LSE 'Europe in Question' Discussion Paper Series

The EU Cohesion policy in context: regional growth and the influence of agricultural and rural development policies

Riccardo Crescenzi and Mara Giua

LEQS Paper No. 85/2014

December 2014

LEQS is generously supported by the LSE Annual Fund

LSE Europe in Question Discussion Paper Series

The EU Cohesion policy in context: regional growth and the influence of agricultural and rural development policies

Riccardo Crescenzi* and Mara Giua**

Abstract

This paper looks at the Cohesion Policy of the European Union (EU) and investigates how the EU agricultural and rural development policies shape its influence on regional growth. The analysis of the drivers of regional growth shows that the EU Regional Policy has a positive and significant influence on economic growth in all regions. However, its impact is stronger in the most socio-economically advanced areas and is maximised when its expenditure is complemented by Rural Development and Common Agricultural Policy (CAP) funds. The top-down funding of the CAP seems to be able to concentrate some benefits in the most deprived areas. Conversely only the most dynamics rural areas are capable of leveraging on the bottom-up measures of the EU Rural Development Policy. This suggests that EU policy makers in all fields should constantly look for the best mix of bottom-up and top-down measures in order to tackle structural disadvantage.

Keywords: regional policy, European Union, regional growth, rural development, Common Agricultural Policy

JEL Codes: O18, R11, R58

---

* **Department of Geography and Environment, London School of Economics and Political Science**
Houghton Street, London WC2A 2AE
Email: r.crescenzi@lse.ac.uk

** **Dipartimento di Economia, Universita' Roma Tre**
Via Ostiense 159, 00154 Roma, Italy
Email: mara.giua@uniroma3.it

Table of Contents

Acknowledgements
The authors are grateful to Roberto Esposti, Vassilis Monastiriotis, Andrés Rodríguez-Pose and to participants in the seminars held in London, Rome and Palermo for their comments to earlier drafts of this paper. The authors are solely responsible for any errors contained in the paper.

The EU Cohesion policy in context: regional growth and the influence of agricultural and rural development policies

1. Introduction

The aim of the EU Regional Policy is to reduce disparities in economic development, employment and opportunities between the most advanced and the most disadvantaged areas of the Union (Art. 158 of the Treaty of the European Union). In its current form, this policy is not only aimed at inter-regional income redistribution but also at creating the basis for long-term sustainable development in the most disadvantaged areas (Rodríguez-Pose and Fratesi, 2004). In terms of financial allocation, the resources devoted by the Union to territorial cohesion have more than doubled since 1975. The EU Cohesion Policy alone accounts for roughly 1/3 of the EU's total budgetary resources for the 2014-2020 programming period.

Despite the political emphasis placed on the 'territorial cohesion' objective, and the substantial amount of financial resources devoted to the EU Regional Policy, there is no consensus on its impact. Territorial disparities within the EU remain significantly higher than within the United States (Farole, Rodríguez-Pose, Storper, 2009; 6th Cohesion Report, European Commission, 2014). The EU is characterized by "increasing economic integration among nation-states with relatively similar levels of development" coupled with "different social, institutional, and technological features in regions" (Barca, McCann and Rodríguez-Pose, 2012, p. 143). The existing literature has identified a variety of factors that can influence the overall impact of the EU Cohesion policy and possibly explain its success and failures. However, very limited attention has been paid so far to the interaction between the EU regional policy and other EU policies that absorb large part of the residual share of the EU budget. The EU Regional Policy is a 'spatially targeted' policy: eligibility and funding are granted on the basis of geographical criteria and its outcomes are also assessed in terms of the performance of well-defined spatial units (administrative regions). The EU Rural Development Policy is also 'spatially targeted' although its targets are defined in terms of a combination of geographical, sectoral and socio-economic attributes that define 'rural areas'. Finally, while some policies can be considered 'space neutral' in terms of both their intent and outcomes (e.g. competition policies) others, albeit neutral in their intent exhibit a considerable spatial impact: this is the case of the Common Agricultural Policy. As a consequence the EU Cohesion Policy does not operate in a vacuum but it interacts at the territorial level with other EU policies that – intentionally or unintentionally - might magnify or curb its influence on regional economic performance. In this sense, the 'New Regional Policy' paradigm (OECD, 2009) advocates that all European policies, irrespective of whether they are 'spatially targeted' or 'spatially blind' (Duhr et al, 2010) should support territorial cohesion and promote growth in 'all regions' (including economically disadvantaged areas) by means of a 'place-based' approach.

In order to situate the EU Regional Policy in a broader EU policy framework, this paper aims to answer the following research questions: how do other EU policies shape the link between the EU Cohesion policy and territorial cohesion?; what can we learn from other EU Policies in order to reinforce territorial cohesion? The answers come from the analysis of the link between

Regional Growth and all key EU policies: Regional Policy, Rural Development Policy (RDP) and Common Agricultural Policy (CAP), accounting for almost 90% of total EU spending. The relative importance of the various policies and the nature of their interactions are assessed by means of a panel data regional growth analysis covering all the regions of the European Union. The analysis is based on a dataset that includes information on regional GDP growth, economic and socio-economic conditions and regional-level expenditure for EU Regional Policy, Rural Development and the CAP.

The paper makes an innovative contribution to the existing literature by looking for the first time at all 'spatially targeted' and 'spatially-blind with territorial impacts' EU policies in the same framework, accounting for almost 90% of total EU expenditure over three budget cycles. The in-depth analysis of the interactions between different policy areas in a territorial perspective is also innovative: disciplinary boundaries have often prevented the cross-fertilisation of regional, rural and agricultural issues. In so doing the paper unveils a number of new challenges for European cohesion.

The empirical results – robust to a large number of checks - show that the EU Regional Policy has a positive and significant influence on economic growth in all regions. However, is also suggests that its impact is stronger in the most socio-economically advanced regions and is maximised when its expenditure is complemented by Rural Development and Common Agricultural Policy (CAP) funds. The top-down funding of the CAP seems to be able to concentrate some benefits in the most deprived areas. Conversely only the most dynamics rural areas are capable of leveraging on the bottom-up measures of the EU Rural Development Policy. This suggests that EU policy makers in all fields should constantly look for the best mix of bottom-up and top-down measures in order to tackle structural disadvantage.

2. Existing evidence and gaps

There is a consensus in the economic literature that the analysis of the relationship between the EU Regional Policy and economic performance needs to consider a broad set of conditioning factors and different contributions have focused their attention upon a very heterogeneous set of territorial characteristics.

The most relevant territorial factors conditioning the policy's impact are institutional and structural. With respect to the institutional elements, the EU Regional Policy impact is positively influenced by the degree of decentralization in the countries in which it is implemented (Bahr, 2008) as well as by the presence of national-level 'supportive Institutions' in terms of inflation controls, trust, openness and the lack of corrupt practices (Ederveen, De Groot and Nahuis, 2006), the degree of openness of the economies (Ederveen, Gorter Mooij and Nahuis, 2002) and national "institutional quality" in terms of the rule of law, corruption, bureaucracy, expropriation risk and governments' treatment of contracts (De Freitas, Pereira and Torres, 2003).

With respect to the role played by regional structural characteristics for the impact of the EU Regional Policy, one of the discriminants is the geographical position of the beneficiary regions with respect to either the geographical 'core' of the European Union or a country's decision-making centres (Soukiazis and Antunes, 2006).

Another discriminating factor refers to the initial conditions of the regions considered. The Regional Policy's effect is positive with regard to less developed European regions ('Objective 1' regions and cohesion-country regions). This has also been confirmed in terms of GDP per capita level, GDP growth, employment (Bouayad-agha, Turpin and Védrine, 2010; Esposti and Bussoletti, 2008; Mohl and Hagen, 2008; Ramajo, Màrquez, Hewings and Salinas, 2008) and cumulative job creation (Martin and Tyler, 2006). The same results were found by analyses that pooled the regions of all the 27 European countries together (Eggert et al., 2008). Furthermore, country-level effects are also relevant. Once regions are clustered by country, the positive impact on convergence is not confirmed for Germany, Greece or Spain (Esposti and Bussoletti, 2008). The policy's impact is stronger in European areas with stronger absorptive capacity and weaker in the most disadvantaged areas (Cappelen, Castellacci, Fagerberg and Verspagen, 2003). Finally, innovative capacity and Social Filters (broader regional socio-economic environment) are discriminants for European Territorial Infrastructural Policies (TEN-T) financed by the EU Regional Policy funds. In their absence, the policy's impact is non-significant or even negative (Crescenzi and Rodríguez-Pose, 2012). There is also consensus on the idea that the effect of total expenditure is not positive in absolute terms but individual areas of policy intervention may produce heterogeneous effects (Dall'erba, Guillain and Le Gallo, 2007). Only 'education and human capital' investments have actually sustained medium term growth. Instead, support for 'agriculture and rural promotion', 'infrastructure' and 'business' was less effective (Rodríguez-Pose and Fratesi, 2004).

The analysis of the existing literature shows that among the factors conditioning the impacts of the EU regional policy very limited attention has been paid so far to the role played by other EU policies that co-exist and interact with the EU regional policy on the ground. From a conceptual standpoint this may hide relevant processes in the understanding of regional growth dynamics and policies (Duhr et al., 2010; OECD, 2009). From a methodological point of view, overlooking (some of) the elements that influence the relationship between the EU Regional Policy and regional economic performance, entails omitted variable and reverse causality biases (Mohl and Hagen, 2010) in part possibly explaining the conflicting conclusions reached by existing studies[1].

During their respective developments, regional policy and the CAP have influenced one another. Together they represent roughly 80% of the total 2014-20 EU budget (EU Commission, 2013). For a long time, the CAP's market measures were at the core of EU policies. Instead, regional policy and rural development policies were underfunded and marginally developed (Crescenzi, de Filippis and Pierangeli, 2014; Saraceno, 2002). With the Reform of the Structural Funds (1989) and Agenda 2000, the CAP and the EU regional Policy became closely interdependent. In the 2000-2006 policy programming period, regional and rural development policies were part of the same joint programmatic framework and their different measures were implemented by the same Institutions (Mairate, 2006; Manzella et al., 2009). In the 2007-2013 EU budget period they were again separated from one another in term of programming and managing authorities. However, both EU institutions and researchers continue to stress their common contribution towards cohesion (Barca, 2009).

Given their 'spatially targeted' nature, the strongest relation is that between regional and rural development policies. However, it is increasingly recognized that the CAP's market measures have also spatial implications. In line with the sector aim of agriculture support, CAP resources are 'captured'

[1] Mohl and Hagen (2010) reviewed at least 15 other quantitative studies, which with similar approaches to those discussed above reached altogether conflicting conclusions on the impact of cohesion policies.

by dynamic, higher specialized and productive agriculture (Duhr et al., 2010). This feature of First Pillar CAP has a potentially perverse impact in terms of 'distributive equity' by favouring the polarization of agricultural income and preventing less developed areas from benefiting from its support (ESPON, 2004).

In the absence of proper coordination the literature has highlighted the risk of a counter-treatment effect on overall economic growth whereby one policy area may counterbalance the pro-cohesion effects of the other (Barca, 2009; European Commission, 2010; Duhr et al., 2010). Sectoral policies such as the CAP are designed to sustain a strategic sector rather than to promote cohesion and the former objective could have a completely countervailing effect on the second (Bivand e Brundstad, 2003; Bureau and Mahè, 2008).

This potential mismatch between sectoral and territorial objectives applies more to first-pillar CAP incentives than to rural development policies, which, on the contrary, can minimize the critical effects of CAP market measures (Shucksmith et al., 2005). In addition other research suggests that the CAP does not counteract the impact of the EU Regional Policy (Esposti, 2007) and once regional characteristics are appropriately controlled for, its contribution to cohesion is even greater than 'Objective 1' funds (Montresor, Pecci and Pontarollo, 2011).

Overall this potentially very critical effect is still unclear as attempts to evaluate it in the literature are few and far between. Regional and agricultural economists very rarely work together in this direction and sometimes this lack of cooperation is exacerbated by the difficulty of integrating different data sources as also by the sharp division in responsibilities between different administrations at the EU, National and Regional levels (Kilkenny, 2010).

3. Model of empirical analysis

In line with the existing literature on the analysis of regional growth dynamics we specify a standard regional growth model (Cappelen et al. 2003; Camagni and Capello, 2010 & 2013; Capello and Lenzi, 2013; Crescenzi and Rodriguez-Pose, 2011 and 2012; Paci and Marrocu, 2013; Petrakos et al. 2005a and b, 2011) augmented by a 'EU policy matrix' that includes expenditure under the EU Regional Policy, Rural Development and CAP; a 'territorial conditioning factors matrix' that includes proxies for regional structural conditions that influence policy outcomes; and a 'Policy interactions matrix' that includes the interaction terms between the different policies and between the policies and regional contextual conditions.

The model is specified as follows:

$$\Delta Y_{it-1,t} = \beta_0\, Y_{i0} + \beta_1\, X1_{it-1} + \beta_2\, X2_{it-1} + \beta_3\, X3_{it-1} + \beta_4\, WX_{it-1} + \beta_5\, C_{it-1} + \varepsilon_{it} \quad (1)$$

Where:

ΔY is the regional GDP average growth rate over the period from t-1 to t;

Y is the natural logarithm of the level of regional GDP per capita at the beginning of each period;

X1 is the 'EU policy matrix';

X2 is the 'Territorial conditioning factors matrix';

X3 is the 'Policy interactions matrix';

WX is the spatially-lagged variables matrix;

C is a matrix of standard control variables;

ε is idiosyncratic error

and where i represents the unit of analysis and t the policy programming period (1994-1999; 2000-2006; 2007-2013/09).

In greater detail, the variables included in the model are as follows:

Regional GDP Growth rate per capita

The growth rate of regional GDP is the dependent variable and is used as a proxy for regional economic performance. It is computed as the logarithmic ratio between average GDP per capita for the first three years of the period t and the correspondent value for the period t-1. As is customary in growth analyses, GDP growth rate is hence computed over multiannual periods rather than on a yearly basis in order to minimize the influence of external macro trends and shocks (the robustness checks confirm that results are robust to different methodological choices in this regard).

'EU Policy matrix'

The role of EU policies in regional growth dynamics is captured by examining the corresponding expenditure in each region for the entire EU budget programming periods 1994-99; 2000-06 and 2007-13 for Regional Policy, Rural Development Policy ('spatially targeted' policies) and CAP ('spatially blind' policy with territorial implications).

'Territorial conditioning factors matrix'

This matrix aims to include the key territorial features that shape policy success and failure under the strong constraint of data availability for all EU regions. It includes structural socio-economic conditions in terms of demographics, productive structure and the labour market as well as regional innovative capacity and infrastructural endowment.

In particular, socio-economic conditions are captured by a Social Filter Index - a composite index extensively used in existing studies on innovation and regional growth (Crescenzi and Rodríguez-Pose 2009 and 2011) combining a set of proxies for territorial structural preconditions conducive to favourable environments for the genesis of innovation and its translation into economic growth. The Social Filter Index covers to two main domains: educational achievement (Crescenzi, 2005; Iammarino, 2005; Lucas, 1988; Lundvall, 1992; Malecki, 1997; Rodríguez-Pose and Crescenzi, 2008) and the productive employment of human resources (Fagerberg et al., 1997; Rodríguez-Pose, 1999).

With reference to the first domain, the index accounts for human capital accumulation (share of tertiary educated population in relation to the population aged 15+) and the skilled labour force (share of tertiary educated employees in relation to total employees). For the second domain, employment in agriculture is included in order to account for the composition of the local productive structure. The long-term component of regional unemployment (long-term unemployment percentage) is included in the index in order to account for such local labour market conditions as the rigidity of local labour markets and the stratification of inadequate skills (Gordon, 2001) that hamper innovation and economic growth[2].

[2] The index is calculated by using Principal Component Analysis (PCA) and accounts (considering only its first component) for around 50% of the total variance in the single variables that it synthetizes (Tables B.1 and B.2, Appendix B). It prevents collinearity problems potentially generated by the simultaneous inclusion of all the variables in the model (Duntenam, 1989; Esposti et al., 2013). The four variables considered enter the composite index with the expected sign: human capital and skilled labour force – which also displays the greatest relative weighting

Other two important features influencing policy impacts are: a) the level of R&D activities (R&D's share of GDP at the territorial unit level, Eurostat) that "captures the existence of a system of incentives (in the public and the private sector) for intentional innovative activities" (Crescenzi and Rodríguez-Pose, 2011, p. 14); b) the level of regional infrastructural endowment (regional kilometers of motorways standardized by 'total regional surface'[3]) as a proxy for a region's existing physical capital endowment.

Interactions matrix

This matrix includes two key types of interactions: interactions between the individual components of the 'EU policy matrix' – in order to capture synergies or trade-offs between different EU policies – and interactions between the 'policies' and the 'conditioning factors' matrices in order to identify factors conditioning the policies' impacts. The elements of this 'interactions matrix' can capture the existence of synergetic/countervailing forces able to influence the policy's impact by augmenting or diminishing its magnitude. In particular, in line with the conditioned impact literature (Ederveen, Gorter Mooij and Nahuis, 2002; Ederveen, De Groot and Nahuis, 2006), the overall impact of the policy is evaluated by assessing the sign and joint significance of the coefficient of the policy itself (i.e. the coefficient of the variable of interest indicated in the 'policy matrix') and the coefficient of the

– have a positive sign, while long-term unemployment and the agricultural share of employment, by contrast, figure in the social filter index with a negative sign. The Index is computed for each year (time variant indicator) holding constant the PCA coefficients (computed on the longitudinal dataset). The stationarity of the variables was preliminarily tested: The tests confirmed the stationarity of the series, allowing us to implement the PCA analysis on the panel dataset and assure the comparability of the index across programming periods.

[3] The standardisation proposed is used in order to purge potential biases linked to the different geographical sizes of the EU regions. Even if it is customary to use this proxy in the literature, it should be stressed that it says nothing about the quality and condition of the infrastructures themselves and nor does it reflect differences in construction and maintenance costs.

term of interaction with the identified conditioning factors (i.e. the 'interaction matrix')[4].

Spatially lagged variables

In order to account for interactions between neighbouring regions, this additional matrix introduces the spatially lagged values of 'conditioning factors'. These values enable us to explicitly model spatially-mediated inter-regional spillovers while, at the same time, minimising the spatial autocorrelation of the residuals. In particular, the spatially lagged variables included in the model are calculated by multiplying each territorial variable by a spatial matrix computed with the k-nearest neighbours (with k=4) criterion, which can minimize not only 'endogeneity' induced by travel-time distance weighting but also potential bias due to differences in the number of neighbours as between central and peripheral European regions. In particular, the 'spatially lagged matrix' includes the spatially lagged value of the social filter index, spatially lagged R&D activities and the spatially lagged infrastructural endowment.

These spatially lagged indicators place each region in the broader European space, thus making it possible to assess their interactions with neighbouring regions. They can capture spillovers of various kinds influenced by geographical accessibility or peripherality. Favourable socio-economic conditions in neighbouring regions (spatially lagged social filter index) influence indigenous economic performance thought imitative effects and the mobility/movement of human capital/skills facilitated by geographical

[4] In the paper, in line with the existing literature on conditioned impact, we focus on the sign and significance of coefficients, rather than on the size of specific point estimates. In general, following Wooldridge (2003), the magnitude of the overall effect can be computed by plugging in interesting values of the interacted variable (e.g. the mean or the lower and upper quartiles in the sample) to obtain the partial effect.

proximity. Accessibility to extra-regional innovative activities (spatially lagged R&D variable) can also influence internal economic performance through localised knowledge spillovers while the infrastructural endowment of neighbouring regions insures adequate accessibility to the region and the lack of transport bottlenecks.

Control matrix

This matrix is included in each specification of the model as it contains a set of standard controls. Controls for the "initial conditions" of the regions are obtained by including the log-level of GDP per capita (Eurostat) at the beginning of each period (OECD, 2009). In addition, the national annual growth rate accounts for the link between the national economic context and regional economic performance (Monastiriotis, 2014) while minimizing the effect of spatial autocorrelation by accounting for some of the common trends that characterize groups of territorial units; the Krugman index of specialization controls for the specialisation in local employment (Midelfart-Knarvik and Overman, 2002) by giving territorial unit i a zero rating if it has an industrial structure identical to other units, and by attributing a maximum value of 2 if it has no industries in common with other territorial units, and finally the population density controls for the local economy's degree of agglomeration.

3.1 Units of analysis and data sources

In terms of geographical units the analysis is based on a combination of NUTS-1 and NUTS-2 regions in order to maximise the homogeneity of the territorial units in terms of the degree of autonomy and administrative roles as also to capture the relevant target area in which the policies under analysis are being implemented.

Consequently, the sample contains NUTS-1 regions for Belgium, Germany and the United Kingdom and NUTS-2 for the other European countries (Austria, Finland, France, Greece, Italy, the Netherlands, Portugal, Spain and Sweden). Denmark, Ireland and Luxembourg are excluded from the analysis because they have no equivalent sub-national regions for the whole period of the analysis. In addition, lack of data prevents the French Départments d'Outre-Mer (FR9) and of Trentino-Alto Adige from being introduced, while, given the introduction of spatially-lagged variables, remote islands or enclaves could not be included. The analysis is necessarily limited to the EU-15 countries that have been recipients of EU Regional Policy, Rural Development and CAP funding for a sufficiently long time span.

Therefore, the final database comprises 139 territorial units (European NUTS-1 and NUTS-2) belonging to 12 European EU-15 countries (Austria, Belgium, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom)[5]. The analysis has been performed over 3 EU-Budget programming periods (1994-1999; 2000-2006; 2007-2013).

[5] Due to lack of data on R&D Activities and on the variables composing the Social Filter Index finally, the effective number of observations in the analysis turned out to be 121.

Structural Fund (ERDF and ESF) data (per capita 'commitments' for each policy programming period) have been provided for by the Directorate General for Regional Policy of the European Commission (DG REGIO) in May 2009. Data referring on Rural Development Policy are based on per capita 'commitments' for each policy programming period. The first-pillar CAP data are instead, based on actual expenditure based on CAP total subsidies on crops and on livestock and CAP decoupled payments included in the Farm Accountancy Data Network (FADN). The details of the computation of the regionalised expenditure data for Rural Development and CAP are discussed in Crescenzi et al. 2014.

The data for all territorial variables (dependent and independent) come from Eurostat[6]. The values assigned to each of the three periods are computed as the average of their annual values over the policy programming period itself. With respect to the latest programming periods (2007-2013) all the territorial data are computed as an average of their annual values from 2007 to 2009, as 2009 is the last year for which data are available.

The choice of aggregating all expenditure/commitment data by programming period is customary in the literature due to the lack of reliability of annual expenditure data, in its turn a consequence of the complexity of EU budgetary and reporting rules: i.e. expenditure reported in a specific year might not necessarily be spent in that year. In addition, this choice allows us to minimize reverse causality (Mohl and Hagen, 2010) much more effectively than with annual data. Whole-period commitments are in fact assigned at the beginning of a multiannual period and, consequently, they do not depend on any subsequent shock (e.g., economic macro trend) that could occur over the

[6] Data on GDP Growth Rate for the Austrian and the Italian regions and data on Population density for the Spanish regions come from national sources because they are not available on the Eurostat System.

period under analysis, thus leading to adjustments to annual expenditure. The same multiannual specification is also generally preferred for the "regional growth rate", which instead of being computed as the ratio between the level of GDP per capita in two consecutive years, is usually considered as the ratio between average GDP per capita levels over a period of at least 5-years (OECD, 2009). The analysis conforms strictly to the literature and in this sense adopts the most common specification for the model: regional growth rate between time t and time t-1 is regressed on the policy at time t-1, where t stands for the policy programming periods.

4. Empirical Results and Robustness Checks

The model specified in Equation 1 is estimated by means of Fixed Effect panel data (FE). In estimating the model, Fixed Effect-FE were found to be preferable to both Random Effect-RE and Correlated Random Effect-CRE specifications[7] (Wooldridge, 2002). Classical tests (such as Wald, R-squared and F-test) were carried out on the estimated FE model. Moreover, the model controls for heteroschedasticity and the spatial autocorrelation of the residuals. Finally, the time Fixed Effects have been captured by including time dummy variables in the analysis after obtaining evidence on their joint significance.

[7] FE results were compared to RE's by applying the Hausman Tests (Hausman and Tylor, 1981). In addition, when comparing FE estimations to the "Modified Random Effect" estimator (Hajivassiliou, 2011) for CRE it was concluded that the FE estimator captures all exogenous variability available in the model and that FE was not only a consistent but also an efficient estimator for the regression coefficients (Hajivassiliou, 2011). These additional results are available upon request.

4.1 Empirical results

The presentation of the results is organised as follows. Table 1 presents some key descriptive statistics. Table 2 looks at total commitments/expenditure for all EU policies (regional, rural development and CAP together) while table 3 looks at each policy separately and at their interactions. The test statistics carried out for all versions of the model (reported at the bottom of the tables) confirm the significance of the regressions (F-test) and their predictive capacity (R Squared). Furthermore, the Wald test confirms not only the significance of the single coefficients but also the joint significance of the coefficients of the variable of interest (policy) and the "terms of interaction" coefficients (Ederveen, De Groot and Nahuis, 2006). The inclusion of the spatially lagged variables allows us to remove spatial autocorrelation with no impact on the significance of the key variables of interests. Moran's Indexes are computed for residuals of all specifications, rejecting the presence of Spatial Autocorrelation after the inclusion of the spatially lagged explanatory variables. In the robustness checks section the key specification of the model is re-estimated by means of spatial panel data models, confirming the results reported in the main tables and allowing us to exclude any bias due to spatial autocorrelation[8].

This is an exploratory analysis aimed at uncovering territorial dynamics linked with the EU Policies rather than identifying causal relationships – consequently, in what follows, we focus mainly on the sign and significance of coefficients, rather than the size of specific point estimates.

[8] In the main tables we prefer to report the standard panel data models in order to maximise comparability with other existing research and facilitate interpretation of the key coefficients.

Table 1 shows the magnitude and distribution of the policies' commitments over time: the most significant part of the total EU funding is represented by the CAP and Regional Policy. Rural Development Policy's role in terms of the amount of resources is still relatively small (Table 1).

Table 1 - Policy Commitments (in Euro values, per capita) and Regional Growth (average rate). Financial Periods 1994-1999; 2000-2006 and 2007-2013.

		Mean	Std. dev
CAP	1994-99	813.47	631.47
	2000-06	1118.44	847.91
	2007-13	1042.24	834.57
Regional Policy	1994-99	413.61	481.23
	2000-06	652.84	707.95
	2007-13	531.17	540.32
Rural Development Policy	1994-99	78.82	95.52
	2000-06	202.25	213.91
	2007-13	206.26	181.36
Regional GDP per capita average growth rate	1994-99	0.0198	0.0017
	2000-06	0.0255	0.0010
	2007-13	-0.0124	0.0026

Source: authors' elaboration using European Commission Data

Moreover, both the CAP and the EU Regional Policy increased their resources from the first to the second programming period but underwent a reduction in the latest period (2007-2013) as a consequence of the extension of the policies to the New Member States of the EU. Funds for Rural Development Policy increased over the whole period studied (1994-1999; 2000-2006 and 2007-2013).

In contrast to the positive trend registered across the first two policy programming periods, the growth rate during the period 2007-2013 diminished, and actually turned negative. As expected, the correlation between the policy commitments (considered as a whole) and GDP growth rate was also positive (0.6) and significant. In considering the negative sign for GDP growth rate over the period 2007-2013, account must, of course, be taken of the major economic crisis that has befallen the European and the world economy since 2008, which most likely driving the general economic growth downward.

Table 2 offers the key initial diagnostics for regional growth dynamics and EU expenditure. Total EU funding is positively and significantly correlated with regional economic growth. There is no evidence of a composition effect neutralising the overall impact of total EU funding: when considering total committed expenditure for EU Regional Policy (ERFD and ESF), the Rural Development Policy and the CAP together, the link with regional economic growth is positive and significant.

When looking at the role of other key drivers of regional economic performance, table 2 shows that the coefficient of initial conditions (level of GDP at the beginning of the period) is negative and highly significant, detecting a process of conditional regional convergence. The social filter – the broader set of socio-economic conditions – has also a positive but only marginally significant correlation with economic growth. The key controls behave as expected. The national growth exerts a positive and significant influence on regional growth, confirming the importance of national framework conditions for regional performance (Monastiriotis, 2014). The Krugman Index – negative and highly significant - confirms that diversification is a key strength for EU regions. When spatially lagged variables are introduced into the regression (column 2) the high significance of Total EU funding is confirmed and inter-regional knowledge spillovers emerge as a key driver for regional growth in line with previous literature (Moreno et al. 2005a and b; Rodriguez-Pose and Crescenzi 2008).

Table 2 - EU Regional Growth and overall EU Spending (All Policies).

Dependent variable: GDP per capita Average Growth Rate		
	1	2
Total EU Funding	0.0570***	0.0520***
	(0.0122)	(0.0125)
Ln of initial GDP p.c.	-0.8016***	-0.7570***
	(0.0676)	(0.0670)
Social Filter Index	0.0190*	-0.0002
	(0.0102)	(0.0176)
R&D Activities	0.0055	0.0070
	(0.0208)	(0.0195)
Infrastructural endowment	1.5220	0.8422
	(1.1194)	(0.9630)
Spatially Lagged Social Filter		0.0249
		(0.0168)
Spatially lagged R&D Activities		0.0330**
		(0.0167)
Spatially lagged Infrastructure		2.1387
		(1.4234)
National Growth Rate	0.1270***	0.1352***
	(0.0141)	(0.0147)
Krugman Index	-0.0670**	-0.0771**
	(0.0286)	(0.0304)
Population Density	0.0001	0.0001*
	(0.0000)	(0.0000)
Constant	7.7730***	7.2372***
	(0.6841)	(0.6717)
Obs	242	242
R squared	0.902	0.908
Prob>F	0.000	0.000

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

Table 3 opens the 'black box' of total EU funding. The first specification (column 1) relates the dependent variable to the policy variables, the territorial conditioning factors (social filter index, R&D activities and infrastructural endowment), the spatially lagged terms and the control variables (coefficients not reported in the table as in line with table 2). Columns 2, 3 and 4 show the results obtained by considering the interactions between the various EU Policies and the territorial conditioning factors: column 2 shows the interaction between each EU policy and the social filter index; column 3 shows the policy's interaction with R&D Activities; column 4 shows the policy's interaction with the infrastructural endowment. Finally, column 5 shows the results obtained by considering the interactions within the 'EU policy matrix' referring with interactions between the regional, the rural development and the common agricultural policies.

Column 1 shows that the positive influence of total European funding should be attributed to the positive and significant role played by the EU Regional Policy while the coefficients of both Rural Development Policy and CAP are not significant. The EU Regional Policy is the only EU budget heading delivering a positive influence on regional growth. The 'spatially targeted' approach of the EU Regional Policy has been successful in supporting regional growth. Conversely, the CAP – notwithstanding the relevance of the financial resources distributed in each region – has not produced any relevant influence on average regional growth. Furthermore, the results for rural development are not more encouraging: even if rural development policies should, in principle, combine an emphasis on rural areas with a bottom-up approach, they seem unable to do better than 'traditional' CAP interventions in terms of territorial cohesion.

Table 3 – Regional Growth and the EU Regional Policy, Rural Development Policy and CAP.

Dependent variable: GDP per capita Average Growth Rate					
	1	2	3	4	5
Regional Policy	0.1028***	0.1365***	0.1095***	0.1184***	-0.0569
	(0.0301)	(0.0359)	(0.0354)	(0.0354)	(0.0551)
Rural Development Policy	0.0026	0.0172	-0.0649	-0.0400	0.1116
	(0.0236)	(0.0273)	(0.0358)	(0.0282)	(0.0734)
CAP	0.0308	0.0245	0.0804	0.0458*	-0.0060
	(0.0235)	(0.0305)	(0.0348)	(0.0254)	(0.0385)
Social Filter Index*Regional Policy		0.0414**			
		(0.0205)			
Social Filter Index*Rural Development Policy		0.0067			
		(0.0397)			
Social Filter Index*CAP		-0.0129			
		(0.0120)			
R&D Activities*Regional Policy			-0.0014		
			(0.0353)		
R&D Activities*Rural Development Policy			0.0264***		
			(0.0001)		
R&D Activities*CAP			-0.0410**		
			(0.0178)		
Infrastructure*Regional Policy				-2.0114	
				(1.5513)	
Infrastructure*Rural Development Policy				3.8648**	
				(1.4986)	
Infrastructure*CAP				-2.8016**	
				(1.1935)	
Regional Policy* Rural Development Policy					0.1452**
					(0.0638)
Regional Policy*CAP					0.0422**
					(0.0185)
Rural Development Policy*CAP					-0.1056***
					(0.0376)
Log of Initial GDP, 'Territorial Conditioning Factors', 'Spatially Lagged terms' , Controls and constant	X	X	X	X	X
Period Dummies	X	X	X	X	X
Obs	242	242	242	242	242
R squared	0.913	0.921	0.916	0.917	0.922
Prob>F	0.000	0.000	0.000	0.000	0.000

Robust and clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 - The log of initial GDP, 'territorial conditioning factors' (Social Filter Index, R&D Activities, Infrastructural endowment Spatially Lagged Social Filter, Spatially lagged R&D Activities, Spatially lagged infrastructure) and the same control variables (Constant; National Growth Rate; Krugman Index and Population Density) reported in Table 1 are included in all regressions but not reported in the table.

The analysis of the interaction terms makes it possible: i) to explore how the role of regional policy depends on the whole structure of the EU policies and of the territorial conditioning factors; ii) to capture potential synergies or conflicts between Regional and other EU policies of different nature and iii) to understand how these interactions can change depending on the territorial context.

The links between expenditure for the various policies and socio-economic contextual conditions are depicted by the interaction terms between the individual EU policy variables and the social filter index. The corresponding results are reported in column 2. Socio-economic conditions turn out to be a positive conditioning factor for regional policy impacts. The relationship between Regional Policy funding and regional growth is stronger for areas with more favourable socio-economic conditions: both the coefficients of the EU Regional Policy and that for the term of interaction 'regional policy*social filter index' are positive and significant. Thus, regional policy generally supports growth but with stronger benefits for areas with favourable socio-economic conditions. It also emerges that the impact of Rural Development Policies and CAP is totally independent of socio-economic contextual conditions: their impact is not significant generally and nor is it conditioned by the socio-economic conditions of the regions.

The interactions between EU policies and regional R&D activities and infrastructural endowment are presented in columns 3 and 4 respectively. The coefficients of the corresponding interaction terms (and the joint significance of the direct and interacted coefficients) suggest that both R&D activities and infrastructure matter when Rural Development and CAP funds are considered. In particular, Rural Development funds might influence economic growth when targeted at regions with a comparatively stronger innovative and infrastructural environment (i.e. the most dynamic rural areas in Europe). Conversely, CAP funds – with their spatially blind approach, uninfluenced by the a priori quality of the region in the allocation of the funds – work better in the most disadvantaged areas, characterised by limited infrastructural and innovation endowment. This section of the analysis, therefore, confirms that 'spatially blind' policies do have spatial implications. Given that CAP funding is not influenced by the capabilities of the different regions to 'bargain' for resources - these are allocated in a top-down fashion by means of subsidies largely linked to 'historical' production data[9] – they are able to exert a positive influence on economic growth in most of the structurally disadvantaged regions. In addition CAP and Rural Development policy, even if funded by the same financial source, seem work in opposite directions when interacting with contextual conditions at the local level. In this sense, Rural Development policy behaves in a manner more in line with 'spatially targeted' approach (Regional Policy).

The results in column 5 of Table 3 provide new evidence on the links within the 'EU policy matrix': the model specification now includes the terms of interaction between Regional Policy and the other EU policies. The EU Regional Policy's role is positively conditioned by synergies with all other policies: all interaction terms are positive and capture the marginal benefit from the policies on cohesion determined by such synergies. Instead, the interaction between the two 'agricultural' policies (CAP and Rural Development policy) shows a negative sign. When both CAP and Rural Development funds are targeted at regions that also benefit from more generous EU Regional Policy resources, the positive influence on regional

[9] The progressive de-coupling of support from production introduced since 2003 by the so called Fischler Reform and the further move of the CAP 2014-2020 towards a first pillar with a fully decoupled support progressively based on a flat rate per hectare reinforces the top-down nature of this policy.

growth is - ceteris paribus – maximised. But the same is not true for the interaction between Rural Development and CAP: when both 'agricultural' policies channel a high level of funding to the same region they tend to generate sectoral distortions detrimental to long-term economic growth. Consequently, it seems to be that synergistic use of different sources of funding and tools of a diversified nature can boost economic growth, while 'specialisation' in one single policy area is likely to generate decreasing returns and reinforce inconsistencies.

4.2 Robustness checks

The robustness of the results is tested in a number of ways and the corresponding additional tables are included in Appendix A available on line.

Measurement error and endogeneity bias

In order to test for measurement error problems the analysis was reproduced with the use of an alternative measure for the key independent variable of interest. The policy variable adopted in the main analysis (whole period Commitments) is replaced by annual payments. Whole-period Commitments are considered in the literature more reliable policy indicators than annual Payments (OECD, 2009; Mohl and Hagen, 2010). Whole-period averages are more accurate than annual data given that annual payments largely reflect reporting and accounting rules rather than actual expenditure patterns. In addition, whole-period commitments are more exogenous with respect to external shocks that can simultaneously influence both economic growth and expenditure. An example of this problem is the well-documented increase in Structural Funds actual expenditure in response to the Crisis started in 2008 (European Parliament, 2014).

The key regressions have been replicated with a specification, sample and time period that enable us to make comparisons as between the results of the estimation of equation 1 obtained by using Commitments (as in previous tables) and actual payments. Further details on these additional estimations are reported in Appendix A. The additional regressions confirm that the impact of the impact of the EU Regional Policy on regional economic growth is positive and significant when commitments from this alternative database as well as when payments are used as an alternative policy measure, provided that their endogeneity is appropriately accounted for in an IV framework.

In order to address any potential endogeneity issues, and identify the parameter of interest more accurately, we explicitly allow actual payments to be an endogenous variable and use commitments (decided a priori and well before actual economic growth is observable) as the corresponding instrument in an Instrumental Variable analysis. The choice of the instrument is confirmed by the first stage regression, and justified by the fact that Commitments, strongly correlated with Payments, only influence the economic performance of regions when transformed into expenditure (through the payments channel). Consequently, they represent an exogenous and relevant instrument to permit the model to correct the endogeneity bias likely to affect Payments.

The Hausman test confirms our intuition as concerns the 'endogeneity' of Payments. The IV regression that instruments Payments with the Commitments is preferred to OLS, as the latter considers Payments exogenous. The results of the IV regression are set out in Table A.1 column 3.

Overall these tests confirm the choice of our key policy variable. Commitments are not only capable of acting as a proxy for the policy by delivering the same results that would have been produced by considering the effective expenditure, but also that the Payments by themselves are unlikely to account for policy in a coherent manner insofar as identified as endogenous by the Hausman test[10] for endogeneity.

As in other transition countries in SEE in the first wave of the EU's Eastern enlargement, Slovenia adopted a gradualist approach to privatisation. Even at the point of accession to the EU in 2004, the main state owned banks had not been privatised. In fact, privatisation in Slovenia resulted perversely in greater state control, since most firms allegedly privatised were bought out by state funds and by state-sponsored privatisation investment funds (Pahor et al., 2004). In the run-up to EU accession, the Slovenian policy changed to a greater emphasis on horizontal industrial policies and the removal of subsidies and state aids for industry in keeping with the EU acquis (Šuštar, 2004). On the eve of accession, the EU's Comprehensive Monitoring Report on Slovenia recommended the termination of the Slovenian Development Corporation, the body that owned state companies, as its main recommendation on the Chapter on Industrial Policy (EC, 2003).

Misspecification of the dependent variable

The specification of the model is in line with the standard panel data literature on regional economic growth and regional policy analysis (OECD, 2009; Mohl and Hagen, 2010). In order to control for the robustness of the results with respect to the specification of the outcome variable, the model is re-estimated with an alternative version of the GDP growth rate. In

[10] The p value of the test is equal to 0.0041.

particular, the main regression is re-estimated with a GDP growth rate computed as the natural logarithmic of average annual GDP growth rate over the first three years of each programming period t. This outcome variable is regressed onto the dependent variables taken at the time t-1 so that the GDP growth rate can be computed with respect to an initial period that is successive to the period to which the policy is related rather than coinciding with it. This eliminates any time overlap between the dependent and explanatory variable and reduce any simultaneity bias likely to affect the model: in this case, the idiosyncratic shocks occurred during the policy multiannual programming period (t-1) do not enter in the computation of the GDP growth rate determined within the following policy multiannual programming period (t). These robustness tests confirm the results of the main analysis (Tables A.2.a and A.2.b. in Appendix A): even when the outcome variable is changed, the role of EU Regional Policy as well as that of overall European support remains positive and significant.

Misspecification of the model and linearity: Quantile Regression analysis

This additional robustness check makes use of Quantile Regression (QR) methods in order to ascertain if the policy's influence on regional growth changes with the distribution of regional growth. QR makes it possible to measure the effect of covariates not only at the centre of the distribution, but also in the upper and lower tails (Koenker and Bassett, 1978; Chernozhukov and Hansen, 2004) and it is employed to determine to what extent the impact of the policy (X) depends on regional features in terms of economic growth (Y). This additional analysis captures if and to what extent areas with different regional growth rate levels (three distribution's quantiles 0.10, 0.5 and 0.75) benefit from the EU Regional Policy. QR estimates are not presented as our key results given that the current state-of-the-art in the literature in the field does not allow to apply QR in a Fixed Effect panel data framework (Kato, Galvao and Monte Rojas, 2012; Ponomareva, 2011). Given the importance of omitted variable bias in this context we prefer to keep FE estimates as our main results and use QR as a robustness check. The details for this additional analysis are reported in Appendix A together with the key results. The results are reported in Table A.3 in Appendix A. The coefficients of the key variables support the results of the main analysis. They also confirm that the link between EU Regional Policy spending and Economic Growth is stronger in relatively richer and faster-growing areas. This finding suggests that although the policy's role is generally positive, it is not working completely in line with its main aim, namely to remedy the gaps between the disadvantaged and the relatively more dynamic areas of the Union. The strength of the relationship between the EU Regional Policy and growth seems in fact maximised in the already best performing EU regions.

Spatial dependence and spatial panel data analysis

The main specification of the Regional Growth model presented in the paper includes the spatial lags of the key conditioning factors: after their inclusion there is no evidence of residual spatial auto-correlation in the regression residuals. However, in order to further check the robustness of the proposed results, other forms of spatial autocorrelation are controlled for by means of alternative specifications of the model. The Spatial Autoregressive (SAR and DURBIN) specifications of model (1) account for the spatial dynamics of the dependent variable with spatially lagged Y (Spatial lag models) coefficient. The Spatial Error Model (SEM) will, instead, account for the dependence determining the spatially inter-correlation between the error terms. The technical details of these additional estimations are discussed in Appendix and Results are reported Table A.4 in the same Appendix. These additional regressions confirm the key results of the analysis: spatial dependence related to Y is not statistically significant while signs and significance of the main coefficient of interest (Regional Policy) are all confirmed.

5. Conclusions

The empirical analysis has shed new light on the relationship between regional growth and EU expenditure for Regional Policy, Rural Development and CAP. The EU Regional Policy expenditure is associated with stronger regional growth rates in all regions. This key result emerges clearly in all specifications of the model and is robust to a large number of tests. However, the positive influence of the EU Regional Policy is stronger in the regions with the most favourable socio-economic environment. This reveals a potential paradox of the EU Cohesion policy that works better in the relatively stronger (and better performing) regions with comparatively smaller (although still positive) gains for the most disadvantaged areas of the Union. The Rural Development policy, that is attracting increasing resources from the progressive reduction in funding of the first pillar of the CAP, is not systematically linked with regional economic growth. Some positive influence of Rural Development funding only emerges in the most advanced and better endowed areas: the rural areas of the 'core' of the EU not the most disadvantaged and peripheral. The 'traditional' agricultural market-related CAP funding has also no direct link with regional growth. However, there is no evidence of a counter-treatment effect working against cohesion. Conversely, where some modest influence of CAP on growth emerges it is in the most disadvantaged areas of the Union (those with less infrastructure and less innovation). This result might send an important message on the possibility that traditional top-down policies (such as the CAP) might be capable to channel their funds towards the most deprived regions of the Union with some positive influence on economic growth. On the contrary the complexity of the programming of more bottom-up interventions might lead to a concentration of the benefits in stronger areas. Finally, the analysis also shows that policy coordination is of paramount importance: returns from the EU Regional Policy are maximised where funding from the other policies is also concentrated. This confirms the OECD (2009) and Barca Report (2009) intuition on the importance of a synergic use of the funds from all EU policies.

Although robust to a large number of tests, some key limitations should be borne in mind when interpreting these results. First, regional economic growth is not the only outcome of interest for the EU Regional Policy and this is even truer for Rural Development and CAP. All these policies produce a number of tangible and intangible outcomes (and public goods) that cannot be captured by the proposed analysis. Second the analysis is unable to unveil causal links: a number of techniques and checks have been adopted to minimise any potential bias due to endogeneity but we still this is not a fully causal analysis. Third, the time period covered by the analysis remains relatively limited and more data will be need for more long-term analysis. The now completely digitalised and harmonised collection of expenditure data will make this possible in the near future.

Having acknowledged these limitations it is still possible to make some relevant policy considerations based on the results presented in the paper. The reinforcement of the local socio-economic environment is a crucial pre-condition for the success of any regional policy. This is of fundamental importance in order to maximise the returns to regional policy expenditure in the most deprived areas of the Union. Addressing this potential paradox is even more relevant to Rural Development interventions whose pro-growth potential is totally conditioned upon the pre-existing conditions of the target areas.

In order to address the structural conditions of the most disadvantaged regions purely bottom-up tools might be insufficient. Tailoring the various policies to local needs is certainly crucial. However, the analysis of the territorial effect of the first pillar of the CAP might be unveiling a relevant story: top-down interventions might be very effective in order to channel resources to the most deprived areas. Where the institutional context is weak and local lobbies might form strong anti-growth coalitions the identification of local needs and the planning and implementation of bottom-up actions might be problematic. As a consequence it is necessary to carefully assess the best mix of bottom-up and top-down interventions to match the conditions of the various EU countries and regions. In the same vein a national-level coordination and agenda setting might also favour the coordination on the ground among the various policies while at the local level conflicts and contrasts between the various agencies and offices might make this more difficult to achieve.

References

Bahr, C. (2008): “How does sub-national autonomy affect the effectiveness of structural funds?," Kyklos, 61(1), 3-18.

Barca, F. (2009). An agenda for a reformed Cohesion Policy. Independent Report prepared at the request of Danuta Hübner, the Commissioner for Regional Policy, http://ec.europa.eu/regional_policy/policy/future/barca_en.htm

Barca, F., P. McCann and A. Rodríguez-Pose (2012): "The Case For Regional Development Intervention: Place-Based Versus Place-Neutral Approaches," Journal of Regional Science, 52(1), 134-152.

Bivand, R.S. and Brundstad R.J. (2003): “Regional Growth in Western Europe: An Empirical Exploration of Interactions with Agriculture and Agricultural Policy in Fingleton, B. (ed.), European Regional Growth. Springer, Berlin Heidelberg New York.

Bouayad-agha, S., N. Turpin and L. Védrine (2010): “Fostering the potential endogenous development of European regions: a spatial dynamic panel data analysis of the Cohesion Policy on regional convergence over the period 1980-2005,” TEPP Working Paper, 2010-17.

Bureau J.C. and Mahé L.P. (2008): “CAP reform beyond 2013: an idea for a longer view,” Notre Europe, Studies and Research n. 64, www.notre-europe.eu.

Camagni, R. and R. Capello (2010): “Spatial effects of economic integration: A conceptualization from regional growth and location theories'," in International Handbook of Economic Integration, ed. by M. Jovanovic. Edward Elgar.

Camagni, R., and R. Capello (2013) “Regional innovation patterns and the EU regional policy reform: Toward smart innovation policies,” Growth and Change 44(2): 355–389.

Capello, R. and Lenzi, C. (2013): “Territorial Patterns of Innovation and Economic Growth in European Regions”, Growth and Change, 44 (2), 195-227.

Cappelen, A., F. Castellacci, J. Fagerberg and B. Verspagen (2003): “The impact of EU regional support on growth and convergence in the European Union,” Journal of Common Market Studies, 41(4), 621-644.

Crescenzi, R. (2005): “Innovation and regional growth in the enlarged Europe: the role of local innovative capabilities, peripherality and education,” Growth and Change, 36(4), 471-507.

Crescenzi, R. (2009): “Undermining the principle of territorial concentration? EU regional policy and the socio-economic disadvantage of European regions,” Regional Studies, 43(1), 111-133.

Crescenzi, R. and Rodríguez-Pose A. (2009): Systems of innovation and regional growth in the EU: endogenous vs. external innovative efforts and socioeconomic conditions in Fratesi U. and Senn L. (eds) “Growth and innovation of competitive regions”, Springer-Verlag, 167-192.

Crescenzi, R. and A. Rodríguez-Pose (2011): "Reconciling top-down and bottom-up development policies," Environment and Planning A, 43(4), 773-780.

Crescenzi, R. and A. Rodríguez-Pose (2012): "Infrastructure and regional growth in the European Union," Papers in Regional Science, Wiley Blackwell, 91(3), 487-513.

Crescenzi R., De Filippis F. and Pierangeli F. (2014): “In tandem for cohesion? Synergies and conflicts between regional and agricultural policies of the European Union”, Regional Studies (in press)

Cuaresma, J., D. Ritzberger-Grunwald and M. Silgoner (2008): "Growth, convergence and EU membership," Applied Economics, 40(5), 643-656.

Dall'erba, S., Guillain R. and J. Le Gallo (2007): "Impact of structural funds on regional growth: how to reconsider a 7 year-old black-box," The University of Arizona, Discussion Papers, GRD 06-07.

de Freitas, M., F. Pereira and F. Torres (2003): "Convergence among EU regions, 1990-2001. Quality of national institutions and "Objective 1" status," Intereconomics, September/October (2003), 270-275.

Duntenam, G.H. (1989): Principal Component Analysis, Sage Publications, London.

Duhr S., C. Colomb, e. Nadin V. (2010): European spatial planning and territorial cooperation. Routledge.

Ederveen, S., H. de Groot and R. Nahuis (2006): "Fertile soil for structural funds? A panel data analysis of the conditional effectiveness of European cohesion policy," Kyklos, 59, 17-42.

Ederveen, S., J. Gorter, R. de Mooij and R. Nahuis (2002): Funds and games. The economics of European Cohesion Policy. The Hague.

ESPON (2004): ESPON Project 2.1.3. The Territorial Impact of CAP and Rural Development Policy. Final Report, August 2004.

Esposti R. (2007): "Regional Growth and Policies in the European Union: Does the Common Agricultural Policy Have a Counter-Treatment Effect?," American Journal of Agricultural Economics, 89 (1), 116-134.

Esposti, R. and S. Bussoletti (2008): "Impact of "Objective 1" funds on regional growth convergence in the European Union: A panel-data approach," Regional Studies, 42(2), 159-173.

European Commission (2014): Investment for jobs and growth: Promoting development and good governance in EU regions and cities: Sixth report on economic and social cohesion. Brussels.

European Commission (2010a): Europe 2020, A European Strategy for smart, sustainable and inclusive growth. COM(2010) 2020. Brussels.

European Parliament (2014) Study on the impact of the economic crisis on social, economic and territorial cohesion, Brussels : http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/529066/IPOL-REGI_ET(2014)529066_EN.pdf

Fagerberg J., B. Verspagen and M. Caniels, (1997): "Technology, growth and unemployment across European Regions," Regional Studies, 31 (5), 457-466.

Farole T, Rodríguez-Pose A., Storper M. (2009): "Cohesion Policy in the European Union: Growth, Geography, Institutions," Prepared for the Independent Report by Barca F., An agenda for a reformed Cohesion Policy.

Gordon I.R. (2001): Unemployment and spatial labour markets: strong adjustment and persistent concentration in R. Martin and P. Morrison (eds.) Geographies of Labour Market Inequality, Routledge, London.

Grossman, G.M. and E. Helpman (1991): Innovation and Growth in the Global Economy, MIT Press, Cambridge (MA), USA.

Hajivassiliou, V. (2011): "Estimation and Specification Testing of Panel Data Models with Non-Ignorable Persistent Heterogeneity, Contemporaneous and Intertemporal Simultaneity, and Regime Classification Errors," LSE Department of Economics working paper.

Harris, R. (2008): "Models of Regional Growth: Past, Present and Future", Journal of Economic Surveys, 25(5), 913-951.

Hausman, J. and W. Taylor (1981): "Panel Data and Unobservable Individual Effects," Econometrica, 49, 1377-1398.

Iammarino, S. (2005): "An evolutionary integrated view of Regional Systems of Innovation: Concepts, measures and historical perspectives," European Planning Studies, 4 (13), 497-519.

Jaffe, A. B. (1989): "Characterizing the "technological position" of firms with application to quantifying technological opportunity and research spillovers," Research Policy, Elsevier, 18(2), 87-97.

Kato, K., Galvao, A. and G.V. Montes-Rojas (2012): "Asymptotics for panel quantile regression models with individual effects," Journal of Econometrics 170 (1), 76-91.

Koenker, R. and Bassett, G. (1978): "Regression quantiles," Econometrica, 46, 33–50.

Lucas, R. (1988): "On the Mechanics of Economic Development," Journal of Monetary Economics, 22 (1), 3-42.

Lundvall, B.A. (1992): National systems of innovation: Towards a theory of innovation and interactive learning. Pinter, London, UK.

Malecki, E. (1997): Technology and Economic Development: The Dynamics of Local, Regional and National Competitiveness. Second edition, Addison Wesley Longman, London, UK.

Manzella, G.P. and Mendez C., (2009): "The turning points of EU Cohesion policy," Prepared for the Independent Report by Barca F., An agenda for a reformed Cohesion Policy.

Martin R. and Tyler P. (2006): "Evaluating the impact of the structural funds on "Objective 1" regions: an explanatory discussion," Regional Studies,40(2): 201-210.

Midelfart-Knarvik H., and H.G. Overman (2002): "Delocation and European integration: is structural spending justified?," Economic Policy, 17(35), 322-359.

Mohl, P. and T. Hagen (2008): "Does EU Cohesion Policy promote growth? Evidence from regional data and alternative econometric approaches," ZEW Discussion Paper, 08-086.

Mohl P. and T. Hagen (2010): "Econometric Evaluation of EU Cohesion Policy – A Survey," ZEW Discussion Paper, 09-052.

Monastiriotis, V. (2014): "Regional Growth and National Development: Transition in Central and Eastern Europe and the Regional Kuznets Curve in the East and the West", Spatial Economic Analysis, 9(2), 142-161

Montresor, E., F. Pecci and N. Pontarollo (2011): "Rural development policies at regional level in the enlarged EU. The impact on farm structures," Paper prepared for presentation at the 114th EAAE Seminar 'Structural Change in Agriculture', Berlin, Germany, April 15 - 16, 2010.

Moreno, R., Paci, R and Usai, S. (2005a): "Spatial Spillovers and Innovation Activity in European Regions", Environment and planning A 37: 1973-1812

Moreno, R., Paci, R., Usai, S. (2005b): "Geographical and sectoral clusters of innovation in Europe", Annals of Regional Science, 39: 715–739

OECD (2009): How Regions Grow, Paris.

OECD (2009): Regions Matter: Economic Recovery, Innovation and Sustainable Growth, Paris.

Paci, R., and E. Marrocu (2013): Knowledge assets and regional performance. Growth and Change 44(2): 228–257.

Petrakos, G., Kallioras, D. & Anagnostou, A. (2011) Regional convergence and growth in Europe: understanding patterns and determinants, European Urban and Regional Studies, 18, 375–391.

Petrakos, G., Psycharis, Y. & Kallioras, D. (2005a) Regional inequalities in the EU new member-states: evolution and challenges, in: J. Bradley, G. Petrakos & I. Traistaru (eds) The Economics and Policy of Cohesion in an Enlarged European Union, pp. 45–64, New York, NY, Springer.

Petrakos, G., Rodríguez-Pose, A. & Rovolis, A. (2005b) Growth, integration, and regional disparities in the European Union, Environment and Planning A, 37, 1837–1855.

Ponomareva, M. (2011): "Quantile Regression for Panel Data Models with fixed effects and small T. Identification and Estimation", working paper, November 2011. http://www.niu.edu/ponomareva/QRPD-short.pdf.

Ramajo, J., M. Marquez, G. Hewings and M. Salinas (2008): "Spatial heterogeneity and interregional spillovers in the European Union: Do cohesion policies encourage convergence across regions?," European Economic Review, 52, 551-567.

Rodríguez-Pose A. and Crescenzi R. (2008): "R&D, spillovers, innovation systems and the genesis of regional growth in Europe", Regional Studies, 42 (1), 51-67.

Rodríguez-Pose A. and Fratesi U. (2004): "Between development and social policies: the impact of structural funds in "Objective 1" regions," Regional Studies, 38,1:97-114.

Rodríguez-Pose, A. (1999): "Innovation prone and innovation averse societies: Economic performance in Europe," Growth and Change, 30 (1), 75-105.

Shucksmith M., K. Thomson e Roberts D. (2005): The CAP and the regions: The territorial impact of the Common Agricultural Policy, CAB International Publishing, 2005.

Saraceno E. (2002): "Rural development policies and the second pillar of the common agricultural policy", paper prepared for the 10th EAAE Congress, Zaragoza, Spain, August 28-31.

Soukiazis, E. and M. Antunes (2006): "Two speed regional convergence in Portugal and the importance of structural funds on growth," Ekonomia, 9(2), 222-241.

Wooldridge, J. M. (2002): Econometric analysis of cross section and panel data. The MIT Press, Cambridge, MA.

Wooldridge, J.M. 2003. Introductory econometrics: A modern approach. Mason: Thomson.

Yu J, de Jong R. and L-F. Lee (2008): "Quasi Maximum Likelihood Estimators for Spatial Dynamic Panel Data with Fixed Effects when both n and T Are Large," Journal of Econometrics, 146, 118-134.

APPENDIX A – Robustness checks

A.1 - Robustness Check 1 – Measurement Error in the policy variable and Endogeneity

The additional dataset that makes it possible to test for potential measurement errors in the policy variable includes actual payments for all NUTS-2regions in the EU27 and includes annual Commitments and Payments for the EU Regional Policy and Rural Development (together and not separable) over the period 2000-2009 only. As customary in the economic growth literature the test avoids annual GDP data to measure economic growth and relies on 5-year periods (OECD, 2009), annual policy data from 2000 to 2009 are aligned to this, and the model was estimated as a cross section, where regional GDP pro capita growth rate over the period 2007-2009 is regressed onto the 'spatially targeted' policies' payments over the 2000-2009 period. The same model was estimated by making use of Commitment data from the previous analysis by linking the regional growth rate of GDP per capita over the period 2007-2009 with 'spatially targeted' policies' Commitments for the last two programming periods (2000-2006 and 2007-2013) in order to maximise comparability.

The results of the model estimated on both datasets are shown in Table A.1 below. In particular, the first column of the table shows the results obtained by running the model on the main dataset of the analysis (and as a consequence policy data refer to the whole period of Commitments). The second column shows the corresponding results obtained by running the model on the actual payments dataset. Finally, column 3 sets out the results obtained by considering Payments as endogenous and, consequently, instrumented by the corresponding Commitments an Instrumental Variable framework.

The check conducted on the main dataset confirms the impact of 'spatially targeted' policies[11] on regional growth: i.e. the coefficient of the 'spatially targeted' policies is positive and significant. The policy variable coefficient in column 2 is positive but not significant. However, once the endogeneity of actual payment is accounted for in column 3 by means of an appropriate IV strategy the key results of the paper are confirmed. In addition the results of this IV analysis confirm that the key conclusions of the paper are robust to endogeneity bias.

Table A.1 - Measurement Error in the Policy Variable and Endogeneity

Dependent variable: GDP per capita Average Growth Rate			
	1 - OLS	2 - OLS	3 - IV
Spatially Targeted	0.0004***	0.00001	0.000001*
Policies	(0.000)	(0.000)	(0.000)
Constant	-0.732***	-0.026***	-0.026***
	(0.1563)	(0.003)	(0.003)
N of Regions	139	198	198
R-squared	0.149	0.170	0.170
Prob>F	0.000	0.000	0.000

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

A.2 - Robustness Check 2 – Measurement Error in the outcome variable

Table A-2.a - Measurement Error in the outcome variable (Total EU Expenditure)

Dependent variable: GDP per capita Average Growth Rate		
	1	2
Total EU Funding	0.0093*	0.0042
	(0.0047)	(0.0034)
Ln of initial GDP p.c.	-0.1484***	-0.1493***
	(0.0270)	(0.0284)
Social Filter Index	0.0014	-0.0038
	(0.0040)	(0.0037)
R&D Activities	0.0030	0.0020
	(0.0051)	(0.0044)
Infrastructural endowment	0.2808	-0.0188
	(0.3082)	(0.3340)
Spatially Lagged Social Filter		0.0046
		(0.0041)
Spatially lagged R&D Activities		0.0225***
		(0.0037)
Spatially lagged Infrastructure		0.1500
		(0.5357)
National Growth Rate	0.0356***	0.0410***
	(0.0050)	(0.0046)
Krugman Index	0.0010	-0.0020
	(0.0082)	(0.0092)
Population Density	0.0001**	0.0001**
	(0.0000)	(0.0000)
Constant	1.3974***	1.3861***
	(0.2636)	(0.2751)
Obs	242	242
R squared	0.870	0.899
Prob>F	0.000	0.000

Robust and clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table A.2.b - Measurement Error in the outcome variable (Regional Policy, Rural Development Policy and CAP).

Dependent variable: GDP per capita Average Growth Rate					
	1	2	3	4	5
Regional Policy	0.0277***	0.0223**	0.0038***	0.0355***	0.0003
	(0.0066)	(0.0091)	(0.0085)	(0.0070)	(0.0206)
Rural Development Policy	0.0093	0.0031	-0.0028	-0.0078	0.0412**
	(0.0085)	(0.0066)	(0.0113)	(0.0120)	(0.0201)
CAP	-0.0198***	-0.0115*	-0.0120	-0.0173	-0.0303***
	(0.0056)	(0.0068)	(0.0095)	(0.0070)	(0.0089)
Social Filter Index*Regional Policy		-0.0128**			
		(0.0054)			
Social Filter Index*Rural Development Policy		0.0215*			
		(0.0115)			
Social Filter Index*CAP		-0.0048*			
		(0.0026)			
R&D Activities*Regional Policy			-0.0096		
			(0.0085)		
R&D Activities*Rural Development Policy			0.0104		
			(0.0083)		
R&D Activities*CAP			-0.0055		
			(0.0057)		
Infrastructure*Regional Policy				-1.2217***	
				(0.3197)	
Infrastructure*Rural Development Policy				1.7491***	
				(0.4157)	
Infrastructure*CAP				-1.4444***	
				(0.2981)	
Regional Policy* Rural Development Policy					0.0145
					(0.0221)
Regional Policy*CAP					0.0111**
					(0.0051)
Rural Development Policy*CAP					-0.0187
					(0.0133)
Log of Initial GDP, 'Territorial Conditioning Factors', 'Spatially Lagged terms' , Controls and constant	X	X	X	X	X
Period Dummies	X	X	X	X	X
Obs	242	242	242	242	242
R squared	0.919	0.927	0.921	0.939	0.924
Prob>F	0.000	0.000	0.000	0.000	0.000

Robust and clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 - The log of initial GDP, 'territorial conditioning factors' (Social Filter Index, R&D Activities, Infrastructural endowment Spatially Lagged Social Filter, Spatially lagged R&D Activities, Spatially lagged infrastructure) and the same control variables (Constant; National Growth Rate; Krugman Index and Population Density) reported in Table 2.a are included in all regressions but not reported in the table.

A.3 - Robustness Check 3 – Misspecification of the model and linearity: Quantile Regression analysis

This Robustness Check is based on Quantile Regression (QR) Techniques. As discussed in the paper QR has a number of advantages over standard linear regression analysis. However, when QR is combined with Fixed Effect panel data in order to control for unobserved heterogeneity constant over time (a primary concern in a policy assessment framework), its identification and estimation become very complex (Kato, Galvao and Monte Rojas, 2012). In particular, when the number of observations on each individual/region is limited on account of the limited number of available time periods, it is difficult to allow for the effect of an individual FE to change across quantiles in the same way as we can allow for the effects of the X covariates. This difficulty stems from the fact that the standard methods used to cancel out FE are no longer applicable: the quantile of the difference in general is not equal to the difference in quantiles but instead become 'intractable objects' (Ponomareva, 2011).

Most of the literature that studies QR models for panel data with FE tries to deal with this difficulty by assuming that the number of periods t reaches infinity with sample size n and then considers individual heterogeneity a "pure locations shift effect" on conditional quantiles (Canay, 2010; Koenker, 2005) or by allowing it to vary across quantiles (Galvao, 2008). Instead, in relation to a relatively short panel, an attempt to estimate QR has been made by applying correlated random coefficients model (Abrevaya and Dahl, 2008), or by focusing on the identification of the coefficients for a single conditional quantile restriction rather than on the whole set of quantiles (Rosen, 2009) or even by estimating the moment of the conditional distribution of either continuous or discrete covariates (Ponomareva, 2011).

Nevertheless, most empirical QR applications prefer a cross-section framework for analysis (Buchinsky, 1994; Powell, 2011; Powell and Wagner, 2011). The robustness check proposed here proceeds accordingly. In particular, pooled OLS models that regress the regional growth rate at time t on the policy and on the other usual covariates at time t-1 are implemented: the average annual growth rate over the period 2007-2009 (computed as in Section 5.2) is regressed onto the Regional Policy Commitments and onto the other covariates related to the 2000-2006 period and the average annual growth rate over the period 2000-2003 is regressed onto the Regional Policy Commitments and other covariates related to the period 1994-1999. As stated earlier, QR analysis focuses on the 0.10, 0.50 and 0.75 quantiles of the Y distribution.

Table A.3 - Quantile Regression

	Quantile 0.10		Quantile 0.50		Quantile 0.75		Mean regression	
Dependent variable: average regional GDP growth rate 2007-2009								
Initial condition	-0.055 (0.0677)	0.032 (0.0273)	0.006 (0.0058)	-0.000 (0.0088)	0.003 (0.0055)	-0.001 (0.0092)	0.000 (0.0127)	0.0001 (0.0149)
Regional Policy	0.00002 (0.0000)	0.000002 (0.0000)	0.000006** (0.0000)	0.000005 (0.0000)	0.000005** (0.0000)	0.000007 (0.0000)	0.00001* (0.0000)	0.00001 (0.0000)
Covariates*	No	Yes	No	Yes	No	Yes	No	Yes
Dependent variable: average regional GDP growth rate 2000-2003								
Initial condition	-0.007 (0.0139)	-0.014 (0.0122)	-0.002 (0.0059)	-0.015** (0.0066)	-0.009 (0.0064)	-0.009 (0.0087)	-0.003 (0.0047)	-0.007 (0.0057)
Regional Policy	0.0000051 (0.0000)	- 0.000004 (0.0000)	0.00001*** (0.0000)	0.00001** (0.0000)	0.000009** (0.0000)	0.00001* (0.0000)	.00001*** (0.0000)	0.00001** (0.0000)
Covariates *	No	Yes	No	Yes	No	Yes	No	Yes

*Covariates included in the model are the Control variables plus those one related to the "Territory" (Social Filter Index, R&D Activities and Infrastructural endowment) and to the "Policy" (Rural Development Policy and CAP) Subsystem .

** Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

A.4 - Robustness Check 4 – Spatial Heterogeneity and Spatial Panel Data Analysis

The recent spatial econometrics literature has identified three different types of interaction effects that could affect local economic phenomena and consequently their analysis: endogenous interaction effects linked to the dependent variable (Y), exogenous interaction effects among independent variables (X) of the units of analysis, and interaction effects among error terms. Hitherto, by inserting spatially-lagged independent variables (spatially-lagged variables matrix) into the key model specification the regressions only included controls for the second types of these spatial interactions. However, the analysis implemented in the paper has not yet fully controlled for the spatial dependence of the dependent variable and error terms. These forms of spatial dependence can be treated in a panel data framework. By accounting for the unobservable spatial and time-period specific effects, the panel data and spatial econometric literatures offer a common setting, enabling us to account for the cross-sectional and state dependence of the Y and the Xs, while at the same time controlling for unknown heterogeneity. We can also account for them simultaneously through 'Spatial Dynamics Panel Data Models' (SDPDM). Such models can easily identify the dynamic responses over time and space of the space-time diffusion of policy impacts through cross-partial derivatives related to changes in the explanatory variables and in the dependent variables (Elhrost, 2005). Once the need to account for spatial dynamics has been identified, the most serious issue seems to be the identification, among the Spatial Panel Data Models, of that model that can best capture and represent the spatial dependence of the data. Some analyses of European regional convergence processes have found evidence of model misspecification if the spatial interdependencies of regional growth are ignored. The most common approaches that address the issue of spatial dependence (Anselin, 2006) adopted in the existing literature refer to 'spatial error autocorrelation' (Arbia and Piras, 2009) and 'spatial lag' models. The latter, often considered a spatial autoregressive model, would seem to be more appropriate for quantifying how a region's growth rate is affected by the growth rate in surrounding regions (Anselin, 2006). The addition of a spatially-lagged dependent variable ('spatial lag; models), however, causes simultaneity and endogeneity problems that GMM (Badinger et al., 2004) and maximum likelihood (Elhorst, 2005) methods can address[12]. As in classical panel data literature, a fixed-effects model is largely preferred (Elhrost, 2005) because the unobserved component is allowed to depend on the other regressors included in the model.

Within this FE spatial panel data framework, this section extends the main analysis of the paper by allowing the model (1) to account, in addition to the spatial dependence of the Xs, for Y and for error-term dependencies. For this purpose, model (1) will assume three additional specifications (SAR, DURBIN and SEM) and the results provided by the estimation (via maximum likelihood) of each of them will be analysed in a comparative sense in order to a) decide the best way to model the spatial dependence of the phenomena analysed and b) test if the results of the main analysis are robust, given the overall spatial dependence of the phenomena under analysis.

In this manner the Spatial Autoregressive (SAR and DURBIN) specifications of model (1) will account for the spatial dynamics of the dependent variable that estimates the spatially lagged Y (Spatial lag models) coefficient. The

[12] In this sense, a variety of estimators have been recently proposed by the literature: Yu et al. (2008) and Lee and Yu (2010) provide the asymptotic properties of a quasi-maximum likelihood for an SDPD model with exogenous explanatory variables. More recently, Korniotis (2010) proposed a solution based on the Least Square Dummy Variable and instrumental methods (Anderson and Hsiao, 1982) extended to allow for the spatial effect.

Spatial Error Model (SEM) will, instead, account for the dependence determining the spatially inter-correlation between the error terms (LeSage & Pace, 2009). Among the Spatial Autoregressive models, DURBIN could be understood as a special case of SAR as besides including the spatially lagged Y it also includes other exogenous spatially-lagged regressors. The choice of the regressors is uncostrained: both Xs and additional variables could be inserted in their spatial lag version. On the basis of the results reported in the literature, the DURBIN version of the model is considered the most appropriate and informative for regional analysis insofar as it is a "Spatial lag" specification that, moreover, makes it possible to control for Xs spatial dependence (LeSage & Pace, 2009).

As already seen for the previous robustness checks, both the data's and the model's structure needs to be adjusted to take due account of the setting in which the robustness check is to be performed, which, in this case, is the framework provided by the spatial panel data model.

In this sense, the panel was reset to comprise two periods: for the first period the independent variables refer to the first period of the main analysis (policy programming period 1994-99) whereas the dependent variable is the GDP Growth rate in the second period of the main analysis (2000-06). For the second period, the data used for the regressors refer to the period 2000-06 whereas the outcome variable is that used in the third period of the main analysis (2007-13). By performing the analysis on such a panel, we deploy explanatory variables with a one-period-lag with respect to the dependent variable, even if the SPDM framework lags prevents us from taking lags directly into account in estimating a model.

Results from the SAR, DURBIN and SEM models, presented in Table A.4 below, refer to the version of model (1) estimated by considering Regional Policy, Rural Development Policy and CAP separately. The estimated models includes all regional conditioning factors, spatially lagged terms and controls included in the main results presented in Tables 2 and 3 of the paper. The analysis was carried out by implementing the STATA routine "XSMLE" (Hughes, Mortari and Belotti, forthcoming) and using a "Rook Contiguity" matrix as a spatial weight.

Table A.4 shows that the spatially lagged Y coefficient is never significant. Spatial influences on regional growth rates seem to be fully accounted for by the spatial correlation among the explanatory values (already included in the main specification of the model reported in tables 2 and 3 in the paper) while the endogenous spatial dependence in terms of Y seems to be irrelevant. This robustness check highlights that the main analysis has already accounted for the overall spatial dependence characterising regional growth. Even by accounting for the additional and potentially strong source of spatial dependence related to Y, the results obtained by the main model do not change. The findings on the main coefficient of interest (Regional Policy) are all confirmed. Moreover, the signs of the other explanatory variables are also generally confirmed, albeit with a different level of significance.

The results from the three different models (SAR, DURBIN and SEM) are coherent with each other. For each variable the coefficients used always have the same signs. By making comparisons between them, the different ways of modelling spatial dependence are shown to lead to similar conclusions. The SEM model, which accounts for the spatial dependence affecting the regression's residuals, leads to very similar results with respect to those (SAR and DURBIN) provided by directly accounting for the spatial dependence of Y.

Table A.4 - Spatial Panel data models

Dependent variable: GDP per capita Average Growth Rate			
	SAR	DURBIN	SEM
Spatially lagged Y	-0.139646	-0.1973682	
	(0.1807)	(0.1630)	
Ln of initial GDP p.c.	0.0706273	0.1195099*	0.076037
	(0.1041)	(0.0677)	(0.0617)
Regional Policy	0.0001165**	0.0001183***	0.0001288***
	(0.0000)	(0.0000)	(0.0000)
Rural Development Policy	0.0000284	0.0000352	0.0000141
	(0.0000)	(0.0000)	(0.0000)
CAP	-0.0000312	-0.0000361	-0.0000378
	(0.0000)	(0.0000)	(0.0000)
Social Filter Index	-0.01765	-0.0177591	-0.0160019
	(0.0143)	(0.0112)	(0.0109)
R&D Activities	0.0378418	0.0390929**	0.0321667*
	(0.0309)	(0.0193)	(0.0189)
Infrastructural endowment	2.713875*	3.237553**	2.989705**
	(1.4307)	(1.3450)	(1.3417)
Spatially lagged Social Filter Index		-0.0610526*	
		(0.0372)	
Spatially lagged R&D Activities		-0.1299134	
		(0.1006)	
Spatially lagged Infrastructure		4.652283	
		(6.1640)	
National Growth Rate	0.1716416***	0.1646388***	0.1663109***
	(0.0231)	(0.0128)	(0.0122)
Krugman Index	0.1649753***	0.1686406***	0.1768534***
	(0.0501)	(0.0317)	(0.0319)
Population Density	0.0000243***	0.0000231***	0.000027***
	(0.0000)	(0.0000)	(0.0000)
Obs	242	242	242
R squared	0.157	0.108	0.144

** Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

A.5 - Additional References cited in the Appendix

Abrevaya, J., and C. M. Dahl (2008): “The Effects of Birth Inputs on Birthweight: Evidence From Quantile Estimation on Panel Data,” Journal of Business and Economic Statistics, 26(4), 379-397.

Anderson, T.W. and C. Hsiao (1982): “Formulation and estimation of dynamic models using panel data,” Journal of Econometrics, 18, 47–82.

Anselin, L. (2006): “Spatial econometrics," in Palgrave handbook of econometrics, ed. by T. Mills and K. Patterson, vol. 1, 901-969. Palgrave Macmillan, Basingstoke.

Arbia, G. and Piras, G. (2009): "A new class of spatial concentration measures," Computational Statistics & Data Analysis, Elsevier, 53(12), 4471-4481.

Badinger, H., W. Muller and G. Tondl (2004): “Regional convergence in the European Union 1985-1999: A spatial dynamic panel analysis," Regional Studies, 38(3), 241-253.

Buchinsky, M. (1994): “Changes in the U.S. wage structure 1963-1987: Application of quantile regression,” Econometrica, 62, 405–458.

Canay, I. (2010): “A Note on Quantile Regression for Panel Data Models," working paper, Northwestern University.

Chernozhukov, V., and C. Hansen (2004): “The Impact of 401(K) on Savings: An Instrumental Quantile Regression Analysis,” Review of Economics and Statistics 86(3), 735 - 751.

Elhrost, J. P. (2005): “Models for dynamic panels in space and time. An application to regional unemployment in the eu,” Paper prepared for 45th meetings of the European Regional Science Association in Amsterdam, 23-27 August 2005.

Galvao, A. (2008): “Quantile Regression for Dynamic Panel Data with Fixed Effects," working paper, University of Wisconsin-Milwaukee.

Huges, G., Mortari A. P. and F. Belotti (2012): “Implementing procedures for spatial panel econometrics in Stata,” forthcoming.

Jaffe, A. B. (1989): “Characterizing the "technological position" of firms with application to quantifying technological opportunity and research spillovers," Research Policy, Elsevier, 18(2), 87-97.

Kato, K., Galvao, A. and G.V. Montes-Rojas (2012): "Asymptotics for panel quantile regression models with individual effects," Journal of Econometrics 170 (1), 76-91.

Koenker, R. (2005): Quantile Regression. Econometric Society Monograph, Cambridge University Press, Cambridge.

Korniotis, G. (2010): “Estimating Panel Models With Internal and External Habit Formation,” Journal of Business & Economic Statistics, 28 (1), 145–158.

Lee, L-F. and J. Yu (2010): “A Spatial Dynamic Panel Data Model with both Time and Individual Fixed effects," Econometric Theory, 26, 564-597.

LeSage, J. P. and K. R. Pace (2009): Introduction to spatial econometrics. CRC Press/Taylor and Francis Group, London.

Powell, D. (2011): "Unconditional Quantile Regression for Exogenous or Endogenous Treatment Variables," RAND Labor and Population working paper series, WR-824.

Powell, D. and Wagner, D. (2011): "The Exporter Productivity Premium along the Productivity Distribution: Evidence from Unconditional Quantile Regression with Firm Fixed Effects," RAND Labor and Population working paper series, WR-837.

Rosen, A. (2009): "Identification via Quantile Restrictions in Short Panels," working paper, UCL.

Yu J, de Jong R and L-F. Lee (2008): "Quasi Maximum Likelihood Estimators for Spatial Dynamic Panel Data with Fixed Effects when both n and T Are Large," Journal of Econometrics, 146, 118-134.

APPENDIX B – Computation of the Social Filter Index

Table B.1 Principal component Analysis. Eigen analysis of the Correlation Matrix.

Component	Eigenvalue	Difference	Proportion	Cumulative
Component 1	2.35352	1.37195	0.5884	0.5884
Component 2	0.981569	0.319494	0.2454	0.8338
Component 3	0. 662075	0.659236	0.1655	0.9993
Component 4	0. 002839	-	0.0007	1.0000

Table B.2 Principal component Analysis. Principal Components' Coefficients.

Variable	Comp 1	Comp 2	Comp 3	Comp 4
Agricultural share of employment	-0.3963	0.4757	0.7852	-0.0094
Long term unemployment	-0.3132	0.7339	-0.6026	0.0105
Human Capital	0.6103	0.3407	0.1101	0.7066
Skilled labour force	0.6102	0.3449	0.0905	-0.7074

Recent LEQS papers

Bartlett, Will**.** "Shut out? South East Europe and the EU's New Industrial Policy" LEQS Paper No. 84, December 2014

Guiso, Luigi, **Sapienza,** Paola & **Zingales,** Luigi. ''Monet's Error?'' LEQS Paper No. 83, November 2014

Costa-i-Font, Joan & **Zigante,** Valentina. ''The Choice Agenda' in European Health Systems: The Role of 'Middle Class Demands'' LEQS Paper No. 82, November 2014

Woodroof, David M. 'Governing by Panic: the Politics of Eurozone Crisis' LEQS Paper No. 81, October 2014

Monastiriotis, Vassilis, **Kallioras**, Dimitris & **Petrakos,** George. 'The regional impact of EU association agreements: lessons for the ENP from the CEE experience' LEQS Paper No. 80, October 2014

Bugarič, Bojan. 'Protecting Democracy and the Rule of Law in the European Union: The Hungarian Challenge' LEQS Paper No. 79, July 2014

Bertsou, Eri. 'The 2014 EP Elections: A Victory for European Democracy? A Report on the LEQS Annual Event 2014' LEQS Paper No. 78, July 2014

Innerarity, Daniel. 'Does Europe Need a Demos to Be Truly Democratic?' LEQS Paper No. 77, July 2014

Hassel, Anke. 'Adjustments in the Eurozone: Varieties of Capitalism and the Crisis in Southern Europe' LEQS Paper No. 76, May 2014

Mabbett, Deborah & **Schelkle**, Waltraud. 'Searching under the lamp-post: the evolution of fiscal surveillance' LEQS Paper No. 75, May 2014

Luthra, Renee, **Platt,** Lucinda & **Salamońska,** Justyna. 'Migrant diversity, migration motivations and early integration: the case of Poles in Germany, the Netherlands, London and Dublin' LEQS Paper No. 74, April 2014

Garcia Calvo, Angela. 'Industrial Upgrading in Mixed Market Economies: The Spanish Case' LEQS Paper No. 73, March 2014

White, Jonathan. 'Politicizing Europe: The Challenge of Executive Discretion' LEQS Paper No. 72, February 2014

Esteve-González, Patricia & **Theilen**, Bernd. 'European Integration: Partisan Motives or Economic Benefits?' LEQS Paper No. 71, February 2014

Monastiriotis, Vassilis. 'Origin of FDI and domestic productivity spillovers: does European FDI have a 'productivity advantage' in the ENP countries?' LEQS Paper No. 70, January 2014

Ward-Warmedinger, Melanie & **Macchiarelli**, Corrado. 'Transitions in labour market status in the European Union' LEQS Paper No. 69, November 2013

Dani, Marco. 'The 'Partisan Constitution' and the corrosion of European constitutional culture' LEQS Paper No. 68, November 2013

Bronk, Richard & **Jacoby**, Wade. 'Avoiding monocultures in the European Union: the case for the mutual recognition of difference in conditions of uncertainty' LEQS Paper No. 67, September 2013

LEQS
European Institute
London School of Economics
Houghton Street
WC2A 2AE London
Email: euroinst.LEQS@lse.ac.uk

http://www2.lse.ac.uk/europeanInstitute/LEQS/Home.aspx