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Economic social and environmental resilience: an analysis for the Italian Regions after 2007

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This paper presents a study on Italian regions after the 2007 crises from resilience point of view. The aim of the paper is twofold. First constructing a resilience social, human capital and environmental indexes at regional level. Second using the resilience indexes to explain the different growth path of the GDP at regional level. The following results are obtained. Social environmental and human resilience index are constructed. The environmental index is correlate with the GDP and the correlation increases after the economic shock of 2007. A sustainable environmental behavior is becoming more important for economic resilience. Social resilience index is highly correlate with GDP. Social resilience is important for economic resilience and to explain the growth path at regional level.

Jel code: R10;

Key words: economic resilience; resilience indexes, Regional economies.

1. Introduction

Resilience from the Latin root *resilire*, to leap back or rebound, refers to the ability of an entity or system to ‘recover form and position elastically’ following a disturbance or disruption of some kind. The concept is rapidly becoming part of the regional studies but there is still ambiguity about the meaning, about how it can be conceptualized and measured and what are the determinants. The literature considers three different interpretations of economic-regional resilience: the engineering resilience, the ecological resilience and the adaptive resilience.

The engineering resilience (Hotelling, 1973; Pimm, 1984; Walker et al, 2006) can be defined as “how fast a system that has been displaced from equilibrium by a disturbance or shock returns to that equilibrium”. In this case the assumption is that the system is in equilibrium and is able to self-restore after the shock or self-correcting mechanisms are activated which operate to restore the *ex ante* equilibrium (de Graff et al., 2002). The focus is on the resistance of a system to a disturbance and on the stability near the equilibrium. A resilient system is a system that returns quickly to its pre shock equilibrium.

Ecological resilience (Hotelling, 1996; Gunderson e Hotelling 2002; Gunderson e Pritchard 2002; Mc Glade et al, 2006; Walker et al, 2006) is *the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity and feedback* (Walker et al, 2006, p.2). In this case the shock to a system can exceed the absorptive capacity or elasticity threshold of the system and it will be pushed into some alternative equilibrium state. The emphasis is on the ability of the system to absorb the disturbance before it will move in another equilibrium state that can be less or more favorable. If the new post-shock configuration or state is ‘inferior’ to its pre-shock predecessor in some way, then such a system would presumably be regarded as having low resilience compared to a system which was able to move to a new post-shock configuration or path that is in some sense or other ‘superior’ to that which obtained prior to the shock or disturbance. The literature on ecological resilience has developed a coherent paradigm that relies heavily on systems thinking within an *adaptive cycle model* and is the ability of a region to reconfigure its productive structures and firms, re allocate the resources, having a qualitative and structural change.

In contrast to resilience as a return to normalcy, resilience in a systems framework refers to the ability to change or adapt in response to stresses and strains (Carpenter et al., 2001). As such, resilience is a dynamic attribute associated with a process. The model is based on a four-phase process of continual adjustment (Pendall et al., 2008; 2010) and each phase is associated with a certain level of resilience. The conservation phase, characterized by stability, certainty and increased rigidity, where the level of resilience is low. The release phase, the time of creative

destruction with some uncertainty, where the level of resilience is low but is increasing. Reorganization phase with a high level of uncertainty but also a high level of innovation and restructuration and a high level of resilience. The exploration phase, characterized by the growth and seizing opportunity, where the level of resilience is high but is decreasing. Each phase is characterized by varying levels of three dimensions of change: 1) the potential of accumulated resources available to the system; 2) the internal connectedness of the system actors or variables; and 3) resilience, a measure of system vulnerability to surprise, stresses, and shocks, with high resilience associated with phases of creative and flexible response (Holling and Gunderson 2002).

The engineering and ecological definitions are based on the idea that the systems are in equilibrium. In a contest of evolutionary economic geography where the growth process is driven by a *regional system of innovation* (Clark et. al., 2010; Howells, 1999), and a *learning region* (Archibugi & Lundvall, 2001), firms, institutions and organizations are continuously changing so there is not equilibrium. Following this approach the resilience can be interpreted as an adaptive ability of the system (Sammie & Martin, 2010). The adaptive resilience finds its theoretical foundations in the theory of complex adaptive systems. They are characterized by a self-organizing behavior driven by co-evolution interaction among their constituent components and elements and an adaptive capacity that enables them to rearrange their internal structure spontaneously (Martin, 2012). Regional economic resilience in this framework could be viewed as having to do with the capacity of a regional economy to reconfigure its structure (firms, industries, technologies and institutions) so as to maintain an acceptable growth path in output, employment and wealth over time (Hill Wial, & Wolman, 2008, Christopherson et. al., 2010). In this case resilience is a dynamic process, not just a characteristic or property. The resilience is a complex phenomenon made of at least four interrelated dimensions: the first is that of *resistance*, that is the vulnerability or sensitivity of a regional economy to disturbances and disruptions, such as recessions. The second is that of the speed and extent of *recovery* from such a disruption. Of interest here is whether the speed and extent of recovery are determined by the degree of resistance to the shock in the first place. The third aspect concerns the extent to which the regional economy undergoes structural *re-orientation* and what implications such re-orientation has for the region's output, jobs and incomes. The fourth dimension concerns the degree of *renewal* or resumption of the growth path that characterized the regional economy prior to the shock (Sammie e Martin, 2010).

Defining economic regional resilience is not straightforward. The fields of application requires answers to four main questions (Carpenter et al, 2001): resilience of what? To what?, By what means? And with what outcomes?. The purpose of our paper is to We well focalize our attention on the economic shock of 2007. There are two main purposes of this paper. First constructing human

capital, social and environmental resilience indexes at regional level and studying the behaviors of Italian Regions after the economic shock of 2007 respect to them. Second, using the resilience indexes to explain the different growth path of the GDP at regional level. The following definition of regional resilience will be used. Some regions after the economic shock may have returned to or exceeded their previous growth path within a relatively short period of time these regions might be called *economically resilient*. Some of them may not have been thrown off their growth path at all; these regions might be called *shock-resistant*. Finally, some regions may have been *unable* to rebound and return to or exceed their previous path; these might be called *non-resilient* (Hill et. al., 2008).

The paper is organized as follows. The following section (section 2) will present some theoretical arguments concerning social and environmental resilience. In section 3 we will discuss the social, human and environmental regional resilience indexes. The methodology and the results are treated in section 4. Finally, the conclusion, are in section 5.

2. Regional resilience: social environmental and economic aspects

Social economic and environmental resilience are strictly connected. Therefore, adaptation processes involve the interdependence of agents through their relationships with each other, with the institutions in which they reside, and with the resource base on which they depend (Adger, 2003). The adaptive process after a shock will involve individuals, communities, organizations and the result it will depend on the capacities to tolerate, absorb, cope with and adjust after the shock. The ability of recovery or to be resistant after a shock of a given area will depend on different elements as infrastructures, firms and government behavior but also from the capacity of people to response to risks, shocks and stresses. Theory of social resilience is strictly related with social capital (Norris 2008, Adger 2003; Coleman 1990). The literature recognize the importance of social capital (Bourdieu 1986, Coleman 1990, Putnam 1993, 1995, 2000) in collective action and social capital influence also the use of natural resources and the collective handling of environmental risks (Adger 2003). The social resilience can be defined as the ability of a community to withstand external shocks using a social infrastructure that is the ability of individuals, organizations and communities to adapt, tolerate, absorb, cope and adjust with respect to the change and threats of various kinds (Adger 2000). Using social engineering definition of resilience the focus will be placed on the vulnerability of places and people after the shock. The social ecological resilience is the ability of a system to absorb shock without changing its structure i.e. it is the ability of a social system to tolerate a shock. In accordance with this definition resilience emerges as a dynamic

process. The analysis will include not only the ability to withstand shocks, i.e. the ability to react, but also the ability to create new options after the shock and the shock can be seen as an opportunity. Social ecological resilience is interpretable as the ability of a social system to respond and recover from a disaster (Cutter 2008) focusing not only on the ability of the system to absorb the impact and cope with the event, but also on the ability to react and reorganizing. Social resilience is therefore the result of different components through a process that activate the adaptive capacity of individuals and communities (Norris et al. 2008). The social resilience has not unique definition. It can be defined as is the ability of individuals, organization and community to react, absorb or tolerate threat, stress, and risk (Adger, 2000) but it can be also defined as the ability of a social system to react, respond or recover after a disaster (Cutter, 2008). Several authors (Voss, 2008; Lorenz, 2010; Obrist et al., 2010; Benè et al., 2012) have underlined that three different types of capacities are necessary for understanding the notion of social resilience: coping, adaptive and transformative capacities. This dimension are closely related. The way they interact with each other depend on the context and on the capacity and ability of a given territory. Other authors (Norris 2008, Brenau et al., 2003) underlined that resilience is a complex phenomenon made of four interrelated dimension. Robustness -the ability to withstand stress without suffering degradation- redundancy - is the extent to which elements are substitutable in the event of disruption or degradation-, rapidity - the capacity to achieve goals in a timely manner to contain losses and avoid disruption-, and resourcefulness -the capacity to identify problems and mobilize resources when conditions threaten the system-. In our study we will focalized the attention on robustness and rapidly.

The review of literature concerning studies on social resilience address on a wide range of threats. Most of the studies focus on specific stressors, which can be broadly grouped into three categories. The first is centered on *natural hazards and disasters* and comprises studies on droughts (Rockstrom 2004; Pearce et al. 2010), floods (Braun and Aßheuer 2011; Cashman 2011; Haase 2011; Lopez-Marrero and Tschakert 2011), tropical storms (Tompkins 2005; Frazier et al. 2010; Howe 2011; McSweeney and Coomes 2011; Pellingand Manuel-Navarret, 2011), volcano eruptions (Tobin and Whiteford 2002), tsunamis (Adger et al. 2005; Lursen et al. 2011; Biggs et al. 2012) and fires (Harte et al. 2009; McGee 2011). A second group of papers addresses more long-term stress associated with *natural resource management, resource scarcity and environmental variability*. Case studies focus on issues such as mangrove forest conversion (Adger 2000), maritime resource conservation (Marshall et al. 2009), desertification (Bradley and Grainger 2004), declining water quality (Gooch et al. 2012), water scarcity (Langridge et al. 2006) and climate variability and climate change (Endfield 2007; Hayward 2008; Rasmussen et al. 2009; Marshall 2010; Garschagen

2011; Marshall et al. 2011; Deshingkar 2012; Traerup 2012). A third group of studies deals with various kinds of *social change and development* issues and examines policy and institutional change (Thomas and Twyman 2005; Marshall et al. 2007), migration (Adger et al. 2002; Porter et al. 2008; Siegmann 2010), regional economic transformation (Evans 2008), tourism (Adams 2010), infrastructural development (Perz et al. 2010), urban socio-spatial transformation (Bouzarovski et al. 2011), economic crisis and uncertainty (Schwarz et al. 2011; Zingel et al. 2011; Keck et al. 2012), and health risks (Leipurt and Reutter 2005; Hoy et al. 2008; Dongus et al. 2010; Obrist et al. 2010b).

3. Social-human and environmental regional resilience indexes

There is no general agreement concerning definition and measurement of economic resilience. As discussed in section 1 our attention will be focalized on economic shock at regional level using resilience definition given by Hill (2008). There are several ways and different methodological approach that can be found in literature to measuring Regional Economic Resilience. The first one, based on case study (Evans e Karecha, 2013) and interview, it involves descriptive data and interviews whit actors. The second based on singular or composite, comparative and counterfactual measure of resistance and recovery (Martin 2012). The third approach in based on statistical time series models, impulse response models and error correction models (Flingeton, Garresten e Martin, 2012). The forth one based on casual structural models (Doran e Flingeton, 2012). The last one is based on the construction of a composite resilience indexes of resilience starting from indicators (Bruguglio et al., 2008; Graziano, 2013) with the aim of measuring the economic resilience of a given area.

The resilience indexes proposed here intend to explain if and how they affect the economic resilience of Regions after the economic shock occurred in 2007. The analysis will be developed for Italian Regions (NUT 2) using the data from Italian Institute of Statistics (ISTAT)¹. It is hypothesized that the indexes that can influence the Regional economic resilience are the following:

- Human capital index;
- Social capital index;
- Environmental index.

The resilience indexes will be obtained using a multivariate technique starting from a set of environmental, human and social capital indicators with the foresight to choose indicators with

¹ We will consider Trentino Alto Adige at aggregate level instead of considering Trento and Bolzano separately

appropriate covered. Economically resilient and non-resilient regions can be identified using data on aggregate economic performance of regions. Figure 1 describes the GDP per capita at Regional level from 2006 to 2012. The GDP grew until 2008 (II) when the crises shock has had its effects in Italy. During 2010 there is a small recovery followed by a new period of recession still in progress. None of the Italian regions reacted resiliently. Using this result the analysis will be developed dividing the period 2006-2012 in four sub-periods. The first one, 2006-2007, named pre shock, 2008-2009, named during the shock, 2010, named after the shock and 2011-2012 named shock. For periods with more than one year was made the average of the period.

Insert about here

Figure 1 *GDP per capita*

Environmental indicators

The literature concerning the social ecological resilience (Adger, 2000; Adger et al., 2005; Walker et al., 2004; Folke, 2006) is mainly focalized on the social ecological impacts of natural disaster. Our aim is slightly different. We want to investigate if a sustainable environmental behavior can affect the economic resilience. The indicators were chosen according with the sustainable development literature. Starting from a set of 25 indicators, some of them were dropped because they do not have appropriate covered. The used indicators are summarized in Table 1.

Insert about here

Table 1: *environmental indicators*

Insert about here

Table 1.a: *environmental descriptive statistics*

Table 1.a shows that, on average, Italy are adopting more sustainable environmental behavior. From 2006-2007 to 2011-2012 are increased the amount of composing (from 19,6% to 36,5%), the consumption of energy from renewable resources (from 27,8% to 44,4%) and the level of recycling (from 24,4% to 37,8%).

Human capital indicators.

Human capital, starting from Adam Smith, has been the object of numerous studies in the economic field. Following Coleman (1990) we can define the human capital as the ability to give skills and capabilities to persons that make them able to act in new ways. The OECD definition (OECD, 2001) of human capital is : *the knowledge skills, competence and attributes embodied in individuals*

that facilitate the creation of personal, social and economics well-being. These definitions underline the intangible attribute of human capital. A greater endowment of human capital will improve non only the jobs opportunity and the innovative capacity at individual level but it will give also better quality of life, more participation to democratic processes and more participation to social activities. Human capital could act on the economic resilience by fostering the process of recovery and resistance. There are a lots of human capital indicators. For our analysis we consider some stock indicators, as the level of education, and some flow indicators as training and long life learning programs. We did not considered indicators as the GDP expenditure on education because the data were not available for all the periods. The used indicators are summarize in Table 2.

Insert about here

Table 2: *human capital indicators*

Indicators in Table 2.a

Insert about here

Table 2.a: *human capital descriptive statistics*

Table 2.a shows that the human capital indicators, in Italy, for period from 2006-2007 to 2011-2012 are stable. It is just increased the amount of people aged 30-34 with degree (from 18,5% to 21,4%).

Social capital

There is not a unique definition of social capital. Moreover each definition pointed out the attention on one or more aspects neglecting others. The following is a summary of the most common definitions used in the literature. Bourdieu (1986) defines the social capital as an aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition. Coleman (1990) underlines that the social capital is not a single entity, but a variety of different entities, having two characteristics in common: they all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure. Putnam (1993; 1995) underlines the importance of social networks and the norms of reciprocity and trustworthiness that arise from them. In that sense social capital is closely related to what some have called “civic virtue”. For the OECD the social capital is defined as a networks together with shared norms, values and understandings that facilitate co-operation within or among groups. Finally the World Bank defines the social capital as a mix of institutions, relationships, and norms that shape the quality and quantity of a society’s social interactions. Social capital is not just the sum of the institutions which underpin a society but it is the glue that holds them together. The aim of our work is to find a social capital index associate with the resilience that it can capture the absorption or recovery capacity of

a Region. Moreover we have considered also the infrastructural capital usually referred as a support system created by people to carry out economic activities in the best possible conditions. For each definition we can find and use different indicators. We started our analysis considering 54 indicators, participation in non-profit organizations, social activities, trust in Institutions and civiness, territorial indicators. A lots of them has been dropped because the indicators do not cover the entire period considered. The indicators are summarized in table 3.

Insert about here

Table 3: *social capital indicators*

Insert about here

Table 3.a: *social capital descriptive statistics*

Table 3.a shows that the social capital indicators in Italy are stable except for use of PC greatly increased (form 35,1% in 2006-2007 to 51,35% in 2011-2012).

4. Methodology and results

To pass from indicators to indexes we used a multivariate technique the Principal Component Analysis applied to standardized indicators previously described in this work. Between couple of indicators with high or low correlation, more than 0,8 and less than 0,3 in absolute value, one were dropped. The indicator were reduced to 12 for social capital, 12 for environmental and 8 for human capital. The analysis has been developed separately on the components of environmental, human and social capital and for the periods 2006-2007 and 2011-2012.

Environmental indicators

The PCA on environmental indicators for the period 2006-2007 gives as results four principal components with total variance explained equal to 82,4%. The eigenvalue of the fourth component is equal to 1,2. Excluding the fourth component the total variance explained becomes equal to 71,6% and a KMO equal to 0,54. The principal components obtained with the confirmatory factor analysis are the following. Component 1, named renewable source of energy and protected zones (RSEPZ), composed by: Consumption of energy from renewable resources, Sites of Community Importance, Special Protection Areas, Gross Energy Efficient from renewable resources, Energy from Renewable Resources, with loadings factors positive and elevate. Component 2, named environmental preservation (EP), composed by: Composting, Municipal waste landfilled, Recycling, Forest area affected by fire with loading factors elevate. The factors Composting and Recycling are positively related with component 2, instead the factors Municipal waste landfilled and Forest area affected by fire are negatively related. The component 3, named pollution (P), is

composed by the following indicators: Air Pollution, Noise, Municipal waste collected with loading factors elevate and positive. To create an environmental resilience index we add the factors scores obtained by regression method for the first two component (RSEPZ and EP) and we subtract the pollution component (P). Pollution has a negative impact on the environmental index.

Using the same methodology as described above the PCA on environmental indicators for the period 2011-2012 we obtain as results five principal components with total variance explained equal to 85,77% and KMO equal to 0,57. The eigenvalue of the fourth and the fifth components is equal, respectively, to 1,2 and 1. Excluding the fourth and the fifth component the total variance explained becomes equal to 67,3%. Making a confirmatory factor analysis we obtain the same components obtained for the period 2006-2007.

To analyze the behaviors of Region before and after the shock we rank the environmental resilience indexes obtained as described above and we compare, graphically, the results. We divide Region in two subgroups named good cases and bad cases. The first case includes regions that improved their rank after the shock and the latter includes regions that worsened their situation. Regions labeled with good cases reacted to the shock with robustness, ability to withstand stress without suffering degradation and in some cases also rapidly because they improved a lot their position.

The results are in Figure 2.a and 2.b.

Insert about here

Figure 2.a: *bad cases environmental resilience index*

Insert about here

Figure 2.b: *good cases environmental resilience index*

Liguria, Lazio, Puglia and Toscana improved significantly their position because this Regions have invested significantly in renewable resources while Molise, Veneto and Umbria have worsened considerably their position².

Analyzing the correlation between GDP and the environmental resilience index we find out that during the period 2006-2007 the environmental resilience index that it is weakly correlated with the GDP³ (Pearson correlation equal to 0,396). Correlation index increased during the period 2011-2012 (Pearson correlation equal to 0,531). A sustainable environmental behavior became more important for growth.

Social capital indicators

² higher value means worst positions
³

To determine the social capital index we use the same the same technique previously described. During the period 2006-2007 the results obtained by the PCA give three principal components with total variance explained equal to 83,0% and KMO equal to 0,814. The eigenvalue of the third component is equal to 1,0 therefore we can exclude it. The total variance explained becomes equal to 74,3%. Making a confirmatory factor analysis we obtain the following principal components. Component 1, named social capital, whose components are: associations, sport, dancing, museum and exhibitions, sport events, theater, books, newspaper, social services and use of pc and component 2, named territorial capital, whose components are cinema and home care. Both components have elevate and positive loadings factors. For the period 2011-2012 the PCA gives as result two principal component with total variance explained equal to 78,3% and KMO equal to 0,785. The components are the same found previously with elevate and positive loadings factors.

Adding the factor scores obtained by regression method for social capital index and the territorial capital index we obtain a social resilience index. The Regions are divided in two subgroups, named good and bad cases, and comparing, graphically, the results in Figure 3.a and 3.b.

Insert about here

Figure 3.a: *bad cases social resilience index*

Insert about here

Figure 3.b: *good cases social resilience index*

we obtain that the ranks variation of social resilience index are smaller than in environmental index. Trentino Alto Adige and Sicilia have worsened considerably their position while Marche, and Campania improved their position. The social-resilience index for period 2006-2007 is highly correlated with the GDP (Pearson correlation equal to 0,876). For period 2011-2012 we find out that correlation between GDP and the social-resilience index highly correlated with the GDP (Pearson correlation equal to 0,863). Social resilience matters for growth.

Human capital

The PCA applied for the period 2006-2007 gives as result two principal component with total variance explained equal to 76,98% and KMO equal to 0,637. Component 1, named training, whose components are: long life learning, adults in permanent education, employed training education and unemployed training education and component 2, named education, whose components are education 15-19 years, university education, rate of education, adults education. The components have elevate and positive loadings factors except the factor adults education which is negative. The

PCA applied for the period 2011-2012 gives as result two principal component, the same obtained for the period 2006-2007, with total variance explained equal to 74,2% and KMO equal to 0,684, elevate and positive loadings factors except the factor adults education which is negative.

Whit the same methodology used previously, we find the human capital index and we compare, graphically, the results dividing Regions in good and bad cases. The results are in Figure 4.a and 4.b.

Insert about here

Figure 4.a: bad cases human resilience index

Insert about here

Figure 4.b: good cases human social resilience index

Trentino Alto Adige, Emilia Romagna and Toscana have worsened their position while Lazio, Molise and Basilicata improved their position. The human-resilience index for period 2006-2007 is weakly correlated with the GDP (Pearson correlation equal to 0,397). There is also a weak correlation (Pearson correlation equal to 0,421) for period 2011-2012.

GDP per capital, social, human and environmental indexes.

It would be interesting to investigate if the GDP per capital is explained by social, human and environmental indexes. Using the ordinary least squares (OLS) method of regression, GDP per capita was regressed on the three indexes produced in this study. For the period 2006-2007 the correlation matrix between the component is shown in table 4. The components are all positively related but some of them are just weakly related. The regression results are in Table 5.

Table 4 Correlation matrix 2006-2007

	Social resilience	Human resilience	capital	Environmental resilience
Social resilience (SR)	1			
Human capital resilience (HC)	0,570	1		
Environmental resilience (E)	0,092	0,129		1

Table 5 Regression results

GDP=	0,953 SR	-0.190 HC	0,333 E
t	(9,505)	(-1,884)	(4.013)
$R^2=0,891$			
Observation=20			

The result show that there is highly positive correlation between social resilience and a weak correlation between GDP and environmental resilience. Using the same technique for the period 2011-2012 we obtain the following results.

Table 6 Correlation matrix

	Social resilience	Human resilience	capital	Environmental resilience
Social resilience (SR)	1			
Human capital resilience (HC)	0,570	1		
Environmental resilience (E)	0,208	0,348		1

Table 7 Regression results

GDP=	0,916 SR	-0.249 HC	0,427 E
t	(10,180)	(-2.653)	(5.408)
$R^2=0,912$			
Observation=20			

The results of the analysis shows that social resilience matters. Regions with higher level of social resilience have also higher level of economic resilience than regions with lower level of social resilience. Moreover regions with high level of social resilience remains resilient after the crises maintaining high level of GDP and regions with lower level of social resilience maintain low level of GDP as shows in Figure 5.a and 5.b.

Insert about here

Figure 5.a: GDP and social resilience index 2006-2007

Insert about here

Figure 5.b: GDP and social resilience index 2011-2012

Like showed in Figure 5.a and 5.b less social resilient Regions are located in the South of Italy.

5. Conclusion

According with more recent literature resilience is a dynamic and multidimensional process that involves different areas. Analyzing quarterly GDP for period 2006-2012 we found out that Italian

regions did not react resiliently after the economic shock occurred in 2007. Nevertheless some of them reacted better than the others. Starting from the idea that resilience is a multidimensional phenomenon to capture different reactions we construct three resilience indexes named environmental, social and human capital. Regions reacted to the shock not uniformly. Some of them reacted robustly, without suffering degradation and increasing their regional rank some of them decreased the regional rank. Moreover crises change the importance of index respect to growth. Before crises there was a weak correlation between environmental index and social index. After the crises we found out that correlation increased. This confirms the theoretical finding of Adger (2003) according to which adaptation processes involve the interdependence of agents through their relationships with each other and with the resource on which they depend.

The main finding of the analysis is that social resilience matters. There is a strong correlation between GDP and social resilience index before and after the crises. Economic resilience depends from social resilience but social resilience depends from the past. Regions with higher social resilience before crises performed better, in terms of GDP, than regions with lower level of social resilience. From policy point of view developing a resilience social capital means investing in social cohesion but is a long run process.

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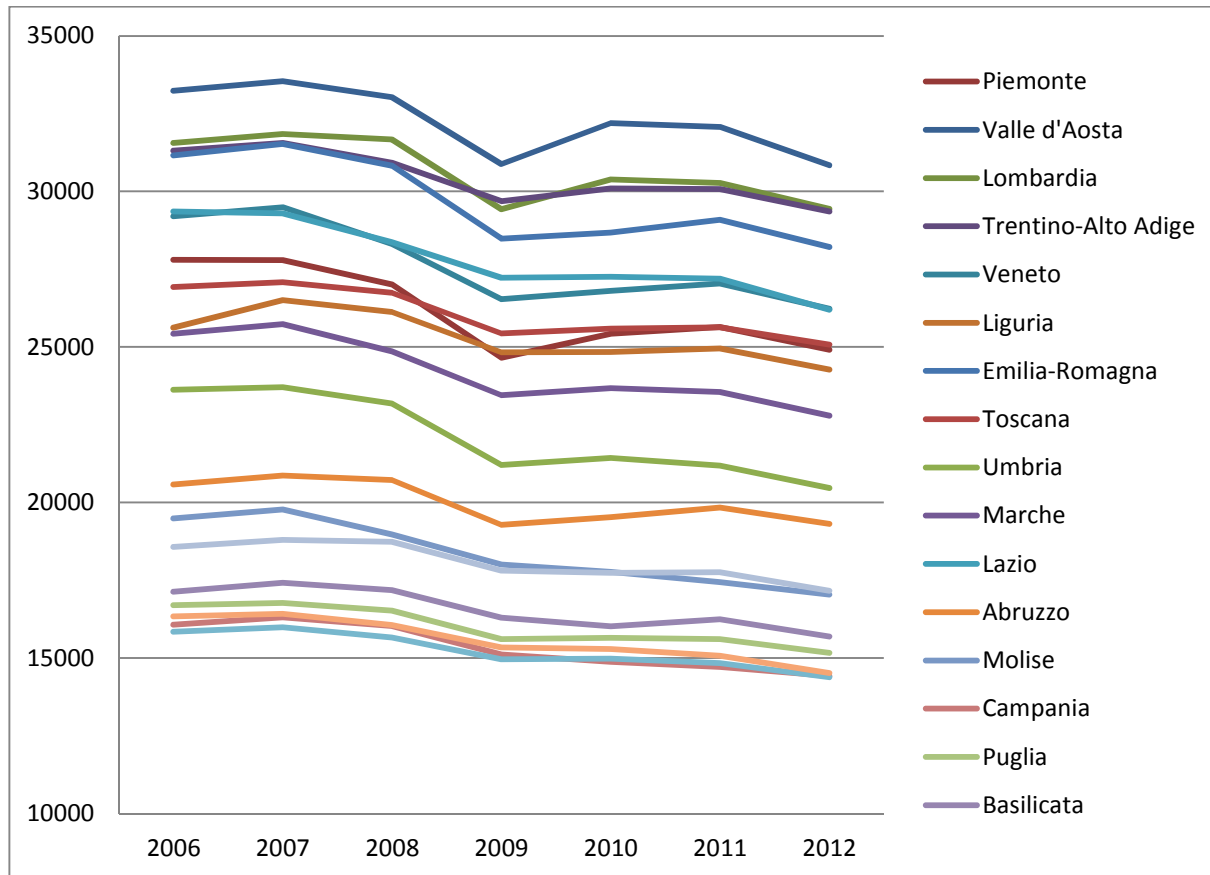
Figure 1 GDP per capita

Table 1: environmental indicators	
Composting	Amount of wet fraction treated in composting plants for the production of quality compost; Fraction wet treated in composting plants on the fraction of urban waste in the wet total; Source, ISTAT 2006-2012.
Consumption of energy from renewable resources	Consumption of energy from renewable sources; (electricity consumption covered by renewable sources) gross production of electricity from renewable sources as a percentage of consumption gross domestic electricity; Source, ISTAT 2006-2012.
Gross Energy Efficient from renewable resources	Source, ISTAT 2006-2012.
Energy from Renewable Resources	Energy produced from renewable sources- GWh of energy produced from renewable sources of GWh produced in total- Source, ISTAT 2006-2012.
Air Pollution	Households reporting very or fairly present air pollution in the area where they live, (per 100 households in the same area), Source, ISTAT 2006-2012.
Municipal waste landfilled	Municipal waste landfilled per capita (kg); Source, ISTAT 2006-2012.
Municipal waste collected	Municipal waste collected per capita (kg); Source, ISTAT 2006-2012.
Recycling	Municipal waste recycled on the total municipal waste
Noise	Noise monitoring; Source, ISTAT 2006-2012.
Site of Community Importance (SCI)	Area of Sites of Community Importance (SCI) on the surface Region; Source, ISTAT 2006-2012.
Forest area affected by fire	Forest area affected by fire of the total forest area; Source, ISTAT 2006-2012.
Special Protection Areas (SPA)	Area of Special Protection Areas (SPAs) on the surface region; Source, ISTAT 2006-2012.
Source: ISTAT	

Table 1.a: environmental descriptive statistics

Composting	Period	Min	Max	Average	Coefficient of Variation
	(2006-2007)	0,157	80,329	19,583	0,967
	(2008-2009)	0	101,296	28,514	0,831
	(2010)	0	106,809	34,19	0,754
	(2011-2012)	0	104,523	36,51	0,793
Consumption of energy from renewable resources					
	(2006-2007)	3,056	221,686	27,729	1,779
	(2008-2009)	4,811	269,997	36,318	1,677
	(2010)	5,354	251,396	41,485	1,377
	(2011-2012)	6,013	249,255	44,404	1,255
Gross Energy Efficient from renewable resources					
	(2006-2007)	3,266	100	30,737	0,893
	(2008-2009)	3,36	100	31,572	0,799
	(2010)	3,935	100,011	34,97	0,695
	(2011-2012)	6,181	99,694	43,155	0,545
Energy from Renewable Resources					
	(2006-2007)	2,121	100,004	23,896	1,091
	(2008-2009)	3,258	100	27,48	0,924
	(2010)	3,659	100	33,547	0,745
	(2011-2012)				
Air Pollution					
	(2006-2007)	14,7	59,45	34,115	0,334
	(2008-2009)	20,55	52,45	33,695	0,28
	(2010)	16,7	51,2	30,605	0,328
	(2011-2012)	15,05	48,35	29,733	0,299
Municipal waste landfilled					
	(2006-2007)	68,964	565,904	335,587	0,386
	(2008-2009)	38,729	524,7	306,674	0,434
	(2010)	39,577	494,376	284,64	0,456
	(2011-2012)	35,372	436,088	244,088	0,531
Municipal waste collected					
	(2006-2007)	407,859	712,93	549,249	0,147
	(2008-2009)	388,47	689,722	540,522	0,145
	(2010)	381,511	694,594	539,594	0,149
	(2011-2012)	380,314	657,789	511,355	0,142
Recycling	(2006-2007)	4,952	51,268	24,441	0,604
	(2008-2009)	6,993	57,324	30,16	0,528
	(2010)	9,406	58,724	33,542	0,472
	(2011-2012)	12,21	61,942	37,791	0,417
Noise					
	(2006-2007)	11,2	33,45	19,463	0,271
	(2008-2009)	10,05	37,15	18,533	0,306

	(2010)	7,8	25,3	16,69	0,275
	(2011-2012)	8,5	28,35	16,063	0,273
Site of Community Importance (SCI)					
	(2006-2007)	5,506	32,424	16,533	0,461
	(2008-2009)	5,633	32,424	16,562	0,457
	(2010)	5,648	26,923	16,313	0,409
	(2011-2012)	5,973	27,051	16,776	0,395
Forest area affected by fire					
	(2006-2007)	0,01	9,496	1,821	1,45
	(2008-2009)	0,001	4,269	0,631	1,697
	(2010)	0,002	4,006	0,89	1,348
	(2011-2012)	0,006	8,971	0,993	2,008
Special Protection Areas (SPA)					
	(2006-2007)	3,622	32,978	13,842	0,559
	(2008-2009)	3,622	36,931	15,518	0,504
	(2010)	3,622	28,427	15,068	0,412
	(2011-2012)	3,631	28,431	15,098	0,411

Source: ISTAT

Table 2: human capital indicators	
Long life learning	Population aged 25-64 participating in lifelong learning; source ISTAT, 2006-2012.
Adults in permanent education	Population aged 25-64 years that has attended a course of study or professional course; Source ISTAT, 2006-2012.
Unemployed training education	Unemployed adults 25-64 years participating in training and education programs for 100 unemployed adults in the age group corresponding; Source ISTAT, 2006-2012.
Employed training education	Employed adults 25-64 years participating in training and education programs for 100 unemployed adults in the age group corresponding; Source ISTAT, 2006-2012.
Rate of education	Population aged 20-24 that has attained at least upper secondary school diploma; Source ISTAT, 2006-2012.
Education 15-19 years	Population aged 15-19 years with at least the middle school; Source, ISTAT, 2006-2012.
University education	Population aged 30-34 years that has a university degree; Source ISTAT, 2006-2012.
Adults education	Population aged 25-64 years that has achieved at most a lower secondary level of education; Source ISTAT, 2006-2012.

Table 2.a: human capital descriptive statistics (percentage)

	Period	Min	Max	Average	Coefficient of Variation
Long life learning	(2006-2007)	4,8	7,9	6,4	14,1
	(2008-2009)	4,7	8,2	6,4	15,8
	(2010)	3,9	8,2	6,2	17,7
	(2011-2012)	4,6	8,7	6,3	15,1
Education 15-19 years					
	(2006-2007)	96,2	99,2	98,2	0,8
	(2008-2009)	97	99,1	98,3	0,6
	(2010)	96,6	99,2	98,1	0,8
	(2011-2012)	96,8	99,3	98,2	0,6
Adults in permanent education					
	(2006-2007)	4,8	7,9	6,4	14,1
	(2008-2009)	4,7	8,2	6,4	15,8
	(2010)	3,9	8,2	6,2	17,7
	(2011-2012)	4,6	8,7	6,3	15,1
University education					
	(2006-2007)	12,9	23,4	18,5	16,9
	(2008-2009)	13,6	25,6	19,4	16,3
	(2010)	12,9	26,2	20,3	18,5
	(2011-2012)	15,7	26,1	21,4	15,7
Adults education					
	(2006-2007)	38,5	58,0	48,3	8,5
	(2008-2009)	35,8	56,8	46,1	7,8
	(2010)	34,6	55,9	44,8	7,3
	(2011-2012)	33,5	54,0	43,1	7,2
Unemployed training education					
	(2006-2007)	5,6	6,2	6,2	6,0
	(2008-2009)	8,5	7,5	7,3	7,2
	(2010)	4,6	9	6,6	17,8
	(2011-2012)	4,9	8,9	6,8	15,7
Employed training education					
	(2006-2007)	4,4	8,4	6,0	20,8
	(2008-2009)	4,4	8,5	6,1	20,8
	(2010)	3,6	8,7	5,9	26,1
	(2011-2012)	3,7	9,1	5,9	21,8
Rate of education					
	(2006-2007)	65,4	82,6	76,4	6,9
	(2008-2009)	67	84,8	77,3	6,9
	(2010)	66,4	86	77,3	6,1
	(2011-2012)	62,8	85	77,8	6,8
<i>Souce: ISTAT</i>					

Table 3: <i>social capital indicators</i>	
Association	Percentage of people aged 14 and over who has done some social activities during the 12 months preceding the interview-meetings in ecological associations, civil rights, for peace; Source ISTAT; 2006-2012.
Sport	people 3 years and older who are involved in sports; Source ISTAT; 2006-2012.
Dancing	Percentage of persons aged 6 and over who declare to be gone in nightclubs, dance halls, nightclubs or other places where you can dance at least once in the last year; Source ISTAT; 2006-2012.
Cinema	Percentage of persons aged 6 and over who declare to have benefited from film shows in the last 12 months; Source ISTAT; 2006-2012.;
Museum and exhibitions	Percentage of persons aged 6 and over who declare to have visited museums or exhibitions in the past 12 months; Source ISTAT; 2006-2012.
Sports events	Percentage of people aged 6 and over who claims to have attended sporting spectacles in the last 12 months; Source ISTAT; 2006-2012.
Theatre	Percentage of people aged 6 and over who claims to have attended theatrical performances in the last 12 months; Source ISTAT; years 2006-2012.
Books	Percentage of persons aged 6 and over who have read books in the past 12 months; Source ISTAT; 2006-2012.
Newspapers	Percentage of people aged 6 and over who read newspapers at least once a week; Source ISTAT; 2006-2012.
Home care	Taking charge of the elderly for the service of integrated homecare - Elderly treated in integrated home care compared to the total elderly population (65 years and over) (percentage); Source ISTAT; 2006-2012.
Social services	People aged 14 and over who have done volunteer work in the total population aged 14 and over, Source ISTAT; 2006-2012.
Use of PC	Percentage of people who said they had used the PC and the Internet in the last 12 months; Source, ISTAT; 2006-2012.

Table 3.a: social capital descriptive statistics (percentage)					
Association		Min	Max	Average	Coefficient of Variation
	(2006-2007)	0,95	3,25	1,91	0,27
	(2008-2009)	1,15	2,9	1,76	0,27
	(2010)	0,6	2,8	1,69	0,29
	(2011-2012)	1,25	2,9	1,71	0,25
Sport					
	(2006-2007)	21,4	52,7	31,10	2,40
	(2008-2009)	21,05	50,25	31,59	2,30
	(2010)	21,2	55,9	33,33	2,40
	(2011-2012)	19,35	50,9	31,87	2,50
Dancing					
	(2006-2007)	18,55	30,75	24,32	0,13
	(2008-2009)	17,9	28,15	22,86	0,11
	(2010)	18,4	28	22,7	0,11
	(2011-2012)	17,85	25,85	21,59	0,1
Cinema					
	(2006-2007)	38,6	53,7	47,27	0,09
	(2008-2009)	38,85	57,3	48,14	0,08
	(2010)	43	59,8	50,64	0,09
	(2011-2012)	42,15	59,55	49,73	0,09
Museum and exhibitions					
	(2006-2007)	15,75	42,05	27,16	0,27
	(2008-2009)	15,75	43,15	28,37	0,27
	(2010)	17,4	43,5	29,64	0,26
	(2011-2012)	15,75	41,25	28,12	0,29
Sports events					
	(2006-2007)	21,1	36	27,72	0,11
	(2008-2009)	21,95	35,6	27,58	0,1
	(2010)	22,8	34,9	27,46	0,12
	(2011-2012)	23,3	35,8	27,58	0,11
Theatre					
	(2006-2007)	11,4	31,45	19,46	0,24
	(2008-2009)	11,7	32,3	19,92	0,26
	(2010)	13,3	31	21,15	0,23
	(2011-2012)	13,45	32,25	20,19	0,23
Books					
	(2006-2007)	29,8	55,7	43,22	0,2
	(2008-2009)	30,3	58,75	44,59	0,2
	(2010)	31,4	57,9	46,17	0,19
	(2011-2012)	31	58,35	45,19	0,21
Newspapers					
	(2006-2007)	43,65	74,6	58,13	0,17
	(2008-2009)	41,4	73,7	56,79	0,18
	(2010)	40,9	71,7	55,16	0,18
	(2011-2012)	36,8	71,25	53,54	0,19
Home care					

	(2006-2007)	0,25	7,38	3,10	0,59
	(2008-2009)	0,41	7,5	3,38	0,59
	(2010)	0,43	11,59	3,91	0,64
	(2011-2012)	0,38	11,27	4,08	0,57
Social services					
	(2006-2007)	5,89	25,32	11,60	0,4
	(2008-2009)	6,22	26,01	11,99	0,37
	(2010)	6,50	27,08	12,79	0,36
	(2011-2012)	6,67	26,74	12,33	0,39
Use of PC					
	(2006-2007)	26,00	43,25	35,10	0,15
	(2008-2009)	32,65	50,75	42,25	0,12
	(2010)	40,40	55,70	48,24	0,1
	(2011-2012)	42,10	59,65	51,35	0,11
<i>Source: ISTAT</i>					

Figure 2.a Environmental resilience index (Rank) Bad cases

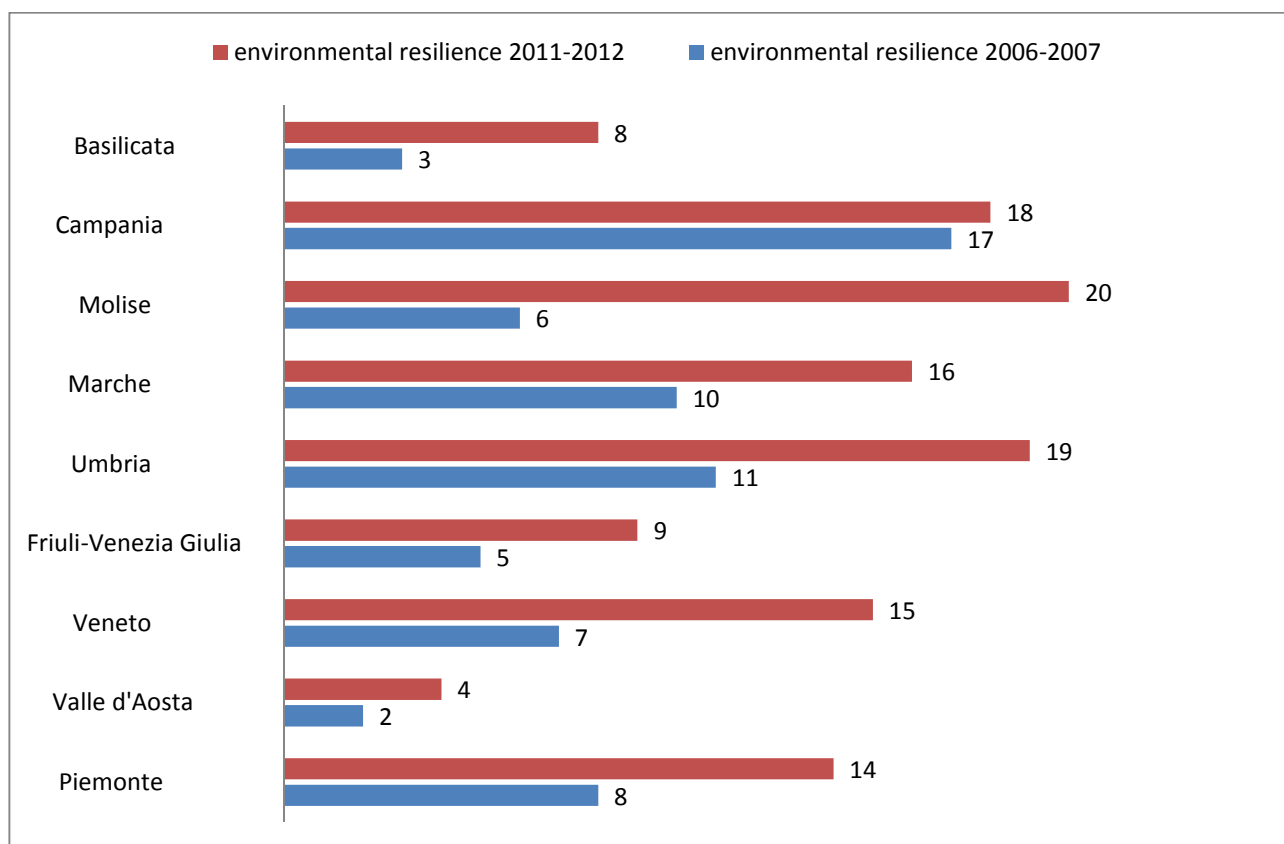


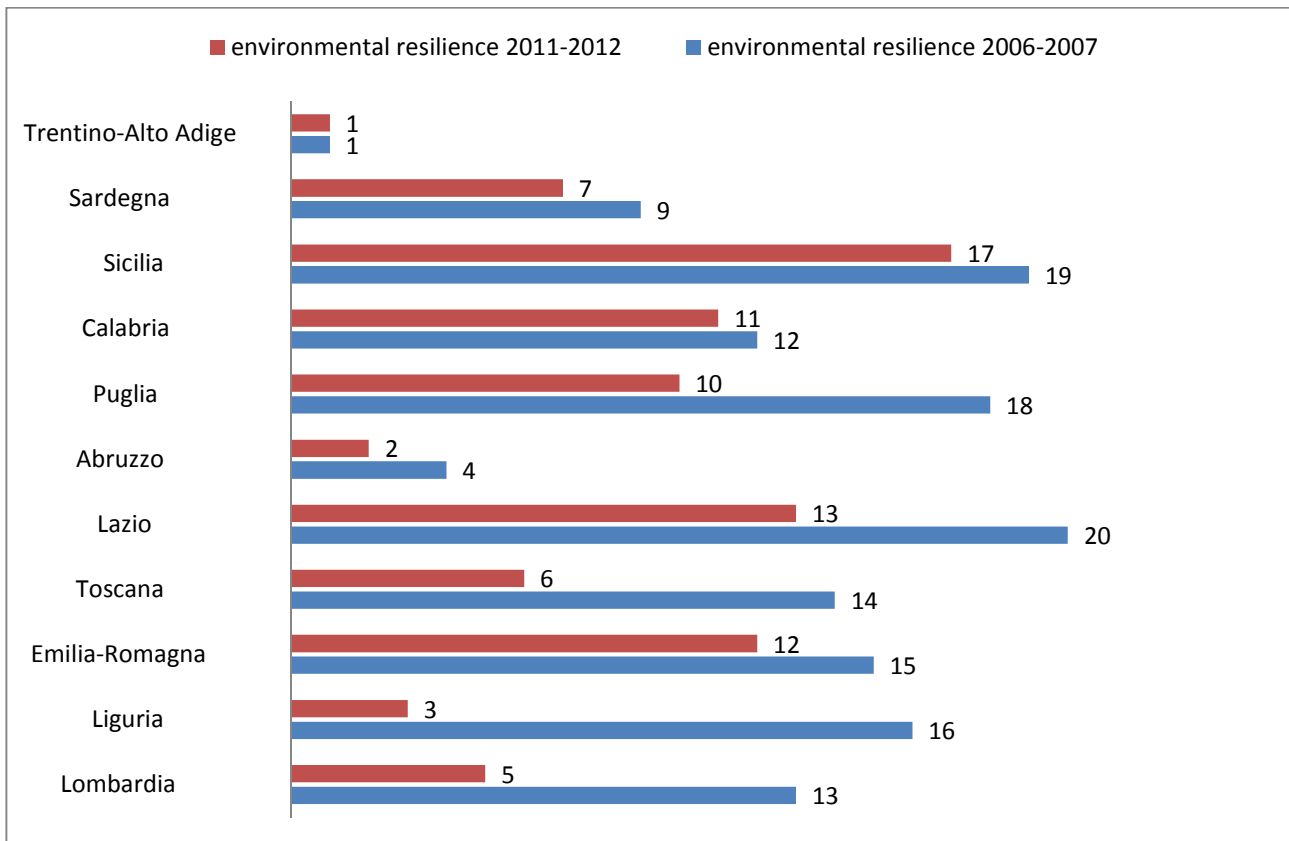
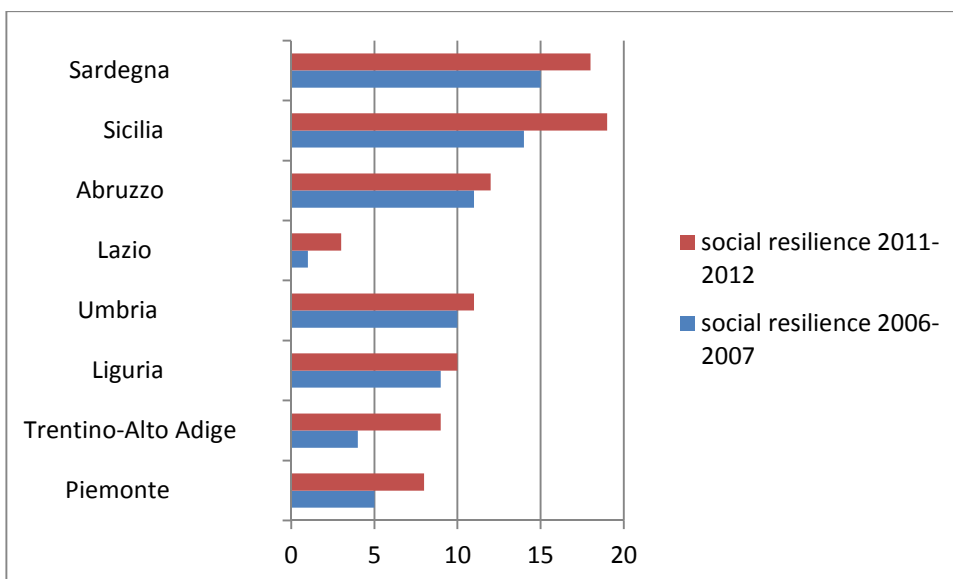
Figure 2.b Environmental resilience index (Rank) Good cases**Figure 3.a Social resilience index (Rank) Bad cases**

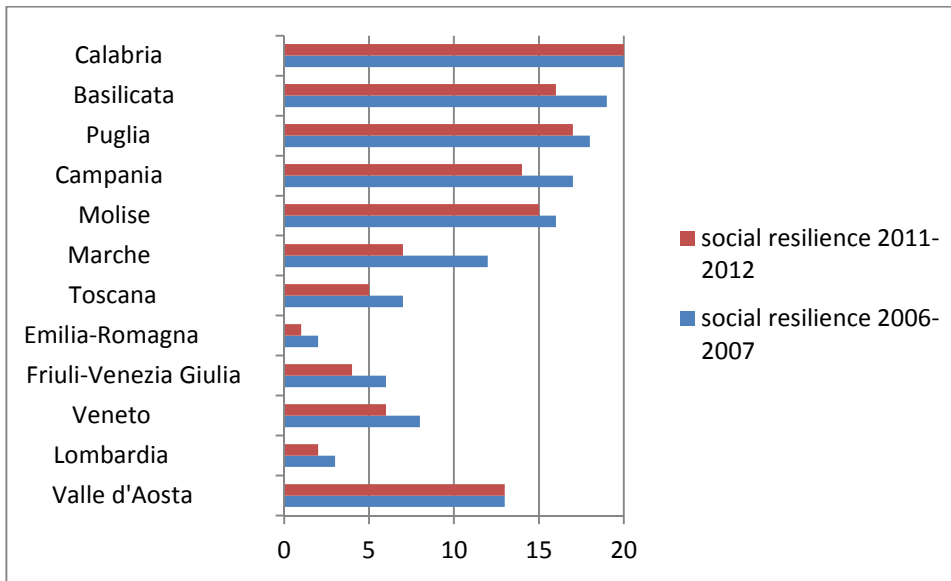
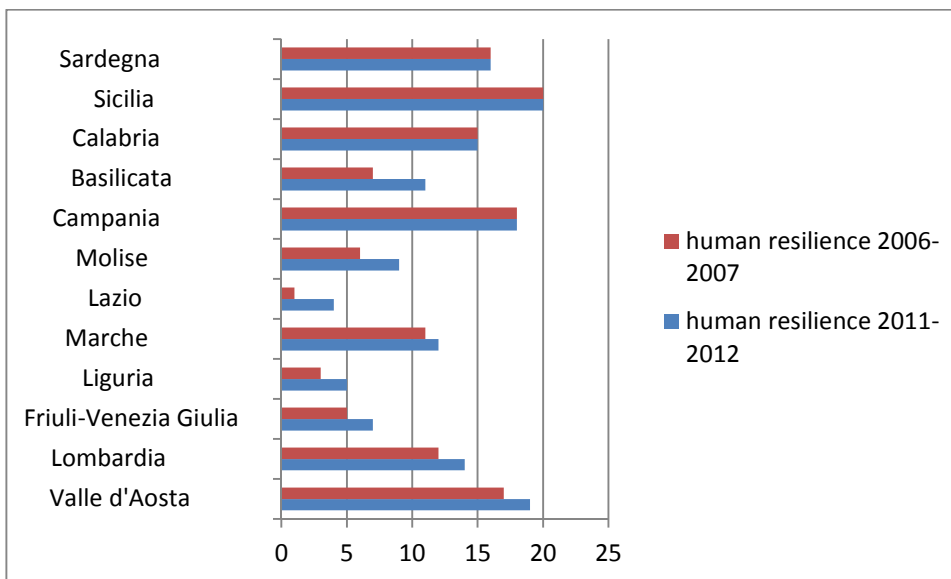
Figure 3.b Social resilience index (Rank) Good cases**Figure 4.a Human resilience index (Rank) Bad cases**

Figure 4.b Human resilience index (Rank) Good cases

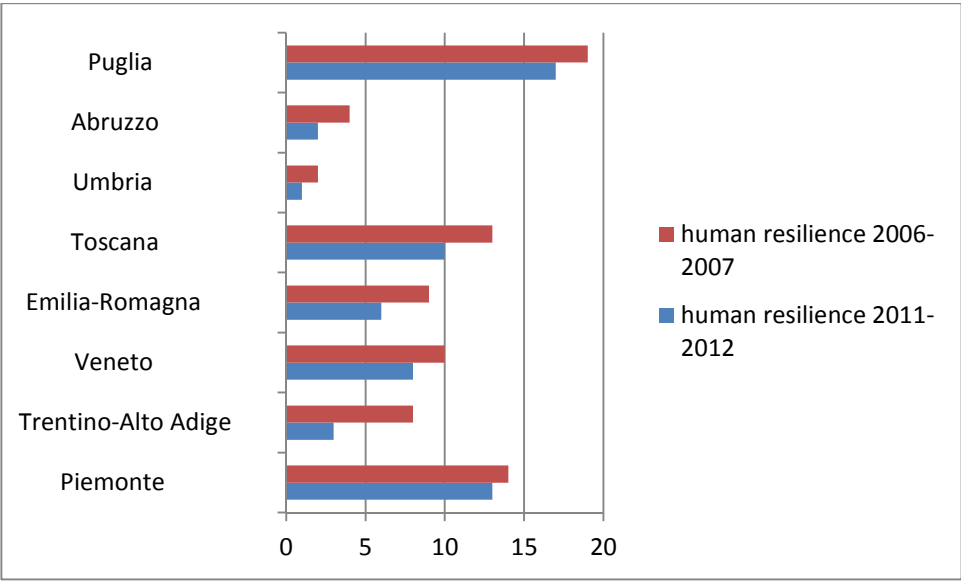


Figure 5.a: GDP and social resilience index 2006-2007

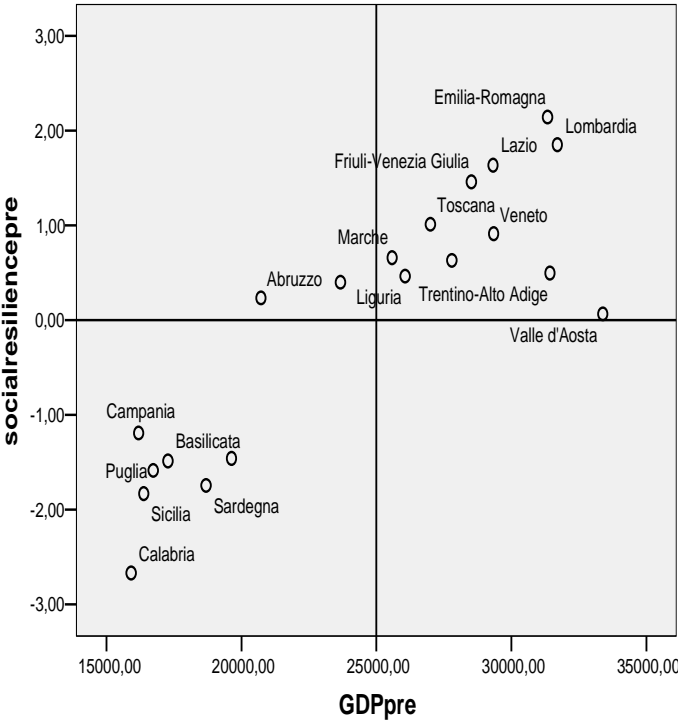


Figure 5.b: GDP and social resilience index 2011-2012

