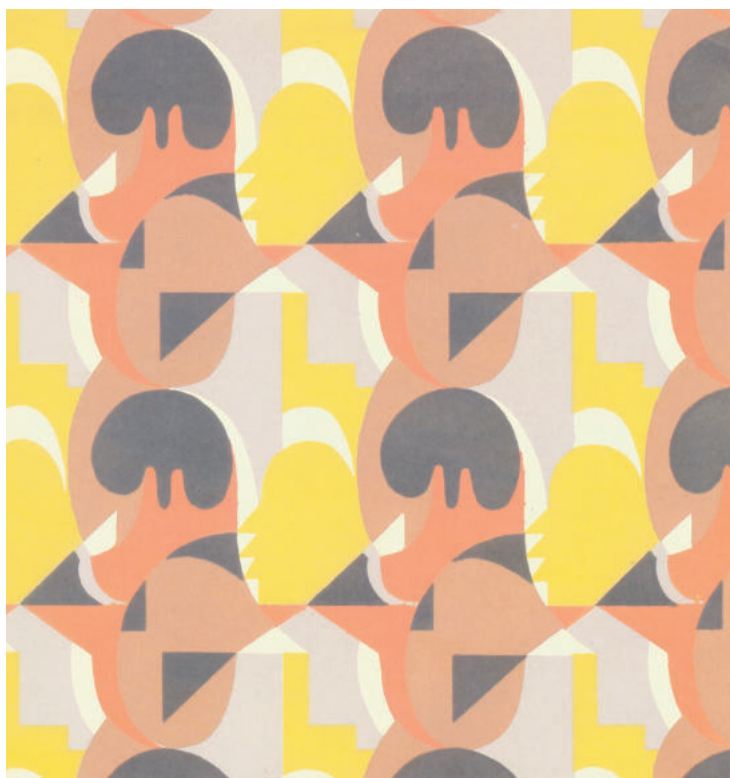


CITIES AND REGIONS IN TRANSITION

edited by
Roberta Capello
Andrea Conte



63 Scienze
Regionali

**Associazione
italiana
di scienze
regionali**

FrancoAngeli

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Associazione Italiana di Scienze Regionali

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Part 3

Socio-Economic Transformations: The Role of Cohesion Policies

The Impact of Spatial Spillovers on Cohesion Funds' Effectiveness: A Spatial Panel Analysis for the Italian Provinces

Debora Gambina*, Fabio Mazzola*

Abstract

The aim of this work is to evaluate the impact of spatial spillovers on the effectiveness of projects financed in the Italian provinces (NUTS-3) by the European and national cohesion policy during the 2007-13 and 2014-20 programming periods. The fall-out of the economic effects of a public intervention outside the directly treated areas is certainly desirable. However, this may generate a displacement effect when the policy affects mainly more neighbouring territories. We employ a panel econometric strategy that incorporates spatial autocorrelation patterns between neighbouring provinces by estimating a spatial panel model. We disentangle the total policy impact into direct effects on the per capita GDP growth of the treated provinces and indirect (spillover) effects captured by neighbouring areas. The paper also examines the change of policy effectiveness and spillover direction across the Great Recession by testing whether regional policy has acted as a resilience factor in local economies. The data set was reconstructed from Opencoesione database and deals, for the first time in the literature, with registered expenditures related with completed projects. Our main results show that, in Italian provinces, during the considered period, spatial spillovers have a positive impact on European and national cohesion policies' effectiveness, in addition to direct effects. In the crisis years, spatial spillovers have drastically reduced and this may have caused a reduction in cohesion policy effectiveness.

1. Introduction

Cohesion funds are addressed to reduce economic imbalances among regions in the European Union. This specific European economic policy deals with the allocation of resources to regions in structural deficit with defined convergence objectives.

The policy has acquired specificity over time since the unequal well-being distribution has required targeted public intervention. The relevance of GDP heterogeneity at the European level also lies in the implications it may have in the

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society. Indeed, income imbalances is one of the possible causes of social tensions and popular discontent (Bénabou, 1996). In addition, the process of European unification itself needs to receive strong popular support. Therefore, regional policy may be seen as a channel to increase consensus towards the EU since it has been empirically demonstrated that the decrease in votes towards Eurosceptic parties is associated also by greater investment in cohesion (Rodriguez-Pose, Dijkstra, 2020).

The implementation of cohesion policy has evolved over time. Starting from 1988 the allocated amount has been calibrated more on regional economic performance. Previously, the Funds' shares were assigned at a national level regardless of regional context indicators.

After the establishment of the European Regional Development Fund (ERDF), starting from the 1989-1993 programming period and through the following ones, a specific feature of European regional policy has become the distinction of resources by thematic area.

To mention the most recent programming periods, in the 2007-2013, allocations amounted to 347 billion, in the 2014-2020 period they increased to 352 billion, the equivalent of more than a third of the EU budget.

The Partnership Agreement drawn up by each member State, in collaboration with the European Commission, binds the national and regional Operational Programs (OP) to assume specific measurable targets, in relation also to the financial allocations. Therefore, the analysis of the effectiveness of cohesion funds in reaching predetermined targets has become more and more relevant at the regional level.

Four principles (concentration, multiannual programming, partnership, and additionality) are applied and the regions are divided in a binary way according to their level of per capita GDP, if this is less than 75% of the European average per capita GDP, the regions are part of the main Objective¹.

As all public investment interventions, cohesion projects may potentially generate relevant spatial spillover effects, especially when place-based policy features are explicitly considered.

In terms of policy making, there are relevant issues to investigate such as: the direction of spatial spillovers, the specific effectiveness of the policy in the treated regions, the dimension of crowding-out effects when the prevailing impact occurs in the neighbouring territories.

This paper contributes to shed light on these issues by measuring spatial spillovers related to cohesion investment projects by distinguishing direct from indirect effects. To carry out the analysis, we use, for the first time in literature, a project-based data of fully operational projects on Italian provinces during the latest programming periods (2007-2013 and 2014-2020) by considering also the

1. "Growth and employment" in 2014-2020, which replaced the "Convergence" Objective of the 2007-2013 programming period and "Objective 1" of the previous ones.

effect of the Great Recession which may have played a role on changing the direction of the spillover effects and on modifying the regional policy impact.

Our objective is also to determine whether the phenomenon of spatial spillover is more relevant for cohesion policy with respect to other public investment policies. In Italy, for instance, the national government also invests its own resources on specific cohesion targets, so our evaluation is also extended to national cohesion impacts.

The rest of the work is structured as follows: the second section is devoted to the theoretical background on the occurrence of spatial spillovers on place-based policy, the third one reviews the prevailing literature while the research design and the main results, are included in section 4 and 5, respectively. A final (sixth) section concludes with policy implications.

2. Cohesion Policy and Spatial Spillovers

To make the cohesion intervention effective, the financed projects should be tailored around the needs of each territory. In both public debate and empirical literature, there is no unanimous agreement on the impact of European regional policy in achieving its objectives of economic growth and convergence.

As for the role of spatial proximity on policy effectiveness, Barro (1990) believes that public intervention may act as a sort of “productive expenditure”, especially when dealing with transport infrastructures, communication networks and business support infrastructures which are among the typical modes of intervention of cohesion policy.

On a different ground, the analysis of agglomeration and dispersion forces of economic activities by the New Economic Geography scholars (i.e., Baldwin *et al.*, 2003), disputes the hypothesis that public intervention is always effective in reversing the regional growth paths. Indeed, in a North-South equilibrium, a condition of path-dependence can occur and this could make public intervention unsuitable for fostering the economic convergence. Among other things, investments in cohesion specifically aimed at adapting transport infrastructures in lagging regions may lead to a reduction in transport costs and, by this way, may determine a concentration of productive activities that, ultimately, could favour income divergence instead of convergence.

Therefore, the occurrence of undesired effects in policy implementation must be considered as a potential pitfall and the spatial element must be taken into account. In particular, a possible effect is that, due to spatial proximities and interactions², the policy outcomes may occur in the neighbouring territories and not in the treated ones.

2. To quote Tobler (1970), the father of the so-called “First Law of Geography”, “everything is related to everything else, but near things are more related than distant things”. This sentence

Hence, in evaluating the impact of a public policy, aimed at generating territorial development, it is important to measure spillover effects caused by spatial interaction and in particular by spatial proximity. When the gains of public investment projects are *also* captured by the territories adjacent to treated areas, spillover effects are inherently positive and desirable. Conversely, may happen that the effects of regional policy are caught *only* by neighbouring territories, thus generating displacement effects.

This paper evaluates the effectiveness of cohesion policy by looking at the completed projects in the last two programming periods before the current one (2007-2013 and 2014-2020) and referring to the Italian case. To measure spatial spillover effects we employ specific econometric techniques that incorporate the spatial autocorrelation pattern between neighbouring territories. The period under evaluation covers the Great Recession years. Therefore, we also control for the effects of the crisis by looking at the potential change of spillovers during severe downturns.

3. Related Literature

The economic literature dealing with the impacts of regional cohesion policy is vast and there is no unanimous agreement on its effectiveness in achieving the target objectives. The lack of consistency between the results may be due to a multiplicity of factors. The choice of the specific focus to analyse and the methodology used play the most important roles.

Prevailing methods in the empirical literature range from OLS to GMM, from panel data methods to Regression Discontinuity Design (see, for instance, Becker *et al.*, 2010; Pellegrini *et al.*, 2013; Gagliardi, Percoco, 2017; Giua, 2017; Crescenzi, Giua, 2020). Macroeconomic models are also used (Bradley *et al.*, 2003; Varga, Veld, 2011).

A specific focus is the potential trade-off between effectiveness and efficiency. Even if the policy reaches its goal of reducing disparities in regional growth processes (effectiveness), the principle of efficient allocation of the resources would be lost when most of the financial funds were distributed to regions that are already leading in economic performance (Pieńkowski, Berkowitz, 2016).

The trade-off between equity and efficiency is traced in the works of Fratesi and Perucca (2014, 2019) which conclude that the effectiveness of the Structural Funds is mediated by the favourable territorial context. Cappelen *et al.* (2003) have already pointed out that cohesion policy was more effective in the most advanced European countries between 1980-1997. Similarly, Ederveen *et*

expresses the concept, widely developed in literature, according to which the first source of interaction is due to spatial proximity.

al. (2006), concluded that the efficacy of the Structural Funds is conditioned by favourable structural context elements including institutional quality. Such conclusion has been stressed also by Rodriguez-Pose and Garcilazo (2015). Conversely, Mohl and Hagen (2010) and Pinho *et al.* (2015) have not found a relevant role for local economic conditions.

Few studies have yet considered the effect of the Great Recession, such as Merler (2016), Bachtrögler (2016) and Becker *et al.* (2018). Among these, the first study found a positive effect of cohesion policy even in the crisis period. No spatial spillovers were included in these analyses.

As for studies focusing on the Italian case, Percoco (2005) found that only two southern Italian regions (Apulia and Basilicata) experienced a very good performance from cohesion Funds. Aiello and Pupo (2012) underlined a greater impact on the Southern regions compared to the Northern ones; Giua (2017) traced a positive impact concentrated in specific strategic sectors and Coppola *et al.* (2020) concluded that European cohesion funds explained economic growth more than national cohesion funds.

Also the analyses capturing the impact of spatial effects did not reach unanimous results. Dall'Erba and Le Gallo J. (2008) first implemented a spatial lag model for the European NUTS-2 level regions in the period 1989-1999. They found that the Structural Funds did not contribute to the convergence process and that the spatial effects were quite relevant. Breidenbach *et al.* (2019) analysed the influence of the funds on per capita GDP growth of 127 European regions in the period 1997-2007 in the context of a spatial Durbin model (SDM) and show a negative effect on growth due to spatial spillovers. Hruza *et al.* (2019) estimated a SAR model for Czech Republic regions in the period 2004-2015, by obtaining a positive effect of cohesion policy and positive strong spillover effects across areas. Antunes *et al.* (2020) used a spatial Durbin model to evaluate the growth of 95 European regions in the period 1995-2009 and found neither a direct nor an indirect policy effect. Falk and Sinabell (2008) implemented a cross-sectional spatial lag and spatial error model for 1.084 NUTS-3 European regions over the period 1995-2004 stressing the relevance of spatial effects. Crescenzi and Giua (2020) employed the spatial extension of the regression discontinuity design method for European NUTS-3 areas in the period 2000-2014, tracing a more than pronounced impact in Germany and the United Kingdom. Fiaschi *et al.* (2018) assessed the influence of European funds in increasing the average annual growth rate of labour productivity in 175 European regions during 1991-2008. From SDM estimation it appeared that the funds addressed to the Objective 1 regions were important for the growth of the same areas (direct effect), but also have a significant indirect spillover effect.

In synthesis, from the international literature it emerges that spatial spillover effects are not negligible with some discrepancy across the studies. In addition, very rarely studies concentrating on the Italian case have considered spatial effects explicitly.

Empirical studies in the literature always use commitments or payments data to measure the Structural Funds' impact. While these data are useful to trace the progress of a public program, they may generate biases in the assessment of the impacts since they include information related to blocked or incomplete projects.

Our spatial analysis in the following section deals with some pitfalls that we found in the previous literature. First, it takes into account of the previous considerations by using actual project data and eliminating uncompleted projects. Second, it analyses the differential effects of a severe global crises (the Great Recession) on the impact of Structural and Investment Funds. Thirdly, it contrasts this effectiveness with the one of an alternative investment policy (the national cohesion policy) by investigating the relative role of spatial spillovers in the two contexts.

4. Empirical Framework

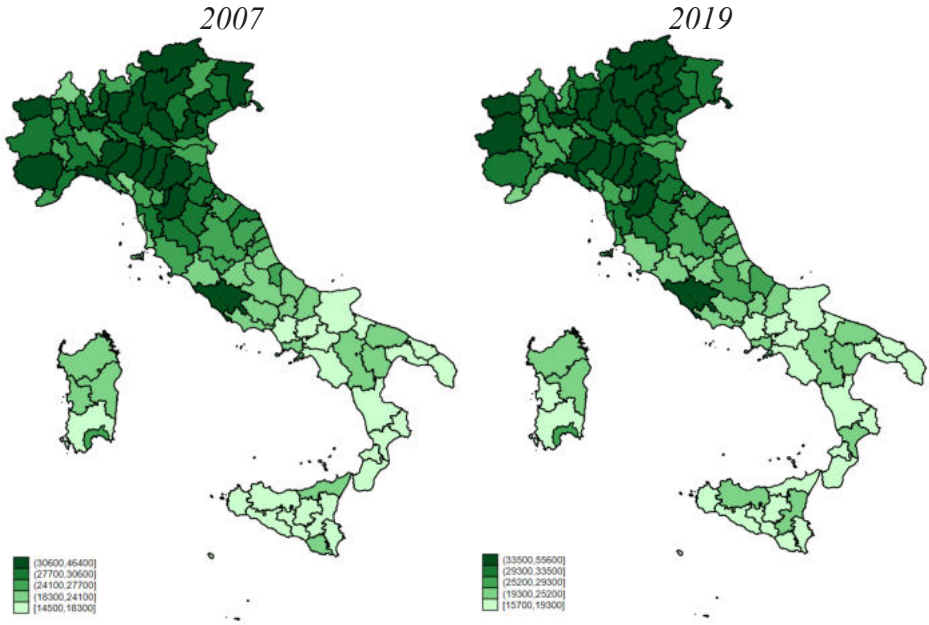
Our analysis focuses on Italian provinces during the period between 2007 and 2020. As shown in Figure 1, regional gaps at NUTS-3 level are substantially unchanged in the period under consideration.

4.1. Data

Our panel data set was reconstructed starting from the data on *Opencoesione*, the Italian cohesion policies database managed by “*Dipartimento per le politiche di coesione*”, in collaboration with “*Agenzia per la coesione territoriale*” and “*Ragioneria generale dello Stato*”. The main purpose of this database is to increase the transparency of expenditure flows by including detailed information relating to each project. It is also useful for potential beneficiaries of the European support since it describes all funding opportunities.

We have chosen this data source because we believe that a project-based disbursement data can be more representative than accounting data (such as payments or commitments) to capture the impact of cohesion resources. As mentioned above, data commonly used in the empirical literature may introduce bias when the paid amounts refer to projects in progress or blocked which are not fully able of generating economic effects. The estimation of a model based on accounting variables may therefore bring to misleading result in the estimation of policy effectiveness. Therefore, we considered data related to completed projects which have been imputed to the year of completion.

Figure 1 – Quantile of per capita income levels: years 2007 and 2019, respectively



Source: Authors' elaboration

The information on completed projects ranges from 2008 to 2017. This information has been calculated for a sample of 103 Italian provinces³.

All projects financed through cohesion policies were considered, with a breakdown between European and national cohesion policy. For the first, the resources of the ERDF and the ESF were considered. For the national cohesion policy we took into consideration the projects implemented through the *Fondo di Sviluppo e Coesione (FSC, former Fondo Aree Sottoutilizzate)* and by *Piano di Azione e Coesione*⁴ (PAC).

A feature of our analysis compared to most existing literature is that the European cohesion variable is constructed as the sum of resources from the ERDF

3. The currently active provinces in Italy as statistical units are 107. However, in this analysis we have excluded those that have undergone transformations or were established during the period in which the analysis is extended. The excluded provinces are Monza and Brianza, Fermo and Barletta-Andria-Trani because they were established in 2004 but became operational in 2009 and, finally, the last province established in Italy: South Sardinia.

4. Active since 2012.

and ESF plus national co-financing by *Fondo di rotazione per l'attuazione delle politiche comunitarie*⁵.

Both European and national cohesion variables were expressed in per capita terms following most of the existing literature (see on this point, Coppola *et al.*, 2020; Rodríguez-Pose, Novak, 2013; Rodríguez-Pose, Garcilazo, 2015).

The dependent variable is in our case the logarithmic growth of the provincial per capita GDP expressed in constant terms. We used the three-year average of these values to control for short-run cyclical variations.

All the variables in the explanatory set are calculated in the initial year of the three-year period to reduce the endogeneity problem. In addition to initial level of per capita GDP (to test the beta convergence), this set includes three types of variables.

The first group is composed of policy variables, namely the European cohesion policy (ECP) which includes the national co-financing and the National cohesion policy (NCP). The second group includes relevant variables which may act as control variables since they take into account the specific features of the local economy. In detail, this set includes:

- 1) Population density (attractiveness index). This variable is potentially suitable for solving the problem of omitted-variable bias, because it is a proxy of urbanization. If an area is more dense, it offers a greater availability of good facilities and infrastructures such as schools, hospitals, local transport etc. by acting, at the same time, as a relevant workplace. We expect a positive role for this variable (Becker *et al.*, 1999; Glaeser, 1999). Data came from ISTAT database.
- 2-3) Public specialization (labour market resilience index) and agricultural specialization (index of vulnerability to exogenous shock). Specialization in public and in agricultural sector was considered to capture the production structure of local economies. We have selected specifically these indicators as more sensitive in a period of economic crisis. Indeed, the specialization in the public sector should improve the resilience in terms of jobs. We therefore expect a positive sign for the coefficient related to this variable. Conversely, the agriculture sector is very vulnerable to exogenous shocks such as climate change, the introduction of sustainable process innovations, international trade (Urruty *et al.*, 2016) and so on. We expect a negative sign for the coefficient related to this variable. Both indicators have been calculated using the ISTAT provincial employment series.
- 4) Trade openness (competitiveness index). Openness to international trade (calculated by trade balance as a percentage of the provincial added value using the ISTAT series) is a proxy of provincial competitiveness. There is agreement in the literature on the propulsive role of internationalization for economic

5. Coppola *et al.* (2020) use this methodology in a study on Italian NUTS-2 regions.

growth (see for instance, Romer, 1990; Harrison, 1996; Frankel, Romer, 1999; Wacziarg, 1999).

- 5) Graduates (human capital index). The accumulation of human capital, defined as tertiary education rate (30-34 year range) in our analyses, is one of the main determinants of economic development (Mincer, 1981). Data came from ISTAT database.

The last set of variables includes elements of a composite indicator developed in the literature, and called “territorial capital” (Camagni, 2008; Camagni, 2009). They describe additional local economy characteristics such as infrastructural, natural, relational and social capital.

- 6) Infrastructural capital. The role of public infrastructure in stimulating economic growth has been much debated and explored among economists (e.g., the works of Aschauer, 1989; Munnell, 1990a, 1990b, 1992). In our work, given the heterogeneity of Italian provinces, we considered the road endowment index calculated by *Istituto Tagliacarne* (see Mazzola *et al.*, 2018; Lo Cascio *et al.*, 2019).
- 7-9) Natural, relational and social capital. As proxies for natural, relational and social capital, we examined the available indicators among those proposed by Nifo and Vecchione (2014). For natural capital we considered the urban green space per inhabitant (data from ISTAT). Relational capital was proxied by the weight of cooperatives on total employees (data from ISTAT) Finally, for social capital (behavioral models, values, reputation) we selected a crime indicator (denounced crimes per 100.000 inhabitants, available in the ISTAT database). We expected a positive coefficient for the proxies of natural and relational capital and a negative coefficient for the proxy of social capital.

To take into account the potential impact of the Great Recession on cohesion policies’ effectiveness, we inserted two dummy variables capturing the interaction between crisis years and cohesion policy variables⁶. The ex-ante impact of the Great Recession is ambiguous since Structural Funds may have acted positively in favouring the resilience of some local economies. Instead, in case of negative sign, the occurrence of a severe global downturn would be associated with a slowdown in Funds’ effectiveness.

4.2. *Econometric Strategy*

Given the potential relevance of the spatial spillovers in evaluating public policies outcomes, even more at a sub-regional level, we employ the Spatial

6. The first dummy is the interaction between European Funds and the crisis years (2008-2009-2010-2011-2012), the other is the interaction between national cohesion funds and the same years.

Autoregressive Model (SAR, Equation 1). When the spatial independence hypothesis between the observations cannot be assumed, the derivative of y_i with respect to x_{ik} is not β_k since the explanatory variable k influences the i -th unit (direct effect), but also the j -th unit (indirect or spillover effect) and there may also be a feedback effect towards the i -th area (LeSage, Pace, 2009).

$$Y_{it} = \alpha + \sum_{(k=1)}^K x_{itk} \beta_k + \rho \sum_{(j=1)}^N w_{ij} y_{jt} + \mu_i + \lambda_t + \varepsilon_{it} \quad [1]$$

$$i = 1, \dots, N \quad t = 1, \dots, T$$

The coefficients w_{ij} take into account the spatial structure of the data as elements of the spatial matrix of the distances (W). We used a $N \times N$ non-negative and non-stochastic binary queen-contiguity matrix:

$$W = \begin{cases} w_{ij} = 0 & \text{if } i = j \quad \text{or } d_{ij} = 0 \\ w_{ij} = 1 & \text{if } d_{ij} > 0 \end{cases} \quad [2]$$

The spatial weights were normalized in order to have the sum of each row equal to one (row normalization):

$$\sum_{(j=1)}^n w_{ij} = 1 \quad [3]$$

$$i = 1, \dots, n$$

where ρ is the coefficient which quantifies the degree of spatial dependence between the growth of the i -th unit and the other territorial areas since the spatial proximity is likely to lead to similar growth paths (Anselin, Bera, 1988).

Mathematically (Belotti *et al.*, 2017), the SAR model computes direct and indirect spillover effects as follows:

SAR direct effects	SAR indirect effects
$\{(I - \rho W)^{-1} \times (\beta_k I)\}^d$	$\{(I - \rho W)^{-1} \times (\beta_k I)\}^{rsum}$

where d is the operator that calculates the mean diagonal element of the matrix and $rsum$ is the operator that calculates the mean row sum of the nondiagonal elements.

A peculiarity of the direct effect is the inclusion of feedback, i.e., the effect of X_i on j affects, in turn, *again* i . As we can see from the formula of the direct effect reported above, feedback is due to the coefficient of the spatially lagged dependent variable. The inclusion of feedbacks in the direct effects may generate discrepancies between impact coefficients (β 's) and direct ones.

We added fixed effects according to the result of Hausman tests and following the consolidated literature (to name one, Wooldridge, 2009) which asserts that the fixed effects are more appropriate to control for unobserved territorial-specific factors, in particular when the regional sample covers the entire national population, as in our case.

Table 1 – Estimations Results of SAR-FE Model (2008-2017) – European Cohesion Policy Impact

<i>Variables</i>	<i>Impact effects</i>	<i>Direct effects</i>	<i>Indirect effects</i>	<i>Total effects</i>
Wy	0.4126 *** (16.81)			
GDPpc	-73.6929*** (-25.45)	-77.4488*** (-26.35)	-48.0846*** (-11.56)	-125.5335*** (-23.03)
EU Cohesion Policy (ECP)	0.0124*** (5.30)	0.0130*** (5.45)	0.0080*** (5.29)	0.0210*** (5.54)
Crisis years*ECP	-0.0185*** (-4.76)	-0.0191*** (-4.91)	-0.0118*** (-4.84)	-0.0309*** (-5.01)
Population Density (Attractiveness)	20.9755*** (3.37)	21.9440*** (3.45)	13.6094*** (3.35)	35.5535*** (3.45)
Public Specialization (Resilience)	1.0862** (5.80)	1.1502*** (5.88)	0.7154*** (5.02)	1.8657*** (5.68)
Agricultural Specialization (Vulnerability)	-0.2743 (-1.39)	-0.2753 (-1.32)	-0.1695 (-1.32)	-0.4449 (-1.32)
Trade Openness (Competitiveness)	0.0718*** (4.00)	0.0756*** (3.87)	0.0469*** (3.72)	0.1226*** (3.87)
Human Capital	0.1837*** (5.24)	0.1929*** (5.26)	0.1195*** (5.05)	0.3124*** (5.31)
N.obs	824			
R2	0.6746			
Hausman test	236.90			

Note: Robust t-test in parentheses. ***: p-value < 0.01, **: p-value < 0.05, *: p-value < 0.10.

Source: Authors' elaboration

5. Results

Tables 1 and 2 show the results of the models with the first and the second groups of variables only, thus excluding territorial capital elements. Table 1 reports the model specification evaluating the effects of the European cohesion policy. European projects are statistically relevant for growth of both the treated provinces and the neighbouring ones, but they display relevant spatial spillover effects. However, the policy effectiveness on the treated areas does not depend exclusively on the spillovers.

The coefficient of the spatially lagged dependent variable (Wy) is positive and statistically important, demonstrating that the growth path of the Italian provinces is connected with the economic growth of neighbouring.

Table 2 – Estimations Results of SAR-FE Model (2008-2017) – National Cohesion Policy Impact

<i>Variables</i>	<i>Impact effects</i>	<i>Direct effects</i>	<i>Indirect effects</i>	<i>Total effects</i>
Wy	0.4498*** (19.21)			
GDPpc	-69.2200*** (-24.45)	-73.5642*** (-25.19)	-52.2510*** (-11.94)	-125.8153*** (-21.55)
National Cohesion Policy (NCP)	0.0432*** (5.31)	0.0456*** (5.50)	0.0323*** (5.24)	0.0780*** (5.52)
Crisis years*NCP	-0.0423*** (-3.62)	-0.0436*** (-3.66)	-0.0309*** (-3.59)	-0.0746*** (-3.68)
Population Density (Attractiveness)	18.5054*** (2.96)	19.5994*** (3.02)	13.9051*** (2.97)	33.5045*** (3.02)
Public Specialization (Resilience)	1.2035*** (6.44)	1.2864*** (6.59)	0.9145*** (5.67)	2.2009*** (6.38)
Agricultural Specialization (Vulnerability)	-0.1750 (-0.89)	-0.1716 (-0.82)	-0.1206 (-0.81)	-0.2923 (-0.81)
Trade Openness (Competitiveness)	0.0787*** (4.36)	0.0837*** (4.23)	0.0594*** (4.09)	0.1432*** (4.24)
Human Capital	0.1947*** (5.50)	0.2062*** (5.50)	0.1461*** (5.34)	0.3524*** (5.57)
N.obs	824			
R2	0.6611			
Hausman test	165.52			

Note: Robust t-test in parentheses. ***: p-value < 0.01, **: p-value < 0.05, *: p-value < 0.10.

Source: Authors' elaboration

The same result in terms of direct and indirect impact is obtained for national cohesion projects (Table 2). In this case the impact is stronger than in the case of European cohesion policies for all types of effects. During the Great Recession years, the impact of the two policies as well as spillover effects have drastically reduced. Therefore, the economic crisis has slowed down the action of Structural and Investment Funds but have not completely eliminated their (positive) effects.

The signs and significance of the estimated coefficients of the other explanatory variables are all consistent with economic theory and prior hypotheses. In particular, the attractiveness, as population density, and the competitiveness, as trade openness, of the *i*-th economy is positive for the growth of the same unit but also for neighbouring areas, thus exerting spatial spillovers.

The two specialization variables partially confirm the initially assumptions: the stability of public employment is a relevant factor for growth, while the specialization in the agricultural sector is negative though not statistically significant.

Table 3 – Estimations Results of SAR-FE Extended Model (2008-2017) – European Cohesion Policy Impact

<i>Variables</i>	<i>Impact effects</i>	<i>Direct effects</i>	<i>Indirect effects</i>	<i>Total effects</i>
Wy	0.3768*** (14.84)			
GDPpc	-74.8514*** (-26.25)	-77.8812*** (-26.99)	-41.8482*** (-10.64)	-119.7295*** (-23.30)
EU Cohesion Policy (ECP)	0.0119*** (5.19)	0.0123*** (5.31)	0.0066*** (4.93)	0.0190*** (5.33)
Crisis years*ECP	-0.0176*** (-4.57)	-0.0179*** (-4.69)	-0.0096*** (-4.49)	-0.0276*** (-4.73)
Population Density (Attractiveness)	15.7137*** (2.48)	16.2102*** (2.53)	8.7178*** (2.44)	24.9280*** (2.52)
Public Specialization (Resilience)	1.0271*** (5.53)	1.0770*** (5.60)	0.5800*** (4.73)	1.6570*** (5.41)
Agricultural Specialization (Vulnerability)	-0.3217 (-1.64)	-0.3218 (-1.56)	-0.1707 (-1.56)	-0.4926 (-1.57)
Trade Openness (Competitiveness)	0.0768*** (4.37)	0.0802*** (4.23)	0.0430*** (4.02)	0.1233*** (4.23)
Human Capital	0.2044*** (5.89)	0.2125*** (5.93)	0.1139*** (5.64)	0.3264*** (6.06)
Infrastructural Capital	0.0471* (1.76)	0.0516* (1.89)	0.0276* (1.87)	0.0793* (1.89)
Natural Capital	0.2621*** (3.29)	0.2748*** (3.30)	0.1477*** (3.15)	0.4226*** (3.28)
Relational Capital	0.3327 (1.13)	0.3460 (1.15)	0.1843 (1.12)	0.5304 (1.14)
Social Capital	-0.3212*** (-5.49)	-0.3317*** (-5.36)	-0.1772*** (-5.66)	-0.5090*** (-5.64)
N.obs	824			
R ²	0.7046			
Hausman test	215.62			

Note: Robust t-test in parentheses. ***: p-value < 0.01, **: p-value < 0.05, *: p-value < 0.10.

Source: Authors' elaboration

Local economies with high levels of human capital tend to cluster since the tertiary education rate is important both as a direct effect and as an indirect one.

Our results are robust to the inclusion of the additional set of territorial capital elements (see Tables 3 and 4), European and national cohesion projects have a positive and statistically significant impact on the provincial per capita GDP growth and spillovers maintain relevance.

Table 4 – Estimations Results of SAR-FE Extended Model (2008-2017) – National Cohesion Policy Impact

<i>Variables</i>	<i>Impact effects</i>	<i>Direct effects</i>	<i>Indirect effects</i>	<i>Total effects</i>
Wy	0.4080*** (16.59)			
GDPpc	-70.5169*** (-25.28)	-73.9602*** (-25.89)	-44.6959*** (-10.93)	-118.6562*** (-21.81)
National Cohesion Policy (NCP)	0.0408*** (5.13)	0.0425*** (5.29)	0.0257*** (4.85)	0.0683*** (5.25)
Crisis years*NCP	-0.0382*** (-3.32)	-0.0388*** (-3.34)	-0.0234*** (-3.21)	-0.0623*** (-3.33)
Population Density (Attractiveness)	11.9106* (1.88)	12.3972* (1.91)	7.5019* (1.87)	19.8991* (1.90)
Public Specialization (Resilience)	1.1339*** (6.11)	1.1965*** (6.25)	0.7241*** (5.28)	1.9207*** (6.03)
Agricultural Specialization (Vulnerability)	-0.2178 (-1.11)	-0.2140 (-1.03)	-0.1271 (-1.02)	-0.3412 (-1.03)
Trade Openness (Competitiveness)	0.0839*** (4.74)	0.0881*** (4.60)	0.0531*** (4.38)	0.1413*** (4.61)
Human Capital	0.2167*** (6.20)	0.2266*** (6.20)	0.1366*** (5.95)	0.3633*** (6.35)
Infrastructural Capital	0.0558** (2.06)	0.0610** (2.20)	0.0368** (2.17)	0.0978** (2.20)
Natural Capital	0.2104*** (2.63)	0.2235*** (2.66)	0.1352*** (2.58)	0.3587*** (2.65)
Relational Capital	0.4834 (1.62)	0.5071* (1.65)	0.3042 (1.63)	0.8113* (1.65)
Social Capital	-0.3426*** (-5.83)	-0.3564*** (-5.66)	-0.2142*** (-6.00)	-0.5707*** (-5.99)
N.obs	824			
R2	0.6969			
Hausman test	208.43			

Note: Robust t-test in parentheses. ***: p-value < 0.01, **: p-value < 0.05, *: p-value < 0.10

Source: Authors' elaboration

The gains from infrastructural adequacy are captured both by the same areas and by neighbouring ones, a result that confirms that Italian territories are linked by tight social and economic relations.

As for more softer indicators, it appears that, as expected, a high crime rate is harmful for economic growth while the positive role of natural capital is confirmed. The association and cooperation attitude seems to have a marginal role on growth.

6. Conclusions

Our work evaluated the economic effects of the completed projects under the European and national cohesion policies by stressing the role of spatial interactions. During the last two programming periods before the current one (2007-2013 and 2014-2020), the European and national regional policy have affected positively the economic growth of the Italian provinces. Through the estimation of a SAR spatial panel model, we found that the action of spatial proximity was clear. It gave additional impulse to the effectiveness of regional policies in the *directly treated areas* since we found a positive and statistically impact both on the direct and indirect effects. However, from this analysis it appears that the funds' impact *has not been completely mediated* by spatial interactions as no displacement effects occurred. We also found that the national cohesion policy had a greater effect on Italian NUTS-3 regions' growth compared to European regional policy. Finally, the Great Recession has reduced the effectiveness of cohesion policy on economic growth in both direct and indirect (spillover) effects.

These conclusions drive some considerations concerning the need to assess policy intervention impact at both local and wider territorial levels. We may also infer that policy efforts should be directed towards projects with higher potential to generate positive spillovers. In addition, our results stress the importance of integrating cohesion policies coming from both national and supra-national institutions to obtain greater effectiveness and of reinforcing support for lagging areas during severe downturns.

Further investigation on these results may consider the evaluation of the role of spatial spillovers for the effectiveness of concluded cohesion projects at a more aggregated level of analyses (NUTS-2 territories). In addition, our research agenda includes the comparison of the results of this analysis with those originated by the application of other spatial methodologies or different measures of cohesion interventions.

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Il ruolo degli spillover spaziali per l'efficacia della Politica Regionale: un'analisi panel spaziale per le province italiane

Sommario

Il presente lavoro valuta l'impatto degli spillover spaziali sull'efficacia dei progetti finanziati dalla Politica di Coesione europea e nazionale nelle province italiane (NUTS-3) durante i periodi di programmazione 2007-2013 e 2014-20. La ricaduta degli effetti economici di un intervento pubblico al di fuori delle aree direttamente trattate è certamente auspicabile. Tuttavia, ciò può generare un effetto di spiazzamento quando la politica risulta maggiormente efficace nei territori limitrofi. La nostra strategia econometrica tiene conto del pattern di autocorrelazione spaziale tra le province adiacenti attraverso la stima di un modello panel spaziale. Nell'impatto totale delle politiche, distinguiamo quello diretto sulla crescita del PIL pro-capite delle province trattate da quello indiretto di spillover. Il lavoro esamina anche l'eventuale variazione dell'impatto delle politiche e della direzione degli spillover nel periodo della Grande Recessione valutando se la Politica Regionale abbia agito come fattore di resilienza nelle economie locali. Il dataset è stato ricostruito dal database Opencoesione e contiene, per la prima volta in letteratura, le spese registrate relative ai progetti completati. I principali risultati dell'analisi mostrano che, durante il periodo considerato, gli spillover spaziali tra le province italiane hanno avuto un impatto positivo per l'efficacia della Politica di Coesione europea e nazionale, in aggiunta agli effetti diretti sulle aree trattate. Negli anni della crisi, gli spillover si sono drasticamente ridotti.