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THREE ESSAYS ON ECONOMIC RESILIENCE AND REGIONAL DISPARITIES

IL DOTTORE
PIETRO PIZZUTO

IL DECANO DEL COLLEGIO
Chiar.mo Prof. FABIO MAZZOLA

IL TUTOR
Chiar.mo Prof. FABIO MAZZOLA

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Introduction and Summary

Why regional resilience

One of the main research questions that motivated this Ph.D. thesis is why economies react and recover from a shock in different ways.

Studies on territorial imbalances have produced considerable efforts mainly in the analysis of per-capita income convergence (divergence). However, there are relatively few studies trying to understand how shocks may affect the long-run growth of different economies. In fact, it would be interesting to understand whether the processes of convergence or divergence happen only as a result of changes in technology and productive forces, or if they are affected by the ability to react to particular shocks. By this way, it would be possible to investigate if different degree of resilience may help in explaining the behaviours of economies in terms of per-capita income, employment and other key variables.

Neoclassical authors claim that shocks should be transitory and should have no permanent effects on the economy's long-run growth trend. However, more recent studies seem to contradict this theory. Blanchard and Katz (1992) found that shocks can affect economies growth paths. Other international studies (Cerra and Saxena, 2008; Cerra *et al.*, 2009) demonstrated that severity and persistency of shocks are associated with lower income growth rates.

Given this context, it would be interesting to understand how the resilience to shocks affects growth and development paths, as well as employment dynamics. The issue is particularly relevant for regional economies. Therefore, we mainly focus on this territorial level (NUTS 2 or TL2 level according Eurostat or OECD classifications, respectively). The focus on regions reflects their role in today's globalised world. They have assumed a growing significance because in regions are rooted the forces that lead to innovation and growth, attract investments and generate knowledge. The growing acknowledgement of the region's role as key spatial unit is clearly embedded in European Cohesion policy that aims to "capitalise on the strengths of each territory so they can best contribute to the sustainable and balanced development of the EU as a whole". By this way, recognizing that development is a localised process that depends on specific characteristics of the regions, it is appropriate to redirect the research to this territorial level.

This dissertation is composed of three papers. They collectively try to shed some light on the identification and explanation of how regions react to shocks and on the related effects on regional disparities. On the other hand, our purpose is to identify the sources of different reactions, taking into consideration that they can vary and interact among each other. To reach these goals, data on regional per-capita GDP and employment concerning European and OECD countries have been analysed.

The remainder of the thesis is organized as follows. The next section provides an outline of the concept of resilience and a brief review of the main empirical methodologies adopted, whereas the third section presents a summary of the purposes and the main results of each paper. After the introduction, the three papers that constitute the thesis are presented followed by some concluding remarks.

What is resilience

Since the outbreak of the Great Crisis in 2008, there has been a proliferation of studies in the field of regional economics trying to understand the different reaction of local units to recessions. Such reaction is often labelled as *resilience*.

The word "resilience" originates from the Latin *resilire,* which means leap back or bounce back, and it is related to the ability of a system to return in an elastic way to the starting position after a disturbance.

Although the concept has spread in economics only recently, particularly in the study of territorial disparities, it has been studied for a long time in engineering as well as in physical, psychological and ecological sciences. For example, in engineering *resilience* defines the "ability of a material to resist to particular stresses". In biology and human ecology it is used to analyse the ability to adapt and thrive in an environment under adverse conditions. In psychology, it expresses the capacity of human to cope positively to traumatic events by rearranging its resources, restoring the psycho-physical balance prior to the crisis with the opportunity to improve it.

From an economic point of view, several recent studies (Pendall *et al.*, 2010; Briguglio *et al.* 2009; Simmie and Martin, 2010; Martin and Sunley, 2013; Boschma, 2014; Hill, 2008) have tried to define the concept. Despite its recent appearance in the current debate, economists try to give a response since long time to the underlying question, namely why some economies better react and recover from particular shocks and others fail in doing it. Thus, the concept of resilience is usually used to examine the way in which economies

react to particular shocks like economic crisis. Over the last thirty years the world's major economies have suffered three major shocks: in the early eighties, in the early nineties and the current economic crisis that began in 2007-2008. In particular, the last economic crisis hit the Western economies much harder than in the past, increasing uncertainty among citizens and policy makers.

Nevertheless, despite its popularity, the debate about the concept and the exact meaning of economic resilience continues. In fact, as observed by several authors (Martin, 2012, Christopherson *et al.*, 2010; Hudson, 2010; Pendall *et al.*, 2010), there are different points of view on the specific meaning of regional (or local) economic resilience. Particularly, opinions differ on how it should be measured, on the positivity or negativity of this attribute, and on how it might affect economic policies.

Different definitions

According to Martin (2012), understanding how the various economies react to major recessionary shocks can be crucial to analyse the issue of regional long-run growth patterns and, thus, the existence, persistence and evolution of regional imbalances among regions. However, from the theoretical point of view, there is no agreement on the exact meaning of resilience and different definitions have been proposed. One of them refers to "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). Furthermore, resilience is also defined by the speed of the return to its equilibrium system after being hit by a shock (Holling, 1973), or as the ability of a system to absorb a shock without changing its structure, its functions and its identity (Walker *et al.*, 2006). On the other hand, Martin and Sunley (2013) suggest a more expansive definition of regional economic resilience as "the capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources".

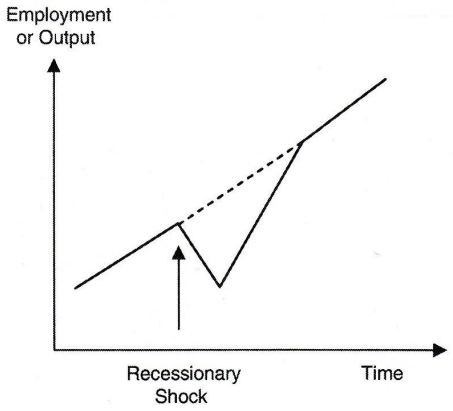
The various definitions available in the literature can be clustered in three ideal categories that, although presented separately, are not unrelated. The first is the concept of *engineering resilience* (Holling, 1973; Pimm, 1984; Walker *et al.*, 2006), that puts emphasis

on the speed of adjustment after the crisis. In particular, this concept mainly refers to the rapidity of a system to bounce back to the former position after suffering a shock. The basic idea is to consider a system able to return to the starting position activating proper adjustment mechanisms automatically (Figure 1). In this case, many authors assume that the system is in equilibrium before the shock and, therefore, this interpretation of resilience can be otherwise defined as the ability of a system to remain stable around its balance (Martin, 2012).

Pendall *et al.* (2010) point out that this approach is mainly adopted in psychological and natural disasters fields. Nevertheless, also in the economic context engineering resilience can be found. We specifically refer to the "Plucking Model" proposed by Milton Friedman (1993). Behind this model, belonging to the neoclassical growth model literature, there is the belief that any recessionary shock, however severe it may be, does not have any permanent effect on the (equilibrium) growth path of an economy. Hence, the concept of return to equilibrium after a recessionary shock, is inherent to this theoretical framework.

However, as noted by some authors, in the context of engineering resilience it is not necessary to assume that the system is in equilibrium before the shock (Fingleton, *et al.* 2012).

Figure 1 – Engineering Resilience

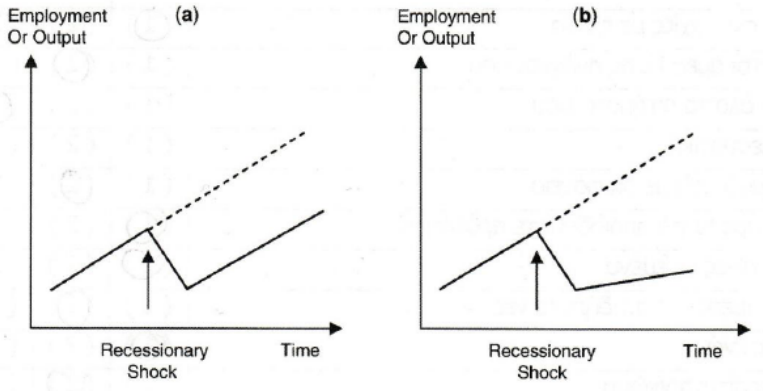


Source: Martin (2012).

Unlike the engineering interpretation, *ecological resilience* focuses on the ability of a system to absorb a disturbance before being forced to change its structure and its functions. Basically, ecological resilience puts the emphasis on the magnitude of the shock that can be tolerated before the system moves to other trajectories. In this circumstance, the concept of bounce back to pre-crisis equilibrium is not admitted. In fact, several authors have written about disequilibrium perspective as theorized by Myrdal and Kaldor, or a multiple equilibria

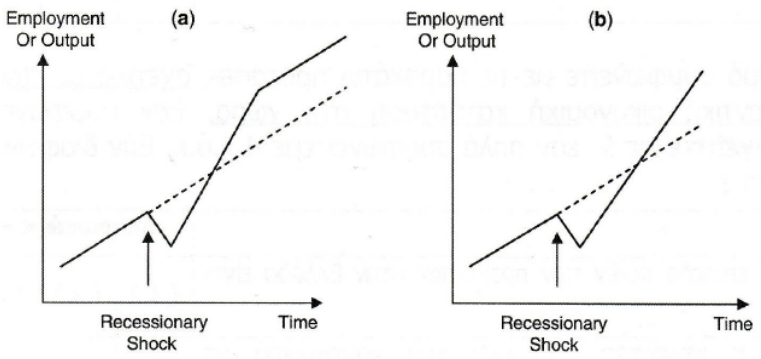
situation towards which a system can move after an adverse event. In synthesis, persistent and strong shocks can affect the development of a system. Hence, a particular system can follow different development trajectories depending on the initial conditions, the agents' expectations and the history of shocks. In this case, resilience will be higher in those systems that will respond to shocks with flexibility, which in turn depends on several aspects such as the ability of businesses to innovate and find new business opportunities, or the ability of institutions to respond in a flexible and persuasive way. In addition, the ecological perspective tries to investigate something similar to what in economics is studied under the notion of hysteresis, a term coined in physics to indicate the long lasting effects of specific events even after the removal of their cause. As a direct result, a resilient economic system in ecological terms does not necessarily have to follow a process of adjustment towards a pre-shock equilibrium, but it can follow new growth paths. However, these new paths may not necessarily be better than in the past. Figures 2 and 3 illustrate the possible post-shock paths that an economy can follow.

Figure 2 – Ecological Resilience: negative effects of crises



Source: Martin (2012).

Figure 3 - Ecological Resilience: positive effects of crises



Source: Martin (2012).

For example, after a shock it is possible that regional growth is revised downwards. This can happen in two ways. Panel (a) in Figure 2 shows a simplified situation in which the system recovers the pre-crisis growth rate but undergoes a fall in level. As a consequence, the system will be placed on a worse development path (in terms of level) than the previous one. In the second case, showed in Panel (b), besides a fall in the level there is also a decrease in the growth rate.

However, the opposite scenario, in which regional growth is revised upwards, can also take place. In particular, Figure 3 shows the case in which recovery from the shock goes beyond the simple bounce back. In fact, in this case the system reaches a higher growth path than the previous one, characterized by a constant growth rate equal to the pre-shock one. Finally, the last graph shows the most optimistic case: after a shock and the fall, the system reacts by far positively favouring a higher growth rate than before the shock.

The third concept of resilience is known in the literature as *adaptive resilience*. Economists that follow this approach argue that a system copes with various shocks depending on its ability to adapt to different conditions of the environment in which it operates. This interpretation come from the complex adaptive systems theory (CAS). It refers to dynamic complex systems with self-organizing ability in which a large number of interacting parts is able to adapt and change as a result of adverse events. In this context, the term used is robust, meaning a system that is not affected by any shock. Furthermore, the concept has been recently extended by incorporating the possibility of some changes that the system may implement to maintain or restore some performance or functionality (Martin and Sunley, 2013).

In a regional context, adaptive resilience can be seen as the ability of a region to reconfigure its structure (industries, technologies and institutions) in order to maintain an adequate level of employment as well as wealth and income growth (Martin, 2012). This view is related to the *evolutionary approach* that considers resilience as a dynamic adjustment process involving both the main structure of the economy as well as the single different components. Some authors define this process as a bounce forward rather than a bounce back towards any equilibrium (Martin and Sunley, 2013; Simmie and Martin 2010). This is the reason why resilience can be interpreted as the ability to recover in the aftermath of a shock as well as the ability to lead the development of the region towards new growth opportunities. According to Christopherson *et al.* (2010), a region can be considered resilient if it is not only successful but, at the same time, able to maintain this position in the long-run, adapting itself to the changing conditions of the environment in which it operates. For

example, the region can adapt positively to changes in consumer preferences, in national and international competition and to other shocks.

In this framework, Pike *et al.* (2010), emphasize the difference between adaptation and adaptability. The authors argue that the concept of *adaptation* can be interpreted as the ability to respond to an adverse exogenous shock bouncing back to the same before-shock path, at last improving along the same. Conversely, *adaptability* is the ability of a system to exploit new opportunities after a shock, even abandoning the previous growth path, in favour of a new one. Although these two concepts are different, what the authors tend to emphasize is that, if we consider resilience as a feature of a system, the two concepts should become complementary. By this way, resilience should not be seen as a concept that refers only to short-term goals, but as a continuous dynamic process. This would be an important implication both for industrial policies as well as for regional policy strategies.

The different views on the definitions are not the only areas of disagreement. In fact, several authors (i.e. Davoudi and Porter, 2012) argue that since social and economic systems differ from ecological, engineering, and psychological ones, resilience concepts borrowed from these disciplines are inappropriate. Some critical issues that can arise from this approach are summarized below (Martin and Sunley, 2013). For example, some authors (i.e. Dawley *et al*., 2010; Martin and Sunley, 2013) have raised the issue that in the socio-economic field, in contrast to other disciplines, the debate on political decisions taken in response to shocks, plays a fundamental role. This does not happen in the ecological sciences. Then, using the concept of resilience derived from ecological disciplines without adjustments, can alter the conclusions.

Another controversial point concerns the intrinsic positive role attributed to resilience. Generally speaking, researchers refers to this concept as a "return to normal" after an adverse event. Therefore, people often ignore what Martin and Sunley call "perverse resilience", that is the resistance to change, which tends to preserve an inefficient state of things. As previously seen, the return to normal vision is something related to the concept of return to equilibrium of neoclassical conception. In this case we are in the presence of another debated point, since hardly a socio-economic system is in equilibrium. Even more doubtful, the neo-liberal conception focuses on self-regulation or the return to equilibrium through the market, that automatically will lead economies in overcoming the shock and return to their growth path.

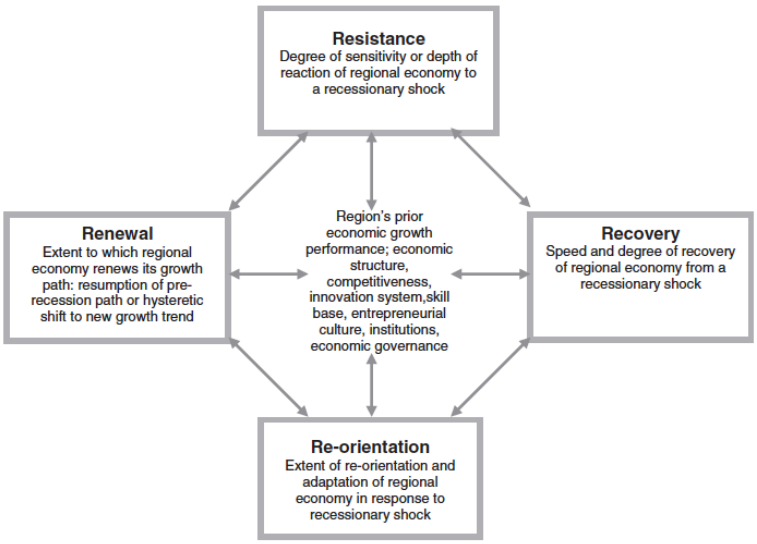
In addition, it is clear that the way in which economies react to a shock may affect their growth paths while, on the the other hand, resilience to future economic shocks, might also be affected by changes in the economic structure (Simmie and Martin, 2010).

It may be pointed out that the analysis of the resilience in general tends to consider reactions to shocks as dichotomous, meaning that an economy can react to them returning to the initial situation or moving to another state without considering that the response can be a complex mix of continuity and changes. The alternative view is considering the resilience as a complex process (adaptive approach) that admits several possible combinations.

Finally, another issue raised is the potentially low value added that the resilience concept would bring to the study of regional development and consequently to that of territorial imbalances (Hassink, 2010). In fact, some authors argue that, in this context, concepts existing in the literature, such as sustainability and competitiveness, already investigate the subjects explored by the resilience. However, even in this case, there are opposite positions. Scott (2013) or Martin and Sunley (2013) argue that, unlike other concepts in the literature, the fundamental contribution of resilience lies in carefully focusing on the impact that shocks may have on different economies (regional or local), and how this can affect the growth and development paths.

In this scenario of different approaches and concepts, Martin (2012) developed a conceptual framework that tries to summarize the different positions. According to the author, describing how regions react to a shock, at least four interrelated dimensions should be considered: Resistance, Recovery, Re-orientation, Renewal (Figure 4).

Figure 4 – The four dimension of the regional economic resilience



Source: Martin (2012).

In this framework, *resistance* is the sensitivity of an economy to a shock. Generally speaking, it is also seen as vulnerability and depends on the intrinsic characteristics of the economy. In particular, the structure of an area may play a key role in resisting to a shock (Capello and Fratesi, 2013). Examples of structural variables may be the degree of economic openness, the concentration of exports, the level of competitiveness and productivity and so on (Briguglio *et al.* 2009; Martin and Sunley, 2013). On the other hand, the term *recovery* refers to how fast a region is able to return to the pre-shock position, and concerns mainly the policy decisions after the shock. The third aspect (*re-orientation*), closely linked to the previous, relates to the extent and nature of adjustments after the shock, that is how firms, workers, and institutions adapt following the shock. Finally, the fourth situation takes into account the degree of *renewal* of the growth path that characterized the economy before the shock. In this case, the main objective is to understand if, after the adverse event, the region will return to the previous growth path or move towards a new one.

Different methodologies

Together with different concepts, different methodologies are correspondingly used to study regional resilience. To this regard, the aim of this section is to provide a brief and not exhaustive review of the main approaches used to analyse this topic.

The existing literature proposes several methods that can be clustered in the following groups. They range from qualitative analysis, making use of case studies, to descriptive analysis, which include the construction of simple or more complex indices and, finally, to more complete econometric approaches.

The first approach is used in the papers by Treado and Giarratani (2008), Simmie and Martin (2010), Wolfe (2010), Colten *et al.* (2012), Evans and Karecha (2013). Usually, the case study methodology is adopted in the context of evolutionary economic geography and consists of a narrative approach, which also uses data from descriptive statistics and interviews with specific subjects.

Another approach involves the use of simple indices or descriptive statistics. Different papers have been published using these methodologies, sometimes combined with others. In the first category we may include the contributions by Davies (2011), Martin (2012), Lagravinese (2015), Dubé and Polèse (2015). In the the second category we find the business cycle approach by Sensier and Artis (2016) and Sensier *et al.* (2016) as well as the work by Groot *et al.* (2011). In general, the main goal of this type of methods is twofold.

On the one hand, it tries to make comparisons between the local and the national performances and, on the other hand, it attempts at identifying regional differences in reaction, recovery and renewal.

In the case of complex indices, constructed with more elaborated techniques, the main goal is to define an index that can approximate the resilience of an economy starting from its inherent characteristics such as infrastructure, human capital, innovation and in general social and economic conditions. Examples of this strand of research are the contributions by Karoulia and Gaki (2013), Graziano (2013), the resilience index developed by the University at Buffalo Regional Institute, as well as the resilience index by Briguglio *et al.* (2009) at the national level, or the index of "*crisilience*" developed in Psycharis *et al.* (2014).

The widest and heterogeneous category refers to econometric approaches. A large and growing amount of research has investigated the resilience from this point of view. For example, one way is the use of SURE models to understand how regions react and recover to the same shock and over time (Fingleton, *et al.*, 2012; Cellini and Torrisi, 2014; Di Caro, 2015; Cellini *et al.*, 2016). Other papers focus on the relation between performances under the period of crisis and specific characteristic of economies. This is the case of Mazzola *et al.* (2014) in analysing NUTS-3 units with panel models, as well as Lane and Milesi-Ferretti (2011) and Rose and Spiegel (2011) with cross country regression estimations, or Petrakos and Psycharis (2015) for Greek regions and Dokic *et al.* (2016) for Croatian regions. Finally, other studies are based on dynamic counterfactual predictions and impulse-response functions (Doran and Fingleton, 2014) or analyse resilience by looking at a lower level of aggregation, such as the one referring to cities (Capello *et al.*, 2015) or firms (van den Berg and Jaarsma, 2016).

In this dissertation we adopt three different methodologies to deal with income and employment regional resilience. In the first chapter, we refer to the convergence club approach by Phillips and Sul (2007, 2009) to investigate the presence of per-capita GDP convergence between European countries and regions as well as the impact of the the Great Recession on this process. In the second chapter, we use the *local projection* approach proposed by Jorda (2005) to investigate the impact of economic downturns on within country disparities in terms of value added. At the same time, we follow the approach proposed by Auerbach and Gorodnichenko (2013) and Abiad *et al.* (2015), to study the role of the economic conditions in shaping the results. In the final paper we use the shift share analysis, both in its classic version and in a recent version with spatial effects (Espa *et al.*, 2014), to

understand the role of the regional industrial structure (*industrial mix*) and of regional competitiveness in explaining employment regional resilience to the 2008 crisis. In addition, to pay more attention to the role played by regional competitiveness in affecting the results we follow the approach by Lane and Milesi-Ferretti (2011), which consists in regressing the employment change over the crisis period, against selected competitiveness variables considered in the pre-crisis period.

Summary of the chapters

As discussed, this dissertation is organised in three chapters besides the introduction. Though independent, they have a common feature since all investigate regional resilience, specifically to the post 2008 recession (so called Great Recession). This choice gave us the opportunity to use different methodologies as well as different regional units.

Specifically, the first paper (chapter 1) aims at investigating the impact of the Great Recession on per-capita GDP convergence process across European regions and countries. To reach this goal, for the period 2000-2014, we use a time-varying factor model developed by Phillips and Sul (2007, 2009), that allows for individual and transitional heterogeneity and convergence clubs identification. Unlike the traditional neoclassical model *à la* Solow that assumes homogeneous technological progress, the approach proposed by Phillips and Sul allows for heterogeneity in technology growth rates and in the speed of convergence. In addition, unlike other approaches in which regions are grouped *a priori*, this methodology enables the endogenous determination of convergence clubs.

In this context, starting from the identification of convergence clubs, the paper provides evidence of the impact of the Great Recession by analysing the relative transition path of each club. In particular, the paper contributes to the existing literature providing further evidence to the common belief of a "multi-speed" Europe by comparing Eastern European countries and regions, with the other EU economies. The results suggest strong evidence of divergence after the Great Recession between the highest and the lowest regional convergence clubs, and a slowdown in country club convergence. Finally, since the period under consideration follows the introduction of the Euro, the paper investigates both the evolution of the convergence process after the monetary unification and the robustness of the results to the sample composition (inclusion or exclusion of the poorest countries). In this case, the findings suggest a somewhat mild evidence of convergence among the lowest

and the middle club at the beginning of the millennium, which slowed down over time turning into divergence (strong for regions, more tenuous for countries) after 2008.

These results are indeed not surprising. In the case of Europe-28, as shown by other researches, the catching up process of weak regions towards the rich ones within the Core European countries has been quite bumpy. Furthermore, the heterogeneous impact of the crisis has left a heavy legacy on the employment and social situation across the European Members, suggesting that unemployment, poverty and inequality have seriously worsened in many countries by making a return to the pre-crisis levels not foreseen before some time. Moreover, in the enlarged Europe another process seems to be in place (not yet strong, but significant): the catching up process of the poor Eastern European regions towards the peripheral regions of the Mediterranean Countries. At the same time, we show that the same process is also evident at the country level with different speeds. Finally, these results are in line with the ones contained in several studies concerning the analysis of the Euro Area imbalances. As discussed in De Grauwe (2013), in an incompletely designed Monetary Union, the endogenous dynamics of booms and busts that are endemic in capitalism could be exacerbated. In addition, in the specific case of the Euro Area, the stabilizers that existed at the national level prior to the EMU have not been adequately transposed at the monetary union level, leaving the member states fragile and unable to deal with the disturbances neither at the country nor at the regional level.

In the second paper (chapter 2) we extend the analysis of resilience both in space by looking at regions belonging to other advanced economies of the OECD countries, and in time, by considering other economic crises in addition to the Great Recession, namely those which occurred in the period 1990-2007. Among these, for example, the Nordic banking crisis of the early 1990s, as well as the economic downturns of some European countries in early 2000s after the currency crisis of the European Monetary System (EMS) and the Japanese's *Lost Decade*, the period after the Japanese asset price bubble.

The second paper focuses on countries internal inequalities in terms of value added, by investigating the impact of the crises on regional disparities and the role played by some specific regional and country conditions. The set of such variables includes, as country specific conditions, the degree of trade openness, the initial level of inequalities and the degree of fiscal decentralization. As regional conditions we consider educational, labour market efficiency and innovation regional disparities.

The methodology used in the paper to assess the impact of economic downturns on regional inequality is particularly suited to assess the dynamic response of the variable of

interest in the aftermath of a shock (economic downturns or financial shocks in our case). Specifically, to reach the identified goals we estimate two different econometric specifications. In the first part, we use the *local projection* approach proposed by Jorda (2005) and advocated, among others, by Stock and Watson (2007), Teulings and Zubanov (2014) and Abiad *et al.* (2015). This method allows the direct estimation of Impulse Response Functions (IRFs) based on local projections of the effect of downturns on regional inequalities. In the second part, to take into account the role of macroeconomic and regional conditions in shaping the response of regional disparities to economic downturns, we follow the approach proposed, among others, by Auerbach and Gorodnichenko (2013) and Abiad *et al.* (2015), which allows for interaction between shocks and economic conditions.

The analysis shows that economic downturns are associated with a significant and long-lasting reduction in regional inequality up to 2007. Conversely, it seems that the Great Recession has had, on average, a positive impact on regional disparities. The results are robust to several tests, such as different measures of inequality and different controls included in the model. Moreover, they are not affected by the spatial level of aggregation. Taking into account the severity of recessions, it seems that moderate recessions have a larger effect in reducing inequalities. At the same time, persistent crises have a larger and long-lasting effect in reducing regional disparities. Lastly, the findings suggest that the impact of economic downturns (and financial crises) on regional inequality varies with the state of the economy, both from a macroeconomic and a regional point of view.

The third and final paper (chapter 3) deals with employment regional resilience in the pre-enlargement European 15 Members. In this case, the aim of the research is to investigate how regions have reacted to the Great Recession and the causes of the different reactions, taking into account that these can be multiple and interact with each other. Specifically, we focus on the potential role of the regional industrial structure (*industrial mix*) and of regional competitiveness, by taking into account the spatial relationships between areas.

To reach these goals, we refer to two different methodologies. First, we use the shift share analysis (SSA), a traditional tool for the comparison of regional performances, both in its classic version and in a recent version with spatial effects (Espa *et al.*, 2014), to understand the contribution of the different components (National Share, Industrial Mix, Regional Shift and spatial effects), to the overall result. Second, due to the dominant role of the competitiveness effect in explaining the reaction to the last crisis, we focus on the role of pre-crisis regional competitiveness endowment. We follow the approach used in Lane and

Milesi-Ferretti (2011) which consists in regressing the employment change over the crisis period against selected competitiveness variables considered in the pre-crisis period. We try to identify the initial conditions in terms of regional competitiveness that can explain heterogeneous behaviours of regions in response to the crisis and the presence of spillover effects (taking into account residuals spatial autocorrelation). In particular, by considering that regional competitiveness arises from the interaction of different drivers, we investigate whether a better competitiveness is associated with better performances.

In this context, despite the importance given in the literature to the industrial structure, we find that the role played by the specific regional competitiveness has been dominant in the explanation of how regions have reacted to the latest economic crisis. In fact, in almost all cases, the competitiveness effect exceeds the industrial mix effect. Moreover, the results obtained using the SSA with spatial effects show that regions with "*neighbourhood advantages*" are generally those that have suffered the crisis less, highlighting the existence of virtuous regional clusters and the importance of spatial relations in determining the final result.

In addition, the paper highlights the fact that there is some correlation between the pre-crisis conditions in terms of competitiveness and the reaction to the crisis itself. In fact, the results suggest a strong correlation between labour market efficiency, innovation and specialization in high value added sectors on one side, and better response to the crisis, on the other. An unexpected role is instead played by human capital, that is negatively correlated with employment growth. In this sense, it seems that investments in education and training are not sufficient to ensure the preservation and the regain of the workplace, if not accompanied by other favourable conditions. Furthermore, it seems that the variables considered well explain the different vulnerability of the economies, but not the ability to recover. In this case, it is possible that other factors may have affected the ability of regions to recover from the crisis, like for example, the policy response of regions and countries as a consequence of the crisis. Finally, our results are also robust to different sub-samples and different estimation techniques. In particular, when we take account of the autocorrelation of residuals and estimate the appropriate models with spatial effects, we find evidence of significant spillover effects, thus confirming the importance of analysing regional phenomena by fully taking into account the spatial interactions.

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Chapter 1

IS THE GREAT RECESSION JEOPARDIZING THE EUROPEAN CONVERGENCE PROCESS?

1.1. Introduction

The European Union, as we know it, has evolved from the European Coal and Steel Union (ECSC) to the actual EU with 28 Members. The 1950 was the year in which ECSC was founded and since then the European countries and regions have been experiencing a period of unprecedented changes. Among them, the first enlargement, the Common or the Single Market, The Maastricht Treaty, the following enlargements, the different growth strategies (Lisbon Agenda, Europe 2020), the Euro, and finally the effects of the Great Recession.

From the beginning, the main strategies of the European Union have aimed at promoting integration and cohesion in order to reduce regional and territorial disparities. To do this, an increasing amount of funds has been allocated by the European Commission to less developed regions and several measures have been undertaken. Furthermore, the process of progressive integration has required greater cohesion efforts among the members.

A large and growing amount of research has investigated the effect of the integration process from different points of view. Its results suggest different conclusions mainly due to the different methodologies adopted and the different periods analysed. In particular, during the last years much debate has concerned the role of the recent crisis in affecting the results. In fact, it seems that the process of progressive integration has been truly jeopardized by the Great Recession, which impacted countries and regions in different ways and determined, also, diversified decisions by policymakers.

Within this framework, this chapter aims at investigating the impact of the Great Recession on per capita GDP convergence process among European regions and countries. To reach this goal, for the period 2000-2014, we apply the time-varying factor model developed by Phillips and Sul (2007, 2009), which allows for individual and transitional heterogeneity, and we make use of a recent algorithm developed by von Lyncker and Thoennessen (2016).

In particular, our paper contributes to the existing literature as follows. First, we add further evidence to the common belief of a "multi-speed" Europe by contrasting in our analysis Eastern Europe countries and regions behaviour vis-à-vis original European members, making direct comparisons among the two spatial levels. The hypothesis of absolute convergence among all the European regions or countries is rejected, leading us in accepting the hypothesis of club convergence. Second, we investigate the impact of the Great Crisis on the convergence process at both levels, national and regional. Our findings suggest strong evidence of divergence after the Great Recession between the highest and the lowest convergence clubs for regions, and a slowdown in country club convergence. Third, since the period under consideration follows the introduction of the Euro, we investigate the evolution of the convergence process after the monetary integration and check if the results are robust to the sample variation (or if they are led by the inclusion of the poorest countries). In this case, our findings suggest some mild evidence of convergence between the lowest and the middle club at the beginning of the millennium, which slowed over time becoming divergence (strong for regions, tenuous for countries) after 2008.

The remainder of the chapter is organized as follows. The next section provides a review of existing literature on convergence, from the point of view of both the results and the methodologies adopted. Section 3 discusses the club convergence hypothesis whereas section 4 describes the data, and presents some descriptive statistics. The methodology used is presented in section 5, whilst section 6 discusses baseline results for the club convergence hypothesis and for the impact of the Great Recession on the convergence process. Sections 7 shows the results of the robustness check using only Euro Area Members. Finally, section 8 discusses some interpretations and policy implications, whereas section 9 concludes summarizing the main findings.

1.2. Literature Review

As known, regional convergence is one of the primary objectives of the European Economic and Monetary Union. Indeed, the question of regional convergence, expressed in terms of economic and social cohesion, is mentioned in the Preamble of the Treaty of Rome.

Nevertheless, from the point of view of the results obtained, questions have been raised about the achievement of the convergence goal in the European context and conclusions are in general mixed. Most of the different results are due to the use of different methodologies, periods and units of analysis.

Theoretically, there are different opinions about the relationship between economic growth and convergence. In particular, two broad and contrasting approaches have dominated the research on this topic. Starting from the neoclassical contributions of Solow (1956) and Swan (1956), a substantial body of literature has been published claiming that, under the assumptions of technological homogeneity and identical preferences, market forces will lead to a general convergence of per-capita GDP between different economies over time. On the other hand, a considerable amount of published studies supports the opposite argument (Myrdal, 1957; Perroux, 1950, 1955; Kaldor, 1967, 1970). Specifically, due to the fact that growth is a spatially selective and cumulative process, it is highly likely that it will increase disparities in incomes that will become permanent and self-perpetuating.

During the 1980s and 1990s, a new generation of growth theories took place. We particularly refer to the Endogenous Growth Theories and the New Economic Geography (NEG) approach. Authors like Romer (1986), Lucas (1988) and Barro (1990), belong to the first area of research. In particular, they claimed that investments in human resources or in technology matter. As a consequence, they developed models in which technology is not longer seen as an exogenous variable but it is explained in the model. On the other hand, the New Economic Geography school, starting from the endogenous growth theory framework, adds the role of space as a key characteristic to take into account. In particular, Krugman (1991, 1992, 1993), and in general the followers of the NEG approach, argue that growth is likely associated with agglomeration, because it requires a minimum set of conditions to take place.

As discussed in Viesti *et al.* (2010), the above mentioned differences in theoretical paradigms are also relevant in the light of different implications in terms of economic policy. In fact, in neoclassical models, regional policy appears not very useful, since it cannot affect the growth rate of the long-run. In this case, market forces ensure the full use of resources, and thus growth, within each region. As a consequence, the perfect functioning of markets is the only mechanism that matters and regional policy may be harmful if it represents a distortion in their operation. Conversely, in the other models, an active regional policy may play a significant role on the long-run growth rate, encouraging capital accumulation, both physical and human, and promoting innovation and technological diffusion.

From the empirical point of view, different methodologies and concepts have been used to test if growth patterns of regions and nations converge or diverge. The most known concepts in this context are those of sigma and beta convergence. The first refers to a reduction of income dispersion between poor and rich economies, whilst the second refers

to the tendency of poor economies to grow at a higher pace than the rich ones. In particular, we use the term "unconditional convergence" if we assume the hypothesis that economies are considered homogeneous (in terms of saving rate, technology, population growth and depreciation rate) and converge all to the same steady-state. On the contrary, "conditional convergence" implies convergence between regions having similar structural characteristics.

From the empirical point of view, a plethora of studies on convergence has been published. Sala-i-Martin (1996) analysed 90 European regions for the period 1950-1990 and found absolute convergence at the annual speed of 1.50%. Similar conclusions are those of Geppert *et al.* (2005) who detected a speed of convergence of 2.4% for 108 regions in the period 1980-2000. Also Tondl (1997) found absolute convergence between 122 regions at a speed of 2% for the period 1975-1994. Slightly different are the results of Armstrong (1995) that identified a lower speed of convergence (1%) for 85 regions (1960-1990).

However, as pointed out by Petrakos *et al.* (2011), many other studies that do not support the convergence hypothesis have been published. For example, some of these claim the emergence of divergence as a consequence of the '70s oil crisis (Fingleton, 1997; Magrini, 1999). Other studies have found mixed results (Ezcurra *et al.*, 2003, 2007), like convergence at the country level but divergence at the regional level (Giannetti, 2002), and different results depending on the period analysed (Meliciani and Peracchi, 2006).

In addition, a growing amount of spatial econometric studies has tested convergence (Fingleton, 1999; López-Bazo *et al.*, 1999; Baumont *et al.*, 2001; Elhorst *et al.*, 2010; Battisti and Di Vaio, 2008; Ramajo *et al.*, 2008; Dall'Erba and Le Gallo, 2008; Arbia *et al.*, 2010, Brasili *et al.*, 2012; Arbia, 2014). Specifically, these empirical studies help in dealing with some of the main weaknesses of convergence analysis, particularly the spatial dependence of residuals, and in general revise downward the speed of convergence.

An alternative approach is given by those studies which refer to time series test or unit root and cointegration methods (Fiaschi and Lavezzi, 2007) or panel data models (Borys *et al.*, 2008; Fingleton and Fischer, 2010).

From the point of view of the relationship between crises and convergence in the European context, relatively scarce attention has been given in the literature to the impact of shocks on the convergence process. An exception is the work by Halmai and Vásáry (2012) that looks at the potential growth rate of European Countries, finding traces of a divergent impact of the last crisis. In addition, two of the most recent and influential works, from an international point of view, are those of Cerra and Saxena (2008), and Cerra *et al.* (2009), that look at the impact of shocks on national growth rates suggesting that countries that have

experienced severe and/or frequent economic disruption tend to have lower growth rates over the long-run.

The issue of how different economies react to crises has recently gained importance in the wake of the recent global crisis. In fact, a growing amount of empirical literature has been published under the research area of the "resilience" at the regional and country level (Fingleton *et al.*, 2012; Chapple and Lester, 2010; Di Caro, 2015; Psycharis *et al.*, 2014; Cellini and Torrisi, 2014; Martin, 2012).

As discussed earlier, this chapter tries to shed some light on the relationship between the last crisis and the convergence process. In particular, it is related to the "club convergence" literature due to the fact that we use the methodology developed by Phillips and Sul (2007; 2009). In particular, as it will be shown later, after the clubs' identification, we provide evidence of the impact of the Great Recession analysing the relative transition path of each club.

1.3. The club convergence hypothesis

In addition to the traditional concepts of beta and sigma convergence, an increasing amount of literature has recently emerged on the concept of "club convergence". This notion was originally introduced by Baumol (1986) to describe convergence among a subset of national economies and it has quickly spread at the regional level. As discussed in Bartkowska and Riedl (2012), a line of research on growth theories (Azariadis and Drazen, 1990; Galor 1996), demonstrates that economies with structural similarities may converge to different steady states if they differ in terms of initial conditions. Hence, the club convergence hypothesis, allowing for multiple steady-states, implies that economies that are similar in terms of structural characteristics converge to the same steady-state only if their initial conditions are also similar.

As argued in Alexiadis (2013), the concept of club convergence has mainly emerged from empirical observation of economic development patterns. However, it is possible to find its theoretical foundations both in the traditional neoclassical and in the endogenous growth theories.

Within the neoclassical framework, two different ways to approach the club convergence hypothesis are represented by Galor (1996) and Azariadis and Drazen (1990). Starting from the traditional neoclassical assumptions (homogeneity of preferences across economic agents, homogeneity of production functions and savings across regions, perfect

competition), Galor (1996) claims that a relaxation of these assumptions can lead to the detection of convergence clubs. Specifically, Galor (1996) suggests that, by modifying the assumption of homogeneous savings, multiple steady-state equilibria can be found. Moreover, Azariadis and Drazen (1990), starting from an empirical analysis about national economies, suggest an interpretation that allows for multiple equilibria and club convergence due to threshold externalities in human capital accumulation.

Within the framework of the endogenous growth theories several studies have instead emphasized the role of technology gaps and technology diffusion in shaping club convergence identification (Baumol, 1986; Bernard and Jones, 1996; Fagerberg and Verspagen, 1996).

Besides these two approaches, other studies emphasize the role of different characteristics or initial conditions in shaping clubs' formation. Particularly, we refer to differences in capital utilisation (Dalgaard and Hansen 2005) and capital market imperfections (Aghion and Bolton, 1996; Benabou 1994, 1996; Becker *et al.* 1990).

From the empirical point of view, other studies have found convergence clubs adopting different methodologies. Trying to not consider regions as "isolated islands", Quah (1996) developed a Markov chain model with probability transitions to estimate the evolution of income distribution. Examining 78 European regions for the period 1980-1989, Quah found four convergence clubs with their own dynamic and potential. Considering the spatial relationships relevant, Le Gallo and Dall'Erba (2003) proposed a spatial approach to detect convergence clubs using the Getis-Ord statistics. By applying this method, they found the well-known "Core-Periphery" framework at the European regional level.

By using a clustering methodology based on predictive densities, Canova (2004) found four convergence clubs over 144 European regions for the period 1980-1992. Analogously, Corrado *et al.* (2005) found no overall convergence in per-capita GDP income at the NUTS 1 level. By using a multivariate stationarity test in order to endogenously identify regional club clustering, they showed that socio-demographic characteristics as well as geographical location are relevant in clubs' formation.

Convergence clubs have emerged also by adopting the Phillips and Sul (2007, 2009) methodology, both at the country (Fritsche and Kuzin, 2011; Monfort *et al.*, 2013; Borsi and Metiu, 2015) and at the regional level (Bartkowska and Riedl, 2012; von Lyncker and Thoennessen, 2016).

Recently, Fischer and Le Sage (2014) proposed a Bayesian space-time approach to identify regional convergence clubs. By applying this procedure to 216 European regions,

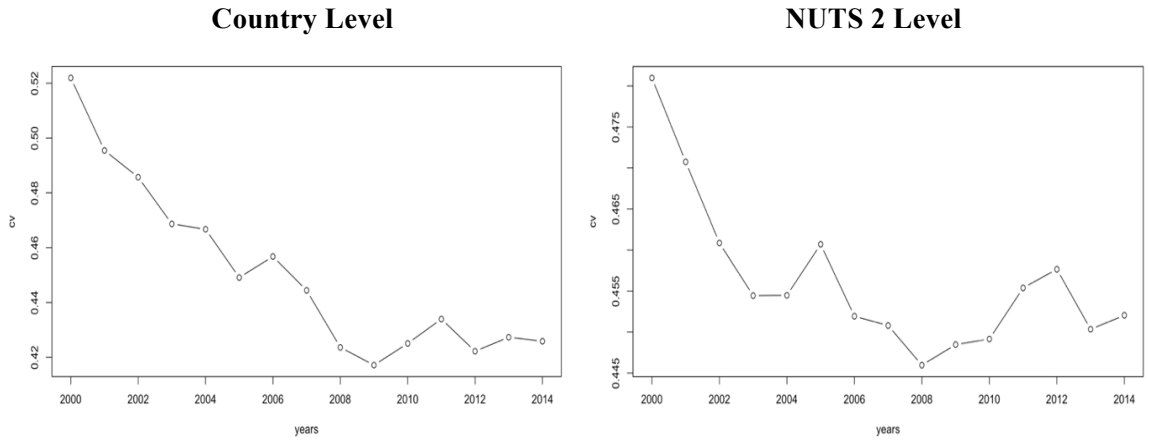
they found two clubs, providing clear evidence of some differences in long-run behaviour of the two groups.

1.4. Data and descriptive statistics

To study club convergence, we use data from Eurostat REGIO database. This dataset covers an unbalanced panel of 268 regions and 28 Countries for the period 2000-2014, namely all Europe Members (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom). Since we are interested in understanding both the presence of convergence among European economies and the effect of the Great Crisis, we refer to the Gross Domestic Product per inhabitant (per-capita GDP) at current market prices by NUTS 2 regions in Purchasing Power Standard as variable of interest[1].

Using one of the classical ways to investigate the presence of convergence among different economies, that is sigma convergence, the following results appear.

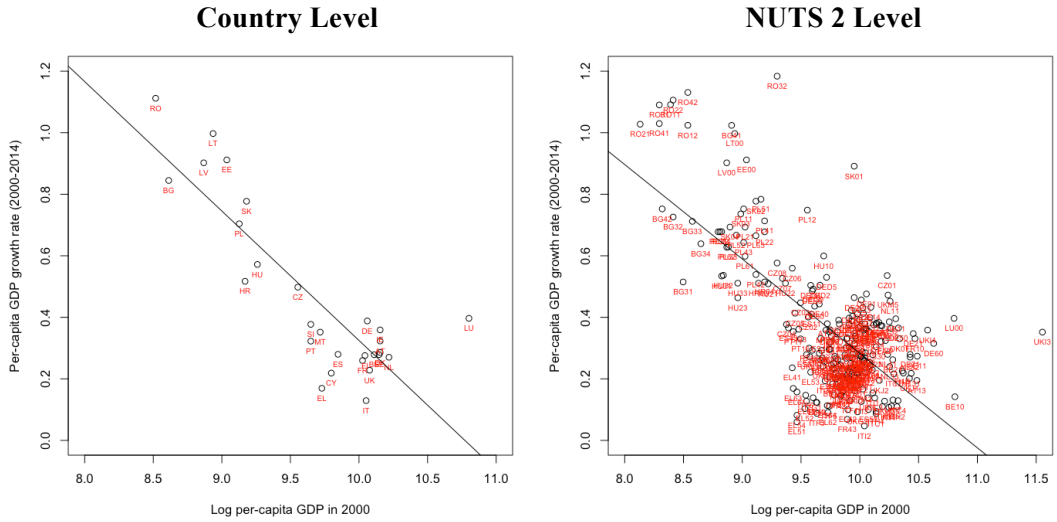
Figure 1.1 - Sigma convergence (coefficient of variation of per capita GDP)



Looking at the graphs it seems that in the fifteen years under analysis there has been a process of convergence, both at a country and at a regional level, that suddenly stops as a consequence of the Great Crisis. The evidence of convergence appears also if we take into consideration the basic case of (unconditional) beta convergence. Figure 1.2 displays the log per capita GDP in 2000 against its growth rate during the period 2000-2014.

[1] For Belgian regions, GDP values for the period 2000-2002 were estimated using their average annual growth rate of per-capita GDP on available years (2003-2014).

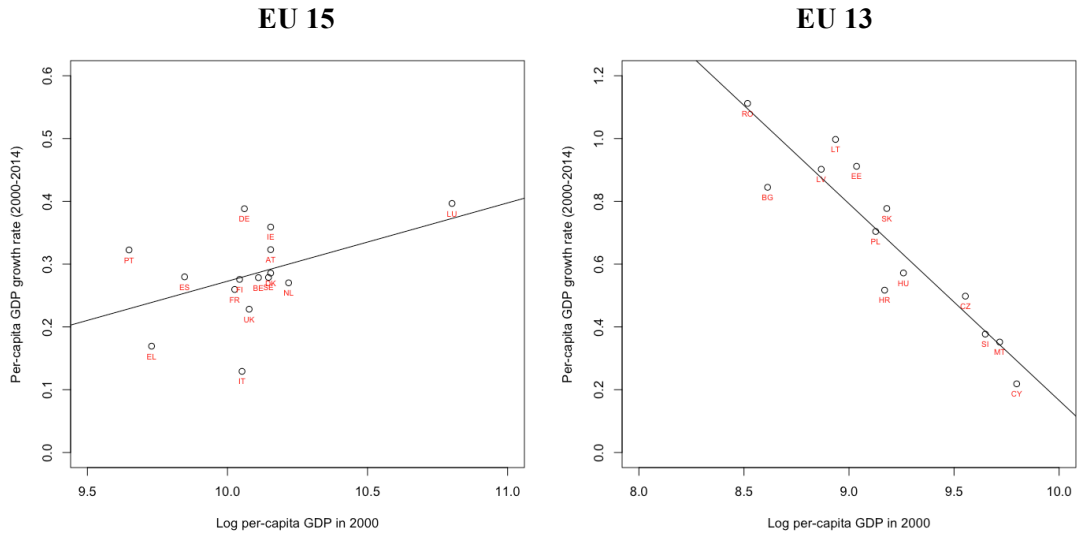
Figure 1.2 - Beta convergence (unconditional)



By inspecting the different points, it seems that there are different regimes of growth, both between and within countries. Therefore, this investigation of convergence across all European economies seems to be not sufficient.

This heterogeneity is shown in Figure 1.3, in which we distinguish the unconditional beta convergence patterns between the old and the new members of the European Union by obtaining opposite results. Namely, EU 15 members seem to be characterized by a divergence rather than by a convergence pattern (which pertains, instead, to the new member countries).

Figure 1.3 - Beta convergence: EU 15 vs EU 13



In the same way, heterogeneity within countries seems to be high. Table 1.1 shows some descriptive statistics for all European members where all values are computed as average over the period under consideration (2000-2014). In particular, the differences in the average coefficients of variation of regional GDP levels and growth rates among countries, are clear indications of heterogeneity in behaviours.

Table 1.1 - Descriptive statistics

Country	Average per-capita GDP (in Euro)	Average Growth Rates	CV per-capita GDP	CV Growth Rates
AT	29592	0.241%	0.202	0.256
BE	27634	0.197%	0.369	1.948
BG	8709	0.581%	0.359	0.521
CY	22967	0.158%	-	-
CZ	19480	0.351%	0.442	0.369
DE	27797	0.282%	0.242	0.491
DK	27629	0.191%	0.204	0.930
EE	15033	0.686%	-	-
EL	18276	0.094%	0.201	0.413
ES	22783	0.191%	0.197	0.245
FI	28668	0.197%	0.229	3.055
FR	21626	0.198%	0.269	0.340
HR	13830	0.389%	0.031	0.081
HU	13333	0.398%	0.402	0.504
IE	29520	0.247%	0.341	0.575
IT	25132	0.092%	0.258	2.670
LT	13947	0.756%	-	-
LU	60813	0.258%	-	-
LV	12713	0.692%	-	-
MT	19807	0.259%	-	-
NL	30112	0.199%	0.222	1.393
PL	12338	0.513%	0.231	0.489
PT	18541	0.248%	0.211	0.181
RO	10645	0.860%	0.500	0.585
SE	28718	0.187%	0.193	1.679
SI	20390	0.268%	0.266	0.177
SK	19020	0.574%	0.642	0.322
UK	27644	0.163%	0.629	0.688

This heterogeneity in the data is the reason why we think that a “multi-speed” Europe exists, and it is also the reason why we use the methodology described in the next paragraph to investigate the presence of convergence among European regions and countries, and the impact of the Great Crisis.

1.5. Methodology

To investigate the presence of convergence both at a regional and at a country level, we follow the methodology developed by Phillips and Sul (2007, 2009)[2]. Unlike the traditional neoclassical model *à la* Solow that assumes homogeneous technological progress, the approach proposed by Phillips and Sul allows for heterogeneity in technology growth rates as well as in the speed of convergence, bringing to convergence clubs identification. In fact, the homogenous condition seems somewhat restrictive, and fails to take into account the heterogeneity observed in the data. As mentioned by Phillips and Sul, there have been several papers which have tried to provide the right representation of endogenous technological progress suggesting different reasons. We refer, for example, to those of Parente and Prescott (1994), Benhabib and Spiegel, (1994), Basu and Weil (1998), Howitt and Mayer (2005), among others.

In the case of Phillips and Sul's more plausible assumption, technology growth rates may vary across economies and over time. Hence, the following representation of the per-capita real income y_{it} is suggested:

$$\log y_{it} = \log \tilde{y}_i^* + \log A_{i0} + [\log \tilde{y}_{i0}^* - \log \tilde{y}_i^*]e^{-\beta_{it}t} + x_{it}t = a_{it} + x_{it}t \qquad (1.1)$$

with:

$$a_{it} = \log \tilde{y}_i^* + \log A_{i0} + [\log \tilde{y}_{i0}^* - \log \tilde{y}_i^*]e^{-\beta_{it}t} \qquad (1.2)$$

where x_{it} is the (time-varying) technological progress parameter, β_{it} is a time varying speed of convergence parameter, $\tilde{y}_{i0}^*$ is the initial level in per-capita real income, $\tilde{y}_i^*$ is its steady-state level and $\log A_{i0}$ is the initial log technology.

As suggested by Phillips and Sul, it is possible and very likely that the growth path of the technological progress has some elements in common across economies (i.e. industrial and scientific revolutions and internet technology). Following this assumption, we can use μ_t to represent the common growth component of the technological growth path $x_{it}\, t$. As a

[2] All the procedures described in this paragraph are programmed in R. We are grateful to Roberto Sichera (University of Palermo) for his collaboration.

consequence, to the extent that all economies share elements or characteristics that promote growth, we can rewrite the equation (1.2) as follows:

$$\log y_{it} = \left(\frac{a_{it}+x_{it}t}{\mu_t}\right)\mu_t = b_{it}\mu_t \tag{1.3}$$

where both the component a_{it}, that describes the transitional dynamics for real effective capital, and the technological component x_{it}, are heterogeneous across individuals and over time. Using the dynamic factor formulation, $b_{it}\mu_t$, we take into account the common growth component μ_t, that may follow either a trend-stationary process or a non-stationary stochastic trend with drift[3]. In this case, b_{it} represents the transition path of the economy to the common steady-state growth path determined by μ_t.

In order to test if different economies converge, a key role is played by the estimation of b_{it}. According to the authors, the estimation of this parameter is not possible without imposing additional structural restrictions and assumptions. However, as a viable way to model this element, they propose the construction of the following relative transition component:

$$h_{it} = \frac{\log y_{it}}{N^{-1}\sum_{i=1}^{N}\log y_{it}} = \frac{b_{it}}{N^{-1}\sum_{i=1}^{N} b_{it}} \tag{1.4}$$

that can be directly computed from the data.

The coefficient h_{it}, also called "relative transition path", is obtained by dividing the per-capita GDP (in log) of region (country) *i* by the average per-capita GDP of the economies under objective. This way it is possible to remove the common steady-state trend μ_t, tracing an individual trajectory for each economy *i* in relation to the panel average.

In presence of convergence, hence, when there is a common limit in the transition path of each economy, the coefficient h_{it} should converge towards unity:

$$h_{it} \to 1, \quad \text{for all } i, \quad \text{as} \quad t \to \infty \tag{1.5}$$

[3] A particular assumption regarding the behaviour of μ_t is not necessary.

At the same time, the cross sectional variation H_{it} (computed as the quadratic distance measure for the panel from the common limit) should converge to zero:

$$H_t = N^{-1} \sum_{i=1}^{N} (h_{it} - 1)^2 \to 0 \qquad \text{as} \quad t \to \infty \tag{1.6}$$

As suggested by the authors, the relative transition path describes the relative individual behaviour as well as the relative departures of economy *i* from the common growth path μ_t.

Finally, to test the presence of convergence among different economies, the following semiparametric specification of b_{it} is proposed:

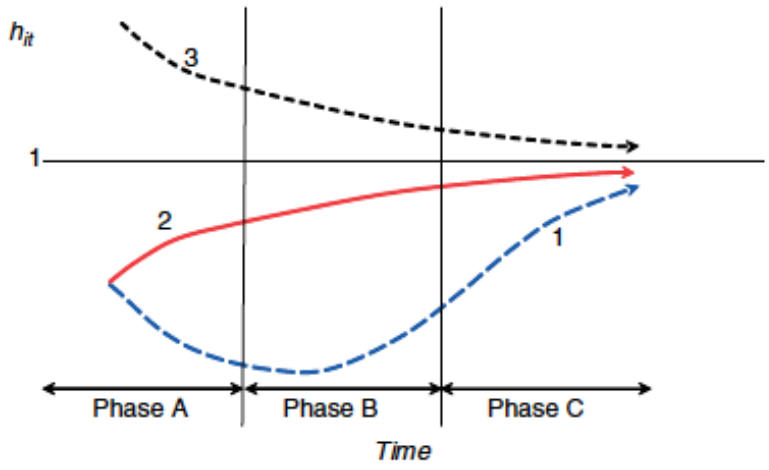
$$b_{it} = b_i + \frac{\sigma_i \xi_{it}}{L(t)\, t^{\alpha}} \tag{1.7}$$

where b_i is fixed (time invariant), ξ_{it} is i.i.d (0,1) across *i* but weakly dependent over *t*, $L(t)$ is a slowly varying increasing function (with $L(t) \to \infty$ as $t \to \infty$), α is the decay rate, or more specifically in this case the convergence rate.

The null hypothesis of convergence can be written as $H_0 : b_i = b$ and $\alpha \geq 0$ vs the alternative $H_1 : b_i \neq b$ for all i, or $\alpha < 0$.

Obviously, under H_0, different transitional paths are possible, including temporary divergence. A stylized way in which economies may converge is showed in Figure 1.4.

Figure 1.4 - Different transition paths and phases of transition



Source: Phillips and Sul (2009).

Under the previous considerations, Phillips and Sul suggest to estimate the following equation by ordinary least squares methodology:

$$\log\frac{H_1}{H_t} - 2\log(\log t) = a + \beta \log t + u_t, \tag{1.8}$$

$$\text{for } t = [rT_0], [rT] + 1, \dots, T \tag{1.9}$$

where $H_t = N^{-1}\sum_{i=1}^{N}(h_{it} - 1)^2$ and H_1/H_t is the cross-sectional variance ratio; β represents the speed of convergence parameter of b_{it}; $-2\log(\log t)$ is a penalization function that improves the performance of the test mainly under the alternative; *r* assumes a positive value in order to discard the first block of observation from the estimation, and *[rT]* is the integer part of rT[4].

At this point, the null hypothesis of convergence is tested through a one-sided *t*-test robust to heteroskedasticity and autocorrelation (HAC) of the inequality $\alpha > 0$ (using the estimated $\hat{\beta} = 2\alpha$). In particular, the null hypothesis of convergence is rejected at the 5% level if $t_{\hat{\beta}} < -1.65$.

This procedure, generally called "log *t*-test", has several advantages. For example, unlike other approaches in which regions are grouped *a priori*, this methodology enables the endogenous determination of convergence clubs. In addition, as earlier discussed and showed in Figure 1.4, under the hypothesis of convergence, different transitional paths are possible. Furthermore, the estimation of the previous equations allows to determine not only the presence of convergence ($\beta \geq 0$) but also the magnitude. In fact, following Phillips and Sul, there will be absolute (in level) convergence only if $\beta \geq 2$. Conversely, if $2 > \beta \geq 0$ there will be only relative convergence, that is convergence in growth rates. Finally, it is robust to heterogeneity and the stationarity properties of the series.

As claimed by Phillips and Sul (2007, 2009), the log-*t* regression has power against cases of club convergence. Hence, if the log *t*-test is rejected for the overall sample, the authors suggest to repeat the test procedures according to the following clustering mechanism:

[4] To this regard, Phillips and Sul suggest to use *r* = 0.3 for small sample size (T<50). This value is suggested as a result of Monte Carlo simulations. For more details, see Phillips and Sul (2007, 2009).

1. (Cross section last observation ordering): Sort units in descending order according to the last panel observation of the period;

2. (Core group formation): Run the log *t* regression for the first *k* units ($2 < k < N$) maximizing *k* under the condition *t*-value > -1.65. In other words, chose the core group size k^* as follows:

$$k^* = \arg\max_k \{t_k\} \text{ subject to } \min\{t_k\} > -1.65 \quad (1.10)$$

If the condition $\{t_k\} > -1.65$ does not hold for $k = 2$ (the first two units), drop the first unit and repeat the same procedure. If $\{t_k\} > -1.65$ does not hold for any units chosen, the whole panel diverges;

3. (Sieve the data for club membership): After the core group k^* is detected, run the log *t* regression for the core group adding (one by one) each unit that does not belong to the latter. If $\{t_k\}$ is greater than a critical value c^* add the new unit in the convergence club. All these units (those included in the core group k^* plus those added) form the first convergence club;

4. (Recursion and stopping rule): If there are units for which the previous condition fails, gather all these units in one group and run the log-*t* test to see if the condition $\{t_k\} > -1.65$ holds. If the condition is satisfied, conclude that there are two convergence clubs. Otherwise, step 1 to 3 should be repeated on the same group to determine whether there are other subgroups that constitute convergence clubs. If no further convergence clubs are found (hence, no *k* in step 2 satisfies the condition $\{t_k\} > -1.65$), the remaining regions diverge.

Due to the fact that the number of identified clubs strongly depends on the core group formation, a key role is played by the critical value c^*. The choice of this parameter is related to the desired degree of conservativeness, where a higher level of c^* corresponds to a more conservative selection. In other words, the higher is c^*, the less likely we add wrong members to the convergence clubs. Related to this, for small samples (T<50) Phillips and Sul suggest to set $c^* = 0$, that is the value also adopted in this chapter[5].

However, as the same authors suggest, a high value of c^* can lead to more groups than those really existing. For these reasons Phillips and Sul (2009) suggest a "club merging

[5] We test the robustness of our results with different values of the critical value c^* and as showed in the Appendix, conclusions are very similar and broadly unchanged to those reported in the following sections.

algorithm" to avoid this over determination. This algorithm suggests to merge for adjacent groups. In particular, it works as follows:

1. Take the first two groups detected in the basic clustering mechanism and run the log-*t* test. If the *t*-statistic is larger than -1.65, these groups together form a new convergence club;

2. Repeat the test adding the next group and continue until the basic condition (*t*-statistic > -1.65) holds;

3. If convergence hypothesis is rejected, conclude that all previous groups converge, except the last one. Hence, start again the test merging algorithm beginning from the group for which the hypothesis of convergence did not hold.

As a robustness check, in this chapter we also apply a recent club merging algorithm developed by von Lyncker and Thoennessen (2016). They introduce two innovations in the club merging algorithm by Phillips and Sul. First, they add a further condition to the club clustering algorithm to avoid mistakes in merging procedures in the case of transition across clubs[6]. Second, they propose an algorithm for diverging regions. In particular, the first algorithm works as follows:

1. Take all the groups detected in the basic clustering mechanism (*P*) and run the *t*-test for adjacent groups, obtaining a $(M \times 1)$ vector of convergence test statistics *t* (where $M = P - 1$ and $m = 1,.., M$);

2. Merge for adjacent groups starting from the first, under the conditions $t(m) > -1.65$ and $t(m) > t(m+1)$. In particular, if both conditions hold, the two clubs determining $t(m)$ are merged and the algorithm starts again from step 1, otherwise it continues for all following pairs;

3. For the last element of vector *M* (the value of the last two clubs) the only condition required for merging is $t(m = M) > -1.65$.

For the second algorithm, von Lyncker and Thoennessen (2016) claim that units identified as divergent by the basic clustering procedure by Phillips and Sul might not necessarily still diverge in the case of new convergence clubs detected with the club merging algorithm. To test if divergent regions may be included in one of the new convergence clubs, they propose the following algorithm:

[6] For further discussions on this point see von Lyncker and Thoennessen (2016).

1. Run a log *t*-test for all diverging regions, and if $t_k > -1.65$ all these regions form a convergence club (This step is implicitly included in Phillips and Sul basic algorithm);

2. Run a log *t*-test for each diverging regions and each club, creating a matrix of *t*-value with dimension $d \times p$, where each row d represents a divergent region and each column p a convergence club;

3. Take the highest *t*-value > e^* and add the respective region to the respective club and restart from the step 1. The authors suggest to use $e^* = t = -1.65$;

4. The algorithm stops when no *t*-value > e^* is found in step 3, and as a consequence all remaining regions are considered divergent.

Hereinafter, in this chapter when we refer to the algorithm by von Lyncker and Thoennessen (2016), we will implicitly consider both above mentioned procedures.

1.6. The club convergence analysis for all EU countries

1.6.1. Regional level

As discussed earlier, the aim of the chapter is twofold. The first is to investigate the presence of convergence among European regions and countries during the period under consideration, whilst the second is to evaluate the impact of the recent Great Crisis on this process.

When we apply the log *t*-test to the overall sample of NUTS 2 regions belonging to Europe-28 Countries, the hypothesis of absolute convergence among all the regions is rejected at the 1% significance level (t-value = -33.36)[7]. This means that all regions do not converge to the same steady-state. As examined earlier, the log-*t* regression has power against the cases of club convergence. Hence, after the rejection of the null hypothesis for the whole sample, we follow the recursive algorithm proposed by Phillips and Sul to verify the presence of convergence clubs. The results of this exercise are shown in Table 1.2.

[7] As suggested by Phillips and Sul (2007, 2009) log-*t* tests have been performed on time series filtered for business cycle fluctuations with the Hodrick-Prescott (HP) filter, choosing the value of 6.25 as a smoothing parameter, in accordance with the literature in this field (Borsi and Metiu, 2015; von Lyncker and Thoennessen, 2016). At the same time, robustness checks with unfiltered series have been performed and are shown in the Appendix. Also in this case conclusions are very similar and broadly unchanged with respect to those reported in this and in the following sections.

Table 1.2 - Results of the Phillips and Sul club clustering algorithm – Regional level

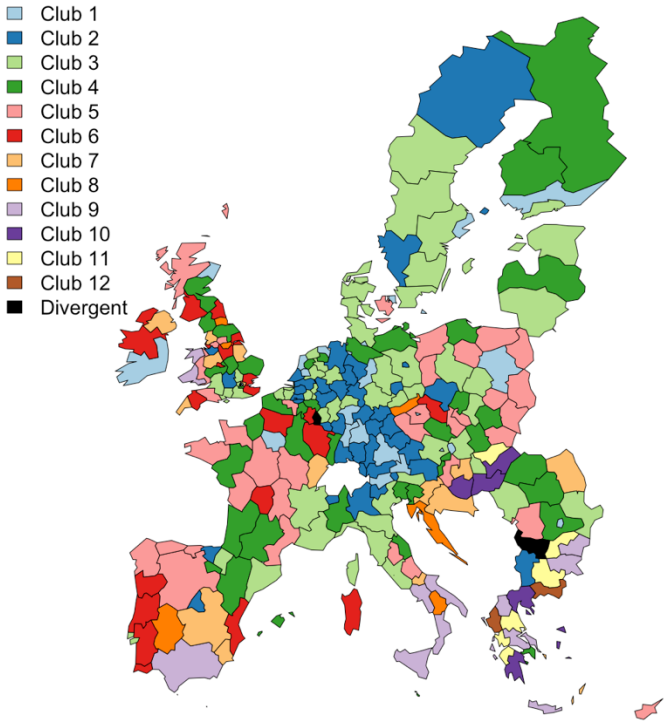
Club	n° Regions	β	se	t-stat
1	25	0.149	0.079	1.884
2	40	0.051	0.078	0.650
3	54	0.098	0.086	1.136
4	41	0.101	0.110	0.920
5	36	0.010	0.128	0.076
6	21	0.091	0.145	0.627
7	16	0.019	0.113	0.169
8	6	0.036	0.058	0.616
9	13	0.082	0.058	1.413
10	6	0.245	0.269	0.908
11	5	0.135	0.039	3.451
12	2	-0.886	1.598	-0.554

Note: Inner London (UKI3), Luxembourg (LU00), Vidin Province (BG31) are divergent regions; $c^{*}=0$.

Table 1.2 shows that the application of the Phillips and Sul algorithm yields twelve convergence clubs for which all *t*-stats are greater than −1.65 suggesting statistical significance for all β coefficients. Second, for all these clubs the hypothesis of absolute convergence among regions belonging to each group is rejected. In fact, for clubs from 1 to 11 the value of β is quite far from 2 that is the minimum value to detect absolute convergence. Hence, in these cases, the β value indicates only conditional convergence, i.e. convergence in growth rates but not in levels. Conversely, club 12 has a diverging behaviour. Third, since the hypothesis of club convergence is accepted, it means that the groups of regions detected converge to different steady-states.

A first picture of the club membership is showed in Figure 1.5.

Figure 1.5 - Convergence clubs in Europe – NUTS 2 level (268 regions)



At a first glance, it seems that the top two clubs include almost all German regions, several regions of Belgium, Austria and Sweden and in general the metropolitan areas both of Western and Eastern Countries (Région de Bruxelles-Capitale, Hamburg, Lombardia, Île de France, Praha, Southern and Eastern Ireland, Comunidad de Madrid, Groningen, Noord-Holland, Helsinki-Uusimaa, Mazowieckie, Bucuresti - Ilfov, Bratislavský - kraj). Conversely, the lowest level clubs include the southern Italian regions, the Greek regions, some of the regions of Bulgaria, Romania and Hungary.

As discussed in the methodological section, the club formation is sensitive to the choice of the critical parameter c*. In fact, looking at Table 1.2 at the Figure 1.5, it appears an over determination for the lowest clubs. To dissipate these doubts, we apply the club merging algorithm originally proposed by Phillips and Sul (2009) and as a robustness check the algorithm developed by von Lyncker and Thoennessen (2016). The results are shown in Tables 1.3 and 1.4.

Table 1.3 - Results of the Phillips and Sul club merging methodology – Regional level

Club	n° Regions	β	se	t-stat	Merging
1	25	0.149	0.079	1.884	1
2	94	-0.127	0.078	-1.617	2+3
3	139	-0.147	0.097	-1.515	4-10
4	7	0.163	0.112	1.464	11+12

Note: Inner London (UKI3), Luxembourg (LU00), Vidin Province (BG31) are divergent regions; $c^*=0$.

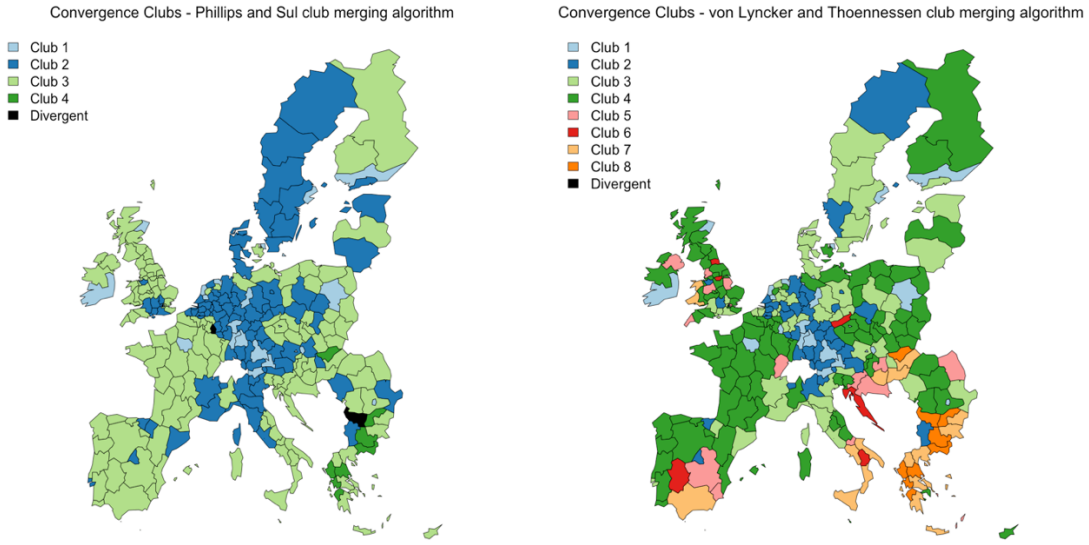
Table 1.4 - Results of the von Lyncker and Thoennessen club merging methodology – Regional level

Club	n° Regions	β	se	t-stat	Merging
1	26	-0.071	0.061	-1.176	1
2	40	0.051	0.078	0.650	2
3	54	0.098	0.086	1.136	3
4	98	0.023	0.121	0.194	4+5+6
5	16	0.019	0.113	0.169	7
6	6	0.036	0.058	0.616	8
7	19	0.033	0.007	4.832	9+10
8	8	0.042	0.091	0.462	11+12

Note: Inner London (UKI3), Luxembourg (LU00), Vidin Province (BG31) are divergent regions; $c^*=0$.

The application of the two club merging algorithms reduces the number of detected clubs to four and eight, respectively. In particular, it seems that in this case the von Lyncker and Thoennessen merging algorithm works better than that of Phillips and Sul. In fact, using the latter, only the first and the fourth groups seem to be stable convergence clubs. This is due to the fact that for club 2 and club 3 the beta coefficient is negative and the *t*-statistic is very close to the threshold level for the null hypothesis rejection. Conversely, using the most conservative algorithm of von Lyncker and Thoennessen, we find eight convergence clubs with homogenous patterns, which is a sign of greater stability. Figure 1.6 shows the club clustering results for both methodologies.

Figure 1.6 - Convergence clubs in Europe after the application of the club merging algorithms – Regional level



As shown in Figure 1.6, the main difference between the two club merging algorithms is in the aggregation of the clubs in the middle and in the lowest positions. At this regard, we believe that the results provided by the von Lyncker and Thoennessen procedure are closer to reality than the other and better describe the current differences in development among European regions.

Our findings, though not directly comparable due to different periods of analysis and different samples, are partly consistent with those of Bartkowska and Riedl (2012) and von Lyncker and Thoennessen (2016). In fact, these authors found the existence of convergence clubs' hypothesis (six and four groups, respectively), where the first club is typically composed of cities and metropolitan areas, the middle ones of the Northern and Central advanced regions, and finally the lowest clubs pertain to the peripheral regions of Western Europe members. The larger sample used in our study allows to add further interesting insights to previous research. First, we find that the metropolitan areas of some Eastern countries belong to the highest club as the metropolitan areas of the original European members. Second, the Eastern regions not necessarily belong to the lowest clubs. In fact, by considering the disaggregation provided by the von Lyncker and Thoennessen algorithm, we find that most of the regions of Slovakia, Slovenia, Poland and Czech Republic belong to the middle clubs. Third, with this disaggregation we better analyse the growth dynamics within the lowest clubs. In fact, the last club is characterised by a catch up (in growth rates) between the poorest regions of Hungary and Bulgaria with respect to several Greek regions. On the other hand, in the seventh club, the catch up concerns the richest regions of the two

Eastern above mentioned countries with respect to the lagging Italian regions (Apulia, Sicily, Campania and Calabria), Spanish regions (Andalucía, Ciudad Autónoma de Melilla) and almost all the remaining regions of Greece[8].

1.6.2. Country level

In order to have a clearer picture of the different behaviours of European economies, the natural extension of the previous paragraph is the analysis at the country level. In fact, as discussed before, several papers have been written to investigate convergence at the country level and, recently, to discuss the role of the new Members in determining the results (for the latter case see Ezcurra *et al.*, 2003, 2007; Cavenaille and Dubois, 2011). As a consequence, this extension allows us to investigate if diverse patterns are in place at different levels of spatial aggregation (for example as suggested by Giannetti, 2002). Hence, the aim of this paragraph is to try to understand what happened during the same period at the country level, by considering all European Members together.

Also in this case, by applying the log *t*-test to the 28 European Countries, the hypothesis of absolute convergence is rejected at the 1% significance level (t-value = -15.14). As a consequence, we use the recursive algorithm proposed by Phillips and Sul to verify the presence of convergence clubs also at the country level, and the results are showed in Table 1.5.

Table 1.5 - Results of the Phillips and Sul club clustering algorithm – Country level

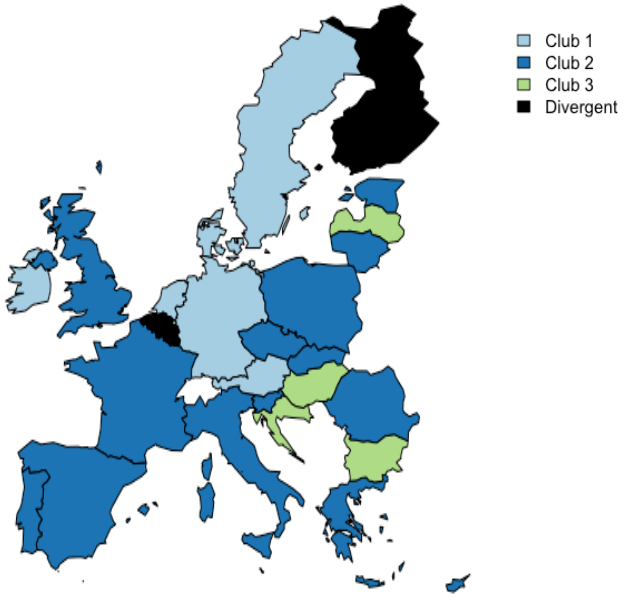
Club	Members	n° Countries	β	se	t-stat
1	Ireland (IE), Netherlands (NL), Austria (AT), Germany (DE), Denmark (DK), Sweden (SE)	6	0.010	0.244	0.042
2	Czech Republic (CZ), Estonia (EE), Greece (EL), Spain (ES), France (FR), Italy (IT), Cyprus (CY), Lithuania (LT), Malta (MT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), United Kingdom (UK)	15	0.398	0.135	2.937
3	Bulgaria (BG), Croatia (HR), Latvia (LV), Hungary (HU)	4	-0.006	0.026	-0.228

Note: Belgium (BE), Luxembourg (LU), Finland (FI), are divergent countries; c*=0.

[8] The composition of each club by NUTS 2 codes is showed in the Appendix.

In this case, we clear identify three different groups that converge towards three different steady-states. Again we find only relative convergence among the countries within the same club ($2 > \beta \geq 0$), considering the third group as a weaker convergence club (β negative but very close to zero).

Figure 1.7 - Convergence clubs in Europe – Country level (28 Members)



As showed in Table 1.5 and in Figure 1.7 the first club is composed of the richest countries of Europe, where the pace of convergence in growth rates is very small (0.5%). This is typical of advanced economies. The second group is more heterogeneous and includes the Mediterranean Countries as well as some Eastern Countries. In this case, the magnitude of the speed of convergence is higher than the previous group, highlighting a sort of catch up within this club. In particular, although only relative convergence is detected, many developing Eastern European Countries such as Slovakia, Lithuania, Estonia, Romania, grew more than the core Mediterranean Countries. Finally, the last group is composed of the poorest countries that form a weak convergence club.

Due to the fact that the club formation is sensitive to the choice of the critical parameter, we apply also in this case the two club merging algorithms discussed above, obtaining the following results (Tables 1.6 and 1.7).

Table 1.6 - Results of the Phillips and Sul club merging methodology – Country Level

Club	Members	n° Countries	β	se	t-stat
1	IE, NL, AT, DE, DK, SE	6	0.010	0.244	0.042
2	CZ, EE, EL, ES, FR, IT, CY, LT, MT, PL, PT, RO, SI, SK, UK, BG, HR, LV, HU	19	0.097	0.091	1.060

Note: Belgium (BE), Luxembourg (LU), Finland (FI), are divergent countries; c*=0.

Table 1.7 - Results of the von Lyncker and Thoennessen club merging methodology – Country Level

Club	Members	n° Countries	β	se	t-stat
1	IE, NL, AT, DE, DK, SE	6	0.010	0.244	0.042
2	CZ, EE, EL, ES, FR, IT, CY, LT, MT, PL, PT, RO, SI, SK, UK, BG, HR, LV, HU, BE, FI	21	-0.029	0.071	-0.406

Note: Luxembourg (LU), is divergent country; c*=0.

Both procedures reduce the number of the groups to two, by merging the lowest two clubs (plus two divergent regions in the case of von Lyncker and Thoennessen algorithm). In both cases, conclusions are similar. In fact, the new merged group becomes a weak convergence club due to the smaller beta coefficient with respect to the club 2 of the baseline estimation in Table 1.5. An explanation can be found in the lower growth rates of the poorest countries. In other words, both developing countries of former club 2 and those of former club 3, have had greater growth rates than the Mediterranean's ones, but on average, lower in the last case (Bulgaria, Croatia, Latvia, Hungary) than in the former (Romania, Poland, Lithuania, Estonia, Slovakia).

1.6.3. The effect of the Great Recession

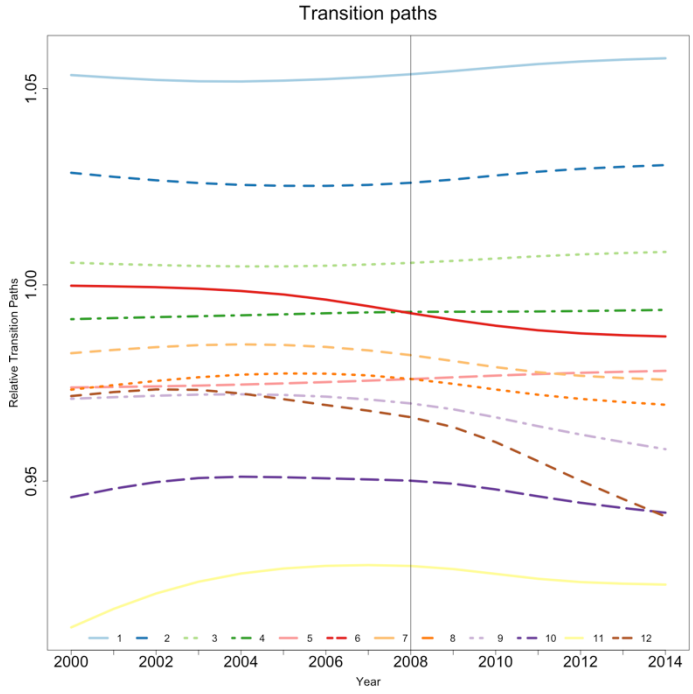
Once we have defined the club membership, we can focus on the second main question of this chapter: in which way has the last crisis modified the convergence process among European regions and countries?

To address this point we look at the transition paths of each economy as defined in section 1.5. In particular, the coefficient h_{it} embodies the economic growth relative to the average performance in a subgroup of economies (in our cases all European regions or countries). In fact, this process enables us to identify the relative transitions that occur within these subgroups measuring these transitions against the corresponding common growth trend.

By this way we are able to assess the path of each economy over time relative to a useful benchmark. As discussed in Phillips and Sul (2007, 2009), the transition curve of an economy is an individual characteristic which allows for the different ways in which a neoclassical steady state can be approached, such as the possibility of growth convergence clusters or even transitional divergence from the steady state. Obviously, it is possible to raise questions about the factors that influence the transition paths. Certainly, they depend upon political, social, cultural and economical characteristics.

We now turn to analyse the way in which the last crisis has modified the convergence process among European regions and countries. Figure 1.8 describes the relative transition paths of the basic groups detected through the application of the Phillips and Sul clustering procedure.

Figure 1.8 - Relative transition curves across clubs (Basic Algorithm) – Regional level



In particular, the lines representing each club are traced using the cross sectional means of the relative transitional coefficients for each year. Due to the fact that in presence of convergence among clubs these lines should converge towards 1, immediately, it appears a clear divergent impact of the crisis among the groups under consideration. In particular, it seems that the crisis has affected more the regions belonging to the lowest convergence clubs, than the richest ones. Further evidence of this intuition is showed in Table 1.8.

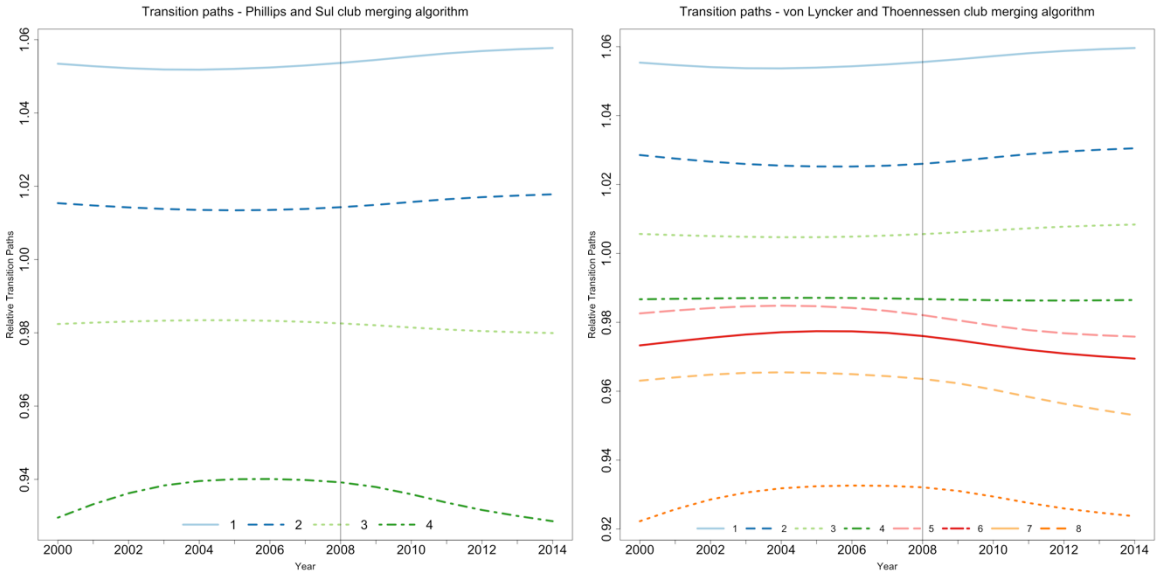
Table 1.8 - Average per-capita GDP by year (Basic Algorithm) – Regional level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	30614	41096	44540	34.24%	8.38%
2	23676	30855	33838	30.32%	9.67%
3	19713	25698	27296	30.36%	6.22%
4	17501	22895	23771	30.82%	3.83%
5	14713	19322	20389	31.33%	5.52%
6	17385	21690	21967	24.76%	1.28%
7	15625	20469	19938	31.00%	-2.59%
8	13700	18583	18400	35.64%	-0.98%
9	13831	18046	16569	30.48%	-8.18%
10	10450	15083	14017	44.33%	-7.07%
11	8160	12500	11900	53.19%	-4.80%
12	12900	17000	13850	31.78%	-18.53%

The table shows that the first five clubs have not been affected, or have completely recovered, from the recent crisis. In fact, the average per-capita GDP for these clubs in 2014 is well above the respective value in 2008. For club 6 the 2014 value is slightly above the 2008 value, suggesting weak recovery and heterogeneous behaviours within. Finally, for the lowest clubs (from 7 to 12) it is clearly observable that the fall in per-capita GPD has not been recovered yet. Furthermore, it seems that, in some cases, the divergence pattern started one or two years before the crisis, but it is also evident that the crisis has accelerated this process.

These findings are confirmed, even more clearly, when we apply the club merging procedures as described in previous sections.

Figure 1.9 - Relative transition curves across clubs (with club merging algorithms) – Regional level



The divergence among the clubs caused by the recent economic crisis is more evident in Figure 1.9. In particular, as discussed earlier, though the divergence is noticeable in both graphs, we believe that the specification of von Lyncker and Thoennessen (2016) is preferable due to more stability (homogeneity) in clubs' formation. Tables 1.9 and 1.10 present the results for the average per-capita GDP in the two cases.

Table 1.9 - Average per-capita GDP. Phillips and Sul club merging methodology – Regional level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	30614	41096	44540	34.24%	8.38%
2	21400	27893	30080	30.34%	7.84%
3	15734	20532	20855	30.49%	1.57%
4	9514	13786	12457	44.90%	-9.64%

Table 1.10 – Average per-capita GDP. Von Lyncker and Thoennessen club merging methodology - Regional level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	31325	42065	45635	34.29%	8.49%
2	23676	30855	33838	30.32%	9.67%
3	19713	25698	27296	30.36%	6.22%
4	16452	21324	22142	29.61%	3.84%
5	15625	20469	19938	31.00%	-2.59%
6	13700	18583	18400	35.64%	-0.98%
7	12763	17111	15763	34.07%	-7.88%
8	8938	13000	11925	45.45%	-8.27%

In particular, with both methodologies the lowest groups show a lower per-capita GDP in 2014 respect to 2008. An exception is represented by club 3 in the Phillips and Sul club clustering methodology, where the 2014 value is just slightly greater than the 2008 one. This may be due to the fact that this group is not a stable one because of the presence of transition across clubs. Therefore, we have preferred the breakdown suggested by the application of the von Lyncker and Thoennessen algorithm. However, even considering the former procedure, the different magnitude in the recovery between the first two clubs and the third, strongly confirm the divergent impact of the crisis.

Moving to the country level, we obtain the following results for the basic club formation (Figure 1.10, Table 1.11).

Figure 1.10 - Relative transition curves across clubs – Country level

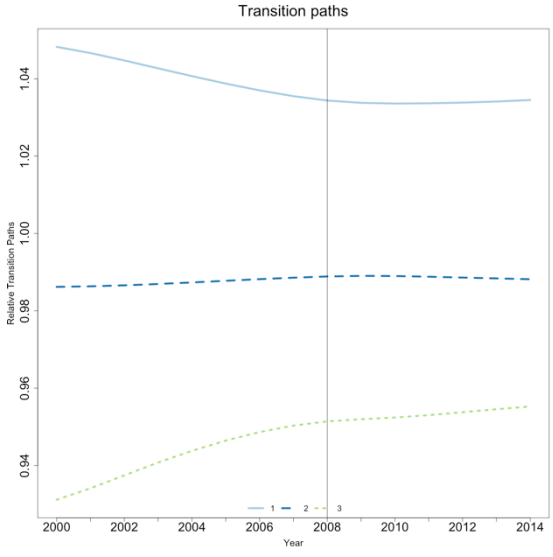


Table 1.11 – Average per-capita GDP by year (Basic Algorithm) – Country level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	25567	32933	35300	28.81%	7.19%
2	15073	21840	22687	44.89%	3.88%
3	8175	14975	16250	83.18%	8.51%

In this case, we clear identify three different groups that converge towards three different steady states. Therefore, it seems that the distance between the richest and the poorest clubs was narrowing before the crisis, while, after the Great Recession, the pace of this convergence among steady states has suddenly slowed down. Results obtained considering the merging algorithms previously discussed, do not change our findings (Figure 1.11, Tables 1.12 and 1.13).

Figure 1.11 - Relative transition curves across clubs with merging algorithms – Country level

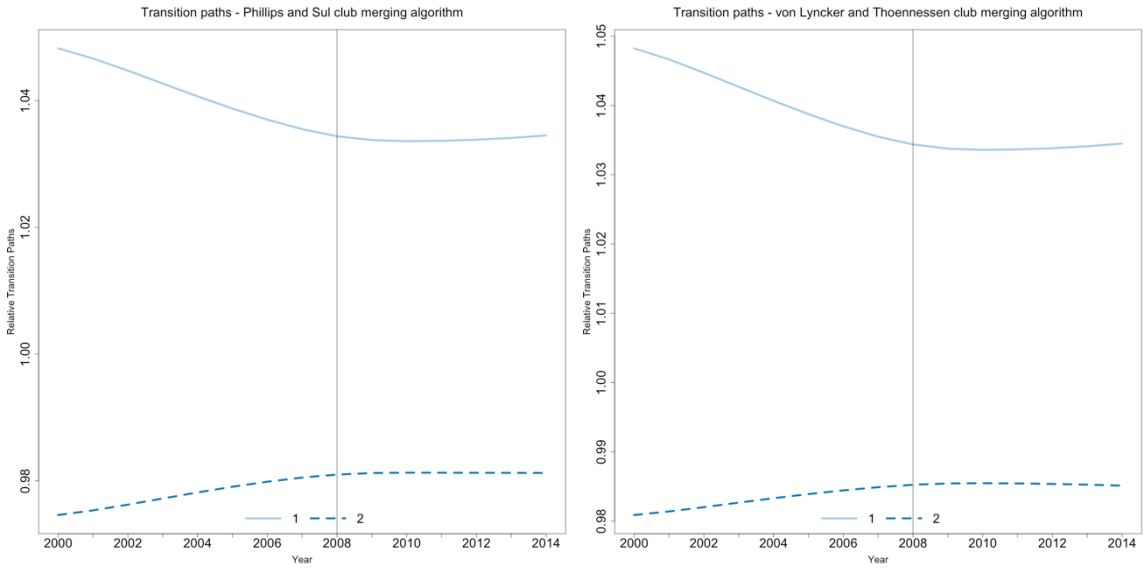


Table 1.12 - Average per-capita GDP. Phillips and Sul club merging methodology – Country level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	25567	32933	35300	28.81%	7.19%
2	13621	20395	21332	49.73%	4.59%

Table 1.13 - Average per-capita GDP. Von Lyncker and Thoennessen club merging methodology – Country level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	25567	32933	35300	28.81%	7.19%
2	14590	21338	22290	46.25%	4.46%

Also, at the country level, the tables and figures presented confirm the well-known "Core-Periphery" pattern advocated by Krugman (1991) and, among others, by Leonardi (1993), Baldwin and Forslid (2000), Bachtler *et al.* (2014), Magone *et al.* (2016). In this case, our results detect a sort of catching up pattern within the "Periphery" (greater growth rates in Eastern countries than in Mediterranean ones, also considering the crisis period), but no trace of convergence between Core and Periphery after the recession. This means that a share of the gains in per-capita GDP convergence has been lost over the past years because of the Great Crisis.

Our results, either from the regional or the national point of view, should not be surprising. In fact, as the previous research has shown, the catching up process of weak regions on the rich ones within the Core European countries has been quite bumpy (Viesti *et al.*, 2010). In addition, as documented in detail in the 2014 Eurostat report "Employment and Social Developments in Europe", the Great Crisis has left a heavy legacy. In particular, this report underlines the heterogeneous impact of the Great Recession on both economic and social context across the European Members, suggesting that unemployment, poverty and inequality have seriously worsened in many countries and a return to pre-crisis levels is not foreseen before some time. Finally, in the enlarged Europe another process seems to be in place (not yet strong, but significant): the catching up process between the poor regions of the weakest Eastern Countries with respect to the peripheral ones of the Mediterranean countries. This is also evident at the country level with a different speed.

1.7. Some robustness checks

Since the methodology used could be sensitive to the sample used, as a robustness check we have tried to restrict the analysis to the Euro area. In this case our aim is twofold. First, we want to evaluate what happened in terms of convergence within the Euro area just after the introduction of the common currency. Second, we are interested in investigating

whether the results are driven by the Eastern countries and regions that joined EU core members only recently. This is why, as discussed before, the coefficient h_{it} is computed by taking into consideration the average performance in a subgroup of economies. When the benchmarks are changed, the relative path of each economy over time could change and, as a consequence, lead to different conclusions.

When we apply the log *t*-test to the regions belonging to Euro Area countries, the hypothesis of absolute convergence among all the regions is rejected at the 1% significance level (t-value = -166.93) like in the previous case. As a consequence, the regions do not converge to the same steady-state and we repeat the analysis following the recursive algorithm proposed by Phillips and Sul. The results are shown in Table 1.14.

Table 1.14 - Results of the Phillips and Sul club clustering algorithm (Euro Area) – Country level

Club	n° Regions	β	se	t-stat
1	14	-0.296	0.022	-13.520
2	20	0.274	0.170	1.621
3	13	0.083	0.019	4.362
4	31	0.065	0.069	0.941
5	70	-0.328	0.069	-4.757
6	9	0.867	0.058	15.095
7	8	-0.341	0.117	-2.928
8	2	-0.886	1.599	-0.554

Note: Luxembourg (LU00), is divergent region; c*=0.

In this case we find eight convergence clubs, so eight different steady states towards these clubs converge. Unlike the EU 28 case, for three groups detected (club 1, 5 and 8) the *t*-value is less than the threshold level of -1.65. Hence, the beta values found are not statistically significant. Furthermore, we find significant relative convergence for clubs 2, 3, 4 and 6, whereas divergence for club 8.

As in the previous case, we apply both club merging algorithms obtaining the same results. They are shown in Table 1.15.

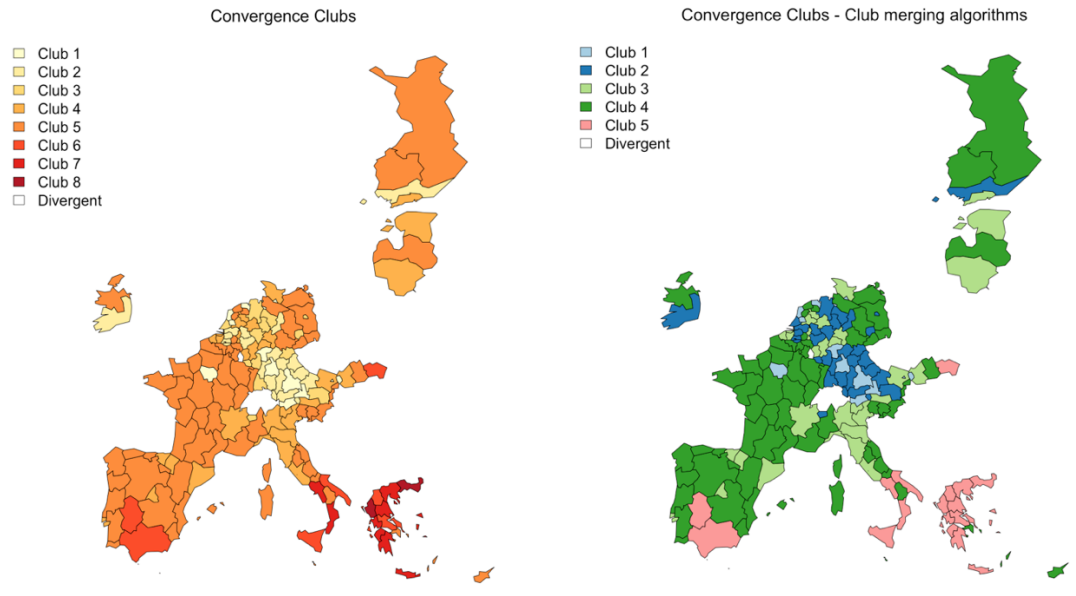
Table 1.15 - Results of the club merging methodologies (Euro Area) – Regional level

Club	n° Regions	β	se	t-stat	Merging
1	14	-0.296	0.022	-13.520	1
2	33	-0.173	0.123	-1.401	2+3
3	31	0.065	0.069	0.941	4
4	70	-0.328	0.069	-4.756	5
5	19	0.095	0.132	0.719	6+7+8

Note: Luxembourg (LU00), is divergent region; c*=0.

Here, the application of the club merging procedures reduces the number of the clubs to five, where only the third and the fifth have a positive β value and a statistically significant convergence in growth rates. For the remaining groups, the β coefficient is negative reporting divergence within these groups, statistically significant only for club 2. The membership of each region according to the two procedures (baseline and club merging algorithms) can be observed in Figure 1.12.

Figure 1.12 - Convergence clubs in the Euro Area – Regional level



PANEL A **PANEL B**

When reducing the sample to the Euro Area regions, we observe more homogeneous regional clusters. In particular, the membership of poor regions of Mediterranean Countries

to the lowest clubs is confirmed also in this case. The first clubs (from 1 to 3 in Panel A and 1 & 2 in panel B) are mostly composed of regions belonging to Germany, Austria and Belgium. The middle clubs are composed of French as well as Finnish regions and of the richest regions of Mediterranean Countries.

We tested the robustness of our results also at the country level. In this case, both the basic clustering algorithm and the club merging methodologies indicate the same results (i.e. no reduction in number of clubs unlike the EU 28 case). They are reported in Table 1.16.

Table 1.16 - Results of the Phillips and Sul club clustering algorithm (Euro Area) - Country level

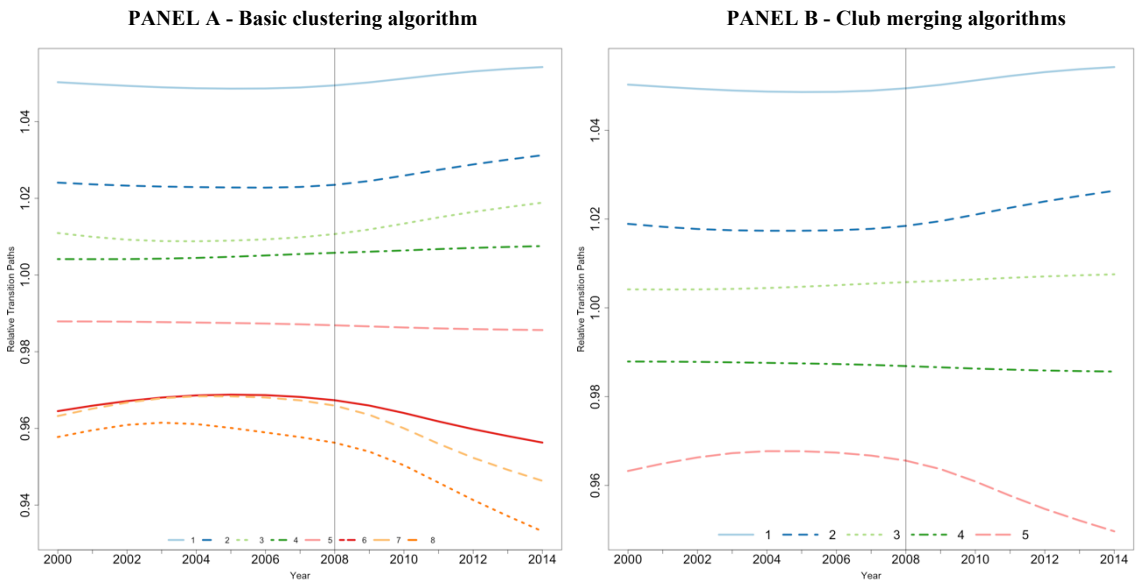
Club	Members	n° Countries	β	se	t-stat
1	IE, NL, AT, DE	4	0.228	0.301	0.758
2	EE, EL, ES, FR, IT, CY, LV, LT, BE, MT, PT, SI, SK, FI	14	-0.012	0.008	-1.501

Note: Luxembourg (LU), is divergent country; c*=0.

Also in this case, the hypothesis of absolute convergence among all the EMU countries is rejected at the 1% significance level (t-value = -38.92). In particular, we find again the well-known framework "Core-Periphery" or the "two speed" Euro Area, where the first club seems to be a strong convergence club, though in a relative sense. On the contrary, for the second group the log-*t* test does not reject the null hypothesis of convergence, but we detect a rather weak evidence of convergence.

At this point, to complete our robustness check analysis, we should look at the impact of the crisis. Again, we refer to the coefficient h_{it} which embodies the economic growth relative to the average performance of regions and countries inside the EMU. In particular, when we refer to EMU regions, we obtain the following results.

Figure 1.13 - Relative transition curves across clubs (Euro Area) - Regional level



As we can easily understand by looking at Figure 1.13, we find strong evidence of divergence among clubs after the Great Recession. Specifically, the transition curves indicate some mild evidence of convergence at the beginning of the millennium between the lowest and the middle clubs, which slowed down over time becoming strong divergence after 2008. In fact, one of the most visible results displayed in the Panel B of the graph is the magnitude of the divergence from the others of the last club, composed mainly of Greek regions, as well as of Southern regions of Italy and Spain. This intuition is also confirmed by looking at the values of per-capita GDP showed in Tables 1.16 and 1.17.

Table 1.16 - Average per-capita GDP by year in the Euro Area (Basic algorithm) – Regional level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	33454	43507	46600	30.05%	7.11%
2	25533	33040	36930	29.40%	11.77%
3	22692	29285	32608	29.05%	11.35%
4	21814	28319	29287	29.82%	3.42%
5	18031	23073	23469	27.96%	1.72%
6	14356	19122	17411	33.20%	-8.95%
7	13763	18888	15863	37.24%	-16.02%
8	12900	17000	13850	31.78%	-18.53%

Table 1.17 – Average per-capita GDP by year in the Euro Area (Club merging methodologies) – Regional level

Club	2000	2008	2014	Δ% 2008/00	Δ% 2014/08
1	33454	43507	46600	30.05%	7.11%
2	24414	31561	35227	29.27%	11.62%
3	21814	28319	29287	29.82%	3.42%
4	18031	23073	23469	27.96%	1.72%
5	13953	18800	16384	34.74%	-12.85%

Moving to the country level we obtain the following results.

Figure 1.14 - Relative transition curves across clubs in the Euro Area – Country level

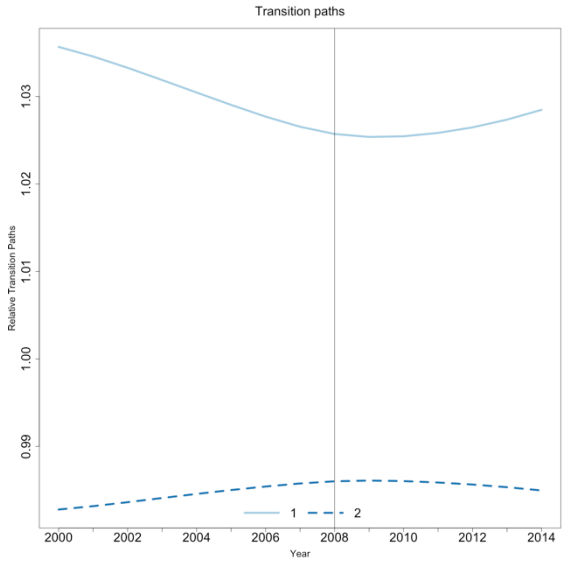


Table 1.18 – Average per-capita GDP by year in the Euro Area - Country level

Club	2000	2008	2014	Δ% 2008-00	Δ% 2014-08
1	25550	33250	35925	30.14%	8.05%
2	16243	23250	23807	43.14%	2.40%

The divergent impact of the Great Crisis is strongly evident in Figure 1.14 and Table 1.18, where the weak signal of convergence among the two clubs found before the crisis has been interrupted in 2008.

Our results confirm other studies on Euro Area imbalances (among others, De Grauwe, 2011; De Grauwe and Yuemei, 2012; Cesaratto, 2012; Alessandrini *et al.*, 2012). As discussed in De Grauwe (2013), the endogenous dynamics of booms and busts that are endemic in capitalism could be exacerbated in a not well-designed Monetary Union. In addition, in the specific case of the Euro Area the stabilizers that existed at the national level prior the EMU have not been adequately transposed at the monetary union level, leaving the member states fragile and unable to deal with the disturbances neither at the country nor at the regional level.

1.8. Interpretations and policy implications

The deepening disparities in Europe and the need for a radical alternative to the recent policies decisions have been widely investigated in the last decade. The persistency of such inequalities have raised questions about the sustainability of the actual development pattern, and the effectiveness of the policies aiming at reducing territorial differences. Moreover, the enlargement to Eastern European Countries has highlighted the difficulties in managing an ever more dissimilar continent (i.e. in terms of local assets endowments, institutions, labour costs, etc.).

The recent crisis seems to have affected regional and national disparities. As shown in the previous sections, our findings suggest a clear and strong divergent impact of the Great Recession on the convergence process among the European regions. We have obtained the same results, though less remarkable, at the country level.

The fact that we detect a divergent impact of the Great Recession also at the country level is something new. As suggested by our results, and found in other studies (i.e. Capello and Fratesi, 2013), national disparities were narrowing before 2008. This was mainly due to the decrease in between countries disparities, in spite of a slow (but constant) increase in within countries differences.

In particular, our results suggest that two different processes seem to be in place. Considering the average behaviour of the detected groups, we find a slowdown in convergence among clubs after the crisis. On the other hand, our results suggest a "multi-speed" catching up pattern within the "Periphery" also considering the crisis period (greater growth rates in Eastern countries than in the Mediterranean ones). Specifically, the group composed of Romania, Poland, Lithuania, Estonia, Slovakia has shown higher average growth rates than the the group composed of Bulgaria, Croatia, Latvia, Hungary.

At the regional level, the divergent impact of the Great Recession is more evident. This means that less advanced regions have been hit much harder than the more developed ones. Why this happened? Further research should be conducted to answer this question. In this paragraph we offer interpretations of the results obtained.

One possible reason may be related to the role played by the globalization process. In fact, by making regional economies more open, this process may have made regions more exposed to external shocks. In addition, as discussed in Capello and Fratesi (2013), the increasing integration process may have resulted in a worsening of regional disparities due to a fiercer competition. In this context, the specific characteristics of the regions assume greater importance suggesting another possible explanation of the divergent impact of the Great Recession. In fact, the heterogeneous impact of the crisis may be related to different endowments in specific local assets, both material and immaterial. The rationale is that, less advanced regions usually tend to have less endowment in context and institutional variables than the most developed ones and such disparities may cause a different vulnerability of each territorial unit. This is also the reason why, in the third chapter of this thesis, we conduct a different analysis to understand if there are relationships between pre-crisis regional competitiveness and employment reaction to the Great Recession.

Another possible source of regional divergence is the well documented increase in income inequality in the last three decades. In fact, income and wealth inequality spread like an endemic disease, causing everywhere economic, social and political failures. It has been a global phenomenon, in which the distance between riches and poor is still creating permanent divisions among different social groups. When wealth is too concentrated at the top of the distribution, aggregate demand begins to fall, jeopardizing the stability of the economic system, and in particular of the weakest economies.

An additional cause can be related to the distortion in the use of regional policy. As it is well-known, the main goal of the Structural Funds is to promote economic and social cohesion and to reduce disparities within the European Union. Numerous papers have been published to discuss their role in enhancing growth, but few researches have been conducted to investigate their possible role in making regions able to response to crises. As discussed in Rodriguez-Pose and Fratesi (2004), European regional support has grown in parallel with European integration, but it is not clear if it has worked properly (Boldrin and Canova, 2001; Viesti *et al.*, 2010). In this context, it seems that the way in which regional policymakers manage the Funds may play a key role. Further investigations on this point are needed.

From an *ex-post* point of view, another policy that certainly has had an effect is the package of austerity measures. The Stability and Growth Pact (SGP), recently modified in 2011 after the European sovereign debt crisis, goes in this direction. Recent researches on the impact of austerity measures on personal income inequality (Ball *et al.* 2013) and on regional disparities (Agnello *et al.*, 2016) show how fiscal consolidations have significant distributional effects, raising personal inequality and territorial disparities, at the same time decreasing wage income shares and increasing long-term unemployment. Although these studies are referred to a period prior the latest crisis, the policy implications are clear. Furthermore, another reason why austerity policies have probably affected more the peripheral regions is that most firms located in these areas mainly sell to local markets. In such conditions, the reduction in public spending reduces demand generating, consequently, lower profits, investments and employment. In addition, "Quantitative Easing" policies without fiscal stimulus may have determined a "liquidity trap", that means a situation in which monetary policies and the reduction in interest rates are not able to raise the demand for goods, consumption and investments. In this context, there is a room for coordination of industrial policy with fiscal and monetary policies.

Finally, imbalances in the Euro Area are well-known. The discussion on optimal currency areas has increased after the crisis. Critics claim that the Euro Area is not an optimal currency area and therefore that asymmetric shocks cannot be absorbed properly. In fact, countries that joined the EMU lost one of the main options to face shocks i.e. currency depreciation. In a context in which fiscal policies are marginal, alternative mechanisms of adjustment are migration and internal wage devaluation. Both options usually tend to damage more peripheral economies.

As a consequence of the discussed points, we believe that policy interventions should be specifically tailored to the conditions of different regional economic and institutional environments. As discussed in Rodriguez-Pose (2013), the "one size fits all" approach should be overcome. This require an in-depth understanding of local conditions and an assessment of the feasibility of different types of intervention. Policymakers should not miss this point if they want to pursue the success of policy reforms.

1.9. Conclusions

The process of European integration may have been truly jeopardized by the Great Recession, as perceived by many analysts just after the outbreak of the crisis.

In this chapter, using a time-varying factor model that allows for individual and transitional heterogeneity, we have investigated the presence of convergence among European economies and the impact of the Great Crisis on this process.

In particular, we find that the hypothesis of absolute convergence is rejected both at the regional and at the country level for EU 28 in the period 2000-2014. In detail, at the regional level we find the existence of several convergence groups with the following characteristics. The first club is typically composed of cities and metropolitan areas both of Western and Eastern countries; the middle clubs are composed of regions belonging to Northern and Central advanced countries and the majority of regions of Slovakia, Slovenia, Poland and Czech Republic; while the southern Italian regions, those of Greece, some of Bulgaria, Romania and Hungary belong to the lowest level clubs. Conversely, at the country level we find a multi-speed Europe, where the leading countries (Germany, Austria, Ireland, The Netherlands, Denmark and Sweden) are followed by a heterogeneous group of countries, among which a tenuous convergence process is in place.

Furthermore, we provide strong evidence of divergence among clubs after the Great Crisis at the regional level. In fact, it seems that the crisis has affected more the regions belonging to the lowest convergence clubs rather than the richest ones. On the other hand, at the country level, we find the well-known "Core-Periphery" framework and some mild evidence of convergence among the two clubs at the beginning of the millennium, which slowed down over time becoming divergence. Moreover, we detect a sort of catching up process within the "Periphery" group also during the crisis period (greater growth rates in Eastern countries rather than in the Mediterranean ones).

Our results are robust to different thresholds of the parameters used in the testing procedure (results are showed in the Appendix), and to a restricted sample (only EMU countries). In particular, in the last case we obtain similar results, suggesting that conclusions are not led by the inclusion of the poorest Eastern European countries and regions.

The paper does not provide evidence of which mechanisms are in place in causing the documented divergence and club membership. Most of these mechanisms are related to the interplay of local and institutional characteristics of the regions which may affect regional vulnerability. At the same time, also the role played by national or European policy decisions as well as by the European regional policies should be taken into consideration. Finally, from the methodological point of view, it would be interesting to understand if the same conclusions would be reached using other methodologies of club detection (i.e. spatial

methods or cluster techniques that take into account institutional characteristics as well as local asset endowments).

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APPENDIX A

A.1 - Club membership NUTS 2 level EU 28

Basic algorithm

Club 1 AT13 AT32 BE10 CZ01 DE11 DE12 DE21 DE50 DE60 DE71 DE91 DK01 FI1B FR10 IE02 ITH1 NL11 NL31 NL32 PL12 RO32 SE11 SK01 UKI4 UKM5	**Club 2** AT22 AT31 AT33 AT34 BE21 BE24 BE31 BG41 DE13 DE14 DE22 DE23 DE24 DE25 DE26 DE27 DE30 DE73 DE92 DE94 DEA1 DEA2 DEA4 DEA5 DEB3 DEC0 DED5 ES21 ES30 FI20 ITC2 ITC4 ITH2 NL33 NL41 PL51 SE23 SE33 UKD6 UKJ1	**Club 3** AT12 AT21 BE22 BE23 BE25 DE40 DE72 DEA3 DEB1 DEB2 DED2 DED4 DEE0 DEF0 DEG0 DK03 DK04 DK05 EE00 ES22 ES51 FI19 FR71 FR82 FR83 HU10 ITC3 ITH3 ITH5 ITI1 ITI4 LT00 NL12 NL21 NL22 NL34 NL42 PL11 PL22 PL41 PT17 RO22 RO42 SE12 SE21 SE22 SE31 SE32 SK02 UKH2 UKI7 UKJ2 UKJ3 UKK1
Club 4 AT11 BE33 BE35 CZ06 DE80 DE93 EL30 ES23 ES24 ES53 FI1C FI1D FR21 FR23 FR30 FR42 FR51 FR61 FR62 ITC1 ITH4 ITI3 LV00 MT00 NL13 NL23 PL21 PL52 PL63 RO11 RO12 RO31 SI04 SK03 UKD1 UKE2 UKF2 UKG1 UKH1 UKI6 UKM2	**Club 5** BE32 CY00 CZ02 CZ03 CZ07 CZ08 DK02 ES11 ES12 ES13 ES41 FR24 FR25 FR26 FR52 FR53 FR72 FR81 HU22 ITF1 ITI2 PL31 PL32 PL33 PL34 PL42 PL43 PL61 PL62 RO41 SK04 UKD3 UKE4 UKK2 UKL2 UKM6	**Club 6** BE34 CZ05 ES52 FR22 FR41 FR63 IE01 ITG2 PT11 PT15 PT16 PT18 UKC2 UKD7 UKE1 UKF1 UKG3 UKH3 UKJ4 UKK4 UKM3
Club 7 EL42 ES42 ES62 ES63 FR43 HR04 HU21 ITF2 RO21 SI03 UKD4 UKF3 UKG2 UKI5 UKK3 UKN0	**Club 8** CZ04 ES43 HR03 ITF5 UKC1 UKE3	**Club 9** BG33 BG34 EL43 EL53 EL62 EL64 ES61 ES64 ITF3 ITF4 ITF6 ITG1 UKL1
Club 10 EL65 EL41 EL52 HU33 HU23 HU32	**Club 11** BG32 BG42 EL61 EL63 HU31	**Club 12** EL51 EL54

Divergent: UKI3 LU00 BG31

As described in the chapter, after the application of the club merging procedures the new groups are composed as follows:

Phillips and Sul (2009)

Club	Merging
1	1
2	2+3
3	4-10
4	11+12

von Lyncker and Thoennessen (2016)

Club	Merging
1	1 + LU00
2	2
3	3
4	4+5+6
5	7
6	8
7	9+10
8	11+12 + BG31

A.2 - Club membership NUTS 2 level EMU

Basic algorithm

Club 1 AT13 AT32 BE10 DE11 DE21 DE50 DE60 DE71 FR10 ITH1 NL11 NL31 NL32 SK01	**Club 2** AT31 AT33 AT34 BE21 BE24 BE31 DE12 DE14 DE22 DE23 DE25 DE26 DE27 DE91 DEA1 DEA2 FI1B FI20 IE02 NL41	**Club 3** AT22 DE13 DE24 DE30 DE92 DE94 DEA4 DEA5 DEB3 DEC0 DED5 ITC2 NL33
Club 4 AT12 AT21 BE23 BE25 DE72 DE73 DEA3 DEB1 DEB2 DEF0 EE00 ES21 ES22 ES30 ES51 FI19 FR71 ITC3 ITC4 ITH2 ITH3 ITH5 ITI1 ITI4 LT00 NL21 NL22 NL34 NL42 PT17 SK02	**Club 5** AT11 BE22 BE32 BE33 BE34 BE35 CY00 DE40 DE80 DE93 DED2 DED4 DEE0 DEG0 EL30 EL42 ES11 ES12 ES13 ES23 ES24 ES41 ES42 ES52 ES53 ES62 ES63 FI1C FI1D FR21 FR22 FR23 FR24 FR25 FR26 FR30 FR41 FR42 FR43 FR51 FR52 FR53 FR61 FR62 FR63 FR72 FR81 FR82 FR83 IE01 ITC1 ITF1 ITF2 ITF5 ITG2 ITH4 ITI2 ITI3 LV00 MT00 NL12 NL13 NL23 PT11 PT15 PT16 PT18 SI03 SI04 SK03	**Club 6** EL53 EL62 EL64 ES43 ES61 ES64 ITF4 ITG1 SK04
Club 7 EL41 EL43 EL52 EL61 EL63 EL65 ITF3 ITF6	**Club 8** EL51 EL54	

Divergent: LU00

As described in the chapter, after the application of the club merging procedures (in this case same results) the new groups are composed as follows:

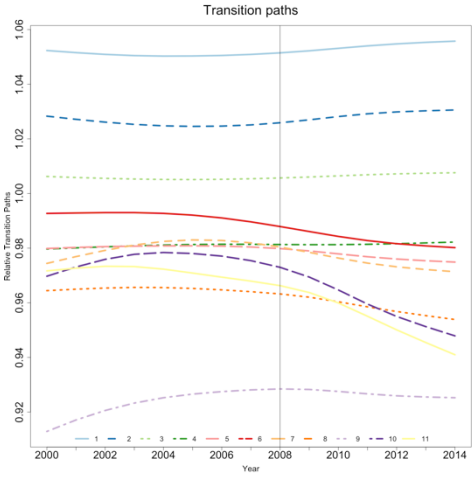
Club	Merging
1	1
2	2+3
3	4
4	5
5	6+7+8

A.3 - Robustness Checks - Critical value c* = –1

Basic Algorithm

Club	n° Regions	β	se	t-stat
1	29	0.068	0.081	0.834
2	27	0.071	0.070	1.015
3	87	0.034	0.104	0.330
4	63	0.073	0.124	0.586
5	16	0.001	0.116	0.005
6	14	-0.060	0.120	-0.497
7	4	-0.005	0.059	-0.089
8	15	0.075	0.011	7.086
9	6	0.001	0.103	0.012
10	2	-0.768	1.157	-0.663
11	2	-0.886	1.598	-0.554

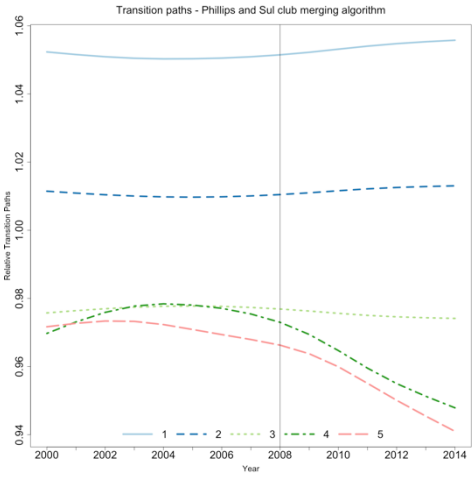
Divergent: UKI3 LU00 BG31



Phillips and Sul (2009) Merging Algorithm

Club	n° Regions	β	se	t-stat	Merging
1	29	0.068	0.081	0.834	1
2	114	-0.128	0.085	-1.502	2+3
3	118	-0.158	0.097	-1.629	4-9
4	2	-0.768	1.157	-0.663	10
5	2	-0.886	1.598	-0.554	11

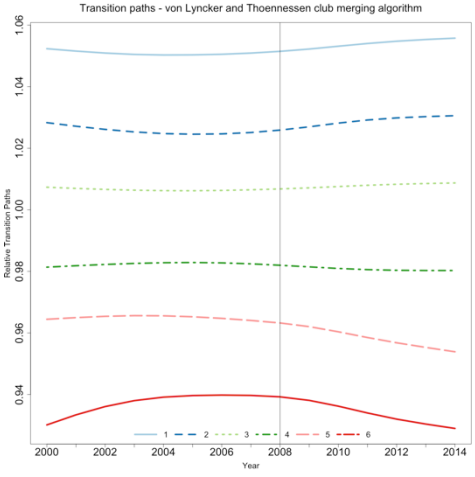
Divergent: UKI3 LU00 BG31



von Lyncker and Thoennessen (2016) Merging Algorithm

Club	n° Regions	β	se	t-stat	Merging
1	29	0.068	0.081	0.834	1
2	27	0.071	0.070	1.015	2
3	88	-0.124	0.094	-1.327	3 + LU00
4	97	0.049	0.121	0.406	11+12
5	15	0.075	0.011	7.086	4+8
6	11	-0.007	0.097	-0.074	9-11 + BG31

Divergent: UKI3

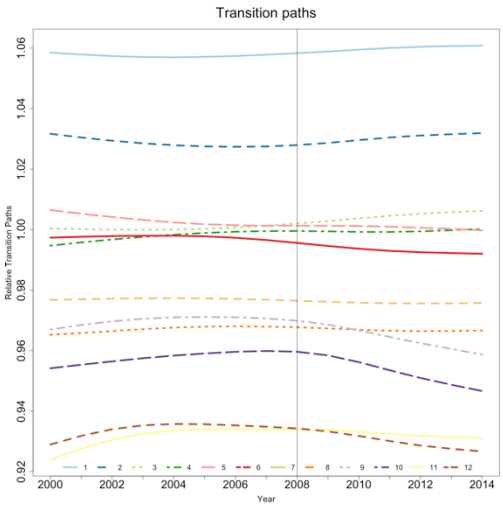


A.4 - Robustness Checks - Critical value c* = 1

Basic Algorithm

Club	n° Regions	β	se	t-stat
1	22	0.295	0.027	11.047
2	44	0.129	0.066	1.938
3	54	0.117	0.103	1.130
4	9	0.085	0.051	1.680
5	13	0.194	0.106	1.827
6	44	0.169	0.095	1.778
7	38	0.224	0.153	1.462
8	14	0.279	0.162	1.725
9	9	0.251	0.066	3.811
10	8	0.225	0.076	2.965
11	6	0.218	0.115	1.896
12	4	0.207	0.249	0.832

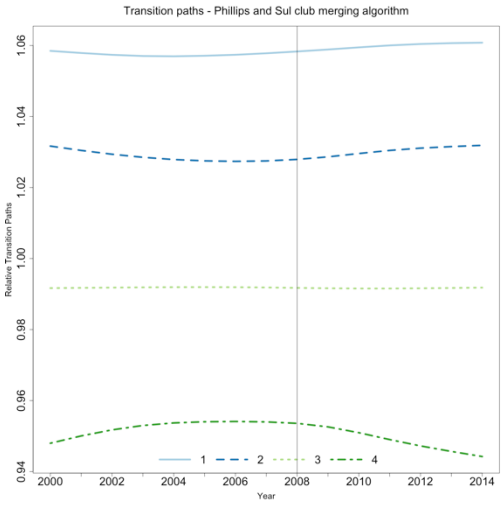
Divergent: UKI3 LU00 BG31



Phillips and Sul (2009) Merging Algorithm

Club	n° Regions	β	se	t-stat	Merging
1	22	0.295	0.027	11.047	1
2	44	0.129	0.066	1.938	2
3	172	-0.118	0.092	-1.273	3-8
4	27	0.039	0.019	2.087	9-12

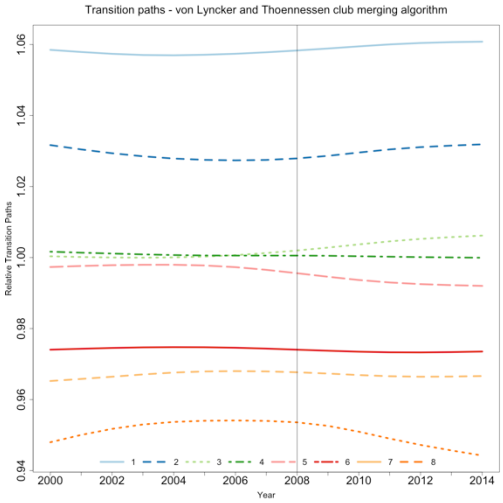
Divergent: UKI3 LU00 BG31



von Lyncker and Thoennessen (2016) Merging Algorithm

Club	n° Regions	β	se	t-stat	Merging
1	22	0.295	0.027	11.047	1
2	44	0.129	0.066	1.938	2
3	54	0.117	0.103	1.130	3
4	22	0.133	0.075	1.771	4+5
5	44	0.169	0.095	1.778	6
6	39	-0.040	0.119	-0.332	7 + BG31
7	14	0.279	0.162	1.725	8
8	27	0.039	0.019	2.087	9-12

Divergent: UKI3 LU00

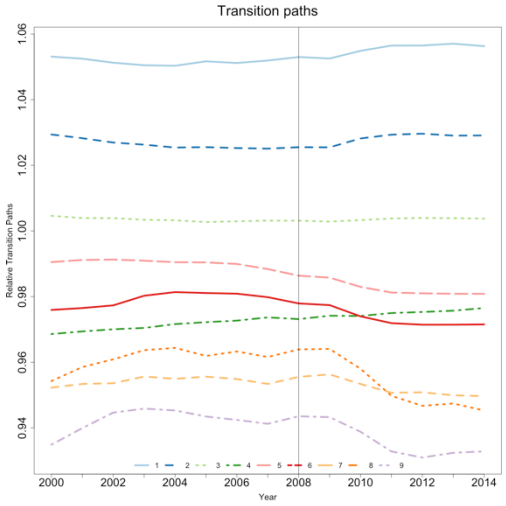


A.5 - Robustness Checks - Unfiltered series

Basic Algorithm

Club	n° Regions	β	se	t-stat
1	26	0.157	0.090	1.746
2	43	0.091	0.083	1.096
3	88	0.125	0.137	0.909
4	49	0.125	0.130	0.961
5	25	0.016	0.134	0.118
6	11	0.106	0.238	0.447
7	10	0.053	0.112	0.472
8	8	0.065	0.215	0.301
9	5	0.207	0.181	1.143

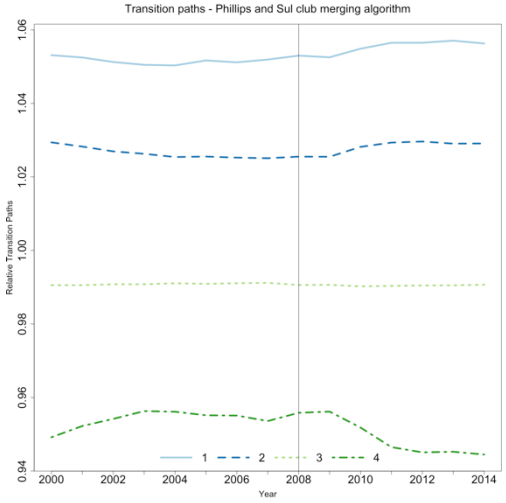
Divergent: UKI3 LU00 BG31



Phillips and Sul (2009) Merging Algorithm

Club	n° Regions	β	se	t-stat	Merging
1	26	0.157	0.090	1.746	1
2	43	0.091	0.083	1.096	2
3	173	-0.127	0.090	-1.403	3-6
4	23	0.025	0.151	0.164	7-9

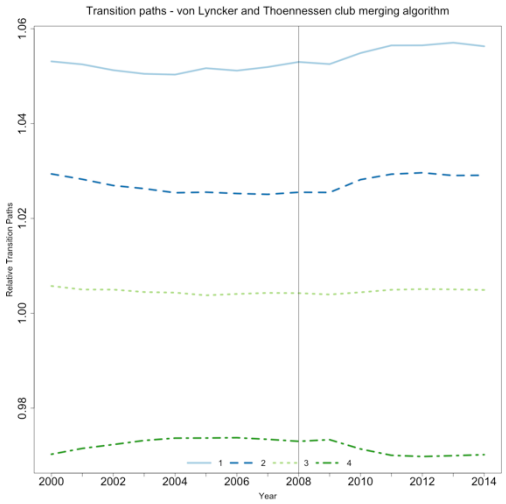
Divergent: UKI3 LU00 BG31



von Lyncker and Thoennessen (2016) Merging Algorithm

Club	n° Regions	β	se	t-stat	Merging
1	26	0.157	0.090	1.746	1
2	43	0.091	0.083	1.096	2
3	89	-0.074	0.108	-0.685	3 + LU00
4	108	-0.119	0.099	-1.202	4-9

Divergent: UKI3 BG31



A.6 - List of regions included in the analysis

NUTS_ID	NAME	NUTS_ID	NAME	NUTS_ID	NAME
AT11	Burgenland (AT)	DK01	Hovedstaden	HU33	Dél-Alföld
AT12	Niederösterreich	DK02	Sjælland	IE01	Border, Midland and Western
AT13	Wien	DK03	Syddanmark	IE02	Southern and Eastern
AT21	Kärnten	DK04	Midtjylland	ITC1	Piemonte
AT22	Steiermark	DK05	Nordjylland	ITC2	Valle d'Aosta/Vallée d'Aoste
AT31	Oberösterreich	EE00	Eesti	ITC3	Liguria
AT32	Salzburg	EL30	Attiki	ITC4	Lombardia
AT33	Tirol	EL41	Voreio Aigaio	ITF1	Abruzzo
AT34	Vorarlberg	EL42	Notio Aigaio	ITF2	Molise
BE10	Région de Bruxelles-Capitale	EL43	Kriti	ITF3	Campania
BE21	Prov. Antwerpen	EL51	Anatoliki Makedonia, Thraki	ITF4	Puglia
BE22	Prov. Limburg (BE)	EL52	Kentriki Makedonia	ITF5	Basilicata
BE23	Prov. Oost-Vlaanderen	EL53	Dytiki Makedonia	ITF6	Calabria
BE24	Prov. Vlaams-Brabant	EL54	Ipeiros	ITG1	Sicilia
BE25	Prov. West-Vlaanderen	EL61	Thessalia	ITG2	Sardegna
BE31	Prov. Brabant Wallon	EL62	Ionia Nisia	ITH1	Prov. Aut Bolzano/Bozen
BE32	Prov. Hainaut	EL63	Dytiki Ellada	ITH2	Provincia Autonoma di Trento
BE33	Prov. Liège	EL64	Sterea Ellada	ITH3	Veneto
BE34	Prov. Luxembourg (BE)	EL65	Peloponnisos	ITH4	Friuli-Venezia Giulia
BE35	Prov. Namur	ES11	Galicia	ITH5	Emilia-Romagna
BG32	Severen tsentralen	ES12	Principado de Asturias	ITI1	Toscana
BG33	Severoiztochen	ES13	Cantabria	ITI2	Umbria
BG34	Yugoiztochen	ES21	País Vasco	ITI3	Marche
BG41	Yugozapaden	ES22	Comunidad Foral de Navarra	ITI4	Lazio
BG42	Yuzhen tsentralen	ES23	La Rioja	LT00	Lietuva
CY00	Kypros	ES24	Aragón	LU00	Luxembourg
CZ01	Praha	ES30	Comunidad de Madrid	LV00	Latvija
CZ02	Střední Čechy	ES41	Castilla y León	MT00	Malta
CZ03	Jihozápad	ES42	Castilla-la Mancha	NL11	Groningen
CZ04	Severozápad	ES43	Extremadura	NL12	Friesland (NL)
CZ05	Severovýchod	ES51	Cataluña	NL13	Drenthe
CZ06	Jihovýchod	ES52	Comunidad Valenciana	NL21	Overijssel
CZ07	Střední Morava	ES53	Illes Balears	NL22	Gelderland
CZ08	Moravskoslezsko	ES61	Andalucía	NL23	Flevoland
DE11	Stuttgart	ES62	Región de Murcia	NL31	Utrecht
DE12	Karlsruhe	ES63	Ciudad Autónoma de Ceuta (ES)	NL32	Noord-Holland
DE13	Freiburg	ES64	Ciudad Autónoma de Melilla (ES)	NL33	Zuid-Holland
DE14	Tübingen	FI19	Länsi-Suomi	NL34	Zeeland
DE21	Oberbayern	FI1B	Helsinki-Uusimaa	NL41	Noord-Brabant
DE22	Niederbayern	FI1C	Etelä-Suomi	NL42	Limburg (NL)
DE23	Oberpfalz	FI1D	Pohjois- ja Itä-Suomi	PL11	Lódzkie
DE24	Oberfranken	FI20	Åland	PL12	Mazowieckie
DE25	Mittelfranken	FR10	Île de France	PL21	Malopolskie
DE26	Unterfranken	FR21	Champagne-Ardenne	PL22	Slaskie
DE27	Schwaben	FR22	Picardie	PL31	Lubelskie
DE30	Berlin	FR23	Haute-Normandie	PL32	Podkarpackie
DE40	Brandenburg	FR24	Centre (FR)	PL33	Swietokrzyskie
DE50	Bremen	FR25	Basse-Normandie	PL34	Podlaskie
DE60	Hamburg	FR26	Bourgogne	PL41	Wielkopolskie
DE71	Darmstadt	FR30	Nord - Pas-de-Calais	PL42	Zachodniopomorskie
DE72	Gießen	FR41	Lorraine	PL43	Lubuskie
DE73	Kassel	FR42	Alsace	PL51	Dolnoslaskie
DE80	Mecklenburg-Vorpommern	FR43	Franche-Comté	PL52	Opolskie
DE91	Braunschweig	FR51	Pays de la Loire	PL61	Kujawsko-Pomorskie
DE92	Hannover	FR52	Bretagne	PL62	Warminsko-Mazurskie
DE93	Lüneburg	FR53	Poitou-Charentes	PL63	Pomorskie
DE94	Weser-Ems	FR61	Aquitaine	PT11	Norte
DEA1	Düsseldorf	FR62	Midi-Pyrénées	PT15	Algarve
DEA2	Köln	FR63	Limousin	PT16	Centro (PT)
DEA3	Münster	FR71	Rhône-Alpes	PT17	Área Metropolitana de Lisboa
DEA4	Detmold	FR72	Auvergne	PT18	Alentejo
DEA5	Arnsberg	FR81	Languedoc-Roussillon	RO11	Nord-Vest
DEB1	Koblenz	FR82	Provence-Alpes-Côte d'Azur	RO12	Centru
DEB2	Trier	FR83	Corse	RO21	Nord-Est
DEB3	Rheinhessen-Pfalz	HR03	Jadranska Hrvatska	RO22	Sud-Est
DEC0	Saarland	HR04	Kontinentalna Hrvatska	RO31	Sud - Muntenia
DED2	Dresden	HU10	Közép-Magyarország	RO32	Bucuresti - Ilfov
DED4	Chemnitz	HU21	Közép-Dunántúl	RO41	Sud-Vest Oltenia
DED5	Leipzig	HU22	Nyugat-Dunántúl	RO42	Vest
DEE0	Sachsen-Anhalt	HU23	Dél-Dunántúl	SE11	Stockholm
DEF0	Schleswig-Holstein	HU31	Észak-Magyarország	SE12	Östra Mellansverige
DEG0	Thüringen	HU32	Észak-Alföld	SE21	Småland med öarna

NUTS_ID	NAME
SE23	Västsverige
SE31	Norra Mellansverige
SE32	Mellersta Norrland
SE33	Övre Norrland
SI03	Vzhodna Slovenija
SI04	Zahodna Slovenija
SK01	Bratislavský kraj
SK02	Západné Slovensko
SK03	Stredné Slovensko
SK04	Východné Slovensko
UKC1	Tees Valley and Durham
UKC2	Northumberland and Tyne and Wear
UKD1	Cumbria
UKD3	Greater Manchester
UKD4	Lancashire
UKD6	Cheshire
UKD7	Merseyside
UKE1	East Yorkshire and Northern Lincolnshire
UKE2	North Yorkshire
UKE3	South Yorkshire
UKE4	West Yorkshire
UKF1	Derbyshire and Nottinghamshire
UKF2	Leicestershire, Rutland and Northamptonshire
UKF3	Lincolnshire
UKG1	Herefordshire, Worcestershire and Warwickshire
UKG2	Shropshire and Staffordshire
UKG3	West Midlands
UKH1	East Anglia
UKH2	Bedfordshire and Hertfordshire
UKH3	Essex
UKI3	Inner London - West
UKI4	Inner London - East
UKI5	Outer London - East and North East
UKI6	Outer London - South
UKI7	Outer London - West and North West
UKJ1	Berkshire, Buckinghamshire and Oxfordshire
UKJ2	Surrey, East and West Sussex
UKJ3	Hampshire and Isle of Wight
UKJ4	Kent
UKK1	Gloucestershire, Wiltshire and Bristol/Bath area
UKK2	Dorset and Somerset
UKK3	Cornwall and Isles of Scilly
UKK4	Devon
UKL1	West Wales and The Valleys
UKL2	East Wales
UKM2	Eastern Scotland
UKM3	South Western Scotland
UKM5	North Eastern Scotland
UKM6	Highlands and Islands
UKN0	Northern Ireland (UK)

Chapter 2

REGIONAL INEQUALITIES AND ECONOMIC CRISES: AN INTERNATIONAL PANEL ANALYSIS (1990 – 2014)

2.1. Introduction

In recent years there has been an expansion in the theoretical and empirical literature on disparities and regional development. In particular, the recent economic crisis has generated a large amount of studies around the concept of resilience, a useful concept to explain the different behaviours of economies in the aftermath of crises. This is the reason why there has been an increasing need for understanding why some economies react to, or recover from, a shock better than others.

Since the influential paper of Williamson (1965), historical literature in regional economics has mainly focused on the relation between regional disparities, growth and development. While this topic has been extensively analysed, scarce attention has been given in the literature to the effect of economic downturns and crises on the evolution of regional inequalities. This issue has recently gained importance in the wake of the recent global crisis. In fact, from a theoretical point of view, regional inequalities may change in the aftermath of economic downturns if different regions have a different degree of resilience to a common shock and/or a different speed of adjustment.

The aim of this chapter is to try to fill this gap and to assess the impact of economic downturns on regional inequalities. Adopting a novel methodology, we try to answer, among others, to the following research questions. What are the effects of economic downturns on regional inequalities? Are there differences if we consider only financial shocks? Did the Great Crisis cause changes in the results? Is it relevant to take into account different economic conditions? By using an unbalanced panel of 29 OECD countries from 1990 to 2014, we show that economic downturns are associated with a significant and long-lasting *reduction* in regional inequality compared to its trend up to 2007. Conversely, it seems that the Great Crisis has had on average a *positive* impact on regional disparities. In addition, we offer evidence on how the effect of economic downturns and financial crises on regional inequalities changes across different states of the economy.

The remainder of the chapter is organized as follows. The next section provides a review of existing literature on regional disparities and economic crises. In the first part, Section 3 describes the data and presents descriptive statistics on the evolution of regional inequality across countries and over time. The second part of section 3 presents the methodology used in the empirical analysis to investigate the effect of economic downturns on regional income dispersions. Sections 4 and 5 discuss the results whereas section 6 discusses some interpretations and policy implications. Finally, section 7 concludes by summarizing the main findings.

2.2 Literature Review

Starting from the classical contributions on regional development theories, there has been a huge debate about the relationship between growth and regional disparities.

For example, some neoclassical economists like Solow (1956) claim that growth and development are connected with a reduction in regional disparities because of diminishing returns to capital. In fact, in his influential work, Solow argues that the growth rate of an economy is inversely related to its initial per-capita income. On the other hand, other economists like Myrdal (1957) claim that high rates of economic growth are likely linked with increasing inequality due to the fact that growth is a spatially cumulative process. In addition, as pointed out by Petrakos *et al.* (2003), the new economic geography school (Krugman, 1991, 1992, 1993), and the endogenous growth school (Romer, 1986), argue that growth is likely associated with a sort of agglomeration because it requires a minimum set of institutions to take place.

From an empirical point of view, since the seminal paper by Williamson (1965) who stated an inverted-U shaped relationship between regional inequality and national development[9], a large body of the literature has analysed the relationship between regional disparity and growth. In addition, after the Williamson's contribution, the well-known work by Barro and Sala-i-Martin (1991) also stimulated a considerable number of studies. This

[9] Using evidence based on descriptive statistics for a number of countries between the end of the XIXth Century and World War II, Williamson found some supportive evidence for a non-linear relationship between regional inequalities and national development. His conclusions derive from the observation that regional disparities are greater in less developed countries and smaller in the more developed ones, and that regional disparities increase over time in the less developed countries and decrease in the more developed.

stream of work has mostly focused on the influence of regional inequality on growth and on the effect of economic development on income dispersion across regions[10].

The studies have produced rather mixed results. For example, from a business cycle point of view, according to some authors (Berry, 1988; Richardson, 1973; Stilwell, 1980), waves of economic growth may give rise to regional inequalities due to spatial concentration, while in periods of economic crisis inequalities may decrease due to spatial dispersion. On the contrary, Dunford and Perron (1994) and Dunford and Smith (2009) show that periods of economic growth are associated with a reduction in regional inequalities whereas the opposite happens in the case of economic downturns. In addition, Barro and Sala-i-Martin (1991, 1992), and Sala-i-Martin (1996), among others, found convergence across the analysed regions, while others have found mixed results, like convergence at the country level but divergence at the regional level (Giannetti, 2002). Finally, Meliciani and Peracchi (2006) found different results depending on the period analysed, specifically a decrease in regional income disparities in the late eighties – early nineties, but an increase after this period.

On the other hand, several economists have examined the relationship between crises and growth. Two of the most recent and influential contributions, Cerra and Saxena (2008), and Cerra *et al.* (2009), look at the impact of shocks on national growth rates. Their results suggest that countries that have experienced severe and/or frequent economic disruption tend to have lower growth rates over the long-run. But, at the same time, they highlight that countries react to shocks in different ways. Therefore, this may have an effect on convergence (or divergence) of national or regional economies.

Moreover, a considerable number of studies have been recently conducted around the concept of economic resilience, both from a theoretical and empirical point of views. They have investigated the ability of regions to withstand and recover from a shock and have identified the drivers of these different behaviours[11]. Within this framework, different studies both at an international (OECD, 2014a) and at a national level (Dokic *et al.*, 2016; Petrakos and Psycharis, 2015; Trigilia and Viesti, 2016) underline that the Global Financial crisis has likely resulted in a widening of regional disparities for several countries.

[10] See for example, Alonso (1980); Amos (1983); Maxwell and Peter (1988); Tsui (1993); Fan and Casetti (1994); Kanbur and Zhang (1999); Nissan and Carter (1999); Azzoni (2001); Davies and Hallet (2002); Kim and Margo (2003), Petrakos *et al.* (2003), Barrios and Strobl (2009).

[11] Among others, Martin (2012), Martin and Sunley (2013), Boschma (2014), Christopherson *et al.* (2010), Fingleton *et al.* (2012), Pike *et al.* (2010), Mazzola *et al.* (2012), Simmie and Martin (2010).

In this context, due to the fact that regional inequalities may change if different regions have a different degree of resilience to a common shock, this chapter tries to asses the impact of economic downturns on regional inequalities, providing evidence that results change across different regimes (or states) of the economy.

2.3 Data and methodology

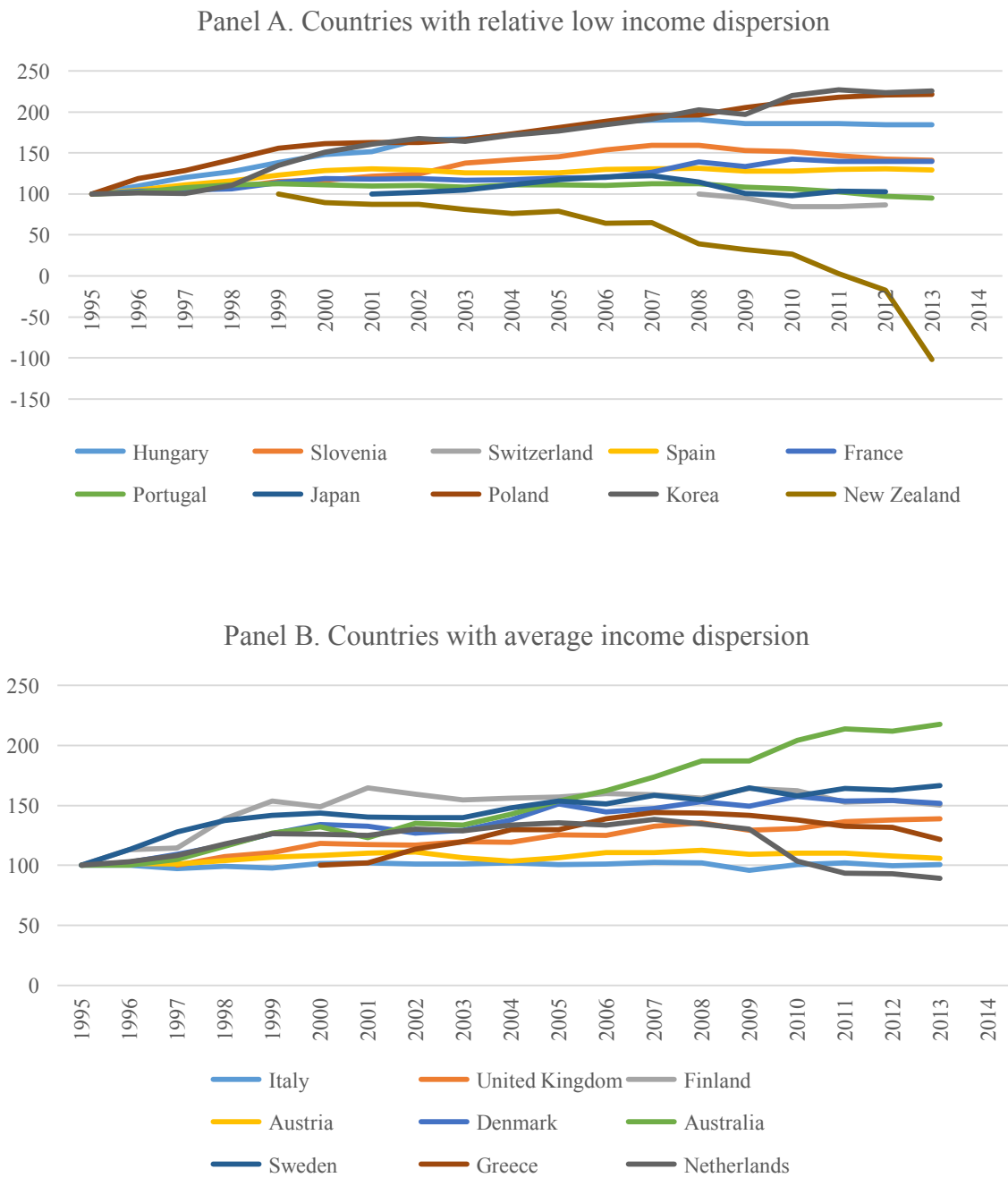
2.3.1. Data

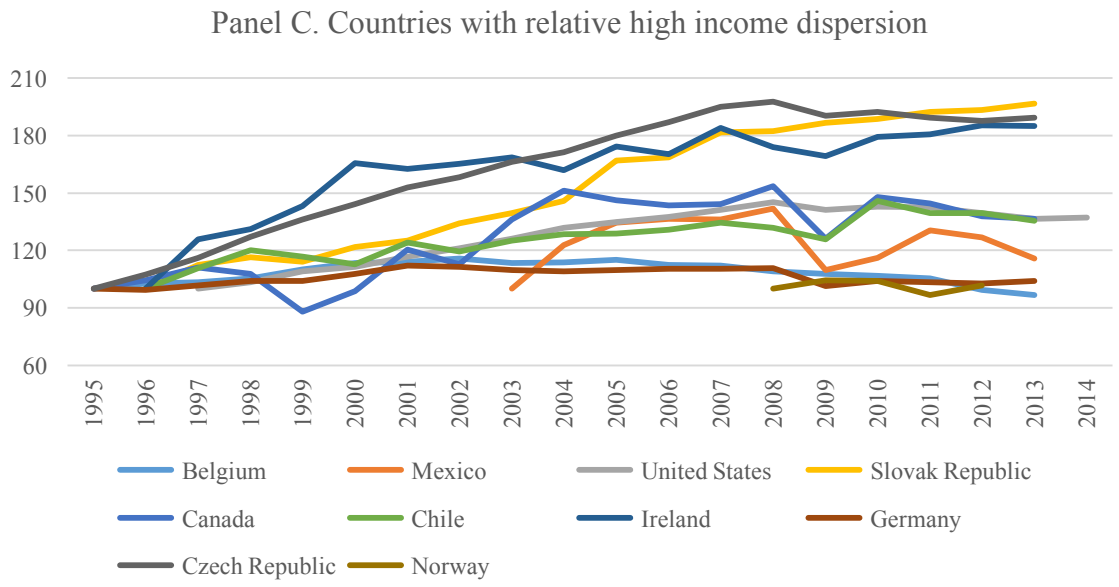
Our data are taken from the OECD Dataset on Regional Account. This dataset covers an unbalanced panel of 29 OECD countries (Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States) for the period 1990-2014. In particular, to measure the regional inequality of a country, we use the standard deviation of per-capita GDP (in USD, constant prices, constant PPP, base year 2010). Figure 2.1 shows the evolution of regional inequality in each country over time starting from 1995. We may see that regional disparities in almost all countries are in an upward trend, over the period under consideration, even if we group countries according to the average income dispersion. There are also some exceptions, such as Netherlands, Switzerland, New Zealand, Japan and Portugal, in which the dispersion in per-capita GDP is lower in the last year considered related to the first. In addition, the countries with the highest (on average) level of disparities are Belgium, Mexico, United States and Slovak Republic[12]. Finally, in Korea, Poland, Australia, Slovak and Czech Republic the level of regional inequality has increased more than in the other countries between 1995 and 2014. However, the upward trend seems to slow down in the last seven years.

[12] To rank countries, we refer to the average of the standard deviation of per-capita GDP over the whole period considered. Table B.1 in Appendix B, presents some descriptive statistics.

Figure 2.1 – Evolution of Regional Disparities Across Countries

(Regional disparities = 100 in 1995 or in the first year of data availability)





Using the coefficient of variation as a measure of regional disparities, we observe a similar trend for each country. However, in this case the upward trend seems to be less marked. Graphs are shown in the Appendix (Figure B.1).

To classify downturns, we refer to the magnitude of the deviation of each country's growth rate from its trend. In detail, the downturn dummy used in our model assumes values equal to one when, for each country in a given time, the deviation of the annual growth rate ($g_{i,t}$) from its trend-average ($\overline{g_i}$) exceeds 1%:

$$D_{i,t} = 1 \quad if\ g_{i,t} - \overline{g_i} \leq -1\%; \qquad D_{i,t} = 0 \quad otherwise \qquad (2.1)$$

As it will be shown later, we also differentiate between moderate and severe downturns. We identify severe downturns when the deviation of the annual growth rate from the average trend exceeds 2%, while moderate downturns are identified when the output loss is between 1 and 2%. Namely:

$$D_{i,t} = 1 \quad if\ -2\% \leq g_{i,t} - \overline{g_i} \leq -1\%; \qquad D_{i,t} = 0 \quad otherwise \qquad (2.2)$$

for moderate downturns and:

$$D_{i,t} = 1 \quad if\ g_{i,t} - \overline{g_i} < -2\%; \qquad D_{i,t} = 0 \quad otherwise \qquad (2.3)$$

for severe downturns.

In this chapter we propose another differentiation between persistent and transitory downturns. To distinguish between these two types of shocks, we use the classification proposed by Furceri and Zdzienicka (2015). The authors identify persistent shocks as those severe downturns with a duration corresponding to the top third quartile of the distribution of downturns, whereas transitory shocks are identified as all other severe downturns.

Finally, we use the dataset constructed by Laeven and Valencia (2013)[13] to identify banking and financial crises episodes.

Table 2.1 summarizes the number of downturns and crises identified by type, for the period 1990-2007.

Table 2.1. Number of downturns and crises by type

Type of Crisis	Baseline	Moderate	Severe	Transitory	Persistent	Banking	Financial
Number	81	53	28	12	16	13	17

2.3.2. Methodology

The methodology used in this chapter to assess the impact of economic downturns on regional inequality is particularly suited to assess the dynamic response of the variable of interest in the aftermath of a shock (economic downturns or financial shocks in our case). Specifically, to reach our goals we estimate two different econometric specifications.

In the first part of the chapter, we use the approach proposed by Jorda (2005) and advocated, among others, by Stock and Watson (2007), Teulings and Zubanov (2014) and Abiad *et al.* (2015). This method allows the direct estimation of Impulse Response Functions (IRFs) based on local projections of the effect of downturns on regional inequalities.

In particular, this is an alternative way to estimate IRFs without specifying a vector autoregressive model (Autoregressive-Distributed Lag) as recently proposed by Cerra and Saxena (2008) and Furceri and Zdzienicka (2011a, 2011b). According to Teulings and Zubanov (2014) and Abiad *et al.* (2015), this approach tends to be sensitive to a variety of misspecifications, such as the choice of the number of lags. In addition, long-lasting effects of shocks may be unduly found, reflecting the use of what Cai and Den Haan (2009) call *one-type-of-shock* models.

[13] This dataset expands the Caprio, Klingebiel, Laeven, and Noguera (2005) banking crisis database by including recent banking crises, information on currency and debt crises, and information on crisis containment and resolution measures. The database covers all important global financial crises from 1970 to 2011.

On the contrary, the former does not impose the dynamic restrictions embedded in ARDL models as well as is particularly suited to estimating nonlinearities in the dynamic response (Abiad *et al.*, 2015), and in general is robust to a variety of misspecifications.

In detail, in the first part of the chapter, in order to evaluate the impact of shocks on regional inequalities, we estimate the following equation for each future period *k*:

$$\sigma_{i,t+k} - \sigma_{i,t} = \alpha_i^k + \varphi_t^k + \sum_{j=1}^{l} \gamma_i^k \Delta\sigma_{i,t-j} + \beta^k D_{i,t} + \vartheta^k \boldsymbol{X_{i,t}} + \varepsilon_{i,t}^k \qquad (2.4)$$

for k = 1, 2,…,5.

where:

- σ_i is a measure of regional inequalities (such as the standard deviation or the coefficient of variation of the regional real per-capita GDP) for country *i*;
- α_i represents country fixed effects, to control for unobservable country specific factors which may affect regional inequality;
- φ_t are time fixed effects, included to take account of such shocks as shift in oil prices or the global business cycle;
- γ_i captures the persistence in changes in regional inequalities;
- $\Delta\sigma_{i,t-j}$ are past changes in regional inequalities;
- β measures the unconditional effect of economic downturns on regional inequality;
- $D_{i,t}$ is a dummy variable that takes value 1 for the occurrence of an economic downturn in country *i* in time *t*;
- $\boldsymbol{X_i}$ is a set of country's controls including: (i) the average regional real per-capita income; (ii) the initial level of dispersion in the regional real per-capita income; (iii) the number of regions in each country; (iv) a time trend.

Impulse response functions are obtained using the estimated coefficient β^k and the confidence intervals are computed using the estimated standard errors of the same coefficient, based on within-group serial correlation-robust standard errors.

Since the method proposed by Jorda (2005) suffers from a bias discovered by Teulings and Zubanov (2014), we apply the correction proposed by these authors. It is noteworthy that both specifications (with and without Teulings-Zubanov bias correction) provide very similar, and broadly unchanged, results.

We estimate the equation (2.4) for two periods, 1990-2007 and 1990-2014, in order to assess the role of the recent economic crisis in shaping the results. Furthermore, several checks will be shown later to confirm the robustness of our results.

In the second part of the chapter, to take into account the role of macroeconomic and regional conditions in shaping the response of regional disparities to economic downturns, we follow the approach proposed, among others, by Auerbach and Gorodnichenko (2013) and Abiad *et al.* (2015), that allows interactions between shocks and economic conditions.

In this case, the theoretical assumption is that the response in terms of regional disparities to an economic downturn depends on the different states of the economy, both from macroeconomic and from regional perspectives.

To test this hypothesis, we modify equation (2.4) by allowing the variation of our variable of interest according to the different state of economy.

Therefore, in this case we estimate an equation with the following specification:

$$\sigma_{i,t+k} - \sigma_{i,t} = \alpha_i^k + \varphi_i^k + \beta_1^k G(z_{i,t}) D_{i,t} + \beta_2^k (1 - G(z_{i,t})) D_{i,t} + \varepsilon_{i,t}^k \qquad (2.5)$$

where, apart from the other already defined variables:

$$G(z_{i,t}) = \frac{\exp(-\gamma z_{i,t})}{1+\exp(-\gamma z_{i,t})}, \quad \gamma > 0 \qquad (2.6)$$

in which z is an indicator of macroeconomic or regional conditions, normalized to have zero mean and unit variance, and $G(z_{i,t})$ is the corresponding smooth transition function between countries[14].

As pointed out by Abiad *et al.* (2015) and Furceri and Loungani (2015), this approach is similar to smooth transition autoregressive (STAR) models, developed by Granger and Terasvirta (1993) but, related to the latter, it has many advantages. According to Auerbach and Gorodnichenko (2013), in the case of few observations, the estimation of SVARs for each regime separately, can provide unstable and imprecise estimations. On the contrary, the method proposed by the authors uses more information, in particular a large number of observation, to obtain impulse response functions, thus improving the stability and precision of the estimates.

[14] We use $\gamma = 1$, but results are robust to different values of the parameter.

In particular, following Auerbach and Gorodnichenko (2013), β_1^k is the coefficient in the case of low regime of the considered variable and β_2^k is the coefficient of the opposite case. Moreover, to take account of the potential correlation of standard errors within countries, we calculate the local projection IRFs estimates by clustering at the country level.

Finally, the set of such variables used to take account of macroeconomic and regional conditions includes, on the one hand, the degree of trade openness, the initial level of inequalities and the degree of fiscal decentralization. On the other hand, as regional conditions, we take into consideration human capital regional disparities, regional differences in labour market efficiency and regional differences in innovation.

2.4. Results

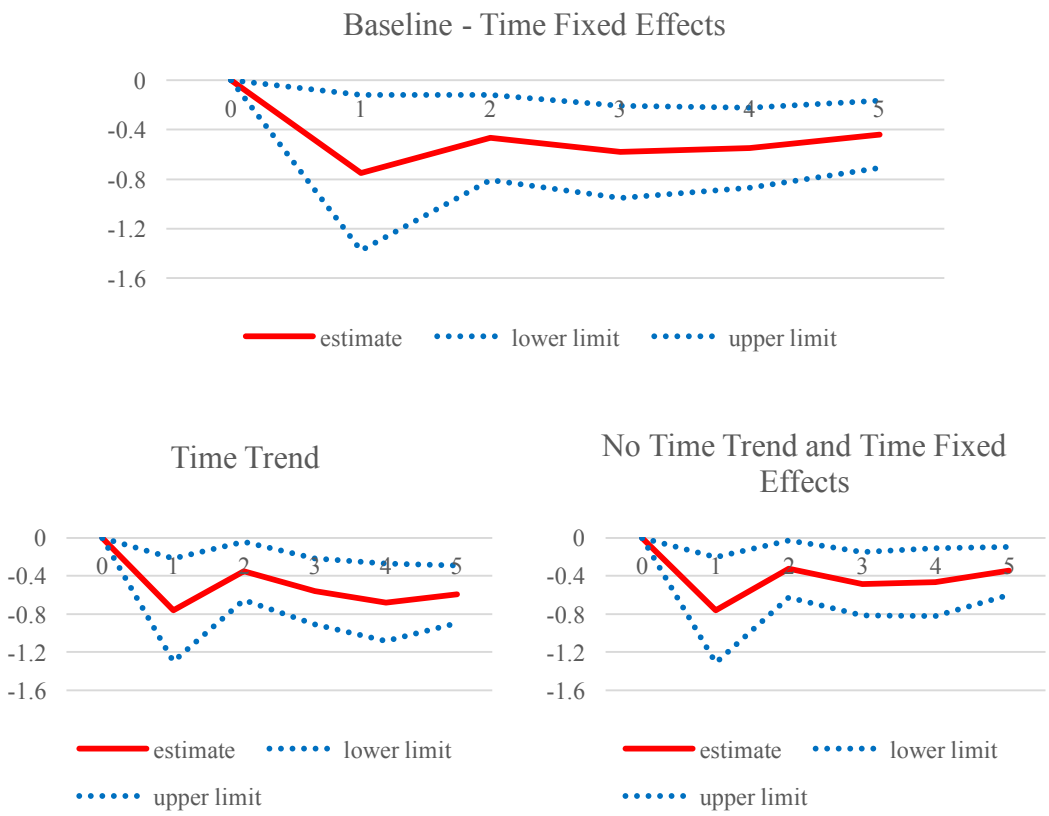
2.4.1. Baseline

Following the first approach proposed in the previous section, we identify 81 downturn episodes in the period 1990-2007. Among these, we find the Nordic banking crisis of the early 1990s, as well as the economic downturns of some European countries in early 2000s after the currency crisis of the European Monetary System (EMS) and the Japanese's *Lost Decade*, the time after the Japanese asset price bubble.

Table B.2 presents the results from estimating the impact of economic downturns on regional inequality using equation (2.4) for the period 1990-2007, without control variables.

The table shows, for each period (column) *k*, the cumulative response of regional income dispersion - measured by the standard deviation of the regional real income per-capita - to economic downturns. Looking at the Figure 2.2, it is immediately apparent that economic downturns have negative, statistically significant and long-lasting effect on regional disparities in each specification considered (Baseline – with Time Fixed Effects; with a Time Trend included to control for common trends in the development of income dispersion; without Time Trend and Time Fixed Effects). The maximum effect is reached after one year of the shock, after which inequalities tend to increase remaining, nevertheless, below the pre-downturns level.

Figure 2.2 – The Effect of Economic Downturns on Regional Inequality - Impulse response function.



Note: Solid line = IRF; Dotted Lines = 90% confidence intervals. The vertical axis represents the effect in rapport to the average value of $\sigma_{i,t+k} - \sigma_{i,t}$.

Since it is possible that past changes in regional inequality can affect the probability of occurrence of an economic downturn, we need to test this hypothesis to avoid endogeneity problems. Only if the test would not be accepted, the exogeneity assumption of economic downturns to regional inequality will determine unbiased OLS-based estimates.

To test for endogeneity, we estimate a Probit model which considers the probability of occurrence of an economic downturn as a function of past changes in regional disparities:

$$Prob(D_{it} = 1) = F(constant + \sum_{j=1}^{4} \beta_j \Delta\sigma_{i,t-j} + \sum_{j=1}^{4} \delta_j D_{i,t-j} + \omega_{it}) \quad (2.7)$$

where, $\Delta\sigma_{i,t-j}$ are past changes in regional inequalities and $D_{i,t-j}$ is the lagged dummy variable that identifies crises.

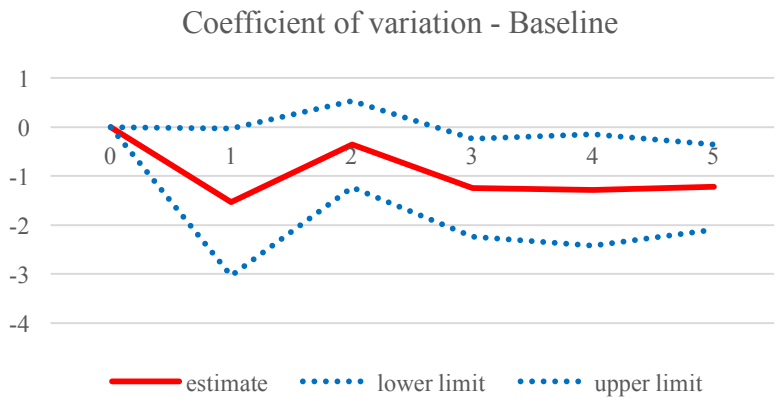
The results reported in Table B.3 suggest that the lagged value of changes in regional income dispersion does not explain the occurrence of economic downturns. Thus, it seems

that the assumption of exogeneity of the downturn dummy to changes in regional real per-capita income dispersion is valid.

2.4.2. Robustness checks

In order to verify the robustness of our results, several checks have been made. First of all, to check the sensitivity of the results to the choice of the dependent variable, we have re-estimated equation (2.4) using the coefficient of variation of the regional income as a measure of regional disparities. The results obtained are shown in Figure 2.3.

Figure 2.3 – Robustness check – Coefficient of Variation



Note: see Figure 2.2.

These results confirm previous conclusions. Over the period under consideration, regional inequalities decrease after an economic downturn, although the estimates in the short term are not statistically significant (Table B.6).

Secondly, as discussed earlier in the chapter, we re-estimate equation (2.4) including a set of control variables such as the average regional real per-capita income to control for the economic size of each country. This is an alternative way to indirectly take into account the size of countries, instead of considering the coefficient of variation. At the same time, we include in the analysis the initial level of dispersion in the regional real per-capita income, to control for the fact that regional inequality may tend to increase less in countries where the initial income dispersion is already large, and the number of the regions in each country. The results of this exercise are presented in Table B.7.

Also in this case, the results confirm a significant and persistent effect of economic downturns on regional inequalities. All control variables have the expected sign. Among

them, we find that the initial level of regional inequality and the number of regions explain a significant share of the variance of the evolution of income dispersion over time.

As an additional robustness check, since it is possible that different levels of spatial aggregation can lead to different results, we test our model at a different geographic detail. Using the lowest territorial level according to OECD classification (Territorial Level 3-TL3), we re-estimate equation (2.4) including all control variables previously defined[15].

Looking at Table B.8, it can be seen that the spatial level of aggregation does not affect the results. In fact, using this different territorial level of aggregation the results remain statistically significant and broadly unchanged. Furthermore, among the control variables included in the regression, the average of per-capita GDP and the number of TL3 units are positively associated with change in territorial disparities, whereas the initial level of inequality is negatively related.

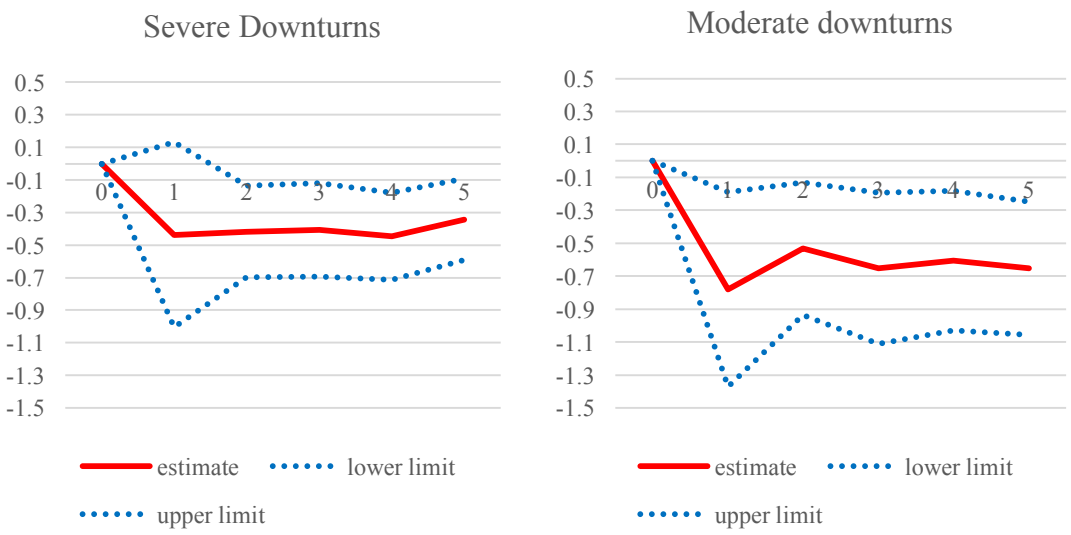
2.4.3. Severe vs Moderate Downturns

So far, we have used only a single measure of downturns. In theory, it is possible that the magnitude of shocks can affect the results. In fact, it is reasonable to think that the response of regional disparities may be a function of output losses and therefore it may vary with the severity of the downturns. For this reason, in this section we distinguish severe from moderate downturns. As discussed earlier, we identify severe downturns when the deviation of the annual growth rate from the average trend exceeds 2%, while moderate downturns are identified when the output loss is between 1 and 2%. According to this classification, we have found 53 moderate downturns, and 28 severe downturns.

Hence, to test for this hypothesis, we re-estimate equation (2.4) by taking into account the magnitude of shocks. The results are presented in Figure 2.4.

[15] In this case, to include in our sample all TL3 units, we have merged TL2 regions composed of only one TL3 unit (32 cases), with the nearest TL2 region. A further check has been made, performing a sensitivity regression on the sample without TL2 regions that are also TL3. Also in this case, we find similar and broadly unchanged results.

Figure 2.4 – Severe vs Moderate Downturns



Note: see Figure 2.2.

As a result of this exercise, it is noteworthy that, except for the first year ahead for severe downturns, all estimated coefficients are statistically significant (Tables B.9 and B.10). Moreover, it can be seen that distinguishing between moderate and severe downturns, a clear distinction on regression results arises. In fact, it seems that moderate shocks have a larger effect in diminishing regional disparities than the severe ones.

2.4.4. Transitory vs Persistent Downturns

Another important distinction is between transitory and persistent downturns. According to Friedman (1993) and in general to neoclassical economists, shocks are temporary in nature and have no permanent effects on pre-shock growth path. Indeed, the *plucking model* of Friedman assumes the existence of a bounce back effect to pre-crisis equilibrium, making "neutral" each shock. However, the recent literature on economic resilience, recalling the concept of hysteresis, has pointed out that the more persistent is a shock, the more difficulties may have economies to recover from it. In fact, typically persistent downturns hit harder the economic structure of an economy, making harder the recovery, or in the opposite case giving opportunities to renew through structural adjustment and bounce forward rather than bounce back.

As argued in section 2.3.1, to differentiate between these two types of shocks we use the classification proposed by Furceri and Zdzienicka (2015). The results of this exercise are shown in Figure 2.5.

Figure 2.5 – Persistent vs Transitory Downturns

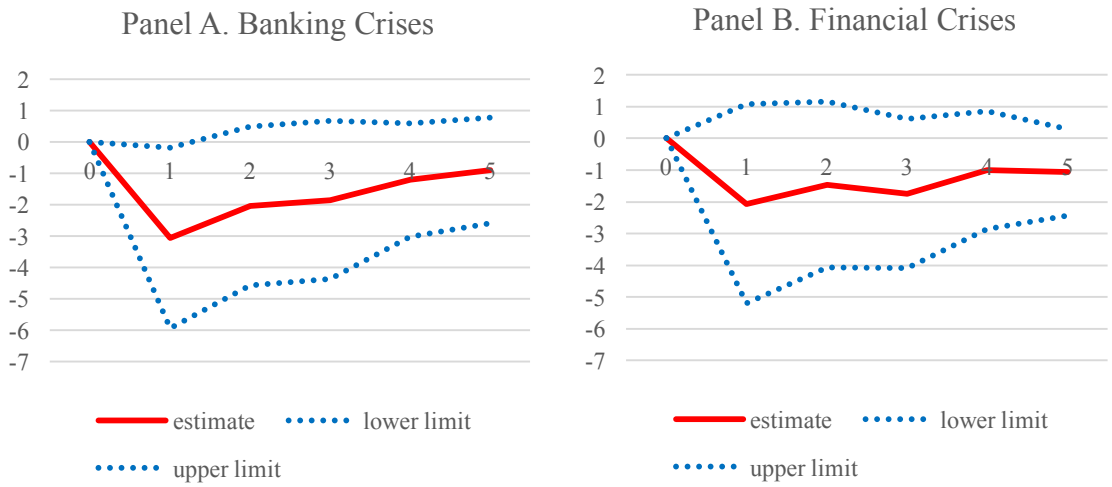
Note: see Figure 2.2.

The results obtained from estimating equation (2.4) taking into account the persistency of the shocks, suggest a clear distinction between temporary and persistent crises. Particularly, persistent downturns have a larger statistically significant and long-lasting effect in reducing regional disparities, with a maximum effect around 1.0 after one-two years. Conversely, for transitory downturns the peak effect is about 0.5 after one year, but the effects are not significant over the whole period under consideration.

2.4.5. Banking and Financial crises

This section discusses how financial crises affect regional disparities. To address this issue, we re-estimated our model using the dataset constructed by Laeven and Valencia (2013) to identify banking and financial crises episodes.

Figure 2.6 – Banking and Financial Crises



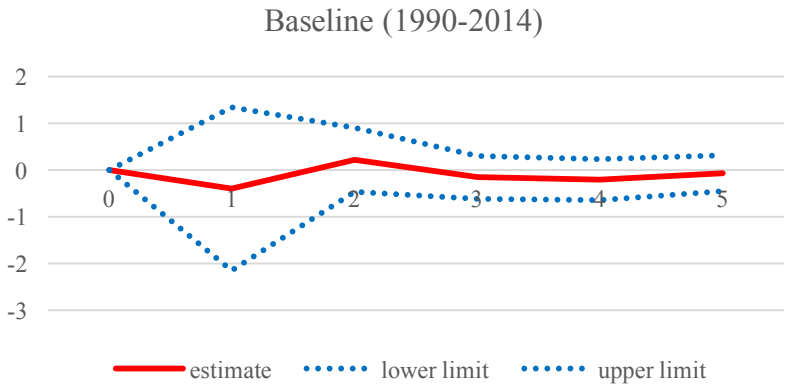
Note: see Figure 2.2.

Our findings suggest a significant decrease in regional disparities (Figure 2.6, Panels A and B). In particular, both for banking and financial crises[16], the peak year is the first, with a magnitude three and two times larger than the baseline effect, respectively. However, except for the short term effects of banking crises (1 year), the effects are not statistically significant different from zero.

2.4.6. The Great Recession

To assess the role of the Great Recession we re-estimated equation (2.4) for the period 1990-2014 following the definition of economic downturn adopted in the first part of the chapter. The results of this exercise are shown in Figure 2.7.

Figure 2.7 – The Effect of Economic Downturns on Regional Inequality (1990-2014)



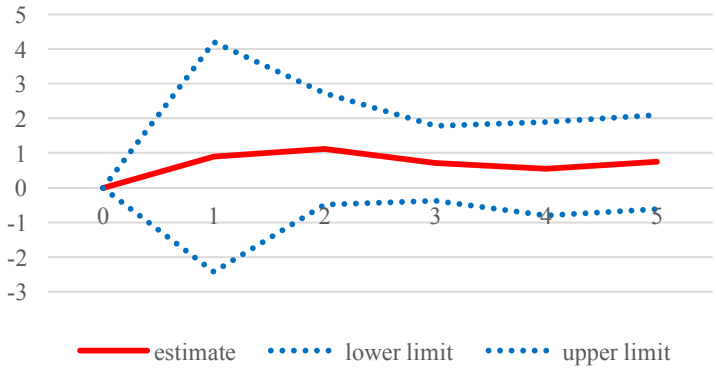
Note: see Figure 2.2.

[16] We have identified 17 financial crises of which 13 banking crises and 4 currency crises.

Including the Great Crisis in the sample, we obtain less clear results. In fact, the strong results we have obtained until now considering all the past crises seem to disappear. This is likely due to the depth of the recent crisis that hit hard all the countries and regions, determining a change respect to previous behaviours.

To further investigate the role of the Great Recession we re-estimated equation (2.4) considering in the abovementioned case the dummy variable $D_i = 0$ for the period before 2007. As Figure 2.8 shows point estimates suggest that the Great Recession has indeed increased regional disparities, though the wide confidence intervals imply that these are not statistically significant different from zero (see also Table B.15).

Figure 2.8 – The Impact of Economic Downturns - The Great Crisis



Note: see Figure 2.2.

We have done other several checks to confirm these findings. For instance, we have re-estimated equation (2.4) also using the database of Laeven and Valencia (2013), and the results are very similar to those showed in Figure 2.7 and 2.8. Moreover, we have re-estimated equation (2.4) only for the period 2008-2014 using both definitions of crisis and also in this case we obtained very similar and broadly unchanged results related to Figure 2.7 and 2.8.

To summarize, it seems that, up to 2007, economic downturns and financial crises impacted negatively regional inequality, while the opposite has happened in the aftermath of the last global crisis. Although in the latter case the wide intervals of confidence suggest caution, our findings are consistent with the results obtained in the first chapter of this thesis and with other studies related to the impact of the Great Recession on regional disparities and inequality in general (Dokic *et al.*, 2016; Petrakos and Psycharis, 2015; Trigilia and Viesti, 2016; OECD, 2014a, 2014b).

2.5. The role of economic conditions

2.5.1. Macroeconomic Conditions

As discussed earlier, it is possible that the response of regional disparities to an economic downturn or a financial shock may depend on macroeconomic or regional conditions.

To take into account macroeconomic conditions, we consider three indicators at the national level: the initial level of regional inequalities, the degree of trade openness, and the level of fiscal transfers.

Particularly, the initial conditions in terms of disparities are measured by the standard deviation in 1995, due to a greater availability of data. To measure the degree of trade openness we use the average (1990-2007) share of trade (exports and imports) to GDP. While, as a measure of the degree of fiscal transfers, we use the share of intergovernmental grants to GDP as average of available years[17].

As discussed in section 2.1, in economics literature the evolution of regional inequalities has often been discussed related to the country average level of development. Since the influential contribution of Kuznets (1955), there has been a large debate on the dynamics of regional inequalities. The Kuznets' hypothesis suggests that as an economy develops, market forces first increase and then decrease personal income disparities (Inverted U-shaped curve). After this contribution, several studies have empirically evaluated the existence of this relation. But no clear results have been reached, mainly due to the fact that conclusions depend on periods and methodologies used in the analysis. However, only few studies find the existence of the Kuznets' hypothesis. Conversely, according to several researchers, there has never been good evidence of an Inverted U-shaped curve in the relationship between regional disparities and level of development. For example, Gallup (2012) analysing a large body of this research's line, claims that: "There has never been good evidence for a pattern of rising inequality in low-income countries and falling inequality in higher income countries. The only evidence that appears to support the Kuznets hypothesis is the cross-sectional pattern of inequality levels across countries, although the Kuznets hypothesis is an assertion about the path of inequality within countries". In particular, according to the author, inequality declines in low-income

[17] Data on fiscal transfers are available for the following years: 1995, 2002, 2005, 2008, 2011.

countries, while it increases in high-income countries. Therefore, the debate around this issue continues.

On the other hand, the linkage between the degree of trade openness and the evolution of regional disparities has been discussed in the macroeconomic and regional science literature during the past decades. Petrakos (2009) pointed out that it is plausible that economies with a weaker production base are more sensitive to trade openness. Conversely, countries with a diversified production base can obtain a gain from the openness of the economy. In a recent paper, Ezcurra and Rodriguez-Pose (2014) found that, for 20 emerging countries over the period 1990-2006, the increase in international trade brought a considerably rise in within country inequality, with a greater effect in the poorest countries. The same authors, in a broader study on the effect of globalization on regional inequalities (Ezcurra and Rodriguez-Pose, 2013), found that countries with a greater degree of economic integration tend to show higher level of regional inequality. Other studies do not necessarily go in the same direction. Milanovic (2005), for example, finds no clear relation between the variables of interest.

With regard to intergovernmental grants, questions have been raised about their role in affecting regional disparities. Generally, the main objective of these transfers is to help poorer regions to catch up with the richer ones. Some studies have discussed a positive role of fiscal transfers in reducing regional disparities. For example, some ECB economists (Checherita *et al.*, 2009) argued that, for some European countries for the period 1995-2005, "net fiscal transfers contribute to income convergence (the distributional effect), but they also seem to impede, on average, output growth". On the other hand, Barro (1999) discussed that greater regional redistribution may lead to distortion in the market, therefore reducing investment and affecting negatively the process of growth. Kessler and Lessmann (2010) found a positive relationship between interregional transfers and regional disparities for 22 highly developed OECD countries over the period 1982-2000 and across countries. Hence, the debate continues about this issue, mainly because political autonomy, does not necessarily imply fiscal autonomy due to the existence of grants[18].

By using the econometric specification discussed in section 2.3.2, we analyse whether the effects of economic downturns on regional inequalities vary with different macroeconomic conditions of the countries. Since the baseline estimation relationship weakens during the Great Crisis we test this hypothesis only for the period 1990-2007.

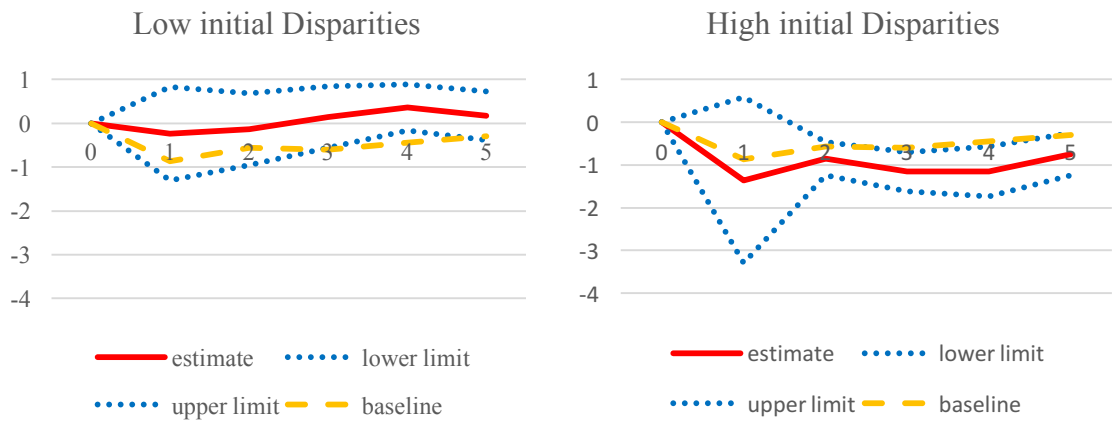
[18] In addition to papers cited in the text, Bahl (2000) and Sorens (2014), provide a deeper discussion about the role of fiscal transfers and fiscal federalism on regional disparities.

We also repeat the analysis for financial crises as defined by Laeven and Valencia (2013). As discussed earlier, it seems that financial crises tend to induce a decrease in regional disparities, although the effects are not statistically significant different from zero. If we take account of different economic conditions, we obtain a clearer picture, because the effects of financial shocks are very different across economic regimes.

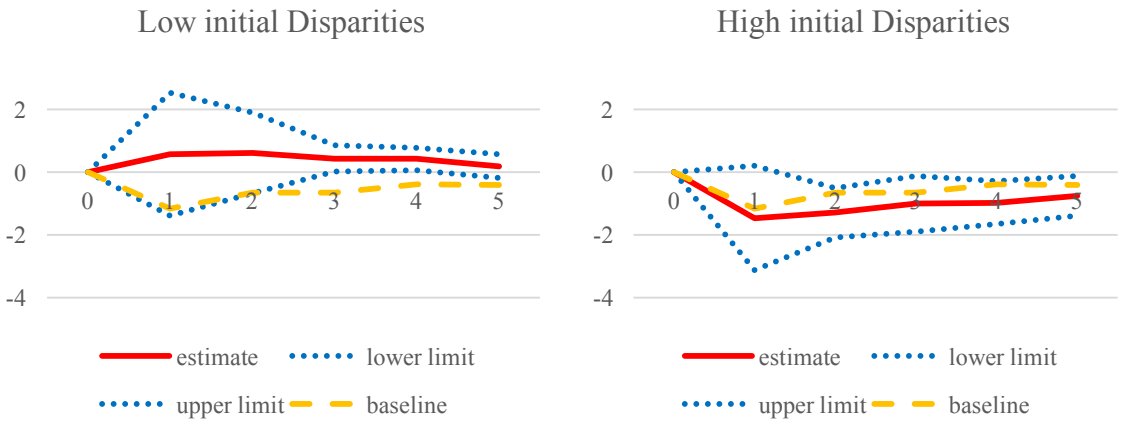
A first result is that the impact of economic downturns on regional disparities tends to be larger in countries with a high level of initial disparities. As it is showed in Figure 2.9 – Panel A, economic downturns reduce regional disparities both in the short and in the medium-run. Conversely, in countries with low initial disparities, the point estimates suggest a reduction in the short-term and an increase in the long-run, though the wide confidence intervals imply that these effects are not statistically significant different from zero. We obtain very similar results considering financial shocks (Figure 2.9 – Panel B).

Figure 2.9 – The role of Initial Disparities

Panel A - Economic Downturns



Panel B – Financial Shocks



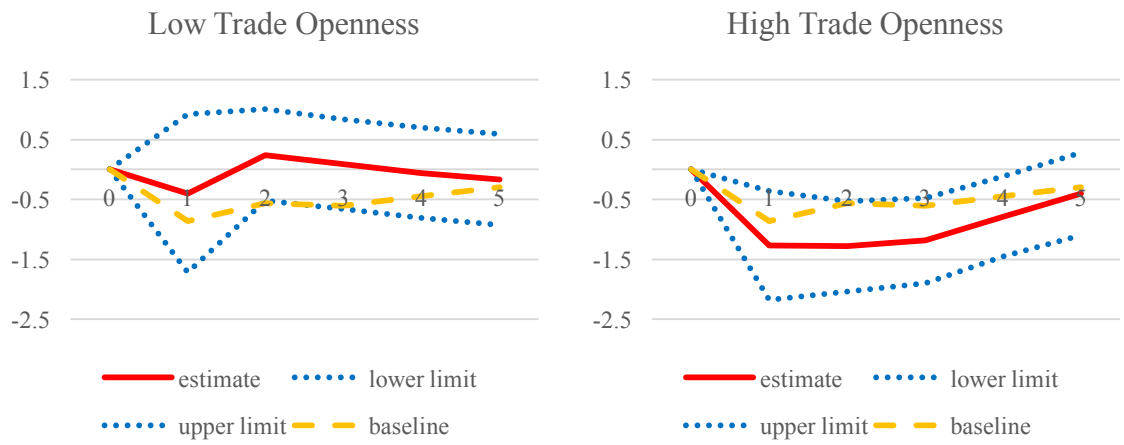
Note: see Figure 2.2.

The impact of economic downturns is also larger in countries with high level of trade openness both in the short and in the long-run. For these countries economic recessions have a significant and long-lasting reducing effect on regional income dispersion. On the contrary, for countries with a low degree of trade openness the effects are not statistically different from zero (Figure 2.10 – Panel A).

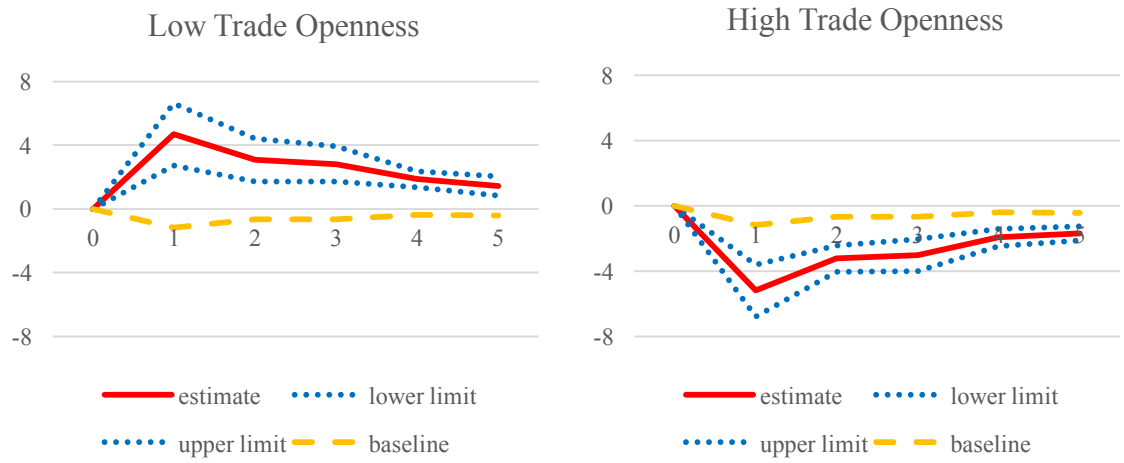
If we consider financial shocks, we obtain a larger effect than in the case of economic downturns. In fact, although with opposite effects, for countries with both low and high level of trade openness we have robust and statistically significant estimates. In particular, in the aftermath of financial crises, countries with low import/export flows show a large and long-lasting increase in regional disparities. The opposite happens for countries with high degree of trade openness (Figure 2.10 – Panel B).

Figure 2.10 – The role of Trade Openness

Panel A - Economic Downturns



Panel B – Financial Shocks



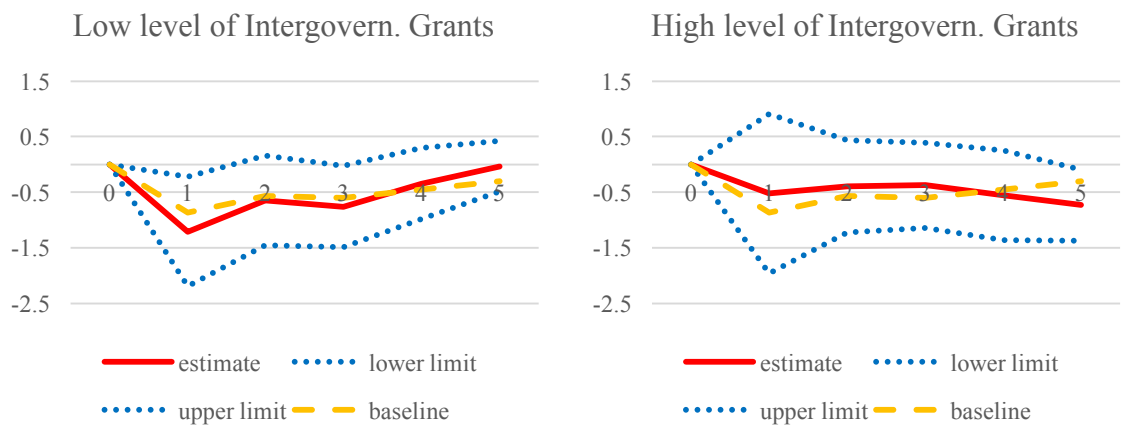
Note: see Figure 2.2.

Finally, when we consider the level of intergovernmental grants, we can observe a larger effect of economic downturns for countries with a low degree of transfers (Figure 2.11 – Panel A), even though effects are not statistically significant (except for the first year ahead in the case of low degree of grants).

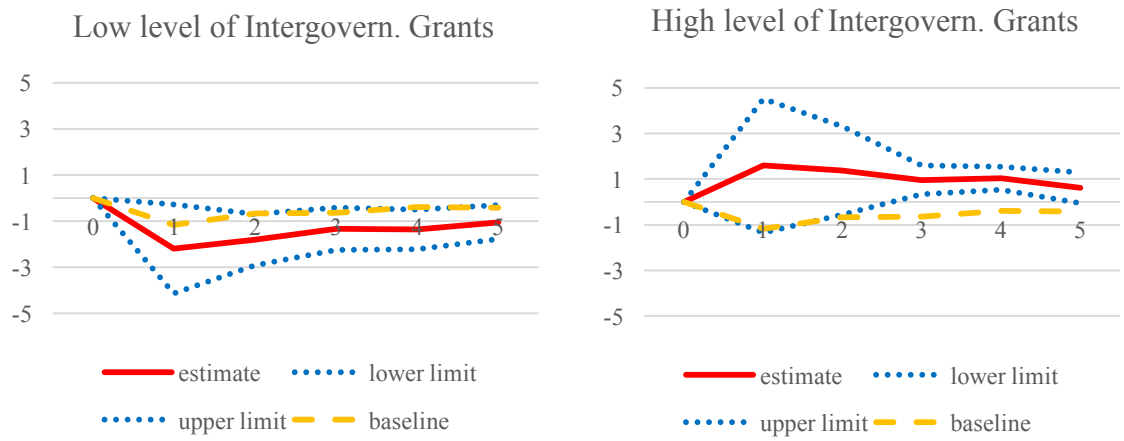
We obtain more robust results in the case of financial shocks. In fact, they tend to significantly reduce regional disparities in the case of low degree of transfers. The peak effect is about 2.0 after one year and the results are statistically significant over the whole period under consideration. On the contrary, although the estimates are statistically different from zero only in the medium-run, in countries with high level of intergovernmental grants we observe an increase in regional disparities in the aftermath of financial crises. However, in both cases regional inequality seems to gradually return to the pre-crisis levels (Figure 2.11 – Panel B).

Figure 2.11 – The role of Intergovernmental Grants

Panel A - Economic Downturns



Panel B – Financial Shocks



Note: see Figure 2.2.

2.5.2. Regional Conditions

The response of regional inequality to a shock can also differ because of different regional conditions. In particular, following the approach proposed in section 2.3.2, we want to test if disparities in these regional conditions can lead to different results.

To test for this hypothesis, we choose some conditions that may play a role in affecting regional disparities. We consider regional human capital disparities, regional differences in labour market efficiency as well as in innovation. In details, we use the share of labour force with tertiary education as a measure of human capital. To take account of regional disparities in innovation we use the ratio of Research and Development (R&D) expenditures to GDP, while for dispersion in regional labour market efficiency, we consider the long term unemployment (LTU) rate[19].

The potential effect of these regional conditions in affecting regional disparities and growth in general has been discussed by a large number of economists over the past decades. For example, it has long been believed that human capital plays a fundamental role in economic growth. Dijkstra *et al.* (2011) claim that for knowledge-driven economies to be based on innovation the presence of two elements is necessary: a well-educated human capital and also an educational system which successfully transmits key skills and competencies. Also, in an OECD specific publication, "Education at a Glance", the matter under discussion concerns the key role of education in general and specifically that of the higher education in boosting growth. In particular, OECD (2014c) points out that "countries invest in educational institutions to help foster economic growth, enhance productivity, contribute to personal and social development, and reduce social inequality, among other reasons". In addition, Petrakos (2009) claims that the more skilled and educated is the labour force, the higher will be the growth of regions. However, Fleisher *et al.* (2010) in analysing a large body of related literature, find that these studies, mainly based on cross-country data, have produced surprisingly mixed results. According to the authors, this is the reason why we find different methodologies and datasets in many studies. Furthermore, results may change because countries have different institutions (quality of education, labour market efficiency, etc.), making difficult the identification of an average effect.

[19] As a measure of disparity we use the coefficient of variation of the average value over the considered period. For disparities in LTU rate and in Human Capital we consider the period 1999-2007, while for disparities in R&D expenditures we consider the period 1995-2007.

The innovation capacity may play a role in the economic development of countries, and may also impact income inequality. For this reason, one of the main goals of the Europe 2020 strategy is to reach a minimum level of R&D expenditures over GDP in each country. Over the last few decades a large amount of literature has explored the relationship between innovation and growth both from a theoretical and an empirical point of view. In particular, the relationship between technological change and economic performance has been the research focus of the neo-Schumpeterian tradition. For example, Mazzucato (2013), underlines the key role of innovation for growth. In particular, in her recent contribution, she discusses the needs of an *Entrepreneurial State*, in the sense that the role of the government is crucial in this field. Furthermore, according to some studies, (i.e. Schwab and Porter, 2007) innovation is especially relevant for developed economies. It requires an adequate environment with developed institutions. Also, Dijkstra *et al.* (2011) claimed that before focusing on technology and innovation, less developed economies should ensure their basic infrastructure, education and health care services.

Finally, to capture the labour market efficiency of a country we use the long term unemployment rate that concerns those people who have been unemployed for 12 months or more. Several studies have shown the relationship between LTU and poor socioeconomic outcomes. In fact, long-lasting unemployment can be seen as an erosion of human capital as well as an inefficiency in labour markets.

As argued earlier in the chapter, we want to asses whether the level of dispersion in these regional conditions play a role in shaping the response of regional disparities to an economic crisis (or a financial shock).

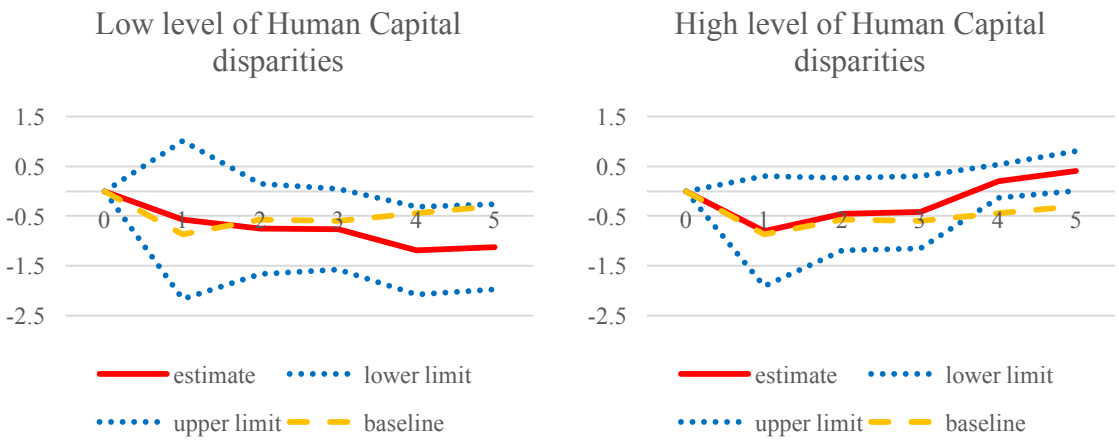
As a results of this exercise, Figure 2.12 – Panel A shows the case of different regimes in human capital regional dispersion for economic downturns. The point estimates suggest that economic downturns have a negative (i.e. reducing disparities) effect and that there is a similar impact for the two regimes at least up to the third period after the shock. After that, regional disparities appear to increase for countries with high inequality in regional human capital endowments, whereas they continue to decrease for the other countries. However, the estimates are statistically significant only in the long-run for the low regime.

The results are slightly different in the case of financial shocks. On the one hand, for countries with a low degree of dispersion in human capital, we observe a rise in regional disparities in the aftermath of an economic downturn. On the other hand, we note a decrease in regional inequalities for countries with high dispersion in human capital regional

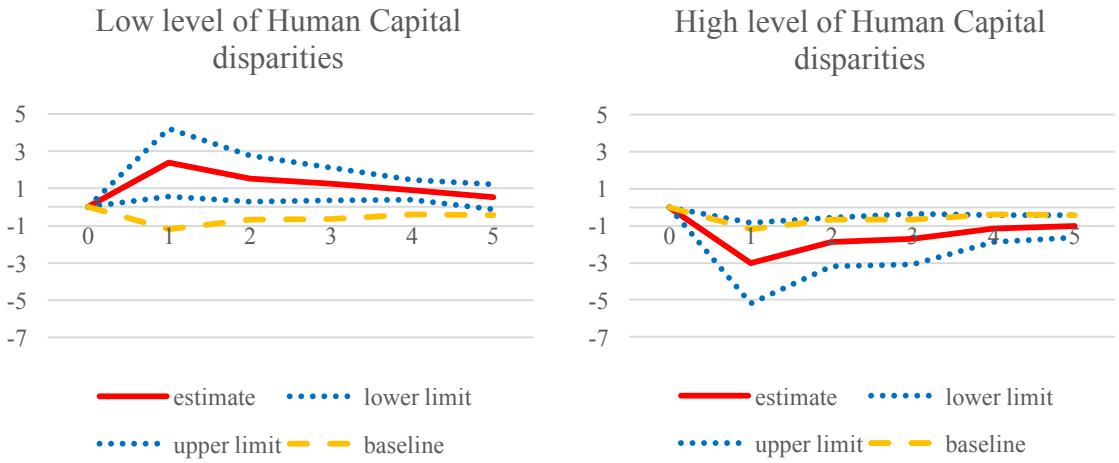
endowments. However, in both cases the regional income inequality seems to gradually return to pre-crisis levels (Figure 2.12 – Panel B).

Figure 2.12 – The role of Human Capital Disparities

Panel A - Economic Downturns



Panel B – Financial Shocks



Note: see Figure 2.2.

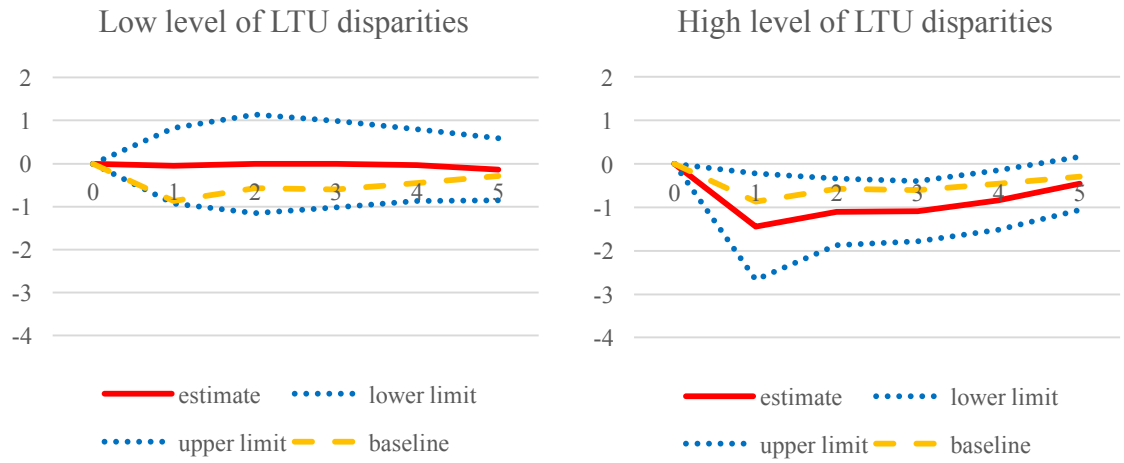
When we consider disparities in regional labour market efficiency we obtain contrasting results. The impact of economic downturns is stronger in the case of high inequality in labour market efficiency. In fact, as it is shown in Figure 2.13 – Panel A, for countries belonging to this regime, recessions have a reducing, statistically significant and long-lasting effect on regional inequalities. Estimates for the opposite case are not statically significant.

On the contrary, financial shocks have a reducing and long-lasting effect on regional inequalities in the case of low level of disparities in labour market efficiency. For the high

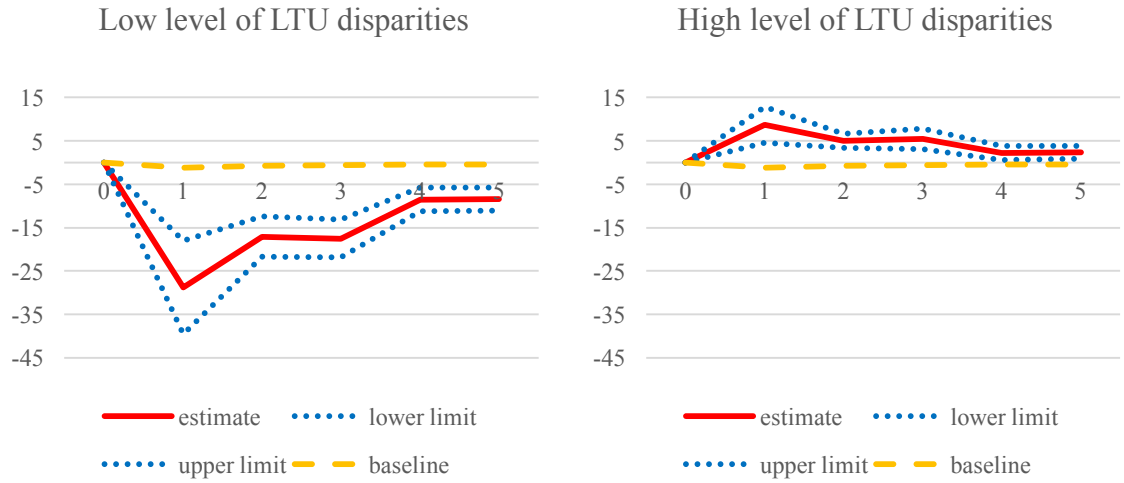
dispersion regime, we find an accelerating effect in regional disparities, that seems to return to pre-crisis level in the medium-run (Figure 2.13 – Panel B).

Figure 2.13 – The role of LTU disparities

Panel A - Economic Downturns



Panel B – Financial Shocks



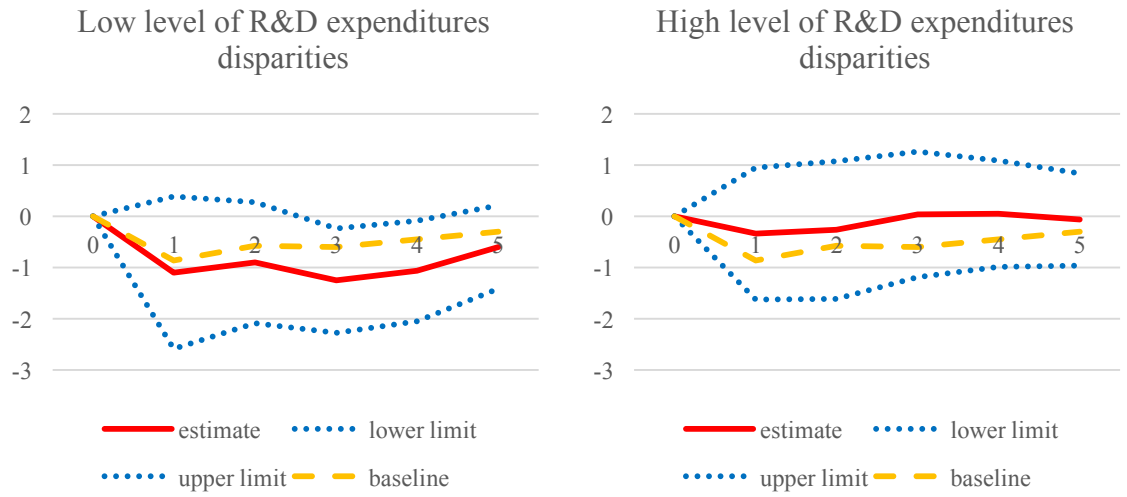
Note: see Figure 2.2.

Lastly, if we classify the regimes with regard to the level of innovation disparity we find that the reducing effect is larger in countries with low dispersion in the degree of innovation input (Figure 2.14 – Panel A). Since confidence intervals are wide, almost over the whole period, the estimates are significant only at a confidence level of 10%, for the low regime in the medium-run. In this circumstance we obtain larger and more robust results in the case of financial shocks. For low level of disparities in innovation, financial shocks have

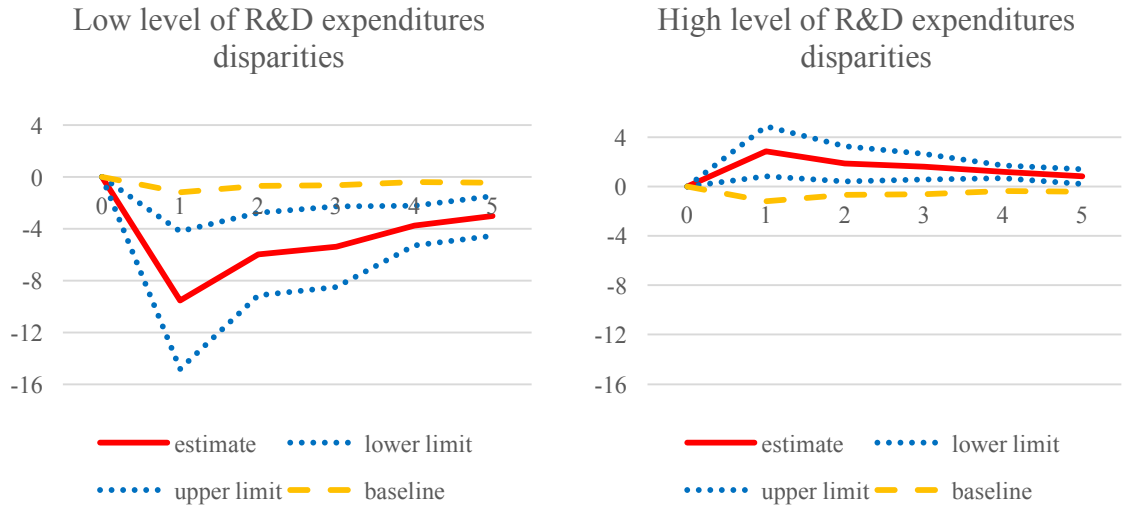
a negative and long-lasting effect on regional inequalities while the opposite happens in the case of the high dispersion regime.

Figure 2.14 – The role of Innovation Disparities

Panel A - Economic Downturns



Panel B – Financial Shocks



Note: see Figure 2.2.

2.6 Discussion of results and policy implications

As discussed in previous paragraphs, we find a clear evidence of reduction in regional disparities in the aftermath of economic crises up to 2007. This evidence disappears when we consider the Great Recession, suggesting a divergent role played by the last crisis.

Several reasons could explain the change. For example, the pervasiveness and the propagation of the 2007-08 crisis, or the role of some neoliberal policies that, quoting Ostry *et al.* (2016), "instead of delivering growth, have increased (income) inequality, in turn jeopardizing durable expansion". Increasing financial openness (or more in general globalization) and austerity measures adopted after the outbreak of the recent crisis, could have caused the change in the relationship between crises and regional inequalities. Globalization has made all economies more vulnerable to external shocks causing at the same time an uneven distribution of winners and losers within countries (Ezcurra and Rodriguez-Pose, 2013). On the other hand, austerity measures undertaken after the crisis have worsened the direct effect of the shock by making the recovery more difficult, mainly for weaker economies. As reported in Ostry *et al.* (2016), the notion that fiscal consolidations can be expansionary by raising output as well as employment and, in part, private sector confidence and investments, although advocated by several economists and policymakers, has been in practice unrealized. In fact, fiscal consolidation episodes have been followed, on average, by falls rather than by expansions in output.

Moving to the other findings of the chapter, the fact that before 2008 severe downturns have been followed by a smaller reduction in regional disparities with respect to severe downturns, could be explained by the similar short term effect of this type of crises. In fact, severe crises tend to be less selective in the short term generating similar output falls across economies. On the other hand, when they become more persistent, the policymakers' intervention becomes usually stronger in order to avoid permanent effects on more exposed economies, thus allowing for a reduction in territorial disparities.

Considering the Great Recession and its consequences as a unique case, not comparable with other crisis episodes in the last decades, the larger impact of banking and financial crises before 2008 is not surprising. In fact, financial crises usually coincide with economic downturns which worsen firm balance sheets or generate difficulties in the banking sector (Dell'Ariccia *et al.* 2008). By this way, the increased financial and banking frictions, like credit crunch or freezing in interbank lending, exacerbate the negative effects of the crisis. At the same time, the most developed economies are often the most advanced from a financial point of view and, therefore, the most exposed to financial shocks. As a consequence, the most developed regions tend to suffer more this type of crises.

Another interesting finding of the chapter is that the impact of economic downturns (and financial crises) on regional disparities varies with the conditions of the economy. Particularly, from the macroeconomic point of view, it seems that all the effects go in the

same direction both in the case of economic downturns and financial crisis, observing larger effects in the last case.

A greater reduction in disparities in countries with higher initial level of regional inequalities is probably related to the forces of spatial concentration and dispersion as claimed by Berry (1988) Richardson (1973) and Stilwell (1980). As discussed in Petrakos and Psycharis (2015), expansion cycles begin in advanced central regions where the interaction of agglomeration effects and market size provides an advantage over other regions. Hence, periods of economic growth are associated with increasing spatial disparities, due to the better position of the leading regions which capture the opportunities generated by an expanding economy. On the contrary, the leading regions are more exposed to demand and supply contractions and therefore they will be hit harder by the pressures generated in a contracting economy.

For the second macroeconomic condition, we may identify in the exposure to international markets the reason of a larger reduction in disparities in countries with higher degree of trade openness. This finding is indeed not new in the literature. In fact, as discussed in the study of Cerra *et al.* (2009), countries that are more open to trade may tend to have slower recoveries partly due to a less effective fiscal policy. In our case, it seems that economies that are more open to trade with the rest of the world are less protected from an incumbent crisis. In fact, economies that are less devoted to trade, because are more specialized in protected sectors where the demand is potentially more stable, are usually less capable to take advantages in high growth periods but at the same time are more sheltered from the risk of external shocks.

Finally, the fact that the reduction in regional inequality is more evident in countries with a low level of intergovernmental grants could be not surprising. Although transfers are motivated by redistributional or stabilization purposes, they do not always work as expected. In particular, here we take into consideration the magnitude of transfers (as a share to GDP), but not their "quality". On this point, numerous contributions have been published mainly in relation to the case of the use of European Structural Funds. The fact that "quantity" is not directly correlated with "quality" and also with the achievement of the objectives, has been well documented in Rodriguez-Pose and Fratesi (2004) and Boldrin and Canova (2001). Another possible explanation could be the presence of moral hazard, due to the fact that stabilization and redistributive policies are often not easily distinguishable (Obstfeld and Peri, 1998) and also regions that do not need transfers receive them in the aftermath of crises. To this regard, the well-known debate on the role of fiscal policies in cushioning the

effect of adverse shocks has been recently discussed in Poghosyan *et al.* (2016) pointing out the different role of stabilizing, risk sharing and redistributive policies.

As for macroeconomic factors, also for regional conditions it seems that almost all the effects go in the same direction either in the case of economic downturns or financial crisis. The only result that differs between the two types of shocks is related to different regimes of LTU rate.

In particular, our results suggest that the reduction of disparities seems larger in countries where differences in terms of human capital are higher. This probably means that a good endowment of human capital may be not enough to withstand the short-term impact of the crisis if other institutions are not in place. Generally speaking, the share of population with higher education is positively correlated with the GDP growth, and also with the degree of development. Hence, the expectation is that economies with high qualified workforce should suffer less the impact of the crises. However, our results imply that in the period under consideration, the regional gap has narrowed more in countries with high disparities in human capital. As a consequence, it seems that regions with a relative poor endowment of human capital have had a better degree of resilience at least in the short-term reaction to downturns.

At the same time, the fact that regional inequality tends to increase (or at last slightly decrease) in countries with higher disparity in innovation expenditure, highlights the key role of the innovative capacity in fostering growth. In fact, innovation usually tends to be determinant mainly in advanced instead of in less developed economies. In particular, more innovative economies may react and recover better from particular shocks due to their dynamicity.

Finally, we are surprised by the conflicting results on the role of the disparities in LTU rates. In fact, as expected, the results obtained suggest a clear increase in inequalities in the aftermath of financial shocks in countries with high disparities in LTU rate. In this case the reason is well-known. A high share of long term unemployed is a clear signal of labour market inefficiency, a characteristic that hardly help economies to easily escape from a crisis. However, the results obtained when we consider all economic downturns, suggesting a decrease in regional disparities also in presence of high disparities in LTU rates, stimulate further research on this topic.

Our results bring important policy implications at the regional and at the national levels. Intergovernmental grants should be drawn in a proper way in order to really cushion

the negative effects of economic crises. Redistribution and stabilization are two different objectives that should be reached with different policy decisions.

In making regions more open, policymakers should carefully evaluate costs and benefits for each region. In fact, although regions may benefit from a higher trade openness in boom phases, on the other hand they might suffer more in the aftermath of economic crises.

At the same time, policymakers should reduce disparities in innovation expenditures within countries. In fact, as suggested by our results, less uneven countries in terms of innovation input, have experienced a greater reduction in per-capita GDP regional inequality. This is why the more innovative is a region, the better performance it should be able to reach, even during economic downturns.

The unexpected results in the case of human capital disparities should be further investigate. We believe that the greater reduction in regional disparities in countries with high level of differences in human capital endowment is only a short-term effect. In fact, by carefully looking at graphs and tables, it seems that after the third or fourth year after the occurrence of crises there is a change in the detected path. At the same time, the role of labour force migration in affecting regional human capital endowment (here not investigated), could have influenced our results (also in the case of LTU rate disparities). However, as discussed earlier, it is possible that good endowment of human capital may be insufficient to offset the short-term impact of the crisis if other institutions are not in place. In particular, this is very likely when shocks hit harder manufacturing and construction sectors, that are mainly characterized by a process of knowledge acquisition based on "learning by-doing". In light of these results, policymakers should promote human capital accumulation by aiming at reducing disparities and at the same time strengthening complementary institutions in order to make the first effective also in early phases of crises.

Our analysis raises some questions that remain unanswered and require further analysis. For example, it could be interesting to analyse the role of institutional characteristics (electoral laws, democratic regime, religions, corruption, etc.) in shaping the results, by including them in the baseline model as control variables, or evaluating their level in each country using the methodology proposed by Auerbach and Gorodnichenko (2013). Moreover, further investigations are required in order to understand whether the relationships between the effects of the crises on regional inequality and the macroeconomic as well as regional conditions have changed with the recent crisis. Data limitation prevent us to conduct such analysis.

2.7 Conclusions

A large body of the literature has analysed the relationship between regional inequality and growth focusing on the connection between the level of economic development and income dispersion across regions. In contrast, a scarce attention has been given in the literature to the effect of crises and economic downturns on regional inequality. This chapter tries to fill this gap.

Using an unbalanced panel of 29 OECD countries from 1990 to 2014, and computing Impulse Response Functions of the evolution of regional income dispersions following an economic downturn, the chapter shows that economic downturns are associated with a significant and long-lasting reduction in regional inequality up to 2007. In contrast, it seems that the Great Recession has had, on average, an increasing effect on regional disparities.

In detail, we find that our results are robust to several checks, such as different measures of inequality, and different controls included in our model. Moreover, the results are not affected by the spatial level of aggregation.

We also show that, for the period 1990-2007, the peak effect is generally reached after one year, and the reduction in regional disparities remains statistically significant up to the fifth year after the occurrence of the downturn. Taking into account the severity of recession, it seems that after moderate recessions inequalities are reduced more. Furthermore, when we make a distinction between persistent and transitory downturns, we find that persistent crises have a larger and long-lasting effect in reducing regional disparities.

The results also suggest that the reduction of regional inequality is greater after banking and financial crises, though estimates are not statistically significant for some years.

Our findings imply that the impact of economic downturns (and financial crises) on regional inequality varies with the state of the economy, and depends both from macroeconomic and regional conditions. For the two types of shocks, the reducing effects are larger in countries with high initial disparities, high degree of trade openness and low level of intergovernmental grants.

Considering regional conditions, both for economic downturns and financial shocks, reducing effects are larger in countries with low level of dispersion in R&D expenditures.

In the case of high level of regional disparities in human capital we find a reducing effect of crises (larger for financial shocks than economic downturns). However, when we consider economic downturns it seems that after the third or fourth year after the occurrence of crises there is a change in the detected path (i.e. increase in inequality).

The results of the two types of shocks differ in the case of different regimes of labour market efficiency. In the case of economic downturns, a reducing effect is detected in countries with high level of regional disparities in LTU rates, while the opposite (low level of regional disparities in LTU rates) happens in the case of financial shocks.

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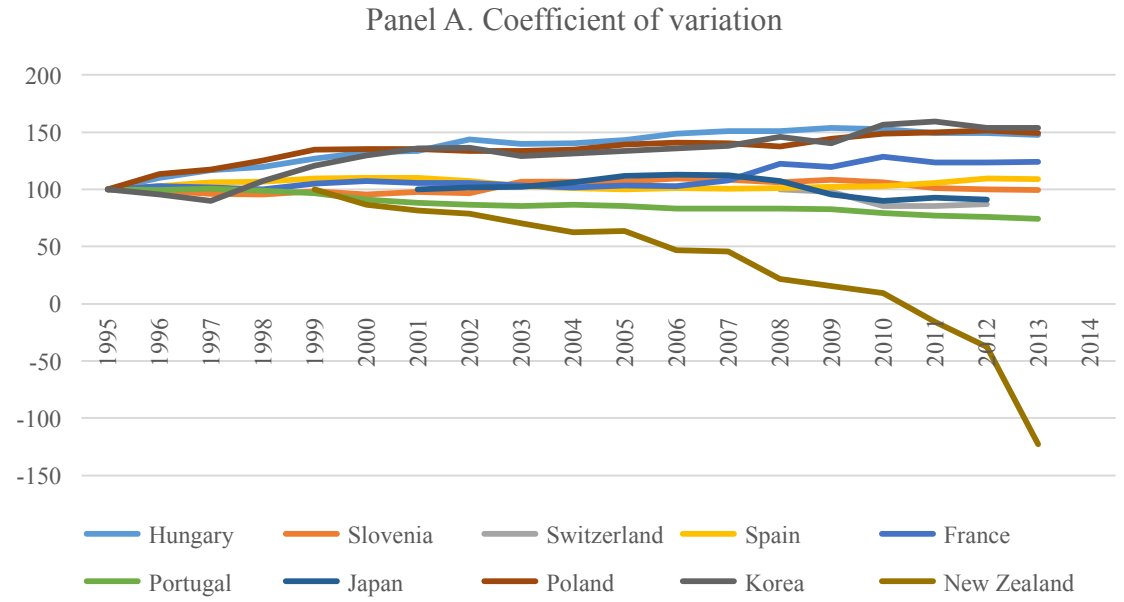
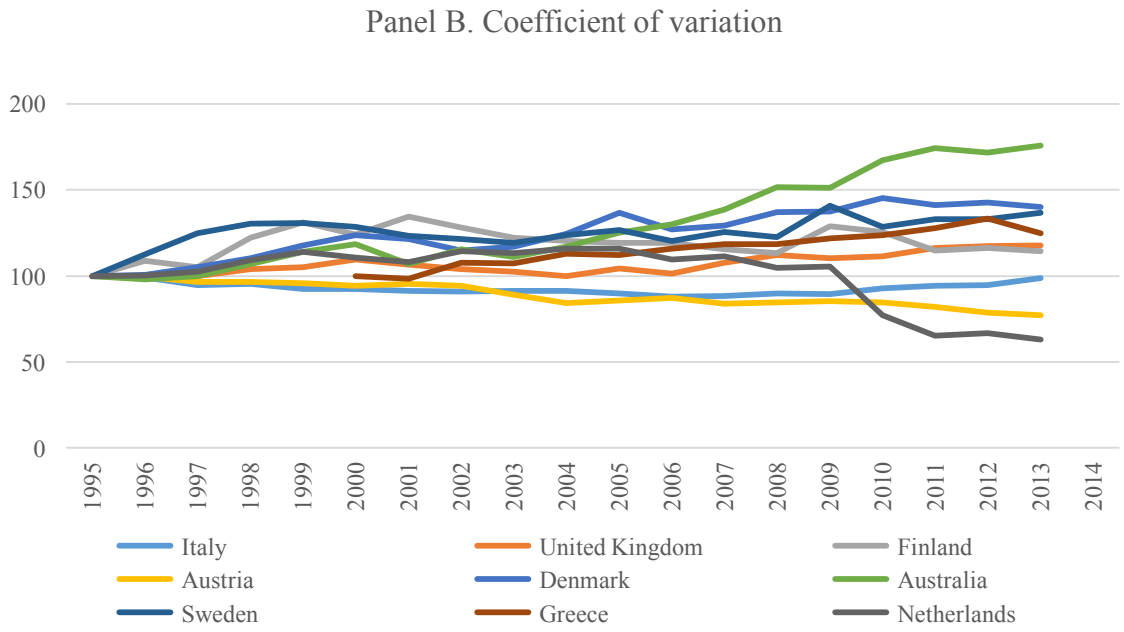
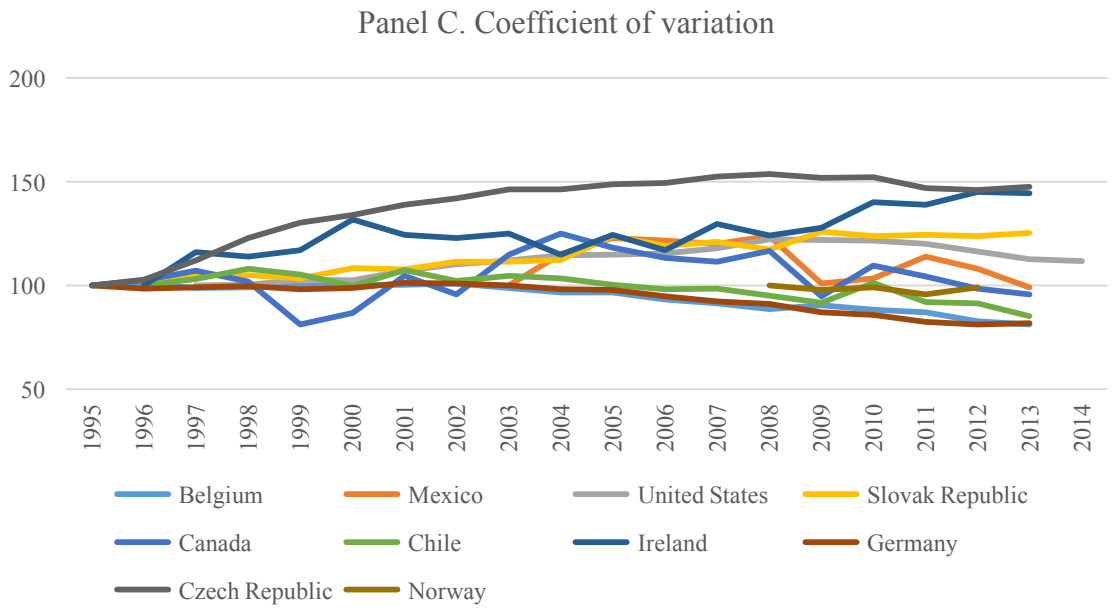
APPENDIX B

Figure B.1 - Evolution of Regional Disparities Across Countries – Coefficient of Variation






Panel C. Coefficient of variation
200
150
100
50
1995
1996
1997
1998
1999
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2006
2007
2008
2009
2010
2011
2012
2013
2014
Belgium
Mexico
United States
Slovak Republic
Canada
Chile
Ireland
Germany
Czech Republic
Norway

Table B.1 - Descriptive Statistics of Standard Deviation of Per-Capita GDP (1990-2014)

Country	Average	Min	Max	Ranking
Australia	6994.515	4295.837	13003.53	16
Austria	7857.629	7324.454	8256.157	14
Belgium	22657.78	20104.72	24415.45	1
Canada	14077.84	8614.798	18580.69	5
Chile	13037.36	10212.54	15511.99	6
Czech Republic	9874.436	5201.06	13321.66	9
Denmark	7055.739	5051.908	8758.871	15
Finland	8259.178	5283.986	9548.012	13
France	5670.614	4558.441	6816.028	24
Germany	10997.73	10283.39	11658.91	8
Greece	6891.522	5253.148	8036.967	18
Hungary	6616.799	3544.6	8420.503	20
Ireland	12300.63	6883.685	14766.51	7
Italy	9283.996	8870.08	9472.961	11
Japan	4073.118	3612.301	4704.06	26
Korea	2474.614	1350.615	4384.649	28
Mexico	17992.02	14809.73	21849.95	2
Netherlands	6634.737	4655.368	8037.65	19
New Zealand	1970.659	130.1076	3112.684	29
Norway	9783.477	9311.65	10090.08	10
Poland	3347.049	1576.986	5015.979	27
Portugal	5495.938	4815.397	5796.314	25
Slovak Republic	14797.39	8489.09	21273.05	4
Slovenia	6292.469	4511.341	8005.863	21
Spain	5855.89	4623.831	6255.705	23
Sweden	6901.155	4438.851	8283.611	17
Switzerland	6242.704	5869.975	6915.37	22
United Kingdom	8441.15	6683.087	9693.138	12
United States	17392.26	13013.1	20261.24	3

Table B.2 - The Effect of Economic Downturns on Regional Inequality - Baseline (1990-2007)

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-221.3*	-256.4**	-476.8**	-581.4***	-555.5**
	(113.5)	(116.3)	(185.8)	(209.2)	(209.0)
Observations	311	284	257	230	203
R-squared	0.278	0.401	0.551	0.636	0.694
Effect in rapport to $\overline{\sigma_{i,t+k} - \sigma_{i,t}}$	-0.75	-0.46	-0.58	-0.55	-0.44

Note: Country and Time Fixed effects, as well as Teulings and Zubanov bias correction included but not reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B.3 - Probit Model of the effect of past changes in regional inequality on the probability of economic downturns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Downturn dummy$_{t-1}$	-	-	-	-	0.755***	0.711***	0.747***	0.703***
					(0.229)	(0.237)	(0.224)	(0.243)
Downturn dummy$_{t-2}$	-	-	-	-	-	0.163	0.327	0.348
						(0.242)	(0.201)	(0.221)
Downturn dummy$_{t-3}$	-	-	-	-	-	-	-0.599***	-0.526**
							(0.216)	(0.214)
Downturn dummy$_{t-4}$	-	-	-	-	-	-	-	-0.272
								(0.205)
$\Delta\sigma_{i,t-1}$	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$\Delta\sigma_{i,t-2}$	-	0.0000	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000
		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$\Delta\sigma_{i,t-3}$	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
			(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$\Delta\sigma_{i,t-4}$	-	-	-	0.0002	0.0002	0.0002	0.0002	0.0002
				(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Observations	311	284	257	230	230	230	230	230
Pseudo R-squared	0.00308	0.00840	0.00836	0.0159	0.0694	0.0716	0.0969	0.101

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B.4 - The Effect of Economic Downturns on Regional Inequality - Time trend

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-224.6**	-193.1*	-461.5**	-724.9**	-751.3***
	(97.26)	(102.4)	(173.1)	(264.1)	(233.6)
Time trend	-0.128	7.075	34.1	84.88*	144.3**
	(9.92)	(17.52)	(27.39)	(41.7)	(55.17)
Observations	311	284	257	230	203
R-squared	0.208	0.34	0.502	0.594	0.648
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.76	-0.35	-0.56	-0.68	-0.59

Note: see Table B.2.

Table B.5 - The Effect of Economic Downturns on Regional Inequality – No time trend and time fixed effects

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-224.8**	-180.3*	-396.6**	-498.7**	-439.7**
	(99.76)	(100.3)	(165.7)	(230.6)	(194.5)
Observations	311	284	257	230	203
R-squared	0.208	0.339	0.493	0.567	0.598
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.76	-0.33	-0.48	-0.47	-0.35

Note: see Table B.2.

Table B.6 - Robustness Check – Change in Coefficient of Variation as dependent variable

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-0.0047	-0.0017	-0.0089*	-0.0111*	-0.0112**
	(0.0028)	(0.0026)	(0.0044)	(0.0060)	(0.0049)
Observations	311	284	257	230	203
R-squared	0.151	0.254	0.43	0.511	0.514
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.53	-0.35	-1.24	-1.28	-1.22

Note: see Table B.2.

Table B.7 - Robustness Check - Addition of Control Variables

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-324.4**	-466.5**	-647.5***	-800.2***	-560.0***
	(129.4)	(190.7)	(209.6)	(212.0)	(179.3)
$\Delta\sigma_{i,t-1}$	-0.0819	-0.00844	0.209	0.131	-0.113
	(0.146)	(0.110)	(0.257)	(0.261)	(0.129)
$\Delta\sigma_{i,t-2}$	-0.0730	0.139	0.0218	-0.0442	-0.0954
	(0.0705)	(0.0891)	(0.112)	(0.0958)	(0.109)
$\sigma_{i,t}$	-0.184	-0.521	-0.829*	-1.193**	-1.202***
	(0.150)	(0.306)	(0.412)	(0.458)	(0.402)
Average per-capita GDP	0.0642	0.138	0.283	0.298	0.238
	(0.0763)	(0.147)	(0.197)	(0.234)	(0.207)
Number regions	43.12	116.8**	170.0**	259.0***	276.9***
	(25.93)	(49.88)	(62.00)	(69.70)	(68.41)
Observations	257	230	203	177	151
R-squared	0.308	0.513	0.682	0.801	0.857
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.10	-0.84	-0.79	-0.75	-0.44

Note: see Table B.2.

Table B.8 - Robustness Check - Different Level of Spatial Aggregation

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-16.98	-100.1**	-212.8***	-215.0***	-130.5*
	(39.60)	(41.40)	(61.98)	(55.45)	(72.83)
$\Delta\sigma_{i,t-1}$	-0.0961	0.0402	-0.112	-0.117	-0.0859
	(0.0797)	(0.0668)	(0.116)	(0.0877)	(0.131)
$\Delta\sigma_{i,t-2}$	0.0519	0.0556	-0.0218	-0.0409	-0.178*
	(0.0541)	(0.0541)	(0.0615)	(0.0789)	(0.107)
$\sigma_{i,t}$	-0.201***	-0.376***	-0.516***	-0.627***	-0.591***
	(0.0641)	(0.118)	(0.159)	(0.159)	(0.165)
Average per-capita GDP	0.106***	0.151***	0.147***	0.142**	0.110*
	(0.0295)	(0.0372)	(0.0479)	(0.0597)	(0.0560)
Number TL3 units	1,012***	1,896***	2,788***	3,486***	3,553***
	(252.6)	(477.9)	(619.4)	(623.2)	(571.9)
Observations	1,402	1,241	1,080	919	762
R-squared	0.359	0.544	0.699	0.799	0.864
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.06	-0.18	-0.26	-0.20	-0.10

Note: see Table B.2.

Table B.9 - Severe Downturns

	K=1	K=2	K=3	K=4	K=5
Severe Downturns	-129.4	-230.5**	-333.3**	-474.8**	-436.2**
	102.2	94.32	143.5	172.2	192.5
Observations	311	284	257	230	203
R-squared	0.187	0.313	0.457	0.532	0.571
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.44	-0.42	-0.41	-0.45	-0.34

Note: see Table B.2.

Table B.10 - Moderate Downturns

	K=1	K=2	K=3	K=4	K=5
Moderate Downturns	-231.1**	-295.1**	-534.4**	-646.4**	-827.3**
	(106.4)	(134.9)	(228.6)	(274.9)	(311.8)
Observations	311	284	257	230	203
R-squared	0.195	0.322	0.466	0.543	0.621
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.78	-0.53	-0.65	-0.61	-0.65

Note: see Table B.2

Table B.11 - Persistent Downturns

	K=1	K=2	K=3	K=4	K=5
Persistent Downturns	-199.7	-452.5**	-274.5	-904.9**	-327.9
	(251.3)	(189.6)	(402.2)	(376.6)	(322.9)
Observations	311	284	257	230	203
R-squared	0.25	0.362	0.503	0.57	0.619
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.67	-0.82	-0.33	-0.85	-0.26

Note: see Table B.2.

Table B.12 - Transitory Downturns

	K=1	K=2	K=3	K=4	K=5
Transitory Downturns	-171.2	-203.2	-322.3	-381.4	-585.7
	(157.6)	(139.7)	(246.9)	(224.7)	(436.6)
Observations	311	284	257	230	203
R-squared	0.266	0.368	0.473	0.531	0.591
Effect in rapport to $\overline{\sigma_{i,t+k} - \sigma_{i,t}}$	-0.58	-0.37	-0.39	-0.36	-0.46

Note: see Table B.2.

Table B.13 - Banking Crises

	K=1	K=2	K=3	K=4	K=5
Banking Crises	-907.5*	-1,130	-1,520	-1,295	-1,152
	(516.7)	(848.5)	(1,257)	(1,172)	(1,299)
Observations	257	230	203	177	151
R-squared	0.259	0.430	0.589	0.696	0.798
Effect in rapport to $\overline{\sigma_{i,t+k} - \sigma_{i,t}}$	-3.07	-2.04	-1.85	-1.22	-0.91

Note: see Table B.2.

Table B.14 - Financial Crisis

	K=1	K=2	K=3	K=4	K=5
Financial Crisis	-611.3	-808	-1,430	-1,066	-1,358
	(564.9)	(878.5)	(1,172)	(1,197)	(1,053)
Observations	257	230	203	177	151
R-squared	0.252	0.424	0.586	0.694	0.801
Effect in rapport to $\overline{\sigma_{i,t+k} - \sigma_{i,t}}$	-2.07	-1.46	-1.74	-1.00	-1.07

Note: see Table B.2.

Table B.15 - The Effect of Economic Downturns on Regional Inequality - Baseline (1990-2014)

	K=1	K=2	K=3	K=4	K=5
Downturn dummy	-64.24	67.49	-75.69	-135.2	-54.03
	(170.4)	(130.5)	(132.9)	(174.6)	(186.9)
Observations	481	452	423	394	365
R-squared	0.203	0.300	0.386	0.459	0.529
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.40	0.22	-0.16	-0.21	-0.07

Note: see Table B.2.

Table B.16 - Global Financial Crisis

	K=1	K=2	K=3	K=4	K=5
Financial Crisis	143.1	347.4	337.1	354.5	595.5
	(322.8)	(304.2)	(313.1)	(535.2)	(662.3)
Observations	481	452	423	394	365
R-squared	0.204	0.306	0.389	0.455	0.534
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	0.89	1.11	0.70	0.54	0.74

Note: see Table B.2.

Table B.17 - Initial income inequalities (Economic Downturns)

	K=1	K=2	K=3	K=4	K=5
Low level of Initial Income Inequalities	-70.27	-74.59	115.4	380.8	220.1
	(191.5)	(276.1)	(347.9)	(343)	(430)
High level of Initial Income Inequalities	-401.7	-474.6***	-948.9***	-1,234***	-950.1**
	(349.6)	(130.1)	(228.2)	(379.3)	(383.2)
Observations	233	215	197	179	161
R-squared	0.193	0.238	0.343	0.407	0.472
Low level of Initial Income Inequalities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.24	-0.13	0.14	0.36	0.17
High level of Initial Income Inequalities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.36	-0.86	-1.16	-1.16	-0.75

Note: Country and Time Fixed effects included but not reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table B.18 - Initial income inequalities (Financial Shocks)

	K=1	K=2	K=3	K=4	K=5
Low level of Initial Income Inequalities	168.2	333	352.2	443.2*	235.6
	(351.7)	(431.9)	(206.7)	(229.7)	(291.5)
High level of Initial Income Inequalities	-433.7	-719.2**	-829.0*	-1,039**	-961.1*
	(300.3)	(264.8)	(442.2)	(444)	(486.1)
Observations	233	215	197	179	161
R-squared	0.175	0.224	0.314	0.378	0.46
Low level of Initial Income Inequalities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	0.57	0.60	0.43	0.42	0.19
High level of Initial Income Inequalities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.47	-1.30	-1.01	-0.98	-0.76

Note: see Table B.17.

Table B.19 - Trade openness (Economic Downturns)

	K=1	K=2	K=3	K=4	K=5
Low level of Trade Openness	-117.7	134.2	74.88	-61.53	-216.4
	(238)	(257.8)	(373.6)	(489.1)	(585.4)
High level of Trade Openness	-375.6**	-709.0***	-973.9**	-833.9*	-513
	(163)	(253)	(356.7)	(435.6)	(531.4)
Observations	311	284	257	230	203
R-squared	0.266	0.371	0.488	0.533	0.58
Low level of Trade Openness					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.40	0.24	0.09	-0.06	-0.17
High level of Trade Openness					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.27	-1.28	-1.19	-0.78	-0.40

Note: see Table B.17.

Table B.20 - Trade openness (Financial Shocks)

	K=1	K=2	K=3	K=4	K=5
Low level of Trade Openness	1,387***	1,694***	2,296***	1,978***	1,796***
	(350.8)	(452.8)	(551.3)	(322.1)	(465.6)
High level of Trade Openness	-1,540***	-1,785***	-2,478***	-2,063***	-2,139***
	(286.6)	(269.1)	(491.1)	(343.6)	(333.9)
Observations	311	284	257	230	203
R-squared	0.257	0.358	0.469	0.52	0.579
Low level of Trade Openness					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	4.69	3.06	2.80	1.86	1.42
High level of Trade Openness					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-5.20	-3.23	-3.02	-1.94	-1.69

Note: see Table B.17.

Table B.21 - Intergovernmental grants (Economic Downturns)

	K=1	K=2	K=3	K=4	K=5
Low level of Intergovernmental Grants	-357.2*	-358.2	-623.4	-366	-44.89
	(176.7)	(270.2	(364.7)	(416)	(351.4)
High level of Intergovernmental Grants	-155	-215.5	-305.9	-590.7	-925.8*
	(258.4)	(279.1)	(381.4)	(520.6)	(491.5)
Observations	260	238	216	194	172
R-squared	0.232	0.308	0.42	0.454	0.489
Low level of Intergovernmental Grants					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.21	-0.65	-0.76	-0.34	-0.04
High level of Intergovernmental Grants					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.52	-0.39	-0.37	-0.55	-0.73

Note: see Table B.17.

Table B.22 - Intergovernmental grants (Financial Shocks)

	K=1	K=2	K=3	K=4	K=5
Low level of Intergovernmental Grants	-653.0*	-998.3**	-1,095**	-1,446**	-1,324**
	(347.9)	(369.9)	(459)	(560.5)	(561.7)
High level of Intergovernmental Grants	470	758.5	787.9**	1,096***	781.1
	(526.8)	(652.7)	(317.5)	(329.7)	(514.7)
Observations	260	238	216	194	172
R-squared	0.213	0.296	0.397	0.439	0.476
Low level of Intergovernmental Grants					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-2.21	-1.81	-1.34	-1.36	-1.04
High level of Intergovernmental Grants					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	1.59	1.37	0.96	1.03	0.62

Note: see Table B.17.

Table B.23 - Human Capital disparities (Economic Downturns)

	K=1	K=2	K=3	K=4	K=5
Low level of Human Capital disparities	-170.6	-417.2	-628.3	-1,272**	-1,422**
	(286.0)	(304.5)	(405.3)	(568.8)	(659.8)
High level of Human Capital disparities	-236.5	-255.2	-345.7	216.7	514.6
	(198.9)	(244.2)	(362.2)	(218.6)	(309.6)
Observations	283	258	233	208	183
R-squared	0.308	0.396	0.494	0.548	0.601
Low level of Human Capital disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.58	-0.75	-0.77	-1.19	-1.12
High level of Human Capital disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.80	-0.46	-0.42	0.20	0.41

Note: see Table B.17.

Table B.24 - Human Capital disparities (Financial Shocks)

	K=1	K=2	K=3	K=4	K=5
Low level of Human Capital disparities	701.2**	846.2*	1,010**	978.9***	684.7
	(326.4)	(416.5)	(437.8)	(340.2)	(518.5)
High level of Human Capital disparities	-891.3**	-1,038**	-1,406*	-1,241**	-1,304**
	(393.1)	(444.8)	(684.3)	(468.6)	(472.8)
Observations	283	258	233	208	183
R-squared	0.306	0.387	0.483	0.533	0.591
Low level of Human Capital disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	2.37	1.53	1.23	0.92	0.54
High level of Human Capital disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-3.01	-1.88	-1.71	-1.17	-1.03

Note: see Table B.17.

Table B.25 - Long Term Unemployment disparities (Economic Downturns)

	K=1	K=2	K=3	K=4	K=5
Low level of Long Term Unemployment disparities	-14.84	-3.009	-10.48	-36.82	-170.3
	(157.8)	(383.6)	(504.1)	(543.6)	(554.4)
High level of Long Term Unemployment disparities	-427.3*	-610.2**	-891.3**	-887.4*	-569.0
	(220.8)	(260.0)	(343.1)	(445.3)	(469.6)
Observations	273	250	227	204	181
R-squared	0.270	0.349	0.454	0.505	0.581
Low level of Long Term Unemployment disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.05	-0.01	-0.01	-0.03	-0.13
High level of Long Term Unemployment disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.44	-1.10	-1.09	-0.83	-0.45

Note: see Table B.17.

Table B.26 - Long Term Unemployment disparities (Financial Shocks)

	K=1	K=2	K=3	K=4	K=5
Low level of Long Term Unemployment disparities	-8,524***	-9,437***	-14,358***	-9,085***	-10,687***
	(1,943)	(1,547)	(2,170)	(1,776)	(2,070)
High level of Long Term Unemployment disparities	2,577***	2,790***	4,488***	2,399**	3,023**
	(746.3)	(559.2)	(1,152)	(1,033)	(1,134)
Observations	273	250	227	204	181
R-squared	0.265	0.339	0.439	0.492	0.580
Low level of Long Term Unemployment disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-28.81	-17.07	-17.51	-8.53	-8.43
High level of Long Term Unemployment disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	8.71	5.05	5.47	2.25	2.38

Note: see Table B.17.

Table B.27 - Innovation disparities (Economic Downturns)

	K=1	K=2	K=3	K=4	K=5
Low level of Innovation disparities	-324.2	-497.5	-1,025*	-1,131*	-750.9
	(268.3)	(395.7)	(509.5)	(634.0)	(626.4)
High level of Innovation disparities	-98.57	-145.3	36.90	60.11	-76.15
	(232.2)	(450.7)	(611.6)	(671.8)	(696.0)
Observations	282	259	236	213	190
R-squared	0.234	0.327	0.442	0.497	0.569
Low level of Innovation disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-1.10	-0.90	-1.25	-1.06	-0.59
High level of Innovation disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-0.33	-0.26	0.05	0.06	-0.06

Note: see Table B.17.

Table B.28 - Innovation disparities (Financial Shocks)

	K=1	K=2	K=3	K=4	K=5
Low level of Innovation disparities	-2,819***	-3,305***	-4,418***	-3,973***	-3,809***
	(955.6)	(1,072)	(1,561)	(994.0)	(1,173)
High level of Innovation disparities	842.7**	1,013**	1,324**	1,254***	1,017**
	(364.1)	(477.0)	(512.8)	(346.8)	(447.7)
Observations	282	259	236	213	190
R-squared	0.230	0.317	0.421	0.477	0.566
Low level of Innovation disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	-9.53	-5.98	-5.39	-3.73	-3.00
High level of Innovation disparities					
Effect in rapport to $\overline{\sigma_{\iota,t+k} - \sigma_{\iota,t}}$	2.85	1.83	1.61	1.18	0.80

Note: see Table B.17.

Chapter 3

THE HETEROGENEOUS IMPACT OF THE GREAT RECESSION AND THE ROLE OF REGIONAL COMPETITIVENESS

3.1. Introduction

The financial crisis that hit the United States in 2007 and quickly spread globally with the characteristics of a severe economic crisis, the most serious since 1929, is still under analysis by economists. Several aspects have been considered in the literature and one of the most debated concerns the different behaviours of states, regions and other territorial units in response to the crisis. To analyse this aspect, a new line of research has quickly spread and enriched with numerous contributions. Resilience became a useful concept to explain the different behaviours of economies in response to crises. Today, the concept of resilience has assumed considerable importance in the economic field because, due to the integration and interdependence of economies caused by the current globalisation process, their vulnerability appears to have increased. In fact, although this concept has been studied for a long time in the physical as well as psychological and ecological science and in engineering, only recently it has spread in economics and, in particular, in the study of territorial disparities.

Several recent studies (Pendall *et al.*, 2010; Briguglio *et al.* 2009; Simmie and Martin, 2010; Martin and Sunley, 2013) have tried to define the concept. Others (Fingleton *et al.*, 2012; Chapple and Lester, 2010; Psycharis *et al.*, 2014) have focused on its empirical testing. In regional economics, the main question is to understand why some areas react and recover better from a particular shock, and while others fail to do it. According to Martin (2012), in fact, understanding how different economies react to major recessionary shock, can be crucial to analyse the issue of long-term regional growth patterns and, thus, the existence, persistence and evolution of regional imbalances among regions across time. Consequently, understanding the different behaviours in response to the crisis becomes imperative, in order to develop appropriate policies to revitalize the European economy.

As suggested by Martin, Sunley and Tyler (2015), efforts in this area must focus on

achieving two objectives. On the one hand, it is important to identify and explain how regions and local units react to shocks. On the other, it is also crucial to identify the sources of the different reactions, taking into consideration their variety and interaction.

In the first part, this chapter aims at contributing in achieving the first goal, by analysing the behaviour in response to the crisis of the European regions (NUTS 2 level) belonging to the core 15 Member States. We focused on employment as a variable of interest. Using the shift share analysis (SSA), a traditional tool for the comparison of regional performances, both in its classic version and in a recent version with spatial effects (Espa *et al.*, 2014), we try to understand the contribution of the different components (National Share, Industrial Mix, Regional Shift and spatial effects) in shaping the overall results.

In the second part, by extending the approach used in Lane and Milesi-Ferretti (2011) to take into account spatial effects, we try to identify the initial conditions in terms of regional competitiveness that can explain the heterogeneous behaviours of regions in response to the crisis and the presence of spillover effects. In particular, by considering that regional competitiveness may arise from the interaction of different drivers, we will investigate whether a better competitiveness is also associated with better performances.

Using the Shift Share Analysis, we find that the regional determinants seem to have played the main role in explaining how regions have reacted to the last economic crisis. In addition, using a spatial version of the SSA to investigate the role of spatial interaction in affecting the results, we find that the locations that show a *neighbourhood advantage* (according to SSA with spatial effect), are in general those which suffered less from the crisis, highlighting the presence of virtuous regional clusters and the importance of spatial relationships in determining the final result.

By investigating the relationship between the initial (pre-crisis) conditions in terms of competitiveness and regional performances during the period considered, we find a strong correlation between labour market efficiency, innovation and specialization in high value added sectors on one side, and better response to the crisis, on the other. An unexpected role is instead played by human capital, that is negatively correlated with employment growth. At first view it seems that investments in education and training are not sufficient to ensure the preservation and the regain of the workplace in the short time, if not accompanied by other favourable conditions. Furthermore, it seems that the variables considered explain well the different vulnerability of the economies, but not the ability to recover. Finally, our results are also robust to different sub-samples and different estimation techniques.

The rest of the chapter is organized as follows. The next section provides an overview

of the different contributions on the impact of the last crisis and the possible role for regional competitiveness. Section 3 presents the data and a descriptive analysis of the variables used. The fourth section describes in detail the shift share analysis method, whereas the results are discussed in the fifth section. Section 6 discusses pre-crisis competitiveness variables and shows the results for the relation between these variables and performances during the crisis. Finally, section 7 discusses some mechanisms and policy implications, whereas section 8 concludes by summarizing the main findings.

3.2. Crises and regional competitiveness: a review

In recent years, there has been a proliferation of studies related to the effects of shocks on economies. For example, Cerra and Saxena (2008), in an international study over 190 different countries for the period 1960-2001, showed that crises are one of the driver of the different growth paths of economies. Decomposing crises in political, financial (currency and banking), civil wars, and dividing countries in different groups (i.e. continents, poor and rich countries, and so on), the authors, through econometric analysis, demonstrated that crises have a different impact, depending on their type, and also that countries have a different degree of resilience to a common shock. At the regional level, Martin (2012) conducted an investigation on the resilience of United Kingdom regions to the recent crisis. Defining a simple index of resilience[20], the author showed the different employment reactions to the crises over the last thirty years. Also Fingleton *et al.* (2012), addressed the issue of employment resilience of UK regions for the period 1971-2008, using a SURE model. From this study both a different reaction of regions to the same shocks and different reactions of the same region to different shocks emerged. The approach of Fingleton *et al.* (2012) has been applied also by Di Caro (2015) for Italian regions for the period 1977-2011. He found that, similarly to the UK case, Italian regions have had different reactions to different crises.

Other authors focused only on the last crisis. Particularly, Lane and Milesi-Ferretti (2011), analysing a sample of 162 countries, demonstrated that the impact and the severity of per-capita GDP reduction is systematically related to specific macroeconomic and financial conditions in the pre-crisis period. Also, Rose and Spiegel (2011) argued that pre-crisis conditions are a key factor in shaping the response to the crisis. In this case, they found

[20] This index is the ratio of the employment performance of the single region to the national average during the period of crisis.

that countries with current account surpluses seem better protected from slowdowns. Moreover, Groot *et al.* (2011), published a study with some stylized facts about the heterogeneous response of European countries and regions to the Great Crisis. They found that the sectoral composition matters and that this may be a key characteristic to understand the different behaviour of countries and regions. Conversely, Brakman *et al.* (2015) focus on the degree and nature of regional urbanization, showing that this is relevant for the resilience of the regions. Particularly, the authors demonstrated that EU regions with a relatively large population share in commuting areas have been relatively more resistant to the impact of the 2008, in terms of both employment and per-capita GDP.

In addition to these studies, a substantial body of literature has been published for single countries. Psycharis *et al.* (2014), introducing an index of "*crisilience*" with different explanatory variables, found some specific clusters for Greece (both at NUTS 2 and NUTS 3 level). On this evidence, they conclude that the recent crisis has had a different impact for each territorial unit. Sensier and Artis (2016), using the Martin's index of resilience in a study on business cycles for UK regions, demonstrated that the South was the most resilient area. Lagravinese (2015), analysing the Italian regional employment performances over the last fifty years, argued that disparities between northern and southern regions are in an upward trend.

As discussed earlier, this study investigates the role of the initial conditions in shaping the reaction to the Great Crisis in terms of competitiveness. The exact meaning of regional competitiveness, has been widely debated. Although there is not a general accepted definition (Kitson *et al.*, 2004; Cambridge Econometrics, 2003; Budd and Hirmis, 2004; Bristow, 2010), we refer to some predominantly territorial characteristics that affect the regional overall performance. As pointed out by Cellini and Soci (2002), it should not be confused with its macroeconomic (state level) or microeconomic (firm level) version. This is the reason why several studies have tried to define the boundaries of regional competitiveness. On the one hand, according to Porter (1998) and Gardiner *et al.* (2004), it can be simply approximated by the level of productivity of a system. On the other hand, other authors pointed out that regional competitiveness results from the interaction of different drivers. For example, Budd e Hirmis (2004) suggested a framework balancing the competitive advantage at the firm level and the comparative advantage at the regional level. Moreover, to better understand the numerous aspects of regional competitiveness, Camagni (2002; 2009) and Kitson *et al.* (2004), argued that local assets are the key drivers of the competitive advantage. In fact, though with different approaches, these authors claim that

the interaction of different drivers (well developed infrastructures, high quality of human capital, strong innovative capacity, etc.) is the source of regional competitiveness. Regard to the latter point, it is noteworthy that several studies have empirically determined which are the specific drivers of different regions, and the connections with the performance of the same regions (Cambridge Econometrics, 2003; Camagni and Capello, 2013; Annoni and Kozovska, 2010).

3.3. Data and descriptive statistics

3.3.1. Data

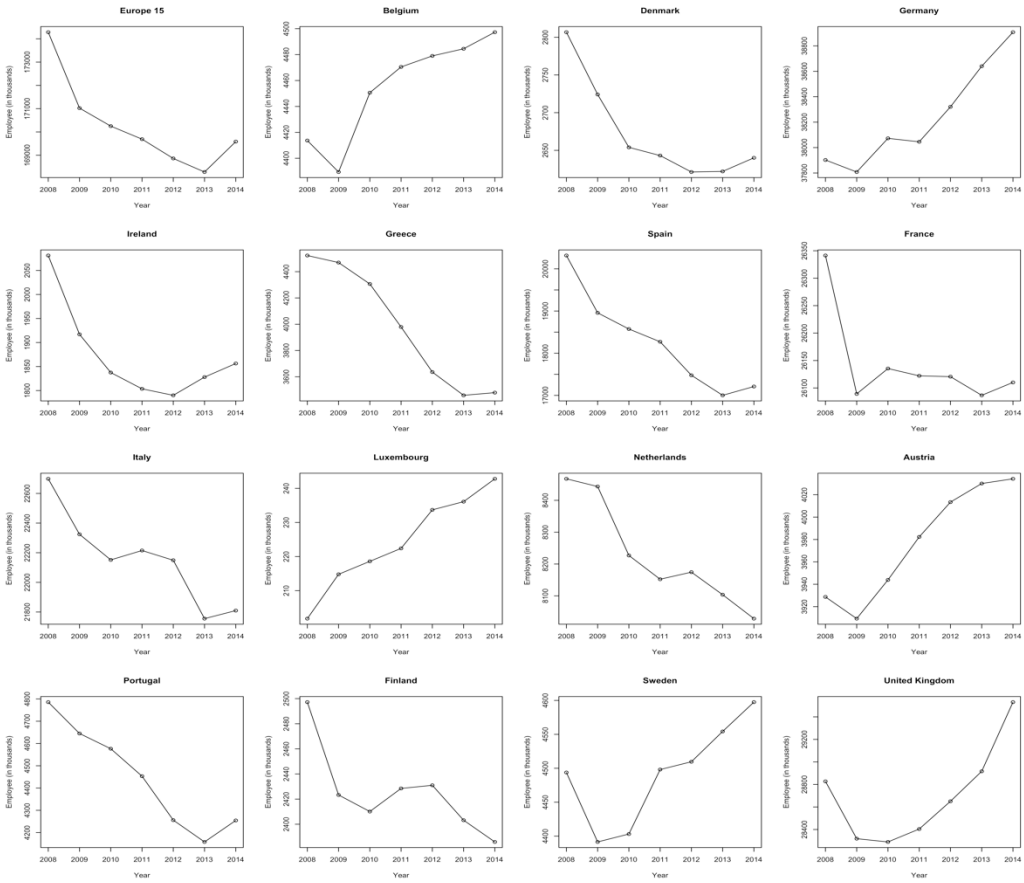
To reach our goals, we explored the potential of the Eurostat REGIO Database. Our dataset covers an unbalanced panel of 207 regions belonging to 15 European countries (Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Netherlands, Luxembourg, Austria, Portugal, Finland, Sweden and Great Britain) for the period 2008-2014 (NUTS 2 level)[21]. As variable of interest, we refer to the number of employed people per region. We have chosen this variable for several reasons. First, employment has a greater social relevance than the value added. Second, employment is preferred to unemployment because the latter is affected by the labour force participation rate. As known, the number of discouraged workers increases in period of crisis. As a consequence, the variations of unemployment rate may depend on statistical reasons rather than by the intrinsic dynamics of the labour market.

3.3.2. Employment patterns in European regions

Several studies have shown that the Great Crisis has had a non-homogeneous impact on different countries and regions. As shown in Figure 3.1, employment growth paths are very dissimilar, after the crisis.

[21] A summary table in Appendix C shows all regions considered in this study.

Figure 3.1 – Number of employed (in thousands) for 15 Members-Europe and single Countries



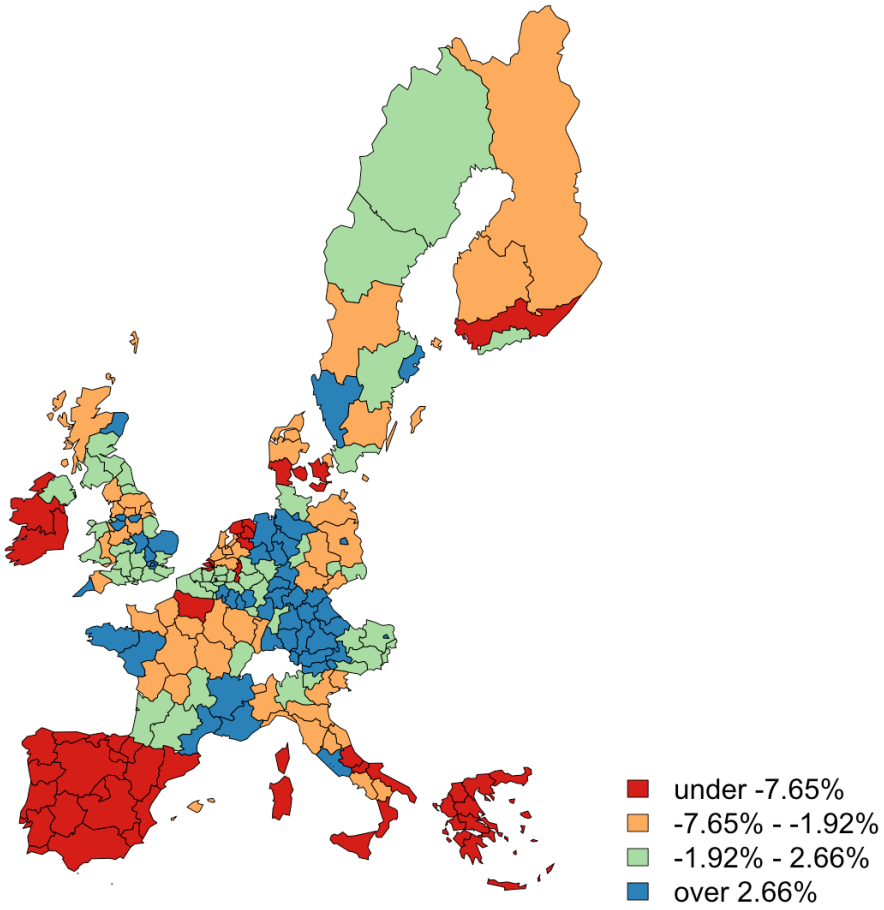
Source: own calculations based on Eurostat data.

Apart from Luxembourg that did not experience a reduction during the period considered, we can clearly identify three groups.

The first group is composed of countries that slightly suffered the crisis and started quickly to recover the employment losses during the crisis. Germany, Belgium and Austria belong to this group. Conversely, Sweden and Great Britain form a second group. For these countries the crisis has been larger and longer than the previous group, but they were able to recover the job losses anyway. In the third and last group we find the remaining countries: Denmark, Ireland, Greece, Spain, France, Italy, Netherlands and Finland. These countries experienced a severe recession both in terms of value added and employment. In particular, up to 2014, they had not yet reached the number of pre-crisis employed. Though with different dynamics, it seems that they entered in a sort of economic stagnation from which it appears to be difficult to escape. In fact, we noticed only a slight growth of employment in some countries, between 2010 and 2011. Too scarce, to call it a robust recovery.

A greater heterogeneity can be seen in regional behaviours (Figure 3.2).

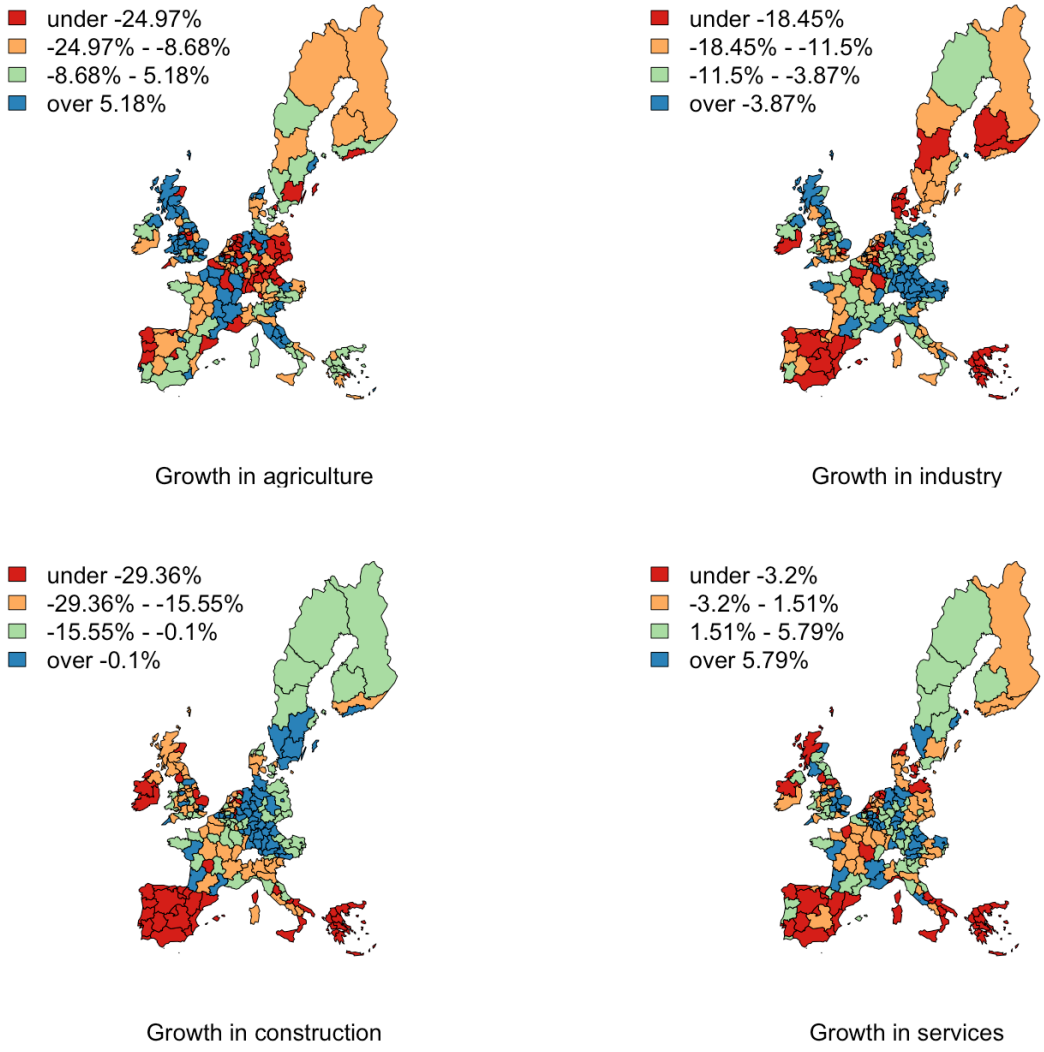
Figure 3.2 – Employment growth rates of European regions (period: 2008-2014)



The map shows the regions which have been more affected by the crisis in terms of job losses. Spanish, Portuguese, Irish, Greek and southern Italian regions belong to this group. On the contrary, the regions belonging to Germany, Belgium, (as well as some of Great Britain and Austria) have experienced an increase in employment rather than a decline.

From a quick look, it seems that the specific cluster to which the regions belong to appears to be more important than the country of origin. For this reason, we have decided to use spatial statistical and econometrical tools. A similar structure of Figure 3.2 can be found when we decompose the employment growth rate across the main sectors (Figure 3.3).

Figure 3.3 – Employment growth rates in the basic economic sectors (period: 2008-2014)



To formally verify our intuition, we refer to one of the most known index of spatial autocorrelation, the Moran's Index. It is defined as follows:

$$I = \frac{N}{S_0} \frac{\sum_i \sum_j w_{ij}(x_i - \mu)(x_j - \mu)}{\sum_i (x_i - \mu)^2} \tag{3.1}$$

where: N is the number of the observations, w_{ij} is the element in the spatial weight matrix corresponding to the observation pair (i, j), x_i and y_j are observations for the locations i and j (with mean μ) and S_0 is a scaling constant.

To calculate this index, a weight matrix W should be defined. This is why we need to establish which regions are neighbours. The matrix W is defined as follows:

$$W = \begin{pmatrix} w_{11} & \cdots & w_{1n} \\ \vdots & \ddots & \vdots \\ w_{n1} & \cdots & w_{nn} \end{pmatrix} \tag{3.2}$$

The matrix is a binary one, and we use the row-standardised version in which each w_{ij} element assumes value 1 if regions i and j are considered neighbours (according to a previously defined concept of neighbourhood) and 0 otherwise. Obviously, w_{ii} =0, so *self-neighbourhood* is not possible.

Several types of weight matrixes have been proposed in spatial analysis literature. Some authors (Brasili *et al.* 2012; Dall'Erba and Le Gallo, 2008; Ramajo *et al.* 2008) have followed the distance cut-off approach. On the other hand, others (Arbia, 2006; Piras and Arbia, 2007) have used a contiguity based approach.

In this chapter to compute the Moran's Index and, for the reminder of the analysis, we use the *k-nearest neighbours* approach. In particular, we use k=4. Our choice is motivated as follows. First, we want to include in the study all regions (also island), and *contiguity* approach does not allow this. Second, it has not been possible to consider the *minimum distance* approach due to the fact that it would have generated a very large number of links, which is difficult to interpret from an economic point of view. Third, we have chosen the *k-nearest neighbours* approach with k=4 because it is the nearest value related to the average links found using the *contiguity-queen* approach[22]. Needless to say, we have tested the robustness of our results with *contiguity-queen* approach and different values of k, and we have obtained similar and broadly unchanged results.

Table 3.1 shows the Moran's Index for the employment growth rate over the period 2008-2014 and its decomposition for the main economic sectors.

[22] In *contiguity-queen* matrix approach, regions with common border and vertex are considered neighbours.

Table 3.1 – Moran's Index for employment growth rate of economic sectors (period: 2008-2014, k=4)

	Moran's Index	Z-values	P-value
Employment growth	0.68602	15.13862	0.00000
Growth in agriculture	0.08339	1.93353	0.02659
Growth in industry	0.45683	10.11648	0.00000
Growth in construction	0.70191	15.48668	0.00000
Growth in services	0.55963	12.36913	0.00000

The results confirm the evidence of spatial autocorrelation both at the aggregate and at sectoral levels. In fact, Moran's I statistic is high in almost all cases and the *p*-value suggests to reject the null hypothesis of no spatial autocorrelation. Only the agricultural sector seems to be in a borderline condition. In the remainder of analysis, we will take into consideration these conclusions.

Summary tables in the Appendix (Table C.1) show the results for Moran's I statistics on the bases of different versions of the spatial weight matrix. Results are very close to the ones presented in Table 3.1.

3.4. Methodology

As discussed in Martin *et al.* (2016), the debates about the role of the economic structure in shaping the impact of exogenous shocks, have recently increased in the light of the Great Crisis. In particular, according to a strand of the related research, the diversification of the activities is the way to reach sustainable growth (Hausmann *et al.*, 2013). Conversely, other researches pointed out that the specialization is the key driver of the growth (Storper, 2013; Storper *et al.*, 2015) but at the same time high specialised economies may be more vulnerable to shocks than those with a diverse economic structure (Garcia-Mila and McGuire, 1993; Belke and Heine, 2006).

To shed some light in how the industrial composition may have had a role in affecting the resilience of the European economies to the recent crisis, we use the shift share analysis (SSA) in the first part of the chapter. As it is known, SSA is a widespread method to study the composition of regional performance. In fact, the classic version allows to determine the part of regional economic growth or decline which can be attributed to national trends, and to separate it from the one related to economic structure and regional factors. Shift share

analysis does not constitute a regional economic model, but allows us to analyse some strengths and weaknesses of the considered regions. In addition, due to the fact that the effects are evaluated for different economic sectors, it allows to examine the productive structure of each region.

In detail, the classical version of the Shift Share Analysis decomposes economic changes in the period (*t*, *T*) into three components, *National Share*, *Industrial Mix*, *Regional Shift*:

$$EC = NS + IM + RS \tag{3.3}$$

where EC (*Economic Change*) = E_T - E_t.

The *National Share* (NS) indicates the regional growth that would have occurred if some economic variables in all industries within a region had grew at the same rate of the national economy. Namely:

$$NS = \sum_i E_{irt}(g_n) \tag{3.4}$$

where:

$$g_n = \frac{E_{nT} - E_{nt}}{E_{nt}} \tag{3.5}$$

Here E_{irt} and E_{irT} are the number of employed people in sector *i* for each region *r*, respectively at the beginning (*t*) and at the end of the period (*T*); E_{nt} and E_{nT} represent the number of the employees in sector *i* at time *t* and *T* at the national level; g_n is the employment growth rate at the national level.

The *Industrial Mix* (IM) shows how employment in an industry would have changed if it had followed the specific industry's national trend deducting the overall national trend g_n. As a consequence, a favourable distribution of industries with good performances will lead the region to a growth advantage. In detail:

$$IM = \sum_i E_{irt}(g_{in} - g_n) \tag{3.6}$$

and

$$g_{in} = \frac{E_{inT} - E_{int}}{E_{int}} \tag{3.7}$$

Except for the already defined variables, E_{int} and E_{inT} are the number of employed at time *t* and *T* in sector *i* at the national level, and g_{in} is the national employment growth rate in sector *i*.

Finally, the *Regional Shift* (RS) is the component that captures the local competitiveness. It is considered the most important effect, since it approximates the unique competitive advantage that a region may have. It shows how an economic variable in an industry would have changed if it had followed the specific industry's local trend deducting the specific industry's national trend. In detail:

$$RS = \sum_i E_{irt}(g_{ir} - g_{in}) \tag{3.8}$$

and

$$g_{ir} = \frac{E_{irT} - E_{irt}}{E_{irt}} \tag{3.9}$$

Here, except for the already defined variables, g_{ir} is the regional employment growth rate for each sector *i*.

To establish if interactions across neighbouring regions affect results, in this chapter we use also a shift share analysis with spatial effects. A large body of literature has been published on spatial shift share analyses. Among these, we remember the pioneering paper of Nazara and Hewings (2004), the studies of Matlaba *et al.* (2014) and Espa *et al.* (2014). In this chapter, we use the latter approach that allows the decomposition of the *Regional Shift* in two effects: the *neighbour-nation regional shift* (NNRS), and the *region-neighbour regional shift* (RNRS), keeping untouched the traditional structure of SSA. The authors suggest the following decomposition:

$$\text{EC= NS + IM +NNRS + RNRS} \tag{3.10}$$

or:

$$\sum_i E_{irT} - \sum_i E_{irt} = \sum_i E_{irt}(g_n) + \sum_i E_{irt}(g_{in} - g_n) + \sum_i E_{irt}(\breve{g}_{ir} - g_{in}) + \sum_i E_{irt}(g_{ir} - \breve{g}_{ir}) \tag{3.11}$$

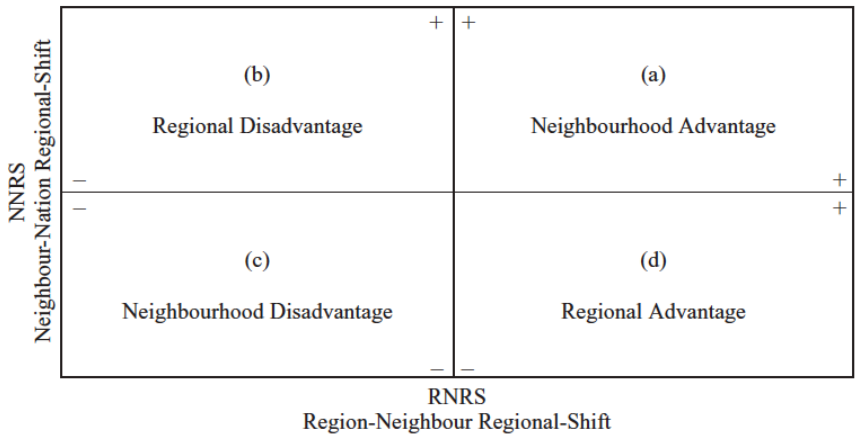
with:

$$\breve{g}_{ir} = \frac{\sum_s w_{rs} E_{irT} - \sum_s w_{rs} E_{irt}}{\sum_s w_{rs} E_{irt}} \tag{3.12}$$

where w_{rs} is the element of row standardized binary weight matrix W corresponding to the observation pair *(r, s)*. As discussed earlier, the weight matrix W is a common way of formalizing the structure of spatial proximity in areal data (Espa *et al.* 2014). In this decomposition we consider a new variable $\breve{g}_{ir}$, that is defined as the spatial lag of the employment growth rate in the period considered.

Through this approach, Espa *et al.* (2014) identify four easily interpretable basic effects, from which the overall result of each region depends. In particular, precisely for the spatial effects, the authors suggest the use of a Cartesian plane, with values represented by the RNRS and NNRS effects (Figure 3.4).

Figure 3.4 – Interpretation of spatial effects in shift-share analysis decomposition



Source: Espa *et al.* 2014.

If the RNRS and NNRS effects are both positive (negative), we can conclude that there is a neighbourhood advantage (disadvantage). In the remaining two cases, we can conclude that the region has an advantage (RNRS positive, NNRS negative), or a disadvantage (RNRS negative, NNRS positive), due to specific characteristics of each region.

Finally, due to the fact that we want to make a comparison among the performances of the regions, as if all belonged to the same country, as "national" value we refer to the average value of 15 Members-Europe. Furthermore, we use a relative version of SSA, by taking into account the growth rate of the variable instead of the absolute value. This is to control for the dimension of the economies, because a variation of 1,000 employees has a different impact on economies with respectively 50,000 or 500,000 employees.

To sum up, we use the following specification:

$$\frac{\sum_i E_{irT}-\sum_i E_{irt}}{\sum_i E_{irt}} = \frac{\sum_i E_{irt}(g_e)}{\sum_i E_{irt}} + \frac{\sum_i E_{irt}(g_{ie}-g_n)}{\sum_i E_{irt}} + \frac{\sum_i E_{irt}(\breve{g}_{ir}-g_{ie})}{\sum_i E_{irt}} + \frac{\sum_i E_{irt}(g_{ir}-\breve{g}_{ir})}{\sum_i E_{irt}} \quad (3.13)$$

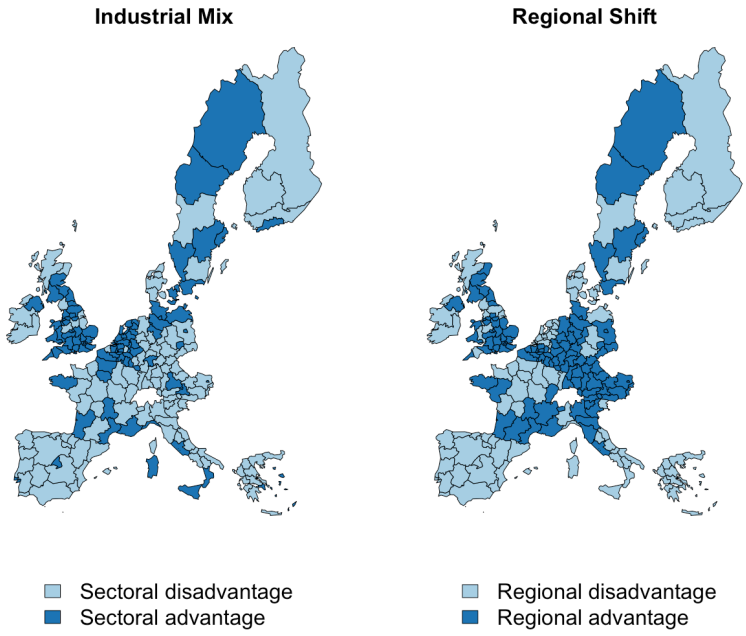
where all variables with subscript "e" refer to 15 Members-Europe aggregate values, and the *economic change* (EC) on the left hand side is decomposed into the four effects on the right hand side, namely, *national share* (NS), *industrial share* (IM), *neighbour-nation regional share* (NNRS*), and the region-neighbour regional share* (RNRS).

3.5. Shift Share Analysis results

Following the approach proposed in the previous section, here we present the results of the shift share analysis[23]. As discussed earlier in the chapter, this methodology allows to split regional employment growth into, at least, three components: the National Share, which describes how much of the regional growth is explained by the aggregate performance of the national economy; the Industrial Mix effect, which represents the share of regional industrial growth explained by the growth of each industry at the national level; and the Regional Shift effect, which explains how much of the change in a given industry is due to some unique competitive advantage of the regions. In particular, since we have chosen the relative version of SSA, we focus on the latter two effects. It is noteworthy that a positive (negative) Industrial Mix underlines the prevalence within the region of sectors that in aggregate have had a better (worse) performance. On the contrary, a positive (negative) Regional Shift emphasises the presence of a competitive advantage (disadvantage) that neither the National Share nor the Industrial Mix are able to explain. The results of these two components are shown in Figure 3.5.

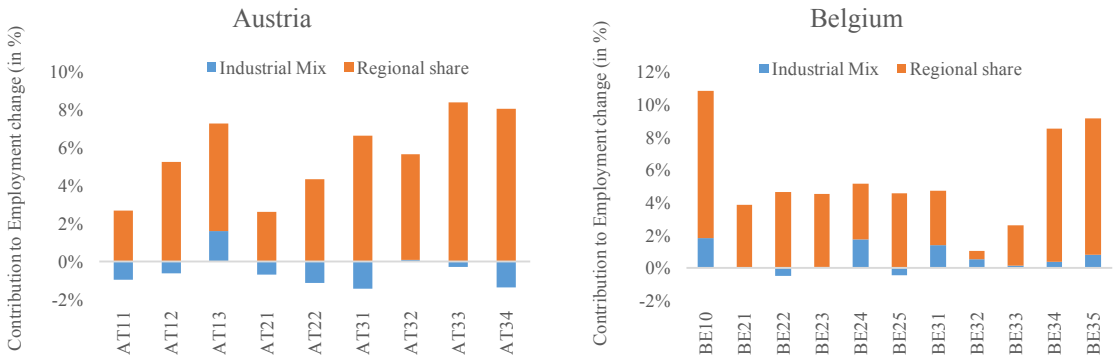
[23] In order to include as many regions as possible, for few regions we assume the starting (2008) and the last (2014) values equal respectively to the first and the last available.

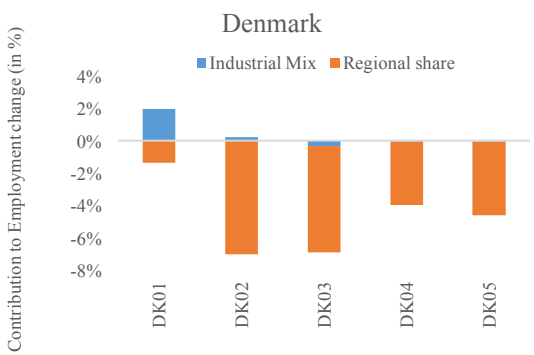
Figure 3.5 – Industrial mix and Regional Shift for European regions.

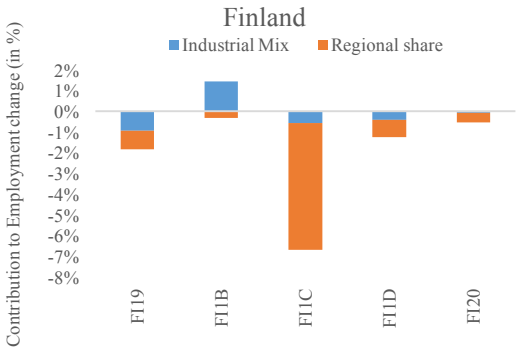


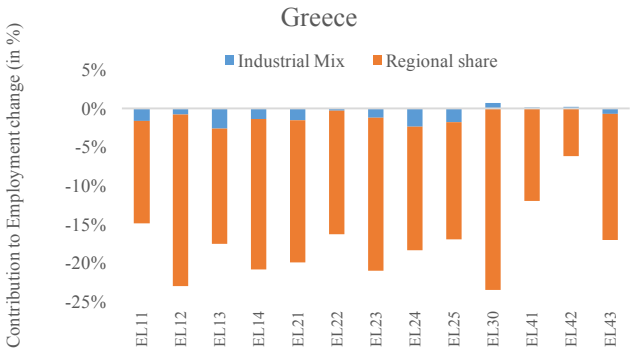
Over the crisis period considered, we can observe a sectoral advantage in southern Italian regions, in northern Sweden, in most of Britain and Benelux regions. On the other hand, regions belonging to southern France, northern Sweden, west Germany, as well as Austrian and Britain ones, are characterized by a competitive advantage. Finally, almost all regions belonging to Greece, Spain, Portugal, Ireland and Finland present a disadvantage both in terms of sectoral composition and competitiveness.

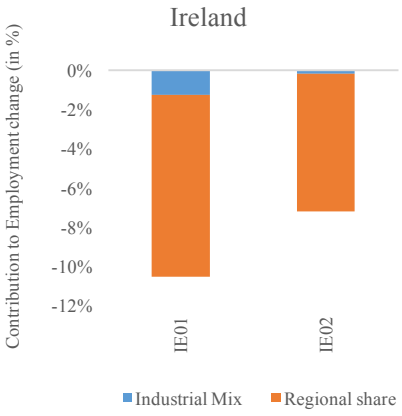
Figure 3.6 – Shift Share Analysis results by country

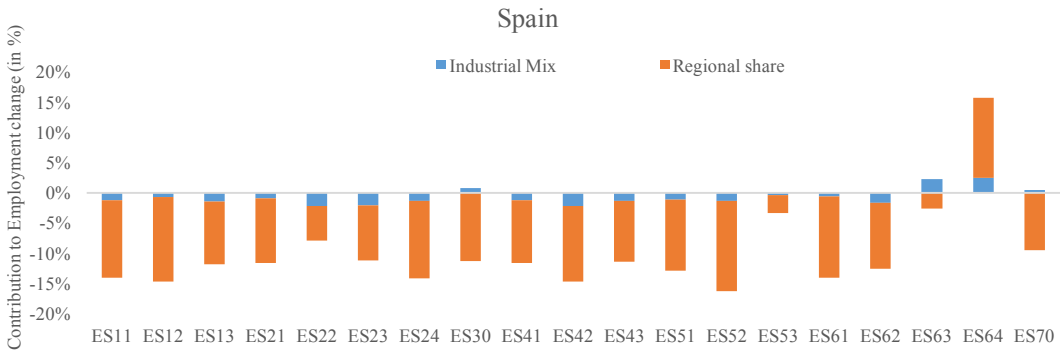


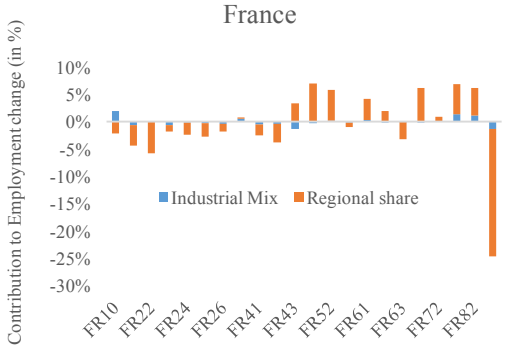

Denmark
Industrial Mix
Regional share
Contribution to Employment change (in %)
4%
2%
0%
-2%
-4%
-6%
-8%
DK01
DK02
DK03
DK04
DK05

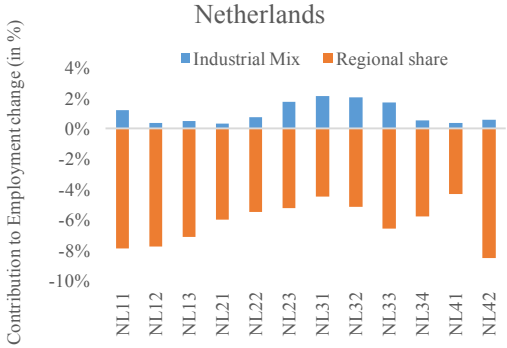

Finland
Industrial Mix
Regional share
Contribution to Employment change (in %)
2%
1%
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
-8%
FI19
FI1B
FI1C
FI1D
FI20

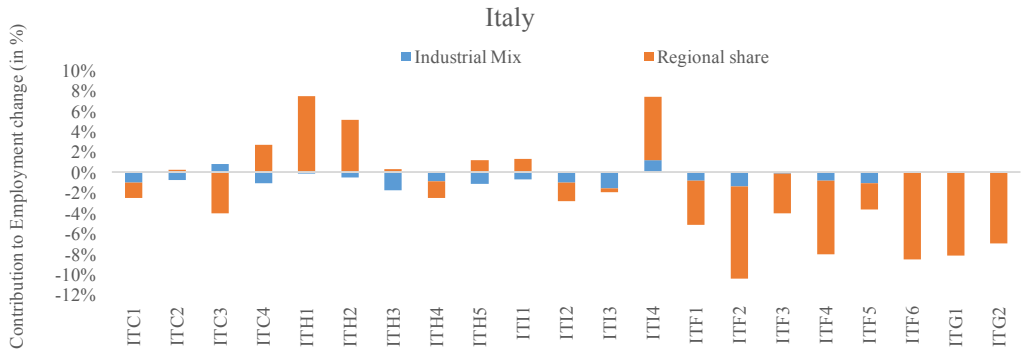

Greece
Industrial Mix
Regional share
Contribution to Employment change (in %)
5%
0%
-5%
-10%
-15%
-20%
-25%
EL11
EL12
EL13
EL14
EL21
EL22
EL23
EL24
EL25
EL30
EL41
EL42
EL43

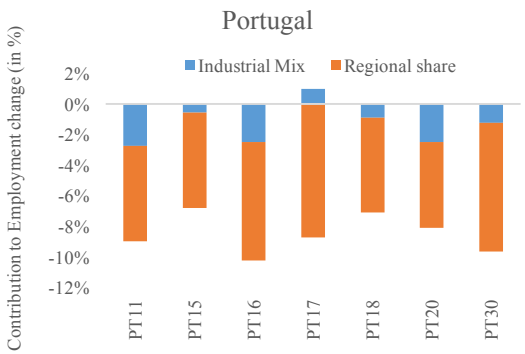

Ireland
Contribution to Employment change (in %)
0%
-2%
-4%
-6%
-8%
-10%
-12%
IE01
IE02
Industrial Mix
Regional share

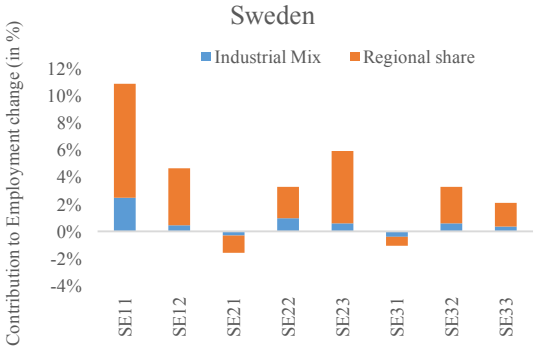

Spain
Industrial Mix
Regional share
Contribution to Employment change (in %)
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
ES11
ES12
ES13
ES21
ES22
ES23
ES24
ES30
ES41
ES42
ES43
ES51
ES52
ES53
ES61
ES62
ES63
ES64
ES70

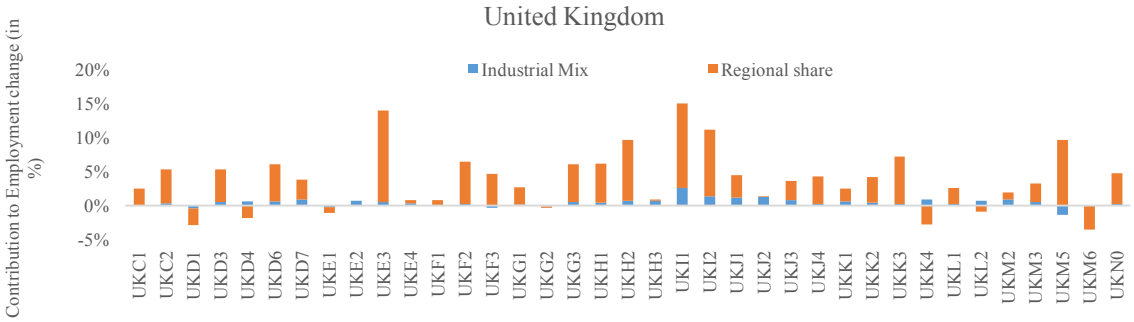

France
Contribution to Employment change (in %)
10%
5%
0%
-5%
-10%
-15%
-20%
-25%
-30%
Industrial Mix
Regional share
FR10
FR22
FR24
FR26
FR41
FR43
FR52
FR61
FR63
FR72
FR82

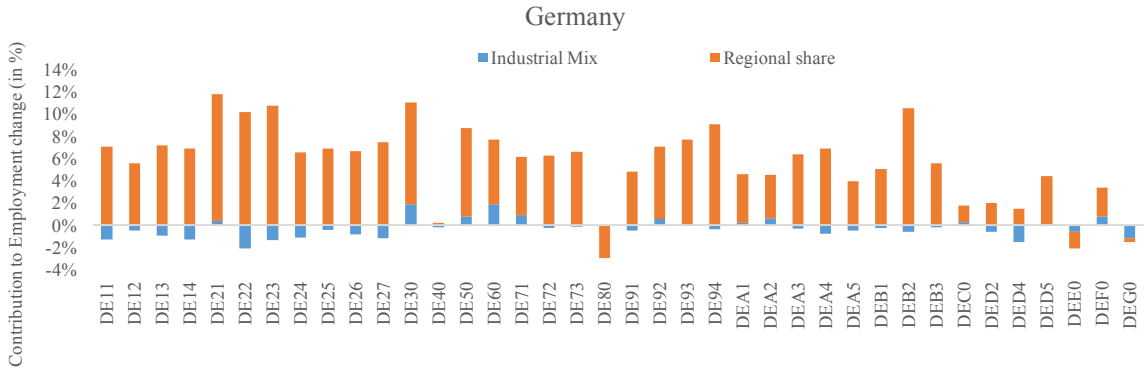

Netherlands
Industrial Mix
Regional share
Contribution to Employment change (in %)
4%
2%
0%
-2%
-4%
-6%
-8%
-10%
NL11
NL12
NL13
NL21
NL22
NL23
NL31
NL32
NL33
NL34
NL41
NL42


Italy
Industrial Mix
Regional share
Contribution to Employment change (in %)
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
-10%
-12%
ITC1
ITC2
ITC3
ITC4
ITH1
ITH2
ITH3
ITH4
ITH5
ITI1
ITI2
ITI3
ITI4
ITF1
ITF2
ITF3
ITF4
ITF5
ITF6
ITG1
ITG2


Portugal
Industrial Mix
Regional share
Contribution to Employment change (in %)
2%
0%
-2%
-4%
-6%
-8%
-10%
-12%
PT11
PT15
PT16
PT17
PT18
PT20
PT30


Sweden
Industrial Mix
Regional share
Contribution to Employment change (in %)
12%
10%
8%
6%
4%
2%
0%
-2%
-4%
SE11
SE12
SE21
SE22
SE23
SE31
SE32
SE33


United Kingdom
Industrial Mix
Regional share
Contribution to Employment change (in %)
20%
15%
10%
5%
0%
-5%
UKC1
UKC2
UKD1
UKD3
UKD4
UKD6
UKD7
UKE1
UKE2
UKE3
UKE4
UKF1
UKF2
UKF3
UKG1
UKG2
UKG3
UKH1
UKH2
UKH3
UKI1
UKI2
UKJ1
UKJ2
UKJ3
UKJ4
UKK1
UKK2
UKK3
UKK4
UKL1
UKL2
UKM2
UKM3
UKM5
UKM6
UKN0


Germany
Industrial Mix
Regional share
Contribution to Employment change (in %)
14%
12%
10%
8%
6%
4%
2%
0%
-2%
-4%
DE11
DE12
DE13
DE14
DE21
DE22
DE23
DE24
DE25
DE26
DE27
DE30
DE40
DE50
DE60
DE71
DE72
DE73
DE80
DE91
DE92
DE93
DE94
DEA1
DEA2
DEA3
DEA4
DEA5
DEB1
DEB2
DEB3
DEC0
DED2
DED4
DED5
DEE0
DEF0
DEG0

If we look at the magnitude of these effects, we find different responses both within and between countries. Specifically, the most evident result is that the regional effect seems to have played the main role in explaining how regions have reacted to the last economic crisis. In fact, in almost all cases the competitiveness effect exceeds the industrial mix effect. As a consequence, also in the cases in which the industrial mix effect is positive and the regional effect negative, the former has not been sufficient to offset the negative effect of the latter.

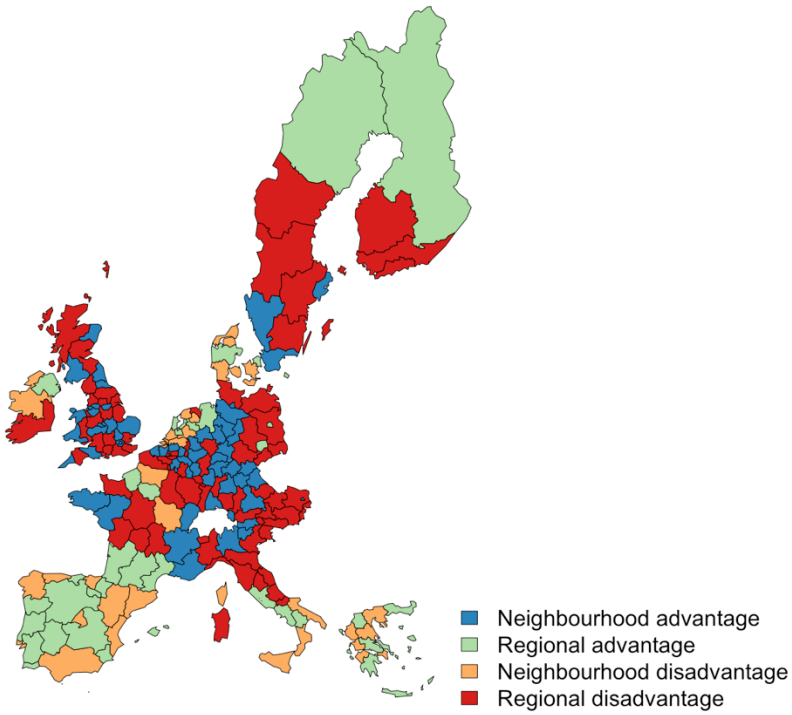
These results are consistent with those found by Martin *et al.* (2016) for major UK regions. In particular, it seems that, in spite of the importance ascribed in the literature to the industrial structure, the role of the competitiveness effect has been larger and dominant in explaining how regions have reacted to the last economic crisis. As suggested by the authors, the level of sectoral disaggregation might affect the results, revising upward the industrial mix effect importance in the case of a finer level of disaggregation. However, we believe that, due to the magnitude of results obtained, the underlying conclusions should not change.

On the other hand, due to the importance of the regional effect, in order to determine if interactions across neighbouring regions affect the results, we use a spatial version of SSA, as proposed by Espa *et al.* (2014). This way we may decompose the Regional Shift effect, showed in the right side of Figure 3.5, in two components: the *neighbour-nation regional shift* (NNRS) and the *region-neighbour regional shift* (RNRS). With this new decomposition we are able to establish if a region has neighbourhood advantages (disadvantages) or specific advantages (disadvantages).

Following the spatial approach, a picture as in Figure 3.7 arises[24].

[24] For each region, a summary table in Appendix C (Table C.2) shows detailed results of the Shift Share Analysis components.

Figure 3.7 – Shift Share Analysis with spatial effects



In this case, several behaviours can be detected. First of all, regions belonging to western Germany, northern Italy as well as southern Sweden, part of Great Britain and almost all of Belgium, are characterised by neighbourhood advantages (positive NNRS and RNRS). This means that the regions considered have had better performance than their neighbours, and at the same time the latters have had better sectoral performances than the corresponding sectoral average (in aggregate).

On the contrary, regions with a neighbourhood disadvantage (negative NNRS and RNRS) include a large part of Greek, Danish and eastern German regions, those of South-East of Spain, French's regions Picardie, Corse and Bourgogne, Lisbon in Portugal, Sicily and Calabria in Italy and the northern region of Northern Ireland. For these regions the aggregate sectoral loss in employment has been greater than in their neighbours. At the same time, the latters have had worse sectoral performances than the corresponding sectoral average (in aggregate).

In the other two cases, NNRS and RNRS have opposite signs. It can be observed a specific regional advantage in those areas that have had a better change in employment than the neighbours (positive RNRS), and at the same time a worse performance than the sectoral average (negative NNRS). This group includes the central regions of Spain, those of South-

West of France as well as the ones of Centre-South of Italy and those of the North of Sweden and Denmark.

Finally, we have the opposite case. Regions with a competitive disadvantage are characterised by a negative RNRS and a positive NNRS effects. It means that these areas have had a worse change in employment than the neighbours and, at the same time, the latters have been better performances than the sectoral average. Some regions of West Germany, North Italy, South Sweden and Finland, as well as those of South-Centre of France and almost all of Austria, belong to this group.

To summarize the results we have obtained up to now, we have shown that the economic structure has not been dominant in explaining how regional employment has reacted to the last economic crisis. Instead, the competitiveness effect played the key role. In addition, our findings confirm the significance of spatial interaction among regions and the relevance of subnational analyses showing the presence of virtuous regional clusters and the importance of spatial relationships in affecting the competitiveness effect.

3.6. Pre-crisis competitiveness and employment change

3.6.1. General Framework

Due to the dominant role of the competitiveness effect in explaining the reaction to the last crisis, we believe that greater attention should be paid to regional specific factors. To address this point, in this chapter we follow the approach of Lane and Milesi-Ferretti (2011) by regressing the employment change over the crisis period against selected competitiveness variables considered in the pre-crisis period[25]. By this way, we try to identify if specific initial conditions in terms of competitiveness can explain heterogeneous behaviours of regions in response to the crisis.

In particular, we use a regression model with the following specification:

$$Y_r = \alpha + \beta_{ir}\boldsymbol{C_{ir}} + \varepsilon_r \tag{3.14}$$

[25] Using panel models, similar approach is adopted by Mazzola *et al.* (2014) in the analysis of the resilience of the southern Italian provinces.

where Y_r is the employment growth rate over the period of crisis (2008-2014) for each region r, $\boldsymbol{C_{ir}}$ is a vector identifying the different dimensions of regional competitiveness considered in the pre-crisis period.

We estimate this model both with the traditional OLS method and with spatial econometric techniques in order to verify the robustness of results and the role of spatial proximity.

To take into account the spatial dependence, several models exist. In this chapter we present results for the *spatial lag* and the *spatial error model*. The spatial lag model or spatial autoregressive model, can be written as:

$$y = \rho \boldsymbol{W} y + \boldsymbol{X}\beta + \varepsilon \tag{3.15}$$

where y is the dependent variable, $\boldsymbol{X}$ is the matrix of explanatory variables, ρ is the spatial autocorrelation coefficient and measures the spillover effects, $\boldsymbol{W}y$ is the spatial lag of the dependent variable.

On the contrary, the spatial error model is defined as:

$$y = \boldsymbol{X}\beta + u \tag{3.16}$$
$$with \quad u = \lambda \boldsymbol{W} \varepsilon$$

In this case the spatial weight matrix is included in the error of the model and λ is a measure of the spatial autocorrelation.

Furthermore, to expand the analysis, estimation is repeated for other dependent variables, such as the Industrial Mix and the Regional Shift previously defined and run separately for two indices of resistance and recovery which will be described later[26].

[26] In order to include as many regions as possible for competitiveness variables, when data were not available (8 cases) we attributed to the region the average value calculated over all NUTS 2 regions in the same country. To check the robustness of our results we have repeated the estimation on a sample without the above mentioned regions. Conclusions are similar and broadly unchanged to those presented in the paper.

3.6.2. The pre-crisis competitiveness variables

The choice of the variables to consider as indicators of competitiveness has been somewhat complex, due to the difficulty of uniquely identifing regional competitiveness and to the well-known scarce availability of data. To overcome these problems, we refer to the Regional Competitiveness Index (RCI) (Annoni and Kozovska, 2010), that is computed for regions of EU Member States. As argued earlier, in this chapter we take into consideration the regions belonging to the core 15 EU Member States.

The RCI is composed of eleven pillars describing different aspects of competitiveness (Institutions, Macroeconomic Stability, Infrastructures, Health, Quality of Primary and Secondary Education, Higher Education and Training and Lifelong Learning, Labour Market Efficiency, Market Size, Technological Readiness, Business Sophistication, and Innovation). Each pillar is the result of the combination of a set of variables trying to catch the different aspects of regional competitiveness[27].

The RCI can be seen as the regional version of the Global Competitiveness Index (GCI) developed by the World Economic Forum (WEF), though the approach is slightly different. As pointed out by Dijkstra *et al.*, (2011), RCI is similar to GCI because it has a similar methodology. On the other hand, there are some key differences that distinguish the RCI from GCI. For example, the GCI is mainly focused on a productivity oriented definition of competitiveness "[national competitiveness is a] *set of institutions, policies and factors that determine the level of productivity of a country*" (Dijkstra *et al.*, 2011). Instead, the RCI departs from a neoliberal oriented definition of competitiveness, defining the regional competitiveness as "*the ability to offer an attractive and sustainable environment for firms and residents to live and work*" (Dijkstra *et al.*, 2011).

In this chapter, the choice of the competitiveness variables has been made trying to cover as many pillars as possible, in relation to data availability. It was necessary to make discretionary choices though based on objective criteria. In fact, having as main goal the identification of initial conditions in terms of regional competitiveness, we have taken only those variables available before 2008. Moreover, given the high number of variables considered for the construction of the index, in order to avoid collinearity problems, we have excluded several variables from the regression model. Finally, the choice of representative variables of each dimension was also made following the prevailing literature.

[27] For more details on the variables and the methodology used for the computation of the Regional Competitiveness Index see Annoni and Kozovska (2010) and Dijkstra *et al.* (2011).

Therefore, the following variables have been chosen to represent the different dimensions[28]:

- for Infrastructures, we consider *Motorway and Railway Density*, available for 2006 and 2007, respectively;
- for Health we consider *Healthy Life Expectancy* and *Infant Mortality*, both available for 2007;
- for Higher Education we refer to *Population aged 25-64 with higher educational attainment* and to *Lifelong Learning* both available for 2007;
- to evaluate Labour Market Efficiency, we consider the *Long Term Unemployment*, namely the labour force unemployed since 12 months or more, available for 2007;
- for Business Sophistication, we refer to *Employment in the Financial intermediation, real estate, renting and business activities (NACE sectors J-K)* and *FDI-Intensity*, available for 2007 and as 2005-2007 average, respectively.
- finally, for Innovation we consider the *Total Intramural R&D Expenditures* and the *Human Resources in Science and Technology* (HRST), both available for 2007.

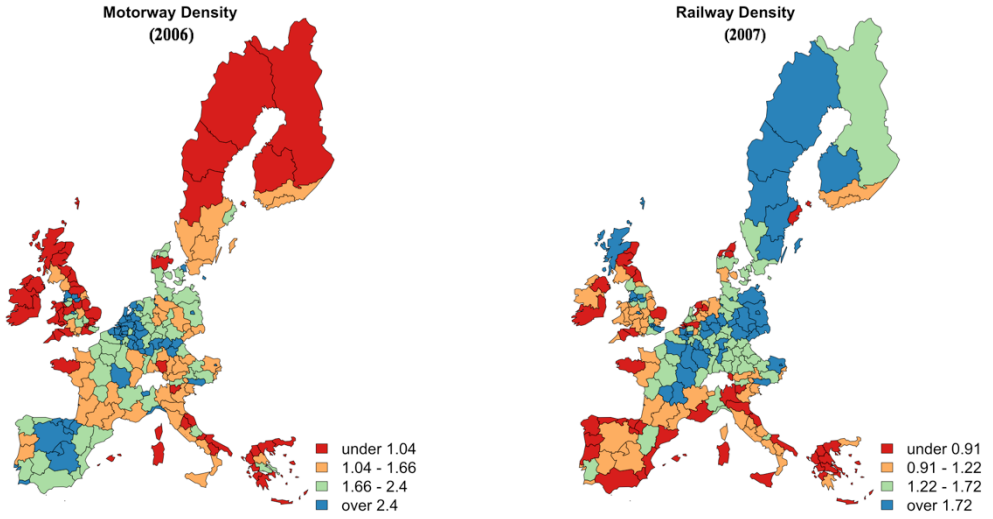
In this section we present a descriptive analysis of the explanatory variables and discuss the expected theoretical relationship between them and the performance results.

With regard to the first dimension, it is a widespread opinion that modern and effective *infrastructures*, such as railways, motorways and other structural elements, positively affect the results achieved by economies (Dijkstra *et al.*, 2011, Mazzola *et al.*, 2014). In fact, Dijkstra *et al.* (2011) pointed out that several studies, particularly the one of Schwab and Porter (2007), claim that infrastructures are one of the most important key factors in determining the location of economic activity. A recent study of an Italian institution of tertiary sector firms (Confcommercio, 2013) highlighted that the deficiency in infrastructures investments in the last decade has had a negative impact on Italian results both in terms of employment and value added. Furthermore, Calderón and Servén (2004) showed that growth and income inequality reduction have been positively stimulated by relevant stock and high quality of infrastructures.

To take account of infrastructures, we consider the motorways and the railways density indices. Both indices take into consideration the length of motorways (or railways) as well as the area and the population of each region.

[28] A summary table in the Appendix (Table C.3), shows the indicators included in this analysis.

Figure 3.8 – Indices of infrastructure density – EU 15



Source: own calculations based on Eurostat data.

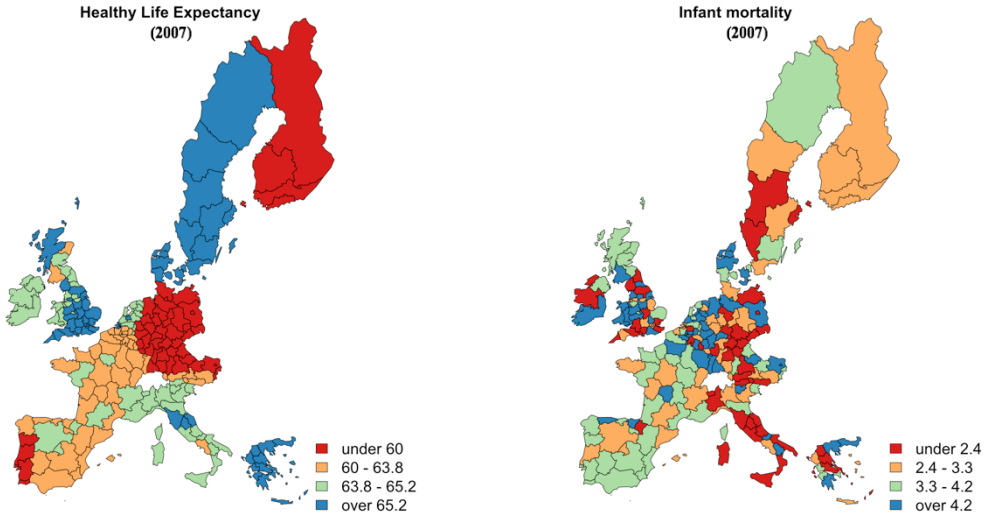
For both variables, some specific clusters, not necessarily contained into the national borders, appear. In particular, we can observe a higher motorways density in central regions of Spain and Belgium. On the other hand, a lower density can be found in the northern regions of Scandinavian countries, Great Britain and Ireland. With regard to railways density, instead, we find greater density in central regions of France, eastern regions of Germany and northern regions of Sweden.

The second category here considered is *Health*. Generally, a good health condition in the population is positively linked to development (Acemoglu and Johnson, 2007). This is for several reasons. For example, health is a key factor in increasing labour market participation as well as in improving labour productivity. Also, a good health condition is related to lower expenses on healthcare (Dijkstra *et al.*, 2011).

As a proxy for *Health* we consider two indicators: the healthy life expectancy and the infant mortality[29]. Eurostat defines the first as a useful indicator to monitor health as productive or economic factor, since it summarizes the life quality concept, whilst the second is considered the natural complement to the first in order to catch the quality of welfare state as well as the healthcare system.

[29] Healthy life expectancy is defined as the number of years of healthy (disability-free) life expected.

Figure 3.9 – Health indicators – EU 15



Source: own calculations based on Eurostat data (DG Regional Policy and Regional Health Statistic).

The maps show that the first indicator, healthy life expectancy, is affected by a stronger national effect. On the contrary, for infant mortality we can observe several clusters which cross national borders. Sweden, Denmark and Greece are the nations with higher healthy life expectancy, opposite to Finland, Portugal and Germany, which are the countries with the lowest healthy life expectancy. For infant mortality, a national component seems to be present, but also specific clusters can be observed. In particular, Italy is the country with the lowest rates of infant mortality, followed by Finland. Conversely, the highest rates can be detected in Spain and France. Finally, a heterogeneous picture can be observed in Greece, Germany, Great Britain and Sweden.

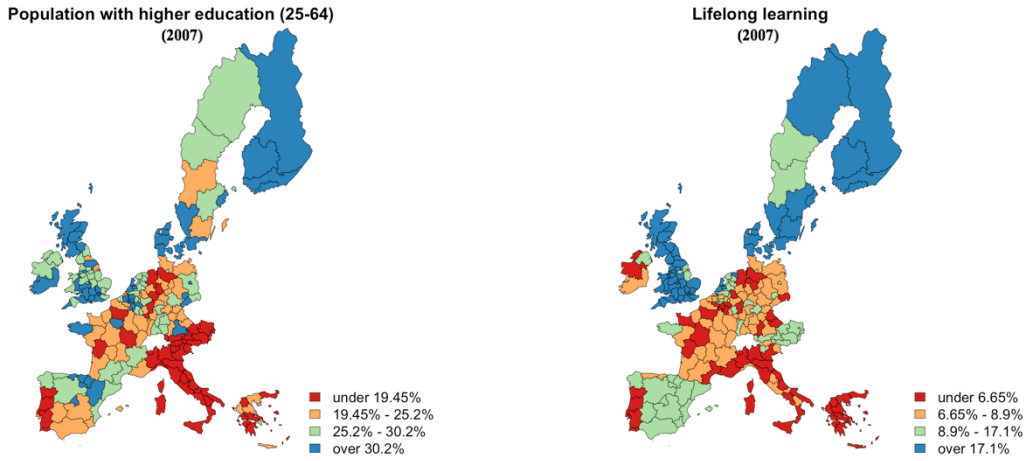
The third dimension considered is *Higher Education*, one of the most important drivers of human capital. To represent this dimension, we have used the the population aged 25-64 with higher educational attainment and a lifelong learning variable measured as the percentage of population aged 25-64 participating in education and training[30].

A substantial body of literature has been published on the positive effect of human capital on economic growth. Mazzola *et al.* (2014) mention Romer (1990) and Lucas (1988) as an example of this strand of research. Within the endogenous growth framework, they argue that the accumulation of human capital besides promoting growth, also stimulates the convergence of income across economies. The assumption is that a high qualified workforce

[30] Higher education attainment corresponds to levels 5 and 6 according to the ISCED classification (first and second stage of tertiary education, namely short-cycle tertiary education and bachelor's or equivalent level.).

is able to create, implement, and adopt new technologies in the best way, and thus to promote growth. For example, Acemoglu *et al.* (2014), by analysing the relationship between institutions, human capital and growth, suggest a positive relationship between higher education and growth. Moreover, Sterlacchini (2008), in a study regarding human capital and growth for twelve European countries over the period 1995-2002, demonstrates that the share of population with higher education is positively correlated with growth in value added. However, Di Liberto (2008) argues that numerous empirical studies have demonstrated the contrary, that is that there is a negative correlation between human capital and growth (Wolff and Gittleman, 1993).

Figure 3.10 – Higher education and training and lifelong learning – EU 15

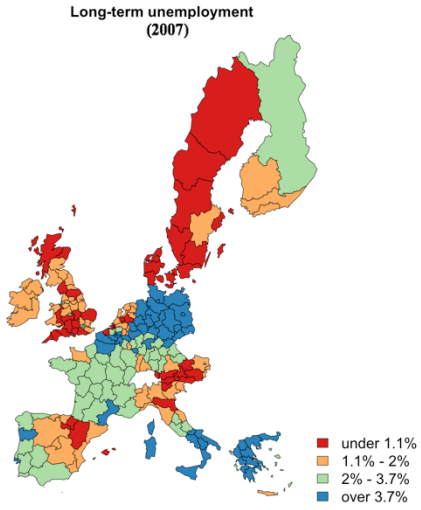


Source: own calculations based on Eurostat data (LFS and Regional Education Statistics).

Also in this case we can observe some specific clusters. A higher percentage of human capital can be detected in Great Britain and Scandinavian countries. Conversely, a lower level of education seems to characterise southern European countries, such as Italy, Greece and Portugal.

Moving to the fourth dimension, i.e. *Labour Market Efficiency*, we consider as proxy the long term unemployment rate (that is the percentage of labour force unemployed for 12 months or more). There is no doubt about the theoretical relationship between the latter, competitiveness and growth. A high share of long term unemployment is a clear signal of labour market inefficiency. The fact that there are people who cannot find a job by more than twelve months, is a factor that discourages economic development.

Figure 3.11 – Labour market efficiency – EU 15



Source: own calculations based on Eurostat data (LFS).

Figure 3.11 shows a dualistic pattern in several countries. Starting from the better results of Nordic countries, it can be easily observed that Greece, southern Italy, Spain and East Germany have an inefficient labour market, opposite to what happens in the remaining areas of the same countries. In addition, in Great Britain and France there is a heterogeneous situation.

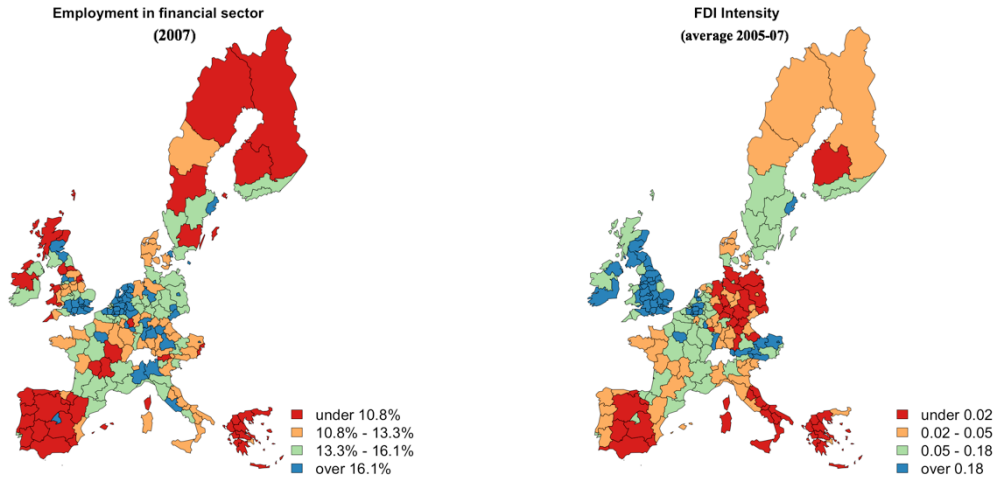
For the *Business Sophistication* dimension[31], we have tried to proxy firms' quality and productivity as well as their level of specialisation in sectors with high value added. In particular, we looked at a FDI intensity variable in order to catch the attractiveness of each region to foreign direct investments. In fact, several international organisations such as Eurostat and OECD suggest that there is a correlation between the presence of firms with foreign investments and the improvement in terms of technological endowment, productivity and general performances. As pointed out by Vitali (2015), the higher dimension of firms controlled by foreign capitals, gives them productivity and innovation advantages that cause spillover effects. However, other authors have questioned this conclusion. First, generally these firms self-select the sectors with high productivity (compared to the average) instead of promoting them (Monastiriotis and Jordaan, 2010). Moreover, by definition, multinational corporations are less tied to the territory, and due to the free movement of

[31] In the RCI framework the *Business Sophistication* pillar concerns "the quality of the business networks of the country and the quality of individual firms' operations and strategies" (Annoni and Kozovska, 2010). The assumption is that specialization in sectors with high value added contributes positively to the competitiveness of regions.

capital, a sudden disinvestment related to more favourable market conditions in other parts of the world can generate serious problems to the region where they originally settled.

Another proxy selected for business sophistication is the share of employment in the financial intermediation, real estate, renting and business activities (NACE sectors J-K). Here we want to proxy the specialisation of regions in high value added sectors, due to its positive effect on competitiveness (Dijkstra, *et al.*, 2011).

Figure 3.12 – Business Sophistication indices – EU 15



Source: own calculations based on Eurostat (LMS) and ISLA-Bocconi data.

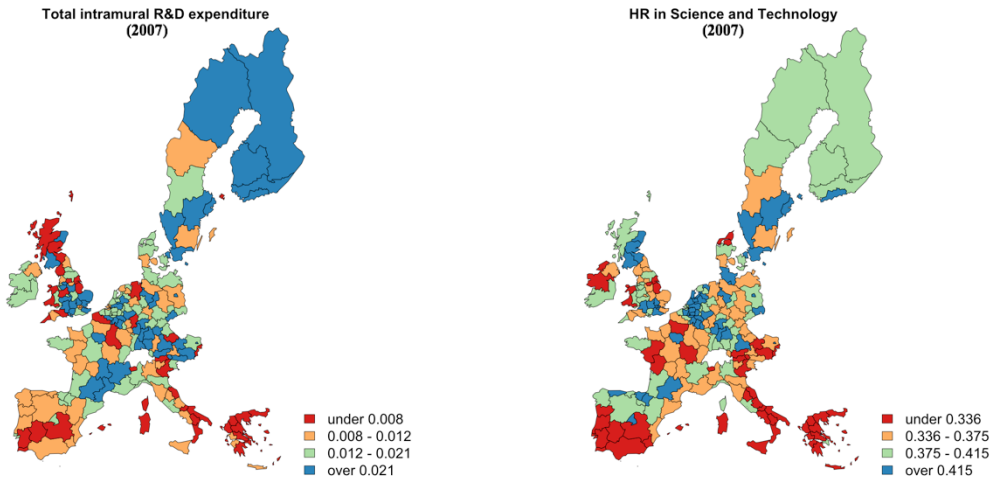
As for the pattern related to the proxy of *Labour Market Efficiency*, with regard to FDI intensity, it seems that there is clear a dichotomy in each country. In fact, in addition to the well-known dualism in Italy, Germany and Spain, clear regional differences can be detected also in Sweden, Finland, and France. For employment in financial sector, instead, a heterogeneous situation can be observed. First, it is clear that there is a solid presence of this type of workers in the capital cities of each state. Furthermore, regions belonging to Spain, northern Finland and Greece, present the lowest share of employment, opposite to the ones belonging to northern Italy, Benelux and western Germany which have a high presence of this type of workers.

Finally, *Innovation* is the last dimension considered, in terms of endowment of innovation input. Also in this case there should be a theoretical positive relationship between innovation and competitiveness. In fact, the more innovative is a region, the better performances it should be able to reach. OECD claims that innovation is the main source of growth for its member countries. Other authors (Cambridge Econometrics, 2003; Dijkstra,

et al., 2011; Annoni and Kozovska, 2010), have argued that innovation tends to be crucial in advanced economies. This is why less developed countries need to develop and strengthen basic institution to enable innovation.

In this study, as proxies of innovation, we consider the Total Intramural R&D Expenditures and the Human Resources in Science and Technology (HRST).

Figure 3.13 – Innovation indices – EU 15



Source: own calculations based on Eurostat data (Regional and Technology Statistics).

Looking at Figure 3.13, clusters can be found both for R&D expenditures and HRST. In addition to northern countries, high shares of R&D expenditure seem to characterise some regions of southern France, western Austria and the South-West of Germany and Great Britain. On the contrary, we can observe low investments in R&D input in northern Britain, in some Greek islands, in central Spanish regions, and in southern Italy. With regard to Human Resources in Science and Technology, we can observe again a dualistic pattern in each country.

3.6.3. OLS results

3.6.3.1. Employment growth rate 2008-2014

Following the approach suggested in section 3.6.1, here we present the OLS estimation results, performed with robust standard errors (White's correction). In particular, since it is possible that the results may change according to the level of development, we estimate the

model both for the full sample and for two subsamples, the convergence and the non-convergence regions, according to the European classification. Table 3.2 shows the results.

Table 3.2 – The competitiveness determinants of employment growth rate (2008-2014) – EU 15 Regions

	All regions	All regions	Convergence	Non-convergence
Constant	0.364***	0.354***	0.420**	0.194
	(0.112)	(0.107)	(0.203)	(0.128)
Railway Density	0.019***	0.014***	0.044***	0.010**
	(0.004)	(0.004)	(0.151)	(0.004)
Motorway Density	-0.015***	-0.016***	-0.033***	-0.014***
	(0.003)	(0.003)	(0.011)	(0.003)
Healthy life expectancy	-0.008***	-0.008***	-0.009***	-0.005**
	(0.002)	(0.002)	(0.003)	(0.002)
Infant mortality	-0.085	-0.007	-0.44	0.021
	(0.297)	(0.296)	(0.439)	(0.316)
Higher Education	-0.401***	-0.361***	-0.504**	-0.333***
	(0.103)	(0.102)	(0.185)	(0.122)
Lifelong learning	0.192**	0.208**	0.464	0.075
	(0.094)	(0.086)	(0.289)	(0.098)
Long term unemployment	-0.644***	0.058	-0.359	0.29
	(0.208)	(0.266)	(0.454)	(0.415)
Employment in financial sector	0.430***	0.312**	0.708*	0.204
	(0.156)	(0.143)	(0.396)	(0.149)
FDI intensity	0.025	0.032*	0.626*	0.044***
	(0.017)	(0.016)	(0.323)	(0.016)
R&D expenditures	0.860**	0.713*	0.695	1.028***
	(0.352)	(0.341)	(1.094)	(0.313)
HR in science and technology	0.351***	0.294**	0.236	0.268*
	(0.131)	(0.126)	(0.234)	(0.149)
Convergence Dummy	-	-0.060***	-	-
	-	(0.016)	-	-
Observations	202	202	38	164
R2	0.558	0.603	0.824	0.436
Adjusted R2	0.532	0.578	0.75	0.395
Residual Std. Error	0.052	0.050	0.044	0.048
F Statistic	24.52***	23.972***	39.46***	13.53***
Jarque-Bera Test	0.5662	0.2946	1.0693	1.7804
p-value JB	0.7535	0.863	0.5859	0.4106
Moran test	9.762	7.0527		
p-value Moran test	0.000	0.000		

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, *p<0.1

With regard to full sample results, it can be detected that almost all coefficients are statistically significant, and that the majority of them have the expected sign. In fact, a greater efficiency of the labour market, more productive firms[32], and greater investments in innovation before the crisis are correlated with a stronger regional resilience. However, contrary to the expectations, regions with a greater share of higher educated people suffered the crisis more than the others. This can be the result of the different impact of the crisis

[32] As discussed in Dijkstra *et al.*, 2011 the level of business sophistication may be interpreted as a proxy of the degree of a firm's productivity and its potential for responding to competitive pressures.

across the economic sectors. As discussed in previous sections and clearly showed in Figure 3.3, the Great Recession had a greater impact on industry and construction sectors rather than in services. As it is well-known, the high educated and skilled workforce is mainly concentrated in the service sector, which has been less affected by the recent crisis. On the contrary, manufacturing and construction sectors are especially characterised by a process of knowledge acquisition based on "learning by-doing".

In this context, also some characteristics of the the actual pattern of development (worldwide competition, delocalisation, and in general the effects of globalization) may have led the number of employed people to an opposite direction, despite a good endowment of human capital. From this point of view, the *wage dumping* of the less developed European countries may have played a role. In period of crisis, indeed, firms may change the location of their plants looking for a lower labour cost, regardless the human capital endowment of the territory where they originally settled.

In other words, it seems that, in periods of crisis and worldwide competition, investments in human capital are not sufficient to ensure or regain the workplace in the short-term, if other favourable conditions are not in place.

If we distinguish convergence regions from the others using a dummy in the model, it can be seen that being a less developed region is relevant. In fact, the beta coefficient associated with the dummy is negative and statistically significant, highlighting, on average, a larger employment loss in convergence regions.

Estimating again the model using these two subsamples we obtain similar results, both in terms of statistical significance and sign. However, it must be noticed that when we estimate the model for convergence regions, the beta coefficients of innovation variables lose significance. This may be related to the fact that innovation is especially relevant for developed economies (on this point, see also Schwab and Porter, 2007; Dijkstra, *et al.*, 2011).

In addition, the explanatory power of considered variables is acceptable, considering that other factors may have affected the change of employment, such as policy choices in response to the the crisis.

3.6.3.2. Industrial Mix and Regional Shift

In this section, we want to evaluate the relationship between pre-crisis conditions and the structural as well as the local components as defined in the Shift-Share Analysis. As known, a positive and greater value of these components reflects advantages in sectoral composition and/or local competitiveness, respectively. Table 3.3 shows the results.

Table 3.3 – Pre-crisis competitiveness and Industrial Mix or Regional Shift (2008-2014)

	All regions		Convergence		Non-Convergence	
	IM	RS	IM	RS	IM	RS
Constant	-0.075***	0.466***	-0.061*	0.507**	-0.076***	0.296**
	(0.013)	(0.111)	(0.031)	(0.191)	(0.015)	(0.125)
Railway Density	0.001*	0.018***	0.004	0.041**	-0.0001	0.011**
	(0.001)	(0.004)	(0.003)	(0.015)	(0.001)	(0.004)
Motorway Density	0.0003	-0.015***	-0.002	-0.031***	0.0004	-0.015***
	(0.001)	(0.003)	(0.002)	(0.01)	(0.001)	(0.003)
Healthy life expectancy	0.001***	-0.009***	0.001	-0.010***	0.001***	-0.005***
	(0.000)	(0.002)	(0.001)	(0.003)	(0.001)	(0.002)
Infant mortality	0.017	-0.102	-0.031	-0.409	-0.008	0.029
	(0.030)	(0.288)	(0.084)	(0.435)	(0.032)	(0.302)
Higher Education	-0.004	-0.397***	0.001	-0.506***	-0.003	-0.330***
	(0.012)	(0.101)	(0.026)	(0.182)	(0.014)	(0.118)
Lifelong learning	0.036***	0.156	-0.073**	0.537*	0.056***	0.019
	(0.011)	(0.095)	(0.035)	(0.287)	(0.012)	(0.010)
Long term unemployment	0.054*	-0.698***	-0.14*	-0.22	0.200***	0.089
	(0.031)	(0.207)	(0.076)	(0.451)	(0.049)	(0.400)
Employment in financial sector	0.117***	0.313**	0.220***	0.487	0.110***	0.094
	(0.018)	(0.153)	(0.055)	(0.396)	(0.02)	(0.144)
FDI intensity	-0.001	0.026	0.057	0.568*	-0.0003	0.045***
	(0.002)	(0.016)	(0.041)	(0.299)	(0.002)	(0.015)
R&D expenditures	-0.050	0.910**	-0.423***	1.118	-0.042	1.070***
	(0.040)	(0.343)	(0.144)	(1.076)	(0.040)	(0.302)
HR in science and technology	0.015	0.336***	0.02	0.216	0.011	0.257*
	(0.018)	(0.131)	(0.036)	(0.224)	(0.021)	(0.146)
Observations	202	202	38	38	164	164
R2	0.627	0.53	0.563	0.824	0.656	0.419
Adjusted R2	0.606	0.503	0.378	0.749	0.631	0.377
Residual Std. Error (df = 190)	0.006	0.051	0.007	0.042	0.006	0.047
F Statistic (df = 11; 190)	34.28***	21.21***	7.539***	32.82***	30.19***	13.28***
Jarque-Bera Test	0.645	0.5747	0.9884	0.4302	0.3738	2.0085
p-value JB	0.7243	0.7502	0.9575	0.8064	0.8295	0.3663
Moran test	6.0311	9.7177				
p-value Moran test	0.000	0.000				

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, *p<0.1

Given the nature of the variables considered, for local competitiveness (RS) the results do not seem to differ significantly from the basic model for all considered specifications, although the coefficients of some variables lose their significance (lifelong learning for the

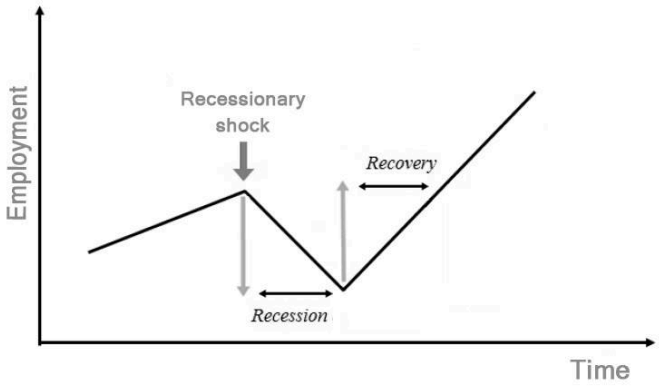
baseline model, and employment in financial sector in the case of the convergence regions sample).

On the contrary, for Industrial Mix only a few variables are significant. In particular, a higher proportion of people employed in the financial sector is associated with better performances in terms of IM. This result is also consistent with the data presented in Figure 3.3 that shows a lower impact of the crisis on the service sector. Contrasting effect appears for lifelong learning and for the long-term unemployment, which are related to worse performance in the convergence regions, and better performance in the others.

3.6.3.3. Resistance and Recovery.

A further analysis of this chapter focuses on the traditional two phases of resilience, namely resistance and recovery (Figure 3.14).

Figure 3.14 – Resistance and recovery



Since the first studies carried out after the occurrence of the recent crisis (Briguglio *et al.*, 2009; Martin, 2012; Davies, 2011), economists have immediately sought to understand if there was a relationship between the vulnerability of different economies and their ability to react, and also if there were specific factors of each territorial unit able to explain this relationship. In this section, we want to contribute to the understanding of these aspects.

To do this, we define the following two indicators:

- Resistance index, defined as the percentage change between the minimum value of the period 2008-2014 and the 2008 value:

$$RES = \frac{E_{r,min} - E_{r,2008}}{E_{r,2008}} \quad (3.17)$$

- Recovery index, defined as the percentage change between the last available value (2014) and the minimum value of the period 2008-2014:

$$REC = \frac{E_{r,2014} - E_{r,min}}{E_{r,min}} \tag{3.18}$$

We use the above mentioned indicators as dependent variables of the previous model, to understand the relationship between the set of competitiveness variables previously specified and the ability of each region to withstand and recover from the Great Crisis. The results of this exercise are shown in Table 3.4.

Table 3.4 –The determinants of resistance and recovery

	All regions		**Convergence**		**Non-Convergence**	
	RES	REC	RES	REC	RES	REC
Constant	0.255***	0.116**	0.447**	0.026	0.067	0.131**
	(0.084)	(0.052)	(0.169)	(0.083)	(0.082)	(0.068)
Railway Density	0.010***	0.005**	0.050***	-0.005	0.005	0.003
	(0.004)	(0.002)	(0.013)	(0.007)	(0.003)	(0.002)
Motorway Density	-0.010***	-0.004**	-0.029**	-0.006	-0.009***	-0.004**
	(0.003)	(0.002)	(0.009)	(0.004)	(0.003)	(0.002)
Healthy life expectancy	-0.007***	-0.002**	-0.010***	-0.0004	-0.003**	-0.002*
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Infant mortality	-0.058	-0.046	-0.692	0.137	0.068	-0.063
	(0.233)	(0.118)	(0.411)	(0.259)	(0.228)	(0.124)
Higher Education	-0.424***	0.028	-0.555***	0.06	-0.385***	0.047
	(0.08)	(0.04)	(0.144)	(0.091)	(0.092)	(0.051)
Lifelong learning	0.255***	-0.008	0.252	0.252*	0.133*	0.002
	(0.078)	(0.038)	(0.285)	(0.087)	(0.078)	(0.044)
Long term unemployment	-0.481**	-0.133	-0.594	0.225	0.083	0.23
	(0.201)	(0.113)	(0.457)	(0.258)	(0.33)	(0.196)
Employment in financial sector	0.498***	-0.03	0.726*	-0.091	0.293***	-0.041
	(0.123)	(0.071)	(0.409)	(0.199)	(0.105)	(0.078)
FDI intensity	-0.008	0.034***	0.531**	0.112	0.007	0.039***
	(0.013)	(0.008)	(0.24)	(0.145)	(0.012)	(0.008)
R&D expenditures	0.560**	0.135	1.024	-0.55	0.677***	0.210
	(0.255)	(0.198)	(1.139)	(0.611)	(0.207)	(0.192)
HR in science and technology	0.318***	0.014	0.27	-0.017	0.289***	-0.031
	(0.102)	(0.057)	(0.18)	(0.129)	(0.108)	(0.073)
Observations	202	202	38	38	164	164
R2	0.583	0.274	0.829	0.369	0.445	0.294
Adjusted R2	0.559	0.231	0.757	0.102	0.405	0.243
Residual Std. Error (df = 190)	0.042	0.025	0.041	0.021	0.035	0.025
F Statistic (df = 11; 190)	20.36***	6.503***	30.24***	3.041**	11.43***	8.365***
Jarque-Bera Test	5.9671	98.2565	4.3563	8.9657	15.5493	87.832
p-value JB	0.05061	0.0000	0.1133	0.0113	0.0004	0.0000
Moran test	9.9698	3.9414				
p-value Moran test	0.000	0.000				

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, *p<0.1

When we refer to the full sample and to the regions' ability to resist to crises, we substantially observe similar results with respect to the baseline. In fact, a greater efficiency of the labour market, greater investments in innovation and more productive firms (in the meaning expressed in footnote 32), are correlated with a stronger resistance in terms of employment. In general, the results are robust to the different samples considered, with the already noted loss of significance of the variables related to the innovative capacity when we only refer to the convergence regions. Also in this case, the explanatory power of the variables under consideration is acceptable, with a higher value in the case of convergence regions.

The scenario that occurs when we consider the ability to recover from the crisis is different. In general, the explanatory power of the set of variables considered in the pre-crisis period decreases and many coefficients become not significant. In particular, it seems that for the less developed regions almost none of the variables considered (except for lifelong learning) could be associated with the ability to recover. Conversely, for non-convergence regions only motorway density, healthy life expectancy and FDI intensity remain still significant.

In addition, it must be noticed a change in the coefficient of our proxy of human capital, namely higher education. In the recovery model this coefficient loses significance and becomes positive suggesting that the negative correlation probably captures a short-term effect.

Although these results appear surprising, it is very likely that other factors may have affected the ability of regions to recover from the crisis, such as the policies adopted by regions and states after the occurrence of the crisis. To this regard further investigations should be conducted to understand the role of post-crisis policies.

3.6.4. Spatial Models Results

As we have hypothesized and partially verified in the first part of the chapter, the results of the Moran's test on the residuals of the presented models confirm the importance of spatial relationships among the regions under consideration. In fact, observing the results of the Moran's Index computed on the residuals of OLS models, we can see that it takes high and significant values, suggesting spatial autocorrelation.

Several studies have highlighted that, if not adequately modelled, the presence of spatial dependence and heterogeneity in cross-section estimates, can affect the reliability of

results (Anselin, 1988; Arbia, 2006; Piras *et al.*, 2006). For this reason, to take account of these considerations, in this chapter we repeat the analysis using the proper techniques of spatial econometrics. Furthermore, by this way we are able to investigate the presence of spillover effects among different regions, as theorized by the New Economic Geography approach.

Following the methodology proposed by Anselin (1988), we use the Lagrange Multiplier (LM) to find the best specification for the models previously presented. Table 3.5 shows the results.

Table 3.5 – Lagrange Multiplier test for testing spatial econometric models

	EC	**IM**	**RS**	**RES**	**REC**
LMerr	73.597***	25.162***	72.690***	77.913***	9.908**
LMlag	99.911***	11.440***	101.794***	125.018***	11.271***
Robust LMerr	2.256	13.727***	0.906	0.108	0.233
Robust LMlag	28.571***	0.005	30.010***	47.214***	1.597

Note: *** p<0.01, ** p<0.05, *p<0.1

For all models (except for IM), the LM test suggests the spatial lag as the best model that can explain the autocorrelation and the heterogeneity existing in the data.

Furthermore, due to the presence of non-normality problems in the residuals distribution for some of the previous models, following Arbia (2014), we use the spatial version of Two-Stages Least Square (TSLS) methodology for spatial lag[33]. On the contrary, with regard to IM model, we use the maximum likelihood estimator (ML) with errors corrected for heteroskedasticity (White's method).

The results, with the indication of the methodology adopted, are shown in Table 3.6.

[33] Spatial lags of explanatory variables (WX) are used as instruments in the spatial two stage least squares (STSLS). Errors are corrected for heteroskedasticity.

Table 3.6 – Spatial models results

Method	**STSLS**	**ML**	**STSLS**	**STSLS**	**STSLS**
Model	**SL**	**SEM**	**SL**	**SL**	**SL**
Dep. Variable	**EC**	**IM**	**RS**	**RES**	**REC**
Rho	0.576***	-	0.630***	0.740***	0.333*
	(0.075)	-	(0.082)	(0.064)	(0.200)
Constant	0.126	-0.078***	0.176**	0.066	0.061
	(0.085)	(0.015)	(0.084)	(0.054)	(0.059)
Railway Density	0.011***	-0.00002	0.010***	0.002	0.005**
	(0.003)	(0.001)	(0.003)	(0.002)	(0.002)
Motorway Density	-0.007***	0.0004	-0.007***	-0.003*	-0.003
	(0.003)	(0.0004)	(0.003)	(0.002)	(0.002)
Healthy life expectancy	-0.003**	0.001***	-0.003**	-0.002**	-0.001
	(0.001)	(0.0002)	(0.001)	(0.001)	(0.001)
Infant mortality	-0.072	-0.011	-0.068	-0.056	-0.044
	(0.206)	(0.027)	(0.196)	(0.14)	(0.110)
Higher Education	-0.156*	-0.027*	-0.125	-0.096	0.016
	(0.089)	(0.014)	(0.087)	(0.067)	(0.038)
Lifelong learning	-0.037	0.032**	-0.059	-0.016	-0.030
	(0.074)	(0.014)	(0.071)	(0.058)	(0.036)
Long term unemployment	-0.390**	0.053	-0.407**	-0.213*	-0.101
	(0.172)	(0.035)	(0.167)	(0.123)	(0.116)
Employment in financial sector	0.217*	0.109***	0.122	0.185**	-0.027
	(0.111)	(0.017)	(0.107)	(0.075)	(0.069)
FDI intensity	0.016	-0.0004	0.016	-0.001	0.026***
	(0.012)	(0.002)	(0.012)	(0.008)	(0.010)
R&D expenditures	0.638**	-0.072*	0.632**	0.489***	0.059
	(0.262)	(0.041)	(0.247)	(0.153)	(0.199)
HR in science and technology	0.162	0.050***	0.119	0.064	0.030
	(0.105)	(0.015)	(0.104)	(0.074)	(0.054)
Observations	202	202	202	202	202
sigma2	0.00162	0.00003	0.00152	0.00084	0.00058
LM Test for residual autocorrelation	0.143	0.008	1.277	5.449**	0.258

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, *p<0.1

These results are consistent with those obtained earlier. In particular, it is confirmed the importance of greater investments in innovation as well as more productive firms and better efficiency of the labour market. In addition, the coefficient for lifelong learning becomes not significant (except for IM), and the coefficient for the spatial lag of the dependent variable is statistically significant, when included in the model.

For all models, except for REC, the results of LM test on residuals autocorrelation, allow us to not reject the null hypothesis. Consequently, for these models there are no more problems of spatial autocorrelation.

In this context, the *spillover* effects analysis become interesting. In fact, for models including the spatial lag of the dependent variable, the change in the explanatory variable *x* for region *r* affects directly the independent variable of the same region, but also it has an indirect effect on regions *j* different from *r*. Table 3.7 summarizes this decomposition.

Table 3.7 – Direct, indirect and total effects for EC, RS, RES and REC models

	EC			RS		
	Direct	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Railway Density	0.012***	0.013**	0.025***	0.011***	0.015***	0.026***
Motorway Density	-0.008***	-0.009***	-0.017***	-0.008***	-0.011**	-0.019***
Healthy life expectancy	-0.003**	-0.004**	-0.007***	-0.004***	-0.005**	-0.009***
Infant mortality	-0.079	-0.091	-0.170	-0.076	-0.107	-0.183
High Education	-0.171*	-0.196*	-0.367*	-0.141	-0.197	-0.337
Lifelong learning	-0.041	-0.047	-0.087	-0.066	-0.092	-0.158
Long term unemployment	-0.429**	-0.492**	-0.921**	-0.459***	-0.642**	-1.101***
Employm. in financial sector	0.238*	0.273*	0.511*	0.138	0.193	0.331
FDI intensity	0.017	0.020	0.037	0.018	0.025	0.042
R&D expenditures	0.701**	0.804**	1.505**	0.713***	0.997**	1.710***
HR in science and technol.	0.178	0.204	0.383	0.134	0.188	0.322

	RES			REC		
	Direct	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Railway Density	0.002	0.005	0.007	0.005*	0.002	0.008
Motorway Density	-0.004**	-0.009*	-0.013*	-0.003	-0.001	-0.005
Healthy life expectancy	-0.002**	-0.004*	-0.006**	-0.001	0.000	-0.001
Infant mortality	-0.068	-0.147	-0.215	-0.045	-0.021	-0.066
High Education	-0.117*	-0.253*	-0.370*	0.016	0.007	0.024
Lifelong learning	-0.019	-0.041	-0.060	-0.030	-0.014	-0.044
Long term unemployment	-0.259	-0.560	-0.819	-0.104	-0.048	-0.151
Employm. in financial sector	0.226***	0.487**	0.713**	-0.028	-0.013	-0.041
FDI intensity	-0.001	-0.002	-0.004	0.027***	0.013	0.040**
R&D expenditures	0.594***	1.283**	1.878**	0.061	0.028	0.089
HR in science and technol.	0.077	0.167	0.244	0.031	0.014	0.046

Note: *** p<0.01, ** p<0.05, *p<0.1.

The results confirm the positive direct impact of investments in innovation for all models, suggesting also a significant indirect effect. The inefficiency of the labour market, for EC and RS models, has both negative direct and indirect effects on the employment growth in the period under consideration. Negative, but not significant are the effect for RES model.

On the contrary, it can be detected a positive significant effect for the specialisation in high value-added sectors, for the models EC and RES.

Finally, the results confirm the ambiguity on the sign of variables representing the infrastructures and the negative coefficient associated with higher education.

3.7. Discussion and policy implications

As showed in the previous sections, the Great Crisis has determined a very heterogeneous impact among European regions. In particular, those that have suffered the most in terms of employment are the peripheral regions of the Mediterranean countries. In detail, by investigating the specific contributions of the industrial mix and the competiveness of each region, we show that (i) the influence of the economic structure has not been dominant in explaining how regional employment has reacted to the last economic crisis, contrary to the competitiveness effect that instead, played the key role; (ii) spatial interactions among regions matter; (iii) in general, better pre-crisis competitiveness is associated with better resistance to the last crisis, but weakly correlated with the recovery. These results raise several issues on the role of policy decision at different levels, regional, national and supranational.

On the one hand, as claimed by Camagni and Capello (2010), one may argue that the persistence of regional disparities is the strongest rationale for regional policies. Particularly, this point of view appears more reasonable in the light of the recent crisis, that seems to have increased already existing differences. Specifically, the authors refer to those policies that aim to improve the regional competitiveness of regions. In their view, regional policies should be targeted to increase the quality of the territorial capital that is "the set of localized assets – natural, human, artificial, organizational, relational and cognitive – that constitute the competitive potential of a given territory". At the same time, also Rodriguez-Pose (2013) shares the idea that specific institution-building is an essential element of economic development and growth and claims that the scarce effectiveness of this type of interventions in the EU is likely undermined by problems on defining "what are adequate, solid, and

efficient institutions". In fact, he criticises the "one size fits all" approach, suggesting that strategies which have worked in one region may not necessarily do the same in another.

In this context, this type of policy can help regions not only to develop and grow in positive phases of the cycle but also to build resilience to external shock. Clearly, at the European level, a key role is played by the Structural Funds, which should focus on helping less advanced economies to improve their institutions. However, research has shown how not always they have worked properly, mainly due to wrong choices of regional policymakers in managing the funds. To this regard, given the great potential usefulness of these regional policies in supporting job creation as well as business competitiveness, economic growth and sustainable development, strong efforts should be made to improve their effectiveness.

On the other hand, the resistance and the recovery of each region also lies in national or macroeconomic factors. In fact, as showed, some regional specific characteristics seem to not properly work in the short term. In particular, we refer to the role played by the human capital that is negatively correlated with the performance immediately after the downturn. In fact, stronger endowment of human capital is generally associated with long term regional growth and development. However, as discussed in previous sections, it seems that human capital endowment is not sufficient to ensure or regain the workplace in the aftermath of a crisis, if other favourable conditions are not in place.

In the depicted framework, macroeconomic policies can help to mitigate the vulnerabilities of regions and the speed of recovery. For example, labour market institutions and policies may play a key role in shaping the response of the labour markets. As discussed in Caldera Sánchez *et al.* (2015), they can cushion the impact of shocks, strengthening the resistance of economies, and at the same time affect the way in which economies recover from a shock, for example affecting the persistence of unemployment after the initial cyclical increase. In this context, policies regarding unemployment insurance, employment protection legislation, wage setting institutions, active labour market policies, minimum wages, may be very useful to reduce regional disparities.

In fact, they shape two of the major mechanisms of adjustment, that are price flexibility and migration. The well-known paper by Blanchard and Katz (1992) and the following literature on this topic (Obstfeld and Peri, 1998; Arpaia *et al.*, 2014; Dao *et al.*, 2014), well demonstrate how important are price rigidities and low workforces' mobility in reducing the speed of recovery after a shock.

To this regard, policymakers emphasize the role of the so-called structural reforms. However, it seems that the claimed reforms in the labour market are not having the desired effect, causing deflation in the majority of cases, and determining simultaneously the reduction of prices, the reduction of wages and the collapse of demand in the weakest economies. In relation to this, a recent report (IMF, 2016) shows how labour market reforms have the potential to boost growth and jobs over the medium term but have different impacts in relation to the types of reforms as well as economic conditions and sequence. In particular, this study claims that "reductions in labour taxes and increases in spending on active labour market policies have larger effects during periods of economic slack, while reforms to employment protection arrangements and unemployment benefit systems are beneficial in economic good times but can have detrimental effects when the economy is weak" (p. 101).

This is one of the reasons why we believe that the weak correlation between pre-crisis competitiveness variables and the recovery is closely related to the role played by macroeconomic policies adopted after the outbreak of the crisis. In fact, like labour market reforms, also monetary and fiscal policies may help economies in deal with adverse shocks. Expansionary monetary policies may boost demand, but usually are less effective in financial crisis and this seems the case of the last economic crisis. Conversely, automatic fiscal stabilisers and discretionary fiscal policies may have a huge impact in helping economies in riding out from a shock. In this case, the austerity measures advocated by European policymakers may have had a detrimental impact mainly on the employment growth of the weakest economies. In fact, recent researches (Ball *et al.* 2013; Agnello *et al.*, 2016) show how fiscal consolidation have significant distributional effects, raising personal inequality and territorial disparities, and at the same time decreasing wage and income shares and increasing long-term unemployment.

In this context, our analysis has tried to shed some light on the regional characteristics that may affect the resilience to a shock. Clearly, our approach has some limitations. For example, a finer decomposition of economic sectors may reveal a strong industrial mix effect, but in this case we are confident that, due to the magnitude of results presented, our main conclusions should not change. Moreover, our approach does not establish the mechanisms behind the correlation. On this point, it would be interesting, as well as useful for policy decision, to understand the mechanisms through which these variables may have affected the response of regions in terms of employment change. Finally, we focus on the last crisis. It would be interesting, to extend this analysis to previous crises in order to evaluate if these relationships have changed over time.

3.8. Conclusions

The economic crisis caused by the financial shock of 2007, has had a heterogeneous impact on economies. In particular, the trajectories of crises and recoveries that European regions have followed have been very different and often linked to specific characteristics rather than to the country of origin.

Using a dataset of 207 regions belonging to 15 Members-Europe, the chapter tries to understand the role of the structural as well as local component and the degree of pre-crisis competitiveness in shaping the response of European regions to the last crisis, in terms of employment.

We find that the regions that have lost proportionally a greater amount of jobs are those of Spain, Portugal, Ireland, southern Italy and Greece. On the contrary, a large group of regions belonging to Germany, Belgium, (but also to the UK and Austria) did not undergo a decrease in the number of employees, but rather an increase, during the period considered.

Furthermore, using the Shift Share Analysis (both with traditional approach and with spatial effects), we find that, during the Great Recession, an advantage due to the sectoral composition is mainly observed in southern Italian regions, in north Sweden, in most regions of Great Britain, as well as in the Benelux area. On the other hand, the presence of a competitive advantage can be detected in the regions of southern France, western Germany, Austria, Belgium, north Sweden and a large part of the UK regions. However, the most evident result is that the regional effect seems to have played the main role in explaining how regions have reacted to the last economic crisis. Specifically, in the majority of the cases in which the industrial mix effect is positive and the regional effect negative, the former has been not enough to offset the negative effect of the latter. In fact, it seems that, in spite of the importance ascribed in the literature to the industrial structure, the role of the competitiveness effect has been larger and dominant in explaining how regions have reacted to the last economic crisis. In addition, using a spatial version of the SSA to investigate the role of spatial interaction in affecting the results, we find that the locations that show a neighbourhood advantage are in general those that suffered the crisis less, highlighting the presence of virtuous regions clusters and the importance of spatial relationships in determining the final result.

With regard to the relationship between the initial (pre-crisis) conditions in terms of competitiveness and regional performances during the period considered, we find a strong correlation between labour market efficiency, innovation and specialization in high value

added sectors one one side, and better response to the crisis, on the other. An unexpected role is instead played by human capital, that is negatively correlated with employment growth. This is likely due to the fact that manufacturing and construction sectors, rather than services, have been the most affected by the crisis. In these sectors, the process of knowledge acquisition based on "learning by-doing" is more relevant than high education. This can explain why the only investment in education and training is not sufficient to keep and to reproduce jobs in the short term, if not accompanied by the presence of other favourable conditions.

If we distinguish the two resilience phases, resistance and recovery, it seems that the variables considered explain well the different vulnerability of the economies, but not their ability to recover. In this case, it is possible that other factors may have affected the ability of regions to recover from the crisis, as for example the policy responses of regions and countries as consequence of the crisis.

The results are also robust to two subsamples identified by the convergence and the non-convergence regions. In particular, it is noteworthy that in the first case the variables related to the innovative capacity lose their significance, probably because these factors affect the competitiveness and the performances of the regions only at a higher level of development.

The results are also confirmed when we take account of the autocorrelation of residuals, and when we include spatial effects into the analysis. In this case, the presence of significant *spillover* effects confirms the importance of taking into account spatial interaction in analysing regional phenomena.

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APPENDIX C

Table C.1 - Moran's Index results for different spatial weight matrixes *W*

k=2

	Moran Index	Z-values	P-value
G_EMP	0.7423	11.8196	0.0000
G_AGR	0.0587	1.0059	0.1572
G_IND	0.4628	7.3985	0.0000
G_CONS	0.7183	11.4410	0.0000
G_SERV	0.6017	9.5952	0.0000

k=3

	Moran Index	Z-values	P-value
G_EMP	0.7147	13.7661	0.0000
G_AGR	0.0852	1.7231	0.0424
G_IND	0.4595	8.8841	0.0000
G_CONS	0.7307	14.0738	0.0000
G_SERV	0.5799	11.1883	0.0000

k=5

	Moran Index	Z-values	P-value
G_EMP	0.6752	16.7108	0.0000
G_AGR	0.0509	1.3710	0.0852
G_IND	0.4377	10.8758	0.0000
G_CONS	0.6994	17.3076	0.0000
G_SERV	0.5677	14.0692	0.0000

k=6

	Moran Index	Z-values	P-value
G_EMP	0.6688	18.1404	0.0000
G_AGR	0.0726	2.0843	0.0186
G_IND	0.4247	11.5675	0.0000
G_CONS	0.6962	18.8787	0.0000
G_SERV	0.5530	15.0226	0.0000

Contiguity-Queen

	Moran Index	Z-values	P-value
G_EMP	0.6296	11.9516	0.0000
G_AGR	0.1221	2.3963	0.0083
G_IND	0.4641	8.8343	0.0000
G_CONS	0.6868	13.0279	0.0000
G_SERV	0.4699	8.9449	0.0000

Table C.2 - List of the regions included in the analysis with corresponding components of the Shift Share Analysis

NUTS_ID	REGIONS	IM	RS	NNRS	RNRS
AT11	Burgenland (AT)	-0.95%	2.69%	5.80%	-3.11%
AT12	Niederösterreich	-0.63%	5.23%	5.84%	-0.61%
AT13	Wien	1.61%	5.66%	2.58%	3.07%
AT21	Kärnten	-0.68%	2.63%	3.19%	-0.56%
AT22	Steiermark	-1.14%	4.35%	5.35%	-1.01%
AT31	Oberösterreich	-1.44%	6.63%	6.71%	-0.08%
AT32	Salzburg	0.10%	5.54%	7.78%	-2.23%
AT33	Tirol	-0.28%	8.39%	10.18%	-1.78%
AT34	Vorarlberg	-1.36%	8.04%	8.00%	0.04%
BE10	Région de Bruxelles-Capitale	1.81%	9.00%	5.14%	3.86%
BE21	Prov. Antwerpen	0.02%	3.82%	0.27%	3.55%
BE22	Prov. Limburg (BE)	-0.50%	4.63%	0.09%	4.54%
BE23	Prov. Oost-Vlaanderen	0.04%	4.46%	3.83%	0.63%
BE24	Prov. Vlaams-Brabant	1.73%	3.41%	5.42%	-2.01%
BE25	Prov. West-Vlaanderen	-0.48%	4.54%	1.00%	3.54%
BE31	Prov. Brabant Wallon	1.39%	3.32%	4.37%	-1.05%
BE32	Prov. Hainaut	0.50%	0.51%	5.31%	-4.80%
BE33	Prov. Liège	0.13%	2.47%	0.07%	2.40%
BE34	Prov. Luxembourg (BE)	0.35%	8.16%	8.56%	-0.40%
BE35	Prov. Namur	0.80%	8.34%	2.48%	5.86%
DE11	Stuttgart	-1.30%	7.03%	6.87%	0.15%
DE12	Karlsruhe	-0.51%	5.53%	6.25%	-0.72%
DE13	Freiburg	-0.96%	7.16%	3.70%	3.46%
DE14	Tübingen	-1.31%	6.86%	7.09%	-0.24%
DE21	Oberbayern	0.39%	11.39%	7.38%	4.01%
DE22	Niederbayern	-2.07%	10.14%	11.51%	-1.37%
DE23	Oberpfalz	-1.32%	10.75%	10.13%	0.61%
DE24	Oberfranken	-1.10%	6.52%	5.26%	1.26%
DE25	Mittelfranken	-0.40%	6.87%	6.74%	0.13%
DE26	Unterfranken	-0.85%	6.64%	6.45%	0.19%
DE27	Schwaben	-1.15%	7.44%	10.27%	-2.83%
DE30	Berlin	1.86%	9.15%	-1.46%	10.61%
DE40	Brandenburg	-0.21%	0.19%	4.10%	-3.92%
DE50	Bremen	0.80%	7.88%	7.07%	0.81%
DE60	Hamburg	1.87%	5.81%	4.59%	1.23%
DE71	Darmstadt	0.87%	5.23%	5.16%	0.07%
DE72	Gießen	-0.27%	6.22%	4.89%	1.33%
DE73	Kassel	-0.13%	6.61%	3.19%	3.41%
DE80	Mecklenburg-Vorpommern	0.01%	-2.92%	4.93%	-7.85%
DE91	Braunschweig	-0.50%	4.78%	4.01%	0.76%
DE92	Hannover	0.54%	6.51%	6.37%	0.14%
DE93	Lüneburg	0.06%	7.60%	5.28%	2.32%
DE94	Weser-Ems	-0.39%	9.06%	-3.83%	12.89%
DEA1	Düsseldorf	0.23%	4.33%	1.09%	3.24%
DEA2	Köln	0.63%	3.86%	2.49%	1.37%
DEA3	Münster	-0.31%	6.33%	3.61%	2.72%
DEA4	Detmold	-0.80%	6.85%	5.61%	1.25%
DEA5	Arnsberg	-0.51%	3.96%	5.43%	-1.47%
DEB1	Koblenz	-0.27%	5.06%	5.53%	-0.47%
DEB2	Trier	-0.58%	10.49%	6.27%	4.22%
DEB3	Rheinhessen-Pfalz	-0.18%	5.56%	4.84%	0.72%
DEC0	Saarland	0.24%	1.52%	3.97%	-2.45%
DED2	Dresden	-0.58%	1.99%	4.54%	-2.55%
DED4	Chemnitz	-1.54%	1.44%	2.94%	-1.50%
DED5	Leipzig	0.06%	4.35%	-0.48%	4.83%
DEE0	Sachsen-Anhalt	-0.60%	-1.48%	5.19%	-6.67%
DEF0	Schleswig-Holstein	0.77%	2.57%	3.76%	-1.19%
DEG0	Thüringen	-1.15%	-0.38%	6.67%	-7.04%
DK01	Hovedstaden	1.97%	-1.35%	-2.91%	1.56%
DK02	Sjælland	0.23%	-6.96%	-1.90%	-5.06%

DK03	Syddanmark	-0.31%	-6.56%	-1.10%	-5.46%
DK04	Midtjylland	-0.03%	-3.91%	-4.58%	0.67%
DK05	Nordjylland	-0.03%	-4.54%	-1.40%	-3.14%
EL11	Anatoliki Makedonia, Thraki (NUTS 2010)	-1.61%	-13.30%	-17.23%	3.92%
EL12	Kentriki Makedonia (NUTS 2010)	-0.81%	-22.29%	-18.98%	-3.31%
EL13	Dytiki Makedonia (NUTS 2010)	-2.66%	-14.94%	-20.57%	5.63%
EL14	Thessalia (NUTS 2010)	-1.35%	-19.54%	-18.47%	-1.06%
EL21	Ipeiros (NUTS 2010)	-1.50%	-18.53%	-18.09%	-0.44%
EL22	Ionia Nisia (NUTS 2010)	-0.28%	-16.01%	-19.09%	3.08%
EL23	Dytiki Ellada (NUTS 2010)	-1.21%	-19.89%	-18.90%	-0.99%
EL24	Sterea Ellada (NUTS 2010)	-2.33%	-16.06%	-20.74%	4.68%
EL25	Peloponnisos (NUTS 2010)	-1.77%	-15.26%	-16.41%	1.15%
EL30	Attiki	0.75%	-23.57%	-23.17%	-0.40%
EL41	Voreio Aigaio	0.14%	-12.02%	-19.38%	7.36%
EL42	Notio Aigaio	0.23%	-6.15%	-21.43%	15.28%
EL43	Kriti	-0.68%	-16.44%	-19.67%	3.23%
ES11	Galicia	-1.29%	-12.82%	-8.11%	-4.70%
ES12	Principado de Asturias	-0.69%	-14.02%	-8.54%	-5.47%
ES13	Cantabria	-1.49%	-10.38%	-11.57%	1.19%
ES21	País Vasco	-0.90%	-10.77%	-8.80%	-1.97%
ES22	Comunidad Foral de Navarra	-2.20%	-5.74%	-11.76%	6.02%
ES23	La Rioja	-2.06%	-9.18%	-11.17%	1.99%
ES24	Aragón	-1.35%	-12.81%	-12.36%	-0.45%
ES30	Comunidad de Madrid	0.79%	-11.35%	-9.85%	-1.51%
ES41	Castilla y León	-1.30%	-10.39%	-12.34%	1.95%
ES42	Castilla-la Mancha	-2.19%	-12.54%	-14.16%	1.62%
ES43	Extremadura	-1.32%	-10.05%	-12.10%	2.04%
ES51	Cataluña	-1.12%	-11.74%	-1.25%	-10.50%
ES52	Comunidad Valenciana	-1.35%	-14.97%	-12.55%	-2.42%
ES53	Illes Balears	-0.40%	-3.01%	-13.03%	10.02%
ES61	Andalucía	-0.65%	-13.47%	-10.18%	-3.28%
ES62	Región de Murcia	-1.71%	-10.88%	-13.55%	2.66%
ES63	Ciudad Autónoma de Ceuta (ES)	2.23%	-2.59%	-10.69%	8.10%
ES64	Ciudad Autónoma de Melilla (ES)	2.41%	13.31%	-10.63%	23.94%
FI19	Länsi-Suomi	-0.93%	-0.92%	1.13%	-2.05%
FI1B	Helsinki-Uusimaa	1.47%	-0.31%	2.59%	-2.90%
FI1C	Etelä-Suomi	-0.56%	-6.12%	2.59%	-8.71%
FI1D	Pohjois- ja Itä-Suomi	-0.39%	-0.86%	-1.56%	0.70%
FI20	Åland	-0.05%	-0.47%	4.45%	-4.92%
FR10	Île de France	1.92%	-2.10%	-3.65%	1.55%
FR21	Champagne-Ardenne	-0.61%	-3.79%	1.53%	-5.32%
FR22	Picardie	0.02%	-5.73%	-1.45%	-4.28%
FR23	Haute-Normandie	-0.56%	-1.26%	-1.71%	0.45%
FR24	Centre (FR)	-0.13%	-2.25%	0.29%	-2.54%
FR25	Basse-Normandie	-0.26%	-2.42%	1.30%	-3.72%
FR26	Bourgogne	-0.35%	-1.42%	-0.93%	-0.49%
FR30	Nord - Pas-de-Calais	0.55%	0.27%	0.57%	-0.30%
FR41	Lorraine	-0.46%	-2.04%	0.33%	-2.36%
FR42	Alsace	-0.38%	-3.37%	4.03%	-7.40%
FR43	Franche-Comté	-1.34%	3.39%	0.89%	2.50%
FR51	Pays de la Loire	-0.30%	6.99%	0.88%	6.11%
FR52	Bretagne	0.15%	5.73%	3.48%	2.24%
FR53	Poitou-Charentes	-0.16%	-0.79%	2.82%	-3.61%
FR61	Aquitaine	0.35%	3.82%	-0.36%	4.17%
FR62	Midi-Pyrénées	-0.05%	1.92%	-5.04%	6.96%
FR63	Limousin	-0.02%	-3.22%	0.67%	-3.89%
FR71	Rhône-Alpes	-0.11%	6.19%	1.89%	4.29%
FR72	Auvergne	0.11%	0.84%	5.29%	-4.45%
FR81	Languedoc-Roussillon	1.34%	5.56%	-3.41%	8.97%
FR82	Provence-Alpes-Côte d'Azur	1.17%	4.95%	1.78%	3.18%
FR83	Corse	-1.29%	-23.37%	-1.17%	-22.20%
IE01	Border, Midland and Western	-1.23%	-9.29%	-0.38%	-8.91%
IE02	Southern and Eastern	-0.16%	-7.03%	0.95%	-7.98%
ITC1	Piemonte	-1.02%	-1.48%	2.84%	-4.32%
ITC2	Valle d'Aosta/Vallée d'Aoste	-0.76%	0.24%	2.34%	-2.10%
ITC3	Liguria	0.83%	-4.04%	0.49%	-4.52%

ITC4	Lombardia	-1.07%	2.69%	0.19%	2.50%
ITF1	Abruzzo	-0.83%	-4.29%	3.63%	-7.92%
ITF2	Molise	-1.41%	-8.99%	1.57%	-10.57%
ITF3	Campania	-0.14%	-3.87%	-6.54%	2.67%
ITF4	Puglia	-0.80%	-7.26%	-4.61%	-2.65%
ITF5	Basilicata	-1.06%	-2.57%	-5.87%	3.30%
ITF6	Calabria	0.01%	-8.51%	-6.42%	-2.10%
ITG1	Sicilia	0.07%	-8.17%	-5.95%	-2.22%
ITG2	Sardegna	0.03%	-6.94%	3.96%	-10.90%
ITH1	Provincia Autonoma di Bolzano/Bozen	-0.12%	7.43%	2.40%	5.04%
ITH2	Provincia Autonoma di Trento	-0.52%	5.12%	2.21%	2.91%
ITH3	Veneto	-1.78%	0.34%	1.99%	-1.66%
ITH4	Friuli-Venezia Giulia	-0.87%	-1.67%	1.44%	-3.10%
ITH5	Emilia-Romagna	-1.11%	1.18%	1.96%	-0.78%
ITI1	Toscana	-0.71%	1.29%	2.95%	-1.66%
ITI2	Umbria	-1.02%	-1.78%	2.94%	-4.73%
ITI3	Marche	-1.59%	-0.34%	2.28%	-2.62%
ITI4	Lazio	1.18%	6.20%	-3.29%	9.49%
LU00	Luxembourg	1.59%	18.92%	3.81%	15.12%
NL11	Groningen	1.19%	-7.87%	0.64%	-8.51%
NL12	Friesland (NL)	0.36%	-7.75%	-6.82%	-0.94%
NL13	Drenthe	0.47%	-7.12%	-6.83%	-0.30%
NL21	Overijssel	0.33%	-6.01%	-6.05%	0.04%
NL22	Gelderland	0.74%	-5.48%	-4.83%	-0.65%
NL23	Flevoland	1.74%	-5.21%	-5.25%	0.04%
NL31	Utrecht	2.13%	-4.48%	-5.72%	1.24%
NL32	Noord-Holland	2.04%	-5.13%	-6.18%	1.06%
NL33	Zuid-Holland	1.70%	-6.56%	-4.74%	-1.82%
NL34	Zeeland	0.52%	-5.80%	-0.70%	-5.09%
NL41	Noord-Brabant	0.35%	-4.29%	-1.42%	-2.88%
NL42	Limburg (NL)	0.59%	-8.51%	2.36%	-10.87%
PT11	Norte	-2.75%	-6.22%	-10.95%	4.73%
PT15	Algarve	-0.56%	-6.23%	-9.86%	3.63%
PT16	Centro (PT)	-2.48%	-7.73%	-8.45%	0.72%
PT17	Área Metropolitana de Lisboa	0.99%	-8.71%	-4.94%	-3.77%
PT18	Alentejo	-0.91%	-6.18%	-8.81%	2.63%
SE11	Stockholm	2.48%	8.38%	2.30%	6.08%
SE12	Östra Mellansverige	0.45%	4.19%	4.50%	-0.31%
SE21	Småland med öarna	-0.30%	-1.29%	1.84%	-3.13%
SE22	Sydsverige	0.98%	2.29%	0.22%	2.07%
SE23	Västsverige	0.56%	5.34%	1.27%	4.08%
SE31	Norra Mellansverige	-0.40%	-0.66%	6.03%	-6.69%
SE32	Mellersta Norrland	0.57%	2.69%	5.32%	-2.64%
SE33	Övre Norrland	0.36%	1.71%	-0.07%	1.78%
UKC1	Tees Valley and Durham	0.02%	2.43%	1.35%	1.08%
UKC2	Northumberland and Tyne and Wear	0.25%	5.07%	1.57%	3.49%
UKD1	Cumbria	-0.50%	-2.44%	2.82%	-5.26%
UKD3	Greater Manchester	0.52%	4.81%	1.22%	3.59%
UKD4	Lancashire	0.58%	-1.83%	3.12%	-4.96%
UKD6	Cheshire	0.59%	5.45%	1.85%	3.60%
UKD7	Merseyside	0.83%	2.97%	2.53%	0.44%
UKE1	East Yorkshire and Northern Lincolnshire	-0.29%	-0.84%	4.30%	-5.13%
UKE2	North Yorkshire	0.64%	-0.04%	3.59%	-3.63%
UKE3	South Yorkshire	0.43%	13.58%	1.91%	11.67%
UKE4	West Yorkshire	0.27%	0.46%	4.34%	-3.88%
UKF1	Derbyshire and Nottinghamshire	-0.05%	0.78%	5.34%	-4.57%
UKF2	Leicestershire, Rutland and Northamptonshire	0.16%	6.25%	4.71%	1.54%
UKF3	Lincolnshire	-0.38%	4.61%	4.73%	-0.13%
UKG1	Herefordshire, Worcestershire and Warwickshire	0.11%	2.56%	2.45%	0.11%
UKG2	Shropshire and Staffordshire	-0.15%	-0.21%	3.77%	-3.98%
UKG3	West Midlands	0.51%	5.55%	2.14%	3.41%
UKH1	East Anglia	0.43%	5.71%	5.36%	0.35%
UKH2	Bedfordshire and Hertfordshire	0.66%	8.97%	7.18%	1.78%
UKH3	Essex	0.67%	0.16%	8.99%	-8.83%
UKI1	Inner London (NUTS 2010)	2.58%	12.41%	6.10%	6.31%
UKI2	Outer London (NUTS 2010)	1.36%	9.75%	6.03%	3.72%

UKJ1	Berkshire, Buckinghamshire and Oxfordshire	1.10%	3.32%	8.44%	-5.12%
UKJ2	Surrey, East and West Sussex	1.24%	0.04%	8.69%	-8.66%
UKJ3	Hampshire and Isle of Wight	0.78%	2.83%	4.58%	-1.74%
UKJ4	Kent	0.23%	4.02%	6.84%	-2.82%
UKK1	Gloucestershire, Wiltshire and Bristol/Bath area	0.55%	1.96%	3.17%	-1.21%
UKK2	Dorset and Somerset	0.40%	3.73%	1.96%	1.77%
UKK3	Cornwall and Isles of Scilly	0.23%	6.99%	2.10%	4.88%
UKK4	Devon	0.85%	-2.85%	2.18%	-5.03%
UKL1	West Wales and The Valleys	0.22%	2.36%	1.74%	0.62%
UKL2	East Wales	0.66%	-0.95%	2.85%	-3.80%
UKM2	Eastern Scotland	0.83%	1.10%	3.61%	-2.51%
UKM3	South Western Scotland	0.46%	2.79%	1.98%	0.82%
UKM5	North Eastern Scotland	-1.40%	9.66%	4.07%	5.59%
UKM6	Highlands and Islands	-0.08%	-3.50%	3.32%	-6.82%
UKN0	Northern Ireland (UK)	0.20%	4.54%	-3.97%	8.51%

Note: By construction, *National Share* = -2.66% for all regions.

Table C.3 - Variables included in the analysis

PILLAR	INDICATORS	UNIT OF MEASUREMENT	SOURCE	YEAR
Infrastructures	Motorway density	Combined index (average population/area) - (EU27=1)	Eurostat	2006
	Railway density	Combined index (average population/area) - (EU27=1)	Eurostat	2007
Health	Healthy life expectancy	Number of years of healthy life expected	Eurostat, DG Regional Policy	2007
	Infant Mortality	Number of deaths of children under 1 year of age during the year to the number of live births in that year	Eurostat, Regional Health Statistics	2007
Higher education	Population aged 25-64 with higher educational attainment	% of total population of age group	Eurostat (LFS)	2007
	Lifelong learning	% of population aged 25-64 participating in education and training	Eurostat, Regional Education Statistics	2007
Labour market efficiency	Long-term unemployment	% of labour force unemployed for 12 months or more	Eurostat (LFS)	2007
Business Sophistication	Employment in the "Financial intermediation, real estate renting and business activities" NACE sectors (J-K)	% of total employment	Eurostat, Regional Labour Market Statistics	2007
	FDI intensity	number of new foreign firms per thousands inhabitants	ISLA-Bocconi	average 2005-07
Innovation	Total intramural R&D expenditure	% of GDP	Eurostat, Regional and Technology Statistics	2007
	Human resources in science and technology (HRST)	% labour force	Eurostat, Regional and Technology Statistics	2007

Concluding Remarks

This dissertation investigates how the resilience to shocks affects both income and employment growth dynamics of regional economies. Using different samples and methodologies, we find that how regions react to and recover from a shock plays a key role in influencing regional disparities. At the same time, our results suggest that the impact of shocks depends on specific characteristics of the regions and the countries.

Particularly, in the first chapter we provide evidence of the divergent impact of the Great Recession across the European regions and countries. We show that the hypothesis of absolute per-capita GDP convergence is rejected both at the regional and at the country level for EU 28 in the period 2000-2014, bringing to convergence clubs identification. Moreover, we find a strong divergent impact of the Great Recession on the convergence process among the European regions that is not affected by the composition of the sample (inclusion or exclusion of the poorest countries). This effect become more tenuous at the country level due to the fact that two different processes seem to be in place after the crisis: a polarization process among the *Core* and the *Periphery* and a catching up process within the *Periphery*.

In the second chapter we extend the analysis of resilience both in space by looking at regions belonging to other advanced economies of the OECD countries, and in time, by considering other economic crises in addition to the Great Recession. Our results suggest a reducing effect of crises on within country disparities up to 2007. On the contrary, it seems that the Great Recession have had, on average, an increasing impact on regional disparities. Here, we provide evidence of how the severity, persistency and typology (economic downturns vs financial shocks) of crises matter in shaping regional disparities. Furthermore, we find that the effect of the shocks varies with the different economic conditions (macroeconomic and regional).

In the third and final chapter, we focus on the employment resilience to the Great Recession of the regions belonging to the the pre-enlargement European 15 Members. In this case we show how the role played by the specific regional competitiveness has been dominant in the explanation of how regions have reacted to the latest economic crisis respect to their industrial structure. Moreover, we investigate the competitiveness determinants of the employment resilience, finding a strong correlation between labour market efficiency, innovation and specialization in high value added sectors on one side, and better response to the crisis, on the other.

It has long been believed that recessionary shocks do not have any permanent effect on the growth path of an economy. Our results show the opposite, highlighting the key role played by the specific conditions of the economies.

These results have several policy implications. First, the regional dimension is crucial. Our analysis show how different regions in the same country may have different reaction to shocks. At the same time, the spatial relationships are important. In fact, it seems that the specific cluster to which the regions belong, appears to be more important than the country of origin. These findings suggest the need for adequate regional policies. The "one size fits all" approach should be overcome in favour of targeted local policies. In a globalized world where the growing economic and financial integration has made all economies more vulnerable to external shocks, the specific characteristics of the regions assume greater importance. As a consequence, targeted policies should be focused on strengthening local assets endowments. In this context, the European regional support, that aim at helping less advanced economies to improve their institutions, has grown in parallel with European integration but it is not clear if it has worked properly. Hence, more efforts should be made to improve the effectiveness of the Structural Funds, due to their potential usefulness in supporting job creation as well as business competitiveness, economic growth and sustainable development.

Second, national policies may have an important role. Improving local assets endowment is a long process that takes time. Immediately after the outbreak of a crisis, when demand for goods, consumption and investments fall the national policy intervention may be essential in avoiding the persistence of the negative effects caused by the crisis. In this sense transfers to lagging regions may be useful to support the aggregate demand. However, as we have shown the "quantity" seem to be not sufficient to ensure a reduction in regional disparities. Hence, transfers should be drawn in a proper way in order to really cushion the negative effects of economic crises.

Finally, it seems that besides the impact of the Great Recession, the austerity measures undertaken after the crisis may have worsened the direct effect of the shock by making the recovery more difficult, mainly for weaker economies. The fact that fiscal consolidations can be expansionary by raising output as well as employment has been in practice unrealized. Recent researches have demonstrated that attempts to reduce debt via fiscal consolidations have very likely resulted in worsening the main economic indicators (i.e. debt to GDP ratio) through their long-term negative impact on output. At the same, time fiscal consolidation have significant distributional effects, raising personal inequality and territorial disparities

as well as decreasing wage, income shares and increasing long-term unemployment. In this context, the European policymakers should rethink their policies by focusing more on territorial and social cohesion through fiscal expansions rather than fiscal consolidations.