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Article *in* Comparative Economic Studies · December 2014

DOI: 10.1057/ces.2014.27

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Symposium Article

The Rise of NEET and Youth Unemployment in EU Regions after the Crisis

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This paper assesses the impact of the recent crisis on the NEET (neither in employment or education or training) rate and the youth unemployment rate in EU regions. We use Eurostat data for the 2000–2010 period and focus on changes in both indices from 2000–2008 to 2009–2010. Employing Generalized Method of Moments (GMM) and bias-corrected Least Squares Dummy Variables (LSDV) dynamic panel data estimators, implemented by pooling both all regions and different groups of countries, we find that NEET rates are persistent and that persistence increases over the crisis period but that results vary depending on which of five regional groups is considered.
Comparative Economic Studies (2014) **56,** 592–615. doi:10.1057/ces.2014.27; published online 25 September 2014

Keywords: NEET rates, youth unemployment, crisis impact, EU regions

JEL Classification: J64, E24, R11, P51

INTRODUCTION

The aim of this paper is to evaluate the sensitivity of regional NEET (neither in employment or education or training) rates in Europe to changes in economic

activity at the regional level, allowing for dynamic persistence and for distinct effects during the recent financial crisis, by comparing NEET rates with youth unemployment and overall unemployment rates (UR). Specifically, we provide an analysis of the EU regions over the 2000–2010 period and focus on changes in both indices from 2000–2008 to 2009–2010. Economic activity is measured by GDP growth. Consideration of the regional level (we use the NUTS-1 level of Eurostat) allows for highly detailed cross-sectional variation relative to the national level. In many countries, especially the larger ones, labor market performance varies widely between regions, and the impact of the crisis, similarly, has differed from one region to another. In addition, it is of interest to assess the importance of various spatial effects, as we do at the end of the empirical section.

An original contribution of this paper is that the analysis is based not only on traditional indicators, youth unemployment rates (YUR) compared with adult or total UR, but also on the more innovative NEET indicator, as we explain in the next section.

The econometric setup is designed to take full advantage of the panel structure of our data: (1) all models incorporate dynamic feedback to identify the degree of persistence in the dependent variables; (2) we accommodate latent heterogeneity at different levels of regional aggregation; (3) we allow the crisis years to exert separate effects on the dependent variable of interest, both through the inclusion of time indicators and in interactions with GDP growth rates. To this end, estimation is primarily based on Generalized Method of Moments (GMM) and bias-corrected fixed effect dynamic panel data estimators. We also implement a simplified version of the GMM estimator suggested by Baltagi *et al.* (2014) to accommodate spatial interactions across regions.

The structure of the paper is as follows. In the next section, we briefly review the literature on NEET and youth unemployment by focusing on the impact of the recent global crisis and on differing responses of different European countries and regions. The section after that presents our econometric analysis, including our data and methodology. The econometric results are presented and discussed in the subsequent section. The last section concludes and discusses some policy implications.

NEET AND YOUTH UNEMPLOYMENT: REGIONAL DIFFERENTIATION IN EUROPE AND THE IMPACT OF THE CRISIS

Before we present our empirical analysis, three issues are worth discussing in this section: (1) the definitions of the two labor market indices, NEET and YUR; (2) the impact of the recent economic crisis on labor market performance

so as to understand the differing effects on NEET and YUR, which we analyze in the econometric section; and (3) spatial variations in performance across European countries and regions.

The YUR, which concerns young people normally in the 15–24 age group, is in most countries two or three times as high as the total UR. In Europe, higher than average YURs are found in several groups of countries: (i) many Mediterranean countries (Spain, Italy, and Greece, as well as France and Belgium); (ii) some Scandinavian countries; and (iii) many new EU member states (NMS).

NEET refers to young people 'neither in employment or education or training', and the NEET rate is computed as a percentage of the population of the same age group (the precise definition by Eurostat is reported in the 'An Econometric Investigation: Data and Methodology' section).[1] The growth of the NEET group is an even greater problem for society than overall unemployment, as it creates the risk of a 'lost generation'. Many authors argue that the size of the group of 'youth left behind' can be better proxied by the NEET indicator than by YUR (eg, O'Higgins, 2011; Scarpetta *et al.*, 2010).[2] Eurofound (2012) reports that in 2011, 12.9% of young people in the age class of 15–24 years, on average, were not in employment, education or training in the EU.[3]

The 2008–2009 financial crisis, the consequent Great Recession, the Eurozone sovereign debt crisis and the ensuing austerity measures have profoundly affected European labor markets. With respect to the timing of labor market responses, it has been estimated (IMF, 2010) that in normal recessions, after output has started to recover, it takes three quarters for employment to begin to increase and an additional two quarters for the UR to peak; however, such lags are longer when a recession is combined with a financial crisis.

With respect to the impact of the crisis on young people, the economic crisis abruptly ended the gradual decline in global YUR that was recorded during the 2002–2007 period (ILO, 2012). Most evidence confirms a deeper impact on youth unemployment compared with adult or total unemployment; indeed, the

[1] Notice that NEET is not computed for the labor force. Thus, the different denominator (compared to UR) explains the lower values compared with the unemployment rate. However, the numerator includes not only the unemployed but also young people who are not in education or training.

[2] International institutions have also recognized the importance of the NEET indicator, which was initially adopted to study problems of young workers in the United Kingdom. The initiative, 'Youth on the Move', part of the Europe 2020 program (European Commission, 2010), emphasizes the importance of focusing on the NEET rate.

[3] Bulgaria, Ireland, Italy and Spain have very high NEET rates (above 17%); high rates are also found in the United Kingdom; average rates are found in France, Portugal and some Eastern European countries; low rates are found in Germany, Sweden and Finland; the lowest rates (less than 7%) are found in the Netherlands and Luxembourg.

YUR is more sensitive to the business cycle than are adult UR (see Choudhry *et al.*, 2012). The main reasons for the differential effects of the business cycle on youth and adult unemployment are found in lower qualifications, less experience and weaker work contracts among young workers than among older workers.[4] Indeed, following severe recessions, hardships for young people both in acquiring jobs as new entrants and in remaining employed increase. Observe that, discouraged by high YUR, many young people give up searching for work altogether; in some cases, they decide to postpone their job search and remain in the education system, but, in other cases, the outcome is even worse because they join the NEET group.[5] In addition to the greater immediate impact of the crisis on YUR than on adult unemployment, further evidence concerns the persistence of unemployment over time and the increasing extent of long-term unemployment. O'Higgins (2011, 2012) warns that the key problem is not only that young people are more vulnerable to the effects of a crisis than are adults, but also that these effects are likely to be more long-lasting for the young.

Turning to the third point, we observe that the impact of the crisis on employment and unemployment varies across countries. In general, there have been two main types of adjustment: (i) in the most 'flexible' countries such as the United States, Ireland, the Baltic states and Spain, employment was cut rapidly and deeply, helping to maintain labor productivity but at the cost of large increases in unemployment; (ii) in some other countries, Germany but also Japan, the Netherlands, Denmark and Italy, labor hoarding practices, working hour adjustments and specific policy measures limited the immediate reaction; however, in cases of prolonged or double-dip recessions, as in Italy, these strategies and policies were much less effective, and the persistence of the impact was much greater.

Thus, labor market institutions, in addition to specific macroeconomic conditions and structural determinants, are the first major determinant of the differing effects of the crisis on unemployment across countries.[6] Some years ago, the OECD (2006) showed that almost two-thirds of non-cyclical unemployment changes are explained by changes in policies and institutions. More recently, the IMF (2010) showed that institutions and policies are a key determinant of changes in Okun coefficients, that is, the parameters linking unemployment change to GDP growth, across countries and over time.

[4] See Arpaia and Curci (2010), who produced a broad analysis of labor market adjustments in the EU-27 after the 2008–2009 recession in terms of employment, unemployment, hours worked and wages.

[5] According to the ILO (2012), if the unemployment rate is adjusted for drop-outs induced by the economic crisis, the global YUR in 2011 would rise from 12.6% to 13.6%.

[6] For a recent review of the main determinants (macroeconomic, demographic, structural, institutional, etc), see Marelli *et al.* (2013).

Here, we note that institutional determinants analyzed in theoretical and empirical studies include several types of variables.[7] An indirect way of assessing the importance of institutional variables is to consider groups of countries or regions that are similar with respect to labor market institutions and policies. For instance, in the case of Europe, we can consider the following 'macro-regions', characterized by certain common features of labor market institutions and the economic setting as a whole, including educational and welfare systems:

1. Continental regions, which are characterized by highly productive industries and dual educational systems where education, training and labor experiences are not separated, as in other systems.
2. Northern (Scandinavian) regions, which are characterized by extensive Active Labor Market Policies and the so-called 'flexicurity' model.
3. Anglo-Saxon regions, which have high quality education and labor market flexibility.
4. Southern regions, where the role of the family is crucial, and there is a substantial amount of temporary work.
5. Regions in New Member States, economies that are catching-up and making efforts to build a modern welfare system.

Esping-Andersen (1990) used a similar classification of welfare systems for the old member states of the EU, a classification further elaborated by Caroleo and Pastore (2007), although their analysis is at the country, not regional, level. A different grouping, into four clusters of countries, not necessarily contiguous geographically, can be found in Eurofound (2012). With respect to labor market performance, we can say that both the cooperative/corporatist models of Continental regions and the flexicurity models of Scandinavian regions appear to be superior to the complete flexibility of Anglo-Saxon countries or the traditional systems of Southern countries.

In addition to spatial variations across countries, there are significant differences, both in institutions and in labor market performance, between regions within countries. In this paper, we focus on developments within the European Union (EU), focusing on the Nuts-1 regional breakdown. Indeed, in many countries, especially in the larger ones, labor market performance varies widely within individual countries, and the impact of the crisis has varied across regions within countries.

[7] To provide a flavor: taxes on labor, unemployment benefits (in terms of amount, duration and replacement ratio), degree of unionization (union density and union coverage), collective bargaining (degree of coordination and/or centralization), minimum wages, employment protection legislation (EPL), incidence of temporary or part-time contracts, active labor market policies and, in the case of young people, educational systems and school-to-work transitions.

The regional dimension of unemployment was initially examined in the seminal work of Blanchard and Katz (1992). Elhorst (2003) presents a comprehensive survey of regional unemployment, and several recent studies highlight various aspects and determinants of regional labor market performance. The key empirical findings are that regional unemployment differentials are wide and persistent, that low unemployment regions tend to cluster close to each other and that the observed differences show a clear and persistent core-periphery pattern, with high and persistent unemployment concentrated in peripheral regions. Despite this evidence, to date, regional or sub-national investigations of the labor market impact of the recent crisis have been rare.[8] Needless to say, the regional level is particularly important not only from an empirical perspective but also a policy perspective, on part because of the EU's cohesion objectives and the structural funds devoted to lagging regions.

In the remainder of this paper, we will propose and estimate a battery of econometric models intended to accommodate most of the issues introduced above.

AN ECONOMETRIC INVESTIGATION: DATA AND METHODOLOGY

In our econometric investigation, we wish to assess the dynamics of NEET and YUR in the EU regions by focusing on changes that occurred during the recent crisis period. The UR refers to the population 15 years old or above; the YUR refers to the 15–24 age group. The NEET rate is defined by Eurostat as 'Young people aged 18–24 not in employment and not in any education and training' as a percentage of the corresponding population. The data concerning the above noted labor market indices are generally available from 2000 to 2011, and our cross-sectional units are the EU regions at the Nuts-1 level according to the Eurostat classification of regions.

The goal of this econometric section is to evaluate the sensitivity of regional NEET rates in Europe compared with youth unemployment and overall UR to changes in economic activity at the regional level, allowing for dynamic persistence and distinct regional effects over the recent crisis period. The key control variable is gross domestic product; because GDP is measured in current market prices, we use the GDP deflator at the national level to obtain the real GDP for the various regions.[9]

[8] For a recent exception, see Marelli *et al.* (2012).

[9] In this way, we have GDP (computed) data through 2010, while the regional data for gross value added in real terms are available only through 2009.

We consider the following baseline model for NEET, YUR and UR:

$$y_{i,t} = \gamma y_{i,t-1} + \beta_0 x_{i,t} + \beta_1 x_{i,t-1} + c_t\left(\gamma_c y_{i,t-1} + \beta_{0c} x_{i,t} + \beta_{1c} x_{i,t-1}\right) + u_{it} \qquad (1)$$

$i = 1, \ldots, N$, $t = 1, \ldots, T$, where

- $y_{i,t}$ is the NEET rate, or, alternatively, YUR and UR, of region i in year t, and $x_{i,t}$ is a variable of economic activity at the regional level (eg, regional GDP growth).
- c_t is a binary indicator that equals one if t is during the crisis period and zero otherwise.
- $u_{i,t} = \alpha_i + \eta_t + \lambda_{r(i),t} + \varepsilon_{i,t}$ is a composite error term comprising the following components: α_i, which indicates correlated latent regional effects; η_t, which are latent aggregate transitory shocks; $\lambda_{r(i),t}$, which captures possibly time-varying effects at a macro-region level, with $r(i)$ indicating the macro-region of region i and with macro-regions defined as in the 'NEET and Youth Unemployment: Regional Differentiation in Europe and the Impact of the Crisis' section, that is, *Continental, Northern, Anglo-Saxon* and *NMS* (Northern regions are not considered here because of the small number of observations); and $\varepsilon_{i,t}$ is a conventional idiosyncratic shock.

Equation 1 enables us to evaluate the short-run effects of growth as the coefficient estimate of GDP growth (t) and to identify an intermediate effect, after at most 2 years, as the sum of the coefficient estimates of the two growth variables. More specifically, we identify the following effects of interest:

- the pre- and during-crisis persistence coefficients: γ and $\gamma + \gamma_c$, respectively;
- the pre- and during-crisis short-run effects of $x_{i,t}$: β_0 and $\beta_0 + \beta_{0c}$, respectively;
- the pre- and during-crisis 2-year effects of $x_{i,t}$: $\beta_0 + \beta_1$ and $\beta_0 + \beta_1 + (\beta_{0c} + \beta_{1c})$, respectively.

Our estimation sample covers the period from 2000 to 2010 because GDP is not observed in 2011. Depending on the model, the sample size ranges from 645 to 735, and the number of regions ranges from 89 to 90. We focus on the crisis period, 2009–2010, during which all European countries had already entered recession. Starting from 2008 produces less significant results, although the signs and sizes of coefficient estimates are largely the same.

We use two popular dynamic panel data estimators: the two-step Difference GMM (DIFF GMM, see Arellano and Bond, 1991) and the two-step System GMM (SYS GMM, see Blundell and Bond, 1998). Econometric results will be presented in the next section. Standard error estimates are corrected using the Windmeijer (2005) procedure. GMM-type instruments nearly always start from the third lag of the dependent variable. Conventional tests such as the Hansen test, difference-in-Hansen test and Arellano-Bond AR tests

do not reject the specifications of any of the models considered here at conventional levels of significance. In addition, it is reassuring that none of the *p*-values obtained in Hansen tests of overidentifying restrictions equal unity, as it generally would in the presence of proliferation-of-instruments bias (see Roodman, 2009).

To capture the η_t effects, all models include time dummies, which always turn out to be jointly significant. The regional effects α_i are accommodated through first differencing, in the case of DIFF GMM, and both first differencing and a mean-stationarity assumption in the case of SYS GMM.

ECONOMETRIC RESULTS AND DISCUSSION

In this section, we present the econometric results of our analysis. First, we provide and discuss the results of NEET rates in the pooled regression. We then consider results for the groups of regions. The following sub-section will illustrate comparisons of NEET rates with youth (YUR) and adult UR. In the final sub-section, we present some results of the spatial analysis.

Results for the pooled regression on NEET rates

Results for the pooled regression on NEET rates are shown in Table 1. Corresponding tables for male and female rates are available upon request. We consider the following models:

- Model 1 applies the constraints $\beta_{0c} = 0$, $\gamma_c = 0$ and does not consider the macro-region component.
- Model 2 is Model 1 without the first constraint.
- Model 3 is Model 2 without the $\gamma_c = 0$ constraint.
- Model 4 also incorporates macro-region effects but only those that are time-constant.
- Model 5 permits time-varying macro-region effects.

At the aggregate level, our estimates consistently tell the following story:

First, NEET rates are persistent and respond negatively to growth over the whole estimation period. Second, the crisis exerts a significant twofold impact. First, persistence of NEET rates over the crisis period appears to be higher than previously, that is, over the 2003–2007 period (the first three years are lost to dynamics and instruments). Second, the crisis effect of GDP growth is significantly smaller for all NEET rates. Interestingly, before 2009, this effect is distributed over a 2-year span, with a peak in the second year as shown by the negative coefficient on *GDP growth*(-1).

Table 1: GMM estimates – Total NEET rates

Variables	(1) DIFF GMM	(2) DIFF GMM	(3) DIFF GMM	(4) SYS GMM	(5) SYS GMM
neetratet(−1)	0.786***	0.764***	0.768***	0.776***	0.714***
	(0.047)	(0.050)	(0.044)	(0.044)	(0.068)
neetratet(−1) × crisis			0.125**	0.111**	0.107*
			(0.055)	(0.045)	(0.058)
GDP growth	−0.169***	−0.173***	−0.170***	−0.189***	−0.227***
	(0.032)	(0.049)	(0.044)	(0.048)	(0.059)
GDP growth (−1)	−0.426***	−0.383***	−0.436***	−0.346***	−0.492***
	(0.112)	(0.110)	(0.115)	(0.110)	(0.149)
GDP growth × crisis		−0.026	−0.005	0.014	0.034
		(0.076)	(0.072)	(0.075)	(0.089)
GDP growth(−1) × crisis	0.358***	0.258*	0.351**	0.245*	0.449**
	(0.116)	(0.138)	(0.140)	(0.140)	(0.221)
Northern				1.208	3.101
				(1.103)	(2.616)
Anglo-Saxon				1.079**	2.251***
				(0.512)	(0.475)
Southern				1.434	2.761**
				(0.890)	(1.184)
NMS				2.913***	4.105***
				(0.675)	(1.168)
Continental × crisis					−2.723***
					(0.911)
Northern × crisis					−2.902
					(2.315)
Anglo-Saxon × crisis					−1.778
					(1.137)
Southern × crisis					−2.566
					(1.591)
NMS × crisis					−3.638**
					(1.652)
Constant				3.500***	3.984***
				(0.647)	(0.850)
Observations	645	645	645	735	735
Number of regions (Nuts-1)	89	89	89	90	90
GDP growth pre-crisis effect	−0.595***	−0.557***	−0.606***	−0.536***	−0.720***
GDP growth crisis effect	−0.237***	−0.325***	−0.260***	−0.276***	−0.236*
t-dummies *F*-test *p*-value	0.000	0.004	0.004	0.002	0.002
Number of instruments	46	46	46	55	64
Hansen test *p*-value	0.267	0.235	0.343	0.400	0.314
AR2 test *p*-value	0.211	0.153	0.198	0.151	0.084
AR3 test *p*-value	0.388	0.372	0.369	0.369	0.436
Crisis effect *t*-test		1.421	2.250**	2.160**	1.915*
Persistence during crisis			0.894***	0.887***	0.821***

Robust standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
GDP growth and all dummies included in the models are assumed to be exogenous. External instruments are of the GMM-type (Arellano and Bond, 1991; Roodman, 2009), obtained from the third through the tenth lags of the dependent variable (except for Model 4, where GMM-type instruments start from the second lag); *GDP growth pre-crisis effect* refers to $\beta_0+\beta_1$; *GDP growth crisis effect* refers to $\beta_0+\beta_1+\beta_{c1}$ for Model 1 and to $\beta_0+\beta_1+\beta_{c0}+\beta_{c1}$ for the remaining models; *Crisis effect t-test* refers to the *t*-test of $\beta_{c0}+\beta_{c1}$; Persistence during crisis refers to $\gamma+\gamma_c$.

Beginning in 2009, this pattern changes, and the lagged effect of growth is almost completely offset by the crisis episode (the positive coefficient on *GDP growth*$(-1)\times$ *crisis*), making NEET rates considerably less sensitive to GDP growth. This finding may be explained by internal flexibility strategies adopted by firms and by successful labor market policies implemented in several regions in our sample in response to lower growth.

Third, overall, male NEET rates appear to be more responsive to GDP changes than are female NEET rates. This difference tends to be attenuated during the crisis years (results by gender are not presented in the paper but are available from the authors upon request).

Results for NEET by groups of regions

It is likely that the results of Table 1 are mostly driven by the largest group of regions in our estimation sample, Continental, dominated by German regions. To shed more light on the different patterns across the groups of regions, we conduct dynamic panel data regressions by macro-region. This exercise excludes the Northern group, which has only six regions.

Moreover, to gain further insight into the crisis effects, we consider two increasingly general extensions of our previous specification: the first allows the threshold year, 2008, to exert a separate impact on NEET rates, while the second goes a step further and also allows for different effects for the crisis years, 2009 and 2010. Due to the reduced number of cross-sectional units in each macro-region, we perform the estimation using the Least Squares Dummy Variables (LSDV) estimator corrected for finite sample bias (LSDVC, see Kiviet, 1995; Bruno, 2005a, b). The results for the first specification are reported in Table 2, and those for the second specification are reported in Table 3.[10]

In both cases, substantial heterogeneity across macro-regions emerges, with the following specific aspects:

First, NEET rates in Continental regions exhibit a lack of responsiveness to GDP growth during the crisis years, especially in 2008 and 2009. This finding confirms that the low sensitivity of NEET rates to GDP growth during the crisis years observed in the aggregate model is primarily due to the predominance of these regions in the estimation sample.

Second, the opposite pattern is observed in the Anglo-Saxon group, where NEET rates are highly sensitive to GDP growth during, but not before, the crisis period.

[10] In this estimation framework, the time dimension spans from 2001 through 2010, as only the first time observation, 2000, is sacrificed to the dynamics.

Table 2: LSDVC estimates by macro-regions – Total NEET rates

Variables	Continental	Anglo-Saxon	Southern	NMS
neetratet(−1)	0.635***	0.481***	0.890***	0.584***
	(0.067)	(0.114)	(0.073)	(0.062)
GDP growth	−0.102	−0.205	0.136	−0.214***
	(0.073)	(0.262)	(0.103)	(0.077)
GDP growth(−1)	−0.127	0.013	−0.044	−0.200**
	(0.087)	(0.258)	(0.106)	(0.086)
GDP growth × crisis	0.037	−0.020	−0.460**	−0.067
	(0.126)	(0.514)	(0.179)	(0.092)
GDP growth(−1) × crisis	0.164	−0.801*	0.188	0.050
	(0.117)	(0.418)	(0.243)	(0.106)
GDP growth × 2008	0.128	−0.613	−0.896**	0.014
	(0.112)	(0.627)	(0.380)	(0.122)
GDP growth(−1) × 2008	0.299**	0.235	0.608	−0.077
	(0.148)	(0.589)	(0.538)	(0.121)
dummy 2003	0.413	−3.621***	0.759	−0.644
	(0.338)	(0.634)	(0.628)	(0.508)
dummy 2004	0.572	−2.756***	−0.183	0.024
	(0.368)	(0.666)	(0.585)	(0.537)
dummy 2005	0.535	−2.538***	0.134	−0.617
	(0.360)	(0.686)	(0.587)	(0.567)
dummy 2006	−0.446	−2.613***	−1.712***	−1.245**
	(0.419)	(0.704)	(0.605)	(0.594)
dummy 2007	−0.557	2.034***	−0.223	−2.422***
	(0.415)	(0.744)	(0.631)	(0.671)
dummy 2008	−1.662***	−2.196	0.051	−2.524***
	(0.503)	(2.653)	(1.554)	(0.866)
dummy 2009	0.056	−0.533	2.349***	−2.285***
	(0.523)	(1.485)	(0.895)	(0.810)
dummy 2010	−0.521	−1.189	2.155*	−2.103**
	(0.454)	(2.593)	(1.233)	(0.831)
Observations	286	114	153	155
Number of regions (Nuts-1)	35	13	17	20
GDP growth pre-crisis effect	−0.229**	−0.192	0.091	−0.414***
GDP growth effect in 2008	0.198	−0.569	−0.197	−0.477***
2008 effect *t*-test	2.261**	−0.748	−0.771	−0.425
GDP growth crisis effect	−0.027	−1.013***	−0.181	−0.430***
Crisis effect *t*-test	1.106	−1.669*	−0.958	−0.136
t-dummies *F*-test *p*-value	0.000	0.000	0.000	0.000

Bootstrapped standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
GDP growth pre-crisis effect refers to $\beta_0+\beta_1$; *GDP growth crisis effect* refers to $\beta_0+\beta_1+\beta_{c1}$ for Model 1 and to $\beta_0+\beta_1+\beta_{c0}+\beta_{c1}$ for the remaining models; *Crisis effect t-test* refers to the *t*-test on $\beta_{c0}+\beta_{c1}$.

Third, NEET rates in the Southern group are the most persistent and unresponsive to GDP growth over the period considered. Focusing on the time dummy coefficients, there is evidence of significantly positive aggregate shocks in 2009 and 2010 in the first specification. These, however, become less significant in the second specification, where, in particular, the size of the shock in 2010 is explained by a larger and significant response to the reduction

Table 3: LSDVC estimates by macro-regions, with separate effects for the crisis years – Total NEET rates

Variables	Continental	Anglo-Saxon	Southern	NMS
neetratet(−1)	0.621***	0.499***	0.893***	0.606***
	(0.067)	(0.116)	(0.073)	(0.062)
GDP growth	−0.107	−0.195	0.137	−0.223***
	(0.073)	(0.274)	(0.105)	(0.077)
GDP growth(−1)	−0.125	0.037	−0.043	−0.207**
	(0.088)	(0.275)	(0.108)	(0.087)
GDP growth × 2008	0.128	−0.683	−0.909**	−0.001
	(0.113)	(0.646)	(0.386)	(0.124)
GDP growth(−1) × 2008	0.281*	0.292	0.624	−0.067
	(0.149)	(0.608)	(0.545)	(0.122)
GDP growth × 2009	0.210	−0.980	−0.351	0.012
	(0.153)	(1.144)	(0.412)	(0.100)
GDP growth(−1) × 2009	0.151	−0.030	0.317	−0.091
	(0.123)	(0.966)	(0.341)	(0.136)
GDP growth × 2010	−0.244	0.269	−0.556***	−0.190
	(0.192)	(0.688)	(0.203)	(0.172)
GDP growth(−1) × 2010	0.107	−0.754	−0.200	0.129
	(0.180)	(0.505)	(0.360)	(0.114)
dummy 2003	0.419	−3.625***	0.760	−0.624
	(0.341)	(0.630)	(0.632)	(0.511)
dummy 2004	0.599	−2.719***	−0.184	0.077
	(0.370)	(0.672)	(0.590)	(0.538)
dummy 2005	0.566	−2.465***	0.135	−0.538
	(0.363)	(0.686)	(0.591)	(0.570)
dummy 2006	−0.404	−2.528***	−1.712***	−1.130*
	(0.421)	(0.710)	(0.609)	(0.595)
dummy 2007	−0.534	2.109***	−0.218	−2.267***
	(0.418)	(0.748)	(0.636)	(0.672)
dummy 2008	−1.614***	−2.485	0.018	−2.360***
	(0.506)	(2.687)	(1.567)	(0.868)
dummy 2009	0.711	−2.875	2.721	−1.230
	(0.632)	(2.397)	(1.890)	(0.953)
dummy 2010	−0.043	−1.355	0.597	−1.420
	(0.649)	(2.628)	(1.637)	(0.920)
Observations	286	114	153	155
Number of regions (Nuts-1)	35	13	17	20
GDP growth pre-crisis effect	−0.232**	−0.157	0.093	−0.430***
GDP growth effect in 2008	0.177	−0.549	−0.192	−0.499***
2008 effect *t*-test	2.143**	−0.776	−0.757	−0.474
GDP growth effect in 2009	0.129	−1.168***	0.058	−0.509***
2009 effect *t*-test	1.794*	−1.930*	−0.095	−0.596
GDP growth effect in 2010	−0.369	−0.642	−0.664	−0.490***
2010 effect *t*-test	−0.456	−0.556	−1.800*	−0.342
t-dummies *F*-test *p*-value	0.000	0.000	0.005	0.000

Bootstrapped standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
GDP growth pre-crisis effect refers to $\beta_0+\beta_1$; *GDP growth effect in 2008* refers to $\beta_0+\beta_1+\beta_{2008,0}+\beta_{2008,1}$; *2008 effect t-test* refers to the *t*-test on $\beta_{2008,0}+\beta_{2008,1}$, and similarly for 2009 and 2010.

in GDP in that year. Overall, such evidence suggests the existence of stronger structural weaknesses and the absence of effective counter-cyclical interventions at the regional and national levels in this group of regions.

Fourth, NEET rates in the NMS regions are significantly sensitive to GDP growth throughout the estimation period, with no evidence of a crisis effect.

Ideally, one would like to check the validity of the homogeneity restrictions of the pooled models in the section 'Results for the pooled regression on NEET rates' through formal statistical tests involving the coefficients of the explanatory variables in equation 1 interacted with the macro-region indicators. In practice, however, this is infeasible, given the severe finite-sample bias that would result from inflating the GMM models with regressors and instruments in a panel such as ours, which has at most 90 cross-sectional units (see, for example, Roodman, 2009). Homogeneity testing could in principle be conducted in the LSDVC framework, which is quite accurate for small panels. This, however, would require a bootstrap procedure to estimate the covariances between the LSDVC estimators peculiar to different equations, a method that is not available in the current version of *xtlsdvc*. We will therefore leave such extensions for future research.[11]

The crisis effects may actually be the outcome of neglected non-linearities in the equation of interest.[12] To test this conjecture, we have added powers of *GDP growth* up to the sixth order to the general specification of Table 3; the results of this experiment are reported in Table 4. Only in the case of the Anglo-Saxon macro-region do the five powers of *GDP growth* turn out to be jointly significant. For all macro-regions, however, the implications of the results in Tables 2 and 3 carry over to the non-linear specifications of Table 4.

Results for YUR and UR

The peculiarities of the regional NEET rates can be better highlighted through comparison with regional UR. To this end, we applied the general specifications of Tables 3 and 4 to YUR and UR. The results, reported in Tables 5–8, suggest a picture that is broadly consistent with that obtained for the NEET rates with respect to most aspects considered.

Remarkably, successful implementation of counter-cyclical labor market policies in the Continental group emerges even more clearly for both YUR and UR, with significantly lower responses to GDP changes during the crisis years. The opposite pattern, specifically for the Anglo-Saxon regions, is also

[11] A further complication is that the bias approximations of *xtlsdvc* do not support interactions involving the lagged dependent variable. Entirely new bias approximations would be necessary in this case.

[12] We are grateful to a referee of this journal for suggesting such extension.

Table 4: LSDVC estimates by macro-region, with separate effects of the crisis years and up-to-sixth order nonlinear effects – Total NEET rates

Variables	Continental	Anglo-Saxon	Southern	NMS
neetratet(−1)	0.612***	0.443***	0.919***	0.609***
	(0.066)	(0.112)	(0.074)	(0.066)
GDP growth	−0.281**	−2.292	0.560*	−0.127
	(0.130)	(1.626)	(0.288)	(0.196)
GDP growth^2	0.000	0.862**	−0.026	−0.013
	(0.043)	(0.370)	(0.073)	(0.027)
GDP growth^3	0.013**	0.187**	−0.036*	−0.000
	(0.005)	(0.083)	(0.019)	(0.001)
GDP growth^4	−0.000	−0.066***	0.004	0.000
	(0.001)	(0.020)	(0.003)	(0.000)
GDP growth^5	−0.000*	−0.004**	0.000*	8.07e-07
	(6.29e-05)	(0.001)	(0.000)	(7.55e-06)
GDP growth^6	7.15e-06	0.001***	−6.64e-05	−1.79e-07
	(1.30e-05)	(0.000)	(4.26e-05)	(4.73e-07)
GDP growth(−1)	−0.112	−0.182	−0.075	−0.197**
	(0.089)	(0.262)	(0.116)	(0.090)
GDP growth × 2008	0.032	1.549	−1.136***	−0.076
	(0.168)	(1.845)	(0.406)	(0.182)
GDP growth(−1) × 2008	0.301**	0.198	0.719	−0.050
	(0.150)	(0.565)	(0.561)	(0.133)
GDP growth × 2009	−0.057	0.420	−0.102	−0.062
	(0.309)	(3.300)	(0.528)	(0.284)
GDP growth(−1) × 2009	0.172	−1.735	0.548	−0.075
	(0.132)	(1.692)	(0.371)	(0.144)
GDP growth × 2010	−0.295	0.950	−0.456*	−0.229
	(0.199)	(1.063)	(0.245)	(0.206)
GDP growth(−1) × 2010	0.093	−0.099	−0.118	0.118
	(0.181)	(0.511)	(0.365)	(0.119)
dummy 2003	0.450	−4.456***	0.763	−0.673
	(0.343)	(0.657)	(0.643)	(0.535)
dummy 2004	0.747**	−3.141***	−0.203	0.018
	(0.374)	(0.651)	(0.594)	(0.592)
dummy 2005	0.663*	−1.969***	0.034	−0.594
	(0.367)	(0.712)	(0.625)	(0.605)
dummy 2006	−0.319	−2.659***	−1.794***	−1.175*
	(0.424)	(0.665)	(0.633)	(0.616)
dummy 2007	−0.532	1.552**	−0.154	−2.280***
	(0.422)	(0.712)	(0.639)	(0.699)
dummy 2008	−1.643***	−2.429	0.247	−2.223**
	(0.511)	(3.593)	(1.630)	(0.940)
dummy 2009	−0.106	−3.791	3.642	−1.023
	(0.862)	(5.259)	(2.237)	(1.098)
dummy 2010	0.174	−0.771	0.691	−1.279
	(0.667)	(2.640)	(1.648)	(1.004)
Observations	286	114	153	155
Number of regions (Nuts-1)	35	13	17	20
GDP growth pre-crisis effect	−0.394**	−2.474	0.485	−0.324
GDP growth effect in 2008	−0.059	−0.727	0.068	−0.451***
2008 effect *t*-test	1.526	0.924	−1.026	−0.638
GDP growth effect in 2009	−0.279	−3.789*	0.930	−0.462**

Table 4: (*Continued*)

Variables	Continental	Anglo-Saxon	Southern	NMS
2009 effect *t*-test	0.355	−0.510	0.928	−0.456
GDP growth effect in 2010	−0.595*	−1.624*	−0.089	−0.435**
2010 effect *t*-test	−0.655	0.678	−1.249	−0.514
t-dummies *F*-test *p*-value	0.000	0.000	0.004	0.002
Non-linear GDPg *F* test *p*-value	0.239	0.001	0.546	0.973

Standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
The *GDP growth pre-crisis effect* and the *GDP growth effects in 2008, 2009 and 2010* are computed as in Table 4. However, due to the presence of the non-linear terms, here they must be thought of as the effects at zero GDP growth.

confirmed here in a more pronounced way. A notable difference among the NEET estimates is that in the NMS regions, similarly to the Continental group on a broader level, the effect of GDP growth on UR is significantly smaller in 2010 than in the pre-crisis period, becoming close to zero.[13] This is observed at the ends of Table 5–8, where the 2010 GDP growth effect turns out not to be significantly different from zero but, at the same time, significantly different from the pre-crisis effect.

As with the NEET rates, the youth and total UR show the highest levels of persistence in the Southern regions, with even greater force. Overall, total unemployment appears to be more persistent than youth unemployment, confirming the findings of Bruno *et al.* (2014) for a panel of OECD countries but also NEET rates. From an econometric perspective, we observe that the presence of unit roots both in the YUR and UR estimates does not affect the validity of our inference methods because (1) there are asymptotic effects for large N and fixed T, and (2) the bias correction method is even more accurate in the presence of unit roots (Kiviet, 1995).

Spatial analysis

Spatial interactions, which may be relevant for reasons explained in the 'NEET and Youth Unemployment: Regional Differentiation in Europe and the Impact of the Crisis' section, may be important in explaining NEET rates at the regional level. We therefore modify equation 1, using a specification close to Baltagi *et al.* (2014), by including two spatial lags, one for the dependent variable, the NEET rate, and the other for our main explanatory variable, GDP

[13] Observe that some Eastern European countries with many regions, such as Poland, were only mildly affected by the Great Recession.

Table 5: LSDVC estimates by macro-region, with separate effects of the crisis years – Youth UR

Variables	Continental	Anglo-Saxon	Southern	NMS
yurt(−1)	0.297***	0.495***	1.024***	0.792***
	(0.064)	(0.108)	(0.053)	(0.055)
GDP growth	−0.167	−0.206	−0.117	−0.404***
	(0.120)	(0.312)	(0.171)	(0.148)
GDP growth(−1)	−0.157	−0.653**	−0.182	−0.557***
	(0.135)	(0.296)	(0.172)	(0.150)
GDP growth × 2008	0.222	−0.470	−0.494	0.065
	(0.179)	(0.657)	(0.559)	(0.241)
GDP growth(−1) × 2008	0.404	0.286	0.068	0.125
	(0.246)	(0.644)	(0.728)	(0.265)
GDP growth × 2009	0.440**	−2.322*	−0.582	−0.078
	(0.207)	(1.254)	(0.615)	(0.210)
GDP growth(−1) × 2009	0.072	1.638	0.417	0.017
	(0.194)	(1.098)	(0.547)	(0.243)
GDP growth × 2010	−0.171	−0.572	−0.718**	0.597
	(0.318)	(0.735)	(0.321)	(0.372)
GDP growth(−1) × 2010	0.536**	−0.528	−0.089	0.379*
	(0.239)	(0.556)	(0.509)	(0.223)
dummy 2003	0.338	0.078	0.395	−0.807
	(0.557)	(0.702)	(1.002)	(1.018)
dummy 2004	2.139***	−0.624	−0.610	1.042
	(0.627)	(0.640)	(0.962)	(1.020)
dummy 2005	3.250***	1.031*	−0.749	−0.507
	(0.610)	(0.579)	(0.956)	(1.081)
dummy 2006	2.282***	0.671	−1.393	−2.224**
	(0.731)	(0.632)	(1.003)	(1.061)
dummy 2007	0.617	0.761	−0.596	−3.622***
	(0.690)	(0.710)	(0.983)	(1.098)
dummy 2008	−1.142	−0.650	2.202	−3.383*
	(0.820)	(2.845)	(2.159)	(1.738)
dummy 2009	2.706***	−4.976*	3.853	−0.544
	(0.904)	(2.603)	(2.712)	(1.799)
dummy 2010	2.997***	−1.444	1.135	−3.153*
	(0.912)	(2.805)	(2.348)	(1.618)
Observations	324	115	162	180
Number of regions (Nuts-1)	36	13	18	20
GDP growth pre-crisis effect	−0.324*	−0.858**	−0.299	−0.961***
GDP growth effect in 2008	0.302	−1.042*	−0.724	−0.770***
2008 effect *t*-test	2.063**	−0.363	−0.711	0.617
GDP growth effect in 2009	0.188	−1.542***	−0.464	−1.022***
2009 effect *t*-test	1.750*	−1.244	−0.285	−0.215
GDP growth effect in 2010	0.041	−1.959***	−1.107*	0.014
2010 effect *t*-test	0.766	−1.165	−1.307	2.533**
t-dummies *F*-test *p*-value	0.000	0.041	0.419	0.000

Standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
The *GDP growth pre-crisis effect* and the *GDP growth effects in 2008, 2009 and 2010* are computed as in Table 4.

Table 6: LSDVC estimates by macro-region, with separate effects of the crisis years and up-to-sixth order non-linear effects – Youth UR

Variable	Continental	Anglo-Saxon	Southern	NMS
yurt(−1)	0.282***	0.397***	0.978***	0.837***
	(0.062)	(0.109)	(0.060)	(0.057)
GDP growth	−0.318*	−3.857**	−0.516	−0.264
	(0.187)	(1.738)	(0.478)	(0.400)
GDP growth^2	−0.000	0.951**	−0.073	−0.079
	(0.058)	(0.407)	(0.119)	(0.061)
GDP growth^3	0.012*	0.167*	−0.003	0.004
	(0.007)	(0.090)	(0.032)	(0.003)
GDP growth^4	−0.000	−0.045**	0.004	0.000*
	(0.001)	(0.022)	(0.005)	(0.000)
GDP growth^5	−7.59e-05	−0.004**	0.000	−1.72e-05
	(7.35e-05)	(0.002)	(0.000)	(1.36e-05)
GDP growth^6	2.86e-06	0.000*	−7.08e-05	−1.76e-06*
	(7.45e-06)	(0.000)	(6.73e-05)	(9.45e-07)
GDP growth(−1)	−0.154	−0.621**	−0.189	−0.524***
	(0.137)	(0.289)	(0.176)	(0.155)
GDP growth × 2008	0.141	3.625*	−0.123	−0.115
	(0.266)	(1.968)	(0.590)	(0.394)
GDP growth(−1) × 2008	0.437*	0.357	0.047	0.297
	(0.248)	(0.622)	(0.725)	(0.279)
GDP growth × 2009	−0.222	5.637	−1.214	−0.270
	(0.536)	(3.701)	(0.786)	(0.655)
GDP growth(−1) × 2009	0.171	−1.758	0.677	0.209
	(0.198)	(1.824)	(0.592)	(0.258)
GDP growth × 2010	−0.251	0.898	−0.531	0.594
	(0.324)	(1.127)	(0.365)	(0.454)
GDP growth(−1) × 2010	0.550**	−0.071	−0.138	0.374
	(0.237)	(0.563)	(0.512)	(0.230)
dummy 2003	0.352	−0.848	0.077	−0.829
	(0.558)	(0.809)	(1.008)	(1.038)
dummy 2004	2.251***	−0.954	−0.484	1.067
	(0.629)	(0.626)	(0.949)	(1.047)
dummy 2005	3.364***	1.294**	−0.859	−0.700
	(0.607)	(0.594)	(0.991)	(1.098)
dummy 2006	2.390***	0.971	−1.239	−2.424**
	(0.737)	(0.622)	(1.023)	(1.073)
dummy 2007	0.691	0.746	−0.401	−3.676***
	(0.691)	(0.706)	(0.980)	(1.121)
dummy 2008	−1.062	−4.192	1.275	−3.233*
	(0.838)	(3.897)	(2.177)	(1.893)
dummy 2009	0.729	2.188	−0.263	0.321
	(1.436)	(5.437)	(3.337)	(2.065)
dummy 2010	3.362***	−1.149	0.577	−2.529
	(0.935)	(2.983)	(2.326)	(1.881)
Observations	324	115	162	180
Number of regions (Nuts-1)	36	13	18	20
GDP growth pre-crisis effect	−0.472**	−4.479***	−0.705	−0.788*
GDP growth effect in 2008	0.105	−0.496	−0.781	−0.605
2008 effect *t*-test	1.588	1.961**	−0.121	0.444
GDP growth effect in 2009	−0.522	−0.600	−1.243	−0.849*

Table 6: (*Continued*)

Variable	Continental	Anglo-Saxon	Southern	NMS
2009 effect *t*-test	−0.090	1.343	−0.680	−0.085
GDP growth effect in 2010	−0.173	−3.652***	−1.375*	0.180
2010 effect *t*-test	0.623	0.624	−1.013	2.076**
t-dummies *F*-test *p*-value	0.000	0.002	0.908	0.000
Non-linear GDPg *F*-test *p*-value	0.204	0.016	0.081	0.169

Standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
The *GDP growth pre-crisis effect* and the *GDP growth effects in 2008, 2009 and 2010* are computed as in Table 4. However, due to the presence of the non-linear terms, here they must be thought of as the effects at zero GDP growth.

growth:

$$y_{i,t} = \gamma y_{i,t-1} + \lambda_y \sum_{j=1}^{N} w_{ij} y_{i,t} + \beta_0 x_{i,t} + \lambda_x \sum_{j=1}^{N} w_{ij} x_{i,t} + \beta_1 x_{i,t-1} + c_t \left(\gamma_c y_{i,t-1} + \beta_{0c} x_{i,t} + \beta_{1c} x_{i,t-1} \right) + u_{it} \quad (2)$$

where $u_{i,t} = \alpha_i + \eta_t + \varepsilon_{i,t}$, $i = 1, \ldots, N$ and $t = 1, \ldots, T$.

We construct the spatial lags for the explanatory variables using the $(N \times N)$ contiguity weighting matrix, W, with zero main diagonal and off-diagonal entries, w_{ij}, of unity if regions i and j share a border and zero otherwise. The region-specific component in the error term is removed by first-differencing equation 2. We allow the spatial interaction variable $\sum_j^N w_{ij} y_{i,t}$ to be endogenous in equation 2 and to minimize proliferation-of-instruments problems; we do not use instruments from this variable.

We then apply the DIFF GMM estimator, using GMM-type instruments, starting from the second lag of y. Following Drukker *et al.* (2013) and Baltagi *et al.* (2014), our instrument matrix also includes spatial lags of x of orders 1 and 2. Our GMM estimator, computationally simpler than Baltagi *et al.*'s (2014), is consistent under a broad range of conditions. In particular, because we do not include spatial lags of the dependent variable in the instrument matrix, it remains consistent also in the presence of a spatially correlated error, although it should be noted that the estimated standard errors may be biased.[14]

The results, shown in Table 9, confirm those of Table 1, with the new finding of a significantly positive spatial propagation of NEET rates. This effect may not only be due to country effects because Nuts-1 regions have the same

[14] Time lags, more remote than the first, of the dependent variable spatial lag yield valid instruments in the absence of serial correlation and are used in Baltagi *et al.* (2014). We decided not to include them to minimize problems associated with instrument proliferation.

Table 7: LSDVC estimates by macro-regions, with separate effects of the crisis years – Total UR

Variables	Continental	Anglo-Saxon	Southern	NMS
turt(−1)	1.020***	0.662***	1.110***	0.853***
	(0.039)	(0.106)	(0.041)	(0.049)
GDP growth	−0.087*	−0.177	−0.125	−0.226***
	(0.048)	(0.117)	(0.079)	(0.060)
GDP growth(−1)	−0.158***	−0.149	−0.035	−0.222***
	(0.053)	(0.113)	(0.080)	(0.061)
GDP growth × 2008	0.083	−0.026	−0.149	0.062
	(0.070)	(0.246)	(0.259)	(0.099)
GDP growth(−1) × 2008	0.136	−0.069	−0.227	0.009
	(0.097)	(0.242)	(0.338)	(0.109)
GDP growth × 2009	0.123	−1.160**	−0.129	−0.019
	(0.082)	(0.476)	(0.283)	(0.086)
GDP growth(−1) × 2009	0.072	0.939**	0.013	−0.043
	(0.077)	(0.416)	(0.252)	(0.099)
GDP growth × 2010	0.049	−0.331	−0.243	0.400***
	(0.128)	(0.283)	(0.149)	(0.152)
GDP growth(−1) × 2010	0.305***	−0.311	−0.201	0.104
	(0.093)	(0.214)	(0.233)	(0.091)
dummy 2003	−0.072	−0.241	−0.251	−0.828**
	(0.221)	(0.265)	(0.465)	(0.419)
dummy 2004	0.291	−0.325	−0.370	0.305
	(0.250)	(0.236)	(0.447)	(0.420)
dummy 2005	−0.269	−0.261	−0.968**	−0.461
	(0.235)	(0.225)	(0.441)	(0.446)
dummy 2006	−0.943***	0.114	−0.810*	−1.374***
	(0.265)	(0.230)	(0.463)	(0.442)
dummy 2007	−1.380***	−0.127	−0.494	−1.749***
	(0.248)	(0.246)	(0.449)	(0.464)
dummy 2008	−1.599***	−0.189	1.776*	−1.675**
	(0.319)	(1.050)	(1.002)	(0.722)
dummy 2009	0.098	−2.669***	1.840	−0.554
	(0.357)	(1.004)	(1.247)	(0.760)
dummy 2010	−0.327	−0.767	−0.296	−1.749**
	(0.348)	(1.059)	(1.070)	(0.696)
Observations	324	115	162	180
Number of regions (Nuts-1)	36	13	18	20
GDP growth pre-crisis effect	−0.246***	−0.326**	−0.161	−0.448***
GDP growth effect in 2008	−0.025	−0.422**	−0.536*	−0.377***
2008 effect *t*-test	1.833*	−0.502	−1.353	0.560
GDP growth effect in 2009	−0.049	−0.547***	−0.276	−0.511***
2009 effect *t*-test	1.684*	−1.057	−0.435	−0.539
GDP growth effect in 2010	0.109	−0.968***	−0.605**	0.056
2010 effect *t*-test	1.864*	−1.740*	−1.555	3.198***
t-dummies *F*-test *p*-value	0.000	0.104	0.047	0.000

Standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
The *GDP growth pre-crisis effect* and the *GDP growth effects in 2008, 2009 and 2010* are computed as in Table 4.

Table 8: LSDVC estimates by macro-regions, with separate effects of the crisis years and up-to-sixth-order non-linear effects – Total UR

Variables	Continental	Anglo-Saxon	Mediterranean	NMS
turt(−1)	1.013***	0.542***	1.081***	0.910***
	(0.040)	(0.106)	(0.046)	(0.049)
GDP growth	−0.093	−0.757	−0.223	−0.217
	(0.075)	(0.652)	(0.221)	(0.157)
GDP growth^2	−0.034	0.250*	−0.031	−0.037
	(0.023)	(0.152)	(0.054)	(0.024)
GDP growth^3	0.006**	0.048	−0.008	0.002
	(0.002)	(0.034)	(0.014)	(0.001)
GDP growth^4	0.000	−0.017**	0.002	0.000***
	(0.000)	(0.008)	(0.002)	(0.000)
GDP growth^5	−4.92e-05*	−0.001**	0.000	−9.89e-06*
	(2.95e-05)	(0.000)	(0.000)	(5.37e-06)
GDP growth^6	−2.73e-06	0.000**	−4.14e-05	−1.06e-06***
	(2.99e-06)	(0.000)	(3.09e-05)	(3.75e-07)
GDP growth(−1)	−0.147***	−0.178	−0.025	−0.201***
	(0.054)	(0.109)	(0.081)	(0.061)
GDP growth × 2008	0.001	0.600	−0.016	−0.030
	(0.105)	(0.736)	(0.272)	(0.156)
GDP growth(−1) × 2008	0.148	−0.037	−0.246	0.101
	(0.097)	(0.233)	(0.334)	(0.110)
GDP growth × 2009	−0.266	1.313	−0.527	0.017
	(0.211)	(1.375)	(0.360)	(0.258)
GDP growth(−1) × 2009	0.093	−0.720	0.195	0.070
	(0.078)	(0.678)	(0.271)	(0.102)
GDP growth × 2010	0.025	−0.333	−0.174	0.454**
	(0.130)	(0.422)	(0.168)	(0.178)
GDP growth(−1) × 2010	0.303***	−0.202	−0.233	0.101
	(0.093)	(0.216)	(0.232)	(0.090)
dummy 2003	−0.081	−0.521*	−0.320	−0.821**
	(0.220)	(0.303)	(0.466)	(0.411)
dummy 2004	0.336	−0.453**	−0.296	0.357
	(0.249)	(0.229)	(0.437)	(0.414)
dummy 2005	−0.258	−0.115	−0.976**	−0.557
	(0.233)	(0.229)	(0.453)	(0.434)
dummy 2006	−0.890***	0.123	−0.693	−1.475***
	(0.267)	(0.216)	(0.469)	(0.427)
dummy 2007	−1.372***	−0.214	−0.396	−1.769***
	(0.247)	(0.240)	(0.445)	(0.454)
dummy 2008	−1.491***	−0.420	1.472	−1.587**
	(0.325)	(1.454)	(1.000)	(0.755)
dummy 2009	−0.581	1.930	−0.307	−0.151
	(0.558)	(2.027)	(1.534)	(0.841)
dummy 2010	−0.203	−0.028	−0.506	−1.440*
	(0.356)	(1.105)	(1.058)	(0.779)
Observations	324	115	162	180
Number of regions (Nuts-1)	36	13	18	20
GDP growth pre-crisis effect	−0.240***	−0.935	−0.248	−0.419**
GDP growth effect in 2008	−0.090	−0.372	−0.511*	−0.349**
2008 effect *t*-test	1.039	0.741	−0.916	0.429

Table 8: (*Continued*)

Variables	Continental	Anglo-Saxon	Mediterranean	NMS
GDP growth effect in 2009	−0.413**	−0.341	−0.580	−0.331*
2009 effect *t*-test	−0.783	0.550	−0.922	0.312
GDP growth effect in 2010	0.088	−1.470***	−0.656**	0.136
2010 effect *t*-test	1.714*	−1.070	−1.347	3.026***
t-dummies *F*-test *p*-value	0.000	0.301	0.297	0.000
Non-linear GDPg *F*-test *p*-value	0.151	0.008	0.037	0.001

Standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
The *GDP growth pre crisis effect* and the *GDP growth effects in 2008, 2009 and 2010* are computed as in Table 4. However, due to the presence of the non-linear terms, here they must be thought of as the effects at zero GDP growth.

Table 9: Spatial-DIFF GMM Estimates – Total sample

Variables	Model 1	Model 2	Model 3	Model 3bis
neetratet(−1)	0.652***	0.652***	0.689***	0.695***
	(0.067)	(0.067)	(0.074)	(0.073)
neetratet(−1) × crisis			0.064**	0.068**
			(0.030)	(0.030)
W × neet	0.057***	0.051***	0.045**	0.043**
	(0.021)	(0.019)	(0.021)	(0.021)
W × neet × crisis				−0.005
				(0.010)
GDP growth	−0.135***	−0.049	−0.129***	−0.123**
	(0.031)	(0.081)	(0.047)	(0.049)
GDP growth(−1)	−0.320***	−0.357***	−0.350***	−0.359***
	(0.075)	(0.086)	(0.079)	(0.096)
GDP growth(−1) × crisis	0.268***	0.311***	0.310**	0.321**
	(0.095)	(0.111)	(0.125)	(0.143)
GDP growth × crisis		−0.199	−0.025	−0.020
		(0.143)	(0.075)	(0.078)
W × GDP growth				−0.011
				(0.014)
Observations	645	645	645	645
Number of regions (Nuts-1)	89	89	89	89
GDP growth pre-crisis effect	−0.455***	−0.407***	−0.479***	−0.482***
GDP growth crisis effect	−0.187***	−0.295***	−0.194*	−0.181*
t-dummies *F*-test *p*-value	0.005	0.041	0.017	0.025
Number of instruments	56	56	57	57
Hansen test *p*-value	0.115	0.167	0.242	0.160
AR2 test *p*-value	0.167	0.226	0.214	0.244
AR3 test *p*-value	0.438	0.476	0.426	0.438
Crisis effect *t*-test		0.791	2.139**	1.843*
Post-crisis persistence			0.753***	0.764***

Standard errors are in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$.
See the notes for Table 1.

institutions as the surrounding regions in the same country, but also due to similarities among regions belonging to the same 'macro group', which normally are spatially contiguous. This spatial effect, nonetheless, appears not to be affected by the crisis episode. The first-order spatial lag of GDP growth is also not significant.

CONCLUSIONS

The main task of this paper has been to investigate the recent dynamics of YUR compared with both total UR and the more innovative NEET indicator. The focus of the study is on the changes that occurred after the 2008 financial crisis and the consequent Great Recession. Our sample units consist of almost 100 Nuts-1 regions of the EU.

Institutional determinants are indirectly taken into account by considering five groups of countries (and regions). While the best performing labor markets, both during and following the crisis (2009–2011), were found in the Continental and Northern regions, the worst performing labor markets were found in the Southern and NMS regions; the Anglo-Saxon regions exhibited performance intermediate between the best performing and worst performing regions.

In the econometric section, using dynamic panel data GMM and bias-corrected LSDV estimators, we sought to detect differences in the persistence of NEET and YUR rates as well as possible changes, following the crisis, in the sensitivity of such labor market indicators to GDP dynamics. The main results can be summarized as follows:

First, NEET rates are persistent over time to a degree comparable to that of YUR; furthermore, persistence of NEET rates increased during the crisis years (2009–2010).

Second, the highest persistence of NEET rates as well as of YUR and UR and the smallest response to changes in GDP are found in Southern regions.

Third, the sensitivity of NEET rates to GDP decreased during the crisis, a result strongly influenced by the dynamics in Continental regions. Anglo-Saxon regions, by contrast, were notably sensitive to GDP during the crisis, while NMS regions were highly sensitive to GDP, although rather homogenously so, over the whole estimation period.

Fourth, the foregoing patterns are largely replicated in the YUR estimates, with the exception that for NMS regions, YUR is not found to be sensitive to GDP in 2010.

In our spatial dynamic panel data analysis, we also found that contemporaneous spatial interactions in NEET rates were significant; that is, regions with high NEET rates tended to cluster close to each other, and *vice versa*

(as already found for UR; see the discussion in the 'NEET and Youth Unemployment: Regional Differentiation in Europe and the Impact of the Crisis' section). Nonetheless, all of the foregoing results survived the spatial extension. Further analysis in this direction is part of our research agenda.

As for policy implications, from the ILO study (2012), we adopt two policy recommendations that are consistent with our empirical analysis to address the youth (un)employment problem. At the macro level, there is a need to increase economic growth; as we have observed, YUR and NEET rates respond significantly to GDP growth. This point is particularly relevant in light of the current debate over austerity measures undertaken by Eurozone countries facing sovereign debt crises. Indeed, contemporaneous fiscal consolidations in several countries have generated a new recession following the Great Recession. This double-dip recession has a continuous negative impact on labor markets: the EU UR has now reached 12%. Thus, macroeconomic policies should be less restrictive and accompanied by growth-oriented policies on the supply side. Indeed, active labor market policies and programs are crucial at this stage to counter persistence effects and structural unemployment. As noted above, persistence was detected in our empirical study although in different ways in different regional groupings.

This persistence is even more important for young people. The appearance of a 'lost generation' in many European countries highlights the need to adopt effective active and passive labor policies and adequate school-to-work processes. Passive policies and social protection, the third point mentioned by the ILO, are also needed, as the urgent situation in the labor markets is having profound social and even political consequences.

Two additional results of our empirical analyses have particularly relevant policy implications. The first of these is that in the case of large crises, it appears that institutions and policies similar to those adopted in Continental Europe, especially in Germany, are especially likely to minimize the impact of such crises on labor markets thanks to working hour adjustments, crisis management agreed with trade unions, targeted policies for young people, etc. The second relevant outcome concerns the Southern regions; the high persistence of NEET and YUR and the low responsiveness of unemployment to GDP imply that, even if the economy eventually recovers, many years will elapse before the situation of young people will improve; thus, a combination of active and passive labor policies is of the utmost importance.

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