have also a higher mobility, which means that long unemployment spells are going to be associated with migration. As O'Reilly et al. (2015) highlight, during the period of the crisis the South–North emigration rose as young people from regions in Spain, Greece, Italy, Portugal, and Ireland moved to regions in Northern Europe to find a job. All of these recent economic changes can have relevant short and long run effects in the demographic composition of the regional economies in Europe, enlarging the existent inequalities on several dimensions. Under this circumstances and forecasts, an analysis of the factors behind the spatial clustering of areas with a better and a worse evolution in terms of youth unemployment growth during the period of the crisis becomes necessary.

To summarise the main findings of this work, the productive specialization of the regions appears as an important factor for explaining the different regional experiences in youth unemployment growth. The global coefficient for the construction location quotient shows that being specialized in this sector had contributed to the increase of youth unemployment during the period studied, in line with the findings of Bell and Blanchflower (2011) and Carrascal (2017). On the other hand, a higher specialization in public activities is related to a lower growth of youth unemployment, since it is associated with more stable contracts.

Spatial Quantile results suggest that the similarity in the productive structure, the specialization in sectors with a higher concentration of young workers (such as construction and wholesale trade and hospitality services), or the working time flexibility had a different effect in those regions at the top or the bottom of the youth unemployment growth distribution. In the case of the specialization in construction activities, it affected more negatively the economies that present a high growth in youth unemployment, while the initial share of part-time helped to reduce it in the low growth

regions (providing opportunities to find a job for the youth labour force through voluntary flexibility, in line with the 'flexicurity' model of northern countries).

The results derived from this study suggest two possible types of policies to address youth unemployment growth, depending on the quantile of the distribution that a certain region belongs to. In this manner, different policies should be instrumented at different geographical levels, either for Europe as a whole or more region-specific. The first set of policies oriented to reduce youth unemployment would be appropriate for the entire group of European regions. Independently of the decile, results show that fostering more stable contracts (reflected by the specialization in public activities) and a more dynamic and young population is synonym of a better performance in terms of youth unemployment. Consequently, implementing Europe-wide policies focused on reducing temporary contracts among the young workers should have a positive impact for all the regions, so as measures aimed to retain and attract young human capital, and to promote fertility rates. On the other hand, the second type of policies should be tailored at the regional level. Applying a convergence rationale linking the initial conditions and the growth to the topic of youth unemployment, and taking into account the divergence result, it can be said that, for those regions with a high initial unemployment rate, being specialized in construction was a factor boosting youth unemployment growth, therefore, they would benefit from being less dependent on the construction sector. Conversely, for those regions with low initial youth unemployment, reducing the levels of early leavers would assist on achieving even better figures.

One of the reasons why the part-time appears to be significant for the low growth regions and not for the high ones is because it works differently in some places than in others. Part-time in Northern countries is associated to more opportunities to find a suitable job and to conciliate, while in Southern counties it is related to underemployment and a lack of other labour market alternatives, as indicated by the national involuntary part-time shares contained in the European LFS. Changing the way part-time works in the regions with high unemployment growth to make it more similar to how it operates in the northern regions can be another way of reducing the gap in youth unemployment growth across European regions.

References

Anselin, L., Florax R.J. & Rey S.J. (2004). *Advances in Spatial Econometrics: Methodology, Tools and Applications*. Springer, Berlin.

Bell, D. N., & Blanchflower, D. G. (2011). Youth unemployment in Europe and the United States. *Nordic Economic Policy Review*, *1*(2011), 11-37.

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.

Brue, S. L., McConnell, C. R., & Macpherson, D. A. (2016). *Contemporary labor economics*. McGraw-Hill Education.

Bruno, G. S., Choudhry, M. T., Marelli, E., & Signorelli, M. (2014). Youth unemployment: Key determinants and the impact of crises. In *Disadvantaged Workers* (pp. 121-148). Springer, Cham.

Caporale, G. M., & Gil-Alana, L. (2014). Youth unemployment in Europe: Persistence and macroeconomic determinants. *Comparative Economic Studies*, *56*(4), 581-591.

Caroleo, F. E., Ciociano, E., & Destefanis, S. (2017). Youth Labour-Market Performance, Institutions and Vet Systems: A Cross-Country Analysis. *Italian Economic Journal*, 3(1), 39-69.

Carrascal, A. (2017). Drivers of change in the European youth employment: a comparative structural decomposition analysis. *Economic Systems Research*, *29*(4), 463-485.

Chernozhukov, V. & Hansen, C. (2006). Instrumental Quantile Regression Inference for Structural and Treatment Effect Models. *Journal of Econometrics, 132*, 491-525.

Choudhry, M., Marelli, E., & Signorelli, M. (2012). Youth unemployment rate and impact of financial crises. *International journal of manpower*, *33*(1), 76-95.

Ezcurra, R. (2011). Unemployment volatility and regional specialization in the European Union. *Regional Studies*, 45(8), 1121-1137.

Ghoshray, A., Ordóñez, J., & Sala, H. (2016). Euro, crisis and unemployment: Youth patterns, youth policies?. *Economic Modelling*, *58*, 442-453.

Gregg, P., & Tominey, E. (2005). The wage scar from male youth unemployment. *Labour Economics*, 12(4), 487-509.

Jimeno, J. F., & Rodriguez-Palenzuela, D. (2002). Youth unemployment in the OECD: demographic shifts, labour market institutions, and macroeconomic shocks. *ECB Working Paper*, No. 155.

Kim, T.H. & Muller, C. (2004). Two-stage Quantile Regression when the First Stage is Based on Quantile Regression. *Econometric Journal*, *7*, 218-231.

Koenker, R. (2005). *Quantile Regression*. Cambridge University Press,Cambridge.

Koenker, R. & Hallock, K.F. (2001). Quantile Regression. *Journal of Economic Perspectives, 15*(4), 143-156.

Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica: journal of the Econometric Society*, 33-50.

Kostov, P. (2009). A spatial quantile regression hedonic model of agricultural land prices. *Spatial Economic Analysis*, *4*(1), 53-72.

Le Masne, P. (1988). Le système productif français face a ses voisins européens. In *Ponencia presentada en Troisiènne Colloque de Comptabilité Nationale, París*.

LeSage, J.P. & Pace, R.K. (2009). *Introduction to Spatial Econometrics*. Taylor & Francis, Florida

Mosteller, F. & Tukey, J. (1977). *Data Analysis and Regression: A Second Course in Statistics*. Reading: Addison-Wesley.

Mroz, T. A., & Savage, T. H. (2006). The long-term effects of youth unemployment. *Journal of Human Resources*, 41(2), 259-293.

Narendranathan, W., & Elias, P. (1993). Influences of past history on the incidence of youth unemployment: empirical findings for the UK. *Oxford Bulletin of Economics and Statistics*, 55(2), 161-185.

O'Higgins, N. (2014). Institutions and youth labour markets in Europe during the crisis. *Economic policy and the financial crisis*, 90-113.

O'Reilly, J., Eichhorst, W., Gábos, A., Hadjivassiliou, K., Lain, D., Leschke, J., ... & Russell, H. (2015). Five characteristics of youth unemployment in Europe: Flexibility, education, migration, family legacies, and EU policy. *Sage Open*, 5(1), DOI:2158244015574962.

Pastore, F., & Giuliani, L. (2015). The determinants of youth unemployment. A panel data analysis. *Discussion Papers 2_2015. CRISEI, University of Naples Parthenope*.

Percoco, M., Dall'erba, S., & Hewings, G. J. (2007). Structural convergence of the national economies of Europe. In M. Van Geenhuizen, A. Regiani & P. Rietveld (Eds.) *Policy Analysis of Transport Networks.* Aldershot: Ashgate.

Perugini, C., & Signorelli, M. (2010). Youth labour market performance in European regions. *Economic change and restructuring*, *43*(2), 151-185.

Pulido, A., & Fontela, E. (1993). *Análisis Input-Output: modelos, datos y aplicaciones*. Pirámide.

Ryan, P. (2001). The school-to-work transition: a cross-national perspective. *Journal of economic literature*, 39(1), 34-92.

Zietz, J., Zietz, E. N., & Sirmans, G. S. (2008). Determinants of house prices: a quantile regression approach. *The Journal of Real Estate Finance and Economics*, *37*(4), 317-333.