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Regional resilience in Italy: do employment and income tell the same story?[*]

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Abstract: The concept of resilience has attracted increasing interest in regional economics. In the flourishing literature, however, results are far from being conclusive, even when referring to the same case study. Undoubtedly, this mixed evidence potentially stems also from different operationalization of the multifaceted resilience concept; the main difference being between studies using GDP series and those measuring regional economic performance in terms of fluctuations in employment levels. The different choices and the subsequent results, far from being interpreted as lack of robustness, are research specific; nevertheless, it is important to address what kind of relationship – if any – exists between the two measures. To this end, we analyse and compare the results concerning the regional resilience in Italy, over the last 40 years, focussing on the differences deriving from the choice between the two aforementioned measures. Our analysis reveals that the information contained in the different series, rather than being alternative and overlapping, is complementary.

Keywords: Resilience, Adverse shock, Impact effect, Recovery.

JEL classification: R11, R12, C32, O18.

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1.Introduction

The concept of resilience –that is, the way in which different subjects react to- and recover from- adverse shocks– has progressively entered the academic and policy debate in economics, and in regional economics specifically. Resilience is a well-established topic in other disciplines like physics and ecology, while the interest of economists is more recent; the interest in economic resilience has been enlarged by the recent so-called "Great recession", that is, the deep negative shock hitting the Western economies in 2008-10. Two of the most compelling consequences of the Great recession are its spatial unevenness at regional and local level, and the long-term damage on economies and societies experiencing a deleterious mix of jobless recovery and secular stagnation (Wilkerson, 2009; Ball, 2014). The relevant current question is whether and how different regions within a country reacted in different manner to the Great recession; this has to do, clearly, with the regional resilience ability.

On theoretical grounds, three main interpretations of regional economic resilience have been suggested. First, *engineering resilience*, that is, the short-term ability of a given area to return to its pre-shock stable equilibrium state, by following a sort of bounce-back trajectory (Simmie and Martin, 2010; Martin, 2012). This view is primarily based upon the idea that recessions are temporary equilibrium disturbances, which are not able to influence a specific system in a permanent way. Second, e*cological resilience*, that is, the capacity of a particular economic context to absorb shocks *lato sensu* before moving to a different equilibrium point or path, among multiple stable or unstable equilibria (Holling, 1973; Walker *et al*., 2006). This second interpretation of resilience admits the possibility of out-of-equilibrium and hysteretic patterns triggered by the unexpected events. A third, and more general notion of regional resilience, is *evolutionary* or *adaptive resilience*, which allows for the consideration of the relationship between the capacity of a regional or local economy to recover from different kinds of shocks and its long-term developmental growth path

(Christopherson *et al.*, 2010; Pike *et al.*, 2010; Simmie and Martin, 2010; Boschma, 2014). The evolutionary approach looks at local economies as complex systems characterized by the interdependence of space- and time-specific institutional, historical and economic aspects, where resilience is interpreted as a dynamic process of robustness and adaptability. Noteworthy, the concept of evolutionary resilience has been deserved the merit to encompass the first two definitions (Martin and Sunley, 2014).

Generally speaking, two broad empirical approaches have been undertaken by the existing regional economics literature to "measure" economic resilience across and within countries: (i) descriptive analysis, using case-study's methods and simple statistical indices (Martin, 2012; Evans and Karecha, 2014; Lagravinese, 2014, on Italy); (ii) time-series and panel data econometric models, aiming to detect and explain resilience, also introducing spatial interactions among neighbouring areas (Groot *et al.*, 2011; Fingleton *et al.*, 2012 and 2014; Fingleton and Palombi, 2013; Di Caro, 2014b; Doran and Fingleton, 2014). However, though the number and variety of recent articles, the empirical analysis on regional data is still in its infancy, confirming both the novelty of the theoretical framework and the presence of challenging econometric issues. Crucial steps in empirical analysis are: the correct identification of shocks; the measurement of the place-specific responses to the shocks; the comparison of resilience across territories; the explanation of differences in regional resilience.

The main aim of this contribution is to provide further evidence on the economic resilience of Italian regions, comparing the results provided by two recent and distinct papers that investigate regional resilience in Italy; namely, Cellini and Torrisi (2014) and Di Caro (2014a). These articles share the common theoretical basis, and also the interpretation of resilience and the general way in which it is assessed, but they make different decisions on how to evaluate it operationally. Common and dissimilar methodological choices, and empirical outcomes resulting from the above studies are discussed here in order to offer a somewhat more general interpretation of the pieces of evidence concerning regional resilience in Italy. From the comparison of the two articles, we are able to throw some light on the importance of some operational details, and we can learn some lessons on the geographical distribution of economic resilience in Italian regions over the past forty years. Most important, we try to derive lessons about the regional behaviours of Italian regions during the recent Great Recession, as compared to previous experience of negative shocks. Thus, the present article can be interpreted as a meta-analysis on available studies; on the other hand, we provide further evidence to arrive at a more precise description of the resilience behaviour of the Italian regions.

The remainder of the paper is structured as follows. Section 2 presents the main methodological and empirical aspects of the articles that evaluate regional resilience. Section 3 outlines the main characteristics of two recent studies on the resilience of the Italian regions, Cellini and Torrisi (2014) and Di Caro (2014a). The former considers annual data on per-capita GDP while the latter chooses annual and quarterly data on employment. Section 4 compares the evidence from the two methodological choices, and combines the results concerning the resilience of Italian regions, with the aim of providing a more clear picture of regional resilience within Italy. Section 5 concludes and addresses future avenues of research.

2. Regional resilience and its measurement

In regional sciences, two research lines can be distinguished, as resilience is concerned. First, a line of research dealing with the effect of ‘major shocks’ on city growth (Davis and Weinstein 2002, Bosker *et al.* 2007). Second, the analyses that study regional growth (Pendall *et al.* 2010, Pike *et al.* 2010, Simmie and Martin 2010) and how regions respond to exogenous (national or international) recessionary economic shocks. The present paper contributes to the latter line.

Fingleton *et al.* (2012) and Martin (2012) clarify that considering resilience can provide an interesting interpretational key for the understanding of differences across regions within a country. In particular, Fingleton *et al.* (2012) proposes a very simple regression analysis approach, to evaluate whether regions react to, and recover from, common adverse shocks in different ways.

Basically, let y_{it} denote the variable of interest (income, or employment, in log-level) in region i in time t, with i=1,2 ...N and t=1,2,...T. Thus, the first difference of y_{it} , denoted by g_{it} , measures the growth rate of the variable. The variable under scrutiny

(GDP or employment) typically follows a statistic process with a unit root (that is, it is a variable integrated of order 1, so that the first difference is stationary; in symbols, $y_{i,t} \approx I(1)$); this statistic nature of the variable has to be taken into account by the econometric analysis design. The point of interest in the evaluation of resilience is to detect the specific influence of exogenous adverse shocks, and the possible specific effect of recovery from that shocks. In other words, the research point is to detect the specific (impact and recovery) effects of exogenous shocks on a variable, provided that such variable is following a $I(1)$ statistic process. Assume to have identified the time of the recessionary shocks (with a total number of shocks equal to K); and associate a dummy variable D_k to each shock (k=1,2,..,.K); finally consider the post-recession period following each shock and associate a dummy variable S_k to each post-recession period (S_k takes value 1 in each time of the post-recession period following the k-shock, and 0 otherwise). The post-recession period may last until the subsequent shock (like in Fingleton *et al.*, 2012), but different choices could be made, by assuming, for instance that each post-recession period (to be evaluated and compared) has a fixed length. Thus, for any region *i*, the following regression can be considered:

$$(1) \qquad g_i = \alpha_i + \beta_{i,(1)} D_1 + \beta_{i,(2)} D_2 + \ldots + \beta_{i,(K)} D_K + \gamma_{i,(1)} S_1 + \gamma_{i,(2)} S_2 + \ldots + \gamma_{i,(K)} S_K + e_i$$

(the time indication is omitted for the easiness sake) and then the beta (β) and gamma (γ) coefficients can be estimated, and compared across regions.

The equations' estimation can be performed as a SURE (Seemingly Unrelated Regression Equation) model, considering the N equation system, but several refinements of this statistic approach can be proposed (see, e.g., Hamilton and Owyang 2011), and are currently adopted (as in the cases of Cellini and Torrisi, 2014, and Di Caro 2014a). Moreover, different applications to specific national cases are available (UK, Italy, Germany, and so on). A review of the different meanings of regional economic resilience is offered by the recent article of Martin and Sunley (2014); a review of different econometric methods employed in assessing the regional resilience is also available in Di Caro (2014c).

However, though the flourishing literature, some issues remain open, in the sense that different works make different operational choices, so that they results –we guess here– cannot immediately and easily be compared, even if they refer to the same country observed in the same time span. Some works consider data on GDP (typically in real, per-capita terms); other consider the employment level. Some works consider quarterly data; other choose annual data. Of course, the choices respond to specific research interests, and the different choices have pros and cons.

One element common to all available studies is the fact that the "external shock" – the reaction to which is under study – is detected exogenously. In other words, the dating of each recessionary shock is *exogenously* identified (Harding and Pagan, 2003); however, the identification is made on the basis of different dataset used in different contributions and, therefore, the timing of each aggregate shock may vary depending on whether one is looking at annual or quarterly data, or whether the variable under scrutiny is employment or GDP.

3. Regional resilience in Italy: evidence from income *vs.* employment

The present analysis deals with the resilience of the Italian regions, as observed over the last four or five decades. The adverse common shocks hitting the regions are, in substantial terms, three (Bassanetti *et al.*, 2010): the economic crisis between the second half of 1970s and early 1980s (linked to oil shocks); the *Lira* crisis associated with the devaluation of 1992; and the more recent Great recession, which is a combination of the financial crisis starting from the second-half of 2008, and the European sovereign debt crises occurring between 2011 and 2012.

Here we provide a description of regional reactions to such shocks, basing on two recent analyses that take the resilience analysis perspective: Cellini and Torrisi (2014) and Di Caro (2014a). However, the former takes into consideration annual data on (per capita, real) income over a long period of time which includes 1960-2010, while the latter takes into consideration annual and quarterly data on employment, in a period starting in 1977. So, the data of reference of the mentioned works are different;[1] even

[1] For comparison reasons, here we limit ourselves to refer to the part of Di Caro's (2014a) analysis that refers to annual data (when not otherwise specified). There is a debate about pros and cons of considering

the definition of the shocks are slightly different, in the sense that Cellini and Torrisi focus on the *first* oil shock in 1974, while Di Caro considers the *second* oil shock started in 1979; the Lira crisis is associated to 1993 by Cellini and Torrisi, and to 1992-95 by Di Caro; the Great recession is located in 2008-09 in Cellini-Torrisi, while it is 2009-13 in Di Caro (of course, neither of the two works are able to analyse the recovery from the Great recession shock).

Most important, the variables under scrutiny to evaluate resilience are different. It is worth mentioning that an ongoing debate is alive in the literature on the economic resilience, concerning pros and cons of considering data on employment *vs.* GDP. Employment data do not need to be deflated, overcoming possible difficulties associated to the adoption of different price indices (Cecchetti *et al.*, 2002). Fingleton *et al.* argue that much of the impact of a recession is borne by the labour market, and declines in employment, after recessionary shocks, are larger than declines in output. However, as yet pointed out in a pioneering contribution of Blanchard and Katz (1992) on regional evolution in the US, the place-specific response of regional and local labour markets to national adverse events –either economic recessions or other unexpected disturbances– can result in a multifaceted set of outcomes and adjustment mechanisms. More precisely, transient and permanent post-recessionary adjustments occurring in the labour market can have direct and differentiated implications on the aggregate demand, local employers' decisions, one-way migration of people and ideas and long-term unemployment. These elements, however, concur to the determination of "resilience", and for this reason, the consideration of GDP could be inclusive of elements that are important in resilience behaviour, and do not affect the labour market directly. In general, the reactions of labour markets are deemed to be less variable (than income) across regions within a country, due to institutional rigidities. Finally, the general choice about GDP *vs.* employment has to do with the final aim of the specific analysis.

Table 1 provides statistical evidence concerning national and regional raw data – considered by the two different analyses of Di Caro (2014a) and Cellini - Torrisi (2014)

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annual *vs*. higher frequency data. As to the frequency, the higher frequency of quarterly observations compared to annual data makes it possible the correct identification of a recession (i.e. two consecutive quarters of negative growth) and the adoption of different time selection criteria to describe recoveries, like one/two year/s after a given recession or the number of quarters between a major recession and the subsequent first technical recession. On the other hand, the quarterly frequency can present problem of seasonal patterns that are not present in annual data. Data availability can be larger for employment or income, depending on the single country case.

– highlighting the years of adverse shock. It is immediate to notice that the two variables provide a rather different picture of the regional situation within Italy. A (admittedly rough) rank correlation analysis on the series concerning the variation rate of employment and income over the whole period, and in the specific selected years as reported in Table 1, leads to the result that the rank correlation between (the average) variation rate of income and employment across regions over the entire period 1977-2011 is 0.07 (p=0.78), definitely very low; the rank correlation statistics between the regional data variation of income and employment (as reported in Table 1), are 0.35 (p=0.12); 0.19 (p=0.41); -0.44 (p=0.05), for the oil shock years, 1993, and the Great recession years, respectively.

Insert about here:
Table 1 - Regional codes and Statistics on the dynamics of regional income and employment

The comparison of the income and employment dynamics in the years when the recessionary shocks occur (as represented in Table 1) has to be done with some points of caution. The comparison concerning the oil shock could be, to some extent, misleading. Indeed –as we already mentioned– Cellini and Torrisi consider the first oil shock, while Di Caro deals with the second one. That said, the figures in the Cellini-Torrisi databank, providing a worse situation than that as shown in the databank considered by Di Caro, could be interpreted as a signal of a less severe impact on employment as compared to GDP downturn. The above evidence would be consistent with the introduction of (then) novel labour legislation *Statuto dei Lavoratori* (Statute of the Workers' Rights, Law 300/1970), marking a new era of industrial relations and providing, among others, a mechanism of strengthened protection against dismissal as compared to the previous individual dismissal law dating back to 1966 (Ferrera and Gualmini, 2004).

As to the facts happening in 1993, the year of the impact response to the Lira shock, it is interesting to note that the situations concerning income *vs.* employment are truly different: Abruzzo, Molise and Puglia (regions in the Southern part of the Adriatic coast) showed the worst performance as far as the income is concerned. Sicilia, Lazio and Puglia, by contrast, were the worst performers along the employment dimension. Therefore, results say that Puglia is the only region that appears among the three worst performers, according to both the income and the employment dimension. Note that the best performers of that year were Veneto and Friuli-VG according to the income, and Sardegna and Valdaosta according to employment.

A truly different picture on raw data is also offered by the data in the years of the Great recession. Consider however that the Great recession is dated 2008-09 in Cellini-Torrisi and 2009-11 in Di Caro. It could be interesting to note that this is the only shock under which all regions display negative variation rate both in employment and in real per-capita GDP (and this leads to judge the ‘Great recession’ label as warranted!). Piemonte and Umbria showed the deepest drop in income (*vs*. Umbria and Basilicata in employment) and Calabria and Trentino-AA the most modest drop in income (*vs*. Valdaosta and Toscana in employment). These facts concerning raw data have to be kept in mind when commenting upon the different pictures of the resilience behaviour of Italian regions, referred to income or employment.

3.1 Analysis on employment

To analyse and explain the disaggregate effects of country-wide shocks on the 20 Italian regions, and more directly for investigating the spatial distribution of economic resilience in Italy, Di Caro (2014a) performs the SURE estimation according to (1) using total employment data from 1977 to 2013. Here, we focus on the dynamics of annual data. Results are in Table 2. An elaboration of the same results will be reported, to ease the comparison with the results from the Cellini-Torrisi study, in Table 4.

Column 2 of Table 2 provides the autonomous growth, that is, the average performance of regional employment growth, conditional on the specific effect of impact and recovery reactions to shocks; Sardegna, Friuli-VG and Trentino-AA have the best (conditional) performance, while Calabria, Umbria, Molise show the worst performance (consider also that Calabria shows the lowest performance in the dynamics of employments, as measured by the constant term in the regression equation). The subsequent Columns report the impact reactions and the recovery reactions (as captured by the coefficient of the associated dummy variables) to the considered recessionary shocks.

Some specific observations could suggest that the geographical distribution has followed a sort of North-South pattern, confirming the rooted regional disparities between these two areas. Observe that, for instance, three Southern regions, i.e., Basilicata, Sardegna and Sicilia, show negative and significant coefficients during both the recessionary shock years and the subsequent recovery periods (so that, no recovery occurred, indeed); this denotes persistent negative employment evolutions which can contribute to explain a widening gap between these areas and the rest of Italy. However, a more puzzling picture emerges if one looks at some selected comparisons within each macro-area. Some Northern regions like the old industrial regions of Liguria and Piemonte have resulted to be less resilient than other Northern regions like Veneto, Emilia-R and Toscana; some regions in the Centre-South such as Abruzzo and Puglia have progressively registered higher resilience than other Southern regions like Campania, Calabria and Molise. All in all, in Italy the highest levels of regional resilience seem to be located along the Adriatic belt.

In any case, one can detect a correlation between the average value of the annual growth rate of employment and the average value of the dummy variables' coefficients capturing the impact effect of recessionary shocks equal to -0.05 (statistically insignificant, at the 5% or 10% level). Similarly, a non-significant negative correlation of -0.02 is detected when relating the average value of the annual growth rate of employment and the average value of recovery coefficients. Thus, in general, no systemic relationships emerge between the general employment performance of regions, and their resilience as described by the impact or recovery reaction to recessionary shocks.

In addition, the specific consequences of each crisis are worth commenting. The (second) oil shock had lower employment losses and narrower regional differences than the *Lira* crisis and the Great recession, with Southern regions having limited overall impact on their economies. This situation changed dramatically during the *Lira* crisis of early 1990s, when the combination of an aggregate currency shock and the concomitant abolition of regional policy interventions caused more relevant employment losses in the South than in the past. An interesting element is the fact that the post-1993 recovery, was not a recovery indeed for the largest part of regions. The dynamics of the post-1993 crisis years is characterised by a negative or not-significant coefficient for the recovery dummies in 17 out of 20 regions.

The long-lasting and puzzled effects of the Great recession derive from the mix of exogenous disturbances like the financial crash and the reduced external demand, and internal destabilizing factors such as the reduced availability of credit and the weak public and private demand. The coefficients of the dummy variables associated to the impact effect of this shock are negative in all the regions (this is the only shock for which this unanimous evidence on impact effects occurs), and they are statistically significant in all Southern regions (lower levels of statistical confidence occur in some Northern and Central regions).

Once regional resilience has been identified and measured, it becomes interesting to explain why different areas show asymmetric short- and long- term reactions to aggregate shocks. Di Caro's paper has addressed this issue by looking at the diversified evolution of manufacturing activities across Italian regions. In particular, in that work, differences among different degrees of resilience across the Italian regions (as captured by the coefficients of dummy variables associated to impact and recovery reactions to shocks) have been found to be significantly correlated to the presence of manufactures at territorial level. On theoretical grounds, the relevance of the industrial sector for explaining local economic growth during booms is suggested to be due to the ability of manufacturing activities of promoting higher investments, capital accumulation, and more stable investment decisions, in combination with the production of tradable goods (Long and Plosser, 1987; Garcia-Mila and McGuire, 1993). Building on these ideas, one can explain the high performance of regions located along the Adriatic sea coast-line, where the concentration of innovation-oriented small and medium enterprises represent the backbone of the economic structure.

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Insert about here:
Table 2. SUR results - annual employment observations

3.2 Analysis on income

Cellini and Torrisi (2014) have analysed the resilience of Italian regions looking at the evolution of regional per-capita real GDP over a very long-run time period (1890-2010), to detect some features of the secular growth process of regions. This final aim of their work supports the choice of considering the GDP variable with the annual frequency. In other words, the adoption of annual data has been motivated by the fact that it reflects the interest of the paper in the long-run regional economic evolution and it is able to overcome both cyclical and seasonal biases.

However, for comparison reason, we focus here on the results obtained by Cellini and Torrisi for the sub-sample of the last 5 decades; the 1975, the 1993 and 2008-09 are the years of adverse shock in that period under consideration here.

Table 3 reports the results of the regression analysis, obtained from the SURE model fitted to annual per capita real GDP over the period 1960-2010. [2]

Insert about here:
Table 3. SUR results, annual per-capita GDP observations

As for the impact of shocks, these results display a lower effect (i.e. higher resistance) registered on average in regions like Sardegna, Umbria and Basilicata, and lower resistance in Liguria, Lazio and Abruzzo. Even considering the lack of statistical significance of the gamma coefficients, one may observe –with caution– that the recovery performance is probably better in regions like Lombardia and Emilia-R, while the opposite is true in Puglia, Calabria, Sicilia and Sardegna. Thus, there is a North-South divide as far as the recovery is concerned, while the evidence is more puzzling as concern the impact reaction. However, it is interesting to note that –like in the case of employment dynamics– even in the analysis on income dynamics, a number of Southern regions (in this case, Puglia, Sicilia, Sardegna) display all negative coefficients associated to the dummy variables both for the impact reactions to recessionary shock, and for the recovery periods (which were no recovery times indeed).

One can detect a (non-significant) correlation equal to -0.02 between the average value of the annual growth rate of GDP and the average value of the coefficients of the dummy variable capturing the impact effect of shock. A positive correlation of about 0.37 (still statistically insignificant at the 5% level) is detected when relating the average value of the annual growth rate of GDP and the average value of recovery coefficients. Only the evidence about the recovery responses is qualitatively in line with

[2] To draw more robust conclusions, Cellini and Torrisi (2014) have combined SURE estimation results with those obtained from the application of a panel random coefficient model (RCM), which has the merit of taking into account heterogeneity across units in a more general way than the SURE specification does (Singh and Ullah, 1974). In general, RCM estimates confirm the results obtained with the application of the SUR estimator – so that we do not report these results here.

the idea that the ability to recover from shocks influences the long-run growth performance.

4. Comparisons

What are the main differences between the resilience analysis on income *vs.* employment? Table 4 (panels A, B, C) reports the different ranking of regions, according to the analyses of Cellini-Torrisi and Di Caro, on the basis of regression equation design (1); panel A compares the general growth performance, as depicted by the (unconditional) average growth rates, and by the constant coefficients in regression equations (alpha coefficients) pertaining to the different regions; panel B reports the impact reaction in the years of negative exogenous shocks (beta coefficients); panel C reports the recovery reactions (as captured by the gamma coefficients).

Insert about here:
Table 4 – Comparison of performance

From Table 4.A one can say that the dynamics over the 1960-2010 period confirms the (well-known) existence of a general beta-convergence in the sense of Barro-Sala-i-Martin (1992): the regions with the lowest growth rate are those characterised by the highest income levels at the beginning of the period (Piemonte, Lombardia, Valdaosta)[3], while such a beta-convergence do not hold longer if the attention is confined to the more restricted period 1975-today. The general performance (1975-today), conditional on the impact and recovery effects associated with the exogenous shocks – that is, the general performance as measured by the alpha-coefficients in regression equations (1) – shows that Piemonte, Lombardia and Valdaosta (that is, rich regions, in broad terms) display the worst performance according to income, while Piemonte, Ligura and Molise are the worst performers according to the employment dynamics data. Only Piemonte appears in both list; very strangely, Molise is among the second best performer, if

[3] Data on income levels are not reported, but they are available upon request; they can be found also in Cellini and Torrisi (2014). Symmetrically, data on the level of the employment rate we are referring here are provided in Di Caro (2014 a, b)

evaluated according to income, and is the worst performer according to employment. Once again, this means that income and employment tell two rather different story as far as the resilience is concerned.

From Table 4.B it is apparent that none of the shocks considered shows that a statistically significant rank correlation arises between the impact effect generated by the *same* shock on income and employment. Nevertheless, a statistically significant ranking correlation involving the reaction to *different* shocks is found in three occasions; two of them relate to correlation between income and employment sensitivities. Namely, it is statistically significant the coefficients of response to Oil Shock (income) and both Lira (employment) and Great recession (employment) with correlation coefficients of -0.4526 and -0.495. Interestingly enough, the sign of the significant correlation is negative: this means that the regions that showed a higher resilience in the income impact reaction to oil-shock, have been showing a lower resilience to the employment impact reaction to Lira shock and the Great recession. Finally, employment sensitivities are found statistically correlated when Great recession and Lira are concerned, with a coefficient of 0.670, as intuitively expected. The determinants of these similar (or dissimilar) behaviour of Italian regions in occasion of the aforementioned shocks are beyond this paper's purpose and are left for eventual future research agenda.

In what follows, we focus our attention to different regional reactions to each shock depending on the reference variable, i.e., income or employment. Graph 1 diagrammatically confirms the absence of a clear pattern involving income and employment reaction to the Oil shock.[4]

Insert about here:
Graph 1 – Income and Employment reaction to the Oil shock

Indeed, Graph 1 shows the sensitivity to the shock (i.e. coefficients in Table 4) in terms of employment (reported on the *x*-axis) and in terms of income (reported on the *y*-axis) along with respective average datum (vertical and horizontal solid lines). In this

[4] Although not all the coefficients are statistically significant, in Graph 1 to 5 we report all of them, for the sake of illustration. We address this issue elsewhere in the paper. The reader interested in the issue of the interpretation coefficients' statistical significance w.r.t the Italian case is addressed further to Cellini and Torrisi (2014) and Di Caro (2014a).

occasion, the better performers both in terms of employment and income are placed in the upper-right I quadrant characterised by an above-the-average responses along both dimensions. These regions are Calabria, Campania, Lazio, Puglia and Umbria. Calabria, Campania and Lazio shown a somewhat counterintuitive positive coefficient in employment sensitivity.

On the straight opposite side are placed regions with a below-the-average response under both aspects, namely: Emilia-R, Liguria, Lombardia, Toscana, Trentino-AA., Valdaosta, and Veneto. As for the remaining regions, Piemonte, and, to some extent, Abruzzo and Friuli have a relatively low performance in terms of income, but an above-the-average response in terms of employment. Vice versa, Marche, Molise, Basilicata, and the main islands Sardegna and Sicilia, are characterised by a relatively bad reaction in terms of employment and a relatively better sensitivity in terms of income.

Replicating the same exercise with regard to the Lira shock, however, we obtain a different scenario; Graph 2 reports these data.

Insert about here:
Graph 2 – Income and Employment reaction to the Lira shock

While Calabria confirms its membership in the club of better performing regions as far as the impact reactions to shocks are concerned (but remember that Calabria has a very poor general performance), Campania, Lazio, Puglia and Umbria leave the club to generate a mixed evidence belonging to either the I, the III or the IV quadrant. Therefore, completely losing their resilient status (Campania and Lazio) or just confirming their former performance under the income (Puglia) or employment (Umbria) dimension only. Hence, in addition to Calabria, the more resilient regions in occasion of this crisis are Emilia-R, Friuli, Lombardia, and Toscana. Abruzzo, Piemonte, and Valdaosta confirm their good resilience in terms of employment. Basilicata, Molise and Sicilia show a worse overall performance falling into the III quadrant. Marche, Sardegna and to some extent TrentinoA-A confirm the resilience behaviour.

Graph 3 refers to the most recent shock, following the 2008 financial crisis. The estimates relative to the impact of the Great recession, again, change the overall picture. Indeed, Abruzzo, Marche, Molise, Puglia, and Veneto are the regions with the worse reaction to this particular shock. Of those regions, only Molise was in the III quadrant in occasion of previous shock. Calabria confirms to have a good resilient behaviour according to both income and employment, along with Lazio, Lombardia, Toscana, Trentino, and Valdaosta. Piemonte, and Umbria confirm their relative better performance in terms of employment with Emilia-R and Friuli-VG shifting in a down-right direction to the II quadrant. Campania, Basilicata, along with the two main islands Sardegna and Sicilia, in this occasion show a relatively better performance in terms of income as compared to the employment one.

Insert about here:
Graph 3 – Income and Employment reaction to the Great recession

Overall, these results do confirm that the resilience behaviour and, in turn, the positioning of regions in the income-employment space is rather shock specific.

Now we move to analyse the recovery behaviour. Table 4, panel C, addresses the recovery periods after each shock to investigate whether a similar evidence arises also in the recovery phase.

Like in the impact case, none of the shocks considered show a statistically significant rank correlation between income and employment recovery coefficients. Interestingly, a statistically significant ranking correlation involving the recovery following the two different shocks is found within measures; namely, between the income recovery coefficients after the oil crisis and the income recovery after the Lira shock (with rho-statistics equal to 0.601) and between employment recovery coefficients related to the above-mentioned shocks (with rho-statistics equal to 0.748). Therefore, it seems that there are similarities in the way regions recovery after a shock, regardless of the nature of the shock and the different point in time. However, as mentioned, income and employment rankings are not significantly correlated.

Similarly to the impact case, we compare the relationship between the measures at hand by means of a diagram. We report the recovery coefficients in terms of employment on the *x*-axis and those in terms of income on the *y*-axis, along with respective average datum (vertical and horizontal solid lines) for each recovery period. Graph 4 refers to the recovery after the Oil shock.

Insert about here:
Graph 4 – Income and Employment recovery sensitivity after the Oil Shock

The graph shows that in occasion of the Oil shock, Abruzzo, Emilia-R, Friuli-VG, Liguria, Lombardia, Molise, Umbria, and Veneto are characterised by recovery coefficients higher than the average in terms of both income and employment. Lazio, Puglia, and Valdaosta show above-the-average recovery coefficient as far as employment is concerned; however, their performance is below the average with respect to income. Basilicata, Calabria, Sardegna, and Sicilia being under-performing under both the aspects herein considered represent the worst scenario. Finally, Campania, Marche, Piemonte, Toscana, and Trentino populate the IV quadrant characterised by above-the-average income coefficients, yet below-the-average employment coefficients.

Graph 5 concerns the recovery after the Lira shock. In the occasion of the Lira shock, only Emilia-R maintains the former *first quadrant* status, with Calabria, Friuli, Lombardia, and Toscana. Puglia improves its relative position in the IV quadrant populated by Friuli-VG, Lombardia, Toscana, Trentino-AA, and Veneto. Basilicata, Campania, Lazio, Liguria, Molise, Trentino and Sicilia show the lowest performance in the III quadrant. Abruzzo, Piemonte, Umbria and Valdosta place themselves in the II quadrant.

Insert about here:
Graph 5 – Income and Employment recovery sensitivity after the Lira Shock

The final part of this comparative analysis is devoted to the investigation of spatial patterns in both the impact and recovery coefficients as estimated w.r.t. income and employment. Indeed, as mentioned earlier in this paper, the results obtained by both Cellini and Torrisi (2014) and Di Caro (2014a) seem to affirm the existence of differences in impact and/or recovery coefficients, potentially interpretable on a geographical basis. To explore this issue, we consider Moran's *I* index of spatial correlation (Moran, 1948). Table 5 below reports the Moran *I* index of impact and/or recovery coefficients for each shock.

Insert about here:
Table 5 - Spatial Correlation in Regional Resilience

The analysis confirms, once again, that resilience story as told by employment and income data is sensibly different. Indeed, as far as income is concerned, the spatial analysis reveals that the null of no spatial correlation of coefficients cannot be rejected in all but two impact cases, namely the Lira and the Great recession shock. Therefore, both the impact and recovery phenomena appear to clearly follow a spatial pattern.

The evidence is substantially different in the employment case. Indeed, only in one out of the five occasions under consideration, coefficients are spatially correlated in a statistically significant way; namely, the impact coefficients in the recent Great recession. Graph 6 reports the latter, showing how the above geographical pattern is declined when the recent crisis in concerned.

Insert about here:
Graph 6 – Great recession: employment and income impact coefficients

The simultaneous consideration of both Graph 3 and Graph 6 along with Table 5 on spatial correlation in regional resilience overall confirm the existence of spatial patterns in the resilience behaviour. Nevertheless, employment and income follow different trajectories with different strength. While income's spatial correlation is not statistically significant (the Moran's p-value is 0.347), the employment's one is statistically significant.

To conclude, this Section simultaneously considering results related to resilience analysis according to income and to employment perspective, has showed that estimates are shock- and, more importantly for the sake of this study, measure- specific.

5. Concluding remarks

Although with significant differences, the two works on regional resilience in Italy, discussed in this contribution, have the merit to undertake a novel route for investigating the spatial distribution of booms and busts within a country, in line with a growing literature in economics and regional sciences looking at the disaggregate effects of aggregate shocks. Also, they can contribute to revitalize the long-lasting debate on economic and social inequalities among Italian regions.

As highlighted by the recent evolutionary turn in the resilience literature, the link between the way regions react to and recover from common disturbances and the factors determining this pattern is interrelated and fundamental to understand regional inequalities in the long-run. However, the present paper suggests that the links between resilience and growth performance are far from being simple and clear-cut. Furthermore, the stories are rather different, if related to income or employment dynamics.

In the next years, further empirical explorations will be required to unveil additional aspects of economic resilience in Italy. The careful distinction of the origins and consequences of different shocks is unavoidable for exploring this argument in depth. Industrial crises differ from financial crashes and the two are quite distinct from currency shocks and sovereign debt crises. To study the evolution of regional employment and output, then, it becomes crucial to consider the entire set of elements associated to a specific shock. In addition, the description of regional resilience shall be integrated with the explanation of it on both theoretical and empirical grounds.

Three main reasons can motivate this sort of puzzle. Firstly, per capita GDP is affected by the dynamics of labour markets, but also by internal trade and services linkages among regions. The channels through which employment and income react to shocks are in large part different. Secondly, the exogenous definition of the timing of each recession and recovery can result too limited, especially when considering annual observations, for taking into account the overall place-specific impact of aggregate shocks. Indeed, it can be the case that Italian regions have asymmetric time of entry in and exit from national recessions. This time mismatching can have more relevant effects if we look at regional resilience by means of the annual output variable (a similar argument has been developed for explaining the different cycles of the States of the US by Owyang *et al.*, 2005). Future contributions could assess the presence of asymmetric resilience in regional output by adopting an endogenous timing of recessions in the spirit of the Markov-switching modelling. Lastly, the resilience story could result more fruitful for explaining regional economic growth patterns and convergence/divergence across geographical areas if we introduce an explicit link between the short- and the long-term impacts of national-wide shocks. In this way, it could be possible to analyse the transient and hysteretic effects of common shocks in a more robust way. For instance, the study of resilience could be enriched by deeply investigating the presence of linear and non-linear cointegration relationships among regional series and between regional and national observations so as to provide a more general understanding of the economic adjustments' of regions when facing aggregate disturbances.

Overall, the simultaneous consideration of results according to the income or to the employment perspective showed that they are shock- and measure- specific. Put differently, in the absence of a clear link between the results obtained using the different measures, we conclude that the information contained in the two series, rather than being alternative, are highly complementary. Therefore, the present analysis raises the opportunity for developing the research involving resilience behaviour along both dimensions in order to address the above and other open-issues left for future research in a more effective way.

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Tables

Table 1 - Regional codes and Statistics on the dynamics of regional income and employment

		Whole period		Oil shock		Lira shock		Great recession	
		Var % y	Var % N	Var % y	Var % N	Var % y	Var % N	Var % y	Var % N
		1975-2011	1977-2011	1975	1982-1984	1993	1992-1995	2009	2009-2011
Piemonte	PIE	0.016	0.0007	-0.065	-0.009	-0.020	-0.014	-0.078	-0.003
Valdaosta	VDA	0.011	0.0059	-0.093	-0.007	-0.022	0.010	-0.060	-0.001
Lombardia	LOM	0.019	0.0059	-0.035	-0.009	-0.020	-0.004	-0.055	-0.006
Trentino-A A	TAA	0.022	0.0117	-0.026	0.001	-0.013	-0.004	-0.028	0.006
Veneto	VEN	0.021	0.0085	-0.020	-0.005	0.003	-0.004	-0.044	-0.003
Friuli-VG	FVG	0.025	0.0031	-0.026	-0.007	0.002	-0.002	-0.064	-0.007
Liguria	LIG	0.023	-0.0002	-0.059	-0.026	-0.023	-0.011	-0.048	-0.003
Emilia-R	EMR	0.019	0.0051	-0.024	-0.005	0.001	-0.004	-0.065	-0.001
Toscana	TOS	0.017	0.0040	-0.027	-0.008	0.003	-0.005	-0.039	-0.004
Umbria	UMB	0.019	0.0057	-0.008	-0.002	-0.009	-0.006	-0.078	-0.007
Marche	MAR	0.017	0.0029	0.001	-0.005	-0.010	-0.010	-0.044	-0.003
Lazio	LAZ	0.018	0.0099	-0.013	0.024	-0.016	-0.019	-0.036	0.000
Abruzzo	ABR	0.023	0.0057	-0.019	0.006	-0.039	-0.004	-0.054	-0.007
Molise	MOL	0.027	-0.0031	0.024	-0.016	-0.024	-0.019	-0.039	-0.019
Campania	CAM	0.015	-0.0013	-0.016	0.014	-0.019	-0.014	-0.045	-0.023
Puglia	PUG	0.016	-0.0004	-0.006	-0.003	-0.032	-0.017	-0.044	-0.013
Basilicata	BAS	0.018	-0.0033	-0.007	0.015	0.006	-0.005	-0.040	-0.012
Calabria	CAL	0.019	-0.0003	-0.010	-0.006	0.022	-0.007	-0.033	-0.009
Sicilia	SIC	0.016	0.0008	0.003	-0.000	-0.018	-0.024	-0.042	-0.010
Sardegna	SAR	0.015	0.0086	-0.008	-0.004	0.005	0.005	-0.042	-0.004
Italia	*Ita*	*0.019*	*0.004*	*-0.026*	*-0.002*	*-0.080*	*-0.009*	*-0.050*	*-0.006*

Note: the Table reports the percentage annual variation rate of: per-capita real GDP and employment, as they are considered in Cellini and Torrisi (2014; source: ISTAT and CRENOS), and Di Caro (2014a; source: Istat).

Table 2. SUR results, annual employment observations

	Region	Autonomous growth	Impact shock 1	Impact shock 2	Impact shock 3	Recovery 1	Recovery 2
1	PIE	0.0008#	-0.0091#	-0.0151	-0.0096#	-0.0011#	0.0074#
2	VDA	0.0079#	-0.0216	0.0016#	-0.0135#	0.0099#	-0.0034#
3	LOM	0.0105	-0.0203	-0.0144	-0.0124	0.0008#	0.0004#
4	TAA	0.0219	-0.0204	-0.0257	-0.0153	-0.0069#	-0.0074
5	VEN	0.0140	-0.0206	-0.0178	-0.0202	0.0006#	-0.0008#
6	FVG	0.0004#	-0.0098#	-0.0046#	-0.0089#	0.0077#	0.0082#
7	LIG	0.0082#	-0.0364	-0.0241#	-0.0213#	-0.0004#	-0.0010#
8	EMR	0.0061	-0.0127	-0.0114	-0.0098	0.0009#	0.0055#
9	TOS	0.0088	-0.0178	-0.0147	-0.0113	-0.0024#	0.0006#
10	UMB	-0.0018#	-0.0034#	-0.0036#	-0.0070#	0.0104#	0.0171
11	MAR	0.0094	-0.0153	-0.0230	-0.0195	-0.0114#	0.0027#
12	LAZ	0.0082#	0.0180	-0.0271#	-0.0116#	0.0030#	0.0080#
13	ABR	0.0094#	-0.0057#	-0.0154#	-0.0194#	0.0009#	-0.0007#
14	MOL	-0.0003#	-0.0181#	-0.0208#	-0.0261#	0.0061#	0.0048#
15	CAM	0.00899	0.00587	-0.0282#	-0.0222	-0.0087	-0.0070
16	PUG	0.00257	-0.00541	-0.0229	-0.0222	0.0005	0.0040
17	BAS	0.01084	-0.01432	-0.0219	-0.0340	-0.0047	-0.0110
18	CAL	-0.00722	0.02195	-0.0012	-0.0081	-0.0061	0.0106
19	SIC	0.01444	-0.01638	-0.0407	-0.0368	-0.0133	-0.0019
20	SAR	0.02389	-0.03616	-0.0194	-0.0414	-0.0042	-0.0159

Note: estimation results from Di Caro (2014a). Coefficients not statistically significant at the 10% level are denoted by #.

Table 3. SUR results, annual per-capita GDP observations

	Region	Autonomous growth	Impact shock 1	Impact shock 2	Impact shock 3	Recovery 1	Recovery 2
1	PIE	0.0240	-0.0891	-0.0435	-0.0736	0.0157#	-0.0018#
2	VDA	0.0193	-0.1122	-0.0414#	-0.0493	-0.0026#	-0.0205#
3	LOM	0.0227	-0.0582	-0.0390	-0.0490	0.0182#	0.0020#
4	TAA	0.0273	-0.0536	-0.0404#	-0.0440	0.0186#	-0.0114#
5	VEN	0.0284	-0.0516	-0.0257#	-0.0681	0.0084#	0.0013#
6	FVG	0.0314	-0.0577	-0.0291#	-0.0769	0.0107#	0.0099#
7	LIG	0.0273	-0.0865	-0.0500	-0.0527	0.0079#	-0.0122#
8	EMR	0.0278	-0.0515	-0.0267#	-0.0690	0.0204#	0.0032#
9	TOS	0.0266	-0.0540	-0.0230#	-0.0498	0.0119#	-0.0030#
10	UMB	0.0320	-0.0403#	-0.0415#	-0.0767	0.0084#	-0.0205#
11	MAR	0.0284	-0.0271#	-0.0381#	-0.0639	0.0182#	0.0072#
12	LAZ	0.0253	-0.0385	-0.0411	-0.0533	0.0062#	-0.0153#
13	ABR	0.0344	-0.0530	-0.0735	-0.0601	0.0140#	-0.0188#
14	MOL	0.0354	-0.0111#	-0.0593	-0.0706	0.0114#	-0.0197#
15	CAM	0.028	-0.0438	-0.0474	-0.0536	0.0068#	-0.0282
16	PUG	0.0366	-0.0440#	-0.0306#	-0.0606	-0.0215#	-0.0075#
17	BAS	0.0306	-0.037#	-0.0623	-0.0583	0.0010#	-0.0196#
18	CAL	0.0318	-0.0421#	-0.0100#	-0.0495	-0.0149#	-0.0184#
19	SIC	0.0345	-0.0316#	-0.0528	-0.0589	-0.0100#	-0.0353#
20	SAR	0.0290	-0.0371#	-0.0245#	-0.0451	-0.0003#	-0.0290#

Note: estimation results from Cellini and Torrisi (2014), limiting the databank to 1960-2011. Coefficients not statistically significant at the 10% level are denoted by #.
Regression is: $dly_i = c_0 + c_1 * dum1975 + c_2 * dum1993 + c_3 * dum20089 + c_4 * dum\_post75 + c_5 * dum\_post93 + error$

Table 4 – Comparison of performance

4A – Unconditional and conditional general performance

	Unconditional						*Conditional*			
	Cellini-Torrisi on income (1960-2011)		Cellini-Torrisi on income (1975-2011)		Di Caro on employment (1975-2011)		Cellini-Torrisi on income (1960-11)		Di Caro on employment (1975-13)	
1	BAS	0.0680	MOL	0.0274	TAA	0.0117	PUG	0.0366	SAR	0.0239
2	MOL	0.0646	FVG	0.0248	LAZ	0.0099	MOL	0.0354	TAA	0.0219
3	ABR	0.0612	ABR	0.0233	SAR	0.0086	SIC	0.0344	SIC	0.0144
4	FVG	0.0570	LIG	0.0226	VEN	0.0085	ABR	0.0343	VEN	0.0140
5	SIC	0.0544	TAA	0.0220	VDA	0.0059	UMB	0.0320	BAS	0.0108
6	CAL	0.0511	VEN	0.0214	LOM	0.0059	CAL	0.0318	LOM	0.0105
7	UMB	0.0506	UMB	0.0195	UMB	0.0057	FVG	0.0314	ABR	0.0094$^{\#}$
8	MAR	0.0493	EMR	0.0195	ABR	0.0057	BAS	0.0306	MAR	0.0094
9	EMR	0.0467	CAL	0.0193	EMR	0.0051	SAR	0.0290	CAM	0.0090
10	PUG	0.0452	LOM	0.0189	TOS	0.004	MAR	0.0284	TOS	0.0088
11	VEN	0.0449	LAZ	0.0180	FVG	0.0031	VEN	0.0284	LAZ	0.0082$^{\#}$
12	TAA	0.0432	BAS	0.0179	MAR	0.0029	CAM	0.0280	LIG	0.0082
13	SAR	0.0427	TOS	0.0175	SIC	0.0008	EMR	0.0278	VDA	0.0079$^{\#}$
14	TOS	0.0411	MAR	0.0173	PIE	0.0007	LIG	0.0273	EMR	0.0061
15	CAM	0.0372	SIC	0.0164	LIG	-0.0002	TAA	0.0273	PUG	0.0026
16	LIG	0.0368	PIE	0.0163	BAS	-0.0003	TOS	0.0266	PIE	0.0008$^{\#}$
17	LAZ	0.0328	PUG	0.0156	PUG	-0.0004	LAZ	0.0253	FVG	0.0004$^{\#}$
18	LOM	0.0322	CAM	0.0154	CAM	-0.0013	PIE	0.0240	MOL	-0.0003$^{\#}$
19	PIE	0.0307	SAR	0.0154	MOL	-0.0031	LOM	0.0227	UMB	-0.0018$^{\#}$
20	VDA	0.0174	VAA	0.0110	CAL	-0.0033	VDA	0.0193	CAL	-0.0072$^{\#}$

4B – Shock impact

	Oil shock				*Lira shock*				*Great recession*			
	Cellini-Torrisi on income		Di Caro on employment		Cellini-Torrisi on income		Di Caro on employment		Cellini-Torrisi on income		Di Caro on employment	
1	MOL	-0.0111$^{\#}$	CAL	0.0219	CAL	-0.0100$^{\#}$	VDA	0.0016$^{\#}$	TAA	-0.0440	UMB	-0.0070$^{\#}$
2	MAR	-0.0271$^{\#}$	LAZ	0.0180	TOS	-0.0230$^{\#}$	CAL	0.0012$^{\#}$	SAR	-0.0451	CAL	-0.00813
3	SIC	-0.0316$^{\#}$	CAM	0.0059$^{\#}$	SAR	-0.0245$^{\#}$	UMB	-0.0036$^{\#}$	LOM	-0.0490	FVG	-0.0089$^{\#}$
4	BAS	-0.037$^{\#}$	UMB	-0.0034$^{\#}$	VEN	-0.0257$^{\#}$	FVG	-0.0046$^{\#}$	VDA	-0.0493	PIE	-0.0096$^{\#}$
5	SAR	-0.0371$^{\#}$	PUG	-0.0054	EMR	-0.0267$^{\#}$	EMR	-0.0114	CAL	-0.0495	EMR	-0.0098
6	LAZ	-0.0385	ABR	-0.0057$^{\#}$	FVG	-0.0291$^{\#}$	LOM	-0.0144	TOS	-0.0498	TOS	-0.0113
7	UMB	-0.0403$^{\#}$	PIE	-0.0091$^{\#}$	PUG	-0.0306$^{\#}$	TOS	-0.0147	LIG	-0.0527	LAZ	-0.0116$^{\#}$
8	CAL	-0.0421$^{\#}$	FVG	-0.0098$^{\#}$	MAR	-0.0381$^{\#}$	PIE	-0.0151	LAZ	-0.0533	LOM	-0.0124
9	CAM	-0.0438	EMR	-0.0127	LOM	-0.0390	ABR	-0.0154$^{\#}$	CAM	-0.0536	VDA	-0.0135$^{\#}$
10	PUG	-0.0440$^{\#}$	BAS	-0.0143$^{\#}$	TAA	-0.0404$^{\#}$	VEN	-0.0178	BAS	-0.0583	TAA	-0.0153
11	EMR	-0.0515	MAR	-0.0153	LAZ	-0.0411	SAR	-0.0194	SIC	-0.0589	ABR	-0.0194$^{\#}$
12	VEN	-0.0516	SIC	-0.0164	VDA	-0.0414$^{\#}$	MOL	-0.0208$^{\#}$	ABR	-0.0601	MAR	-0.0195
13	ABR	-0.0530	TOS	-0.0178	UMB	-0.0415$^{\#}$	BAS	-0.0219	PUG	-0.0606	VEN	-0.0202
14	TAA	-0.0536	MOL	-0.0181$^{\#}$	PIE	-0.0435	PUG	-0.0229	MAR	-0.0639	LIG	-0.0213$^{\#}$
15	TOS	-0.0540	LOM	-0.0203	CAM	-0.0474	MAR	-0.0230	VEN	-0.0681	PUG	-0.0220
16	FVG	-0.0577	TAA	-0.0204	LIG	-0.0500	LIG	-0.0241$^{\#}$	EMR	-0.0690	CAM	-0.0222
17	LOM	-0.0582	VEN	-0.0206	SIC	-0.0528	TAA	-0.0257	MOL	-0.0706	MOL	-0.0261$^{\#}$
18	LIG	-0.0865	VDA	-0.0216	MOL	-0.0593	LAZ	-0.0271$^{\#}$	PIE	-0.0736	BAS	-0.03399
19	PIE	-0.0891	SAR	-0.0361	BAS	-0.0623	CAM	-0.0282$^{\#}$	UMB	-0.0767	SIC	-0.03685
20	VDA	-0.1122	LIG	-0.0364	ABR	-0.0735	SIC	-0.0407	FVG	-0.0769	SAR	-0.04141
Rho	0.197 (0.405)				0.205 (0.387)				-0.0122 (0.609)			

Note: Rho refers to the Spearman rank correlation index between the income and employment coefficients for each shock; *p*-value is reported in parenthesis.

4C – Recovery

Region	*Oil shock*				*Lira shock*			
	Cellini-Torrisi on income		Di Caro on employment		Cellini-Torrisi on income		Di Caro on employment	
1	EMR	0.0204#	UMB	0.0104#	FVG	0.0099#	UMB	0.0171
2	TAA	0.0186#	VDA	0.0099#	MAR	0.0072#	CAL	0.0106#
3	LOM	0.0182#	FVG	0.0077#	EMR	0.0032#	LIG	0.0082#
4	MAR	0.0182#	MOL	0.0061#	LOM	0.0020#	LAZ	0.0080#
5	PIE	0.0157#	LAZ	0.0030#	VEN	0.0013#	PIE	0.0074#
6	ABR	0.0140#	EMR	0.0009#	PIE	-0.0018#	EMR	0.0055#
7	TOS	0.0119#	ABR	0.0009#	TOS	-0.0030#	MOL	0.0048#
8	MOL	0.0114#	LOM	0.0008#	PUG	-0.0075#	PUG	0.0040#
9	FVG	0.0107#	VEN	0.0006#	TAA	-0.0114#	MAR	0.0027#
10	VEN	0.0084#	PUG	0.0005	LIG	-0.0122#	TOS	0.0006#
11	UMB	0.0084#	LIG	-0.0004#	LAZ	-0.0153#	LOM	0.0004#
12	LIG	0.0079#	PIE	-0.0011#	CAL	-0.0184#	ABR	-0.0007#
13	CAM	0.0068#	TOS	-0.0024#	ABR	-0.0188#	VEN	-0.0008#
14	LAZ	0.0062#	SAR	-0.0042	BAS	-0.0196#	TAA	-0.0010#
15	BAS	0.0010#	BAS	-0.0047	MOL	-0.0197#	SIC	-0.0019
16	SAR	-0.0003#	CAL	-0.0061	VDA	-0.0205#	VDA	-0.0034#
17	VDA	-0.0026#	TAA	-0.0069#	UMB	-0.0205#	CAM	-0.0070#
18	SIC	-0.0100#	CAM	-0.0087	CAM	-0.0282	FVG	-0.0074
19	CAL	-0.0149#	MAR	-0.0114#	SAR	-0.0290#	BAS	-0.0110#
20	PUG	-0.0215#	SIC	-0.0133	SIC	-0.0353#	SAR	-0.0159
Rho	0.100 (0.0.672)				0.209 (0.375)			

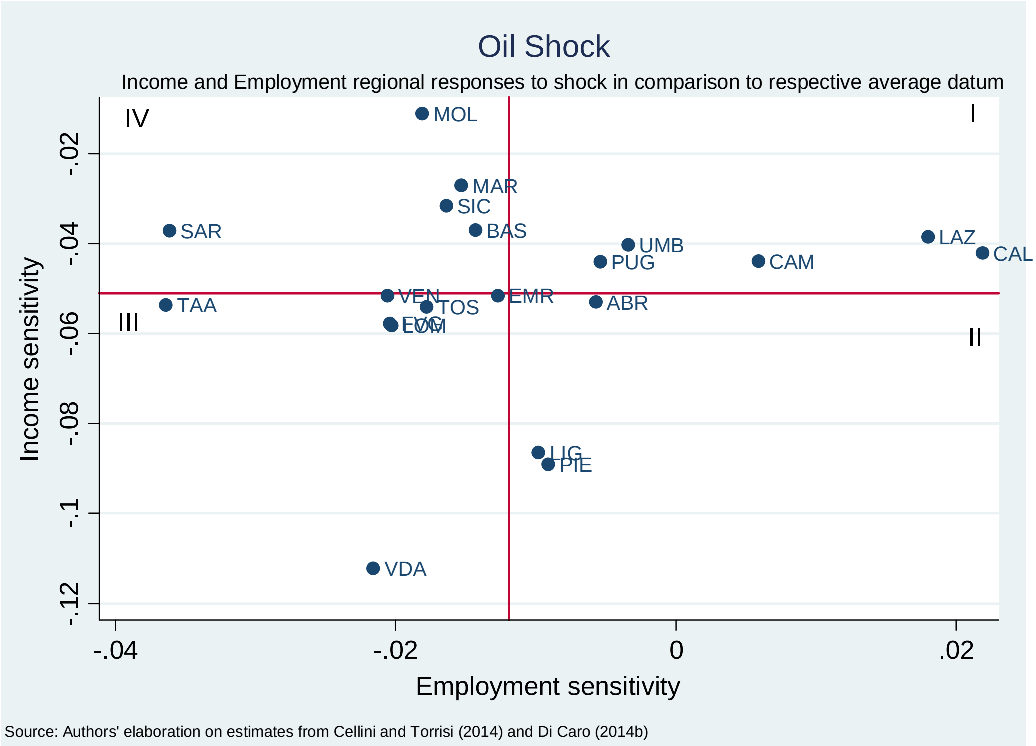
Note: Rho refers to the Spearman rank correlation index between the income and employment coefficients for each shock; *p*-value is reported in parenthesis.

Table 5 - Spatial Correlation in Regional Resilience

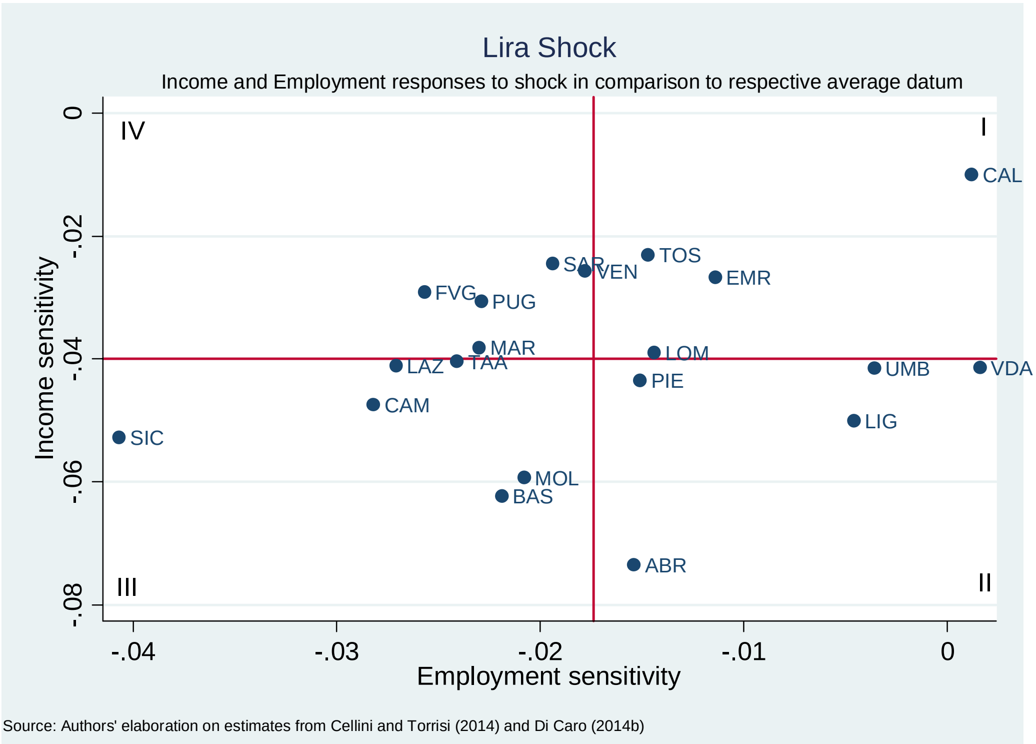
	Oil shock		Lira shock		Great recession
	Impact	Recovery	Impact	Recovery	Impact
Income	0.317 (0.000)	0.243 (0.000)	-0.147 (0.089)	0.236 (0.000)	-0.024 (0.347)
Employment	-0.068 (0.411)	0.181 (0.000)	0.050 (0.070)	-0.113 (0.192)	0.181 (0.000)

Notes: Moran's *I* on respective estimates from Cellini and Torrisi (2014) and Di Caro (2014a). Results refer to the cumulative (0,5] distance band. 1-tail *p*-value in parenthesis.

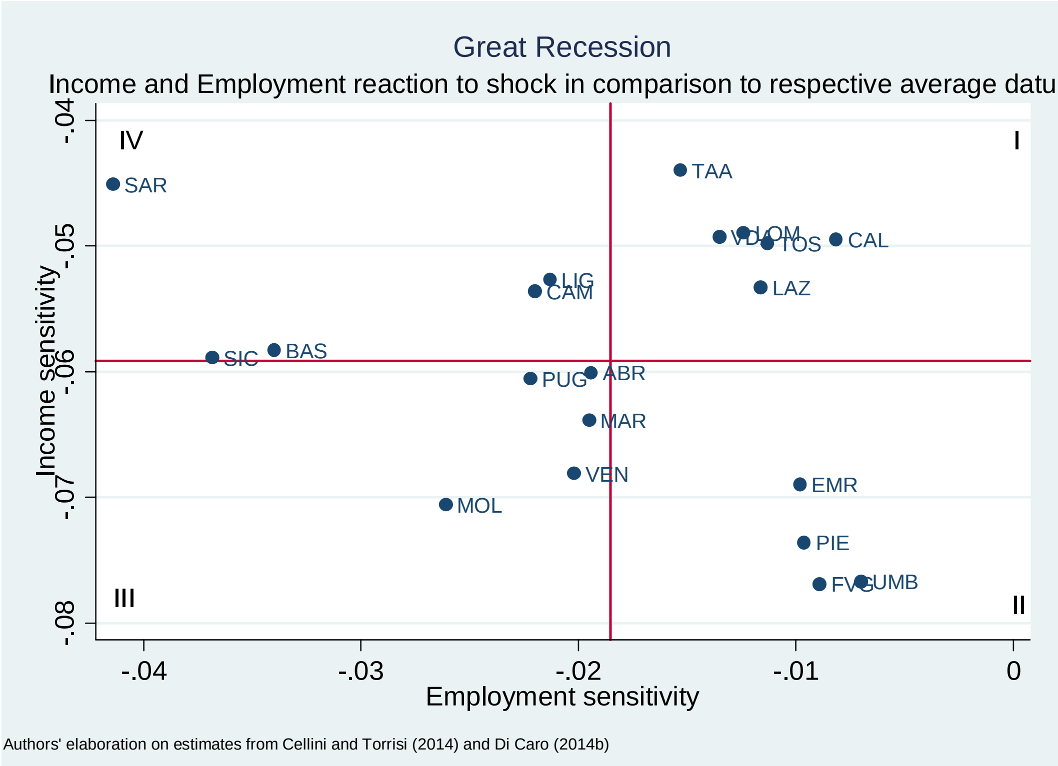
Graph 1 – Income and Employment reaction to the Oil shock



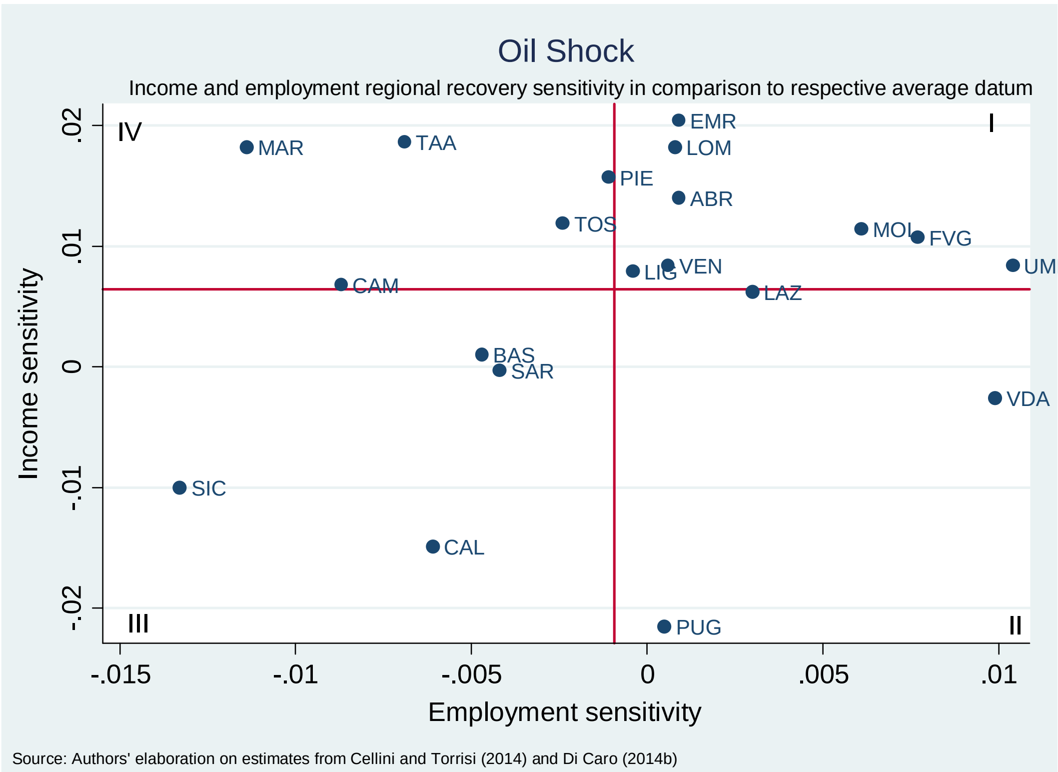
Graph 2 – Income and Employment reaction to the Lira shock



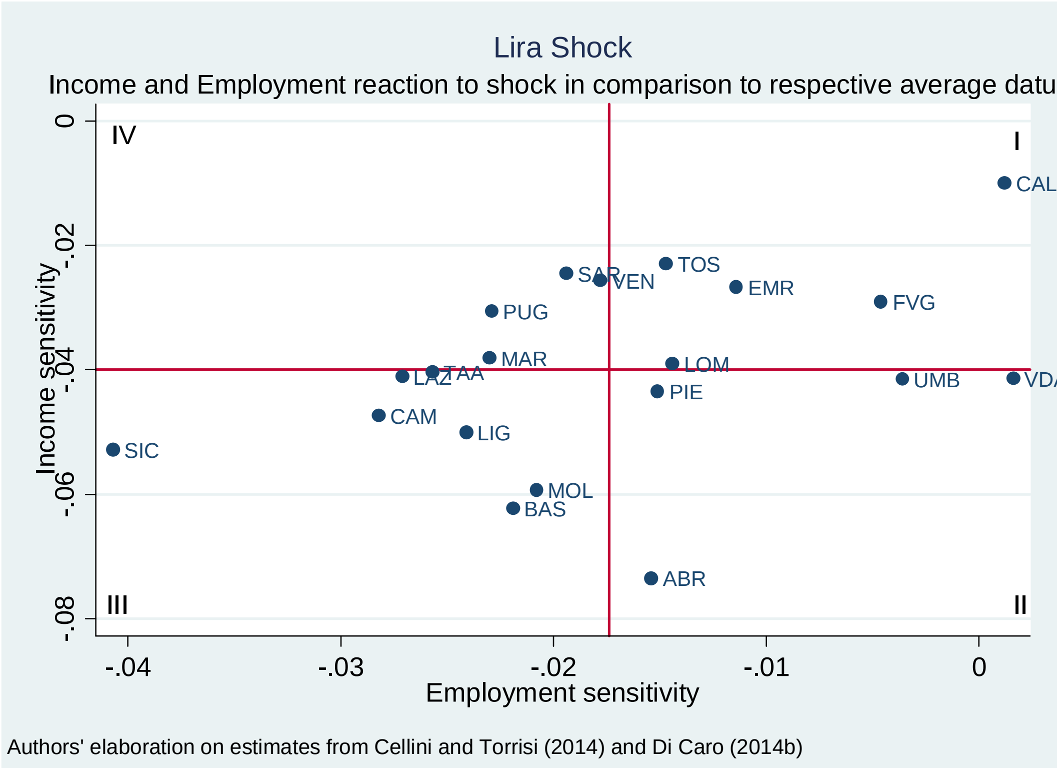
Graph 3 – Income and Employment reaction to the Great recession



Graph 4 – Income and Employment recovery sensitivity after the Oil Shock



Graph 5 – Income and Employment recovery sensitivity after the Lira Shock



Graph 6 – Great recession: employment and income impact coefficients