

# Territorial capital and the resilience of European regions

Ugo Fratesi<sup>1</sup> · Giovanni Perucca<sup>1</sup> 

Received: 21 November 2016 / Accepted: 17 April 2017  
© Springer-Verlag Berlin Heidelberg 2017

**Abstract** Starting in 2007–2008, an economic crisis with no comparable precedent after WWII has affected most of the World, and Europe in particular. Yet, despite the pervasiveness of the crisis, its impact was highly differentiated across countries. The macroeconomic country-level effects are very important, but also within countries the impact on the various regions has been far from uniform, with some regions, often the most urban, able to resist the crisis better than others. Among the many factors which can have influenced the differential impact of the crisis in Europe, this paper looks at the regional endowment of structural territorial assets, those which have been labelled as “territorial capital”. Territorial capital comprehends all those assets, being material or immaterial, public or private, which represent the development potential of places. Territorial capital enhances regional growth in ordinary times, and, being structural, can be expected to also act as a factor of resilience in times of crisis. To investigate this hypothesis, a database of territorial capital indicators for all regions of the European Union at NUTS3 level is exploited, and a classification of regions based on the endowment of territorial capital is built. It appears that regions belonging to different groups, i.e. being differently endowed with territorial capital, have had different degrees of resilience, with some being able to maintain their income levels better than their country and others losing ground. The structure of regions is hence

---

**Electronic supplementary material** The online version of this article (doi:[10.1007/s00168-017-0828-3](https://doi.org/10.1007/s00168-017-0828-3)) contains supplementary material, which is available to authorized users.

---

✉ Giovanni Perucca  
giovanni.perucca@polimi.it  
Ugo Fratesi  
ugo.fratesi@polimi.it

<sup>1</sup> Department of Architecture, Built Environment and Construction Engineering, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

an important determinant of how they can afford periods of distress, and in particular, more resilient have been those regions endowed with less mobile territorial capital assets and with those territorial capital assets of mixed levels of materiality and rivalry.

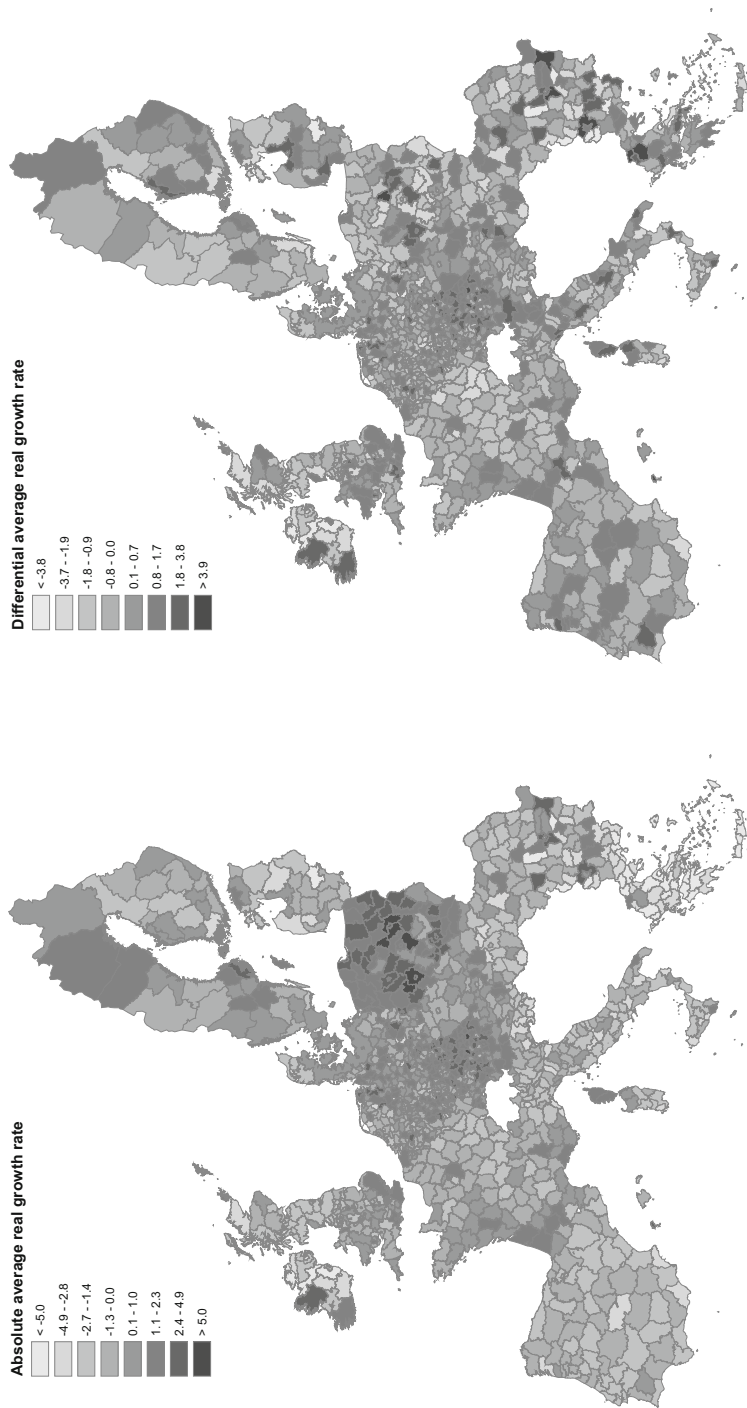
**JEL Classification** R1 · R11 · R12

## 1 Introduction

Starting with the subprime crisis of 2007, the world, and Europe in particular, has been hit by a large economic crisis, with important losses of employment and GDP in many countries. The OECD estimates that the loss of potential 2014 GDP in OECD countries which experienced a banking crisis in 2007–2011 amounts on average to 5.5%, while the average for OECD countries is of 3.5% (Ollivaud and Turner 2015).

However, despite the pervasiveness of the crisis, its effects on different European countries have varied, with some losing a large percentage of GDP and/or a very large number of jobs (e.g. Greece, Italy and Spain), and others, such as Germany and Poland, being able to maintain employment and GDP levels. A country-level analysis of the impact of the financial crisis, however, conceals the highly differentiated levels in regional performance. By looking at the real GDP growth rate of European regions between 2008 and 2012 (Fig. 1, map on the left), it is certainly clear that national aspects are indeed very important, as the national boundaries are clearly identifiable. At the same time, different situations also occur *within* countries. For instance, one group of countries, such as France and the UK, had some regions with positive and others with negative growth rates. In a second group of countries, in particular Poland and, to a lesser extent, Germany, almost all regions had a positive average annual growth rate due to favourable national macroeconomic conditions and, finally, in a third group of countries the adverse national conditions led all regions to have negative growth rates. However, in all cases regional differences were also significant: the regional divergences from the national trend easily range from 4% more to 4% less than the national average. These differences are shown in the map on the right in Fig. 1, where the real GDP growth rate of regions is mapped relative to the national average value. The map shows that in each European country the differences between regions are highly relevant, and that all countries have some regions significantly outperforming others, and other regions significantly underperforming. There is often, but not always, a significant urban divide, with the regions of the largest cities generally performing better than other regions in the country, confirming the relative strength of metropolitan areas in the crisis (Capello et al. 2015) (Fig. 1).

The literature has analysed the impact of the crisis at regional level, adopting the notion of “resilience”. This concept arose from engineering and environmental studies and is meant to represent the ability of a system to deal with shocks, either by anticipating them, by responding to them or, finally, by returning to the equilibrium which has been disturbed. The literature generally identifies three types of resilience (Martin 2012): engineering resilience, defined as the ability of a system to return to its state of equilibrium after a shock; ecological resilience, defined as the scale of shock or disorder that a system is able to absorb before it is destabilized and moves to a



**Fig. 1** Absolute and differential regional growth rate 2008–2012

different state or stable equilibrium; and, finally, adaptive resilience, defined as the ability of a system to reorganize its forms or functions in an anticipatory or reactive way so as to minimize the impact of a destabilizing shock.

The concept of resilience has been widely used, often with quite different nuances, but this has also led to important criticism of its applicability to regional analysis (these objections are listed and addressed in [Martin and Sunley 2015](#)) despite that it has been extended to include references to adaptation or adaptability ([Hassink 2010](#)) and, more recently, to the long-term ability to develop new growth paths ([Boschma 2015](#)).

A large number of studies have empirically addressed the existence, definition and measurement of resilience. A first wave of works, mainly in the years immediately after the start of the crisis, focused on the spatial asymmetries in the reaction to the exogenous shock (e.g. [Cellini and Torrisi 2016](#); [Fingleton et al. 2015](#); [Sensier et al. 2016](#)). A second wave of studies, drawing on the conceptualization presented in the first wave and the availability of more data from the years after the crisis, started to investigate the determinants of the crisis. For instance, [Groot et al. \(2011\)](#) studied the factors behind the different sensitivity levels of countries and regions to the first phase of the crisis, identifying sectoral composition as the most important condition for resilience. [Lee \(2014\)](#) found that highly skilled UK cities experienced lower increases in unemployment. [Martin et al. \(2016\)](#) demonstrated the decreasing role of economic structure and the rise of a number of region-specific factors. [Fratesi and Rodríguez-Pose \(2016\)](#) showed that economies which were protected from cyclical downturns in the period prior to the crisis were not protected from the crisis itself.

This paper is part of the second wave of literature and looks at the determinants of economic resilience in a holistic way, adopting the concept of territorial capital (TC), defined as the system of territorial assets of an economic, cultural, social and environmental nature, that determine the development potential of places (OECD 2001; [Camagni 2009](#)). Our assumption is that these structural territorial growth potentials characterizing each region are not neutral in the response to exogenous shocks. Rather, they allow local economies to be more resilient to negative macroeconomic trends.

Obviously, this is not expected to hold true for all of the components of territorial capital. The link between territorial capital and resilience, in fact, goes beyond a mediation effect such as that hypothesized above. As with any kind of capital, territorial capital can be either accumulated or dispersed. In some cases, as in institutions, agglomeration economies and cultural heritage, for example, these processes of accumulation and dispersion are likely to occur over the long term. On the other hand, certain territorial assets, such as private capital, human capital, are less sticky and persistent over time. Therefore, since the different components of territorial capital have a more or less immediate transmission link with economic growth, and given the fact that their accumulation or decumulation times might be different, we hypothesize here that different typologies of territorial capital play different roles in the distinct phases of recession. Expectations are that the least sticky factors are also those less able to induce resilience, and that those factors whose relationship with the economy is less direct are also less able to affect resilience, which is connected to short-run adjustments.

Based on this reasoning, the remaining sections of the paper are organized to meet three goals. First (Sect. 2), a review of the relationship between territorial capital and

regional growth is presented. Section 3 is then devoted to the definition and empirical measurement of the endowment of territorial capital in EU NUTS3 regions, in order to highlight their specificities. Afterwards (Sect. 4), the paper analyses and measures, for the same areas, different kinds of resilience to the economic recession, which allows a distinction to be made between short-term and medium-term effects. Then, in Sect. 5, the empirical measures of resilience and territorial capital are jointly examined in an econometric analysis in order to derive conclusions about regional reaction and adaptation to the global crisis. Finally, Sect. 6 concludes by showing which aspects of territorial capital are more important and presents some policy implications.

## 2 The theoretical definition of territorial capital and its relationship with resilience

The concept of territorial capital was firstly defined by the OECD 2001 as “the stock of assets which form the basis for endogenous development in each city and region, as well as [...] the institutions, modes of decision-making and professional skills to make best use of those assets” (OECD 2001, p. 13). More recently Camagni (2009) observed that this set of endogenous territorial factors is highly diversified, each of them following different laws of accumulation/depletion and impacting economic development through different mechanisms. More precisely, he classified the components of territorial capital into the two dimensions of rivalry and materiality.

This taxonomy has two main advantages. First, it allows for identification of the different territorial assets expected to stimulate economic development: from public and tangible capital, such as the infrastructural endowment of regions, to intangible and private assets, represented by the skills and competences held by the resident population, to those elements with intermediate levels of materiality and rivalry. Second, it explicitly recognizes that each territorial element is subject to very different processes of accumulation and depletion.

An increasing number of works have applied the concept of territorial capital empirically in order to study regional patterns of economic growth. For instance, Perucca (2014) analysed the relationship between different territorial assets and economic growth in Italy, pointing out positive interaction effects of some of these resources. Servillo et al. (2012) interpreted territorial capital as an important determinant of regional attractiveness, able to influence development policies.<sup>1</sup>

Much less is known about the link between territorial capital and resilience to exogenous shocks. Although an array of evidence has indicated the asymmetrical impact of the economic crisis within EU countries (Groot et al. 2011; Townsend and Champion 2014; Palaskas et al. 2015), few studies have focused on the determinants of these imbalances, and the topic remains understudied in the literature. Among the exceptions, Martin et al. (2016) claimed that a prominent role is played by certain conditions in the regions, such as their institutions, labour market characteristics and accessibility to neighbouring areas. In their analysis of Greek regions, Giannakis

<sup>1</sup> For a review of the papers analysing the association between territorial capital and regional development, see Tóth (2015).

and Bruggeman (2015) found a higher resilience for those areas characterized by specialization in the agricultural and tourism sectors. These findings are consistent with those from the study carried out by Sánchez-Zamora et al. (2014) on the rural areas of the Andalusia region.

This evidence calls for more comprehensive analysis of the link between the territorial capital of regions and their resilience to the economic recession. Even when used as a concept to explain economic development, in fact, the territorial capital of regions cannot be expected to be neutral in the event of an external shock. High levels of human capital, for instance, are likely to facilitate the processes of adaptation and reconversion of local economies. Moreover, the relationship between the territorial assets of regions and their reaction to an exogenous event cannot be expected to be constant over time, i.e. in the different phases of the recession. Regions with high levels of accessibility to other regions, for example, are more exposed, in the short term, to the rapid propagation of an economic slowdown. However, they are more likely in the medium/long term to find new markets and to regain competitiveness.

### 3 Territorial capital in EU regions: an empirical measurement

The main difficulty in translating the taxonomy of territorial capital into empirical terms is the identification of appropriate metrics. The list of proxies for various elements of territorial capital (measured for 2006 at the NUTS3 level<sup>2</sup>) is presented in Table 1.<sup>3</sup>

The choice of the empirical measurements is consistent with that of a previous study on Eastern European countries (Fratesi and Perucca 2014). The endowment of public tangible capital is captured by the multimodal accessibility of each region and therefore by its potential access to external markets. Tangible resources with an intermediate level of rivalry are measured by the number of beds in accommodation facilities. The assumption on which the choice of this measurement is based is that these reflect the attractiveness of places, whatever the reason (cultural or natural heritage, amenities, etc.). The number of IP addresses is the proxy for private capital due to its high correlation with the stock of physical investments (not available at the NUTS3 level). Gender disparities in the labour market are often associated with other dimensions of social deprivation (Molyneux 2002), and they have been chosen to capture the regional behavioural modes. The empirical measurements of human capital and agglomeration economies are those typical of most literature in regional development, represented

<sup>2</sup> This is valid for all countries except Germany. In the latter case most of the data are not available at this level of territorial disaggregation. For this reason, in the case of Germany we consider data at the NUTS2 level, because the average size of German NUTS3 regions is smaller than the area of NUTS3 regions in another EU countries. Other scholars have made the same choice in previous works on EU NUTS3 regions (e.g. Paci 1997).

<sup>3</sup> Seven components of territorial capital out of nine have been empirically measured. Relational capital and cooperation networks are missing, since a satisfactory empirical measure is not available for all regions of Europe. Summary statistics of all empirical measurements are presented in Appendix A of Electronic Supplementary Material.

by the share of population with tertiary education and by population density, respectively. Territorial assets with intermediate materiality and high rivalry are assumed, in the end, to be conceptually close to the functional specialization of the regional economies, measured by the share of professionals and managers relative to the total workers.

Having identified the empirical measures of territorial capital, the next step is to analyse the distribution of these assets across regions. In order to identify homogeneous typologies of areas (i.e. characterized by a similar endowment of territorial assets), we applied clustering techniques to the data set described in Table 1.<sup>4</sup> The results of this analysis are presented in Table 2.

Clustering identified seven groups of regions. The first (cluster A—*areas rich in territorial capital*) includes only 12 areas. These are found in the major metropolitan regions of the EU and are characterized by the highest endowment of territorial capital of all the categories considered, with the exception of collective goods. The second cluster, labelled as *public tangible capital* (Cluster B), accounts for a much higher number of regions (191). These are mostly second-rank cities and peri-urban areas, whose main distinguishing feature is a high level of tangible public assets (public infrastructure and agglomeration economies) and relational private services. The third group (cluster C—*intangible capital*) is comprised of regions with a low degree of urbanization but with high levels of both human capital and behavioural modes, immaterial components of territorial capital. The fourth cluster (cluster D) includes those regions marked by a prevalence of *natural and cultural capital* assets. The fifth group (cluster E) has the highest number of regions (235) and is called *intermediate areas*, since their endowment of territorial capital shows no specificity and, at the same time, is generally lower than that of the previous groups but higher than that of the two last groups. Cluster F encompasses regions particularly *poor in private capital*, in particular human capital and the stock of private capital. Finally, the last group (cluster G—*low territorial capital*) includes the areas that are generally endowed with the lowest levels of territorial capital.

Consistent with the previous literature, territorial assets are found here to be positively associated with economic development. As the last line of Table 2 shows, the average per capita GDP decreases from left to right, i.e. from the areas with the highest endowment of territorial capital to those with the lowest. Differences in the overall level of wealth are not significant for the groups with comparable assets (for instance cluster B vs. cluster C), while they are considerably larger when contrasting the regions with poor territorial capital with the others.

<sup>4</sup> The clustering analysis was carried through model-based clustering and, more specifically, the (R Development Core Team 2008) library *mclust* (Fraley and Raftery 1999), in order to test several parameterizations with a variety of distributions (spherical, diagonal and ellipsoidal) and variable shape and volume. The drawback of the most popular clustering techniques is that they are not able to identify clusters with varying shape and volume, as in the case of *k-means* clustering, which leads to the identification of spherical clusters of identical volume and shape. Model-based clustering selects the “best” model by fitting models with differing parameterizations and/or numbers of components to the data by maximum likelihood and then applying the Bayesian Information Criterion for model selection. This approach selected diagonal clusters with varying volume and shape.

**Table 1** Empirical measures of territorial capital

Name	Typology	Empirical measure	Source
Accessibility	High materiality/low rivalry	Multimodal accessibility (population potential)	ESPON
Collective goods	High materiality/intermediate rivalry	Per capita bed places in registered tourist accommodation	EUROSTAT
Private capital	High materiality/high rivalry	Number of registered IP addresses	ESPON
Behavioural modes	Low materiality/low rivalry	Ratio between male and female unemployment rates (age over 15)	EUROSTAT
Human capital	Low materiality/high rivalry	Share of high educated residents (ISCED 5 and 6) over the total	EUROSTAT
Agglomeration economies	High materiality/low rivalry	Resident population per square km	EUROSTAT
Relational private services	Intermediate materiality/high rivalry	Share of professionals and managers over the total	EUROSTAT

**Table 2** EU regions and their territorial capital endowment

Territorial capital elements	Cluster A	Cluster B	Cluster C	Cluster D	Cluster E	Cluster F	Cluster G
	Areas rich in territorial capital	Public tangible capital	Intangible capital	Natural and cultural capital	Intermediate areas	Poor private capital	Low territorial capital
Accessibility	0.182	0.181	0.175	0.175	0.177	0.171	0.171
Collective goods	0.038	0.040	0.073	0.430	0.071	0.056	0.026
Private capital	0.085	0.009	0.008	0.003	0.003	0.001	0.004
Behavioural modes	1.093	1.013	1.171	0.553	0.633	0.291	1.004
Human capital	0.321	0.230	0.272	0.146	0.146	0.116	0.084
Agglomeration economies	5.822	1.092	0.097	0.169	0.189	0.082	0.115
Relational private services	0.353	0.267	0.201	0.175	0.169	0.185	0.157
Number of regions	12	191	103	47	235	57	192
Per capita GDP 06	0.630	0.297	0.285	0.244	0.227	0.189	0.078

## 4 The resilience of EU regions with different endowments of territorial capital

Resilience can be measured through time series parameters (e.g. [Cellini and Torrisi 2016](#)) or through indexes (e.g. [Sensier et al. 2016](#)). The first approach has the advantage of being econometrically sound, but also requires long time series and is not able to provide immediately readable snapshots of what the crisis brings in its various phases. Using indexes, on the other hand, requires less data and, although simpler, is able to disentangle different phases of the economic crisis. This study takes the second approach, due to the availability of data and the aim of disentangling the role of different components of territorial capital in different crisis phases.

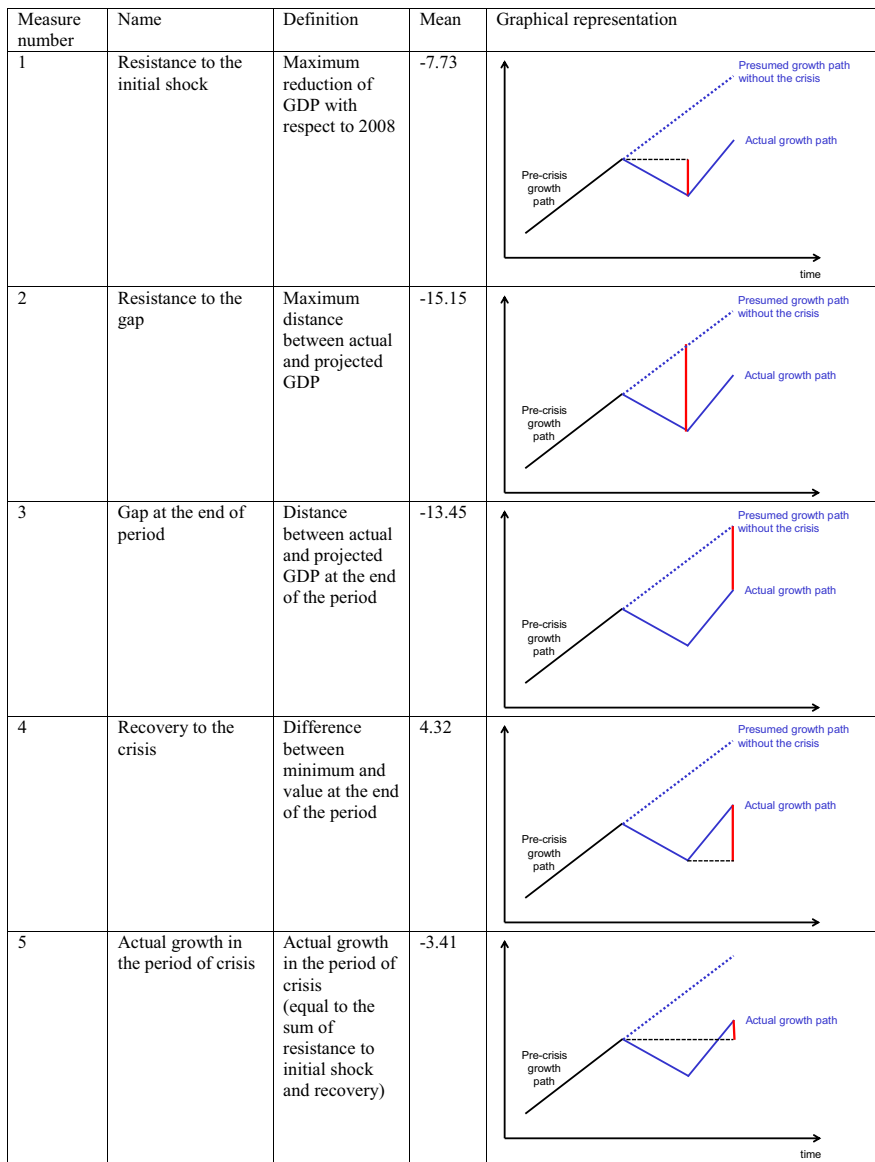
Another issue is the choice of the economic variables to measure the resilience of regions, for which the literature is not consistent. Some studies have analysed resilience in terms of the fluctuations of employment levels (e.g. [Fingleton et al. 2012](#); [Holm et al. 2015](#); [Fratesi and Rodríguez-Pose 2016](#)), while other works used real GDP growth (e.g. [Brakman et al. 2015](#); [Di Caro 2015](#); [Cellini et al. 2017](#)). The present paper focusses on output growth for the reason that territorial capital is a concept which is mostly linked to regional competitiveness rather than job market inclusiveness, even if the theory of territorial capital could provide a way out of the dichotomy between competitiveness and cohesion for regional policies ([Camagni 2017](#)).

The choice of resilience indicators is inspired by those available in the literature (e.g. [ESPON 2014](#)), although it does not precisely follow any of them, because the aim is to obtain a complete span of measures. The measures used are presented in [Fig. 2](#), where each one is defined conceptually and also represented graphically.

Building the measures shown in [Fig. 2](#) requires not only having actual data, but also constructing the presumed path which regional growth would have followed in the absence of the crisis. This path is different for different regions, since some are more dynamic than others. In order to provide a plausible path (apart from normal statistical error), an ARIMA model was used, similar to [Capello and Lenzi \(2015\)](#), in which a projection of the real regional GDP for the years after the crisis was estimated though an ARIMA for each region.

Thus, the five measures constructed are as follows: the “resistance to the initial shock”, which measures the maximum reduction of GDP with respect to 2008 (year of peak total real GDP in Europe before the crisis); “resistance to the gap”, which measures the maximum distance between actual and projected GDP; “gap at the end of period”, which measures the distance between actual and projected GDP at the end of the period; “recovery from the crisis”, which measures the difference between the minimum and the value at the end of the period; and, finally, “actual growth in the period of crisis”, which is not only the difference between the initial and the final level of GDP, but is also equal to the sum of resistance to initial shock and recovery measures. These five indicators are clearly related to each other but also capture different aspects; for example, two regions with the same resistance to the initial shock may have a very different resistance to the gap because the loss with respect to the presumed GDP without the crisis is larger for a region whose past dynamism was greater.

All measures are estimated for the period 2008–2012, which brings with it the implication that the recovery from the crisis for some regions is a less reliable indicator



**Fig. 2** Measures of regional resilience

than for others because there are still a number of zeroes in those regions (in Greece, for example) where no actual recovery has yet occurred.

An analysis of variance (ANOVA) makes it possible to test the different resilience of European regions according to their territorial capital typology, introducing a descriptive analysis which is complemented in the next section by a more comprehensive econometric one. This ANOVA is presented in Table 3, showing the different average

**Table 3** Resilience of territorial capital clusters

Clusters	Resistance to initial shock	Resistance to the gap	Gap at the end of period	Recovery	Actual growth in the period of crisis
A Areas rich in TC	−3.03	−10.38	−8.81	6.71	3.68
B Public tangible capital	−5.94	−12.58	−11.07	4.05	−1.89
C Intangible capital	−9.88	−17.91	−16.25	5.32	−4.56
D Natural and cultural capital	−7.00	−15.24	−14.01	4.00	−2.99
E Intermediate areas	−7.70	−12.49	−10.62	3.93	−3.76
F Poor private capital	−13.02	−21.86	−21.46	0.80	−12.22
G Areas poor in TC	−7.35	−17.97	−15.75	5.49	−1.86
Average	−7.73	−15.15	−13.45	4.32	−3.41
F test	7.80*	10.59***	6.78***	4.69***	7.07***

\*\*\*  $p < 0.01$ 

values in the clusters defined in Sect. 3. The table also shows the F test and its levels of significance.

The different clusters behave in significantly different ways for each resilience indicator. In particular, two main messages appear: first, regions better endowed with territorial capital appear to be more resilient than those with lower endowments. This is shown by the higher values of clusters A (areas rich in territorial capital) and B (public tangible capital) in almost all five indicators and by the lower values for clusters F (low territorial capital) and G (poor private capital). It is interesting to observe that for cluster A (areas rich in territorial capital), the strength of recovery was enough to make the actual growth rate positive in the period of crisis.

The second message is very interesting: clusters whose endowment of territorial capital is similar quantitatively but different qualitatively (i.e. the different clusters are strong in different assets) appear to be characterized by different behaviours in response to the crisis, i.e. to be resilient in different ways. For instance, areas rich in public tangible capital (Cluster B) are more resistant than average to the shock, while areas rich in intangible capital (Cluster C) are less resistant than the average but also better able to recover. This seems to indicate that public tangible capital entails more resistance, while intangible capital, whose impact on firm performance needs more time, is not able to make a region resistant but also allows it to recover more rapidly.

The limitation of this analysis is that, although it is able to show that territorial capital is linked to resilience and that more territorial capital is a good thing, it is not able to demonstrate which territorial capital elements are linked with which types of resilience.

The expectations are that the least sticky factors are also less able to induce resilience, and that those factors whose relationship with the economy is less direct are also less able to affect the resilience of regions, being more linked to the short term. The next sections investigate this with a multivariate analysis.

## 5 The relationship between territorial capital and resilience: an empirical analysis

### 5.1 Methodology

Starting from the descriptive analysis above, the goal of the present section is to provide evidence on the effect of the different elements of territorial capital on the resilience of EU regions.

The first step is to construct a Barro-line regional growth model (Barro 1991) with the following specification:

$$\text{resilience}_{c,i} = \alpha * \text{per capitaGDP}_i + \beta * \text{special. in public sector}_i + \sum_{n=1}^{28} \gamma_n \text{country}_n + \varepsilon_{c,i} \quad (1)$$

where the five typologies of resilience ( $c = 1, \dots, 5$ ) in EU regions (marked with  $i$ ) depend on per capita GDP at the end of 2007, while the specialization in the public sector, which is expected to be more sticky than private one (Rodríguez-Pose and Fratesi 2007) is measured by the share of GDP from the provision of non-market goods and services. Country dummies control for unobserved fixed effects specific to each national context. The error term  $\varepsilon_i$  represents what is left unexplained by model [1] after controlling for the overall level of wealth (richer regions are expected to respond better to the exogenous shock), the relevance of the public sector in the local economy (public investments are less mobile than private ones, and therefore, we expect areas with a strong public sector presence to be more resilient) and all the institutional and social features that vary across nations but are homogeneous across regions within the same country.

The second step of the analysis focusses on the relationship between territorial capital and resilience. What is left unexplained by the general regional growth model (i.e. the error term of Eq. 1) is assumed to depend on the endowment of different territorial capital elements:

$$\begin{aligned} \varepsilon_{c,i} = & f(\text{accessibility}_i + \text{collective goods}_i \\ & + \text{private capital}_i + \text{behavioural modes}_i \\ & + \text{human capital}_i + \text{agglomeration economies}_i \\ & + \text{rel. private services}_i) + \omega_{c,i} \end{aligned} \quad (2)$$

As Eq. (2) shows, for each of the five types of resilience, the error terms are assumed to depend on the territorial characteristics of regions. Both models [1] and [2] were estimated by means of robust OLS where the spatial dependency tests did not suggest a different approach (for more on this, see Appendix B of ESM).

## 5.2 Results

The estimates of the general model (1) are shown in Table 4. The overall level of per capita wealth is associated with a higher resistance to the initial shock, while regions with a strong involvement of the public sector tend to be more resistant but also significantly less able to recover from the lowest point reached during the crisis. This finding is consistent with the hypothesis that the public sector is more protected in the initial phase against the effect of the recession, but it is also stickier in the medium/long term in the process of adaptation to the new conditions generated by the exogenous event. Country-specific effects (not reported individually in the table) are generally highly statistically significant, as expected from the fact that, during the crisis, macroeconomic factors and conditions are very important and highly dependent on the national situation.

In the second step of the empirical analysis, the residuals of the five models whose estimates are reported in Table 4 were regressed on the elements of territorial capital. In order to avoid multicollinearity issues, the territorial capital components were introduced separately into the model specification. The results are reported in Tables 5, 6, 7, 8 and 9, with each table devoted to one measure of resilience as defined in Fig. 2.

Table 5 reports the findings on the *resistance to the initial shock*. Two elements of territorial capital are statistically significant: the endowments of collective goods and relational private services. The first element captures the regional stock of natural and cultural capital, i.e. the tourism attractiveness of regions. It is worth mentioning that this characteristic is not typical only of purely touristic areas (e.g. maritime or mountain regions), but also of those post-industrial regions that have experienced a reconversion towards tertiary activities (Miles and Paddison 2005). Its positive relationship with the resilience indicator suggests that, in the initial phase of the crisis, consumer demand (in this case the demand for amenities) decreases less than other territorial capital elements, especially private investments (Eugenio-Martin and Campos-Soria 2014). The presence of high-value functions, on the other hand, makes regions more able to adapt their productive environment to the new conditions generated by the crisis compared to areas specialized in low-value functions, for example.

The results for *resistance to the gap* are shown in Table 6. In this case, the most resilient regions are those marked by the highest degree of urbanization. Urban areas, where financial sector businesses are usually located, experienced the most immediate consequences of the crisis in the period immediately after 2008. However, they were able to adapt very rapidly.

The endowment of natural and cultural capital, on the other hand, correlates negatively with resilience in this case. These regions are in fact the same ones that experienced the highest levels of GDP growth in the period from 2000 to 2008 (Lee and Brahmasrene 2013). As a consequence, the negative impact of the crisis between 2008 and 2012 was stronger relative to their ARIMA predicted performance than for the other regions.

The result linking urban areas to higher resilience is confirmed if we consider the *gap at the end of the period analysed*. In 2012, in fact (see Table 7), the distance between the observed and potential growth rates was less for those regions with a high degree of urbanization. The degree of accessibility and the endowment of relational

**Table 4** Resilience and regional characteristics [general model, Eq. (1)]

	Resistance	Gap	Gap (end)	Recovery	Resistance + recovery
Per capita GDP	62.589*** (23.686)	37.063° (25.147)	18.485 (33.533)	19.123 (18.852)	81.712** (37.066)
% GDP from the public sector	3.912 (3.596)	2.494 (4.725)	-2.894 (5.501)	-11.343*** (3.493)	-7.431° (4.935)
Country-fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	-102.057*** (1.053)	-115.596*** (1.266)	-114.056*** (1.578)	2.131** (1.017)	-99.926*** (1.563)
Observations	813	813	813	813	813
R-squared	0.657	0.643	0.595	0.381	0.612

Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ , °  $p < 0.15$

**Table 5** Resistance to the initial shock and the territorial capital of EU regions

Resistance	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Accessibility	0.511 (0.361)						
Collective goods		2.849* (1.719)					
Human capital			0.032 (0.025)				
Private capital				16.724 (15.690)			
Behavioural modes					-0.223 (0.358)		
Relational private services						6.645** (3.124)	
Agglomeration economies							0.168 (0.119)
Lambda	0.082 (0.186)		0.110 (0.193)			0.135 (0.186)	
Sigma	4.462*** (0.142)		4.462*** (0.142)			4.452*** (0.143)	
Constant	-8.989 (6.379)	-0.207 (0.199)	-0.537 (0.476)	-0.103 (0.179)	0.189 (0.328)	-1.309** (0.653)	-0.825 (0.626)
Observations	813	813	813	813	813	813	813

Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ , <sup>o</sup>  $p < 0.15$

**Table 6** Resistance to the gap and the territorial capital of EU regions

Gap	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Accessibility	0.493 (0.482)						
Collective goods		-3.478 <sup>°</sup> (2.203)					
Human capital			-0.002 (0.028)				
Private capital				-20.187 (21.458)			
Behavioural modes					-0.549 (0.566)		
Relational private services						3.045 (3.415)	
Agglomeration economies							0.269* (0.144)
Lambda				0.228 (0.173)			
Sigma				6.198*** (0.204)			
Constant	-8.673 (8.539)	0.253 (0.272)	0.035 (0.547)	0.086 (0.309)	0.461 (0.494)	-0.599 (0.717)	-1.321 <sup>°</sup> (0.872)
Observations	813	813	813	813	813	813	813

Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ , <sup>°</sup>  $p < 0.15$

**Table 7** Gap at the end of period and the territorial capital of EU regions

Gap (end)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Accessibility	0.885° (0.552)						
Collective goods		-2.188 (2.425)					
Human capital			0.026 (0.038)				
Private capital				-8.644 (27.870)			
Behavioural modes					-0.611 (0.635)		
Relational private services						7.597° (4.733)	
Agglomeration economies							0.480** (0.199)
Lambda				0.151 (0.185)			
Sigma				7.621*** (0.388)			
Constant	-15.575° (9.787)	0.159 (0.319)	-0.444 (0.734)	0.026 (0.353)	0.514 (0.564)	-1.495° (0.980)	-2.358** (1.028)
Observations	813	813	813	813	813	813	813

Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ , °  $p < 0.15$

**Table 8** Recovery to the crisis and the territorial capital of EU regions

Recovery	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Accessibility	0.078 (0.250)						
Collective goods		2.747* (1.466)					
Human capital			0.000 (0.020)				
Private capital				-1.328 (11.360)			
Behavioural modes					-0.264 (0.276)		
Relational private services						0.455 (2.273)	
Agglomeration economies							-0.033 (0.108)
Lambda							
Sigma							
Constant	-1.372 (4.440)	-0.200 (0.156)	-0.003 (0.405)	0.008 (0.164)	0.222 (0.263)	-0.090 (0.486)	0.160 (0.541)
Observations	813	813	813	813	813	813	813

Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ , °  $p < 0.15$

**Table 9** Actual growth in the period of crisis (equal to the sum of resistance to initial shock and recovery) and the territorial capital of EU regions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Resistance + recovery							
Accessibility	0.674 (0.558)						
Collective goods		5.596*** (1.956)					
Human capital			0.036 (0.038)				
Private capital				15.395 (23.869)			
Behavioural modes					-0.488 (0.491)		
Relational private services						7.295* (4.425)	
Agglomeration economies							0.135 (0.162)
Lambda	0.148 (0.222)		0.152 (0.211)			0.154 (0.200)	
Sigma	6.381*** (0.447)		6.382*** (0.448)			6.374*** (0.447)	
Constant	-11.853 (9.865)	-0.407° (0.267)	-0.602 (0.740)	-0.095 (0.260)	0.411 (0.436)	-1.438° (0.937)	-0.665 (0.828)
Observations	813	813	813	813	813	813	813

Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ , °  $p < 0.15$

private services are also statistically significant, although to a lesser extent. Regions specialized in high-value functions, then, were not only able to soften the impact of external shocks on the local economy but also, in the medium term, to reduce the distance between their actual situation and their potential growth scenario. Accessibility, on the other hand, allows regions to reach new markets (Östh et al. 2015).

The analysis of the indicator *recovery from the crisis* (Table 8) further suggests that the endowment of collective goods played a major role in overcoming the negative consequences of the exogenous shock. The same result is confirmed if we take into account the *actual growth in the period of crisis* (Table 9). In this case, a second element significantly promoting growth during the economic recession is the endowment of relational private services.

All in all, it is clear that different territorial capital assets have different effects, and that those more closely linked to resilience measures are those that have an intermediate level of materiality and/or rivalry, i.e. those belonging to what Camagni (2009) calls the “innovative cross”. Another general result concerns, as expected, the more mobile factors of both private and public nature, which are indeed those less linked to resilience.

## 6 Conclusions

This paper investigated the extent to which territorial capital is related to the resilience of European regions. This conceptualization brings with it the possibility of assessing the impact on growth of all the different typologies of capital with which a region is endowed.

After classifying the regions of Europe at the NUTS3 level in different clusters based on the quantity and type of territorial capital, the paper’s analysis showed that regions with more territorial capital tended to be more resilient than others in the period of crisis 2008–2012. The paper also demonstrated that regions with similar total endowment but different typologies of territorial capital tend to be resilient in different ways, for example by being more resistant to the initial shock or more able to recover after the shock.

The econometric analysis investigated the impact of the different components of territorial capital on the different resilience indicators of the regions. As expected, no indicator has a negative and significant correlation with resilience, confirming the expectation that having territorial capital never hampers regional resilience.

A first strong result emerges in the fact that the endowment of intangible assets does not appear to be significantly related to resilience. One hypothesis was that factors with a weaker direct relationship to short-term economic growth were less significantly related to resilience, and in fact behavioural modes are not significant in any model, although this does not prevent them from being significantly related to regional growth in the long run (Östh et al. 2015). A bit more surprisingly, human capital per se is also not directly associated with resilience, most likely for two concurrent reasons: first, it is also an increasingly mobile factor, and second, its productivity depends on the sector in which it is employed.

As concerns private but tangible goods, private capital also does not significantly impact resilience. This is fully in line with the expectations because by definition this factor is the most mobile and can more easily move out of a region in times of distress.

The most interesting result obtained in the empirical analysis concerns those elements included in what Camagni (2009) calls the “innovative cross”. This encompasses territorial capital factors which have intermediate levels of materiality and/or rivalry. These factors turn out to be significant in total resilience, in the different types of resistance to the crisis and in the ability to recover. These factors include relational private services, collective goods and agglomeration economies.

All these mixed materiality/rivalry territorial capital factors are by definition very sticky in space and also have very slow mechanisms of accumulation and decumulation. It is therefore these assets which more than any others endow regions with solid and immovable rocks on which to anchor in hard times.

Unfortunately, these territorial capital intermediate factors also constitute elements which are more difficult to produce in places where they are absent. This entails a clear limitation of regional policy, as it is difficult to affect these factors through policy interventions. Moreover, it is difficult to see an impact of this type of policies in the short and medium term, meaning that there is no time during a crisis to see their effects. Finally, there is also a complementarity between territorial capital and policies, which makes the latter more effective when territorial capital is present (Fratesi and Perucca 2016).

These issues do not imply that regional policy is not helpful for regions in hard times, but rather that it is too late to intervene by trying to affect the structure of regions once a large crisis has already started. In the short term, other policies might be more immediately effective to ease the pain of an ongoing crisis. However, the evidence presented here also calls for structural regional policies never to be discontinued in bad times or in good times, as the territorial capital of regions, and especially those aspects which are more sticky, is able to make those regions more resilient in hard times and more competitive in the long run.

## References

- Barro RJ (1991) Economic growth in a cross-section of countries. *Quart J Econ* 106(2):407–443
- Boschma R (2015) Towards an evolutionary perspective on regional resilience. *Reg Stud* 49(5):733–751
- Brakman S, Garretsen H, van Marrewijk C (2015) Regional resilience across Europe: on urbanisation and the initial impact of the Great Recession. *Camb J Reg Econ Soc*. doi:[10.1093/cjres/rsv005](https://doi.org/10.1093/cjres/rsv005)
- Camagni R (2009) Territorial capital and regional development. In: Capello R, Nijkamp P (eds) *Handbook of regional growth and development theories*. Edward Elgar Publishing, Cheltenham, pp 118–132
- Camagni R (2017) Territorial capital, competitiveness and regional development. In: Huggins R, Thompson P (eds) *Handbook of regions and competitiveness*. Edward Elgar Publishing, Cheltenham
- Capello R, Lenzi C (2015) Relevance and utility of European Union research, technological development and innovation policies for a smart growth. *Gov Policy Environ Plan C*. doi:[10.1177/0263774X15614655](https://doi.org/10.1177/0263774X15614655)
- Capello R, Caragliu A, Fratesi U (2015) Spatial heterogeneity in the costs of the economic crisis in Europe: are cities sources of regional resilience? *J Econ Geogr* 15(5):951–972
- Cellini R, Torrisi G (2014) Regional Resilience in Italy: A very long-run analysis. *Reg Stud* 48(11):1779–1796. doi:[10.1080/00343404.2013.861058](https://doi.org/10.1080/00343404.2013.861058)
- Cellini R, Di Caro P, Torrisi G (2017) Regional resilience in Italy: do employment and income tell the same story? In: Huggins R, Thompson P (eds) *Handbook of regions and competitiveness*. Edward Elgar Publishing, Cheltenham

- Di Caro P (2015) Recessions, recoveries and regional resilience: evidence on Italy. *Camb J Reg Econ Soc* 8(2):273–291
- ESPON (2014) Territorial observation No. 12 September 2014, European Union, The Luxembourg. ISBN 978-2-919777-82-2
- Eugenio-Martin JL, Campos-Soria JA (2014) Economic crisis and tourism expenditure cutback decision. *Annal Tour Res* 44:53–73
- Fingleton B, Garretsen H, Martin R (2012) Recessionary shocks and regional employment: evidence on the resilience of UK regions. *J Reg Sci* 52(1):109–133
- Fingleton B, Garretsen H, Martin R (2015) Shocking aspects of monetary union: the vulnerability of regions in Euroland. *J Econ Geogr* 15(5):907–934
- Fraley G, Raftery AE (1999) MCLUST: software for model-based cluster analysis. *J Classif* 16:296–306
- Fratesi U, Perucca G (2014) Territorial capital and the effectiveness of cohesion policies: an assessment for CEE regions. *Investig Reg J Reg Res* 29:165–191
- Fratesi U, Perucca G (2016) EU regional development policy and territorial capital: a systemic approach, mimeo. Politecnico di Milano, Milan
- Fratesi U, Rodríguez-Pose A (2016) The crisis and regional employment in Europe: what role for sheltered economies? *Camb J Reg Econ Soc* 9(1):33–57
- Giannakis E, Bruggeman A (2015) Economic crisis and regional resilience: evidence from Greece. *Paper Reg Sci*. doi:[10.1111/pirs.12206](https://doi.org/10.1111/pirs.12206)
- Groot SPT, Möhlmann JL, Garretsen JH, De Groot HLF (2011) The crisis sensitivity of European countries and regions: stylized facts and spatial heterogeneity. *Camb J Reg Econ Soc* 4(3):437–456
- Hassink R (2010) Regional resilience? A promising concept to explain differences in regional economic adaptability? *Camb J Reg Econ Soc* 3(1):45–58
- Holm JR, Østergaard CR, Drahokoupil J (2015) Regional employment growth, shocks and regional industrial resilience: a quantitative analysis of the Danish ICT sector. *Reg Stud* 49(1):95–112
- Lee N (2014) Grim down South? The determinants of unemployment increases in British Cities in the 2008–2009 recession. *Reg Stud* 48(11):1761–1778
- Lee JW, Brahmasrene T (2013) Investigating the influence of tourism on economic growth and carbon emissions: evidence from panel analysis of the European Union. *Tour Manag* 38:69–76
- Martin R (2012) Regional economic resilience, hysteresis and recessionary shocks. *J Econ Geogr* 12(1):1–32
- Martin R, Sunley P (2015) On the notion of regional economic resilience: conceptualization and explanation. *J Econ Geogr* 15:1–42
- Martin R, Sunley P, Gardiner B, Tyler P (2016) How regions react to recessions: resilience and the role of economic structure. *Reg Stud* 50(4):561–585
- Miles S, Paddison R (2005) Introduction: the rise and rise of culture-led urban regeneration. *Urban Stud* 42(5–6):833–839
- Molyneux M (2002) Gender and the silences of social capital: lessons from Latin America. *Dev Change* 33(2):167–188
- Ollivaud P, Turner D (2015) The effect of the global financial crisis on OECD potential output. *OECD J Econ Stud* 2014:41–60
- Östh J, Reggiani A, Galiasso G (2015) Spatial economic resilience and accessibility: a joint perspective. *Comput Environ Urban Syst* 49:148–159
- Paci R (1997) More similar and less equal: economic growth in the European regions. *Weltwirtschaftliches Arch* 133(4):609–634
- Palaskas T, Psycharis Y, Rovolis A, Stoforos C (2015) The asymmetrical impact of the economic crisis on unemployment and welfare in Greek urban economies. *J Econ Geogr* 15(5):973–1007
- Perucca G (2014) The role of territorial capital in local economic growth: evidence from Italy. *Eur Plan Stud* 22(3):537–562
- R Development Core Team (2008) R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna. ISBN 3-900051-07-0, available at: [www.r-project.org/](http://www.r-project.org/). Accessed 14 Sep 2016
- Rodríguez-Pose A, Fratesi U (2007) Regional business cycles and the emergence of sheltered economies in the southern periphery of Europe. *Growth Chang* 38–4:621–648
- Sánchez-Zamora P, Gallardo-Cobos R, Ceña-Delgado F (2014) Rural areas face the economic crisis: analyzing the determinants of successful territorial dynamics. *J Rural Stud* 35:11–25
- Sensier M, Bristow G, Healy A, Kiel C (2016) Measuring regional economic resilience across Europe: operationalizing a complex concept. *Spat Econ Anal* 1772:1–24

- Servillo L, Atkinson R, Russo AP (2012) Territorial attractiveness in EU urban and spatial policy: a critical review and future research agenda. *Euro Urban Reg Stud* 19(4):349–365
- Tóth BI (2015) Territorial capital: theory, empirics and critical remarks. *Eur Plan Stud* 23(7):1327–1344
- Townsend A, Champion T (2014) The impact of recession on city regions: the British experience, 2008–2013. *Local Econ* 29(1–2):38–51