Spatial heterogeneity in the costs of the economic crisis in Europe: are cities sources of regional resilience?

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1. Introduction

Since 2007–2008, most advanced economies experienced the worst economic crisis after the 1929 financial crash. Although several previous analyses have been performed on the overall magnitude of the immediate effects generated by the crisis, insufficient attention has been paid on the one hand to the long-run costs associated to the economic slowdown, and on the other to the understanding of the spatial distribution of these effects. In fact, while the crisis is a world phenomenon, its costs are characterized by a high degree of spatial heterogeneity.

The aim of the article is to measure this spatial heterogeneity, beyond the crisis' short-run impacts, doing so through a scenario-building exercise, with the final goal to direct regional growth policies towards more targeted interventions. In fact, most of the presently available literature has so far been focusing on the a-spatial direct impacts of the crisis, in terms of employment and GDP contraction, social distress, rising youth and structural unemployment (Belloc and Tilli, 2013; Tan and Zeng, 2014). Only few existing works focus on the spatial distribution of the impacts of the crisis. For instance,

Hadjimichalis (2011) argues for the existence of regional causes of the present crisis, beyond pure macroeconomic factors; Groot et al. (2011) relate the spatial heterogeneity of the effects of the crisis to trade integration, institutional and industrial factors; Diodato and Weterings (2015) explore the resilience of regional labour markets to economic shocks. Other descriptive works exist on the trend in employment and GDP growth at regional level for specific countries (Cuadrado-Roura and Maroto-Sanchez, 2014; Petrakos and Psycharis, 2014; Raagmaa et al., 2014).

In the existing literature, two main shortcomings can be identified. The first relates to the fact that these works focus only on the short-run impacts of the crisis. It is instead our belief that of even higher relevance are the long-run costs associated to the crisis; in fact, the crisis has induced structural changes that prevent countries and regions from bouncing back to pre-crisis development paths. Costs are therefore not only a matter of short-term impacts on unemployment, GDP and social distress, but also a forceful restructuring process of the economy. The second shortcoming relates to the fact that none of the previous studies takes into consideration the different structural characteristics of regions that might be of help in explaining the resilience of their economies against strong external shocks.

This work tries to overcome both limitations. By building on a previous work of ours (Capello et al., 2014a), this article measures the long-run costs of the crisis through a scenario-building exercise which aims, as will be made clear later on, at capturing the past and future effects of the crisis. Besides, it describes the costs of the crisis not only at regional level, but also in terms of regional typologies based on regional settlement structures, with the idea that regions hosting strong, large and dynamic cities might be more resilient to adverse external shocks with respect to rural ones.

The capability of regions to be resilient to adverse economic events is a particularly interesting issue because two opposite conceptual explanations on the role of cities during the crisis could be argued. On the one hand, as the crisis originated from financial activities that are typically hosted in major urban areas, regions hosting major cities could be those facing the highest costs. On the other hand, cities are the hotspots of innovative activities and of industrial diversification and, as such, regions hosting large and diversified urban areas could be more resilient to economic downturns. The way out from this conceptual loop is through an empirical analysis.

At this point, a definition of regional economic resilience is necessary. Economic resilience can be classified as the stability of a system near a steady state (*engineering resilience*) or, alternatively, as the structural response of a regional economy to shocks permanently affecting its long-run growth path (*ecological resilience*) (Simmie and Martin, 2010). As we aim at assessing the long-run costs associated to the crisis, throughout this article, regional economic resilience is interpreted as ecological resilience.[1] In order to match this definition of resilience, the concept of economic crisis is here defined as the *prolonged slowdown of economic growth with respect to long-run trends*.[2]

1 For the sake of this article, resilience is defined as '*the ability of a region to recover successfully from shocks to its economy that either throw it off its growth path or have the potential to throw it off its growth path*' (Hill et al., 2008, 4).

2 This definition, therefore, does not consider as proper crises short-run economic contractions, such as recessions, that are usually defined as two consecutive quarters of GDP reduction.

The analysis of the long-run costs of the crisis implies a scenario approach for several reasons. The first is a very simple one, regarding the insufficient availability of up-to-date regional and urban data for the EU, which prevents from drawing a full account of the extent of the damages done at the regional and urban levels by the crisis. National statistics suggest that while some countries (and, arguably, some typologies of regions and urban areas) have already re-emerged from the economic slump, some others still stagnate in a swamp of massive youth unemployment, high public debt and low productivity growth. The lack of data calls, therefore, for an integration that only a macroeconometric regional growth model can provide.

The second reason for quantifying the long-run crisis costs through a scenario exercise is, as above anticipated, that the crisis has generated structural adjustments in the economy, that inevitably will show their effects only and precisely in the long run. In some areas, especially those that proved to be more sensible to the negative impact of the economic downturn, economic growth has structurally slowed down, as a consequence of various regional and industrial changes, like possible re-industrialization processes, already taking place, for instance, in the USA (Skroupa, 2012; Curtis, 2013)—also because of the decreasing incentives to relocate manufacturing plants in developing countries due to real wage increases (The Economist, 2012). If one wants to measure the costs of the crisis, these changes need to be properly taken into account; however, even the most updated data cannot quantify the effects of these changes nowadays, and an econometric growth model turns out to be useful in this respect.

The third reason is that the spatial asymmetry in the costs of the crisis is difficult to grasp through a conceptual reasoning. In fact, when the first phase of the crisis was associated with real estate mortgage bankruptcy, the negative effects were easily attributed to the presence in an area of financial activities directly or indirectly related to real estate, and of a hypertrophic and overvalued building and construction sector. Urban areas were those that suffered most. In a second phase, the crisis rapidly involved the real sector through the credit crunch and the shrinking of global demand. In a third phase, the crisis retroacted on the financial sector as a consequence of the large sovereign debt of many European countries and the exposure of the financial sector with public debtors. This evolution led to greater pressure on industry and in general on 'exposed' sectors, but also cumulatively on internal consumption growth in general and on demand for investments. Industrial areas were those most exposed to massive unemployment growth and to the loss of GDP potentials. In the absence of a convincing theoretical explanation, the use of a simulation model allows to formalize the economic structure that channeled the effects of the crisis, thereby isolating particular effects, like the urban settlement structure of regions, on economic performance.

In order to quantify what the long run costs of the crisis will be, a scenario is required able to keep the normative and economic situation as it is today, and able to extrapolate the situation over 15 years, a sufficient time in which all changes exert their effects. Only in this way, the effects of the structural changes induced by the crisis are all taken into account.

The results of the scenario exercise are able to identify which European geographical areas (nations or regions) register the highest costs, measured as both unachieved growth in GDP and employment, and loss of convergence in GDP per capita across regions in Europe. Moreover, the exercise makes it possible to present the results by different types of regions on the basis of the presence/absence of large cities, medium

cities and rural areas. Another distinction is also taken into account, that is, the presence in a region of particularly modern and advanced cities. The article highlights that the crisis generates different growth opportunities to regions and that the presence of cities makes a difference in how regions react to the crisis. But this is not all: the type of city is what really makes the difference. Large cities, identified on the basis of pure size, are compared with cities that in the past have registered a particular capacity to attract high value functions, high cooperation activities and to develop high quality accessibility projects. Interesting results emerge. Agglomeration economies stemming from pure urban size are not enough to guarantee regional resilience: the quality of the activities and of the production factors hosted, the density of external linkages and cooperation networks and the quality of urban infrastructure, are all factors giving greater economic resilience to cities and to the regions that host them.

The article is structured as follows. Section 2 describes the methodological aspects of the scenario-building exercise, presents the assumptions of the model and provides a general explanation of the MASST3 model, which is used to run simulations. Section 3 describes the classification of regions in terms of urban settlement structure used to differentiate simulation results, whereas Section 4 sets out the results at various levels of aggregation. Section 5 presents the policy implications and makes some concluding remarks.

2. Scenario methodology and description

2.1. Scenario building methodology

The methodological approach used in this article is termed a *quantitative foresight*. The aim is in fact neither to achieve precise quantitative values of economic elements nor merely to provide a qualitative image of what the economic system will look like. The aim is instead to show the main trends and relative behavioural paths that will be at work under specific assumptions on how the main driving forces of change will evolve. Both the values assigned to the target variables in the forecasting model and the regional values emerging from the final results indicate an order of magnitude and some relative behavioural classes (high–medium–low increase or decrease), rather than precise quantitative values. The scenario therefore depicts tendencies and relative behavioural paths of regional GDP growth in each individual region under certain conditions. In other words, they represent possible states of the system that may become real under given exogenously assumed, multidimensional (socio-economic, demographic and technological), mutually consistent hypotheses.

It is hence clear why a quantitative foresight differs from a forecast, whose aim is to obtain precise values of specific economic variables in the future on the basis of extrapolations from a system of past socio-economic relations (see, e.g. Armstrong, 1985; Loomis and Cox, 2000; Hawkins, 2001; Hendry and Clements, 2001). Precisely because they extrapolate from past tendencies, forecasts yield the best results in a short-term perspective.

It is also clear why a quantitative foresight is different from a foresight, which is mostly qualitative in nature, and aims to provide an image of the future based on radical breaks, that is, structural effects that destroy past tendencies (see, e.g. Miles and Keenan, 2000; CEC, 2004; UNIDO, 2004). Foresights do not normally address the dynamic processes that will produce the final outcome, but explore instead the general

consistency of the final image by analysing all the adjustment processes that are likely to happen. In general, a foresight is built on an image of what the future will look like (explorative projections), but also of what the future should look like (desirable projections). A foresight provides insights into the future based on a structural and radical break with the past and assuming in general a long-term perspective (usually decades).

The scenario-building exercise is organized around three major methodological steps (Capello et al., 2008, 2011; Capello and Fratesi, 2009). First of all, a conceptual logic is needed which depicts the assumptions on which the scenario has to be developed. In this work, this effort is presented in in the next sub-section. The second step is to include the qualitative assumptions into a regional growth forecasting model, called MASST (Macroeconomic, Social, Sectoral and Territorial Model), whose third version is briefly illustrated in Section 2.3.[3] The third step is to translate the qualitative scenario assumptions into quantitative levers of the model. Being this a rather technical exercise, this third step is presented in the Supplementary data.

2.2. Scenario assumptions

A scenario developed for the purpose of measuring the long run costs of the crisis has to be built with some cautiousness. First of all, in order to get the pure long-term crisis effects, future trends have to be depurated from any other element that might influence the local resilience and the crisis trend. To avoid the risk that an uneven recovery from the crisis can depend on new policies rather than resilience itself, European, national and regional policies have to be kept constant. Moreover, we are not interested in the most likely recovery scenario; our interest lies in a scenario able to disentangle the effects of the crisis from the effects of many changes that can and probably will take place in the medium run in both the global and national economies. For these reasons, the scenario that will be used to project the impact of the crisis into the future is one in which no radical change takes place, so that the recovery of regions and cities from the crisis can be evaluated without noise. A scenario of this type must therefore be based on two macro-assumptions, namely:

1. *The continuity of past global socio-economic, technological and demographic trends*, so that the EU economy is not altered by any event of fundamental importance. In particular, it is assumed that no significant changes will occur in Europe's role in the world economy, which registers a decline relatively to the emerging areas. Moreover, no major change is assumed in technology, so that no significant technological leap will take place before 2030. These assumptions appear to be relatively straightforward, but translating them in a scenario is a complex exercise. In fact, the crisis altered a large number of pre-crisis trends in socio-economic variables, and for each of them a careful understanding of permanent versus short term changes is necessary.
2. *The continuity of European economic policies, which will remain as they currently are*. In order to detect the costs of the crisis, there is the need to depurate from new policies that are put in place to react to the crisis. These policies, in fact, are likely to mitigate the impact of the crisis and are hence likely to falsely lower the detected

3 For a detailed presentation of the MASST3 model, see Capello et al. (2014b).

costs induced by the crisis itself. No new policy intervention is hence introduced in the scenario, and Europe, its countries and its regions stick to the current ones. In particular, the policy assumptions of the scenario assume that at European level the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union will continue to be applied strictly, for example, maintaining the 3% target for the ratio of public deficit on GDP. At national level, the various countries will continue to put efforts in maintaining balanced budgets. At European level, the current amount and allocation of Cohesion policy (those of 2007–2013) will also continue in the future programming periods.

These assumptions will be translated into quantitative levers of the model and inserted into the regional growth forecasting model, briefly explained hereafter.

2.3. The MASST3 model in a nutshell

The crisis is affecting the economy in a large number of ways, at both national and regional level. In order to investigate the regional impacts of the crisis, therefore, one needs a tool capable of considering national—macroeconomic—levers of growth as well as regional—territorial—ones. Moreover, the tool must be flexible enough to incorporate the changes in the economy's behaviour between ordinary times and periods of crisis. The MASST3 model has been improved so as to embed these characteristics.

The purpose for which the MASST model is built is to *create territorial scenarios* under different assumptions about the main driving forces of change that will act in the future. In a scenario-building of this kind, the presence of the MASST model guarantees that the results are neutral *vis-à-vis* the assumptions, because they are based on the structural relationships that hold together the economic system in an objective way (estimates). Used with such a purpose, it is not a short-term forecasting tool, but a long-term quantitative foresight model.

The MASST model has some distinct features that differentiate it from other forecasting models. First, it contains a mixture of demand and supply side elements that explain regional growth at national and regional level. Second, it makes it possible to simultaneously model *competition* and *cooperation* among regions. Third, it is a purely territorial model, in which not only regional growth spillovers are modelled, but also the effects of variables are differentiated with respect to the settlement structure of regions (Capello, 2007; Capello and Fratesi, 2012; Capello et al., 2014b).

In the MASST model (in all its versions), regional growth is the outcome of both regional and national factors: regional growth is the result of the sum of the national component and of the differential growth component (Figure 1), which are the basis of the two sub-models: the national one encompasses all national macroeconomic aspects that are of paramount importance in a period of crisis like the present one. The regional sub-model explains instead the competitiveness (supply side) aspects of growth, taking territorial capital characteristics into consideration. The MASST3 model is in fact deeply rooted in endogenous development theories in which the competitiveness of an economic system depends on the presence of structural elements and on the ability of the economic system to cumulate them over time through endogenous and self-reinforcing mechanisms. Among these elements, a role is given to both tangible and intangible ones. The two sub-models are not separate but instead interact, so that any

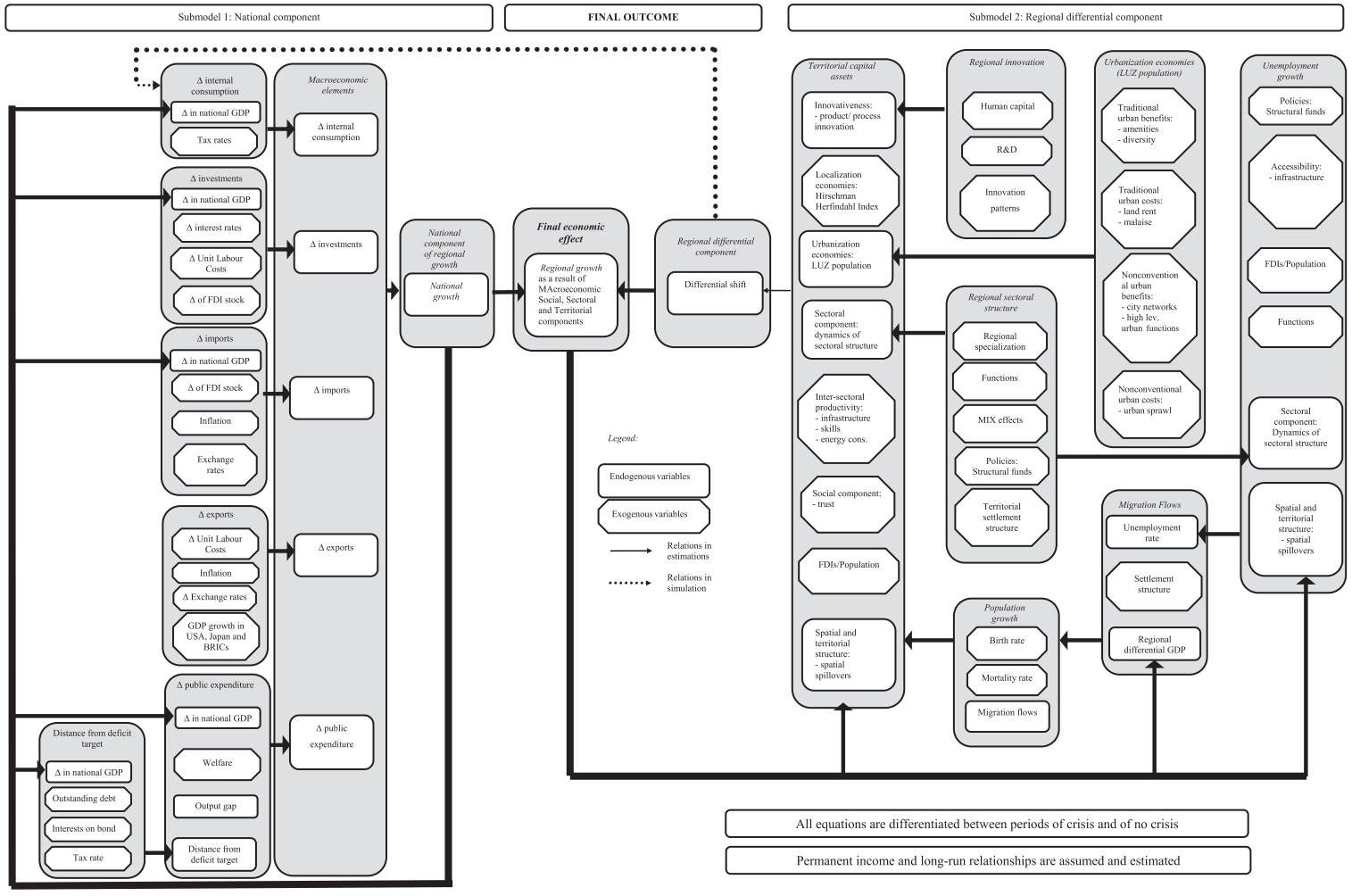

Figure 1. Flow chart of the MASST3 model.
Source: Capello et al., 2014b.

shock affecting one or more regions impacts on the growth rates of their countries (and of the neighbouring regions through spillover effects), whereas any shock at national level impacts on regions of that country in a heterogeneous way on the basis of their own territorial capital elements.

The national model has largely a traditional Keynesian structure. Each component of the aggregate demand depends on the conventional elements. Consumption growth depends on income growth; investments growth depends on changes in interest rates; import growth depends on exchange rate variations, whereas export growth is influenced by exchange rate adjustments and world demand volatility. With respect to the Keynesian approach, some supply-side elements concerning the competitiveness of the national economy are added in the model specification in order to take account of the strong competitive environment that the global economy generates for national economies. In particular, global competition strongly affects investments, import and export growth; national efficiency certainly plays a role in dealing with the high level of competition. New investments depend on productivity gains furnished by the national economic system and on the capacity of the national economy to attract FDIs; import growth also depends on the capacity of national economies to attract FDIs representing strong importers of intermediate goods. Finally, the capacity of a national economic system depends not only on world demand but also, once international markets grow in size, on the capacity of the economic system to conquer a position in the international division of labour. Export growth is therefore strongly influenced by productivity gains capturing the efficiency of institutional elements (legislative, judicial and governmental functions of the nation state) and organizational elements (e.g. the quality of services of general interests like education).

The national sub-model is estimated in a panel data with 27 country observations over the period 1990–2011,[4] distinguishing the coefficients in ordinary periods and those of the years of crisis when theoretically and empirically relevant.

The regional sub-model, which produces the regional differential shift, is more complex and recursive with respect to the national one. As in the previous versions of MASST, the basis of the regional component is the equation of the regional differential growth with respect to the country. This differential component depends on a large number of structural assets, some of them endogenous to the model through second-order equations, and some exogenous through the scenario assumptions.

As in the previous version of the model, the structural elements come from two conceptually different groups of variables (Figure 1). The first group is meant to measure sectoral dynamics, through both manufacturing and service employment growth rates. The second group seeks to measure the effects of inter-industry productivity through the presence of innovation capacity, regional localization economies, accessibility, relative geographical position with respect to other regions, relational capital, an equilibrated urban system and regional attractiveness of FDIs.

Regional estimates are performed on a panel of three periods; each period is a 3 years' average in order to reduce volatility and detect the impact of structural variables for which time-series are scarcely available. Lagged dependent variables are used in order to reduce endogeneity (which implies two estimation periods, one for pre-crisis

4 At present, the MASST3 model does not yet include the 28th EU member, Croatia.

and one for in-crisis years). When empirically relevant, the coefficients for the years of crisis are different from the pre-crisis ones.

The regional component of the MASST model also has a number of structural equations, which feed the regional differential shift. These equations are the following ones (Figure 1):

- The dynamics of employment growth, distinguishing between manufacturing and service employment that depends on regional sector specialization, policy support, functional specialization and regional characteristics in terms of settlement structure or belonging to new member countries.
- Regional innovation, which estimates the innovativeness of regions as a function of R&D expenditure, regional innovation patterns and of the human capital endowment of the region (Capello and Lenzi, 2013).
- Urbanization economies that estimate the size of the larger urban zone within the region depending on the urban amenities and urban costs (see Camagni et al., 2013).
- Unemployment growth, which depends on employment growth, the level of functions performed in the region, the accessibility of the region, the growth spillovers received by the region, the investments attracted by the region and the received policy support.
- Regional population growth, whose estimated values depend on crude birth and death rates, on the number of immigrants and on the regional typologies.
- Regional migration rates for three age classes, which depend on regional differential GDP, on unemployment rates and on the characteristics of regions in terms of settlement structure.

The simulation procedure is performed by including in the model the new values that the independent variables are expected to have in the last year of the simulation process (2030 in our case), given the scenario assumptions. The model adjusts in a recursive way the dependent variables to the new values assumed by the levers of the model year by year, and provides the final results.

As already mentioned, the quantitative numbers adopted as 2030 targets for the model exogeneous variables to simulate the scenario are presented in the Supplementary data.

3. A taxonomy of cities in Europe

As mentioned in the introductory section, the major aim of the article is to assess the role of cities and urban systems as sources of regional resilience. Cities are the loci of financial activities severely hit during the first period of the crisis; but they are also the loci of soft and hard territorial capital elements—in the form of high physical accessibility, access to information and knowledge, presence of advanced functions, agglomeration economies—that may play an important role in generating inter-sectoral productivity growth, and therefore an ability to adjust to the crisis.

The analysis of the role of cities in regional resilience required a subdivision into European regions with different urban settlement structures, so as to be able to obtain from the MASST model the measurement of GDP growth rates by groups of regions characterized by different urban settlement structures. An official typology in this

Table 1. Criteria for the definition of agglomerated, urban, and rural regions

Typology of region	Quantitative criteria for its definition
Agglomerated regions	With a centre of more than 300.000 inhabitants and a population density more than 300 inhabitants/km sq or a population density between 150 and 300 inhabitants/km sq.
Urban regions	With a centre between 150.000 and 300.000 inhabitants and a population density between 150 and 300 inhabitants/km sq (or a smaller population density—between 100 and 150 inhabitants/km with a bigger centre (more than 300.000) or a population density between 100 and 150 inhabitants/km sq.
Rural regions	With a population density less than 100/km sq and a centre more than 125.000 inhabitants or a population density less than 100/km sq with a centre less than 125.000.

Source: ESPON 1.1.1.

regard is the one drawn up by ESPON,[5] which distinguished the 270 European NUTS2 regions into three main types according to the size and densities of cities present in the region. The types identified are presented in Table 1.

This mutually exclusive typology is useful for capturing the morphological aspects of regions, and the associated advantages that stem from the presence of large cities, that is, the traditional agglomeration economies depending on the size of cities, with the associated productivity gains.[6] The fact that this definition only focuses on the morphological aspects implies a relative shortcoming, viz. that it fails to capture functional/economic issues related to cities (such as the presence of advanced and modern functions).

In order to capture the functional aspects typical of modern and advanced cities, an additional, mutually exclusive, classification has been applied, namely the distinction between MEGA and non-MEGA regions, also elaborated within the ESPON research programme. MEGA regions have been identified on the basis of five functional specialization and performance indicators (population, accessibility, manufacturing specialization, degree of knowledge and distribution of headquarters of top European firms). All these variables have been collected at FUA (functional urban area) level, and then combined to yield an overall ranking of FUAs; the 76 FUAs with the highest average scores have been labelled MEGAs.[7] MEGA regions are, therefore, NUTS2 level administrative areas hosting at least one of the 76 FUAs.

The share of European regions belonging to both the morphological and the functional classifications are shown in Figure 2 below. Figure 2a, in particular, displays the division of the 270 EU NUTS2 regions according to whether they are classified as prevalently agglomerated, urban or rural; Figure 2b shows instead the classification of

5 ESPON (European Observation Network for Territorial Development and Cohesion, www.espon.eu) is a research programme currently on hold, partly financed by the European Commission, partly by its 31 member countries (EU27 countries, plus Iceland, Lichtenstein, Norway and Switzerland). Its aim is to provide targeted scientific evidence on spatial and territorial processes in Europe, identify their determinants and provide cutting-edge insight into possible future developments of such trends.

6 It has recently been advocated that the advantages stemming from urban agglomeration economies are still very relevant, and that the costs stemming from diseconomies of size have tended to be overestimated as they rise only slowly after a certain size (Cheshire et al., 2014).

7 Details on the classification adopted can be found in Nordregio (2004).

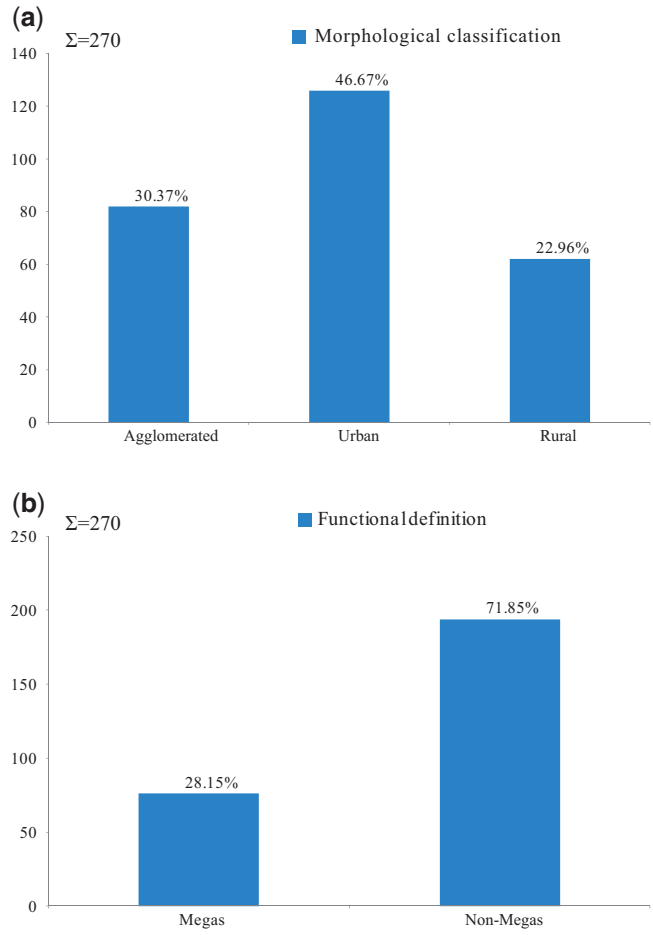

Figure 2. Share of European regions by morphological (a) and functional (b) typologies. (a) Morphological classification. (b) Functional classification.

Table 2. Annual average GDP growth rates: comparison between expansion and crisis periods

	1990–2007 GDP growth rate	2008–2011 GDP growth rate	2012–2030 GDP growth rate
EU27	2.32	−0.05	1.89
EU15	2.01	−0.06	1.88
Central and Eastern European Countries (CEECs)	4.02	0.09	1.93

the NUTS2 regions in terms of MEGAs and non-MEGAs. The mutually exclusive nature of both classifications is also shown by the summation symbol in the top-left corner of the histograms; each of the classification methodologies implies all regions sum up to the universe of NUTS2 regions analysed (270).

As evident in Figure 2, the largest share of regions is classified as urban (Figure 2a), and non-MEGAs (Figure 2b). The two classifications, far from being inconsistent, are rather logical; MEGA regions are never classified as rural; thus, MEGA regions are typically either agglomerated or urban.

4. Cities as sources of regional resilience

4.1. The regional costs of the crisis: the role of cities

The first step of the empirical analysis is to highlight the general costs of the crisis in terms of losses of GDP growth rates. As Table 2 shows, the period 2008–2011 has registered a strong slowdown of the EU economic performance. The table already suggests that the negative impact of the crisis is not space-invariant: CEECs lose momentum and drastically slow down their convergence pattern towards EU15 levels. If a forward-looking perspective is taken, the results show that the costs of the crisis have long-lasting effects. In the period 2012–2030, the EU27 still registers a lower annual average GDP growth rate with respect to the past. This is true for both CEECs and EU15, even if the highest costs are to be found in CEECs. In fact, in this block of countries the very high pre-crisis growth rates are far from being achieved again.

These first results stimulate further and deeper analyses of the spatial distribution of the costs of the crisis. Looking at the regional distribution of GDP growth, an astonishing picture emerges. Figure 3 presents the annual average regional GDP growth rate, showing that:

- The costs of the crisis are spatially differentiated. There are a very limited number of regions in southern Europe, where the recovery after the crisis is even unable to overcome the negative effects of the crisis in the first years of the period 2011–2030. These regions are the rural areas of Greece and Castilla-La-Mancha in Spain.
- The cost of the crisis is also represented by an emerging *two-speed Europe*. Regions belonging to southern peripheral countries grow in general significantly less than those in northern countries. Southern European countries pay the price of the difficult present macroeconomic conditions on their future evolutionary trajectories, and their post-crisis growth is insufficient to recover with respect to other countries where the crisis has milder effects. Eastern countries grow but at lower pace than the past; the result is that international disparities increase.
- Within countries, the costs of the crisis are felt differently in different regions, and in all Western countries the costs are considerably lower for the agglomerated regions where large cities are present. In these regions, in fact, normally GDP growth rates are significantly higher than in the rest of the country, and this pattern can also be detected in faster growing countries such as Germany (Berlin, Munich and Frankfurt are all driving their respective regions to the best economic performance), Denmark (Copenhagen) or Sweden (Stockholm, Goteborg and Malmö), but also in Southern ones, characterized by slower growth such as, Spain (Madrid, Barcelona and Seville) or Italy (Rome, Milan and Turin).
- Due to this metropolitan concentric pattern of recovery from the crisis, which sees a fast recovery in agglomerated regions, disparities within countries increase.

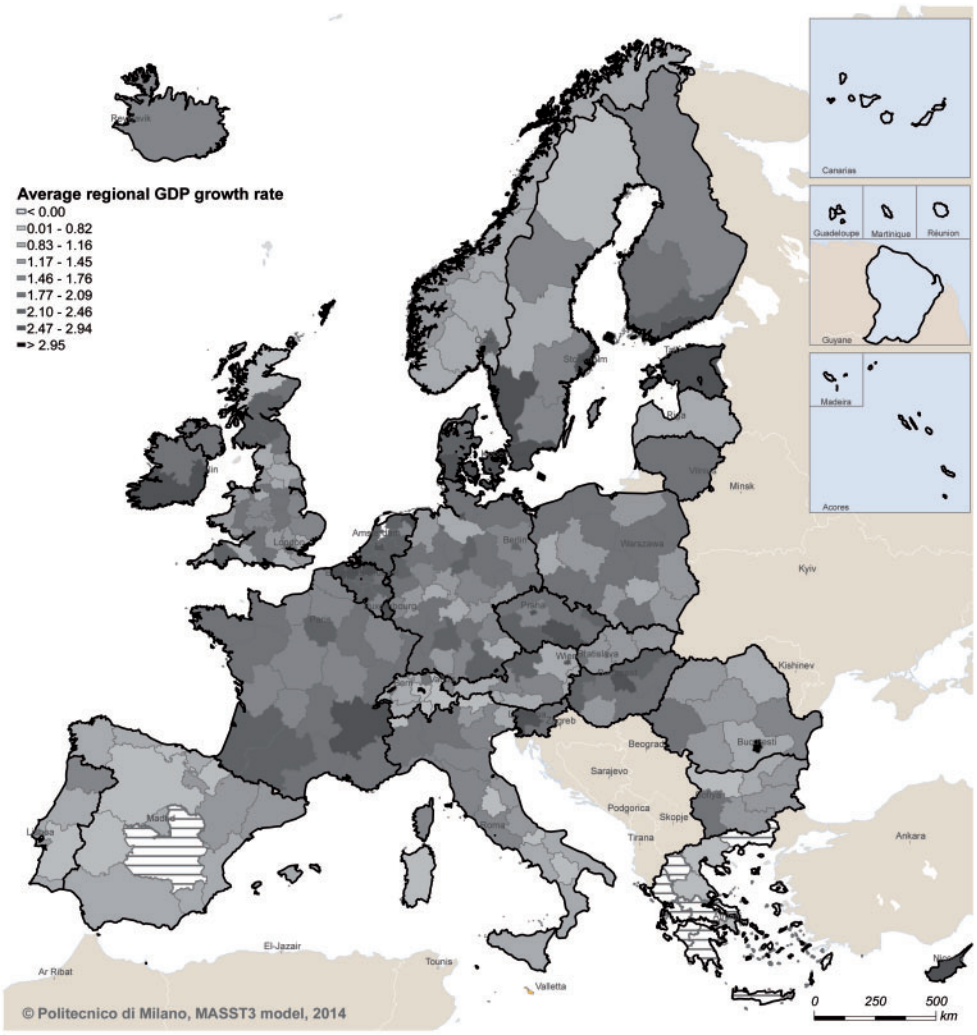

Figure 3. Average annual regional GDP growth rate, 2012–2030. Positive values are represented with increasingly darker shades of grey; negative values are instead represented with textures.

- With the crisis, convergence by the New 12 countries slows down considerably. These countries are only slightly outperforming the Western ones. This statement is spatially uneven; also within the New 12 countries, GDP growth rates are differentiated with strong metropolitan regions growing much faster than peripheral rural areas. All regions hosting capital cities experience fast growth rates (Warsaw, Prague, Budapest, Bucharest and Sofia), whereas regions with a weak urban fabric are left with very slow growth rates. Eastern European countries, on average, still grow more than Western ones; however, the differential is not sizeable enough for them to catch up with the GDP per capita levels of the Western countries by 2030.

These simulation results confirm that the crisis does have permanent effects and, considering the business-as-usual nature of the simulated scenario presented here, these results demonstrate that the 15 years of non-crisis (2016–2030) are not sufficient to fully reverse the negative trend experienced in the years of crisis (2008–2015) in the absence of significant policy changes. These years point up a striking persistence of the current slowdown of Mediterranean countries with respect to Nordic areas. This also applies to some peripheral areas in Spain and specifically in Greece, where an even negative (although modest) GDP growth rate is maintained for the simulation period as a result of both out-migration (with a consequent reduction of the size of regional economies) and poor productivity performance. Greece seems to be paying the direst cost in this scenario, and in the absence of more expansionary policies, most Greek regions will not fully recover from the current contraction of investment and consumption.

All these results testify that the growth engine, in the absence of policies able to correct the current imbalances, is insufficient to restructure the damage caused by the long period of downturn, and that the costs are distributed unevenly on the European territory.

4.2. Regional resilience: the role of cities

Figure 4 focuses on the urban settlement structure in regional economies. In fact, it presents the annual average GDP growth rate by urban settlement structure for three different periods of time: the pre-crisis period (1995–2007), the crisis period (2008–2015)

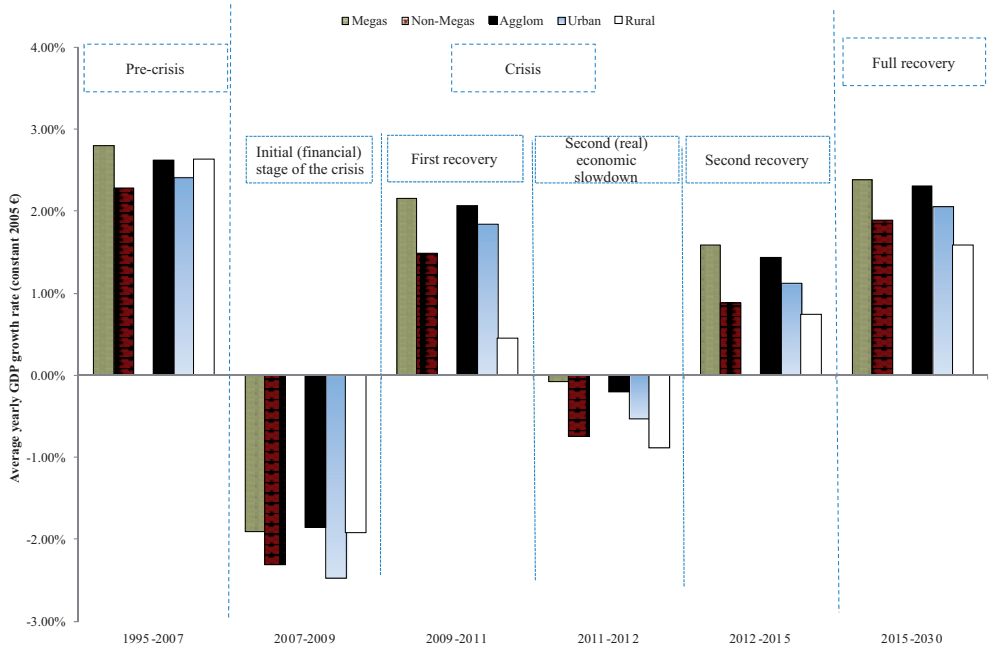

Figure 4. Annual average GDP growth rate by periods and types of regions.

and the recovery period (2016–2030); for the first period, the data are from EUROSTAT, whereas for the second and third periods the data are obtained from the simulation exercise.

As also evident from aggregate figures, the crisis that began in the summer of 2007 has been undergoing a series of relatively minor events that configure four, shorter and thus more precise, sub-periods. In fact, the initial slump halted in 2009, with a mild resumption of GDP growth in 2009–2011. In 2012, EU27 GDP was hit by a further generalized contraction, mostly due to the extension of the financial crisis to the real economy. In this period, the most dramatic consequences in terms of employment occurred. Much as in the 2009–2011 period, we also assume this slump to be partially reversed with a second minor recovery covering the period 2012–2015.

In Figure 4, each period results are presented in two blocks of histograms. First, GDP growth for MEGAs and non-MEGAs regions are shown (textured shapes in Figure 4); next, results for agglomerated, urban and rural regions are presented (black/grey shapes in Figure 4). The aim of this way of presenting the results is to highlight the different roles played by the morphological and functional aspects of the contribution of urban settlement structure to regional resilience. The theoretical expectation is that regions hosting urban areas that are not only morphologically large, but also functionally strong contribute more to regional growth. This would mean lower GDP decreases in periods of crisis and faster GDP growth in periods of expansion.

These four sub-periods have been identified on the basis of time marks suggested by macroeconomic trends. In fact, over the period 1995–2009 (for which EUROSTAT regional data are currently available), 2007–2009 is the first period of generalized GDP contraction for the EU27. By assumption (see also Section 2 above), the crisis is expected to end in 2015. Finally, 2030 is the end year of the forecasting exercise.

Figure 4 shows that, in the 1995–2007 period, MEGAs regions registered the highest performance (along with rural areas mostly located in the Eastern and Southern European countries, and therefore under the positive effects of the EU pre-accession and accession period). Agglomerated and urban areas follow with lower GDP growth rates.

During the initial crisis years, the highest loss is recorded by urban regions that can be considered as those regions characterized most by a network of second-rank cities. MEGAs and agglomerated regions, and rural ones, have instead been relatively less affected.

From the first partial recovery period onwards, a clear ranking characterizes the economic performance of these four types of regions. The best performance (i.e. the highest GDP growth rates for the 2009–2011, 2012–2015 and 2015–2030 periods) is achieved by MEGAs and agglomerated areas, which gain the most from the re-expansion of the EU's economic activity. Agglomerated and MEGAs regions are followed by urban and rural areas. This result is in line with the expectation that, because cities are the loci of productive activities, they lose more than other areas during the crisis period, but are the first to gain in the recovery period.

Finally, this analysis yields a striking result. Whatever period we analyse, MEGAs regions lose less (or gain more) than agglomerated regions. This result highlights that advantages stemming from pure urban size play a role in regional resilience, but the quality of the activities hosted and of the production factors, the density of external linkages and cooperation networks and the quality of urban infrastructure, are all factors that give greater economic resilience to cities and to the regions that host them.

An additional feature to be taken into account is the degree of concentration of such performances. In order to address this last issue, Figure 5 shows the percentages of the four types of regions described above (i.e. MEGAs, agglomerated, urban and rural) whose GDP grew faster with respect to the EU27, in each of the six periods discussed above. The horizontal dashed line shows the 50% threshold; thus, histograms above the dashed line indicate periods in which, within a given type of region, more than half of the regions grew faster than the overall EU rate. Regions falling in this area suggest a process of growth diffusion within each class; in other words, when histograms are higher than the dashed line, growth concentrates in a large number of areas of that type. Clearly, growth diffusion in one class of regions often implies a loss of relative economic performance in other areas.

An important finding from Figure 5 is the constant presence of MEGAs regions above the 50% threshold, apart from the first (2009–2011) recovery period. For all other periods, a large number of MEGAs display growth rates higher than that of the EU27, which simultaneously suggests the important role of regions of this type as growth engines, but also the large number of such areas achieving outstanding results. While MEGAs retain their crucial role as growth engines, a relatively large number of them contribute to this result, highlighting the role of modern and advanced functions as means to absorb the crisis. A less concentrated phenomenon is that of agglomerated regions. During the crisis, agglomerated regions have played a role in limiting GDP growth losses (Figure 4). However, this role has been played by less than 50% of agglomerated regions (Figure 5), which highlights that the role of agglomeration economies in generating growth does not depend only on size, but on high value

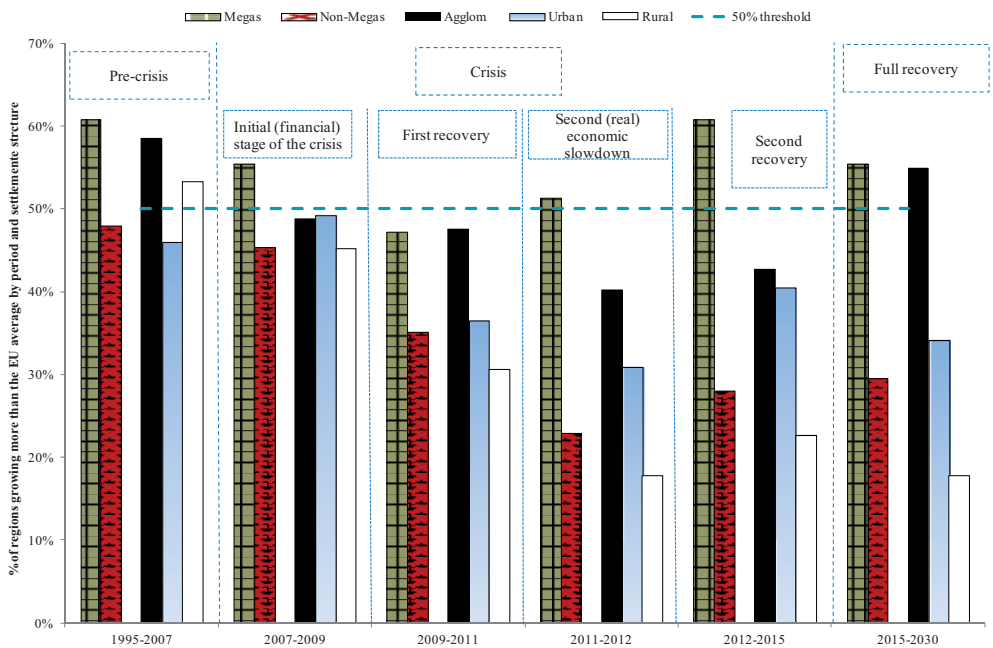

Figure 5. Share of outperforming regions with respect to EU27 by typology of regions.

functions. This result is not new in the recent literature on agglomeration economies (Camagni and Capello, 2015; Camagni et al., 2015).

Evidence has recently been emerging on the halt that the economic crisis has imposed on the long-run process of regional convergence, in terms of both GDP (Hadjimichalis, 2011) and innovation capacity (Archibugi and Filippetti, 2011). Beyond the traditional categorization of convergence processes along classic geographical boundaries (e.g. New Member States versus EU15 countries), this section follows up on the discussion of the simulation results in terms of regional settlement structure and proposes a new reading of the growing EU disparities.

To this end, Figures 6 and 7 show total Theil indices (represented with a continuous line in both figures), broken down by two main determinants, respectively, the fraction of the Theil index due to the differential economic performance of agglomerated regions and MEGAs regions, respectively, in Figures 6 and 7; in both figures, these are represented with a dotted line. In both figures the dashed line represents the fraction of the Theil index that is due to the disparities of income per capita within regions stemming from all other possible factors affecting regional disparities.

As evidenced in both figures, while overall disparities were structurally decreasing before 2007, the crisis period reversed this trend and pushed overall disparities upwards again. The largest part of EU disparities is not due to the different income levels of either agglomerated or MEGAs regions (whose scale is one order of magnitude lower than overall disparities, and can be read on the right-hand side Y-axis).

Figure 6. Total Theil index (continuous line) and its subdivision: disparities due to agglomeration characteristics (dotted line) and to all factors other than agglomeration characteristics (dashed line), 1995–2030.

Figure 7. Total Theil index (continuous line) and its subdivision: disparities due to MEGAs characteristics (dotted line) and to all factors other than MEGAs characteristics (dashed line), 1995–2030.

Taken together, Figures 6 and 7 suggest that the different incomes per capita of MEGAs regions contribute to overall EU economic disparities less than do those of agglomerated regions (as evidenced by the lower absolute Theil index due to the former type of region with respect to the latter). However, the MEGAs Theil index (dotted line in Figure 7) only flattens after a period of relatively significant growth, pointing up the relatively increasing weight of MEGAs regions in the overall disparities (Figure 7). A relatively large number of MEGAs experience fast growth rates, thus limiting possible growth *concentration* in a small number of hyper-densely populated FUAs. In contrast, agglomerated regions participate less in increasing regional disparities (Figure 6); the concentration of growth in fewer agglomerated region highlighted in the previous section can easily explain this result.

As overall disparities are expected to rise even beyond the assumed end of the crisis—in the absence of corrective measures—these results suggest the heterogeneous performance of regions within their respective types. However, these results also point up the incomplete process of forming a strong structure of second-rank cities, especially in new member-state countries and an incomplete process of re-launching efficient economic activities in rural areas, which may cause a lack of bottom–up stimulus to economic growth.

5. Conclusions

The results on the spatially variant costs of the crisis obtained in this work present elements of absolute novelty, and they have major policy implications. A general result,

which is common to a previous study of ours and to other studies in the USA (Greenstone and Looney, 2011; Capello et al., 2014a), is that, for many reasons, even assuming that the present economic crisis will end in 2015 and that GDP and employment will slowly return to faster growth rates, without ad hoc policies to correct the current regional imbalances, macroeconomic trends and policies are likely to generate asymmetric and differentiated regional impacts, especially in periods of financial turmoil and sluggish development. The restrictive macroeconomic and fiscal policies imposed on highly indebted countries exert an influence on regional disparities. These findings are very important, because they provide a clear justification for regional policies in a period of economic downturn, when structural policies may seem less urgent and appropriate than short-term demand policies (Camagni and Capello, 2015).

What is new in this article is that the simulation exercise clearly showed that the costs of the crisis have a high degree of spatial heterogeneity, especially at regional level. Our modelling efforts show that the presence of large cities in a region is associated with a higher increase (or a lower loss) of GDP growth during the crisis, which bears out that cities have greater economic resilience. However, economic resilience increases not only when the size of cities is considered, but especially according to the type of functions hosted in them; those cities with higher value-added activities, with higher quality of production factors, higher density of external linkages and cooperation networks and a better quality of urban infrastructure (the so-called MEGA cities), are those showing the highest economic resilience.

These findings contribute to provide a reply to the recent question raised whether in a period of crisis like the present one, policy makers should concentrate their limited resources in larger cities in order to fully exploit agglomeration economies, or spread their investment in a larger set of cities. This question is also linked to the debate on the best design of European cohesion policies. On this issue, there is a robust scientific debate, dealing with the way in which cohesion policies should be built. In fact, a 'paradigm shift' has occurred from a mainly redistributive logic, typical of the last Century's approach, to a development logic (Bachtler and Yuill, 2001; OECD, 2001). On the one hand, we find the long-standing position of the OECD (OECD, 2001, 2009, 2011) and the influential Barca Report to the European Commission (Barca, 2009) in favour of a 'place-based' regional policy. These policies are founded on place specificities and territorial assets, are designed in a transparent and inclusive way by local actors with the support of external institutional and economic actors (multilevel governance) and are subject to precise 'conditionalities' imposed by the Union in order to prevent local rent-seeking and monopolistic practices (Coffano and Foray, 2014; McCann and Ortéga-Argilés, 2014).

The old redistributive logic is conceptualized in the so-called space-blind strategy supported by the World Bank: this points out the superior efficiency of large metropolitan areas and the need to support them for the sake of aggregate wellbeing (Sapir et al., 2004; World Bank, 2009). This approach has been criticized for not being in fact space-neutral (Rodríguez-Pose, 2012). Market forces are no longer supposed to lead to a spatial re-equilibrium through the virtuous opposite movements of capital (towards lagging regions) and labour (towards large core cities): they are instead conducive to economic disequilibria generated by the agglomeration economies achieved in a few large cities.

The reply to the above mentioned question, that is, whether it is better to invest in large or small-medium cities, is, according to our results, the following. The most rewarding strategy would be to invest in cities where an evolutionary and innovation-oriented perspective is taken up, independently of the size of the city. In practical terms, this means that in emerging countries (like the EU CEECs) a strategy based on the provision of basic accessibility and human capital infrastructure to a larger set of cities, including both large and second rank ones, may prove as a more forward-looking one with respect to investing only in a few capital cities. In more developed countries, a strategy investing in cities with strong and qualified territorial capital assets seems to be a more promising one with respect to simply investing in large or medium cities.

Supplementary material

Supplementary data for this article are available online.

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