REGIONS BETWEEN CHALLENGES AND UNEXPECTED OPPORTUNITIES

edited by
Cristina Bernini, Silvia Emili

61 Scienze Regionali

Associazione italiana di scienze regionali

FrancoAngeli
OPEN ACCESS

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 ISBN 9788835125860

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 ISBN 9788835125860

Regions Between Challenges and Unexpected Opportunities

Cristina Bernini, Silvia Emili**

In early January 2020, most European countries were called upon to actively respond to one of the most alarming and disastrous crises of the past hundred years, the Covid-19 pandemic. In the search for a new normality, the Italian Section of the Regional Science Association International – AISRe, confirmed its annual appointment with the XLI Annual Scientific Conference. The health emergency forced the event to be reorganised and switched to an online conference. The Web Conference, held on September 2-4, 2020, gathered a large number of contributions by scholars from different disciplines belonging to the Regional Sciences.

These studies significantly contribute to the scientific debate on regional challenges and opportunities in times of crisis. As well as economic and natural crises, special attention is devoted to the investigation and measurement of the pandemic. Globalisation, innovation, productive transformation, economic growth, territorial transformation, disparities, well-being and sustainability are also among the major challenges for regional development in a medium and long-term perspective. Such challenges are significantly related to the relevant territorial and urban characteristics. In this contest, it is essential to identify the factors influencing local capacities to absorb and react to crises and to the socio-economic transformations that they cause. The discussion of conceptual and theoretical frameworks that enable an interpretation of urban, regional and national development can complement the understanding of regional opportunities and the proposal of policy interventions and instruments.

The book collects contributions covering different topics on the economic, social, and regional consequences of crises and recovery processes. The first part is dedicated specifically to the impact of the Covid-19 pandemic and to the ability of a territory to react. The challenges of the new pandemic came in addition to the economic and financial crises and the natural and environmental disasters

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 ISBN 9788835125860

that have occurred in recent decades. The second part then gathers contributions that discuss more broadly the resilience and regional responses to natural and economic shocks. Crises have largely affected the quality of life of citizens and may have compromised sustainable regional growth. To contribute to the discussion of these issues, the third part of the volume collects some studies that aim to analyse in depth the effects of crises in terms of individual and regional well-being, and their relationship with sustainability. The last part is dedicated to a discussion and empirical assessment of the role of regional and national policies in supporting recovery and resilience processes for regional development.

Part 1. Socio-economic Impact of Covid-19

To improve understanding of the factors influencing the ability of an area to react to the effects of the pandemic, AISRe launched a Special Call for contributions on Coronavirus and its territorial impacts in view of the XLI Annual Conference. As well as the health effects, elements of interest included analyses of the economic and social effects of the COVID-19 pandemic on labour participation, household living conditions, disparities, and short and long–term growth at the regional level. Of the forty proposals received for the Special Call, the contributions selected for this part aim to depict the effect of the pandemic on national economic growth, regional employment and industrial productivity, but primarily on health and mortality.

The first paper is by Augusto Cerqua, Roberta Di Stefano, Marco Letta, and Sara Miccoli, and focuses on the possibility of a harvesting effect related to Covid-19 in Northern Italy, the epicentre of the pandemic and one of the mortality hotspots in Europe during the peak of the first wave. As argued by the authors, Italy experienced a particular mirror-image phenomenon: a short-term increase in mortality due to the Covid-19 pandemic followed by a corresponding decrease in deaths. Looking at the data collected at municipality level, the authors estimate the excess mortality trends in these areas as the difference between the observed mortality in the presence of the pandemic and the counterfactual mortality scenario in the pandemic's absence. The results do not show evidence of a sizable Covid-19 harvesting effect; only a minor proportion of the total excess deaths detected in Northern Italian municipalities over the entire period under scrutiny can be attributed to an anticipatory role of Covid-19. Besides, in the most severely affected areas (i.e., the provinces of Brescia and Bergamo), the harvesting effect can only account for a small percentage of excess deaths. The low presence of short-run mortality displacement supports containment policies aimed at minimizing the health impacts of the pandemic.

In addition to its impact on society and the healthcare system, the pandemic has had devastating effects on the global economy. National governments are

struggling to absorb the shock generated by the pandemic and to overcome the crisis and begin the recovery phase. Economic analyses to understand the effects of Covid-19 on growth in the European regions are essential. This is the objective of the paper presented by Roberta Capello and Andrea Caragliu. From a counterfactual perspective, the authors measure the impact of Covid-19 as the difference between two economic scenarios: a "New Normality" scenario imposed by Covid for the period 2021-2030, and a "Reference" scenario in which Covid-19 did not take place. The costs of the pandemic are then depicted as missed growth under the "New Normality" over the long term. The tool used in this investigation is MASST4, the fourth generation of the MAcroeconomic, Sectoral, Social, Territorial model developed by the authors, in which regional growth determinants and macroeconomic growth elements are considered. The results show that, despite the short-run costs of the pandemic, regions will not necessarily suffer a substantial loss in the long-term. Moreover, the expected response to the pandemic is not homogeneous across Europe, but depends on the ability of countries to bounce back and show particular resilience.

In a similar vein, the study by Marco Pini and Alessandro Rinaldi investigates the new employment opportunities that have been missed due to the decline in the number of start-ups during the pandemic. The role of start-ups is widely recognized in the literature, especially in terms of productivity growth, innovation and job creation, as is the negative economic consequences of a decline in start-ups during a crisis which may generate persistent effects at the macroeconomic level and in terms of the speed of the post-crisis recovery. In particular, the authors estimate how many employment opportunities have been lost due to the decrease in start-ups during the two-months of lockdown in the Italian regions (March-April 2020). The procedure that they use identifies missed employment opportunities representing about 46% of theoretical employment (i.e., the employment that would have been generated over the two months in a scenario without Covid-19). The primary area suffering from this lack of opportunities is Northern Italy; Lombardy is the region that lost the most, with missed employment constituting almost 57% of theoretical employment. A substantial negative effect is also detected in Southern regions where, although the decrease in start-ups is lower than that observed in the rest of Italy, the corresponding missed new employment has a stronger effect in view of the higher unemployment in these regions.

Part 2. Natural Disaster, Economic Shock and Resilience

In recent decades interest in the concept of resilience has increased substantially. The ability of a system to recover quickly from difficulties is closely related to the nature of the shock, the initial conditions in the system that experienced

the shock, and the characteristics of micro and macro agents for supporting the recovery process. This part of the book collects contributions that describe different mechanisms of resilience to economic crises in peripheral areas, the ability to measure the reaction to crises by using a high-tech indicator, and the response to crisis of one of the most vulnerable segments of the population.

The first paper, presented by Fabiano Compagnucci and Giulia Urso, focuses on the definition of resilience in internal areas of Central Italy with respect to the Great Recession Crisis. Although the Great Recession affected the entire global economy, it caused asymmetric recessionary shocks particularly at the regional and local level. Using municipality data, the authors investigate whether the use of different variables affects the measure of resilience in the four Italian regions hit by the 2016-2017 earthquake (Marche, Lazio, Umbria, and Abruzzo), looking at both inter-regional heterogeneity and intra-regional heterogeneity along the urban gradient, moving from core areas to more peripheral areas. Unlike in previous literature, the three variables used to investigate resilience relate to population, employment, and individual income subject to taxation. The use of different indicators to proxy resilience produces different outcomes, furnishing alternative pictures of resistance and a high level of sensitivity to conditions within each context. This heterogeneity in evaluating responses highlights the need to develop place-specific indicators that are better able to capture the peculiarities of the local reaction to changes of varying abruptness, thus informing both space-sensitive preparedness and post-shock recovery policies.

High-tech is a phenomenon that leads to economic growth; it implies a firm's ability to stay competitive, to renew itself, to be innovative. A greater level of high technology can also be used as an indicator of an area's ability to recover and have better resilience in periods of crisis. With a European perspective, the contribution of Simona Brozzoni, Silvia Biffignandi and Matteo Mazziotta presents a novel High–Tech Composite Indicator that can detect regional disparities in recessions. High technology is a multidimensional concept; to reflect this, the composite indicator is constructed based on the level of R&D spending, high technology employment, specialized human resources and ability to exploit the results of innovation. The proposed HTCI also offers an appropriate understanding of the European regional breakdown in terms of high technology content, as well as highlighting territorial disparities in high-tech and depicting trends and development factors. The results confirm the relationship between the localization of high-tech and the characteristics of the external context. Moreover, the high-tech sector is suffering the effects of the crisis less severely and is recovering rapidly, confirming the central role of high technology as an indicator of economic development.

Several studies have highlighted that, as well as having strong economic effects on firms, crises give rise to significant increases in socio-economic inequality

since the most vulnerable segments of the population, such as young people, migrants and women, suffer a greater impact. But to what extent are the recovery processes of vulnerable individuals related to the area they live in? Young people who are not in employment, education, or training (known as NEETs) have been extensively affected by the recent crises. An analysis of NEETs and the determining factors in their territorial distribution is the core of the third contribution of this part, presented by Giuseppe Cinquegrana, Giovanni De Luca, Paolo Mazzocchi, Claudio Quintano, and Antonella Rocca. Using multilevel regression, the authors focused on a spatial perspective of the NEETs phenomenon to analyse the influence of the place where individuals live on their propensity to be classified as NEETs. The results show the strong effect on NEET rates of factors linked to the economic vitality of an area, to outcomes connected with education systems, and to social participation. Densely populated areas appear to correspond to higher levels of NEET status, as catalysts for social exclusion rather than hubs for innovation and job opportunities.

Part 3. Well-being and Sustainability

The third part of the book focuses on well-being and sustainability. Sustainability is widely seen as the ability to meet the current needs of individuals or communities without damaging the capacity of future generations to meet their needs. Global crises and the Covid-19 pandemic may have compromised progress towards sustainability; the impact of these crises on the well-being of citizens is also unclear and reflects the diversity in the places where people live. The contributions presented in this part present a number of insights on these issues, and in particular on the relationship between well-being and sustainability, the determinant of life satisfaction and the impact of occupational vulnerability on the individual life domain.

The relationship between regional well-being and sustainability is the focus of the study by Giovanni D'Orio and Rosetta Lombardo. In particular, the authors calculate an objective composite indicator of well-being for Italian regions over the period 2010 – 2015, and highlight its relationship with economic, social, and environmental sustainability. The relevance of this analysis relies on identifying which dimensions of well-being are significantly related to the principal dimension of sustainability, and on the ability of the composite indicator to rank regions by the different dimensions, enabling the design of policy responses suited to current needs and those of future generations. The results show that income, employment, and some social relationship aspects are the most important well-being factors related to economic and social sustainability. As for environmental sustainability, waste management aspects have the most significant incidence

on well-being. Additionally, looking at the regional ranking, the results confirm a divide between the Northern and Southern Regions that reflects the economic development of Italy. As regards social sustainability, inequality of well-being also matters, while for environmental sustainability the findings show less divergence. The need emerges for policies that have an impact in the labour market and on social capital, at the local and national level.

The analysis by Barbara Baldazzi, Rita De Carli, Daniela Lo Castro, Isabella Siciliani and Alessandra Tinto moves the focus from objective to subjective well-being and aims to investigate the association between life satisfaction and individual and contextual variables, as well as regional variations in these associations. Although income is confirmed as one of the factors associated with high levels of life satisfaction, other characteristics are also extremely influential such as educational attainment, health, employment status, and housing conditions. At the territorial level, living in areas with a higher level of employment, higher levels of social expenditure by the municipality, and better environmental conditions gives an advantage in terms of life satisfaction. The results also depict significant regional variations in the association between equalized disposable income and life satisfaction. An inverse relationship emerges between the magnitude of the effect linked to disposable income and the level of wealth in the area; in other words, having more disposable income matters more in poorer areas than in richer areas. This finding suggests that additional non-economic factors may have a greater impact than economic factors on subjective satisfaction levels in less deprived areas. A residual propensity for high life satisfaction, which considerably varies across regions, was also detected.

Increasing risks of unemployment and changes in working conditions have progressively worsened job insecurity in Italy. The new "atypical" forms of work, which in most cases involve contracts of limited duration, have become increasingly widespread especially among the younger generations. A growing body of scientific literature has highlighted the negative consequences of this occupational insecurity in several domains of life. This issue is particularly relevant in post-crisis periods. Giulia Cavrini and Evan Tedeschi examine the relationship between precarious employment and health in the Italian social context; in particular, they investigate the causal effect of temporary work on perceived health by exploring regional differences. The study demonstrates that fixed-term contracts are negatively associated with perceived health. Secondly, the authors show that this causal relationship between geographical areas is higher in the case of part-time contracts in Southern Italy. Finally, among those on very high incomes there are differences in perceived health between people in precarious and stable employment. As in some previous studies, the negative link between temporary employment and health reveals differences between geographical areas.

Part 4. The Role of Policies

Economic and financial crises, as well as the COVID-19 pandemic, have had a relevant but heterogeneous impact at the territorial level, requiring policy responses by national and subnational governments. The last part of the book investigates the role of regional policies in mitigating and managing the territorial effects of crises and in overcoming disparities between regions. Among others, the main issues addressed in this part are: What are the main justifications for and challenges of regional policies? Are EU funds more effective compared to national cohesion-oriented policies? What are the redistribution and risk-sharing effects of intergovernmental transfers?

Based on reviews of the main definitions of and justifications for regional policy, the paper by Ugo Fratesi offers some reflections on the existence and surmounting of trade-offs between equity and efficiency using various types of place-based policies. The paper also analyses the specific relevance of these issues for the current and future situation of lagging regions. The situation of less developed regions has continued to deteriorate, which provides an argument for reducing the importance of the trade-off and also implementing policies that accept it. Fratesi provides evidence that such an approach may not have been sufficient for lagging European regions that have had to face major global challenges, and presents a new taxonomy of regional policies based on internal and external effects, efficiency, and net social benefits. This novel taxonomy shows that, while it is desirable to overcome the trade-off, worthwhile policies also exist that accept the trade-off, which has been defined in terms of the impact in the region where they are implemented and the impact in other regions. Moreover, the classification shows that efficiency is a useful but not a sufficient or necessary condition for the implementation of regional policies.

The gap in terms of per capita GDP between Southern Italy and the North-Centre became stronger in the periods leading up to the economic crisis. Thus, the debate on the persistence of territorial differences in Italy and on the effects of cohesion policies is almost relevant. The two issues are closely linked, because after the end of the Intervento Straordinario in Southern Italy in 1992, EU Structural Funds have become the main tool for reducing these gaps. A fairly large body of literature exists on the effectiveness of EU funds, but less attention has been paid to national cohesion policies. In this regard, Gianluigi Coppola and Sergio Destefanis evaluate the effects of EU and national cohesion-oriented funds through a control function approach based on a model of the regional allocation of funds. Moreover, this study aims to identify effective practices and sectors of intervention, and to assess the impact of cohesion policies on GDP per employee vs. employment rate. The results show that EU funds are very

significant (with and without fund allocation controls) in determining GDP per capita. National funds are basically not significant. When GDP per capita is broken down into GDP per employee and employment rate, EU funds are found to act more strongly upon the latter.

The economic crisis following the Covid-19 pandemic has also hit local economies asymmetrically; thus, the increase in their needs and the drop in revenues have put subnational government budgets under strain, with differing impacts across jurisdictions. In this context, the analysis of how fiscal arrangements can absorb the idiosyncratic shocks that hit local economies and thus affect the fiscal position of subnational governments attracts further attention. Giampaolo Arachi, Francesco Porcelli and Alberto Zanardi investigate the role of intergovernmental equalization schemes in providing risk sharing and stabilization across local jurisdictions by means of local budget intervention. The empirical analysis is based on the Italian municipal equalization system that was reformed in 2015 by introducing formula grants to equalize the fiscal gap, updated yearly according to local social-economic factors. The Italian case is particularly interesting because the reform was applied only to municipalities located in the territories of standard regions; while the allocation of grants to municipalities in special regions continued using the previous system based on the equalization of historical expenditure. The results show that formula grants can produce more income redistribution across municipalities than transfers based on historical expenditures. Conversely, the new formula-based transfers continue to have very low contemporary risk-sharing effects. This result critically depends on lags in the data available for evaluating fiscal capacity and standard expenditure needs.

PART I – SOCIO-ECONOMIC IMPACT OF COVID-19

 ISBN 9788835125860

Was there a Covid-19 Harvesting Effect in Northern Italy?

Augusto Cerqua, Roberta Di Stefano°, Marco Letta*, Sara Miccoli°*

Abstract

We investigate the possibility of a harvesting effect, i.e. a temporary forward shift in mortality, associated with the Covid-19 pandemic by looking at the excess mortality trends of an area that registered one of the highest death tolls in the world during the first wave, Northern Italy. We do not find any evidence of a sizable Covid-19 harvesting effect, neither in the summer months after the slowdown of the first wave nor at the beginning of the second wave. According to our estimates, only a minor share of the total excess deaths detected in Northern Italian municipalities over the entire period under scrutiny (February – November 2020) can be attributed to an anticipatory role of Covid-19. A slightly higher share is detected for the most severely affected areas (the provinces of Bergamo and Brescia, in particular), but even in these territories, the harvesting effect can only account for less than 20% of excess deaths. Furthermore, the lower mortality rates observed in these areas at the beginning of the second wave may be due to several factors other than a harvesting effect, including behavioral change and some degree of temporary herd immunity. The very limited presence of short-run mortality displacement restates the case for containment policies aimed at minimizing the health impacts of the pandemic.

1. Introduction

At the onset of the Covid-19 pandemic, there was much speculation in Italy as elsewhere about a potential "harvesting effect" of Covid-19, i.e. a short-term increase of mortality later followed by a corresponding decrease in deaths. The claim was that Covid-19 fatalities, whose median age was around 80 years, were, for the vast majority, very vulnerable people who, in the absence of the pandemic, would have "died anyway" shortly after they actually did, due to other causes. According to the proponents of this hypothesis, Covid-19 excess mortality would

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 ISBN 9788835125860

have been largely re-absorbed in the months after the mortality peak, as the virus would have simply anticipated a large number of occurred deaths. Stated differently, this implies that when the spread of Covid-19 progressively slows down, one should observe a significant reduction in mortality, which would counterbalance the abnormal increases experienced during the peak.

Albeit this position has been quickly picked up by Covid-19 "skeptics" to protest against the social distancing policies introduced by most governments,[1] research on the plausibility of this claim is still scarce as documented in Section 2, both due to lags in data availability and the short time-span observable so far. We investigate the possible harvesting effects of the Covid-19 pandemic by looking at the excess all-cause mortality trends in Northern Italy, one of the areas with the highest Covid-19 death toll in the world. Specifically, we employ the data-driven methodology introduced by Cerqua *et al.* (2020) to estimate excess mortality and then investigate how it has evolved during three separate periods: i) the peak of the first wave in Italy, February-May 2020; ii) the "summer break", i.e. the tail of the first wave, going from June to September; and iii) the beginning of the second wave, i.e. October and November 2020.

During the "summer break", a "negative" excess mortality is detected. Nevertheless, this reduction in *observed* mortality compared to the counterfactual mortality figures *predicted* by our model is far too limited (corresponding to 16% of the total excess deaths observed during the first wave) to compensate for the abnormally high excess mortality of the first wave. During the onset of the second wave, new excess mortality clusters are detected, and we estimate that, as a consequence, the harvesting effect further shrinks to less than 12% when considering the entire February-November period. Still, we do observe a negative and statistically significant spatial autocorrelation between the mortality patterns of the two waves in some areas (the provinces of Bergamo and Brescia, in particular) where, remarkably, we also detect a "negative" excess mortality not only during the summer months but also in October and November. This is consistent with the well-documented lower incidence of Covid-19 during the beginning of the second wave in these Lombardy provinces, which even led some mayors to ask to be exempted from the November 3, 2020 decree, which imposed a "red zone" in the entire region. While such reversal of patterns between the two waves could be due to several factors, such as a behavioral change and some degree of herd immunity in the most affected areas, it is by no means enough to compensate for the mortality boom of the first wave. Indeed, even in these hardest-hit areas, the harvesting effect can only explain up to 17% of the Covid-19 related deaths experienced during the entire period under scrutiny.

1. In Italy, early in the pandemic, there was a fierce debate, which featured heavily in media outlets, about whether Covid-19 victims had died "with coronavirus" or "from coronavirus'.

On top of these period-by-period comparisons, we also compute the cumulative number of deaths over the entire period under scrutiny (February-November 2020), which sums to 49,816 deaths more than "expected" in Northern Italy. This corresponds to an increase in mortality of +20% with respect to an "ordinary" year, i.e. in a "no-Covid" counterfactual scenario. Overall, this evidence suggests that, although Covid-19 has probably anticipated the death of some of the frailest individuals of the Italian population, in the vast majority of cases, it killed relatively healthy people who did not have a short life expectancy before the pandemic's arrival.

2. The Harvesting Effect

The harvesting effect, or mortality displacement, is identified as an increase in deaths followed by fewer deaths than expected after the mortality crisis. During exogenous shocks such as heat waves or cold spells, the selective mortality among the frailest individuals increases the deaths among the total population and leaves a relevant proportion of strong survivors (Luy *et al*., 2020). After the shock, the number of deaths is below the expected number, and, therefore, a compensation in mortality can be observed between the crisis and the following period (Toulemon, Barbieri 2008).

Several scholars studied the harvesting effect caused by particular events, such as heat waves or cold spells (e.g. Baccini *et al.*, 2013; Cheng *et al.,* 2018; Grize *et al.,* 2005; Qiao *et al.,* 2015; Stafoggia *et al.,* 2009; Toulemon, Barbieri, 2008), seasonal influenza (e.g. Lytras *et al.,* 2019) or air pollution (Rabl *et al.,* 2005). Lytras *et al.* (2019) found out that the influenza A(H1N1)pdm09 affected the frailties individuals that would have died in the short-term because of other causes, while influenza A(H3N2) and type B caused an excess of influenza deaths among people who would not have died in the same year. Stafoggia *et al.* (2009), studying deaths that occurred in Rome between 1987-2005, figured out that high levels of mortality during winter periods can reduce the effect of heat waves on mortality compared with years of winters with low levels of mortality.

To our knowledge, only a few papers assess the potential presence of the harvesting effect during the Covid-19 pandemic. Rivera *et al.* (2020) stated that in the US, the very high mortality due to Covid-19 spans over a more extended period than other influenza or pandemic, and probably no harvesting would be observed in periods following the worst waves of the Covid-19 pandemic. In fact, in a study that analyzes the 2020 life expectancy decrease in the US, Andrasfay and Goldman (2021) did not find evidence of a harvesting effect due to Covid-19. Alicandro *et al.* (2020) indicated the possible presence of a harvesting effect at the end of the first wave of the pandemic in Italy, except for the Lombardy

region, where this effect was less pronounced at that time. Similarly, Scortichini *et al.* (2020), by analyzing excess mortality across Italian provinces, suggested the possible presence of harvesting effect in some areas of Central and Southern Italy at the end of the first wave of the pandemic. The Italian National Institute of Statistics (Istat) and Italian National Institute of Health (ISS) (2020b) reported some evidence of harvesting effect in some areas of Northern Italy during the summer months when the infections were minor. In contrast, the recent study by Canoui-Poitrine *et al.* (2021), who estimate the number of excess deaths among nursing home residents during the first wave of the pandemic in France, finds no evidence harvesting effects up to the end of August.

3. Data and Methodological Approach

To determine the potential presence of a harvesting effect in Northern Italy, we first estimate the excess all-cause mortality due (directly or indirectly) to the Covid-19 pandemic at the municipality-level and then investigate its evolution over time across the three different periods described above. The first step is made necessary by the lack of reliable data on the deaths caused by Covid-19, especially at a disaggregated level. Indeed, official data on the death toll of Covid-19 at the local level are scarce,[2] and they are likely to suffer from substantial underreporting (Ghislandi *et al.*, 2020).

Excess mortality is defined as the difference between the observed mortality in the presence of a pandemic and the counterfactual scenario of mortality in the pandemic's absence. It includes the number of deaths due directly to Covid-19 infections as well as the deaths due indirectly to Covid-19, i.e. the collateral effects of the lockdown. During the lockdown, the likelihood of dying for road[3] and workplace accidents, pollution-related diseases, or criminal activities decreases. At the same time, the likelihood of dying for the stress on the public health system increases. The estimation of excess mortality is made possible thanks to the data released on February 3, 2021, by Istat on the number of daily certified deaths for the period January 1, 2015-November 30, 2020, for all Italian municipalities.[4]

2. In Italy, official data on SARS-CoV-2 reported cases are released only at the provincial level (the number of infected people) or at the regional level (the number of Covid-19 deaths).

3. The Istat, ACI (2020) report, records a decrease in victims due to road accidents in the period January-September 2020 of 1,788 (-26.3%). The percentage increases to 34% by considering the period January-June 2020.

4. Due to the creation of Mappano as a new administrative unit in 2017 and to the lack of mortality data for all years, we cannot analyze six municipalities: Borgaro Torinese, Caselle Torinese, Leini, Mappano, and Settimo Torinese. Besides, as 2020 is a leap year, we decided to ignore the deaths on February 29 for comparability with data from previous years.

An accurate estimation of excess mortality requires the construction of a reliable counterfactual scenario. In the context of the pandemic mortality estimation, different approaches were used.[5] The most common is what we call the "intuitive" approach. It consists of using the simple average of the numbers of deaths observed for the same unit in the past. This approach has been adopted by several national and international institutions and employed in many scientific works. It is a simple approach that does not employ any model, but it may provide excess mortality estimates which are too sensitive to outliers. Another possible approach is the use of the counterfactual approaches, such as the difference-in-differences or the synthetic control method estimators. However, these approaches are ill-suited in a setting where it is hard to find plausible control groups, i.e. municipalities potentially not affected (directly or indirectly via containment measures) by the pandemic for several months.

An attractive methodological solution to such an estimation problem is the recently developed Machine Learning Control Method (MLCM) inspired by the train-test-treat-compare process proposed by Varian (2016). In the context of Covid-19, the MLCM can be applied by drawing on the predictive ability of ML algorithms to generate a no-Covid counterfactual scenario for each unit by using exclusively pre-pandemic information (Cerqua, Letta, 2020). In our setting, the use of the MLCM is made possible by constructing a comprehensive time-series cross-sectional database on Italian municipalities.

The reason to prefer MLCM over the "intuitive" approach lies in its ability to estimate more accurate counterfactual scenarios. Cerqua *et al*. (2020) demonstrate that considering the Mean Squared Error (MSE), on average, there is a sizable gain in terms of estimation accuracy compared with the intuitive estimates, especially for small and medium-sized municipalities. For this reason, we investigate the presence of the harvesting effect on Northern Italy by applying the MLCM approach used by Cerqua *et al.* (2020) to retrieve excess mortality estimates at the municipality-level. The mortality scenario without the pandemic, i.e. the cumulative number of deaths per 10,000 inhabitants in an ordinary situation, is estimated using 16 selected covariates from 2015 to 2019, including the demographic, health system, economic, and contamination (air pollution) features.[6]

5. See Section 2 of Cerqua *et al.* (2020) for a review of the methodologies used to estimate excess mortality during pandemics.

6. The full list of covariates is the following: the share of men in the population, the share of those aged 65+ (overall as well as only men), the share of those aged 80+ (overall as well as only men), the resident population, the overall number of deaths in the previous year, the overall number of deaths in the 7 weeks before the Covid-19 outbreak in Italy, the number of employees, the share of employment in manufacturing, the PM-10 as a measure of air quality, the population density, the degree of urbanization of the municipality, the dummy of the presence of a hospital in the

For each considered period (in our case, the peak of the first wave, the "summer break", and the beginning of the second wave), we train and test our random forest algorithm on the pooled 2015-2019 (on which, as typical in the ML literature, we apply a random split and use 80% of the full sample as the training set and the remaining 20% as the testing sample) dataset to predict, for the 2020 sample, estimates of local mortality in a counterfactual scenario without the pandemic. It is then easy to retrieve excess mortality as the difference between observed and predicted mortality.

Cerqua *et al.* (2020) use three ML algorithms: Least Absolute Shrinkage and Selection Operator (LASSO), random forest, and stochastic gradient boosting. In this work, we apply the ML using the random forest algorithm, a fully non-linear technique based on the aggregation of many decision trees (1000, in our case), as Cerqua *et al.* (2020) demonstrate that it performs well for all municipality sizes. The choice to circumscribe the analysis only on Northern Italy is dictated by the fact that it was the epicenter of the pandemic in Italy during the peak of the first wave (February-May 2020) and one of the mortality hotspots in Europe. As such, we deem it a representative case study to test for a potential Covid-19 harvesting effect.[7] We investigate how all-cause deaths have evolved during three separate periods: i) the peak of the first wave in Italy, February-May 2020; ii) the "summer break", i.e. the tail of the first wave, going from June to September; iii) the beginning of the second wave, October and November 2020, according to the division made by the fourth report Istat, ISS (2020a).

We do so by showing the choropleth maps of each separate period as well as by using one of the most important indexes for studying spatial relationships: the Moran's I. Moran's I can be of two types: the global bivariate Moran's I and local bivariate Moran's I (bivariate Local Indicators of Spatial Association, or more simply bivariate LISA). The former provides summary statistics for overall spatial clustering. It varies between +1 and –1: a value close to +1 indicates a strong positive spatial autocorrelation. Otherwise, a value close to –1 reveals that the spatial autocorrelation is negative, while 0 indicates a random spatial pattern. The bivariate LISA is instead applied to depict the spatiality of how the value of one variable is surrounded by values of a second variable (Anselin, 1995). Basically, the bivariate LISA measures the relationships between spatial units and their neighboring spatial units and maps statistically significant clusters of the phenomena under analysis. The neighboring structure across municipalities is measured by a spatial weights matrix based on the inverse geographical

municipality, the dummy of the presence of a hospital in at least one of the neighboring municipalities, and the number of deaths due to road accidents in the previous year. For more details, see Cerqua *et al*. (2020).

7. On the contrary, the excess mortality observed during the peak of the first wave in Central and Southern Italy could be too mild and uneven to determine a harvesting effect.

(Euclidean) distances between municipalities" centroids.[8] The weight matrix is then standardized such that its rows sum to unity (in order to compute neighborhood averages) and have zeros along the leading diagonal (see Maddison, 2006).

Thanks to the bivariate LISA, we will identify the following types of association: positive autocorrelation, which occurs where high values of variable 1 are surrounded by high values of variable 2 (High-High hotspots, HH) or where there is a concentration of low values (Low-Low coldspots, LL); or negative spatial autocorrelation, namely places where low values of variable 2 surround high values of variable 1 (High-Low clusters, HL), or vice versa (Low-High clusters, LH). As in Frigerio *et al.* (2015), we will use 999 random permutations to determine the statistical significance for each cluster.

In our analysis, we will use the global bivariate Moran's I to study the overall spatial correlation of excess mortality values of the first wave on the "summer break" (second wave) in Northern Italy and the bivariate LISA to measure the clustering patterns of excess mortality values of the first wave and the "summer break" (second wave). We will investigate whether the patterns of similarity and dissimilarity in the clustering of excess mortality values remained stable across the three time periods.

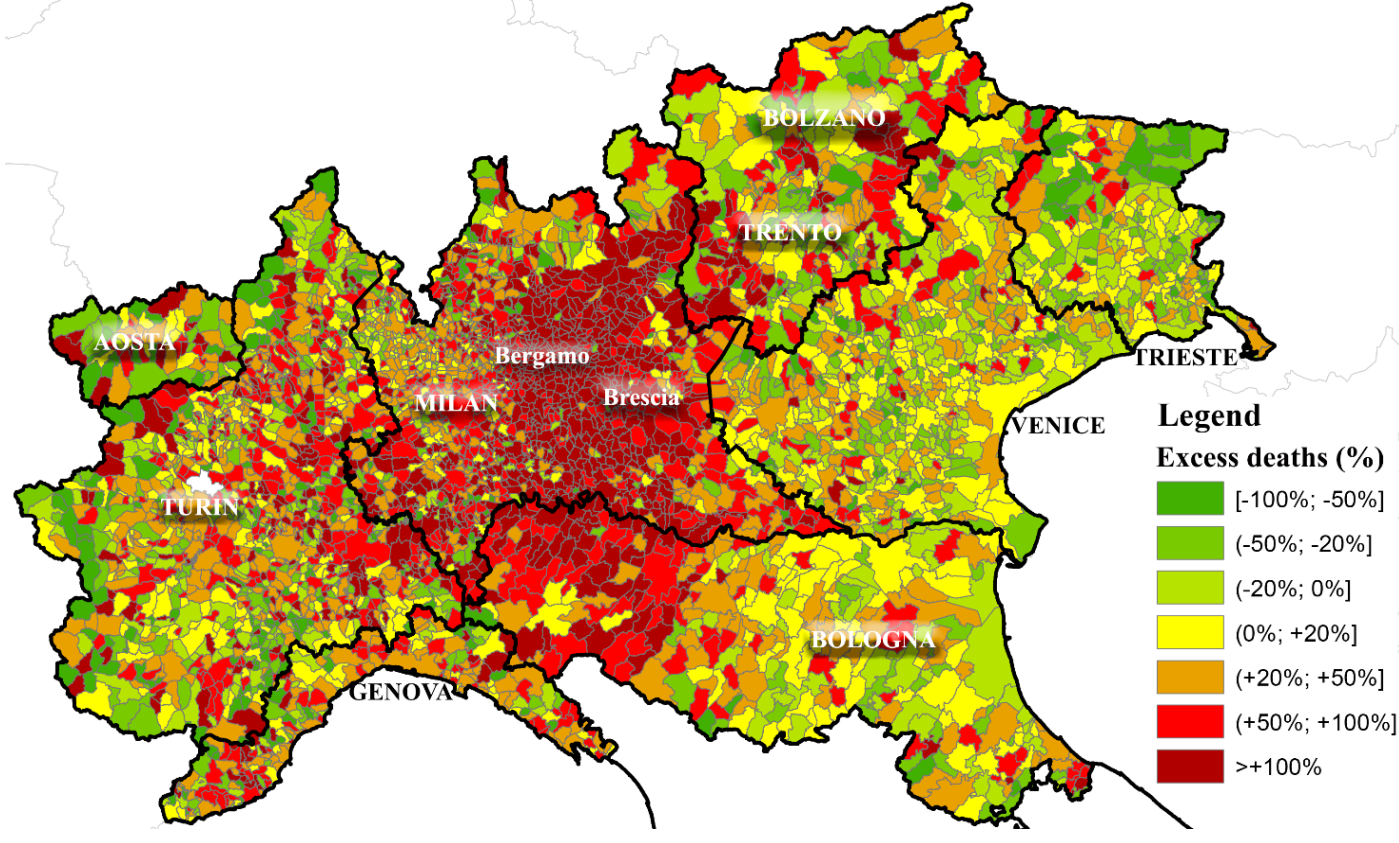
4. Results

4.1. Excess Mortality Estimates

The excess mortality estimates from all-cause deaths relative to the first phase of the pandemic, the so-called peak of the first wave from February 21 to May 31, are shown in Figure 1 for Northern Italy. Compared with the counterfactual scenario, the municipalities with the highest excess mortality are located in the provinces of Bergamo, Brescia, Cremona, Lodi in the Lombardy region. Quite impressively, 40.9% of the Lombardy municipalities recorded excess mortality of over 100%. Wide clusters of municipalities with excess mortality above 100% are also present in Piacenza and Parma provinces in the Emilia Romagna region and the Lombardy region. Clusters of municipalities with an excess of deaths over 50% are located in Milan, Mantova and Pavia (Lombardy), again in Piacenza and Parma provinces (Emilia Romagna), but also in the provinces of Imperia (Liguria), Cuneo and Alessandria (Piedmont), and Trento (Trentino Alto-Adige). In many municipalities of the Liguria region and the provinces of Turin (Piedmont), Reggio Emilia, Rimini, and Forlì-Cesena (Emilia Romagna), the excess mortality is between 20% and 50%. During the first wave, 126,896

8. The distance threshold is 15.1 km, which is the minimum threshold in order to avoid neighborless municipalities.

Figure 1 – Percentage of municipal excess deaths detected during the peak of the first wave with respect to the counterfactual scenario estimated via random forest



deaths were recorded in Northern Italy, and we estimate 41,586 excess deaths in this period. This corresponds to an increase of +48.7% in the number of deaths due directly or indirectly to the pandemic during the peak of the first wave in Northern Italy.

In the "summer break" from June 1 to September 30, defined by Istat, ISS (2020a) as a transition phase, there are few municipalities with excess mortality over 50%, as displayed in Figure 2. Most of the municipalities in Northern Italy do not record excess mortality, and small clusters of municipalities with an excess of deaths above 50% are located in the Aosta Valley region and Turin and Cuneo provinces in Piedmont. Our estimates confirm the evolution described by Istat, ISS (2020a), which has connected the presence of "negative" excess mortality with the lower number of deaths recorded in this period in comparison with the average deaths in the years 2015-2019. During the "summer break", 94,382 deaths were recorded in Northern Italy, 6,608 less than predicted by our random forest model for a "no-Covid" counterfactual scenario. This evidence might suggest a moderate presence of harvesting effect during the summer months. However, this reduction in the number of all-cause deaths is extremely limited with respect to the massive number of deaths observed in the first wave, as it only accounts for less than 16% (6,608/41,586) of the total excess deaths of the first wave.

At the onset of the second wave, many Northern Italy municipalities register a relevant excess of deaths, but the geographical pattern is different from what was observed during the first wave of the pandemic. As shown in Figure 3, broad clusters of municipalities with excess mortality above 100% are located in Cuneo (Piedmont) and Belluno (Veneto), and the Aosta Valley region. In various provinces of Piedmont, Trentino Alto-Adige, and Lombardy, many municipalities have an excess of deaths over 50%. Notably, the areas of Lombardy which had been most affected during the first wave of the pandemic, such as the provinces of Bergamo, Brescia, Cremona, and Lodi, experience low or even no levels of excess mortality. In the province of Milan, which had already been severely affected by the virus during the first wave, there are many municipalities with excess mortality of over 20%. In the most affected areas of Emilia Romagna during the first wave, namely Piacenza and Parma provinces, most municipalities record negative excess mortality or low levels, while in areas surrounding Bologna, more municipalities record an excess of deaths over 20% in comparison to the first wave. In Liguria, a cluster of municipalities with a mortality excess above 50% is located around Genova. In October and November 2020, there were 67,865 deaths in Northern Italy, and we estimate 14,838 excess deaths, i.e. an increase of +28% with respect to a "no-Covid" scenario. For Northern Italy

Figure 2 – Percentage of municipal excess deaths detected during the "summer break" with respect to the counterfactual scenario estimated via random forest

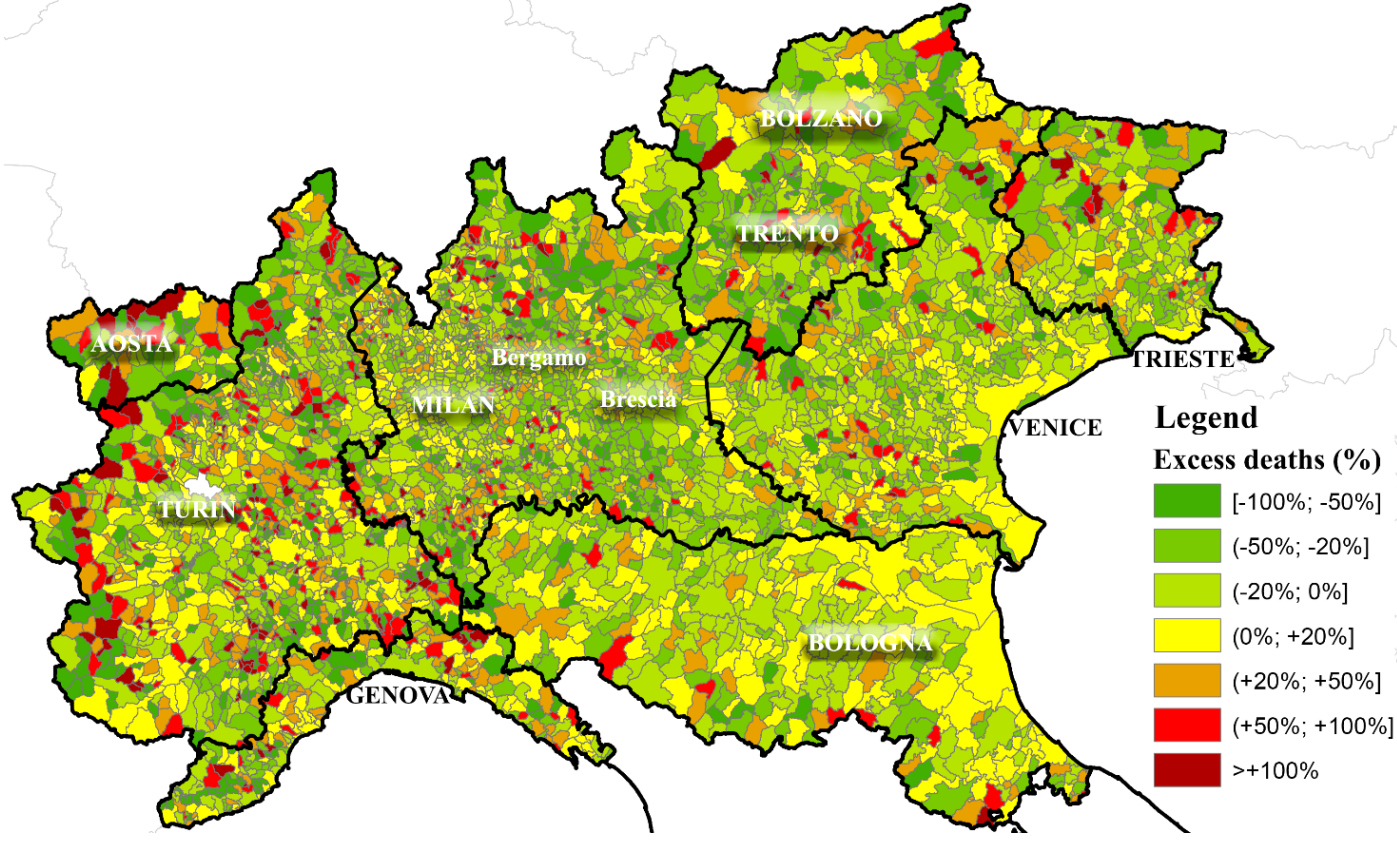
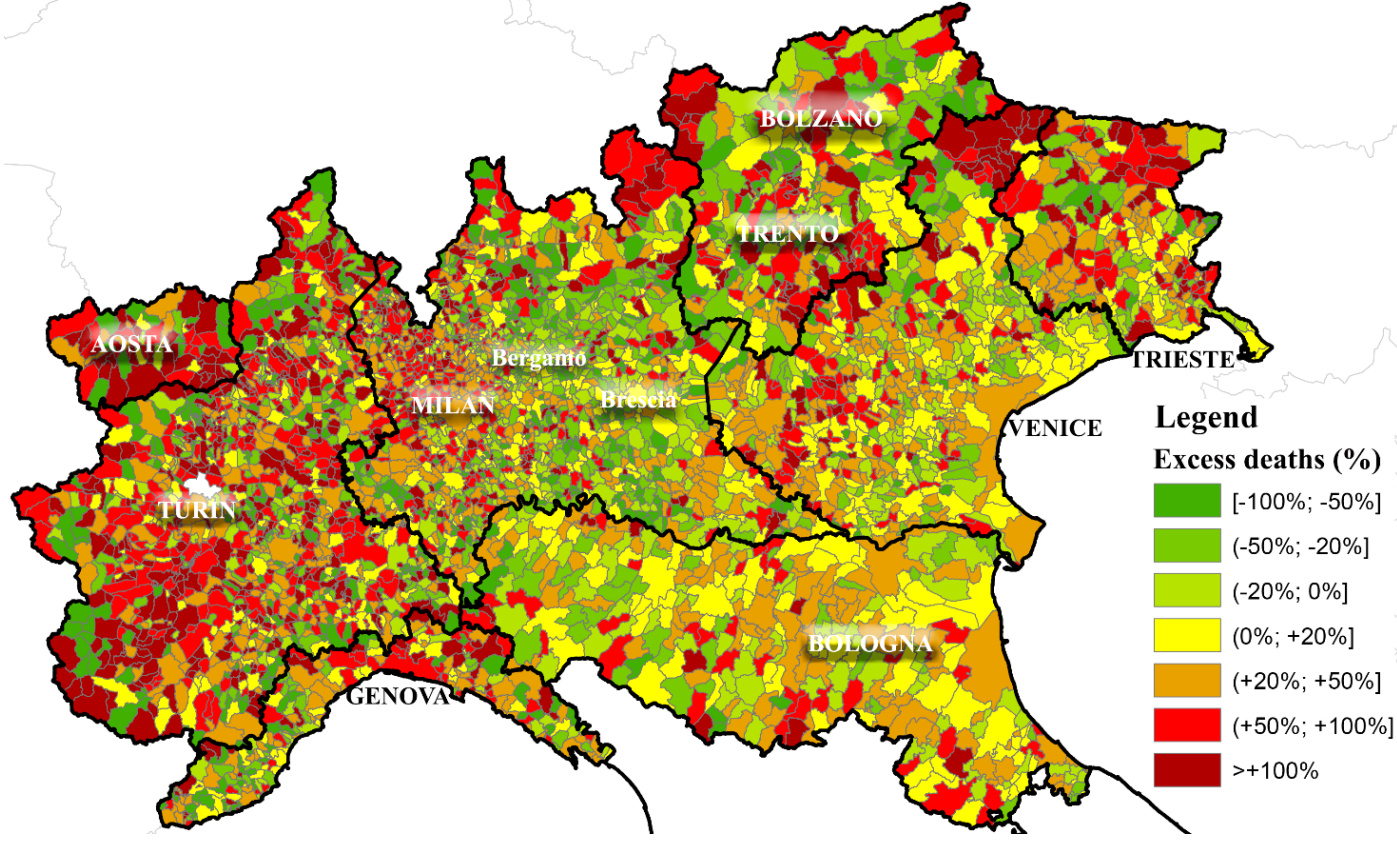


Figure 3 – Percentage of municipal excess deaths detected during the onset of the second wave with respect to the counterfactual scenario estimated via random forest



as a whole, therefore, the harvesting effect during the entire February-November period can only account for a small portion of the total excess deaths detected.

At the beginning of the second wave, the excess mortality is lower in some particular areas harshly hit by the deaths' increase during the first wave, and it is exceptionally high in areas that did not experience a very high excess mortality in the first period of the pandemic. During the first wave, the areas with the highest rate of infection were well-defined and less widespread in comparison to the "summer break" and the second wave.

4.2. Spatial Correlation Indexes

Our starting point is the spatial correlation between the excess mortality values of the first wave and the "summer break". The global bivariate Moran's I statistic is –0.053, indicating low negative spatial autocorrelation. This means that, on average, in the North of Italy, the spatial association between excess mortality values of the first wave and the "summer break" has only a small degree of spatial clustering. However, the global statistic can mask substantial local variation in spatial autocorrelation. Hence, we also computed bivariate LISA to map spatial autocorrelation for each municipality. The resulting maps are displayed in Panel A of Figure 4, which maps bivariate LISA clusters, and in Panel B of Figure 4, which shows their statistical significance at the 5%, 1%, or 0.1% significance levels. Overall, this analysis demonstrates that there are a few distinct geographic patterns of spatial clustering.

In the map in Panel A, the HH hotspots (dark red) are areas where municipalities with higher-than-average excess mortality in the first wave are surrounded by municipalities with higher-than-average excess mortality in the "summer break". As evident from the map, very few municipalities exhibit high excess mortality in both considered periods.

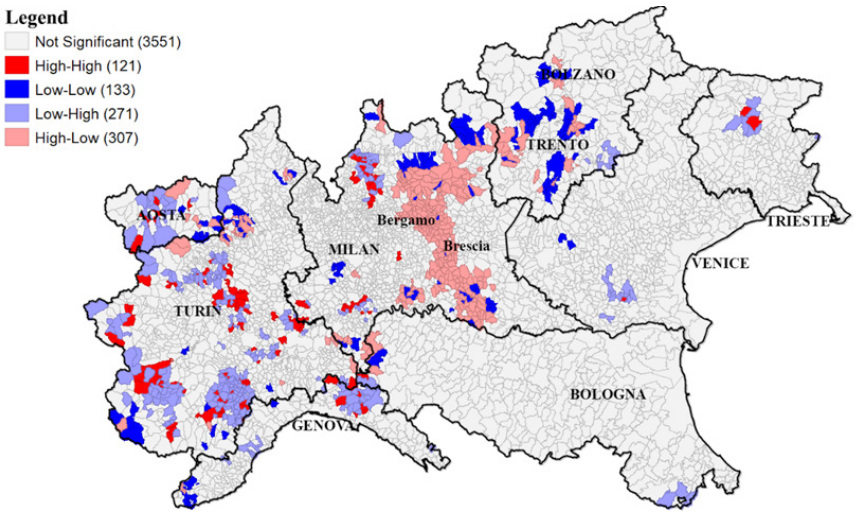
The HL clusters (salmon-colored) are areas where municipalities with high excess mortality in the first wave have neighboring municipalities with low excess mortality in the "summer break". These clusters are most prominent in the Bergamo and Brescia provinces, harshly hit by the virus during the first phase of the pandemic.

The LH and LL clusters also demarcate places of bivariate extremes. The LH clusters represent areas with low excess mortality in the first wave, with neighboring municipalities with high excess mortality in the "summer break". LH clusters are present in Aosta Valley and Piedmont, while tracts in LL clusters appear primarily in the areas around Trento. These places have the lowest levels of excess mortality in the first wave as well as in the "summer break".

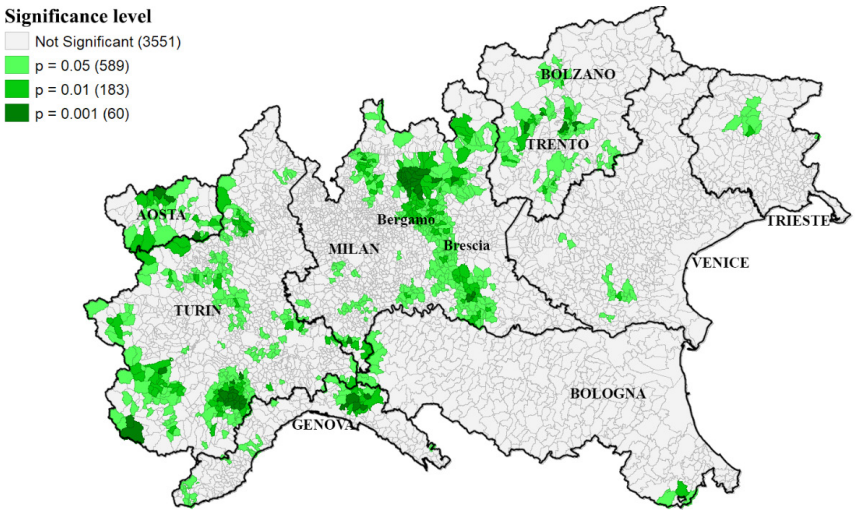
We then investigate the spatial correlation between the excess mortality values of the first wave and the onset of the second wave. The global bivariate

Figure 4 – Bivariate LISA of excess mortality values of the peak of the first wave and the "summer break"

Panel a – Cluster map



Panel b – Cluster significance



Moran's I statistic stays negative and low (–0.091). We then use the bivariate LISA to identify clusters of the excess mortality values of the first and second waves and report them in Figure 5. Two relevant patterns emerge: i) some areas which were only moderately hit during the first wave experienced high levels of excess mortality in October and November. In particular, these areas are concentrated in the provinces of Varese, Como, and Milan in Lombardy, Belluno in Veneto, Udine in Friuli-Venezia Giulia, Cuneo and Biella in Piedmont; ii) the municipalities surrounding Bergamo and Brescia, the most harshly hit during the first wave in Italy, exhibit low levels of excess deaths at the beginning of the second wave.

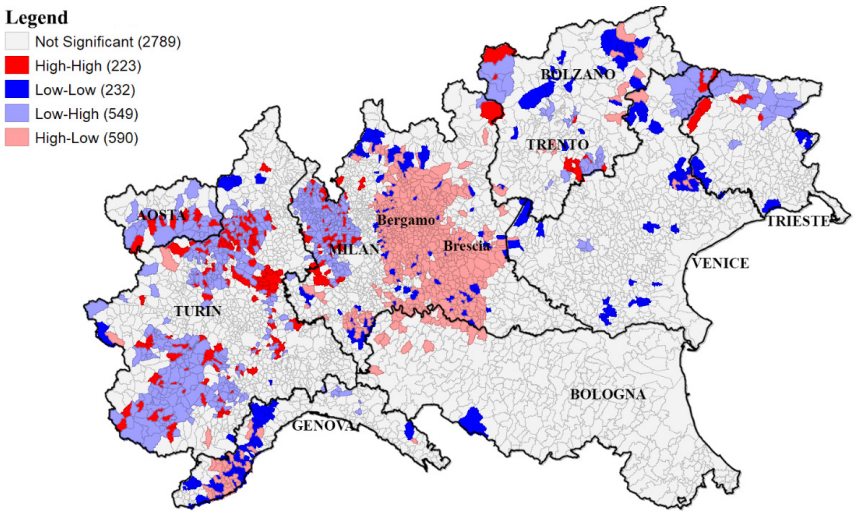
Overall, while our examination of overall trends in excess deaths for Northern Italy suggests very limited evidence of relevant harvesting effects, our spatial analysis gives compelling evidence that the areas of Northern Italy which were hit the hardest in the first phase of Covid-19, then experienced a decrease in the number of deaths of a larger magnitude, and over a longer time-span, with respect to the majority of the other Northern Italy municipalities. Let us, therefore, take a closer look at excess mortality dynamics in these most affected areas. By focusing on the provinces of Bergamo and Brescia, in the first wave, we observed excess mortality of +164% (16,754 individuals died in front of an "expected" number of deaths of 6,351), during the "summer break", a drop in the number of deaths of –17.2% (6,579 individuals died in front of an "expected" number of deaths of 7,948) and at the onset of the second wave a drop in the number of deaths of –5.1% (3,936 individuals died in front of an "expected" number of deaths of 4,147). Remarkably, in these areas, the all-cause mortality balance sign is negative even at the beginning of the second wave. This evidence suggests a somewhat more pronounced harvesting effect in the most affected areas of Northern Italy during the first wave. Of the 10,403 excess deaths that occurred during the first wave in these areas, we estimate that 1,580 individuals would have died anyway by the end of November 2020. However, this still means that over 83% of the deaths due (directly or indirectly) to Covid-19 concern relatively healthy people that did not have a short life expectancy before the pandemic's arrival.

5. Conclusions

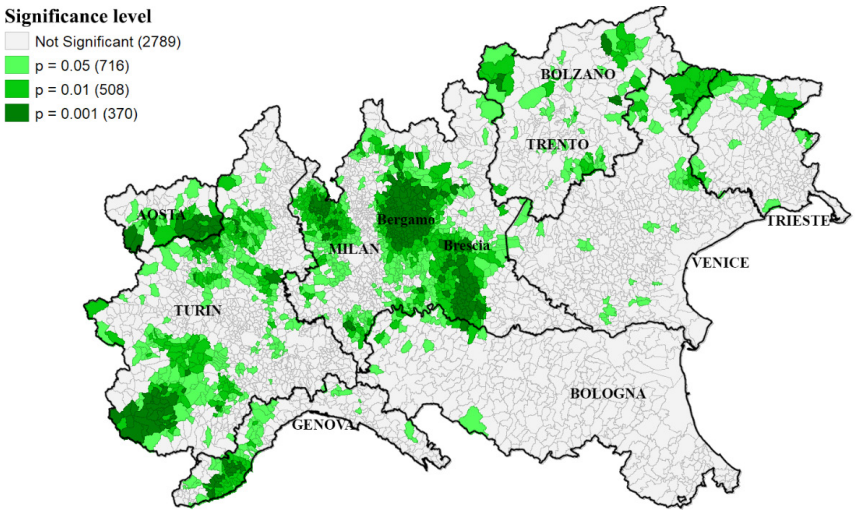
By studying mortality dynamics in the immediate aftermath of the first Covid-19 wave in Northern Italy, one of the hardest-hit territories of the world, we find only limited evidence of a Covid-19 harvesting effect. The impressive Covid-19 first wave excess mortality in Northern Italian municipalities was only marginally "compensated for" by a subsequent decline in mortality. In line with Canoui-Poitrine *et al.* (2021) findings for nursing home residents in France, we

Figure 5 – Bivariate LISA of excess mortality values of the peak of first wave and the onset of the second wave

Panel a – Cluster map



Panel b – Cluster significance



do not find that Covid-19 only affected those whose health was already inevitably compromised. The vast majority of Covid-19 deaths are not "anticipated" deaths but sudden and "unexpected" ones.

We document a slight reduction in total mortality during the summer months and new excess mortality clusters at the beginning of the second wave. When considering these dynamics jointly, for Northern Italy as a whole, the harvesting effect can account only for a minor share of the total excess deaths detected over the entire period. We also detect a statistically significant and negative spatial autocorrelation between the mortality trend of the first wave and that of the second, and a negative mortality balance at the beginning of the second wave, in some territories such as the provinces of Bergamo and Brescia. In these areas, the most severely affected ones during the first wave, less than 20% of the Covid-19-related deaths might have occurred anyway by the end of November 2020. However, these inverse dynamics are likely the joint outcome of a combination of causal factors, such as some degree of temporary herd immunity coupled with long-lasting behavioral consequences of the pandemic, rather than an exclusive outcome of the harvesting effect. In this respect, the recent re-explosion of cases and hospitalizations in the area of Brescia in the second half of February 2021, which led to the rapid imposition of *ad hoc* more severe restrictive measures, is a telltale sign that Covid-19 did not exhaust its impetus with the first wave in these territories.

Finally, excess mortality estimates computed over the entire February-November 2020 period confirm that subsequent reductions did not counterbalance the initial boom in Northern Italy mortality. Indeed, total excess mortality over this time-span is still 20% above what would have happened under "ordinary" conditions.

Two caveats are in order regarding the credibility of our findings. While Covid-19 incidence was extremely low throughout the summer in Italy, including Northern regions, there is a possibility that many Covid-19 survivors from the first wave may have been fatally weakened by the virus and died several months later (Canoui-Poitrine *et al.*, 2021). We acknowledge that this mechanism may be at play, but at the same time, we do not deem it to be so substantial to significantly alter the overall mortality trend, let alone reverse the sign of the excess mortality detected. Second, we only focus on the very short-run. Even though the harvesting effect is intrinsically a short-run phenomenon, the few months for which we have data may not be sufficient for the reabsorption to arise, and mortality displacement could take place over a longer time span.

Still, the very limited presence of Covid-19 induced mortality displacement in the short-run makes the health costs of the pandemic even more dramatic, suggests that Covid-19 can significantly shorten life expectancy, and restates once more the case for containment policies aimed at minimizing as much as possible the sanitary emergency and the death toll of the pandemic.

Our evidence is indeed preliminary. We look at a circumscribed area, Northern Italy, and focus on the very short-run due to current data availability. Further research should extend this type of analysis to other parts of Italy, other countries, and other waves of the current pandemic. When Covid-19 is eventually brought under control, it will be possible to provide a definitive answer on whether the pandemic played a significant anticipatory role and triggered a substantial mortality displacement or not. For the moment, the answer seems to be no.

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Sommario

Covid-19 nel Nord Italia: c'è stato un effetto *harvesting*?

Questo lavoro testa l'ipotesi di un effetto "harvesting" (mietitura) associato alla pandemia di COVID-19, ossia un aumento temporaneo della mortalità seguito da una diminuzione della stessa, attraverso un'analisi dell'andamento degli eccessi di mortalità nel Nord Italia, un'area che ha riportato tassi di mortalità tra i più alti al mondo durante la prima ondata. Non si rileva alcuna evidenza empirica di un consistente effetto harvesting

nei comuni del Nord Italia, né durante la fase estiva di rallentamento della prima ondata, né all'inizio della seconda ondata. Le stime suggeriscono che solo una piccola percentuale della mortalità in eccesso rilevata durante il periodo in esame (Febbraio-Novembre 2020) può essere attribuita ad un'anticipazione dei decessi causata dal COVID-19. Tale quota è più alta nei territori colpiti in modo più duro (in particolare nelle province di Bergamo e Brescia), ma anche in queste aree l'effetto harvesting ammonta a meno del 20% del totale delle morti in eccesso. Inoltre, la minore mortalità registrata in queste zone all'inizio della seconda ondata potrebbe essere dovuta anche ad altri fattori causali, quali cambiamenti comportamentali o una parziale e temporanea immunità di gregge. L'assenza di supporto empirico a favore della tesi secondo cui gran parte dei decessi da COVID-19 sarebbero comunque avvenuti nel breve periodo ribadisce l'importanza di politiche di contenimento volte a minimizzare l'impatto della pandemia sulla salute della popolazione.

Regional Impacts of Covid-19 in Europe: The Costs of the New Normality

Roberta Capello, Andrea Caragliu**

Abstract

This paper discusses the effects of the Covid-19 pandemic on growth of European regions. The impact is measured as a difference between a "New Normality" scenario, imposed by Covid, for the period 2021-2030 and a Reference scenario, whereby Covid-19 did not take place. Scenarios are obtained through the MAcroeconomic, Sectoral, Social, Territorial (MASST4), built by the authors, and able to generate regional growth scenarios for regions (NUTS2) in EU member states (UK included) on the basis of the interaction bewteen macroeconomic elements and local specificities. Some EU Countries and regions will actually be capable of bouncing back and show remarkable resilience. Other regions, instead, register a high cost in terms of missed growth.

1. Introduction[1]

The recent and largely unexpected pandemic of Corona-19 virus has caught healthcare systems all over the world unprepared, thus exerting a dramatic toll in terms of both casualties as well as in terms of missed economic performance, mostly because of the lockdown measures enacted in many Countries to prevent the diffusion of the contagion.

While countless attempts at gauging the extent of the slump caused by the pandemic have been made over the past few months, the absence of reliable real-time economic statistics and the limited availability of regional macroeconometric growth models have to date yielded scarce evidence on the regional extent of the potential economic losses engendered by the Covid-19 pandemic. Besides, insufficient information available for short-run costs makes it difficult

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1. The Authors would like to thank Camilla Lenzi for suggestions on the presentation of results, and Chiara Del Bo for comments to an earlier version of this work. The usual disclaims matter.

to foresee the likely future development paths of European regions in the aftermath of the pandemic.

This paper fills this gap with the use of the fourth version of the MAcroeconomic, Sectoral, Social, Territorial (MASST4; Capello, Caragliu, 2021a) model to build scenarios for 2021-2030, since a longer simulation period would not be credible, given the substantial degree of instability of the overall situation in these difficult times. The MASST4 model merges two conceptual streams by linking regional growth determinants and macroeconomic growth elements. In order to foresee the impacts of long run regional economic development patterns for European regions, a New Normality scenario, first developed in Capello and Caragliu (2020b), is here presented. On the basis of the short-run costs of the pandemic as happening in Spring 2020, the New Normality scenario produces the regional growth rates out of the economic contraction for the period 2021-2030.

The long term impact of the Covid-19 pandemic is measured as the missed growth of the *New Normality* scenario with respect to a *Reference* one, whereby Covid-19 did not take place. This offers the unique chance of highlighting the counterfactual nature of the pandemic. The achievement of this goal is not an easy task. Two long term scenarios have to be built, one of which based on short term estimates of the pandemic, which have to be estmated.

In the paper, we proceed as follows. In Section 2 we present a concise description of the MASST4 model, used to derive the simulated regional economic growth rates for both scenarios. The scenario construction methodology is presented in Section 3. Section 4 illustrates national and regional results for the New Normality scenario, against the backdrop of results obtained simulating the Reference scenario. Finally, Section 5 concludes and derives a few policy implications.

2. The MASST4 Model

Results presented in this paper are built through a process of simulation based on the MASST model in its fourth version. While the reader is referred to Capello and Caragliu (2021a) for a more thorough description of the latest generation of the model, it is here worth briefly recapping how the model works.

In order to generate future growth rates, the MASST model first estimates structural relations among exogenous and endogenous variables; in the second stage, the equation parameters identified through econometric estimates are used to calculate predicted values for the dependent variables, with exogenous variables set to previously predetermined targets. Target values for exogenous parameters are set according to internally coherent mix of assumptions of possible future combinations of context conditions that depict specific scenarios; this approach has been termed *quantitative foresight* (Capello, Caragliu, 2016).

In the MASST model, a national and a regional sub-model co-exist, both contributing to the simulation of future regional differential shifts, i.e. the deviations of regional GDP growth rates from their national means (Equation 1).

$$\Delta Y_r = \Delta Y_n + s, r, \in \mathbb{N} \quad [1]$$

In Equation [1], *r* indicates each of the 276 NUTS2 region in our sample, *n* represents the 27 EU Countries, while *s* stands for the regional differential shift.

The MASST model is simultaneously generative and distributive. It is a generative growth model, in that regional growth is interpreted mainly as a competitive process (Richardson, 1973). In this class of models, regional growth is seen as a "*zero-sum allocation and distribution of production*" (Harris, 2011, p. 914), and a region's growth takes place at the expense of another's (Richardson, 1978, p. 145). In the MASST4 model, the economic performance of a region depends mainly on its institutional context, i.e. on the national performance. Institutional features, organizational quality, and competitiveness in international trade influence regional economic performance; in the MASST4 model, the global economy acts as a trigger to regional economic performance through the increase in the demand for Country's products, within a classical Keynesian aggregate demand setting.[2]

The MASST model is also distributive; national growth rates are distributed to single regions depending on their factor endowments, which explain regional differential shifts (Garcilazo, Oliveira-Martins, 2015). In this sense, regional differential performance is mostly a supply-side mechanism, with both tangible (accessibility; regional policy expenditure; energy efficiency) and intangible (trust; human capital; quality of governance) assets making regions more competitive with respect to the Country mean. In the long run, exogenous variables tend instead to reach predetermined targets whose value is set depending on each scenario's underlying assumptions.

In its 4th version, the MASST model has been strengthened in many ways. The MASST4 has been reinforced in the macroeconomic part, measuring the macroeconomic changes in the period of post crisis, the regional part, inserting an endogenous productivity influenced by the 4th industrial revolution, and its urban part as well. For the last one, it now contains the role of city dynamics in stimulating national economies through their endowment of hosted functions, the quality of local governance (Peirò-Palomino *et al*. 2020), and the capacity to cooperate through quality long-distance scientific networks (Capello, Caragliu, 2018).

A final important remark on the MASST4 model is related to the relevant effort in building a comprehensive data base covering the universe of EU NUTS2 regions. In the 2013 version, these comprise 276 administrative units, with a

2. For a historic review of the different versions of the model, see Capello and Caragliu (2020b).

panel structure covering the period 2000 through 2017 for the national model and comprising for the first time a full panel structure for the regional model as well. The first year for which MASST4 produces simulated growth rates is 2018, and the simulation process can potentially reach 2035. A longer simulation would lose credibility in that constant coefficients in the estimated structural equations would become less and less meaningful as the economic structure of EU regions adjusts.

3. The Reference Scenario and the New Normality Scenario

3.1. The Reference Scenario

In order to highlight the substantial impact exerted by the Covid-19 pandemic on European regional economies, as previously anticipated, this paper presents the results of simulating a *New Normality* scenario (Capello, Caragliu, 2020b) seen as a difference with respect to results of a so called Reference scenario (Capello, Caragliu, 2021a).

Starting from a reference scenario, this is not a simple extrapolation of past trends, since it takes into account the structural changes that have appeared in the decade prior to the Covid-19 pandemic as a consequence of the 2008 crisis.

The assumptions of the Reference scenario are presented in Table 1. In the reference scenario, several pre-crisis macroeconomic conditions are unlikely to remain valid in the aftermath of the 2008 crisis, while other trends could prove to be persistent. For instance, while a high volatility of investments brought about by the crisis is expected to remain for the years to come, a standard reactivity of investment growth to GDP growth will be replaced by a high reactivity, even though at decreasing rates; free international trade between US and EU is replaced by the ongoing risk of protectionist measures between US and EU, leading to lower increases in export with respect to the past trend. Other trends likely to remain valid include substantial limitations to national deficits and debts (with limited exceptions for low-growth and indebted countries), low inflation rates, and a close end to expansionary monetary policy.[3]

Also at the regional level, new trends have emerged, that need to be captured by MASST4 in the *Reference* scenario. For instance, slow increases in R&D expenditure and human capital in Central and Eastern European Countries (henceforth, CEECs) are expected to remain also in the aftermath of the 2007/2008 financial crisis. A redistribution of the European budget would take place in favor of new fields – security and migration – decreasing the share of

3. For an in depth analysis of the post-crisis structural changes, see Capello and Caragliu (2021b).

budget devoted to cohesion policies and Community Agricultural Policy (CAP), setting national shares to the levels decided in EC (2018), and maintaining regional shares as in the 2014-2020 programming period.

Moreover, major changes occurred in structural economic relations, following the emergence of populistic movements (the celebrated *geography of discontent*; Mc Cann, 2020), ultimately leading the UK to the decision to leave the European Union.

In addition, the Reference scenario assumes the surge of the new technological paradigm (labelled *Industry 4.0*) for the future of Europe. A new technological revolution is in fact taking place, comprising wide-ranging technological fields, such as artificial intelligence, robotics, internet of things, autonomous vehicles, 3D printing, sensors, nano-technologies, biotechnology, energy storage, just to name a few of them (Brynjlfsson, McAfee, 2014; Schawb, 2017), which also pushes to 10 years trend of deindustrialization (Wink *et al*., 2016; Lee *et al*. 2015). The MASST4 model has been revised so as to also endogenize the probability of a regional economy to go through a structural evolution in its innovation modes (Asheim, 2012; Capello, Lenzi, 2018).

3.2. The New Normality Scenario

In Spring 2020, Covid-19 quickly reached Europe, forcing most EU countries to enact severe lockdown measures aimed at preventing the further diffusion of the virus, in the absence of effective cures for the health problems caused by it (Capello, Caragliu, 2020a). As a consequence, a post-2008 crisis *Reference* scenario can no longer represent a realistic scenario for any future simulation, in that the overall picture likely to emerge from the end of the pandemic will very likely be rather different from the one depicted with a *Reference* approach. The scenario built to model the likely way European regions will emerge out of the presently ongoing crisis is labelled *New Normality*.

In order to develop this scenario, two intermediate steps are needed. Firstly, short-run estimates of the GDP during the pandemic are calculated for all European NUTS2 regions. Secondly, a long-run scenario of the economic growth taking place from 2021 through 2030 is also modeled, assuming that no further national lockdowns will be undertaken in European countries.[4] In other words,

4. It is important to emphasise that, at the time of writing, it is not possible to determine how the pandemic will develop over the last quarter of 2020 and early into 2021; we have assumed that no additional strict national lockdowns will take place in autumn and winter. While at the time this paper is being written evidence that a second wave of lockdowns (in general with milder measures with respect to the Spring ones) is being enacted, incorporating their effects into these simulations given that the time required for assembling the hard evidence on the way lockdowns are put in practice is not compatible with the timeframe of this work. It can nevertheless be argued that results of our simulations would not change from a qualitative point of view, especially because

Table 1 – Qualitative Assumptions for the Reference Scenario

Qualitative assumptions	*Model's levers*	*Quantitative assumptions (targets in 2035)*
	Assumptions on macroeconomic trends	
High volatility of investments, decreasing in the long run	Coefficient of investment trends	Lower value
High reactivity of investments growth to GDP growth, decreasing in the long run	Coefficient of GDP growth with respect to Investment growth	Lower value
Risk of protectionism and therefore lower export increase	Constant of export growth	Lower value
Permanent controls on national deficits and debts	Targets on deficits and debts	3%: Deficit / GDP 60%: Debt / GDP for Eastern countries 90%: Debt / GDP for Western countries 110%: Debt / GDP for Western countries belonging to cluster 1*
Some controlled exceptions of public expenditures	Targets on debts	110%: Debts over GDP on "problematic countries"
Low inflation rate	Inflation rate	2.5% Western countries 5% Eastern countries
End of the expansionary monetary policy (quantitative easing)	Interest rates	3% Western countries; 4% Eastern countries 4% Western countries belonging to cluster 1; 6% Eastern countries belonging to cluster 1
	Assumptions on industrial trends	
Initial launch of high-tech industry in Europe	EU growth rate of High-tech industrial sectors	Increase of value added at European level for high-tech industries (+1.5% as an average with respect to the past)
Increase in high-value added services related to the adoption of Industry 4.0 related technologies	EU growth rate of High-tech service sectors	Increase of value added at European level for service industries (+1.5% as an average with respect to the past)
A slow catching-up in R&D expenditure in CEECs	R&D / GDP in CEECs countries	+ 0.5% with respect to the post crisis period in Eastern countries
A slow catching-up in human capital in CEECs	Human capital in CEECs countries	+2% with respect to the post-crisis period in Eastern countries

(follows...)

(...continue)

Qualitative assumptions	*Model's levers*	*Quantitative assumptions (targets in 2035)*
	Assumptions on institutional trends	
Brexit from 2020	Regional input-output trade between UK NUTS2 and all other NUTS2 in Europe, applied as a distance for spillovers of growth	Trade distance increased to a maximum, limiting growth spillovers.
	Geographical distance between UK NUTS2 and all other NUTS2 in Europe	Distance increased to a maximum, limiting growth spillovers.
Decrease in the cohesion policy expenditures	Expenditures of cohesion funds by NUTS2	National shares equal to the levels decided in the document of 29th May, maintaining regional shares as in the 2014-2020 programming period
	Urban settlement related assumptions	
Increase in urban amenities in Western countries	Urban amenities	2% increase in large cities 1% 0.5%
Upgraded quality functions	High-value functions	Increase of: 3% large and medium cities in Western countries 1% small cities in Western countries 2% large cities in Eastern countries 1% medium cities in Eastern countries 0.5 small cities in Eastern countries
Cooperative behaviour among cities everywhere	Networking behaviour	10% large cities in Western countries 5% medium cities in Western countries 3% small cities in Western countries 8% large cities in Eastern countries 4% medium cities in Eastern countries 2 small cities in Eastern countries

Legend: * cluster 1 countries include Cyprus, Finland, Greece and Italy, i.e. the slowest-growth countries in the after-crisis period

the *New Normality* scenario still assumes that structural changes resulting from the global financial crisis in 2008 (higher investment volatility, higher dependence of investments on GDP, volatility of export and imports, higher tolerance for Southern countries' stability pact) continue to characterize the EU.

Regional GDP levels at 2020 are first estimated, with the inclusion of short-run targets modeling the way Covid-19 has impacted European regional economies. *Reference* targets are next applied to this first vector of (estimated) data, covering the year 2020, with targets set for the period 2021-2030 under the assumption that longer simulation periods would not be credible, given the substantial degree of instability of the overall situation in these difficult times.

Qualitative assumptions for the *New Normality* scenario are summarized in Table 2. Particular attention has been paid to model the funds available by the recovery plan drawn up by the European Commission. These measures support the recovery of EU economies through investment that amount to EUR 1.82 trillion, comprising the multiannual financial framework (MFF) and the extraordinary recovery effort termed *Next Generation EU*. The New Normality scenario also captures structural changes likely taking place in the economic and social spheres as an enduring consequence of the Covid-19 pandemic. These include evolving consumption patterns, still focusing on online sales, at the expense of traditional commercial activities. New social behaviors will also emerge, including a persistent use of digital communications imposed by the Covid pandemic, with a consequent contraction of business travels. Within this framework, Industry 4.0 would also resume its growth at full extent, thus reinforcing high-tech manufacturing in Europe.

The results of a *New Normality* scenario simulation are not necessarily worse than in the *Reference* case. For instance, additional investment spurred by the Next generation EU plan may actually prove, in the long run, to be more than enough to compensate the dramatic costs of the Spring 2020 lockdowns. On the other hand, the initial contraction may be so severe that, even expecting a major rebound from 2021 onwards, average annual GDP growth rates will be on average lower in the New Normality scenario, reflecting the long term cost of the Covid-19. The answer to this question is presented in Section 4.

4. The Costs of the New Normality

This section presents results of the simulation of the costs of the New Normality, measured as difference between the New Normality scenario and the results

the second wave of the pandemic in Europe is proving to be, unfortunately, more pervasive and spatially homogeneous even than in Spring 2020 (Cacciapaglia *et al*., 2020), thus likely causing less spatial imbalances than those already illustrated by the foresights here presented.

Table 2 – Qualitative Assumptions for the New Normality Scenario

	2020 (costs of Covid)	*2021-2030 (New Normality)*
	Coefficients in the crisis period	*Coefficients in the post-crisis period*
	Assumptions on macro factors	
Debt/GDP	General relaxing of Maastricht rules, proportional to starting levels	Convergence towards Maastricht parameter
Interest rate	Interest rates remain low in the short run	Increased debt levels cause higher interest rates
Inflation rate	Nil across all Europe	Reprisal of inflation rates
Deficit/GDP	Relaxed Maastricht rules (8% deficit everywhere)	Maastricht targets are met by northern European countries; some relaxing of Maastricht rules for southern European countries
GDP growth US-JP-BRIC	Major GDP contraction in US and Japan; milder contraction in BRIC Countries	Mild GDP growth in US and Japan; growth in BRIC Countries
FDIs	Major contraction of FDIs w.r.t. before the lockdown	FDIs resume to pre-Covid levels
Consumption levels	Contraction of consumption levels everywhere	Consumption levels regain pre-Covid levels
Investment	Contraction of investment levels everywhere	Major boost in investments due to the recovery plan
Export and import levels	Contraction of import and export levels everywhere	Major reprisal of import and export levels (+10% w.r.t. pre-Covid levels)
	Assumptions on regional factors	
Industrial specialisation	Major contraction in all activities, other than agriculture and public administration	Pre-Covid levels for high-tech activities; permanent minor contraction for tourism and transport; contraction for other manufacturing
Input/Output relations	20% decrease in the intensity of I/O relations everywhere	I/O relations resume to pre-Covid levels
Innovation	No major change	Major increase in innovation-intensive regions; medium increase in medium performing regions; minor increase in other areas
Trust and social capital	Contraction (-10%) of trust levels everywhere	Partial (+5%) reprisal of trust levels everywhere w.r.t. the lockdown period
Death rate	+40% in the areas hit the hardest by the Covid pandemic; +10% elsewhere	Return to pre-Covid rates
Energy efficiency	No change	Increase (+10%) due to the measures issued in the recovery plan

Source: Authors' elaboration

of the Reference scenario, where the COVD-19 would have not taken place. Table 3 shows the difference in the average annual GDP growth rates between 2017 and 2030 for all EU28 Countries obtained in the New normality scenario with respect to the *Reference* scenario.

Reconnecting to the question concluding Section 3, Table 3 shows a rather complex picture, with some of the countries hit the hardest from the immediate costs of the pandemic being actually capable of recovering faster in its aftermath. This is in particular the case of France, Italy, Belgium, and Spain. Another outcome shown in Table 3 refers to countries whose economic growth would be faster in the case of the *New Normality* scenario, with however a smaller difference with respect to the *Reference* case. This is typical of Countries that initially faced lower costs from the Spring lockdowns (e.g. Germany).

A third typology of Countries shown in Table 3 encompasses those whose GDP growth substantially benefits from additional investment spurred by the EU plan devised to counterbalance the negative economic impact of Covid-19, or whose initial costs incurred in Spring 2020 have been somewhat lower. These include mostly Central and Eastern European Countries, such as Romania, Estonia, Bulgaria, and Slovakia, although this does not uniformly applies. Poland, for instance, has exactly the same GDP growth rate forecasted in the two scenarios.

Lastly, Table 3 suggests that some Countries will not fully counterbalance the major slump taking place in 2020, ultimately being damaged by the costs of Covid-19 more than recovery measures will be able to amend. This is the case of Austria, Croatia, and Finland. Moving to the regional set of results, Figure 1 shows the map of average annual GDP growth rates in European regions between 2020 and 2030 as a difference between the New Normality and the Reference scenarios. In Figure 1, colors are represented with darker red when the difference between the New Normality and the Reference scenarios are larger, while increasingly smaller differences are represented with increasingly more intense green shades.

Not only does this map display remarkable spatial heterogeneity, as indirectly implied also by national results shown in Table 3. Also, within the same country regions present a rather substantial degree of within countries differences.

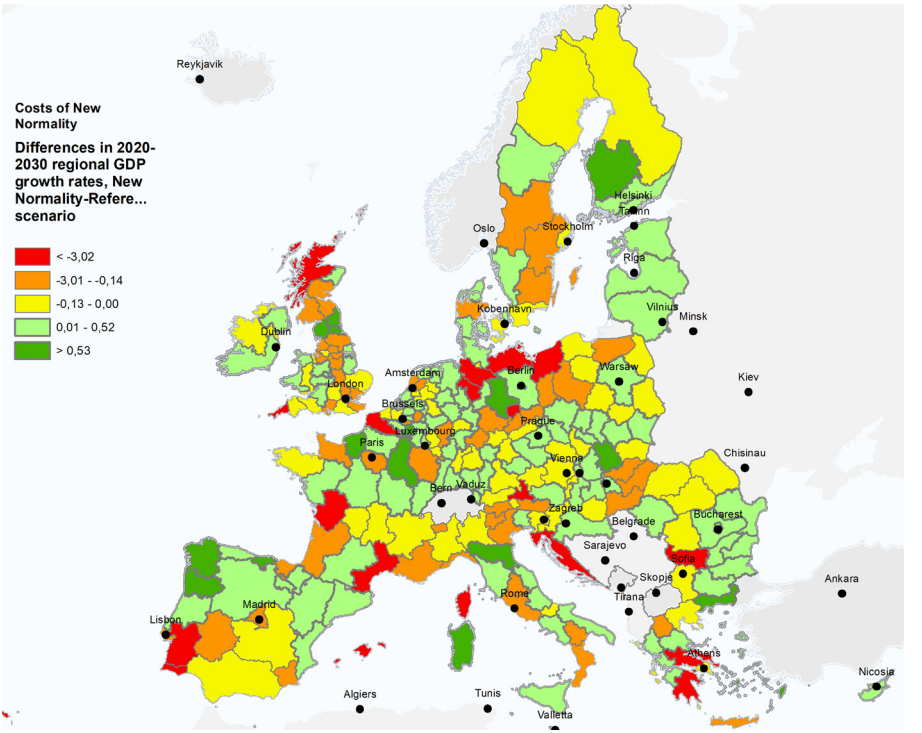
For instance, this is the case of several areas (marked in dark red, i.e. regions incurring the highest long run costs due to the Covid-19 pandemic) located in peripheral regions in France, Italy, Spain, and Portugal, whose country performance will benefit from the bounce back logically following the initial slump, but whose economic growth will lack. In these Countries, other regions (e.g. Champagne-Ardenne in France, Emilia-Romagna in Italy, Galicia in Spain) will compensate for losses mostly concentrated in other peripheral and rural areas.

Table 3 – Differences in Average Annual National GDP Growth Rates in the New Normality and in the Reference Scenarios, 2020-2030

Country	*Differential GDP growth rate (new normality vs reference)*
Austria	-0.03
Belgium	0.12
Bulgaria	0.75
Croatia	-0.39
Cyprus	0.53
Czech Republic	0.17
Denmark	0.12
Estonia	0.62
Finland	-0.13
France	0.16
Germany	0.06
Greece	0.01
Hungary	0.20
Ireland	0.13
Italy	0.18
Latvia	0.57
Lithuania	0.55
Luxembourg	0.39
Malta	0.77
Netherlands	0.23
Poland	0.00
Portugal	0.04
Romania	0.42
Slovakia	0.31
Slovenia	0.10
Spain	0.12
Sweden	0.13
United Kingdom	0.00

Source: Authors' elaboration on the basis of MASST4 simulations

Figure 1 – Differences in Average Annual Regional GDP Growth Rates in the New Normality and Reference Scenarios, 2020-2030



Source: Authors' elaboration on the basis of MASST4 simulations

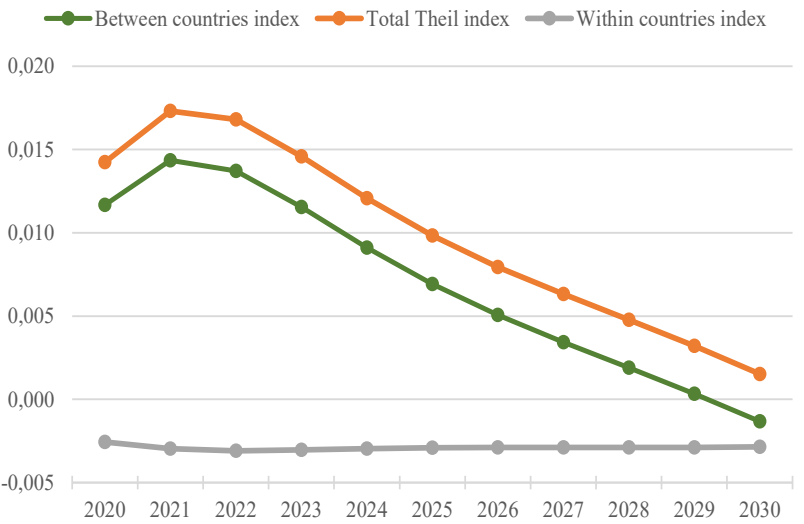
The British situation shows all its drama, registering mostly all regions in the country paying a high cost due to the pandemic; especially Scotland and the rich South pay the highest cost.

While in general losses do tend to be highest in rural and non-core regions, some major urban areas show significant long-run losses, despite facing initially lower health costs. This is for instance the case of the Lisbon area in Portugal, and Attiki (with the capital city Athens) in Greece. And Ile de France with the capital city Paris in France.

The causes behind the positive rebound that drives regions to a higher GDP growth the respect to a reference scenario are namely:

- urban areas with respect to rural ones (p-value of the t-test for mean differences equal to 0.12); this weakly suggests that urban areas basically do not lose from the *New Normality* scenario;

Figure 2 – Differences in Total, between and within Countries Theil Indices, in the New Normality and Reference Scenarios, 2020-2030



Source: Authors' elaboration on the basis of MASST4 simulations

- quality of government (Charron *et al*., 2019) (p-value of the t-test for mean differences equal to 0.13), which confirms the importance of good formal and informal institutions for the efficient spending of the Recovery fund;
- presence of high-tech firms and industries (Simonen *et al*., 2015) (p-value of the t-test for mean differences equal to 0.11), getting all advantages from the digital technologies, fundamental to do business, to entertain people and to teach during the pandemic and moving towards a 4th technological transformation of the society.

A last set of analyses has been performed for verifying whether the New Normality scenario will have any effect on regional disparities. This is done by calculating a Theil index of regional inequalities, which is amenable to a useful decomposition of total disparities (green line in Figure 2) into inter-national disparities (Between Countries Index; orange line in Figure 2) and intra-national disparities (grey line in Figure 2).

The Theil Index of Regional inequalities is calculated as follows (Equation 2):

$$Theil = \frac{1}{N}\sum_{i=1}^{N}\frac{y_i}{\bar{y}} ln\left(\frac{y_i}{\bar{y}}\right) \quad [2]$$

where N is the number of regions, y_i is the variable of interest in the ith region (in this case, regional GDP) and is the average regional GDP calculated for all regions (OECD, 2016).

Figure 2 presents the difference in the regional disparities between the two scenarios. Being the total disparity line (continuous line) always above zero (also in the last year), the first important result is that the Covid-19 has substantially generated an increase in disparities that remain over time. Moreover, between country disparities are greater in the New Normality w.r.t. the reference, in that the between country line (dashed line) is above the total disparity line, witnessing that the Covid-19 pandemic hit differently the different countries, but that the difference decreases with time. The within country disparities (dotted line) are lower in the New Normality than in the Reference, witnessing that within each country the costs of the New Normality are spatially diffused, and remain constant over time.

5. Conclusions and Policy Implications

This paper presents the results of the costs of a *New Normality* scenario, measured as the costs of a scenario with Covid-19 and one without.

Results show that, despite substantial short-run costs of the Covid-19 pandemic, in the long run European Countries and regions will not necessarily lose from the massive negative exogenous shock just happening as we write these conclusions. Some EU Countries and regions will actually be capable of bouncing back and show remarkable resilience. While further research is definitely called upon to understand the microfoundations of these effects, the two most likely causes for such resilience can be traced to the robust injection of EU money (totaling EUR 1.82 trillion for the 2020-2027 period), meant to sustain the rebound of European economies, and the reaction of European manufacturing to the further diffusion of ICT as means of long-distance communication and boosting productivity.

However, our findings also hint at two sources of relevant costs. On the one hand, we do identify some net losers even after taking the two above-mentioned positive factors into account. On the other hand, spatial heterogeneity in the short-run and long-run impacts of the healthcare emergency will also cause a substantial increase in (in the short-run) international and (in the long run) intranational disparities. For both sources of costs, policymakers may want to further analyze their causes, and find suitable remedies.

Policies dealing with these costs will be sorely needed not only for reasons of equity, but also to increase overall efficiency. It is in fact difficult to accept leaving countries and regions behind; the laggards are typically areas most exposed to the costs of the pandemic either because of their demographic structure, or also because of structural limitations of their healthcare systems or industrial

structure. However, it is also important to stress that by fostering a higher rebound than a GDP growth obtained in a situation without Covid-19, an important role is played by the quality of governance, which guarantees an efficient way of spending the extra budget made available by the Recovery Plan.

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Sommario

Impatti regionali del Covid-19 in Europa: i costi della Nuova Normalità

In questo articolo viene presentato l'impatto di lungo periodo della pandemia da Covid-19 sulla crescita delle regioni Europee. L'impatto è calcolato come differenza tra uno scenario di Nuova Normalità, imposto dal Covid, per il periodo 2021-2030 rispetto a uno scenario di Reference, ottenuto nell'ipotesi che la pandemia non avvenisse. Gli scenari sono costruiti grazie al modello MAcroeconomic, Sectoral, Social, Territorial (MASST4), costruito dagli autori, e in grado di creare scenari di crescita regionale per tutte le NUTS2 dei paesi membri dell'Unione Europea (UK inclusa) sulla base di un'interazione tra elementi macroeconomici e specificità locali. I risultati mostrano come alcune aree e paesi siano in grado di riprendersi dalla crisi Covid-19 e superare in dieci anni il tasso di crescita che avrebbero avuto senza pandemia. Altre, invece, registrano alti costi dovuti a una mancata crescita.

Lockdown and Startups Decline in the Italian Regions: the Missed New Employment

Marco Pini, Alessandro Rinaldi**

Abstract

The aim of this paper is measuring the effect of the lockdown on the startups decline and the consequences in terms of the missed new employment opportunities. We study the case of Italy through an analysis at the regional level. We found that during the two months of lockdown (March-April 2020), new business applications fell by 45.1% compared to the same period of the previous year, with greater reductions in the northern regions. In the face of this startups decline, we estimated that 30,400 people missed out on employment opportunities. Furthermore, considering all months until December 2020, we estimated 54,100 people missing out on possible employment, corresponding to 2% of total unemployed people in Italy.

1. Introduction[1]

The discovery of a novel coronavirus in late 2019 (Zhu *et al.*, 2020) which led to the global pandemic of Covid-19 (WHO, 2020) in March 2020 had a massive impact on the world economies (Jordà *et al.*, 2020; Ma *et al.*, 2020; OECD, 2020a; Liguori, Winkler 2020), dramatically changing the political and economic environment (Winston, 2020). Since Covid-19 turned out to be a highly infectious virus that can be easily transmitted, and also involving asymptomatic or peri-symptomatic phases (Bai *et al.*, 2020), governments had to adopt lockdown and social distancing measures (Glass *et al.*, 2006) to combat the spread of the virus, in order to also attenuate the pressure on the healthcare system. This

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1. The present paper is an in-depth analysis within the research line of the Centro Studi delle Camere di commercio "Guglielmo Tagliacarne" on the territorial impact of the Covid-19 crisis on the business demography. The views expressed in the article are those of the authors and not of the institution they are affiliated with. The Authors thank Carmine Pappalardo for valuable suggestions and the partecipants of the AISRe Conference 2020.

has led to a particular shock that has affected up to one third of GDP in the major economies (OECD, 2020b).

Currently, policies have been focusing on protecting the existing industries and employment, with less attention to the future of economic activities, such as startups (Kuckertz *et al.*, 2020). The important role of startups in job creation is widely recognized in the literature (more recently, e.g., Fritsch, Wyrwich, 2017), as well as the negative economic consequences of a decline in startups during a recession (Sedláček, 2019; Ayres, Raveendranathan, 2016; Gourio *et al.*, 2014).

The combination of the Covid-19 pandemic and the lockdown measures represents an unprecedented situation that has still not been addressed in the entrepreneurship literature. Recently, Sedláček and Sterk (2020) studied the effect of the decline in startups on employment in the United States in view of the Covid-19 crisis, as well as Karimov and Konings (2020) for Belgium; and Kuckertz *et al.* (2020) analyzed the effect of lockdown on the survival of startups. For Italy, some scholars have studied the effects of Covid-19 by the economic geography perspective investigating the role of the geographical concentration of economic activities (Ascani *et al.*, 2020), the socio-economic and environmental factors (Musolino, Rizzi, 2020), and the relationship with the startups activity (Pini, Rinaldi, 2021).

This paper aims to enrich this new strand of literature on the connections between entrepreneurship and Covid-19 under the lenses of the economic geography by estimating, for Italy, how many employment opportunities have been missed because of the decrease in startups during the two-months of lockdown (March-April 2020).

Being the first country in Europe to be hit, Italy is one of the countries most affected by Covid-19 and the consequences of the lockdown on the new entrepreneurship were very evident: in the two-months March-April 2020, new business applications fell by 45.1% compared to the same period of the previous year.

The remainder of the paper is structured as follows. Section 2 reviews the literature about the role of the startups activity for the economic system. Section 3 presents the background. Section 4 illustrates the data. Section 5 describes the method. Section 6 presents the results. Section 7 concludes.

2. Literature Review

The positive effect exerted by startups on employment growth is widely recognized in the literature (Fritsch, Wyrwich, 2017; Doran *et al.*, 2016; Fritsch, Schroeter, 2011; Fritsch, Mueller, 2008). Despite new firms undergoing a high failure rate in the short-term, the surviving firms grow faster in the long-run than the average existing firms (e.g., Haltiwanger *et al.*, 2013; Fort *et al.*, 2013).

In the current period of economic recession, the downside is that a decline in startups may have negative effects on employment, as it may lead to a persistent void in aggregate employment (e.g., Gourio *et al.*, 2016; Sedláček, 2019). This is because a lack of new firms today means fewer older firms in the future, which contribute the most to employment levels (Sedláček, 2019). In fact, some scholars have highlighted the relationship between the slow recovery of firm entry and the slow recovery of employment (e.g., Elsby *et al.*, 2011; Jaimovich, Siu, 2014; Haltiwanger *et al.*, 2013).

Many studies have focused on the effects of the decline in startups on employment during the Great Recession in the United States (US). Sedláček (2019) found that if the firm entry had remained constant, the level of unemployment would have been 0.5 percentage points lower over 10 years after the crisis. Gourio *et al.* (2014) studied the long-run effects of a decline in startups on employment levels, finding that the reduced entry rate resulted in a loss of 1.7 million jobs between March 2006 and March 2011, compared to a loss of only 500,000 between March 2006 and March 2009. Ayres and Raveendranathan (2016) also highlighted the strong relationship between startup rate and employment, estimating that 22% of the difference in the employment levels per labor force participant between March 2012 and March 2007 (pre-recession period) was due to the lack of firm entry.

With specific reference to the Covid-19 pandemic and the related lockdown, Sedláček and Sterk (2020) studied the effect of the disruption in startups activity on US employment. Focusing on three margins corresponding to the number of startups, the growth potential, and the survival rate, they estimated that a reduction in these margins for one year to their minimum levels since 1977, would lead to a 1.1% aggregate employment reduction in 2020. More specifically, they developed a calculator to compute the long-term effects on employment caused by different scenarios related to the above three margins.

Lastly, several studies have studied the impact of the Covid-19 and the lockdown on unemployment (e.g., Kong, Prinz, 2020; Gregory *et al.*, 2020), as well as on employment by combining epidemiological and macroeconomic models (e.g., Kaplan *et al.*, 2020; for a literature review, see Bank of Italy, 2020).

For Italy, there are some studies analyzing the phenomenon under the lenses of the economic geography through analyses at the provincial level: Ascani *et al.* (2020) investigated the relationship between the spread of Covid-19 and the geographical concentration of economic activities finding positive results; Musolino and Rizzi (2020) analyzed the influence of demographic, socio-economic and environmental factors (always on the spread of Covid-19), finding significant effects exerted by several variables such as ageing population, commuting, pollution; while Pini and Rinaldi (2021) found a high significant effect

of the spread of Covid-19 on the decrease in startups, but not on the level of firms closures.

3. Background

3.1. The Covid-19 Pandemic in Italy

On 31 December 2019 the World Health Organization (WHO) was informed about cases of pneumonia of an unknown cause in Wuhan (China) and on 7 January 2020 the Chinese authorities informed the World Health Organization about a novel coronavirus (2019-nCov) that had not previously identified in humans, which was subsequently named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses on 11 February: the disease caused by SARS-CoV-2 was officially named as coronavirs disease 2019 (Covid-19) by WHO. Covid-19 can cause mild illness, moderate and severe pneumonia, respiratory failure, and death (Centers for Disease Control and Prevention, 2020).

In March 2020 the cases increased outside China, and Europe became the epicenter of the epidemic involving over 40% of globally confirmed cases. On 11 March the WHO announced that the outbreak had become a pandemic (WHO, 2020).

At the end of February cases of Covid-19 started to spread in Italy, and the number of cases increased exponentially. Italy was the first country in Europe to have an outbreak of Covid-19 and is one of the most affected countries. According to WHO data, as of 7 June 2020 (we consider the spread of virus during the first months of pandemic that are the most intensive), with over 200,000 cases, Italy is the seventh country in the world in terms of the number of Covid-19 confirmed cases, after the United States, Brazil, Russian Federation, United Kingdom, India and Spain, and the fourth in terms of the number of deaths (33,846 in Italy), after the United States (109,038), United Kingdom (40,465) and Brazil (35,026).

Within Italy, the Covid-19 outbreak originated in Lombardy, where, as of 7 June 2020, almost 40% of the total number of cases in Italy are concentrated. This amounts to 8.9 cases per 1,000 inhabitants compared to the national average of 3.9 (Table A1). Other northern regions also registered high values in relative terms, such as Piedmont (7.1 cases per 1,000 inhabitants), Trentino-South Tyrol (6.5), Liguria (6.4), Emilia-Romagna (6.2), in addition to the highest value in Aosta Valley (9.5). In central Italy Covid-19 spread especially in Marche (4.4 cases per 1,000 inhabitants); while in southern Italy, all regions recorded a lower

number of cases per 1,000 inhabitants than the national average, also in most areas with a value of less than one.

3.2. Non-Pharmaceutical Interventions in Italy

In Italy, in the light of its exponential diffusion, policymakers were forced to adopt lockdown measures to curb the transmission and attenuate the pressure on the public health system.

On 23 February 2020 Italian Government takes the first emergency policy through a decree introducing a quarantine to the most affected municipalities of the regions of Lombardy and Veneto. In the light of the exponential growth of the infections, on 4 March 2020, the Italian government suspends meetings, events (including sporting events), shows (including the cinema and theatre), teaching activities in schools and universities, in the whole country besides other restrictions, and promotes flexible workplace practices whenever possible. On 8 March with a new decree the Government imposes lockdown measures (e.g., limitations to people's mobility and prohibited gatherings in public places) in the region of Lombardy, in five provinces of Piedmont, five provinces of Emilia-Romagna, three of Veneto, and one of Marche, involving about one quarter of the Italian population. On 9 March the lockdown measures are extended to the whole country with a decree known as *#Io resto a casa (#I stay home*). On 11 March the Government suspends all retail trade activities (except food and primary goods, pharmacies and parapharmacies), bar and restaurant activities (except for deliveries), and personal services (except for laundries and funeral services). On 22 March nearly all economic sectors were temporarily suspended, and this suspension was extended by subsequent decrees until 3 May, with the exception of activities considered "essential" to the survival of the population and to the operation of the healthcare system. Only children's clothing shops, stationaries, book shops, and the forestry and wood industry were allowed to reopen from 14 April.

3.3. Startups Evolution in Italy in the Months of Lockdown

We consider March-April 2020 as the period of lockdown in Italy in the light of the following evidence: i) data on startups are monthly; ii) as explained above, the first measure in Italy of the lockdown in 2020 was in early March, and the end of lockdown was between the end of April and the beginning of May.

According to the Business Register data of the Chambers of Commerce, in this period startups decreased by 45.1% compared to the same period in the previous year (Unioncamere, 2020a) (Figure A1). This is the highest reduction in the last ten years (since monthly data have been available), and the magnitude

indicates the potential risk of losing a generation of firms. It appears that the lockdown affected the setting up of firms more than the closures, as the latter even decreased. However, in terms of closures, the stay-at-home orders might have attenuated the decision to close down a firm, in addition to the government measures implemented to sustain business activities (Restore Liquidity Decree, suspension of tax payments, etc.).

The decline in startups affected all regions (the largest administrative unit) in Italy, but particularly those in the center and north, where Covid-19 spread the most. The region with the greatest decrease in startups was Lombardy (Figure A2), the same region most affected by Covid-19. In fact, we found a significant and negative regional bivariate correlation between decrease in startups and Covid-19 cases per 1,000 inhabitants ($\rho = -0.4$, p-value<0.10).

4. Data

To estimate the impact of the decline in startups on missed employment we combine different data sources: the Italian Business Register of the Chambers of Commerce; the Statistical Archive of Active Enterprises; and the Labor force survey of the Italian National Institute of Statistics (Istat).

The Italian Business Register, managed by Infocamere (IT Company for the Italian Chambers of Commerce) is an administrative data source which provides data on new business applications and closure of businesses in Italy (www.infocamere.it). The register was established in computerized format from 1993 and it represents a unique case across Europe. This Register is the country's most updated source of business demography since it provides monthly data with a lag of about 15 days from the reference month. Thus, this data source allows us to analyze the evolution of startups during the months of lockdown.

The Statistical Archive of Active Enterprises of Istat represents the official statistics for Italy on enterprises and related persons employed (www.istat.it/it/archivio/216767), reference for Eurostat statistics. This archive is used as information base to reproduce census data since it provides information on enterprises and persons employed integrating administrative and statistics data available in Italy. For this reason the data have a lag time of about a year and a half from the reference year. Data are annual. This archive provides information on persons employed through a Linked Employer-Employees Database (Leed) process. The data are detailed by several structural information including the firm's birth date. Thus, this data source is important to study the employment in the startups.

The Labor force survey is conducted by Istat aimed at estimating the main aggregates of the labor supply, employed and unemployed. The survey is continuous since the information are collected every week of the year; it involves

each year a sample of over 250,000 households, representing 600,000 individuals who are resident in Italy (Istat, 2006). The main features of the survey are harmonized at the European level, and consistent with the International standards defined by the International Labor Organization (ILO), and are defined by specific regulations of the Council of the European Commission. The survey is inserted in the National Statistical Program and the results are part of Eurostat statistics. At the regional level (NUTS-2) data are quarterly and annual. For our purposes, the survey provides detailed information on previous status of the employed people helping us to estimate the new employment generated by the startup entrepreneurs.

5. Method

According to the data of the Business Register of the Chambers of Commerce, we calculated the change in startups. First, we calculated, for each region *i*, the absolute change in startups ΔS that occurred in the two-months March-April 2020 on the same period of the previous year:

$$\Delta S_i = S_{it_1} - S_{it_o} \qquad [1]$$

Where t_1 indicates the two-months March-April 2020 and t_0 indicates the two-months March-April 2019.

Second, we calculated, for each region *i*, the theoretical change in startups Δ*ST* that would have occurred in the two-months March-April 2020 on the same period of the previous year assuming a scenario without Covid-19 pandemic. We estimated the regional theoretical values of the startups in March and April 2020 through X-12-ARIMA program (U.S. Census Bureau, 2011, see also Box, Jenkins, 1976) using a time series starting from January 2010. We used a specific SARIMA specification in order to properly model the high level of seasonality of the time series (peak in March and bottom in August). Specifically, SARIMA(*p d q*)(*P D Q*) where: (*p d q*) refers to the orders of the nonseasonal autoregressive (AR), differencing, and moving average (MA) operators, respectively; and (*P D Q*) refers to the seasonal autoregressive, differencing, and moving average orders. Each region has a specific seasonal ARIMA specification: the best ARIMA model for each region shows an average forecast error over last year below 10% (in six regions less than 5%); for Italy it is 3%. In all cases we accepted the null of no autocorrelation of the residuals using the Ljun-Box Q Statistics (Ljiun-Box Q Statistics not significant at 0.01%).

Once analyzed the change in startups during the months of lockdown (actual and theoretical), we estimated the new employment missed related to the startups decrease.

First, according to the data of the Statistical Archive of Active Enterprises, we calculated at the regional level the average size of enterprises born in the year (start-ups). We used the average of startups size in the last three years to smooth a possible high data variability from one year to another. In Appendix (Table A2) we report the average startups size in the last three years according to data availability of the datasource. As robustness check of this choice, we calculated also the average start-ups size on a monthly basis finding for March and April (mean of the two-month period) any particular difference from the yearly data (e.g.: average startup size March-April 2017: 1.4; year 2017: 1.4; March-April 2018: 1.5; year 2018: 1.4)

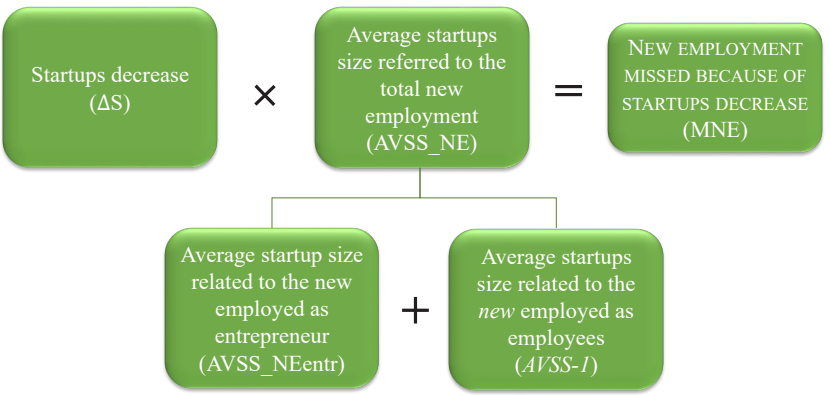
Second, we estimated the *new* employment (*new* means people not employed before working in the startup) generated by startups in each region *i*. Specifically, we estimated the part of the new employment referred to the entrepreneurs and those referred to the employees. We followed the steps below (see also Figure 1):

1) we calculated at a national level the part of the average startup size related to the entrepreneurs as *new* employed (*AVSS_NEentr*):

$$AVSS\_NEentr = 1 * coeff \qquad [2]$$

considering that the value 1 of the average startup size refers to the entrepreneur (regardless of whether he is a new employed or not), *coeff* is the share referred to the entrepreneurs having a status of not employed in the previous year (hence they are *new* employed as entrepreneurs), according to specific elaborations on the Istat Labour force survey data (we considered the average of the shares resulting from the last three Labour force surveys; however the share is revealed quite stable over time ranging from 55.1% and 59.5%). While, concerning the employees in the

Figure 1 – Estimation of the New Employment Missed Because of Startups Decrease



startups, since we have no information on their previous status (whether they were already employed or not employed before working in the startup), it was assumed that everyone is *new* employed. Namely, we assume that the value over 1 of the average startup size ($AVSS_i$–*1*) refers to the *new* employees.

2) so, assuming that the part over the value 1 in the average startups size ($AVSS_i$) refers entirely to *new* employees, we calculated at a regional level the average startups size referred to the total *new* employment (*new* employed as entrepreneur + *new* employed as employees) (*AVSS_NE*) as follows:

$$AVSS\_NE_i = AVSS\_NEentr + (AVSS_i - 1) \quad [3]$$

Finally, to estimate at a regional level the absolute value of the Missed New Employment (MNE) by the startups missed in the two months of lockdown in each region *i*, we multiplied the decrease of the startups (ΔS_i) by the average startups size referred to the total *new* employment ($AVSS\_NE_i$):

$$MNE_i = \Delta S_i * AAVSS\_NE_i \quad [4]$$

from which we can calculate the share of the *new* employment missed because of the startups decrease in the two-months March-April 2020 on the theoretical employment (TE_i):

$$Empl\_miss_i = \frac{MNE_i}{TE_i} \quad [5]$$

where TE_i is obtained by multiplying the theoretical number of startups related to a scenario without Covid-19 pandemic (as above explained) by the average startups size referred to the total *new* employment (*AVSS_NE*).

6. Results

6.1. Baseline Results

In the two-months of lockdown (March-April 2020) the startups diminished by 45.1% in comparison to the same period of 2019 (Figures A1-A2). Table 1 reports the results of the missed new employment, of which first preliminary analyses were published in Pini and Rinaldi (2020). Missed employment refers to the new employment opportunities not created because of the decrease in startups in the two-months March-April 2020 on the same period of the previous year. Theoretical employment refers to the employment that would have been generated by a flow of startups between March-April 2020 in a scenario without the Covid-19 pandemic. We estimated that 31,400 people had missed out on employment, corresponding to 46.2% of the theoretical employment.

Table 1 – Employment Missed for Startups Decrease in the Lockdown Period on Italy by Region

Regions	*Employment Missed (Thousand)*	*% on Italy*
Piedmont	2.2	7.1
Aosta Valley	0.0	0.1
Lombardy	6.4	20.4
Trentino-South Tyrol	0.5	1.6
Veneto	3.2	10.2
Friuli-Venezia Giulia	0.4	1.3
Liguria	0.7	2.2
Emilia-Romagna	3.6	11.6
Tuscany	2.5	8.1
Umbria	0.3	0.9
Marche	0.9	2.8
Lazio	4.3	13.6
Abruzzo	0.5	1.5
Molise	0.1	0.2
Campania	1.8	5.6
Apulia	1.8	5.6
Basilicata	0.1	0.2
Calabria	0.6	1.9
Siciliy	0.9	3.0
Sardinia	0.6	1.9
Italy	31.4	100.0

Note: Employment missed refers to the new employment not realized because of the startups decrease in the two-months March-April 2020. The data of Aosta Valley is less than 100.

Source: Authors' estimations

Lombardy is the region that lost the most: both in absolute terms with 6,400 people missing out on possible employment (1st region), and in relative terms since this value represents 56.8% of the theoretical employment (1st region) (Figures 2-3). More generally, the central-northern regions showed the highest values. The top-four regions by absolute values of employed people missing out on possible employment are all central-northern, as well as in terms of the percentage on theoretical employment: Lombardy, Lazio, Emilia-Romagna and Veneto in the first case; Lombardy, Marche, Tuscany and Lazio in the second

case. Thus, the employment potentially missed occurred in the most developed Italian regions, considering that all the above-mentioned regions have a GDP per capita that is above the national average (source: Istat). Moreover, the regions displaying the highest values are also those most affected by Covid-19.

We found a high regional bivariate correlation between the employment missed and the number of Covid-19 cases (ρ=0.8, p-value<0.01).

Figures 2-3 show that most regions (14 out of 20) are situated above or below the national average in both indicators (absolute values and in percentage terms). This is the effect of the Covid-19 pandemic on the startups decline (ρ = –0.4, p-value<0.10). Analyzing this relationship using relative values, we also found a positive and significant regional bivariate correlation between the percentage of employment missed on the theoretical employment, and the number of Covid-19 cases per inhabitants (ρ = 0.5, p-value<0.05) (Figure 4).

6.2. The New Employment Missed During the Months After the Lockdown

The strong startups decline registered in the two-months of lockdown (March-April) continued also in May with a decrease by 37.7% compared to the same month in the previous year. Then the startups decline started falling gradually in June and July (respectively –7.2% and –2.4%), arriving to register an increase in August (+1.5%) and no change in September. Nevertheless, in the last three months of 2020 the startups trend turned negative (around –8% in October and in November; –15.3% in December), also in view of the worsening of the epidemiological crisis, causing especially in November and in December new lockdown measures (e.g. restrictions for bar and restaurant activities) even if lighter than those of the March-April. This new scenario deteriorated the general climate of confidence. In this regard, we underline the existence of a strong relationship between firm births trend on the one hand, and the business and consumer confidence index on the other hand (Unioncamere, 2020b) (Figure 5) (we found the same relationship also using the Social Mood on Economy Index elaborated by Istat based on the tweet).

On the basis of the startups trend in the months after the lockdown, we estimated (with the same methodology) also the employment missed because of the startups decrease for the entire period of 2020, namely from March to December. The results indicate a value of 54,100 people missing out on possible employment, of which nearly two-thirds (58%) referred to the two-months of lockdown (March-April 2020) (Figure 6). This total value corresponds to 2% of the total unemployed people in Italy.

Figure 2 – Regional Ranking on the Basis of the Absolute Values of Employment Missed for Startups Decrease in the Lockdown Period in Italy

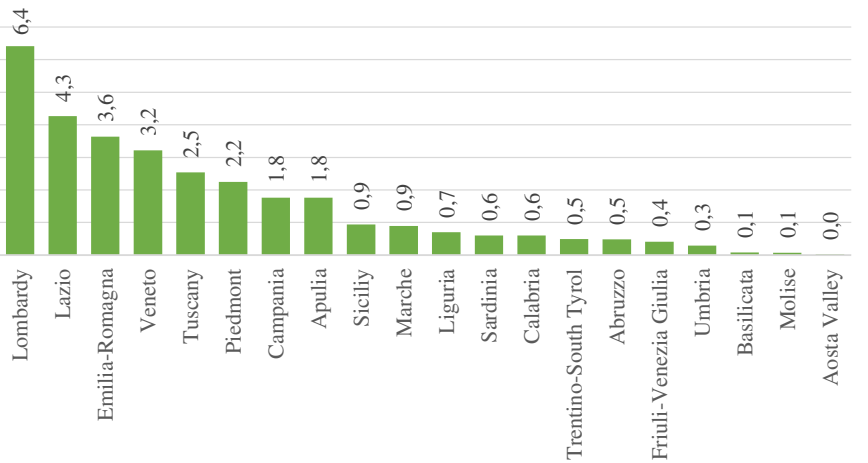
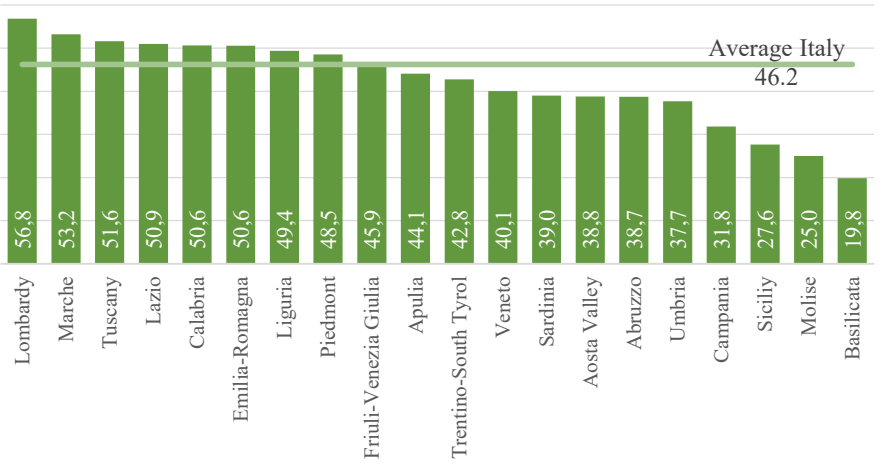


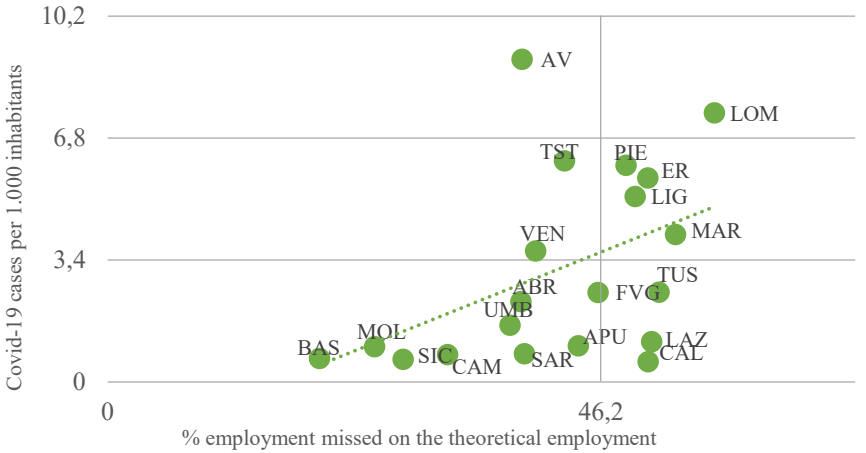
Figure 3 – Regional Ranking on the Basis of the Percentage of Employment Missed for Startups Decrease in the Lockdown Period in Italy on the Theoretical Employment



Note: Employment missed refers to the new employment not realized because of the startups decrease in the two-months March-April 2020. Theoretical employment refers to employment generated by the flow of startups in the two-months March-April 2020 in a scenario without Covid-19 pandemic.

Source: Authors' estimations

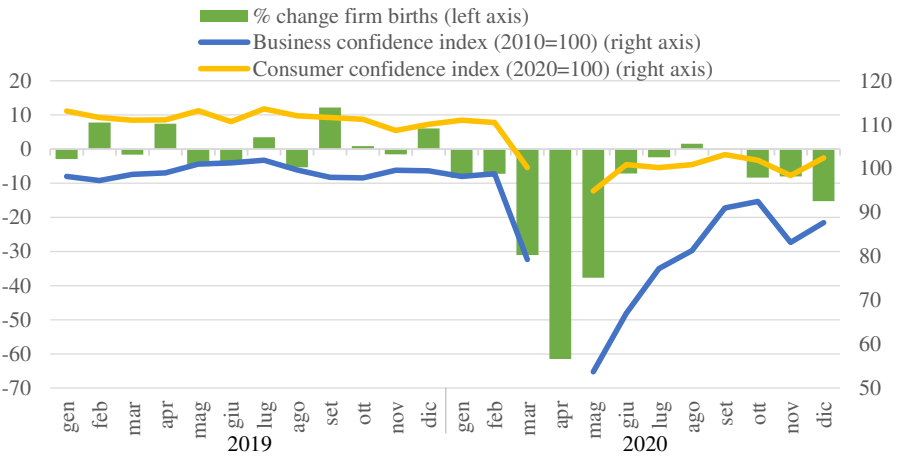
Figure 4 – Employment Missed for Startups Decrease in the Lockdown Period and Covid-19 Cases in Italy by Region



Note: Employment missed refers to the new employment not realized because of the startups decrease in the two-months March-April 2020. Theoretical employment refers to employment generated by the flow of startup in the two-months March-April 2020 in a scenario without Covid-19 pandemic. Covid-19 cases until 30 April 2020. For each indicator, the horizontal and the vertical line is situated in correspondence to the national average.

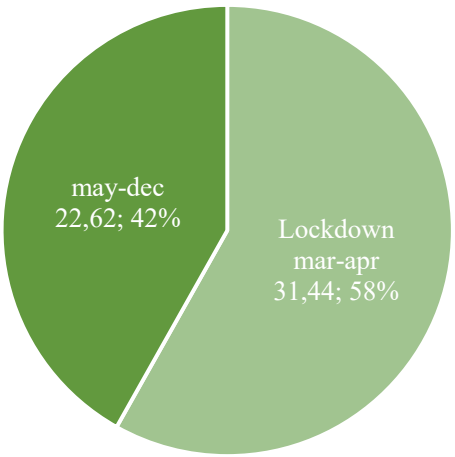
Source: Authors' estimations

Figure 5 – Firm Births Trend in Italy and Business and Consumer Confidence Index



Source: Authors' elaboration on Unioncamere-Infocamere and Istat data

Figure 6 – Employment Missed for Startups Decrease in the Lockdown Period and in the Following Months of 2020



Source: Authors' elaboration on Unioncamere-Infocamere and Istat data

7. Conclusions

This paper estimates the missed new employment opportunities related to the decline in startups during the months of lockdown in Italy (March-April 2020) at the regional level. To the best of our knowledge, to date in the literature there are very few studies about the Covid-19 influence on the economy from the entrepreneurship perspective.

We estimated that 31,400 people missed out on employment opportunities because of the startups decline in the months of lockdown. This corresponds to 46.2% of the theoretical employment that would have been generated by a flow of startups in a scenario without the Covid-19 pandemic. Lombardy shows the highest values in both absolute and relative terms. Moreover, considering also the startups trend during the following months of the 2020 after the lockdown, we estimated 54,100 people missing out on possible employment with reference to the entire period March-December 2020, corresponding to 2% of total unemployed people in Italy.

Despite the southern regions registered a smaller decrease of startups decline, however we underline that the corresponding missed new employment in this area has a stronger effect (than in the north-central regions) in view of its higher unemployment.

The first message that emerges from the results is the strong effect of the lockdown on the setting up of firms. This highlights the employment opportunities missed as well as the potential threat to the overall level of innovation in the economic system that new firms tend to promote. One recommendation that we propose to policy makers is the need to also sustain entrepreneurship, especially in the post-lockdown months in order to recover the decline in startups, and to prevent a lost generation of firms.

The effects provided by startups to the economy are several: i) in terms of productivity growth, innovation and job creation (Nielsen *et al.* 2020; Liu *et al.* 2020); ii) in the specific case of a recession, a decline in startups may generate persistent effects at the macroeconomic level (e.g., Sedlácek, Sterk, 2017, Gourio *et al*., 2016) because of a "missing generation" of firms (Clementi, Palazzo, 2016; Siemer, 2016); ii) the speed of recovery post-crisis also depends on firm entry (Clementi, Palazzo, 2016). In view of these considerations, Italy cannot afford a lost generation of firms since its low level of innovation, however with wide differences across regions (Pini, Quirino, 2017), and the weak structural economic growth.

In the current scenario the support of policy makers is determinant because this crisis is involving radical changes that may discourage new entrepreneurs, raising the sense of competition and creating new challenges (OECD, 2020c). Specifically, besides the various financial incentives (e.g. tax reduction, government bank guarantees, subsidies) and the reduction of the administrative burdens – which would help counteract the uncertainties in times of crisis –, may be important: i) favoring the increased awareness concerning the new business opportunities related to the new needs that have emerged from the crisis (Fairlie, 2020); fostering both entrepreneurial training in line with the challenges of the new global scenario, and university-business collaborations to facilitate the transition from universities to entrepreneurship; iii) investing in incubators and accelerators helping new potential entrepreneurs to overcome barriers related to the lack of trust as well as of knowledge of the new market demand and global challenges.

The final goal is to support a type of entrepreneurship: i) more opportunity-driven (instead of necessity-driven); ii) more equipped with the appropriate skills to address the new challenges of the competitiveness (recently, on the new challenges of the recovery, see Esposito, 2020) by focusing on innovative processes, innovative products that would really boost the economy (Padilla, Petit, 2020) in line with the new demand that has been profoundly changed by the crisis; iii) more based on a greater work and production flexibility. For such purposes, the digitalization is an essential factor, because the recovery will have to go through the digital transition as recently recognized by the EU Next Generation program

(European Commission, 2020), which could play a key role also in the entrepreneurship field. In this regard, the preliminary results of a survey carried out by Unioncamere (2020c) on Italian manufacturing firms show that the share of firms that will be to return to pre-Covid production levels by 2022 is higher for those who are increasing their level of digitalization (digital business models, digital skills, etc.) compared to the others (67% vs 55%).

All these considerations should be designed under the lens of geography: if on one hand the startups decline most occurred in the north-central regions (more developed), on the other hand the policy indications above explained should primarily focus on southern regions (less developed) for several reasons. First, southern regions suffer of a gap of digitalization and innovation, also in the startup field: for instance, there is a less diffusion of innovative startups (at the end of 2020, south: 15 per 100,000 inhabitants vs 23 in the case of north-central regions: source: Infocamere for innovative startups and Istat for population). Second, in southern regions the startup activity is most driven by necessity than opportunity. Third, in southern regions the firms' death rate is higher. Thus, supporting the born of competitive startups is determinant to favor the economic territorial convergence because, right now, there is a risk of an increase of the widening economic gap between more developed and less developed Italian regions (Meliciani, Pini, 2020): indeed, the recovery in 2021 is expected to be stronger in the north-central regions than in the southern ones (+1.2% vs +4.5%) (Svimez, 2020).

Despite the difficult economic period, adversity often leads to opportunities: looking at the past, we discover that over half of the companies on the 2009 Fortune 500 list were set up during a recession or bear market (Stangler, 2009). Thus, the role of regional governments and institutions in favoring this new entrepreneurship, through for instance one-stop support shops (European Commission, 2020), such as those managed by Chambers of Commerce, is particularly important.

This analysis represents a first step in a potentially fruitful line of research. The study presents several limitations. First, we assume that firms that might have been started would have had the same employment potential as existing startups. Second, we did not take into account the failure rate of the firms that might have been started, thus negatively influencing the job creation. Moreover, we should also to take into account also the future possible effects of a job loss when the layoffs block (in force since the beginning of the crisis) will finish.

Future research could extend the analysis in at least two directions: studying the impact of lockdown and Covid-19 pandemic with particular regard to women entrepreneurship (for first analyses see Unioncamere, 2020d) and to youth entrepreneurship; studying the territorial differences in the recovery of startups activity together to the firms' resilience (on the basis of the firm deaths), in the post-lockdown months.

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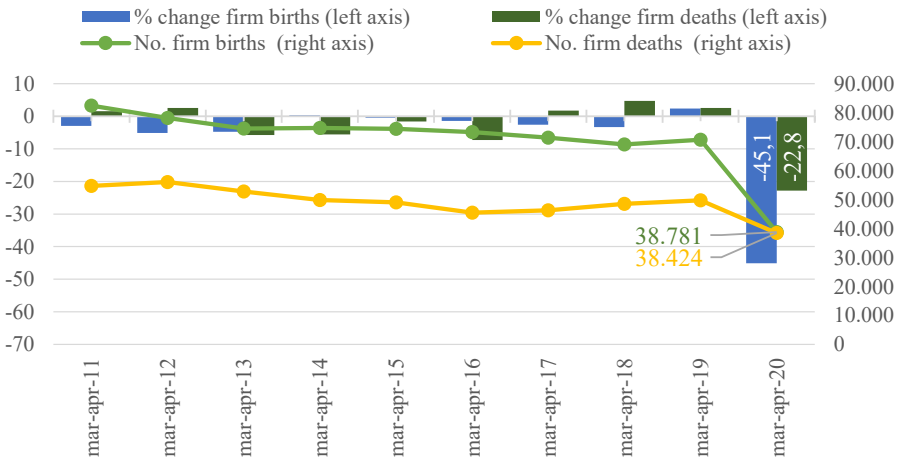
Sommario

***Lockdown* e riduzione delle *startup* nelle regioni italiane: la nuova occupazione mancata**

Nel presente contributo si analizza l'impatto del lockdown in Italia (marzo-aprile 2020) sulla riduzione della natalità imprenditoriale a livello regionale e viene stimata la relativa nuova occupazione mancata. Nel bimestre marzo-aprile 2020 il numero delle iscrizioni di impresa si è ridotto del 45,1% rispetto allo stesso bimestre del 2019, con una maggiore accentuazione nelle regioni settentrionali. La nuova occupazione mancata causata da tale calo delle startup viene stimata in 30.400 persone. Inoltre, sulla base dell'evoluzione della natalità imprenditoriale nei mesi successivi al lockdown, si stima una mancata occupazione di 54.100 persone per l'intero periodo marzo-dicembre 2020: un valore che corrisponde al 2% del totale disoccupati in Italia.

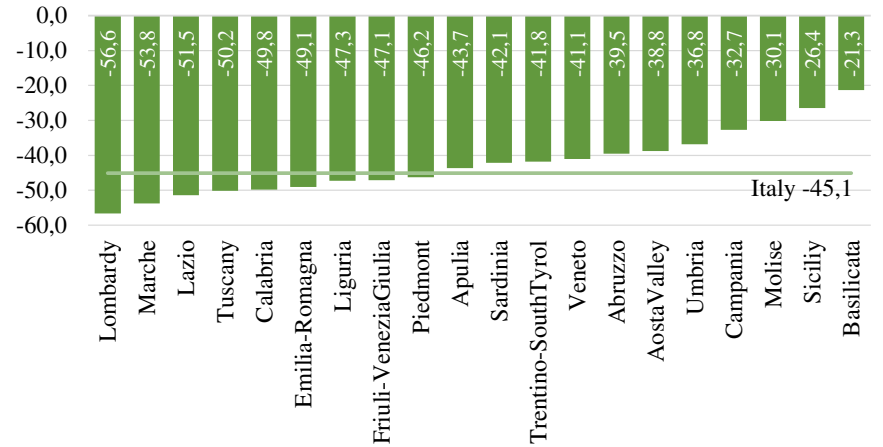
Appendix

Figure A1 – Firm Births and Firm Deaths Trend in Italy (Two Months March-April of each Year)



Source: Authors' elaboration on Unioncamere-Infocamere

Figure A2 – Percentage Change of Firm Births in March-April 2020 Compared to the Two Months March-April 2019 in Italy by Region



Source: Authors' elaboration on Unioncamere-Infocamere

Table A1 – Covid-19 Cases in Italy by Region (Updated to 7 June 2020)

Regions	*No. cases*	*% of the total*	*Per 1,000 inhabitants*
Piedmont	30,855	13.1	7.1
Aosta Valley	1,191	0.5	9.5
Lombardy	90,195	38.4	8.9
Trentino-South Tyrol	7,038	3.0	6.5
Veneto	19,183	8.2	3.9
Friuli-Venezia Giulia	3,283	1.4	2.7
Liguria	9,812	4.2	6.4
Emilia-Romagna	27,908	11.9	6.2
Tuscany	10,135	4.3	2.7
Umbria	1,432	0.6	1.6
Marche	6,745	2.9	4.4
Lazio	7,812	3.3	1.3
Abruzzo	3,265	1.4	2.5
Molise	436	0.2	1.4
Campania	4,826	2.1	0.8
Apulia	4,511	1.9	1.1
Basilicata	399	0.2	0.7
Calabria	1,159	0.5	0.6
Siciliy	3,451	1.5	0.7
Sardinia	1,362	0.6	0.8
Italy	234,998	100.0	3.9

Source: Authors' elaboration on Italian Civil Protection Department and Istat data

Table A2 – Average Startups Size in Italy by Region

Regions	*Year 1*	*Year 2*	*Year 3*	*Average*
Piedmont	1,4	1,5	1,2	1,4
Aosta Valley	1,0	1,1	1,1	1,0
Lombardy	1,5	1,4	1,4	1,4
Trentino-South Tyrol	1,5	1,3	1,4	1,4
Veneto	1,5	1,3	2,9	1,9
Friuli-Venezia Giulia	1,4	1,4	1,2	1,3
Liguria	1,2	1,2	1,2	1,2
Emilia-Romagna	1,4	2,8	1,3	1,9
Tuscany	1,4	1,6	1,4	1,5
Umbria	1,2	1,2	1,3	1,2
Marche	1,4	1,3	1,4	1,4
Lazio	2,1	1,2	1,3	1,5
Abruzzo	1,2	1,2	1,2	1,2
Molise	1,1	1,1	1,3	1,2
Campania	1,2	1,2	1,2	1,2
Apulia	1,2	1,2	1,2	1,2
Basilicata	1,0	1,2	1,1	1,1
Calabria	1,0	1,0	1,1	1,1
Siciliy	1,1	1,1	1,1	1,1
Sardinia	1,1	1,2	1,2	1,2
Italy	1,4	1,4	1,4	1,4

Source: Authors' elaboration on Istat data

PART II – NATURAL DISASTER, ECONOMIC SHOCK AND RESILIENCE

 ISBN 9788835125860

Exploring "Resiliencies" to the Great Crisis along the Peripherality Gradient in Central-southern Italy

Fabiano Compagnucci, Giulia Urso**

Abstract

The notion of resilience has been widely studied over the last two decades in the field of regional studies. Different dimensions have been used so far to proxy it. We suggest that the choice of these variables is not neutral in terms of evaluation of the resilience capacity, depending on the different socioeconomic structure of different territorial contexts. By using municipal data on population, employment, and personal income from 2004 to 2017 of the Abruzzo, Lazio, Marche and Umbria regions, our analysis is meant to provide empirical evidence to our assumptions by investigating the resilience of these regions in the face of the 2007-2008 Great Crisis and the subsequent recovery period. Our study intends to contribute to the production of knowledge on resilience assessment, especially with reference to peripheral areas, which are in most cases already challenged by prolonged slow-burning pressures. Results may eventually fuel both the theoretical and policy debate on the resilience of inner areas.

1. Introduction

The notion of resilience has been widely studied over the last two decades in the field of regional studies, mainly because of the outbreak of the 2007-2008 crisis. Although the Great Recession has affected the entire global economy, it caused asymmetric recessionary shocks at the national, and especially, at the regional and local level (Capello *et al*., 2015; Groot *et al*., 2011). It has eventually resulted in different degrees of the magnitude of the crisis and of the extension of the recovery period depending on the different resilience capacity of places. Many scholars have corroborated these initial findings at various spatial levels: NUTS-2 (Doran, Fingleton, 2016; Crescenzi *et al*., 2016), NUTS-3 (Fratesi, Perucca, 2019; Angulo *et al*., 2018), functional areas (Faggian *et al*., 2018), and municipality level (Geelhoedt *et al*., 2021). Along with various territorial levels, different dimensions have

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been used so far to proxy resilience. Indeed, despite the popularity it has gained both in the political and academic discourse, there is no unanimous consensus about what (regional) resilience precisely is (Stanickova, Melecký, 2018; Muštra *et al*., 2020), neither in terms of definition nor in terms of measurement (Martin, 2012). Resilience is, however, commonly assessed considering three main variables: population, employment rate and GDP (Dubé, Polèse, 2016). Together with Dubé and Polèse (2016), we suggest that the choice of these variables is not neutral in terms of evaluation of the resilience capacity. Each of them, in fact, could proxy different aspects of resilience which peculiarly react to the recessionary shock depending on the concerned territorial context. For instance, assessing resilience on the basis of employees can be more effective when carried out in urban areas than in rural/peripheral ones. Within these latter, the share of retired people is usually much larger, and with it also the share of households receiving an income independently from the crisis. It follows that, when attempting to measure resilience, we must be aware of territorial level we are analyzing, be it composed by regions, local systems, towns or villages (Compagnucci, Morettini, 2020).

Against this background, the aim of this paper is twofold. First, exploiting the spatial classification provided by the National Strategy for Inner Areas (SNAI), the paper empirically investigates how the use of different variables affects the measure of resilience to the 2008 Great Crisis in the territories of the four Italian regions (Marche, Umbria, Lazio and Abruzzo) which were hit by the 2016-2017 earthquake. Second, our research aims at exploring whether using a specific variable or another can be considered more appropriate in assessing the resilience of different territorial contexts, looking at both in-between regional heterogeneity and within regional heterogeneity along the urban gradient, moving from core to more peripheral areas.

The remainder of the paper is structured as follows. After having contextualized the why question of this study within the theoretical debate, we will provide empirical evidence to our assumptions through a descriptive analysis based on municipal data on population (ISTAT), employment (ISTAT) and individual income subject to taxation (Ministry of Economy and Finance) from 2004 to 2017. Relying on previous studies reflecting on the operationalization of the notion of resilience, we will finally discuss the main findings arising from the descriptive analysis about the assessment of resilience especially when investigating inner areas, which, in most cases, are territories already severely challenged by prolonged slow-burning pressures.

2. Resilience of What: The Appraisal of Context

When discussing the concept of resilience several aspects need to be taken into account, hence the complexity of both its conceptualization and empirical

application (Christopherson *et al*., 2010; Martin, Sunley, 2015). Even when limiting the scope to Regional Science and Economic Geography, without contemplating the various interpretations within other domains, a broad agreed-upon definition of resilience of territories still remains far to be reached.

The geographical scale of investigation or more appropriate boundaries to be considered – a crucial dimension, or likely the primary concern, in spatial disciplines – could be controversial and must be carefully pondered. To start with, Faggian *et al*. (2018), for instance, argue that answering three fundamental questions is pivotal to guide research on resilience: 1. resilience "to what?" (referring to the kind – natural disaster, economic recession, etc. – and nature of the shock – acute, one-time or chronic stress (i. e. financial crisis vs. deindustrialization, see Pendall *et al*., 2010); 2. resilience "of what?" (which implies the definition of what we mean by economic system or, more generally, the geographic area to be scrutinized); 3. resilience "over what period?" (in order to assess the ability of a territorial system to resist the shock, bounce back or bounce forward toward new growth paths). We add to this list a fourth question which covers another crucial, lively debated point within the knowledge produced so far on resilience – to which this study aims to contribute to – and further accounts for its complexity: 4. resilience "through what indicator?"

Reviewing the huge literature on the topic (starting from the overview provided by Modica, Reggiani, 2015), the "of what" question seems to be the less investigated or, better, the one less critically scrutinized, given the (also data-driven or taken-for-granted) reliance on administrative (mostly regions) or functional areas (local labour systems). However, we deem instead essential a reflection on the geography of resilience, primarily considering the possibly different spatiality of the alternative measures to proxy it.

This because, as acknowledged for instance by Ward *et al*. (2003) discussing more generally rural development (see also Irwin *et al*., 2010), theoretical and empirical tools, being biased towards urban problem definitions, are in some cases not sufficiently sensitive to account for the peculiarities and performances of non-urban areas.

Also, an over-reliance on a narrow set of indicators could accentuate this issue further. When it comes to resilience this might be the case as well. In fact, as underlined by Fantechi *et al*. (2020), among others, referring to the academic literature on disaster resilience, the majority of studies focus on urban contexts, while research on rural areas is still a residual category that typically does not take into account the geographical characteristics of places. These latter could instead play a key role, like the degree of peripherality or accessibility moving along the urban gradient.

Even analyses at the sub-regional level if, on the one side, do allow for an appraisal of the high heterogeneity of context, on the other side very rarely go beyond the

mere urban vs. rural analytical opposition, having been designed mainly on the basis of urban areas as a reference category. However, resilience may imply different dimensions relative to those which are salient in the case of urban environments and hence be more properly detected through different measures which might better capture the actual ability of non-urban or non-core places to react to a disturbance.

Dubé and Polèse (2016) very well account for this issue in conceptualizing and empirically analyzing resilience. Essentially combining the two questions "over what period?" and "through what indicator?", they assess the resilience of Canadian regions to the 2007-2009 crisis over three phases from a short to a longer-term period (1. resistance, 2. rebound and 3. recuperation) and by means of four standard metrics (1. population, 2. employment, 3. unemployment and 4. employment rate). As largely expected, they found that regional resilience varies depending on the chosen measure.

More interestingly for the purposes of our research, empirical evidence also led to a further reflection: responses to a recessionary disturbance – or any kind of disturbance, we would add – cannot be unequivocally explained for all regions, because context as well matters a lot in revealing the ability of territories to react to a pressure. In the two authors' own words, "*the differing responses to shocks also invite the question whether 'resilience' is a concept uniformly applicable across all regions, big and small, urban and rural, industrial and resource dependant. Should the criteria be the same for a large metropolis like Toronto as for a rural region in Saskatchewan?*" (Dubé, Polèse, 2016: 626).

In the exploratory attempt to answer this question, we assume here that the context-specific socio-economic features of places along the urban – or more precisely peripherality – gradient might influence results in evaluating resilience. Against this backdrop, we thus add a further element of complexity which we deem as highly salient, especially from a regional science and economic geography perspective, to operationalize the notion of resilience: the spatial dimension.

We aim to contribute to the advancement of knowledge in this respect by including also the "of what" question in the framework outlined by Dubé and Polèse (2016) who built on the empirical literature hitherto produced on the topic, by analysing, at a more granular level, the responses of the municipalities of 4 Italian Central regions as classified within the National Strategy for Inner Areas (henceforth, SNAI, see next section), that is according to the travel-time distance from the closest service provision centre(s).

In our study, then, the spatiality issue is not tackled only as a matter of scale – i.e. sub-regional vs. regional – but also as a critical rationale in the exploitation of municipal data – i.e. overcoming the mere urban vs. rural analytical lens. The SNAI classification was utilized in other studies on resilience to the 2008 global financial crisis (Urso *et al.*, 2019), but only for a single-metric assessment.

The value of the present investigation is mainly empirical in nature in the first place, which is namely to understand what measure is more relevant to and more responsive in what territories, hence what "resilience" is more salient in what place along the peripherality gradient. Also, beyond providing insights on the operationalization of the notion from a scholarly perspective, results might help detecting the specific vulnerabilities of territories based on the dimension they are more sensitive to, and hence, policy-wise, they might input policies targeting preparedness and resistance to shocks, limiting their magnitude.

3. Data and Methodology

The empirical section is based on a set of descriptive statistics providing stylised facts on resilience measured through three different metrics in four Italian central (Lazio, Marche, Umbria) and southern (Abruzzo) regions. These regions, and especially their mountain areas, form the macro-region of what is now commonly referred to as the "crater of the Central Italy 2016-17 earthquake". Aiming in the future at investigating also the resilience of the area to this natural disaster as soon as updated data will be released, our research project seeks to realise whether some lessons can be learnt from the past, specifically from the effects caused by the outbreak of the 2007-2008 crisis.

More precisely, our analysis focuses on: a) a different assessment of resilience resulting from the use of different variables for its computation; and b) the kind and level of resilience of the different areas moving along the urban gradient (from poles to ultra-peripheral areas). For the latter point (b), we adopt the classification of Italian municipalities as provided by SNAI, which is based on three breakdowns both for urban and inner areas.

Urban areas are split into 3 categories: A) "poles": single-municipality service provision centres; B) "intermunicipal poles": multi-municipality service provision centres, the main difference with A lying in their capacity to jointly (and not individually) provide education, transportation and health services; and C) their "urban belts": municipalities that are less than 20 minutes far from poles and intermunicipal poles. Inner areas are split into 3 classes as well: D) "intermediate": municipalities that are between 20 and 40 minutes far from poles and intermunicipal poles; E) "peripheral": from 40 to 75 minutes, and F) "ultra-peripheral": more than 75 minutes, areas (UVAL, 2014).

To perform the descriptive analysis, building on the reflections by Dubé and Polèse (2016), we use three different variables at the municipal level to proxy resilience: 1. population (Istat, Atlante Statistico dei Comuni); 2. employment (Istat, ASIA database) – as in Dubé and Polese (2016) – and 3. total individual income subject to taxation according to the normal progressive tax rates set forth

by the financial administration[1]. We were not able to also use GDP, since in the Italian context its estimation is not available at the municipal level.

The eighteen-year period has been further subdivided into three periods with respect to the outbreak of the Great Crisis: the pre-crisis period, between 2004 and 2007, the crisis period, between 2007 and 2009, and the post-crisis period, between 2009 and 2017. Regarding this last period a comment should be made. Even though it can be considered a quite long period after the Great Crisis to assess resilience, it is worth noting that Italy also suffered from the sovereign debt crisis in 2010-2011. The sovereign debt crisis, whose effects lasted until 2014, slowed down a merely embryonic and very fragile recovery process which eventually started only in 2015.

Although the three variables can be alternatively used to describe the resilience capacity of places, as is commonly found in the empirical literature on the topic, each of them can capture different dimensions of resilience, stressing different functions taking place at the local level. More in depth, population trends can be used to describe the capacity of a place to keep its inhabitants, thus pointing to the local/residential function; employment trends, since employees are recorded on the basis of the municipality where they do work, describe the job attractiveness of a place; and finally, total individuals' income denotes the trends in the purchasing power of a given territory.

These different aspects must be taken into account when performing a territorial analysis on resilience. For instance, it is important to consider that for some municipalities the residential function might be more important than attractiveness. In a functional perspective, in fact, considering the metric of local systems or cluster of municipalities, some places can be primarily specialised in hosting households whereas some other can play as local economic engines providing job opportunities. This means that in the first case resident population might be the most affected variable in the aftermath of the shock, whereas in the latter this might be the case for employment.

These metrics will be analysed and compared on the basis of sequential variations (Δ) of annual mean growth, calculated as the geometric mean of annual variations through the following equations:

$$\Delta pop = \left(\frac{pop_{t+k}}{pop_t} \right)^{\frac{1}{k}} - 1 \qquad [1]$$

$$\Delta emp = \left(\frac{emp_{t+k}}{emp_t} \right)^{\frac{1}{k}} - 1 \qquad [2]$$

1. Because of data availability constraints related to "employment" we had to limit our analysis to the period 2004-2017.

$$\Delta \sum inc = \left(\frac{\sum inc_{t+k}}{\sum inc_t} \right)^{\frac{1}{k}} - 1 \qquad [3]$$

In equation [1] we consider the ratio between population at the end of the period ($t+k$) on the value of the population at the beginning of the period (t), we raise the result to the power of one divided by the period length (k) and we subtract one from the subsequent result.

In equations [2], [3] we perform the same calculation using the variables employment (*emp*), and the sum of individual income at municipal level (Σinc)[2].

Building on and partially rearranging Dubé and Polèse (2016), the different trends (under the three scrutinized variables) followed by the selected municipalities can be classified into 8 categories. More specifically, we can consider two blocks of trends: a first block (1-4, see Table 1) includes different crisis and post-crisis trends following a pre-crisis negative variation, whereas in the second block (5-8, Table 1) the pre-crisis variation is positive.

4. Discussion of Results

In 2007, in Abruzzo, Lazio, Marche and Umbria there are 1003 municipalities, most of which are located in inner areas (67,5% against 32,5% belonging to core areas). In terms of population the situation is completely reversed: only 26,2% of the total population live in peripheral areas, while 73,8% in urban ones. Looking at the different typologies identified by SNAI, data show that the most common category is that of intermediate inner areas (43,4%), followed by urban belts (27,7%), peripheral inner areas (20,8%), ultra-peripheral (3,3%), poles (3,1%) and intermunicipal poles (1,7%) (See Statistical Appendix, Table A1 and A2).

A first stylised fact arising from the descriptive analysis revolves around one of the main why question inspiring this contribution. Does considering different variables affect the measure of resilience? Results show that, at the regional level, using population or employees or income leads to different results in terms of degrees of resilience (as identified in Table 1): a resistance trend when using population, or a severely hit trend, when employees or income are concerned. This is true for all the regions considered but Lazio, where employees and population followed a resistance path while total income proved to be severely hit by the crisis (Table 2).

The differences in terms of resilience arising from the choice of one of the three variables, however, become striking when considering the local level. Table 3, which reports the number of municipalities following the same trend independently from the variables used in assessing resilience, suggests that

2. Regional values of population, employment and individual income have been calculated by summing their respective municipal values. In the case of individual income, for the calculation of the regional value, we obviously considered the total amount of individual income at the municipal level and not the mean of the municipal individual income.

selecting different variables affects the measure of resilience. When considering population, employment and total income, in fact, only 48 municipalities (4,8% out of total) follow the same sequential variations, independently from the concerned variable.

Moreover, although the existence of some common macro-pattern related to pre-crisis, crisis and post-crisis periods, the choice of a given variable results in different territorial outcomes, both in the number and the typology of the concerned municipalities (Figures 1 and 2).

As for population trends, among the municipalities following a negative pre-crisis performance, which were 42% out of total, about half of them (208 units) were affected by a systemic declining (– – –) (Tables B, C and D, Statistical Appendix). It is worth noting that 90,1% of these municipalities belong to inner areas (Figure 1), a share which is quite higher than their relative weight on the total number of municipalities. The second most common trend was the one labelled as counter cyclical (– + –), which characterized 170 municipalities. Here again, the phenomenon has affected inner areas more than proportionally.

Concerning the municipalities that were following a positive growth path before the crisis (58% out of total), we find that the most common trends are resistance (+ + +, 302 units) and lagged shock (+ + –, 211 units). Unlike the first block, and particularly regarding resistance (+ + +), these trends are more common in all the typologies of urban areas (poles, intermunicipal poles, and belt areas).

From a regional perspective, each of the four regions behaved accordingly with the average outlined above described. The only difference concerns Umbria region, where systematically declining municipalities were substantially fewer than counter-cyclical ones (Figures 1 and 2).

When considering employment, the picture changes considerably. First of all, the difference between municipalities following a growth path and those following a declining path before the crisis is larger. Municipalities with a negative performance between 2004 and 2007, in fact, amount to 24,7%, which is about half of those showing a declining demographic trend (Tables B, C and D, Statistical Appendix).

Here again the trends with the highest frequencies are those characterised by a systemic declining path (– – –, 96 municipalities) and a counter cyclical one (– + –, 80 municipalities). As for the former, it affected more than proportionally the belt areas, whereas the counter cyclical trend is a feature of mostly all the three classes of inner areas.

Among the municipalities that experienced an employment growth before the crisis, the highest number of them followed the severely hit trend (+ – –), which affected more than proportionally all the typologies of urban areas. On the contrary, the lagged shock trend (+ + –), with 214 municipalities, is not linked with any specific typology of municipalities (Tables B, C and D, Statistical Appendix).

Table 1 – Pre-crisis, Crisis and Post-crisis Resilience Trends

	Trend	Periods (2004-2007)	(2007-2009)	(2009-2017)
1	Systemic declining	–	–	–
2	Turnaround	–	–	+
3	Counter cyclical	–	+	–
4	Positive jolt	–	+	+
5	Resistance	+	+	+
6	Severely hit	+	–	–
7	Standard resilience	+	–	+
8	Lagged shock	+	+	–

Note: + indicates positive sequential variations of annual mean growth; – the opposite

Source: Authors' elaboration building on Dubé and Polèse (2016)

Table 2 – Resilience Trends per Region and Variable

Region	Population	Employees	Income
Umbria	+ + +	+ – –	+ – –
Marche	+ + +	+ – –	+ – –
Lazio	+ + +	+ + +	+ – –
Abruzzo	+ + +	+ – –	+ – –

Source: Authors' elaboration on Istat and MEF data

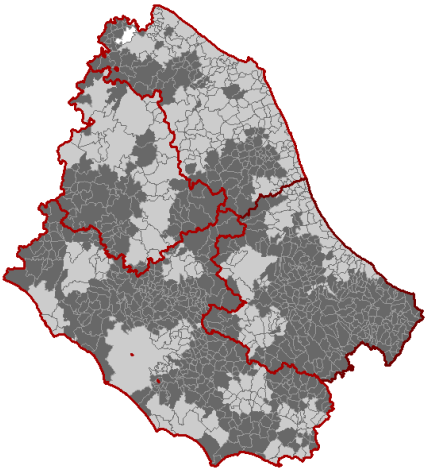
Table 3 – Resilience Trends along the Peripherality Gradient

	Urban areas		Inner areas		Total
	Poles	Belt areas	Intermediate areas	Peripheral areas	
+ – –	0	1	3	2	6
+ – +	0	0	2	0	2
+ + –	0	10	15	4	29
+ + +	1	4	4	2	11
Total	1	15	24	8	48
% on total municipalities					4,8

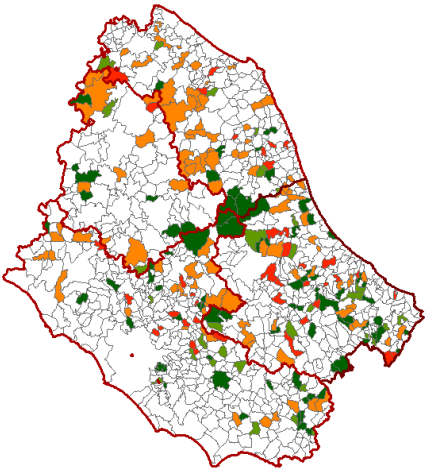
Note: Table 3 reports only the typologies of municipalities within which at least one municipality followed the same trend independently from the concerned variable.

Source: Authors' elaboration on Istat and MEF data

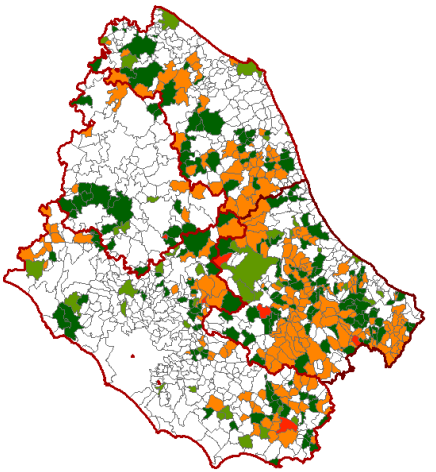
Figure 1 – Post-crisis Trends Following a Pre-crisis Negative Variation



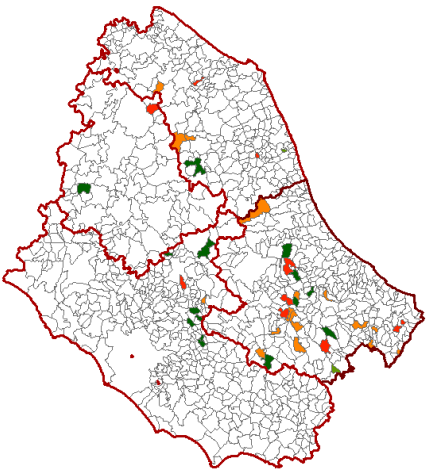
Inner areas: dark grey; Urban areas: grey



Employees



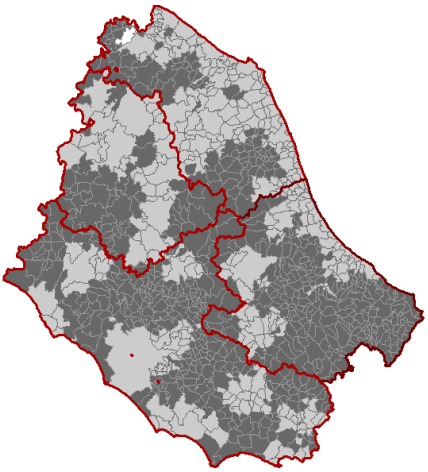
Population



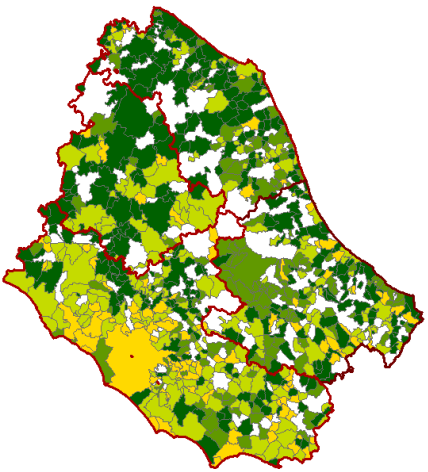
Income

Legend: – – – – – + – + – – + +

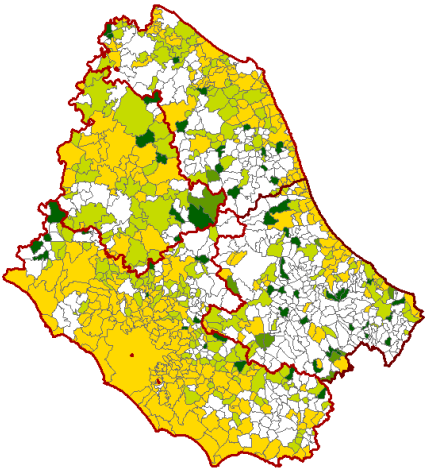
Figure 2 – Post-crisis Trends Following a Pre-crisis Positive Variation



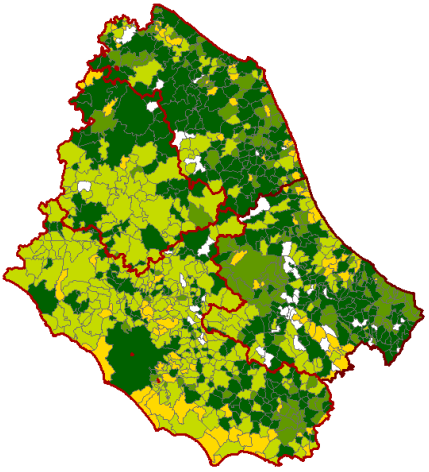
Inner areas: dark grey; Urban areas: grey



Employees



Population



Income

Legend: + – – + – + + + – + + +

Unlike demographics trends, some differences are found across the four regions when considering employment. While Marche and Umbria followed the average trends, some peculiarities distinguish Abruzzo and Lazio. In both regions, in fact, the highest number of municipalities followed the counter cyclical path (– + –). Furthermore, in Abruzzo, unlike the general average and in common with Marche region, we find that the second trend in terms of frequencies was the standard resilience path instead of the lagged shock one (Figures 1 and 2). It will be worth exploring whether this result is related to both the L'Aquila earthquake in 2009 and to the Central Italy earthquake in 2016-17 and to the possible effects arising from the implementation of targeted local policies for recovery.

The analysis of total income trends at the municipal level produces a further different geography. In this case the number of municipalities which followed a declining path before the crisis is a minority, amounting to only 4,3% out of total. As in the previous cases, the most common trends we found are the systemic declining path (– – –, 17 municipalities), which had a more than proportional incidence on peripheral and ultra-peripheral areas, and the counter cyclical one (– + –, 15 municipalities), which had a more than proportional incidence on intermediate and peripheral areas. Finally, regarding the municipalities that experienced a total income growth before the crisis, we find the same patterns found for employment, namely with severely hit trend (+ – –) and lagged shock trend (+ + –) as the most common. In the first case the incidence was higher in poles and intermunicipal poles, but also in peripheral and ultra-peripheral areas. In the second case, the incidence was higher only in peripheral and ultra-peripheral areas.

Finally, looking at the regional scale, the use of the total income variable produces a quite heterogenous outcome. Municipalities of Lazio and Umbria preferentially followed the lagged shock (+ + –) and the severely hit (+ – –) patterns in the same order. In Abruzzo and Marche region, on the contrary, the most common trends were respectively the standard resilience (+ – +) and the severely hit sequences (+ – –) (Figures 1 and 2).

5. Concluding Remarks

Operationalizing the notion of resilience remains a very complex issue. This, however, in our view, does not undermine the explicative power of the concept in examining and interpreting the different reactions of territories to more or less unexpected changes. If this is true, and also in light of a growing abuse of the term outside the scientific debate which might weaken it, much effort is still needed academic-wise in making resilience an effective analytical tool through which producing usable knowledge for policy-making. This is even more compelling due to the huge global shock carried out by the ongoing COVID-19 pandemic, which has made increasingly salient the necessity of a workable definition of resilience (think, for instance, of the National Recovery and Resilience

Plan – PNRR, the name of the Italian investment program within the Next Generation EU, the European plan to respond to the pandemic crisis).

In the attempt to contribute to this endeavour and enrich the literature on the topic, in this article we resume the work made by other scholars in this direction and we add some further elements of reflection on the issue of the empirical investigation of resilience. Engaging with and intersecting two fundamental defining questions when dealing with it – that is the space/scale-related one, i.e. "resilience of what?", and the measurement-related one, i.e. "resilience through what indicator?" – we assess the reaction of different territories located in four central-southern Italian regions (Marche, Umbria, Lazio and Abruzzo) in the face of the 2007-2008 economic-financial crisis. In doing so, we consider the peripherality gradient (made up of six classes from core to ultra-peripheral areas) and three metrics (population, employment and income) in order to ultimately understand which dimension of resilience is relevant to which context.

First of all, as largely expected, the use of different indicators to proxy resilience produces different outcomes. Broadly speaking, i.e. for three of the regions under scrutiny out of four, Lazio, the only one with a metropolitan city within its boundaries, population variation is less sensitive to the recessionary disturbance, hence through this lens the territories under scrutiny are globally resistant. However, if their resilience is measured through employment or income, they seem to be in general severely hit by the shock. In Lazio, while using population and employment as proxies, municipalities proved to be mostly resistant, when looking at income they appear to be severely impacted by the crisis. This very first evidence leads us to investigate further the role of context in explaining resilience. As is intuitively inferable, the appropriateness of the metric used clearly depends on the nature of the stress which is considered (namely, if it is a natural disaster or a recession, for example), but also on the socio-economic characteristics of places. In fact, when coming at the spatial variation of the three "resiliencies" that we explored along the peripherality gradient, as interpreted in this contribution, we find that this is rather large.

As regards resilience measured through population, the territorial factor plays a key role. If the pre-crisis trend was negative, as is mostly the case for inner areas, a systemic decline is detected. Conversely, in the case of a positive pre-crisis population growth, resistance is the most common trend which mainly characterizes core (urban) areas.

Resilience measured through employment proves to be more sensitive in terms of intensity and context variation. Following a pre-shock negative performance, urban belts kept on declining while inner areas showed a counter cyclical trend. In the case of growth trends before the Great Recession, most of municipalities falling in this class, mainly urban areas, were severely affected by the economic stress.

Resilience measured through income displays further specific territorial features, starting from a more positive initial condition, with few municipalities

negatively performing in the pre-crisis period. High-performing territories show the same patterns as the ones detected through the employment metric in the aftermath of the recession, with core areas largely impacted by it and inner areas showing a lag in displaying the effects of the crisis (as also found in Urso *et al*., 2019).

The differing responses assessed through different metrics result therefore in a heterogeneous geography which deserves further attention to be unveiled in its underlying determinants. Given the multiple layers it is made up of, interpretations of results could thus be rather complex. What our findings definitely highlight is the significance of context in the examination of the ability of territories to resist recessionary disturbances, especially when aiming to account for the cases when these combine with vulnerability conditions as the ones connected to peripherality. The evidence that the magnitude of a shock, or the resilience ability of a region, are highly dependent on the type of measurement and of context, calls for a scientific reflection on place-specific indicators better able to capture the peculiarities of the local reaction to more or less abrupt changes, hence informing space-sensitive both preparedness and post-shock recovery policies.

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Sommario

“Resilienze” dell’Italia centro-meridionale alla Grande Crisi lungo il gradiente di perifericità

La nozione di resilienza è stata ampiamente studiata negli ultimi due decenni nel campo delle scienze regionali. In letteratura sono state individuate diverse dimensioni per indagare la resilienza dei sistemi territoriali. L’assunto da cui muove questa riflessione è che la scelta delle variabili utilizzate per descriverla non sia neutra in termini di valutazione della capacità di resilienza, poiché questa può dipendere anche dalla diversa struttura socio-economica dei diversi contesti territoriali. Utilizzando dati a livello comunale sulla popolazione, sull’occupazione e sul reddito delle persone fisiche dal 2004 al 2017 delle regioni Abruzzo, Lazio, Marche ed Umbria, la nostra analisi intende fornire evidenza empirica alle ipotesi formulate rispetto alla Grande Crisi del 2007-2008, contribuendo così a produrre conoscenza sulla valutazione della resilienza. Questo obiettivo assume una rilevanza particolare rispetto alle aree periferiche, che, nella maggior parte dei casi, hanno subito fenomeni di declino socio-economico prolungato.

Statistical Appendix

Table A1 – Number of Municipalities per Region and SNAI Classification

		Poles	*Inter-municipal poles*	*Belt areas*	*Inter-mediate areas*	*Peripher-al areas*	*Ultra-peripher-al areas*	*Total*
Abruzzo	N.	6	4	65	115	84	31	305
	%	2,0	1,3	21,3	37,7	27,5	10,2	100
Lazio	N.	10	0	78	205	83	2	378
	%	2,6	0,0	20,6	54,2	22,0	0,5	100
Marche	N.	11	8	109	75	25	0	228
	%	4,8	3,5	47,8	32,9	11,0	0,0	100
Umbria	N.	4	5	26	40	17	0	92
	%	4,3	5,4	28,3	43,5	18,5	0,0	100

Table A2 – Population per Region and SNAI Classification

		Poles	*Inter-municipal poles*	*Belt areas*	*Inter-mediate areas*	*Peripher-al areas*	*Ultra-peripher-al areas*	*Total*
Abruzzo	N.	362619	67005	415824	330447	125240	21112	1322247
	%	27,4	5,1	31,4	25,0	9,5	1,6	100
Lazio	N.	3399140	0	881741	1374679	238089	4475	5898124
	%	57,6	0,0	14,9	23,3	4,0	0,1	100
Marche	N.	568524	134053	626010	182087	27381	0	1538055
	%	37,0	8,7	40,7	11,8	1,8	0,0	100
Umbria	N.	373330	72166	221701	190436	31275	0	888908
	%	42,0	8,1	24,9	21,4	3,5	0,0	100

Table B – Crosstab between Typology of Municipalities and Total Income Trends

		Poles	*Inter-municipal poles*	*Belt areas*	*Inter-mediate areas*	*Peripheral areas*	*Ultra-peripheral areas*	*Total*
- - -	N.	0	0	2	6	8	1	17
	% inc.	0,0%	0,0%	11,8%	35,3%	47,1%	5,9%	100%
	% mun.	0,0%	0,0%	0,7%	1,4%	3,8%	3,0%	1,7%
- - +	N.	0	0	2	2	5	0	9
	% inc.	0,0%	0,0%	22,2%	22,2%	55,6%	0,0%	100%
	% mun.	0,0%	0,0%	0,7%	0,5%	2,4%	0,0%	0,9%
- + -	N.	0	0	2	8	5	0	15
	% inc.	0,0%	0,0%	13,3%	53,3%	33,3%	0,0%	100%
	% mun.	0,0%	0,0%	0,7%	1,8%	2,4%	0,0%	1,5%
- + +	N.	0	0	1	0	1	0	2
	% inc.	0,0%	0,0%	50,0%	0,0%	50,0%	0,0%	100%
	% mun.	0,0%	0,0%	0,4%	0,0%	0,5%	0,0%	0,2%
+ - -	N.	20	10	92	159	84	23	388
	% inc.	5,2%	2,6%	23,7%	41,0%	21,6%	5,9%	100%
	% mun.	64,5%	58,8%	33,1%	36,6%	40,2%	69,7%	38,7%
+ - +	N.	2	2	57	65	23	5	154
	% inc.	1,3%	1,3%	37,0%	42,2%	14,9%	3,2%	100%
	% mun.	6,5%	11,8%	20,5%	14,9%	11,0%	15,2%	15,4%
+ + -	N.	8	4	77	162	69	4	324
	% inc.	2,5%	1,2%	23,8%	50,0%	21,3%	1,2%	100%
	% mun.	25,8%	23,5%	27,7%	37,2%	33,0%	12,1%	32,3%
+ + +	N.	1	1	45	33	14	0	94
	% inc.	1,1%	1,1%	47,9%	35,1%	14,9%	0,0%	100%
	% mun.	3,2%	5,9%	16,2%	7,6%	6,7%	0,0%	9,4%
Total	N.	31	17	278	435	209	33	1003
	% inc.	3,1%	1,7%	27,7%	43,4%	20,8%	3,3%	100%
	% mun.	100%	100%	100%	100%	100%	100%	100%

Table C – Crosstab between Typology of Municipalities and Employment Trends

		Poles	*Inter-municipal poles*	*Belt areas*	*Intermediate areas*	*Peripheral areas*	*Ultra-peripheral areas*	*Total*
- - -	N.	1	1	35	43	13	3	96
	% emp.	1,0%	1,0%	36,5%	44,8%	13,5%	3,1%	100%
	% mun.	3,2%	5,9%	12,6%	9,9%	6,2%	9,1%	9,6%
- - +	N.	0	0	11	20	5	2	38
	% emp.	0,0%	0,0%	28,9%	52,6%	13,2%	5,3%	100%
	% mun.	0,0%	0,0%	4,0%	4,6%	2,4%	6,1%	3,8%
- + -	N.	0	1	13	38	23	5	80
	% emp.	0,0%	1,3%	16,3%	47,5%	28,8%	6,3%	100%
	% mun.	0,0%	5,9%	4,7%	8,7%	11,0%	15,2%	8,0%
- + +	N.	0	0	4	18	10	2	34
	% emp.	0,0%	0,0%	11,8%	52,9%	29,4%	5,9%	100%
	% mun.	0,0%	0,0%	1,4%	4,1%	4,8%	6,1%	3,4%
+ - -	N.	13	10	98	104	55	10	290
	% emp.	4,5%	3,4%	33,8%	35,9%	19,0%	3,4%	100%
	% mun.	41,9%	58,8%	35,3%	23,9%	26,3%	30,3%	28,9%
+ - +	N.	5	3	46	62	37	1	154
	% emp.	3,2%	1,9%	29,9%	40,3%	24,0%	0,6%	100%
	% mun.	16,1%	17,6%	16,5%	14,3%	17,7%	3,0%	15,4%
+ + -	N.	9	2	53	98	45	7	214
	% emp.	4,2%	0,9%	24,8%	45,8%	21,0%	3,3%	100%
	% mun.	29,0%	11,8%	19,1%	22,5%	21,5%	21,2%	21,3%
+ + +	N.	3	0	18	52	21	3	97
	% emp.	3,1%	0,0%	18,6%	53,6%	21,6%	3,1%	100%
	% mun.	9,7%	0,0%	6,5%	12,0%	10,0%	9,1%	9,7%
Total	N.	31	17	278	435	209	33	1003
	% emp.	3,1%	1,7%	27,7%	43,4%	20,8%	3,3%	100%
	% mun.	100%	100%	100%	100%	100%	100%	100%

Table D – Crosstab between Typology of Municipalities and Population Trends

		Poles	*Inter-municipal poles*	*Belt areas*	*Intermediate areas*	*Peripheral areas*	*Ultra-peripheral areas*	*Total*
- - -	N.	3	0	16	100	70	19	208
	% pop.	1,4%	0,0%	7,7%	48,1%	33,7%	9,1%	100%
	% mun.	9,7%	0,0%	5,8%	23,0%	33,5%	57,6%	20,7%
- - +	N.	0	0	1	3	1	1	6
	% pop.	0,0%	0,0%	16,7%	50,0%	16,7%	16,7%	100%
	% mun.	0,0%	0,0%	0,4%	0,7%	0,5%	3,0%	0,6%
- + -	N.	1	2	36	77	49	5	170
	% pop.	0,6%	1,2%	21,2%	45,3%	28,8%	2,9%	100%
	% mun.	3,2%	11,8%	12,9%	17,7%	23,4%	15,2%	16,9%
- + +	N.	3	1	8	20	8	1	41
	% pop.	7,3%	2,4%	19,5%	48,8%	19,5%	2,4%	100%
	% mun.	9,7%	5,9%	2,9%	4,6%	3,8%	3,0%	4,1%
+ - -	N.	0	0	11	23	17	5	56
	% pop.	0,0%	0,0%	19,6%	41,1%	30,4%	8,9%	100%
	% mun.	0,0%	0,0%	4,0%	5,3%	8,1%	15,2%	5,6%
+ - +	N.	0	0	2	3	4	0	9
	% pop.	0,0%	0,0%	22,2%	33,3%	44,4%	0,0%	100%
	% mun.	0,0%	0,0%	0,7%	0,7%	1,9%	0,0%	0,9%
+ + -	N.	2	5	67	102	34	1	211
	% pop.	0,9%	2,4%	31,8%	48,3%	16,1%	0,5%	100%
	% mun.	6,5%	29,4%	24,1%	23,4%	16,3%	3,0%	21,0%
+ + +	N.	22	9	137	107	26	1	302
	% pop.	7,3%	3,0%	45,4%	35,4%	8,6%	0,3%	100%
	% mun.	71,0%	52,9%	49,3%	24,6%	12,4%	3,0%	30,1%
Total	N.	31	17	278	435	209	33	1003
	% pop.	3,1%	1,7%	27,7%	43,4%	20,8%	3,3%	100%
	% mun.	100%	100%	100%	100%	100%	100%	100%

The High-tech Composite Indicator (HTCI). A Tool for Measuring European Regional Disparities Over Crises

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Abstract

Composite indicators are a tool for territorial economic policy strategies as they allow the dimensional reduction of complex socio-economic phenomena not directly measurable with single elementary indicators. This paper focuses on the measurement and study of high technology in European regions: a new indicator of high-tech is constructed and used for the spatial and temporal analysis. In particular, the proposed indicators consider the period 2006-2016 for regions of Europe. Through the statistical analysis of this indicator have been verified some hypothesis of territorial disparities of high-tech, of their trend and development factors.

1. Introduction

This research provides a new definition and measurement of high technology in European Regions, classified according to NUTS 2 Regulation. A new and innovative composite indicator has been constructed to underline European Regional disparities (in a spatial and temporal comparison) and what are the determinants of the development of high technology.

The period covered in the analysis is from 2006 to 2016. The data source is Eurostat, the Statistical Office of the European Union. The analysis on two levels (spatial and temporal) allows an adequate understanding of the European regional breakdown according to the high technology content, as well as highlighting possible changes over time (particularly in relation to economic and financial crises). What is obtained is a synthetic and robust measurement of this phenomena, expressed as a combination of elementary indicators which, independently, represent specific dimensions of the concept to be measured.

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To structure composite indicators in a proper and transparent way, every step of the construction methodology is deeply studied, different techniques are applied and results compared. It came out that the best method in this case is the Adjusted Mazziotta-Pareto Index (AMPI) because it allows a spatial and temporal comparison, as well as ensuring robust results. The scores of the new computed high-tech indicator (based on AMPI method) have been compared through the construction of maps of European regional geography in order to obtain a discrimination of the different territories in terms of high technology. The results have highlighted a constant disparity between the regions of Eastern and Northern Europe, where the latter are the most performing. Moreover, the crisis of 2007-2008 has negatively affected the whole European regional scenario, slowing its high technology content. However, regions have experienced an increase over time in their level of high-tech (in 2016, have been registered higher index scores).

2. Backgrounds

2.1. Composite Indicators

According to Saisana and Tarantola (2002), a composite indicator is a combination of elementary indicators representing different dimensions of a phenomenon and it is usually applied when a multidimensional concept cannot be measured by a single one. Composite indicators are widely used by various national and international organizations to analyse economic, environmental and social scenarios (i.e., industrial competitiveness, sustainable development, quality of life assessment, globalisation, etc.) (OECD, 2008). Maximum benefits can be obtained if and only if the composite indicator is structured correctly and transparently: just think that each choice made in the construction phase will have a direct impact on both the quality and reliability of the results.

For this reason, ten steps have been defined for the construction of a composite indicator (OECD, 2008; Mazziotta, Pareto, 2017).

2.2. High Technology

The phenomenon of high technology diversifies according to specific factors such as research and development spending, intellectual property rights, specific capabilities but also external and territorial influences. For the construction of composite indicators, this work will focus on various aspects that influence the growth of high technology in European Regions.

The definition of “high technology” is quite complex and several problems have been addressed by the literature to define it, also considering the context

in which it is applied. Although recognised in almost all countries, there is little harmonisation between the various definitions (Joseph, 1988).

However, by reviewing the researchers' definitions, it is possible to give a new characterization of high technology. The concept could uniquely be expressed as the ability of a firm to remain competitive, to renew itself, to be innovative, as well as to steer investment in science and technology and in R&D. On the other hand, from a general point of view, high technology could be interpreted as the tight network of social, political and economic forces that interact each other, leading to economic growth. This new interpretation can be traced back to the common features of the actual literature overview (Porter *et al.*, 1996; Johnson *et al.*, 2010; Steenhuis, De Bruijn, 2006; Erlhoff, Marshall, 2007; Eurostat, 2018; 2020). In addition, thanks to its enormous growth, high-tech arouses considerable economic and social interest. The existing literature has brought to light several definitions, triggering problems related to the understanding of the phenomenon. In addition to this ambiguity, it is essential to determine whether it exists and which are the differences with "digitalization", a concept often associated or used as synonymous. According to Salento (2018), there is a close relationship between high technology and digitalization: the former is seen as a key element for economic development and value creation; while the latter, on the basis of technological progress, should create a society compatible with this progress and avoid the increase of inequalities that lead to significant negative consequences.

3. High-tech Research: Objectives and Data Description

Existing literature discusses various definitions of high-tech. This paper doesn't go through them, which would need extended comments. On the contrary, considering some common characteristics emerging from the literature, some hypotheses are fixed that should hold across different definitions.

The *first* hypothesis is about the fact that the territory plays a prominent role in the development of high technology. Thus, considering Europe, it is expected that regional disparities in high-tech intensities exist, as well as disparities inside the territories of a single country.

The *second* hypothesis is about the localization factors of high-tech. It is expected that high-tech is especially affected from externalities. In particular, high-tech is relevant when some factors are present on the territory like existence of universities, laboratories, large enterprises, services and demographic intensity. Summing up, a complex interaction between social, political and economic forces is the critical positive factor of high-tech.

The *third* hypothesis is that high-tech is a phenomenon leading to economic growth, in particular it implies the ability of a firm to remain competitive, to

renew itself, to be innovative, thus the hypothesis is that a high level of the indicator is a signal of the ability to recover of a territory as well of better resilience in crisis periods.

The aim of the paper is to construct in a rigorous statistical way a high-tech indicator by verifying the above-mentioned hypotheses. The analysis has been carried out using data on socio-economic characteristics at European regional level provided by Eurostat. To support its primary objectives (growth and employment, promotion of territorial cooperation and reduction of the disparity between the European Regions) Eurostat has organised the European Union into territorial units for statistics, establishing the so-called NUTS (Nomenclature of Territorial Units for Statistics) classification[1].

As previously mentioned, among the most important statistics developed by Eurostat are regional statistics. As they are better able to highlight the disparities and similarities between EU Member States than in a comparison between nations, where there is often a risk of comparing small states with large ones, a strong focus has been placed on them in this work. Eurostat provide a wide range of socio-economic data, covering different area: the "science and technology" one is the most interesting to build a composite indicator. In detail, the indicators and filters considered are shown in Table 1.

In the analysis carried out, starting from the NUTS 2 classification, 238 regions belonging to 25 of the 28 Member States of the European Union were taken into account. Due to a lack of data, such countries have been excluded: Greece, Lithuania and Slovenia. Furthermore, candidate countries and potential candidates for accession to the European Union were not taken into account. The analysis period starts in 2006 and ends in 2016. This time period makes it possible to investigate the possible impact of crisis phases on the development of high technology. Moreover, the choice of this period of time allows to have available all the elementary indicators set out in Table 1 and, consequently, to build a more complete picture of the phenomenon under study.

4. Methodology

This section deals with the construction of high-tech composite indicators, followed by the analysis of the results obtained. First, an overview of the theoretical framework has been provided, other than different techniques to select elementary indicators, i.e., those that are sufficient and suitable to describe the phenomenon (Mazziotta, Pareto, 2019a). In fact, by means of multivariate

1. The classification assigns a specific code and name to each territorial unit and subdivides the EU Member States into NUTS level 1 territorial units, each of which is subdivided into NUTS level 2 territorial units, which in turn are subdivided into NUTS level 3 territorial units.

Table 1 – Regional Science and Technology Statistics

Indicator	*Filters*	*Unit of Measure*
Intramural R&D expenditure (GERD)	• NUTS 2 regions • Sector of performance (all sectors)	% GDP
Employment in technology and knowledge-intensive sectors	• NUTS 2 regions • Employed people between 15 to 74 years • High technology sectors (high technology manufacturing and knowledge-intensive high technology services) (NACE classification)	% total employment
Human resources in science and technology	• NUTS 2 regions • People between 15 to 74 years • Tertiary level education (ISCED classification) and/or employed in science and technology • Managers excluded (ISCO classification)	% active population (in 15-74 age group)
EU trademark applications	• NUTS 2 regions	% total population
Community designs	• NUTS 2 regions	% total population

Source: Author's elaborations from Eurostat Regional Statistics

analysis, the variables needed to describe different dimensions of the phenomenon are appropriately selected and inserted in the composite indicator model. The construction process occurs using different methods that are then compared in order to identify the one that meets the requirements of temporal and spatial comparability as well as robust results.

4.1. Composite Indicator Construction

The first step for the construction of the composite indicator is the development of a theoretical framework. A formative model of measurement has been developed in which elementary indicators are the cause of the phenomenon (Mazziotta, Pareto, 2019b).

The elementary indicators of regional science and technology selected have been explained in Table 1 and all of them have positive polarity with the phenomenon (i.e., there is a positive relationship between indicators and "high-tech") and, therefore, no mathematical transformation is required. As previously stated, several studies (in particular Marullo, Perugi, 2011) define high technology through the level of R&D spending, the high technology employment, the specialized human resources and the ability to exploit the results of innovation (i.e., the patents intensity).

In contrast, the importance of the use of industrial trademarks is emphasized by a study conducted by Millot (2009), in which emerges a significant positive relationship between industrial trademarks and a multiplicity of innovation variables (i.e., R&D expenditure and patents) in different sectors. Moreover, the study confirms what many academic researchers have already said: there is a very significant positive correlation between industrial trademarks and the knowledge-intensive service, high technology and para-pharmaceutical sectors.

Furthermore, Mendonça *et al.* (2004) stress the existence of a positive correlation between the use of patents and trademarks: the latter are used more in high technology sectors than in low ones. In this respect, the authors argue that trademarks can be used as indicators of innovation. Instead, Kotro and Pantzar (2002) argue that industrial design, although slightly used for the definition of high technology, is an essential component of innovation. Indeed, the major high-tech companies are significantly engaged in the so-called "cultural reinvention". This means that considering the product design component is fundamental for a company that seeks to achieve market competitiveness by introducing its products as a lifestyle, especially in relation to high-tech products. This is confirmed by an analysis of Assolombarda (2018) and Assolombarda (2019) in which the evaluation of the level of research and development in Europe considers different factors, including industrial designs. In this research, patents are not considered in composite indicator construction, since they are not available for the entire period analysed and the different issues associated.

Afterwards, missing data should be allocated. As stated by Mazziotta and Pareto (2019a), it is advisable to have a database that does not exceed twenty-five percent of the missing data for each indicator and/or geographical area. For this reason, this study excludes countries such as Greece, Lithuania and Slovenia due to a significant lack of data in the variables included in the construction of indicators. The elimination criterium of these areas from the database relies on the missingness of data for more than one elementary indicator over the whole covered period, so that it is impossible to apply an appropriate imputation method.

The current study is based on an imputation method that has been defined as "temporal proximity". Data missing from a specific unit and for a particular variable have been replaced by the value of the variable of the same unit in the following year. In case the subsequent value is not available, the two previous values have been considered, according to the following rules: (1) if the closest temporal proximity value is greater/equal than the second closest previous value, then the missing data has been imputed equal to the first previous temporal value; (2) if the closest previous time value is less than the second closest previous value, then the average of these two values has been used as imputed value.

The next step for the construction of the composite indicator is multivariate analysis. Different methods can be used for an explorative analysis and for the evaluation of the elementary indicators ability to describe the phenomenon. Principal Components Analysis (PCA) is probably considered the most popular one. PCA has been developed for the entire period considered, i.e., from 2006 to 2016, in order to construct the proposed formative composite indicator on high-tech. PCA allows to obtain a small number of principal components that explain most of the observed variance, starting from a large number of quantitative elementary variables. By considering the PCA results, this study has computed the composite indicator by maintaining all five elementary indicators (Table 1). This choice is mainly dictated by the numerous negative aspects related to PCA, including the omission from the model of fundamental variables for the measurement of high technology. In fact, all the variables included in the model explain a particular dimension of the phenomenon and so, it is not appropriate to exclude some of them: each aspect of the high-tech should be analysed in order to provide a synthetic measure able to measure correctly the concept. Furthermore, it should be re-stressed that PCA is based on a reflective model, while the indicator of the observed phenomenon makes use of the formative model.

The selection of variables for the construction of the composite indicator precedes the normalisation phase. The elementary indicators have to be made comparable by stripping them of the unit of measurement. All indicators designed to provide a synthesis of high technology assume positive polarity and are expressed in percentage values, except for community design which are in index number (the Adjusted Mazziotta Pareto Index has been constructed using percentage values of community design applications, community designs and registered community designs): in this way, variables are measureless. As regards the weighting of the elementary indicators, a subjective approach has been used: the equal weight of one has been attributed to all of them.

In order to compare different composite indices an Influence Analysis (IA) is calculated: the aim is to assess the robustness of the methods, in terms of capacity to produce stable measures. In particular, IA wants to empirically quantify the 'weight' of each individual indicator in the calculation of the composite indicator. Given K individual indicators, K replications are conducted, removing each time a different indicator and calculating the values of the composite indicator based on the remaining K-1 indicators. For each replication, the rankings are constructed according to the various methods and, for each region, the absolute differences of rank between the position in the original rank and the position in the ranking for the K-1 indicators are calculated. Subsequently, the arithmetic mean, the standard deviation and the coefficient of variation (CV) of absolute rank differences are computed: obviously, the method with the lowest

coefficients of variation is the most robust because it is less influenced by disturbance factors. The Adjusted Mazziotta-Pareto Index appears to be the most robust over the whole considered period. In fact, the coefficients of variation (CV) of the Influence Analysis of this indicator are the lowest in comparison to the other methods applied[2].

4.2. Results

As regards the results, the general objective of the study is to provide an indicator to measure the level of high technology in each European region and, based on the indicator, make comparisons in terms of space and time to verify the considered hypotheses. To better understand and synthetize the phenomenon at the beginning of the period, during the Great Recession and at the end of the period, an overview is provided for 2006, 2008 and 2016 through geographical maps (Figures 1-3). Subsequently, the trends of the regions have been analysed and an evaluation of the 10 worst and 10 best composite indicator scores in 2006 and 2016 has been performed (Figure 4). For the illustration of the composite indicator marks, ten equidistant classes have been constructed and each of them has been assigned a specific blue shade. The classes have been organized in ascending order, as well as the colours, from the lightest to the darkest ones.

The development of high technology in the European Regions appears to be almost stable over time (from 2006 to 2016), although small variations are easily discernible. In terms of relative frequency (Table 2), 50% of the regions are concentrated in the third and fourth class of values (respectively from 94.354 to 97.832 and from 97.833 to 101.311). Considering the crises year 2008 there is an increase in the frequency in the second class of distribution (from 90.875 to 94.353). Thus, the hypothesis that there is a reduction in the high technological content during the economic crisis is confirmed. It is also interesting to note that the indicators return to rise steadily, albeit slightly in 2015. Increasing frequencies are especially recorded in the last years (2014 to 2016) where the indicators value is rather relevant, i.e. from 111.749 to 122.185, (classes from eight to ten).

These results confirm the hypothesis that high-tech has, in general, a resilient behavior and can be one of the drivers in the recovering phase of the economy. However, the impact of the crises and the ability for fast recovering is different across countries; higher composite indicators regions, i.e. more relevant penetration of the phenomenon, are more resilient. The above can be observed in Figures 1-3.

The maps show that low values of high-tech (lighter blue colours) are registered in the Eastern countries: Bulgaria, Romania, Hungary, Slovakia and

2. For more details, the authors are available to provide all the computations.

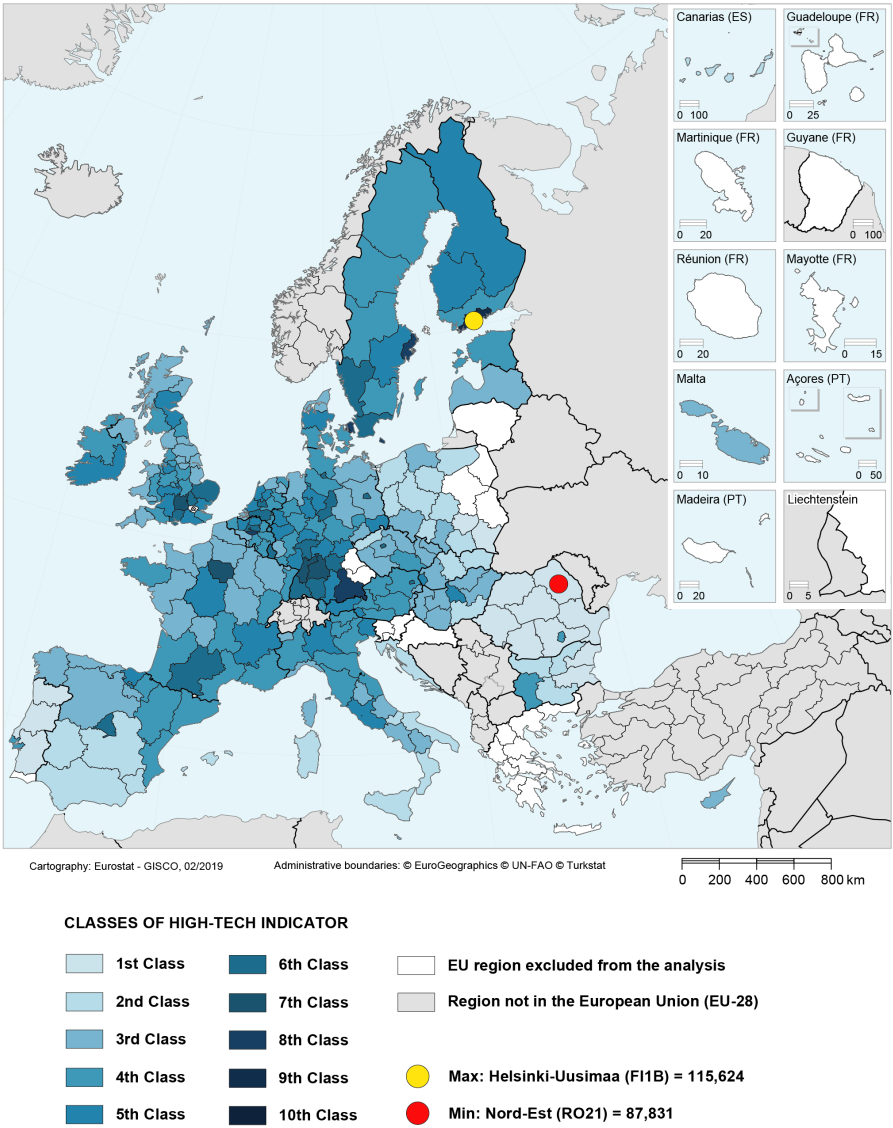
Table 2 – Relative Frequency of High-tech Index Classes per Year

Class	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
1	5.88	4.62	3.36	3.78	3.78	2.94	2.52	1.68	1.68	1.68	1.68
2	11.34	12.61	18.07	16.81	14.29	13.45	13.87	12.61	12.18	10.50	10.92
3	26.05	24.79	26.47	24.37	24.79	22.27	21.01	23.11	21.01	19.75	21.01
4	28.99	28.57	25.21	28.15	29.41	31.09	29.83	27.73	27.73	30.25	29.83
5	15.13	15.97	15.13	14.29	13.45	15.55	15.97	16.39	18.49	17.65	17.23
6	8.82	7.98	7.14	6.72	7.14	6.30	7.98	10.08	10.92	10.50	12.18
7	1.68	2.52	2.52	3.36	4.20	5.04	5.04	5.04	3.78	6.30	3.78
8	1.68	2.52	0.84	1.26	1.26	1.26	1.68	1.26	2.10	0.42	2.10
9	0.42	0.42	1.26	1.26	1.68	1.68	1.68	1.26	1.68	2.10	1.26
10	0.00	0.00	0.00	0.00	0.00	0.42	0.42	0.84	0.42	0.84	0.00

Poland. Higher values have been found in Northern European regions of Belgium, Germany, Denmark, Luxembourg, Sweden and Finland. The temporal analysis displays that the colour scheme did not change significantly in 2008 compared to 2006: the conclusion is that, despite regions recorded a decrease in composite indicator score during the economic crisis, this did not lead to a shift towards the lower class of high-tech indicator. On the contrary, the map is predominantly darker in 2016, indicating that the regions have experienced an increase in the level of high technology over time. After identifying the minimum and maximum values for each year, it is possible to view the partial ranking of the ten worst or best performing regions, in order to get a complete picture of the European situation in 2006 and 2016. In addition, line graphs can be used to assess the trend over the whole period considered (Figure 4).

In 2006, the countries with the lowest-tech regions have been Romania, Portugal and Poland. From the worst to the best region, there are: RO21 (Northeast), RO41 (South-East Oltenia), RO31 (South – Muntenia), RO22 (South- East), PT16 (Centre – PT), RO11 (Nord-Vest), PT18 (Alentejo), PT11 (Norte), RO12 (Centru) and PL33 (Swietokrzyskie). The range of values of the composite indicator is between 87.831 and 90.411. Analysing the time trend, it is visible how all these regions have increased their scores over time, albeit with different patterns. The communality of these areas is the remarkable technological development they have experienced since 2011, with a peak reached in 2015. However, the regions on the podium in 2006 have maintained their position almost unchanged (this is shown graphically by the gap between them and the regions with higher scores).

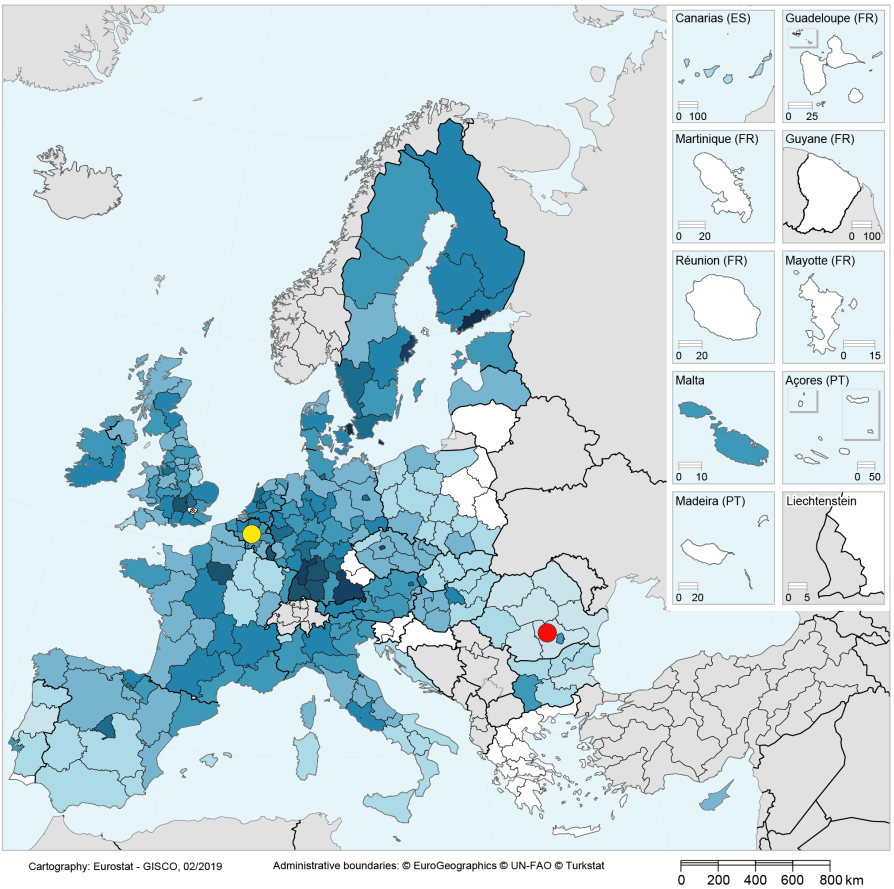
Figure 1 – High-tech Composite Indicator (AMPI method) in 2006



Notes: The classes and the correspondent range of high-tech indicator values (AMPI Method) are: first class from 87.395 to 90.874, second from 90.875 to 94.353, third from 94.354 to 97.832, fourth from 97.833 to 101.311, fifth from 101.312 to 104.790, sixth from 104.791 to 108.269, seventh from 108.270 to 111.748, eight from 111.749 to 115.227, ninth from 115.228 to 118.706 and tenth from 118.707 to 122.185.

Source: Author's elaborations

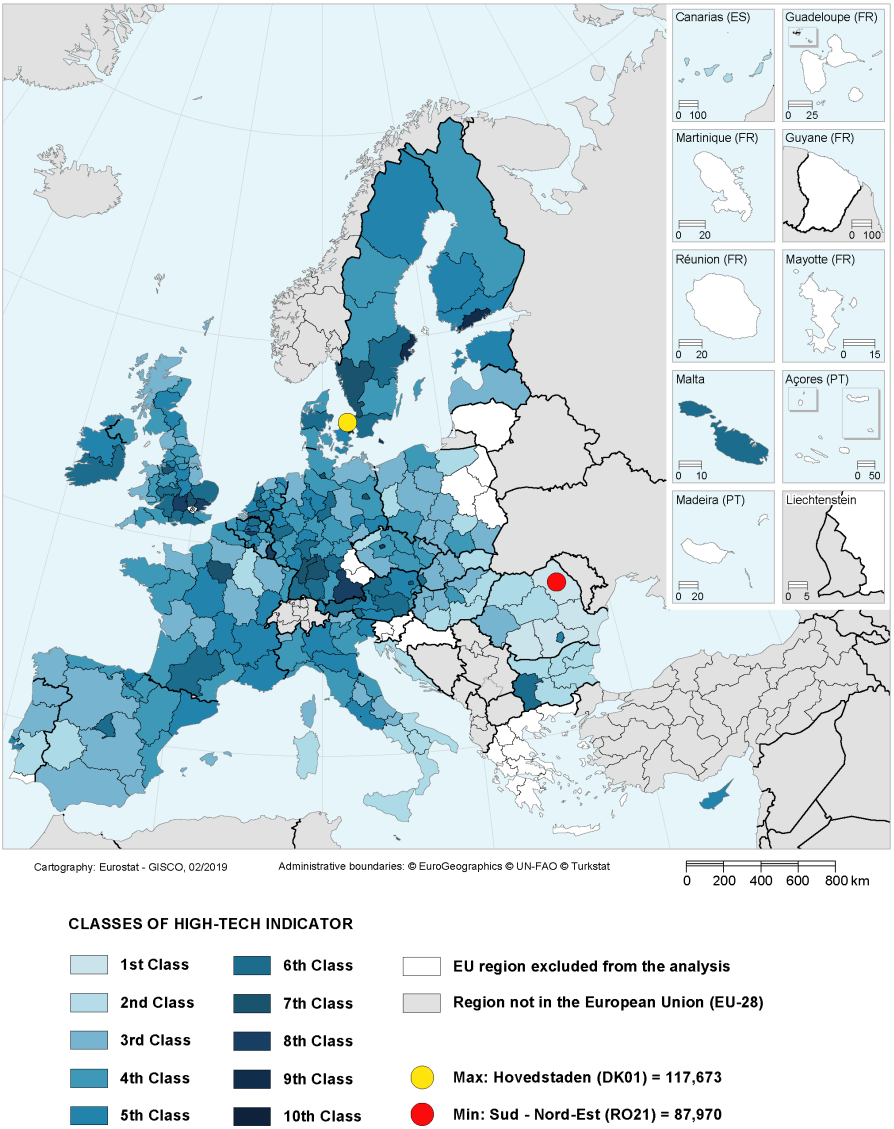
Figure 2 – High-tech Composite Indicator (AMPI method) in 2008



Notes: The classes and the correspondent range of high-tech indicator values (AMPI Method) are: first class from 87.395 to 90.874, second from 90.875 to 94.353, third from 94.354 to 97.832, fourth from 97.833 to 101.311, fifth from 101.312 to 104.790, sixth from 104.791 to 108.269, seventh from 108.270 to 111.748, eight from 111.749 to 115.227, ninth from 115.228 to 118.706 and tenth from 118.707 to 122.185.

Source: Author's elaborations

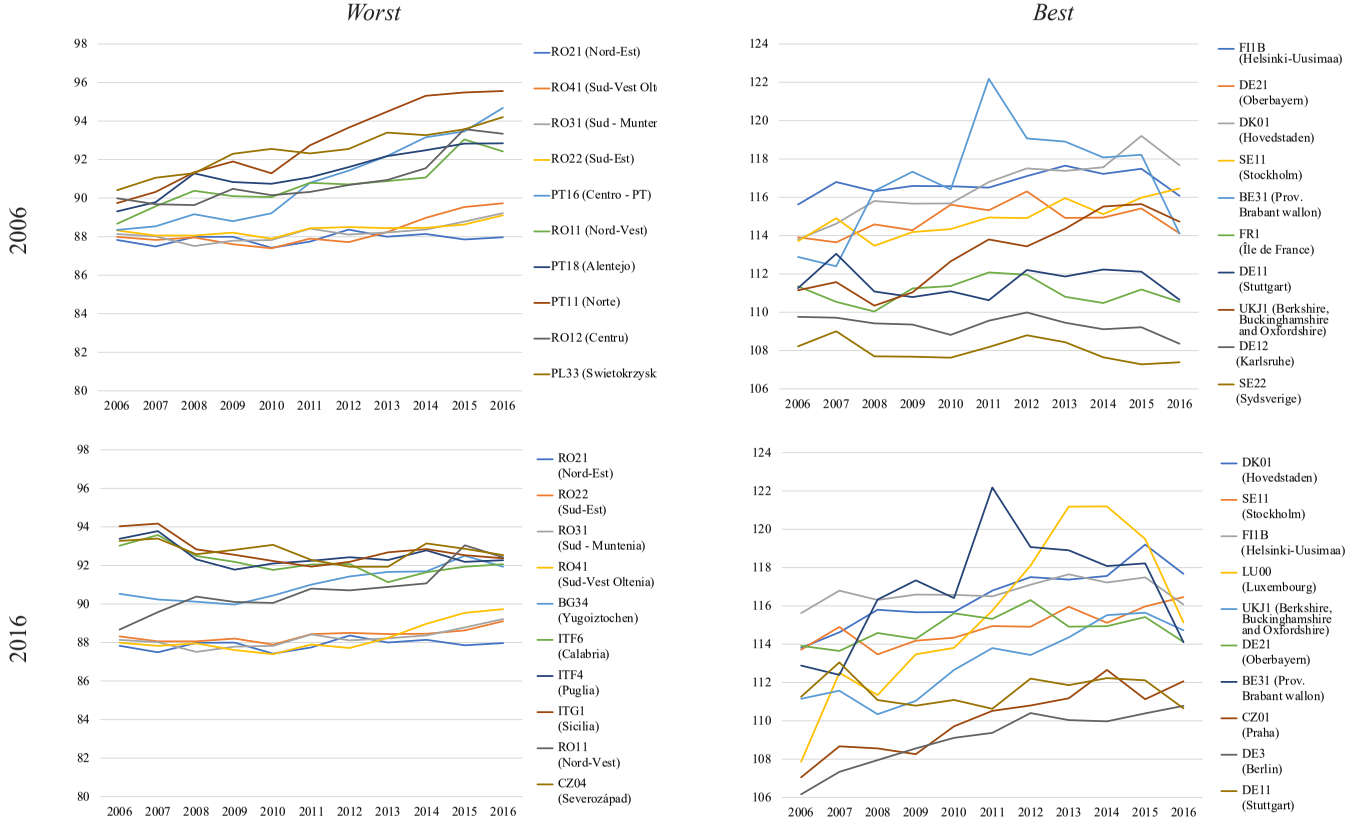
Figure 3 – High-tech Composite Indicator (AMPI method) in 2016



Notes: The classes and the correspondent range of high-tech indicator values (AMPI Method) are: first class from 87.395 to 90.874, second from 90.875 to 94.353, third from 94.354 to 97.832, fourth from 97.833 to 101.311, fifth from 101.312 to 104.790, sixth from 104.791 to 108.269, seventh from 108.270 to 111.748, eight from 111.749 to 115.227, ninth from 115.228 to 118.706 and tenth from 118.707 to 122.185.

Source: Author's elaborations

Figure 4 – Ten Worst and Best Regions in 2006/2016 and Their Trends



Source: Author's elaborations

The ten best regions in 2006, in descending order of technological content, belong to Northern European countries and are: FI1B (Helsinki-Uusimaa), DE21 (Oberbayern), DK01 (Hovedstaden), SE11 (Stockholm), BE31 (Prov. Brabant wallon), FR10 (Île de France), DE11 (Stuttgart), UKJ1 (Berkshire, Buckinghamshire and Oxfordshire), DE12 (Karlsruhe) and SE22 (Sydsverige). The interval of values is between 108.22 and 115.624. All regions show a fluctuating trend over the entire period and their positions in the ranking are almost unchanged. As for the worst regions, there is a decrease in scores in 2008, coinciding with the recessionary phase that affected the entire European economy. Two peculiarities that immediately appear from the trend graph are the behaviours assumed by UKJ1 (Berkshire, Buckinghamshire and Oxfordshire) and BE31 (Prov. Brabant Wallon).

The first shows significant growth from 2008 onwards and then decreases again in 2015, while the second has a positive peak of about 6 points in 2011 compared to 2010. Moreover, the Province Brabant Wallon (BE31) exhibits a significant growth and decrease over time. As regards the variation they have undergone over time, both positive and negative differences can be noted (Figure 4). Regions in the top two positions of the ranking have experienced a slight positive increase: Helsinki-Uusimaa (FI1B) and Oberbayern (DE21) reach respectively 0.207 and 0.449. Different is the positive change of Hovedstaden (DK01), the greatest among the ten regions (equal to 3.865). Finally, the decreases in technological content occurring between 2006 and 2016 are slight and in a range between -0.606 and -1.402. Analysing 2016, among the ten worst regions there are still those of Romania that had already been in this position in 2006.

However, the positions covered by the regions of Portugal and Poland have been replaced by BG34 (Yugoiztochen), ITF6 (Calabria), ITF4 (Puglia), ITG1 (Sicily) and CZ04 (Severozápad). The range of values is comprised between 87.97 and 92.537. From the lowest to the highest rating, there are: RO21 (North-East), RO22 (South-East), RO31 (South-Muntenia), RO41 (South-West Oltenia), BG34 (Yugoiztochen), ITF6 (Calabria), ITF4 (Puglia), ITG1 (Sicily), RO11 (North-West) and CZ04 (Severozápad). These regions show a fluctuating trend over time. For what concern the best regions, there are: DK01 (Hovedstaden), SE11 (Stockholm), FI1B (Helsinki-Uusimaa), LU00 (Luxembourg), UKJ1 (Berkshire, Buckinghamshire and Oxfordshire), DE21 (Oberbayern), BE31 (Prov. Brabant wallon), CZ01 (Praha), DE30 (Berlin) and DE11 (Stuttgart). Part of them have already been the best in 2006 and, as underlined in Figure 4, a growing trend can be seen in most cases since 2008. Looking at the best and the worst, both show positive and negative fluctuations compared to 2006. In particular, the Italian regions have worsened over time, as for Severozápad (CZ04), while the others

report a positive change. Among the top ten, only Stuttgart (DE11) records a negative change of -0.606, while the others show favourable variations. The shift observed in Luxembourg (LU00) is interesting and equivalent to +7.273.

Summing up, as regards regional disparities, the territorial distribution of the values of the high-tech indicator confirms that more intense presence is observed where there is a interaction of context factors and structural characteristics. In fact, it is possible to notice that high technology content is recorded in European capitals or big cities where statistical data show high population density, elevated household disposable income, low unemployment rate, presence of universities and research centers. For example, Northern capitals show these characteristics: Berlin, defined as 'Digital Friendly capital' and Silicon Valley of Europe; Munich is another city constantly evolving in terms of innovation and high technology.

Focusing on the trend, a downturn or stability during the crisis is observed in several regions; an upward is observed soon after the crisis. Thus, the tendency supports the hypotheses of the important and critical role of high-tech in the recovering phase. Indeed, most relevant upward is registered where high-tech indicator shows a considerable importance of this phenomenon.

Focusing on Italy, in 2006 and 2016 the worst region is Calabria (ITF6), positioned in the European ranking at 214th and 233rd respectively with a composite indicator value of 93,024 and 92,064. In 2006, the best is Friuli Venezia Giulia (ITH4) in 33rd position with a high-tech score of 104,578, while in 2016 Lombardia (ITC4) is the one to gain the supremacy with its 66th position and a value equals to 102,544. These results underline that the presence on Italian soil of a gap between North and South in terms of technology is in line with the hypotheses considered in this paper about regional factors disparities in high-tech.

5. Conclusions

This research has constructed, in a rigorous way, a high-tech composite indicator, devoting particular interest to different methods that can be used, as well as the steps needed to compute an indicator correctly.

The literature argues that there are ten steps to construct a composite indicator, starting from the theoretical definition to the various techniques of representation and dissemination of results. There are many advantages to using these methods of dimensional reduction, but it is equally true that there can be many problems if the choices made during the construction process are not dictated by solid and well understood study bases. In particular, accuracy and adequacy in the selection of elementary indicators assumes a relevant role: data has to be of good quality and in relevant quantities, so sufficient and appropriate to describe the phenomenon.

The composite indicator approach has been applied to the high-tech phenomenon in European Regions, using Eurostat data from 2006 to 2016.

Following a careful methodological analysis, composite indicators have been constructed with different methods and subsequently compared: the study has demonstrated that, in this case, the best one is the Adjusted Mazziotta-Pareto Index (AMPI) and therefore, has been used for the analysis of the results. This aggregation technique satisfies the requirements of spatial and temporal comparability, as well as robustness of the results (an analysis of the variation coefficients has identified that the AMPI shows lower values than the others and this indicates that the estimates are the most precise).

High technology is a multidimensional phenomenon that has no single definition: literature states that several meanings can be attributed to this concept, depending on the various approaches used. However, a number of authors stress the importance of defining high technology unambiguously, given its considerable relevance as an indicator of economic development. Indeed, researchers claim that it can be conceived as the result of an interaction of social, political and economic forces, as well as the ability of companies to remain competitive in the market. The indicators values confirm the hypothesis of the existence of regional disparities in Europe, the localization of high-tech seems to be related to the characteristics of the external context. Moreover, high-tech is suffering crisis effects in a smoothed way and is fast recovering.

In this regard, the results show that the "high-tech" regions of Europe are those of the North, while those of the East have the lowest scores of the composite indicator (i.e., low high-tech). Trend in the considered period is different. The detailed analysis of the results (paragraph 4.2) is useful to get specific insights for general conclusions.

This research has reached its objectives through a theoretical study of the composite indicators' construction process and then the implementation of what has been learned. The analysis provided a synthetic measure of the high technology phenomenon by building a new composite indicator: this innovative approach is an informative contribution at regional policy level. This makes it possible to identify the disparities between European Regions in technological terms and to understand their development and competitive capacities. This new composite indicator has been constructed by including in the model factors that have been chosen on the basis of a detailed analysis of the literature: the variables used gauge different dimensions of the concept and so, the synthetic measure is well representative. Furthermore, it is important to point out again that, although the geographical coverage of this research is wide, it is limited by the lack of some European Regions and countries (Greece, Lithuania and Slovenia) in the data matrix.

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Sommario

L'indicatore composito dell'alta tecnologia (HTCI). Uno strumento per misurare le disparità regionali europee

Gli indicatori compositi sono uno strumento per le strategie politico economiche territoriali in quanto consentono la riduzione dimensionale di fenomeni socio-economici complessi non direttamente misurabili con singoli indicatori elementari. Questo paper si focalizza sulla misurazione e studio dell'alta tecnologia nelle regioni Europee: un nuovo indicatore dell'alta tecnologia è costruito e utilizzato per un'analisi spaziale e temporale. In particolare, gli indicatori proposti considerano il periodo 2006-2016 per le regioni d'Europa. Attraverso l'analisi statistica di questo indicatore sono verificate alcune ipotesi relative alle disparità territoriale dell'high-tech, al loro trend e fattori di sviluppo.

Italian NEETs: An Analysis of Determinants Based on the Territorial Districts

Giuseppe Cinquegrana, Giovanni De Luca°, Paolo Mazzocchi°, Claudio Quintano§, Antonella Rocca°*

Sommario

This paper aims at analyse the NEET phenomenon (young people not in employment, education or training) in the post-2007 financial crisis in Italy, using municipality as unit of analysis. Through new databases with high territorial detail made available by the Italian National Institute of Statistics (ISTAT) and Ministry of Education, we regress the municipal NEET rate on a selection of municipal and provincial social, economic and education indicators. We used a multi-level model to account for the nested structure of data (municipalities nested into the provinces). Results highlight the importance on NEETs, in particular, of indicators measuring the effectiveness of the education system.

1. Introduction[1]

NEETs, that is young people not in employment, education and training, are a significant share of the total youth population, especially in such Southern European countries – and in particular in Italy – which are among the countries more hit by the 2007 financial crisis. NEETs represent a relevant economic loss for each country because this condition may affect also their future career prospects. First pioneering studies on the current socio-economic crisis due the Covid-19 pandemic – which occurred when the recovery from the previous crisis

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1. A preliminary version of this paper was presented at the XLI Scientific Web Conference of the Italian Association of Regional Sciences, held on the 2nd-4th of September 2020. The authors wish to thank all seminar participants and, above all, Antonella Bianchino, for some valuable suggestions.

was still not completed – have demonstrated that the crisis is producing, besides strong economic effects on firms, relevant increases in socio-economic inequalities, because the most vulnerable segments of population, such as young people, migrants and women, result more invested (Tamesberger, Bacher, 2020; Eurofound, 2020; Shanahan *et al*., 2020). Young people are very disadvantaged in comparison to their adult peers because in entering the labour market they lack of job experience and in experience in job search. Even young workers are in a disadvantaged condition because they are usually more widespread among precarious jobs, more easily fired in time of crisis (Quintini *et al*. 2007; Scarpetta *et al*., 2010). However, young generations are the key drivers for future economic growth and development (Boulianne, Theocharis, 2018; ILO, 2020) and their contribution to each country economic growth and development is nowadays still more urgent, considering the digital revolution in progress, still more stimulated by the Covid-19 pandemic (Iivari *et al*., 2020).

The aim of this paper consists in identifying the factors which mainly affect the distribution of young NEETs in Italy. In the last years, a wide stream of literature has studied young people condition in the labour market. Economists, sociologists and psychologists have till now mainly investigated the causes leading to the NEET status acting at individual level and due to the socio-economic context, that is the labour market conditions, education and the institutions regulating the school to work transition. However, these studies were unable to explain why young people living within the same country, sharing the same institutions and having identical personal characteristics manifest so many different propensities to the NEET condition. In this paper, we propose a new approach, focused on a spatial perspective, in order to account for the influence in the NEET propensity exerted by the place where the individuals live. Recently, the Italian National Institute of Statistics (ISTAT) has made available data at provincial and municipal level. Referring in particular to "A misura di comune", that is a multi-source experimental statistical information system, we look at the share of NEETs in each municipality and verify the relationship with many other socio-economic indicators observed with a municipal or a provincial detail. The empirical evidence shows a strong concentration of NEETs in the South of Italy, but we demonstrate that the North-South divide is not the only key-lecture in explaining the stronger variability in the NEET phenomenon. Focusing the analysis on a single national domain, with identical policies and laws, but also strictly homogeneous in the cultural and social aspects, we can better identify the role of the place of residence in terms of degree of urbanisation and socio-economic aspects directly ascribable to it.

The outline of the paper is as follows. Section 2 clarifies the concept of NEETs while Section 3 focuses on the Italian regional disparities. Section 4

shows methodology and data. Finally, Section 5 presents the results and Section 6 concludes.

2. Inactivity and Unemployment

The NEET indicator refers to the condition of unemployment or inactivity, out of education. Even if unemployment and inactivity are very different conditions, their effect is the same and consists in total disengagement from the labour market. The age class involved in the NEET identification, initially limited to 16-18 years, has been extended to 15-24 or even 15-29 years (see *Yearly Report 2019*, Istat, and for a detailed collection of NEET data by age-class, see on http://dati-congiuntura.istat.it) in reason of the recent more prolonged stay of young people in education and of the increase of the mean duration of the school-to-work (STW) transition. STW represents the period from the end of studies to the attainment of a stable job and, in this paper, we refer to 15-29 age class. When individuals leave school, they may decide to enter the labour market and starting the job search or may decide to remain inactive. Therefore, after completing the studies and until the achievement of a stable job, young people are in the NEET status if they are not involved in occasional jobs or in brief experiences of training and apprenticeship. More prolonged is the period of STW transition, higher is the share of NEETs. This explains why high shares of NEETs are usually linked to the long-standing structural problems of the youth labour market, which holds to high levels the youth unemployment rates and makes the transition from school to work slow and problematic (Bratti *et al*., 2008; Caroleo, Pastore, 2012; Hadjivassiliou *et al*., 2018; Piopiunik, Ryan, 2012; Choudhry *et al*., 2012).

Many economists have studied the NEET issue referring almost exclusively to unemployment. However, the expansion of the focus from unemployment to the broader concept of NEET responds to the need to involve in the analysis also youth who have given up looking for a job or who are unwilling to join the labour market (UCW, 2013). According to the consequences of the NEET status, at individual level, it drives towards marginalization and exclusion from the labour market (Eurofound, 2012; Thompson, 2011), impoverishing human capital and reducing the probabilities of future engagement at work, with potential scarring effects on successive generations and concomitant economic and social impacts (Ryan, 2001; Manfredi *et al*., 2010; Gregg, Tominey, 2004). At macro-level, it induces to a loss of economic productivity and growth (Eurfound, 2012). However, the distinction between unemployment and inactivity assumes relevance because when the status of NEET derives from unemployment, it depends only by the incapacity of the labour market to satisfy the labour offer or to stimulate the match between the demand and labour offer. Conversely, inactivity is a

personal propensity to be disengaged by the labour market. Only when inactivity is referrable to discouragement (the condition when one would be available to work, but is not searching a job for the belief that no job is available), it finds its roots in the labour market dysfunction (Elder, 2015; Boesler, 2014; Davig, Mustre-del-Rio, 2013; Finegan, 1978). Other causes of inactivity, especially among young people, are mainly ascribable to the unavailability of services for elderly or children care (De Luca *et al*., 2019; Balan, 2015; Walsh, 2010). However, the NEET condition may derive also from negative attitudes to school, and lack of resilience capacities and skills. Again, it may find its roots in a deprived familiar background (Spielhofer *et al*., 2009).

Individual characteristics mainly linked to the NEET status are being a woman, having an immigrant background, a low education level and a deprived familiar and social context (Quintano *et al*., 2018; Brunello, De Paola, 2014; Bertola *et al*. 2007; Billari 2004).

With reference to the macro-economic determinants, the education system plays a relevant role. Many authors highlighted the strong connection between high rates of NEETs and rigid and sequential education systems failing in transferring to young people the skills required by the labour market (Caroleo *et al*., 2020; Pastore, 2019). This is the case of Italy (Pastore, 2019; Quintini *et al*., 2007), where the STW transition is one of the longest ones (Pastore *et al*., 2020). The Italian education system shows a centralised organisation demanded to the Ministry of Education, but also a certain autonomy in the management at local level. Indeed, local authorities at regional (NUTS 2) level have legislative power for education and each educational institution has its own organizational didactic autonomy (www.miur.gov.it). The recent reforms aimed at introducing the apprenticeship system are still in the running-in step, and vocational oriented higher education still remains limited in scope. As a result, while the share of high-educated in Italy is one of the lowest ones in comparison to the other EU countries, the share of early school leavers is higher than EU average.

With reference to the labour market, Italy, such as the other Southern countries, shows very high levels of unemployment and of labour market rigidity, with limited and underdeveloped active policies and scarce recourse to employment offices. However, the Italian labour market characteristics differ a lot at regional and provincial level. Unemployment, undeclared work, absence of training strongly penalize especially the South.

Another important factor which exerts a strong influence on the propensity to be NEET is connected with the place where an individual has grown and started the STW transition. Indeed, according to many social theories, the place where an individual lives strongly influences his attitudes and behaviours (Brofenbemmer, 1979) in terms of consolidated practices and customs. On the other side,

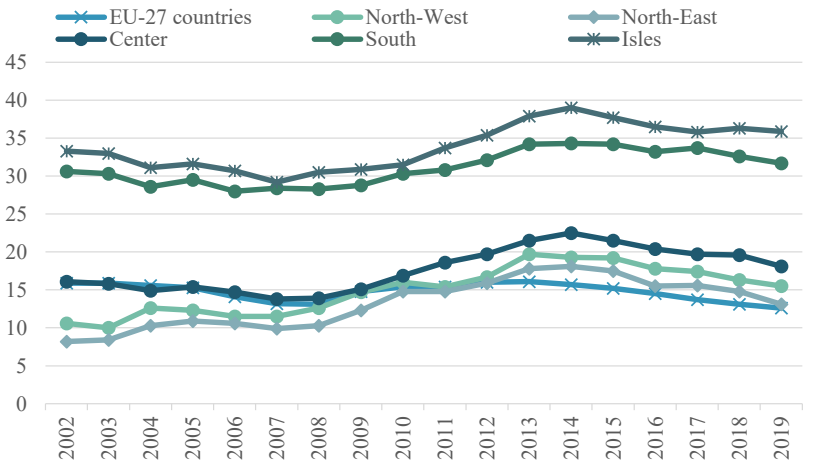
economic theory shows that municipalities and the bordering areas influence labour market outcomes through the specific opportunities available as well as through the local network which can help people with their job search. They are in particular connected with the degree of urbanisation (Simoes, 2020).

3. The Italian Regional Divide and the 2007 Financial Crisis

Within EU, some countries show high internal socio-economic disparities. Italy is one of them. Indeed, while the Northern Italian regions are among the most developed European areas, very similar to such regions of Norway and Germany, the Southern regions appear among the most depressed areas, more similar to the poorest regions of Spain and Greece than to the Italian Northern regions. The analysis of the regional labour markets in Italy is in any case extremely difficult. Italian population in the South is younger, due to the fact that in these regions the fertility rates remained higher for a longer period, in comparison to the North and Centre of Italy. However, Southern regions show also the highest share of unemployment rates and NEET rates, due to, first of all, the absence of adequate investments and a significant presence of organised crime.

The past decade financial crisis has further increased, besides the gap among countries at European level, also regional disparities between the North and the South of Italy. Figure 1 shows that before the crisis, the level of NEETs was lower than the EU-27 average for the Northern Italian regions, very similar to the EU-27 average for the Italian regions of the Center while for the South and the Isles the NEET rates were already double than the EU-27 average. However, in the years before the Covid-19 pandemic, the recovery from the financial crisis was still not totally completed for Italy. In 2018, the levels of NEETs were indeed very close to the EU-27 average for the North-East of Italy, while for all the other areas they remained higher than the EU-average and higher than the pre-crisis levels. While the last decade financial crisis hit more severely the South of Italy, the current crisis due to pandemic has interested more severely the North than the South of Italy, at least in its first wave, occurred in the Spring of 2020. This makes still less predictable the future scenario. Again, in Italy there is also a strong heterogeneity within the North and within the South regions, with some example of virtuous economic growth in the South (see for example the case of touristic towns in the Apulia region) and cases of economic underdevelopment in the Centre-North of Italy (many municipalities located in the mountains in the Centre-North are experiencing depopulation for lack of economic opportunities, especially after various earthquakes). All these reasons explain why it is extremely relevant to analyse the NEET phenomenon with a higher territorial detail.

Figure 1 – NEET Rates in the NUTS1 Italian Areas and Average Values for the EU-27 Countries. Years 2002-2019. Age class 15-29 years



Before this study, only few papers have looked at the territorial domain, but they are all limited to a higher regional detail. The NUTS2 detail was used for example by Cefalo *et al*. (2020) for the analysis of the Italian youth labour market and by Bacher *et al*. (2017) with reference to the NEET indicator in the Austrian regions. However, in our knowledge, there are not precedent works with a municipal detail.

4. Data and Methodology

4.1. Data

The indicators used in the present analysis are extracted from the ISTAT and MIUR (Italian Ministry for Education and Research) databases. They have all a provincial or a municipal detail. In particular, some of these indicators come from the ISTAT "Benessere Equo e Sostenibile" project at provincial level, which aims at evaluating the progress not only from an economic, but also from a social and environmental point of view (ISTAT, 2019). Indicators on the education system are extracted from the MIUR database and show a provincial detail too. As mentioned in the introduction, the indicators at municipal level are instead extracted from the platform "A misura di comune", which is a project belonging to the ISTAT experimental statistics framework finalised to give information

with a very specific territorial detail by multi-source, very useful for the planning, programming and management of local authorities.

In particular, in this chapter, the domains considered for the identification of the main determinants of the NEET rates are the following: i) Economic development; ii) quality of the education system and human capital equipment; iii) cultural and social participation; influence of criminality and informal economy; iv) geographical and urban aspects.

As the most recent available NEET indicator at municipal level refers to the year 2014, all the selected indicators refer to the same year. The only exceptions are the MIUR data on high secondary school teachers, extracted from the MIUR database and available only for 2008. However, as we analyse NEETs aged 15-29 years in 2014, most of them have attended high secondary school six or more years before. Therefore, MIUR indicators correctly refer to the school characteristics for the young people analysed.

Economic development: Many indicators can be used to describe the local economic development. We refer to indicators linked to enterprises and innovation, to the population wellbeing and to the attractiveness of the territory. According to the first aspect, we consider the entrepreneurial rate, the share of exports in sectors with a dynamic world demand, the patent intensity index and the share of employees in high-tech sector. These latter two indicators allow to control for the innovative aspects. The well-being of people living in the territory can be measured considering the share of unstable employees, the per-capita gross income, the tax collection capacity at municipal level and the availability of services in the house. Finally, the economic attractiveness of territories has been accounted for through the attractiveness index, measuring the incoming flows of people as ratio of total mobility flows, the migration rate and the migration for health cure reason.

Quality of the education system and human capital equipment: We try to detect the territorial differences in the efficacy of the education system through the mean scores achieved by students in numerical and literal competencies based on the INVALSI (Institute for the assessment of the education and training system) test results. The capacity of the education system to retain for a long period young people is measured considering the share of 25-64 years old population with a high secondary education level and the share of tertiary educated in the 30-34 age class. Furthermore, we detect the different equipment of high secondary schools in terms of teachers' characteristics considering their distribution by age class, the share of teachers having a temporary contract and the share of support teachers.

Cultural and social participation: Social participation and cultural interests of people living in the territory have been measured through the share of citizens

who voted in political elections, the endowment of cultural heritage resources and two indicators of the importance of cultural enterprises on the territory, given by the number of no-profit organisations and the share of employees in cultural enterprises. Other important indicators linked to the civic sense of inhabitants concern their attitudes towards sustainability, detected through the share of separate waste collection and the electricity consumption covered by renewable sources.

Influence of criminality and informal economy: Criminality and informal economy can strongly influence the NEET rate because on the one side young people classified as NEETs by the official statistics may be actually involved in the informal economy. On the other side, high levels of NEETs may determine a major propensity to engage in criminality and illegal economy, as unemployed people represent potential work force for organized crime. For these reasons, as proxies for the degree of criminality of the place of residence, we considered the number of reported crimes, the crowding of prisons and the weight of the micro-crime on total crimes.

Geographical and urban aspects: The geographical aspects of the place of residence, such as the altitude and the distance from the sea may affect the economy of the place and therefore also the employment opportunities. On the other side, the degree of urbanisation plays a relevant role in determining the different opportunities reserved to young people and therefore the share of NEETs, as well.

Economic literature recognizes the significant relationship between all these indicators and the share of NEETs. However, for some of them, the problem of reverse causality may arise. We refer in particular to social indicators such as electoral participation, waste separate collection and criminality. Indeed, NEETs are characterised, on the one side, by a scarce political participation and lack of trust in institutions (Caroleo *et al*., 2020) and, on the other side, by lower levels of perceived environmental responsibility (Bonanomi, Luppi, 2020). Even economic indicators such as per-capita income and availability of services in the house are connected with the economic condition and therefore with the professional condition. Therefore, some of these variables are analysed only in terms of correlation with the NEET indicator. NEET rates show high inverse correlation with electoral participation (–0.6457), waste separate collection (–0.6328) and per-capita income (–0.5410).

This first analysis confirms some already known evidence, e.g. the presence of higher NEET rates in municipalities with a diffused condition of economic deprivation, but also a negative attitude towards the society and the propensity to change[2].

On the other hand, very weak associations are detected between the share of NEETs and the covariates assumed as proxies of criminality, that is the number of reported crimes, the crowding of prisons and the micro-crime rate.

2. The complete analysis of correlation is here not reported for sake of brevity, but it is available on request by authors.

4.2. Methodology

When data show a nested structure, as in the case of municipalities grouped into provinces, OLS models are liable to suffer from estimation problems while multilevel model appears as the best choice (Bickel, 2007).

As Italy is politically and administratively divided into regions and regions into provinces, with some degree of autonomy at local level, it is reasonable to suppose that municipalities belonging to the same province are more similar than municipalities belonging to different provinces.

In our analysis, we opted for a multilevel model with fixed coefficients – that is, with the same coefficients across provinces/regions – but with intercepts varying across groups (Heck, Thomas, 2000; Rabe-Hesketh, Skrondal, 2008).

In the first step, we test the relationship between NEETs and indicators belonging to the same domain (economic, education and social dimension). In the second step, the most significant indicators highlighted within each dimension at step 1 are used for the identification of the best model in predicting the share of NEETs at municipal level.

We refer to literature for methodological aspects of the multilevel models (Aiello, Bonanno, 2017) and limit to report the basic model with the two-level structure. It is:

$$y_{ij} = \beta_0 + \beta_1 X_{ij} + \beta_2 z_{.j} + u_j + e_{ij} \qquad [1]$$

Where $u_j \sim N(0, \sigma_u^2)$ and $e_{ij} \sim N(0, \sigma_e^2)$ such that σ_u^2 is provincial/regional-level variance (i.e. Level 2), and σ_u^2 is variance at the municipal level. The equivalent model for the expected value of y_{ij} for givens x_{ij} and u_j was:

$$E\left(y_{ij}\right) = \beta_0 + \beta_1 x_{ij} + \beta_2 z_{.j} + u_j \qquad [2]$$

in which y_{ij} is the share of NEETs in the *i*–th municipality in the province/region *j*, x_{ij} is the municipal-level predictor, $z_{.j}$ is the provincial/regional-level predictor, and β_0, β_1 and β_2 are, respectively, the intercept, the vector of coefficients for municipal characteristics and the vector of coefficients of provincial characteristics.

The model's adequacy is assessed using the chi-square test, measuring the goodness of fit for the entire model, the Bayesian information criterion (BIC) and Akaike information criterion (AIC), based on the likelihood function, according to which the best model is that with the lowest BIC and AIC values. Another way to evaluate alternative model specifications involves the comparison of the intra-class correlation coefficient (ICC). This latter approach identifies the proportion of variance of the outcome variable that is explained by the grouping structure of the hierarchical model. When the ICC approaches 0, grouping by provinces is

useless, and simple regression is sufficient. Otherwise, when the ICC approaches 1, no variance exists to explain the share of NEETs at the municipal level.

5. Results

In the first step, we limit to analyse separately the effects on the NEET rates of the economic, educational and social dimensions. These relationships should be interpreted only in terms of correlation because we cannot exclude some endogeneity issues. The economic dimension allows better than the other dimensions to catch the differences among the groups. The ICC indicated that the 42% of the total variability in the share of NEETs is captured by the groups identified. Municipalities with the higher entrepreneurial rates, where the share of individuals employed in the high-technology sector is higher, with a high patent production and with a high degree of attractiveness show the lower NEET rates. The direct relationship between the NEET rate and the endowment of capital resources suggests instead that the only economic assets are not able to create the conditions in reducing the share of NEETs.

Model 2 analyses the connection between NEET rates and the characteristics of the education system. It presents the highest Wald statistic, demonstrating the very strong connection between, on the one side, a high educational attainment and low NEET rates and, on the other side, lower NEET rates where the education system shows a major capacity to transfer the educational competencies measured by tests. The very high correlation between the scores for numerical and literal competences (0.985) suggested to introduce into the model only one of them. Finally, with reference to the social dimension, Model 3 shows the best fit according to the AIC and BIC indicators. The regressors included in the model concern the percentages of electoral participation, of separate waste collection and no-profit organisations. They all show an inverse and significant relationship highlighting lower resilient attitude towards the environment and the society in places with higher NEET rates.

The last model includes a selection of all the previous indicators chosen according to their statistical significance. In a first step, we inserted all the variables included in models 1, 2 and 3 and added also the indicators of the degree of urbanisation. Subsequently, we proceeded removing those variables which appeared no more significant. Surprisingly, living in a densely populated area (city) increases the probability of being NEET.

In other words, Italian cities, instead of representing job opportunities catalysts for young people, are the places where the lack of job opportunities and social exclusion are maximum.

Table 1 – Multilevel Models on NEET Determinants Observed on 7,842 Italian Municipalities

NEET	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Economic dimension				
Entrepreneurial rate	-0.007**			
Attractiveness index	-0.12*			
Patent intensity	-0.035***			-0.004
High tech employees	-0.072***			-0.042***
Endowment capital resources	0.001*			
Education dimension				
Numerical competences		-0.317***		-0.099**
High secondary school graduated 25-64 (%)		-0.151***		-0.154***
Tertiary educated 30-34 %		-0.037***		-0.041***
Social dimension				
Separate waste collection			-0.094***	-0.081***
Electoral participation			-0.316***	-0.215***
No-profit organisations			-0.044***	
Geographical indicators (ref. rural area)				
City				2.562***
Town				0.417**
Constant	34.803***	104.195***	57.812***	77.557***
Var(_cons)	24.09	12.81	9.674	8.875
Var(res)	33.43	31.62	33.558	31.523
Wald chi2	62.49***	568.09***	181.12***	704.58***
AIC	49509	49661	49441.93	48936.30
BIC	49565	49703	49483.65	49019.73
ICC	0.419	0.288	0.224	0.220

Source: Authors' ad hoc elaborations on ISTAT and MIUR data

6. Conclusions

Analysing the NEET phenomenon is very challenging because of the complexity of the causes originating it. In this paper, we have proposed a new key lecture, analysing the share of NEETs using as unit of analysis the municipalities and referring to municipal and provincial indicators connected to the labour market, education and social dimensions. Further, the municipal detail also allowed us to control for the effect on the NEET rates of the degree of urbanisation. Results highlight the strong effect on the NEET rates of factors linked to the economic vitality of territory (entrepreneurial rate, attractiveness, share of employees in the high-tech sector and patent intensity), to the outcomes connected with the education systems (in terms of share of high educated and of mean scores got for numerical competences) and to the social participation (electoral participation, separate waste collection and no-profit organisation). Finally, as the NEET rates appear to be higher in densely populated areas than in the rural ones, this result suggests that Italian cities are a catalyst for social exclusion, rather than hubs for innovation and job opportunities. However, all these results need to be elaborated on. In reason, above all, of the significant gap between the North and the South of Italy, it should be interesting to analyse separately the Italian macro-regions (North and South) or to adopt a different hierarchical structure in the multi-level models, accounting also for the regional dimension.

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Sommario

I giovani NEET in Italia: un'analisi delle determinanti a livello comunale

Il presente lavoro propone una nuova chiave di lettura per l'identificazione delle determinanti del fenomeno dei NEET (giovani che non studiano e non lavorano) nel periodo post-crisi finanziaria del 2007 in Italia, il paese che, a livello europeo, presenta i tassi più elevati. Sulla base, infatti, di alcune banche dati dell'ISTAT e del Ministero dell'Istruzione che presentano un elevato dettaglio territoriale, si è proceduto ad identificare le determinanti della quota di giovani NEET osservata a livello comunale. A tal fine, si è adoperato un modello multilevel, con indicatori aventi dettaglio municipale e provinciale. I risultati evidenziano l'importanza dei fattori legati, oltre che al tessuto economico-produttivo del territorio, al funzionamento del sistema educativo.

PART III – WELL-BEING AND SUSTAINABILITY

 ISBN 9788835125860

Regional Well-being and Sustainability: Insights from Italy

Giovanni D'Orio, Rosetta Lombardo**

Abstract

It is widely recognized that, to go beyond the usual income-related aspect of well-being, it is fundamental to consider well-being as a multidimensional phenomenon concerning several dimensions of people's lives. Until recently, a number of countries and organizations proposed their own well-being measures and multidimensional well-being has been mainly studied at country level. However, the well-being of individuals living in the same country might differ from one region to another. The focus of the chapther is centered on the possibility of connecting the Well Being generated in all the Italian Regions in the period 2010-2015, estimated through a factor analysis, to some aspects of economic, social and environmental sustainability.

1. Introduction

The Gross Domestic Product per capita has been considered, for a long time, the main instrument to measure a country's economy. The awareness of the limitations of economic measures for assessing a country's living conditions and overall well-being has spread in recent years. It is also emerged that an exclusive focus on the economic dimension of well-being gives no relevance to social, environmental and economic sustainability (Altken, 2019; Heys, 2019).

The literature on well-being revolves around physical limitations which might inhibit the achievement of the desired level of well-being, while one of the fundamental aims of sustainability studies, for example, is to highlight ways to increase or maintain intergenerational well-being (Quasim, 2017).

Sustainability is a relatively new concept emerging in the late 1980s around the time of the report of the UN World Commission on Environment and Development,

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 ISBN 9788835125860

better known as the Brundtland Report (Bruntland *et al*., 1987). That document was concerned with the tension between the aspirations towards a better life on the one hand and the limitations imposed by nature on the other hand. The concept has been re-interpreted as encompassing three dimensions, namely social, economic and environmental (Spangenberg, 2002; Omann, Spangenberg, 2002; for other dimensions see Vincke, 1992). Sustainability, in its in original meaning, refers to irreplaceable natural resources determining the well-being of future generations and may contrast with the satisfaction of present generations needs known as well-being.

The fundamental aim of the three dimensions of sustainability is to highlight ways to increase or maintain intergenerational well-being. Furthermore, the growing interdisciplinary literature in the field of sustainability and well-being poses a challenge in selecting which indicators should be used to quantify sustainable well-being comprehensively (Quasim, 2017).

Sustainability and well-being are typical issues where composite indicators have been used. According to Michalos (1997), the success of a particular comprehensive system of indicators to measure sustainability and well-being (SaW) is limited by the researcher's subjective point of view about the consumption of capital stocks (e.g. natural capital, produced capital, human capital, social capital etc.) in order to satisfy present needs and the preservation of these stocks to meet future needs.

Present generations use up natural resources at the expense of future generations, but they also generate capital (including knowledge) which raises future well-being. A major question is to what extent the one compensates for the other. This debate centers around the problem of substitutability.

Sustainability may be defined as maintaining well-being over a long, perhaps even an indefinite period. On the one hand, considering this, we need to carefully consider some forms of environmental degradation. On the other hand, what we bequeath to future generations also includes cultural heritage: art and cultural landscapes as well as infrastructure, technology and institutions (EU Guidelines for Impact Assessment, 2005).

Sustainability and well-being (SaW) as a combined concept is a strand of literature with a very brief history starting in the early 1990 when World Bank's Genuine Savings or adjusted net savings emerged as a long-term sustainability indicator followed by other similar SaW indicators including comprehensive wealth, Human Development Index (HDI), etc. (Wilson *et al*., 2007).

Identifying countries that are particularly efficient or inefficient in generating human well-being relative to their impact on the environment is a key theme in the environmental intensity of well-being literature (e.g. Dietz *et al*., 2009; Lamb *et al*., 2014).

The literature focusing on the trade-off between environmental stress and human wellbeing may also help us develop new ways of thinking about

sustainability. In this approach, sustainability might be defined as increasing the efficiency with which well-being is produced relative to the damage done to the environment. Such an approach is consistent with recent policy calls to look beyond GDP as a measure of wellbeing (Stiglitz *et al*., 2009).

It is now widely recognized that, to go beyond the usual income-related aspect of well-being, it is fundamental to consider well-being as a multidimensional phenomenon concerning several dimensions of people's lives. Increasingly, scholars are calling for a shift toward measuring societal well-being using indicators that assess not only people's physical conditions, including their health, but also how people themselves evaluate their own well-being (Diener *et al*., 2010, among others).

The measures aimed to take into account multiple aspects of well-being proposed in recent literature can be grouped into two different approaches: a dashboard of indicators and the composite index (Ciommi *et al*., 2013 among others). A dashboard of indicators provides a detailed picture of the well-being; however, because of the high number of indicators considered, it does not allow for a simple comparison across countries or regions in a country and over time. A composite index may be used for measuring the performance of a country (or regions in a country) over time even if one of the main problems in constructing composite indices is the choice of a method which allows time comparisons (Mazziota, Pareto, 2018). The primary motivation behind indicator initiatives lies, in fact, in the supposed ability of indicators to give a reliable picture of the ecological, social, and economic trends in a concise form. Nevertheless, well-being, given its multidimensional nature, probably, should not be reduced to a single measure; a synthesis of all the information in a single number might leave hidden relevant aspects (Bleys, 2012).

Until recently, multidimensional well-being has been mainly studied at country level and a number of countries proposed their own well-being measures. However, many of the features that influence well-being are likely to be locality-specific and hence spatially variable. The well-being of individuals living in the same country might differ by region (Aslam, Corrado, 2011). Within the same country, people have different access to collective provisions (health care, education, wealth, political climate, etc.) depending on where they live. People living in the same region share a common cultural, political and socio-economic environment, which contributes, alongside individual characteristics, to life satisfaction. Many rural areas, for example, are likely to have a cleaner and greener environment, less crime and less road congestion than most cities but are also likely to have inferior access to a number of public services and cultural facilities. Furthermore, at a regional level the leading steps towards sustainability can be done, because this is the scale where the community is more easily mobilized for collective action and where there is the opportunity for local government to dialogue with the community.

In 2014 the Organization for Economic Co-operation and Development (OECD) has proposed a computation of the Better Life Index (index first proposed in 2011) at a regional level in order to monitoring the performance of 362 Regions across 34 countries.

The aim of this work is to shade some light on the geography of well-being in Italian Regions and, going beyond a ranking of the regions, to try to understand possible effects of well-being production on economic, social and environmental sustainability.

To this end, we use a composite index of well-being built with a Factor Analysis on all Italian Regions in the period 2010-2015. In order to try to limit arbitrariness in choosing the well-being dimensions, we consider the insights that emerge from a project carried out by the Italian National Institute of Statistics (ISTAT) in conjunction with the National Council for Economy and Labour (CNEL).

The work is structured as follows. In Section 2 we present a literature review, Section 3 presents the adopted methodology and the data. Section 4 illustrates the results. Section 5 concludes.

2. Related Literature

This work is related to the research on well-being measurement and deals with sustainability.

2.1. Well-being

In the first bunch, two strands of research have been attracting growing interest in recent economic literature: studies that look at subjective well-being (Diener, 2009 for a survey) and others that, trying to go beyond the usual income-related aspect of well-being, focus on aggregate measures of the quality of life (objective well-being; Gasper, 2005; Smith, Clay, 2010).

The first approach relies upon individuals' stated satisfaction or happiness. The measurement of happiness generally draws upon surveys collecting people's responses to questions such as "All things considered, how happy are you with your life?" They consist of numerical scores ranging from the highest to the lowest level of satisfaction. The empirical economic literature groups the determinants of happiness into three different sets of variables: personal aspects, economic and socio-institutional factors (Blanchflower, Oswald, 2011; Rodríguez-Pose, Maslaukaite, 2011 among others).

The second approach considers well-being as a multidimensional phenomenon concerning several dimensions of quality of life. Starting from the idea that the well-being nature might be captured by the aggregation of elementary macro-level

objective indicator, several methods of measurement have been proposed (Fleurbaey, 2009). Among these latter, composite indicators, suitable for synthesizing the multidimensionality of well-being are widely used. Macroeconomic or aggregate measures of economic and non-economic dimensions of quality of life (such as environment, education, health, essential public services, research and innovation, institutional quality, etc.) are, indeed, usually weighted and aggregated following different statistical methodologies (i.e. the simple arithmetic mean, the geometric mean, the principal component analysis) to form synthetic indices of well-being domains. These latter, in turns, could be combined in order to obtain an overall composite indicator of well-being. These measures provide useful information, however – since they are usually computed by using different components, weights and aggregation methods that refer to different years and countries – their use in empirical analysis is often limited as they are not comparable across countries or over time (Sébastien, Bauler, 2013; Becker *et al*., 2017; Patrick *et al*., 2019).

The most used alternative indicator to GDP for measurement of well-being is the Human Development Index (HDI), calculated by the United Nations Development Programme (UNDP) for a large number of countries since 1990. Since 2010, the HDI has been calculated as a geometric mean of three indicators (standard of living, life expectancy, and education). As the index neglects most of important dimensions of quality of life, it is often "augmented" to consider these.

Over the last decade, initiatives for developing well-being indicators at the community, national and international level, have multiplied. New impulse to the research aimed at improving data and indicators which integrate the GDP has been added by the European Commission ''GDP and beyond'' (European Commission, 2009), the results of the so-called Stiglitz-Sen-Fitoussi report (2009).

Bandura (2008) has provided a review of 178 composite indices for ranking or assessing country performance according to some economic, political, social or environmental measure. The most used are additive methods, but they imply requirements and properties that are often not desirable or difficult to meet. For example, they assume a full substitutability among the different dimensions: a deficit in one dimension can be compensated by a surplus in another, but a complete compensability among the main components of the phenomenon is often not desirable. Therefore, it is necessary to combine in a consistent way both the selection of indicators representing the phenomenon and the choice of the aggregation function in order not to miss some statistical information (Mazziotta, Pareto, 2016).

A number of empirical papers use composite indicators calculated as weighted averages of variables and sub-indices (Marchante *et al*., 2006; Berloffa, Modena, 2012; OECD, 2011, 2014, among others). Other works are based on mixed statistical strategies with the principal component analysis to assess the internal coherence

of the various domains and the weighted average of the partial indices to calculate the respective composite indicators (Annoni, Weziak-Bialowolska, 2012).

Ivaldi *et al*. (2016) propose an approach to measuring well-being in the European Union 27-Countries by creating a composite well-being index, the European Well-being Index (EWI), using the factorial analysis (FA) and adopting the social indicator approach. The EWI is designed to describe the European reality and to try to understand which policies in different countries might ensure best results.

Mazziotta and Pareto (2013) propose a non-additive method, the Method of Penalties by Coefficient of Variation. This method uses the assumption that the individual components are non-substitutable, i.e. it does not allow full compensation among them. This procedure rules out the unit of measurement and the variability effect, using a non-linear function to normalise the values around the mean, penalising more heavily the observations that are relatively far from the mean. The resulting Mazziotta-Pareto index (MPI) is easy to compute and comparable over time. The Adjusted Mazziotta-Pareto Index (AMPI) is based on a re-scaling of the individual indicators by a Min–Max transformation, in contrast with the classic MPI where all the indicators are normalized by a linear combination of z-scores (Mazziotta, Pareto, 2016).

Ferrara and Nisticò (2015) propose a regional well-being index (RWBI) that synthetizes ten dimensions of people's quality of life by using a principal component analysis, in a two-steps approach. The overall RWBI is used to compare the dynamics of regional well-being in Italy with those of the traditional indicator of economic performance, the per capita GDP.

It is noteworthy to understand how policies affect natural resources and, in turn, human well-being, as well as how changes in human well-being may alter human behaviours and consequently affect natural resources (Dietz *et al*., 2009; Milner-Gulland *et al*., 2014). A few initial efforts have attempted to improve the understanding and measurement of human well-being by revealing the ecological embeddedness of human well-being. Summers *et al*. (2012) emphasized the contribution of nature to well-being by classifying HWB into four dimensions as basic needs, economic needs, environmental needs, and subjective happiness.

2.2. Sustainability

Sustainability is a natural topic of study for economists, the scarcity of resources is of central concern to economics. An example is the work of Malthus, who published his theory about looming mass starvation (due to the inability of available agricultural land to feed an expanding population) in 1798.

Dietz *et al*. (2009; 2012) and Knight and Rosa (2011) emphasize the goal of sustainability: by this they mean the minimization of the environmental impact combined with the maximization of human well-being. These studies introduce the concept of 'efficient well-being' for measuring how efficient an economy

is in producing well-being. Using a stochastic frontier production model, they measure the efficiency of a country in producing well-being (i.e. output) considering physical, natural and human capital (i.e. inputs). Their results suggest that environmental efficiency in producing well-being increases with affluence at low to moderate levels of economic development but declines at high levels.

Sustainability indices for countries provide a one-dimensional measure to valuate country specific information on the three dimensions of sustainable development. At the policy level, they suggest a yardstick against which a country's development can be measured and a cross-country comparison can be performed (Böhringer, Jochem, 2007).

Cobb (1989) proposes the Index of Sustainable Economic Welfare (ISEW) to integrate environmental and social externalities in national welfare accounting. With some modifications to the original accounting method, the ISEW has been relabeled as Genuine Progress Indicator (Cobb *et al*., 1995).

The Environmental Sustainability Index (ESI) proposed by Esty *et al*. (2006) quantifies the likelihood that a country will be able to preserve valuable environmental resources effectively over the period of several decades. The ESI consists of five components which are based on 21 indicators. The 21 indicators are derived from 76 variables. For normalization the standard deviation is calculated of each (normal distributed) variable. The three aggregation steps consist of arithmetic means with equal weights.

Floridi *et al*. (2011) build a composite indicator for Italian Regions sustainability following the methodological framework provided by the handbook developed by OECD and European Commission-Joint Research Centre (Nardo *et al*., 2005). They choose only indicators whose values are concordant (i.e. either all positive or all negative) so as to be able to use a number of normalization schemes for the robustness check. Their choice is guided also by the Tuscan analytic model to evaluate the impact of regional plans and programs.

3. Research Methodology and Data

In this section we present the methodology adopted to build the overall indicator (3.1) and the dataset with a synthetic comment on variables used (3.2).

3.1. The Estimation of Wellbeing Synthetic Indicator (WB)

To go beyond the usual income-related aspect of well-being, we need to consider well-being as a multidimensional phenomenon concerning several aspects of people's lives. The multidimensional nature of well-being, however, makes its calculation complex (Ivaldi *et al*., 2016).

The construction of composite indicators is complex because of two principal criticalities. Firstly, the selection of important domains of well-being and the weights given to each domain in the aggregation procedure. Secondly, the choice of an adequate method of the aggregation.

In order to try to limit arbitrariness in choosing the well-being dimensions, we consider the insights that emerge from the Equitable and Sustainable Well-being (BES) project, resulting from the collaboration between the Italian National Institute of Statistics (ISTAT) and the National Council for Economics and Labor (CNEL). In order to do not incur in the criticism of having chosen in an arbitrary manner the weights of the relevant well-being domains, and to limit the subjectivity in attribution of weights to each domain, we opt for equal weighting. Decancq and Lugo (2013) identify equal weighting as the preferred procedure when the theoretical scheme assigns to each indicator the same adequacy in defining the variable to measure and it does not allow hypotheses consistently derived on differential weightings and when the empirical knowledge is not sufficient for defining specific weights.

We compute, in fact, a composite well-being index, for Italian regions, by using the factorial analysis (FA, hereafter). The FA is a statistical technique that aims at simplifying a complex data set by representing it in terms of a smaller number of underlying variables. It allows the study of correlations between large numbers of variables, grouping them around factors, so that they are arranged on factors highly correlated with each other (Dillon, Goldstein, 1984). This methodology permits to explain the variance of the phenomenon under analysis and it can summarize a set of sub-indicators while preserving the maximum possible proportion of the total variation in the original set.

If we have p variables $X_1, \ldots, X_p$ measured on a sample of n subjects, then variable x_s can be written as a linear combination of m factors $F_1, \ldots, F_m$ where $m < p$:

$$x_s = k_{s1}F_1 + \ldots + k_{sm}F_m + w \qquad [1]$$

where k_s are the factor loadings for variable x_s; w is the variability of x_s not explained by the factors.

FA condenses the information contained in a matrix of correlation or variance/covariance; it aims to identify statistically the latent, not directly observable dimensions of the observed phenomenon (Ivaldi *et al*., 2016).

We compute our composite well-being index starting from a panel data of 49 variables[1] that synthesize – through the AMPI method adopted by ISTAT – the original variables grouped into the twelve domains of the BES project.

1. The variables that synthetize the 129 variables of the 12 BES dimensions are 63. We do not consider some of those variables because data do not cover the needed time interval.

3.2. Data

Table 1 describes the variables[2], presents the sector of pertinence in well-being (Economics, Eco; Social, Soc; Environment, Env), the average value at national level in 2010, the average value at national level in 2015 and the expected sign of effect of each variable on well-being.

It is noteworthy to highlight some potential effects that these variables can have on well-being and to consider possible effects of variables that in a "well-being" approach are very important, but have been neglected in previous works.

We will not discuss in details the role of some variables commonly used in studies on well-being, such as "income", "employment" or "innovation", since it is widely recognized that, for instance, "income" matters for well-being.

Economic Well-being

The set of indicators on economic well-being contains information on Average disposable income (per capita) of consumer households and on an Index of inequality of disposable income (Table 1). While the impacts of income inequality differ across various dimensions of well-being, reducing economic inequality will generally help to improve the well-being of a society. For us inequality is not just "economic". Other indicators on "social" inequality are contained in the set of indicators labelled Well-being and minimum conditions that will be discussed in next paragraph.

Well-being and minimum conditions, education, health and participation in the labour market

The variables for this topic, illustrated in Table 1, are Well-being & minimum conditions from 1 to 4, Education from 1 to 5, Health from 1 to 5, Labour occupation 1 and Labour quality from 2 to 6.

Here we want to focus on some effects on the need to associate the concept of social exclusion with a specific set of indicators. This will be useful to assess and monitor the problem of exclusion as a proxy of "negative" economic and social sustainability, as stated in the definition of the definition of the so-called "Laeken indicators", established by the European Council in December 2001.

These indicators are helpful to measure the progress made by European Regions on some agreed objectives in areas deemed crucial, such as the fight against poverty and social exclusion, health, education and participation in the labour market. In one word, "inequality".

2. The full explanation of each of them is provided by ISTAT (https://www.istat.it/it/benessere-e-sostenibilità/misure-del-benessere).

Table 1 – Variables, Meaning and Expected Signs

Indicator	*Meaning*	*BES Type*	*Ita 2010*	*Ita 2015*	*Exp Sign*
Economic Well-being 1	Average disposable income (per capita) of consumer households	eco	17,78	17,88	+
Economic Well-being 2	Index of inequality of disposable income	soc	5,7	6,3	-
Education 1	Children of 4-5 years attending kindergarten	soc	94,7	92,1	+
Education 2	People aged 25-64 who completed at least second grade secondary school	soc	55,1	59,9	+
Education 3	People aged 30-34 who have obtained a university degree	soc	19,9	25,3	+
Education 4	People aged 18-24 who have only completed middle school and are not included in a training program	soc	22,0	25,7	-
Education 5	People aged 25-64 who participated in education and training activities in the 4 weeks prior to the interview	soc	6,2	7,3	+
Environment 2	Urban waste sent to waste disposal site	env	46,3	26,5	-
Environment 4	Availability of urban green	env	31,1	30,9	+
Environment 5	People ≥ 14 very or fairly satisfied of environmental situation where they live	env	69,0	69,8	+
Environment 7	Electricity consumptions generated by renewable sources	env	22,2	33,1	+
Environment 8	Urban waste subject to recycling	env	35,3	47,5	+
Health 1	Life expectancy at birth	Soc	81,7	82,3	+
Health 2	Life expectancy in good health at birth	Soc	57,7	58,3	+
Health 5	Life expectancy without limitations in activities at the age of 65 years	Soc	9,0	9,7	+
Innovation 1	Research intensity	Eco	1,2	1,4	+
Innovation 2	Employees with scientific-technological university degree	Eco	13,4	15,9	+/-
Innovation 3	Employees in creative businesses	Eco	2,8	2,8	+
Labour quality 2	Employees on temporary contracts and employees who started their current job at least five years before	Eco	19,7	19,5	-
Labour quality 3	Rate of incidence of employees with low pay	Eco	11,2	10,5	-
Labour quality 4	Rate of incidence of non-regular employees	Eco	12,3	13,5	-
Labour quality 6	Share of involuntary part-time employees on total employees	Eco	7,3	11,8	-
Labour-occupation 1	Employment rate of the population aged 20-64 years	Eco	61,0	60,5	+
Landscape 2	Index of illegal buildings	Env	12,2	19,9	-
Landscape 3	Share of agri-touristic farms	Env	6,6	7,4	+/-
Politics 1	People ≥14 that express confidence in the Italian Parliament	Soc	3,4	3,4	+
Politics 2	People ≥14 that express confidence in the judicial system	Soc	4,6	4,0	+

(Continues...)

(...follows)

Indicator	*Meaning*	*BES Type*	*Ita 2010*	*Ita 2015*	*Exp Sign*
Politics 3	People ≥14 that express trust in the political parties	Soc	2,6	2,3	+
Politics 7	Index of overcrowding of prisons	Soc	151,0	105,0	-
Security 1	Burglaries rate	Soc	12,0	16,5	-
Security 2	Pickpocketing rate	Soc	5,1	7,7	-
Security 3	Robbery rate	Soc	1,4	1,4	-
Security-murders	Murders rate	Soc	0,9	0,8	-
Services quality 2	Children 0-2 years old who have used the services for children	Soc	13,6	12,6	+
Services quality 3	Families that signalled difficulties to access at least 3 essential services	Soc	7,0	7,4	-
Services quality 4	Families that reported shortages in water supply	Env	11,4	9,3	-
Services quality 5	Seats-km available in all types of transportation	Env	4983,7	4502,7	+
Services quality 6	Percentage of users who expressed a satisfaction grade ≥8 for the public transportation they use	Soc	16,0	14,2	+
Social relationship 1	People ≥14 that express satisfaction with family relationships	Soc	35,7	34,6	+
Social relationship 2	People ≥14 that express satisfaction with their friendships	Soc	25,4	24,8	+
Social relationship 4	People ≥14 that participated at least one social activity in the last 12 months+	Soc	26,9	24,1	+
Social relationship 5	People ≥14 that are very or fairly satisfied with the environmental situation of the area in which they live	Soc	26,9	24,1	+
Social relationship 6	People ≥14 that talk about politics or who are informed about politics at least once a week, who have participated online in consultations or votes on social or political problems or have read and posted opinions on social or political problems on the web in the last 3 months	Soc	67,4	66,4	+
Social relationship 8	People ≥14 who have financed associations in the last 12 months	Soc	17,6	14,9	+
Subjective Well-being 1	People ≥ 14 with a satisfaction score for life between 8 and 10	Soc	43,4	35,1	+
Well-being & minimum conditions 1	People living in families with severe material deprivation	Soc	7,4	11,5	-
Well-being & minimum conditions 2	People living in overcrowded housing without services and with structural problems	Eco	7,0	7,6	-
Well-being & minimum conditions 3	Subjective evaluation index of economic difficulty	Eco	17,4	15,4	-
Well-being & minimum conditions 4	People < 60 living in very low labour intensive families	Eco	10,6	11,7	-

Source: ISTAT

There are forms of non-economic inequality that may have significant implications in terms of well-being. In order to assess issues related to economic and social sustainability, it is therefore essential to consider, in a well-being indicator, information concerning equal opportunities as well as policies for the family and child poverty, unemployment benefits and poverty among mature workers, old-age pensions and poverty among the elderly. Full understanding of the real level of economic and social sustainability of well-being requires a proper investigation of the institutional system in the level and distribution of social rights.

Social relationship and subjective well-being

The variables for this topic, illustrated in Table 1, are Social Relations from 1 to 8 and Subjective well-being 1. Here we want to focus on some potential effects on social sustainability of "relational goods".

The theory of modern relational goods raises questions that are simple but of fundamental importance for the definition of specific targets in the realization of a well-being indicator. The production of relational goods, the multiplication of socialization and support opportunities that may reduce the discomfort of minors, young people, the elderly and families are, in all respects, essential areas of well-being.

For these reasons, social relationships, as relational goods, are very important since, in this perspective, they may assume "materiality" when they are perceived as a "well-neing good". Subjective well-being and social non-instrumental relations could signal, for example, that the time spent in personal relationships (affective, family, social), regardless of intrinsic motivations strongly influences our happiness. Therefore, using relational goods and subjective well-being into economic analyses produces important effects on the overall well-being.

Environment, landscape and crime

The variables for this topic, illustrated in Table 1, are Environment from 1 to 8, Landscape from 1 to 4, Security from 1 to 3 and Security-murders.

Concepts of well-being and its connection with landscape and environmental features provide a wealth of information for popular phrases including "exercising outside is better than gym," "a nice view from your hospital bed will aid recovery" and "living in a greener environment affects happiness." These variables are related to environmental sustainability of well-being.

Providing precise evidence for these statements and analysing what the real relationships are, is an ongoing challenge but it is quite evident that environmental and landscape factors may influence people's quality of life. Landscape, natural beauty & scenery are connected to psychological well-being. A bulk of literature exists about people's mental health and state of relaxation when looking at natural

landscape images or when being outside in areas of parkland, gardens or the 'wilderness.' At the same time, a person or group of people could feel a deep loss and grief when the environment in their community has dramatically changed. The physical health of a person increases with greater contact with nature.

Ecosystems play a critical role in the recycling and redistribution of nutrients. Disruption of nutrient cycling can impair soil fertility, resulting in reduced crop yields. This impairs the nutritional status of households (medium certainty) and diet deficiencies (both macro and micro-nutrients) harm children's physical and mental development. In turn, this can impair the livelihoods of farmers and limit the options open to their children. Toxic chemicals in water (especially the one derived from percolation of rubbish dump sites) and food can have adverse effects on various organ systems. Exposure to low concentrations of some chemicals (such as PCBs, dioxins and DDT) may cause endocrine disruption, interfering with normal human hormone mediated physiology and impairing reproduction.

People are expected to be more satisfied with their life and happier if they feel safe and secure in well-kept, tidy and pleasant business or residential area. Understanding if crime is associated with well-being is also important.

Criminal victimization and well-being may be linked to health outcomes. Experiencing violence or theft victimization is normally associated with significantly lower happiness and life satisfaction. This may influence negatively a victim's overall quality of life and results in diminished well-being.

Politics

This set of variables, presented in Table 1 – Politics 1-7, includes people attitude towards Parliament, Judicial System and Political Parties. Furthermore, a variable (Share of women elected to Regional Councils) can be seen as a proxy of equal opportunities in politics, and two extra variables are relative to the effectiveness of judicial system (average duration of trials defined in ordinary courts) and to the rate of prison overcrowding.

Innovation

This set of variables, illustrated in Table 1 – Innovation 1-3, illustrates the Research intensity of each Region, the share of Employees with scientific-technological university degree and the share of Employees in creative businesses.

Services quality

This set of variables, illustrated in Table 1 – Service quality 1-6, is related to the use and perception of quality of some public services like Transportation, Childcare, Residential services for elderly people, and Water.

4. Results and Discussion

We utilize the factor analysis in order to obtain an overall well-being indicator (WB) for each Italian region from 2010 to 2015.

4.1. Application of Factor Analysis

Table 2 reports the results of the factorial analysis employed to obtain the indicator. For an easier reading, we decided to present the first 9 of the 49 factors since they explain a high level of variability and they are the ones with an eigenvalue greater than 1.

Just to be sure that "unclear" results like the previous one could not affect the stability and reliability of the Factor Analysis performed, we conducted a test of "rotation" of the factors.

The so-called rotation (Ivaldi *et al*., 2016) is an important issue in the factorial analysis stability since it causes the reduction of factor loadings that already, in the first phase, were relatively small, and the increase of the absolute values of factor loadings that predominated in the first phase. In order to avoid some mathematical problems, a process of rotation of the axes can transform the factors. In fact, in an un-rotated solution every variable is explained by two or more common factors, while in a rotated solution each variable is summarized by a single common factor (Ivaldi *et al*., 2016).

In Table 3, we employ the Varimax rotation matrix as robustness check and we find no significant differences with un-rotated results (Abdy, 2003). Note

Table 2 – Factor Analysis to Calculate Our WB Indicator

Factor	*Eigenvalue*	*Difference*	*Proportion*	*Cumulative*
Factor 1	21.815	16.037	0.484	0.484
Factor 2	5.778	2.291	0.128	0.612
Factor 3	3.487	1.005	0.077	0.690
Factor 4	2.482	0.479	0.055	0.745
Factor 5	2.003	0.582	0.045	0.789
Factor 6	1.421	0.190	0.032	0.821
Factor 7	1.231	0.096	0.027	0.848
Factor 8	1.135	0.084	0.025	0.873
Factor 9	1.051	0.214	0.023	0.897

Source: Authors elaborations on ISTAT data

that un-rotated factor analysis for results of Table 2 are on 120 observations; 9 retained factors and 405 parameters.

The eigenvalue shows the variance of the factor. In the initial factor solution, the first factor will account for the most variance, the second will account for the next highest amount of variance, and so on. Some of the eigenvalues are negative because the matrix is not of full rank, that is, although there are 49 variables the dimensionality of the factor space is much less. To choose which are the important factors to be considered we used the Kaiser method, retaining factors with eigenvalue greater than 1. In our case, this leads to consider the first nine factors with a cumulative variance explanation of well-being of almost 90% (0,897).

The column Difference gives the differences between the current and following eigenvalue, the column Proportion gives the proportion of variance accounted for by the factor and finally the column Cumulative gives the cumulative proportion of variance accounted for by this factor plus all of the previous ones.

Given these results, Table 4 reports the pattern matrix of the nine retrieved factors. The factor loadings for this orthogonal solution represent both how the variables are weighted for each factor but also the correlation between the variables and the factor. The higher the load the more relevant in defining the factor's dimensionality. A negative value indicates an inverse impact on the factor.

Most importantly, in the column 'Uniqueness' of Table 3 we report the proportion of the common variance of the variable not associated with the generated factors.

Table 3 – Robustness Check on WB Measurement: Rotation Matrix

Factor	*Variance*	*Difference*	*Proportion*	*Cumulative*
Factor 1	19.445	14.597	0.432	0.432
Factor 2	4.848	0.245	0.108	0.539
Factor 3	4.603	1.599	0.102	0.641
Factor 4	3.004	0.919	0.067	0.708
Factor 5	2.086	0.117	0.046	0.754
Factor 6	1.969	0.366	0.044	0.798
Factor 7	1.603	0.159	0.036	0.834
Factor 8	1.443	0.041	0.032	0.866
Factor 9	1.402		0.031	0.897

Notes: orthogonal varimax; LR test: independent vs. saturated: chi2 (1176) = 8963.33 Prob>chi2 = 0.000.

Source: Authors elaborations on ISTAT data.

Table 4 – Factor Loadings (Pattern Matrix) and Unique Variances

Variable	*Factor*									*Unique-ness*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	
economic well-being 1	0.934	0.124	0.208	0.006	0.067	0.102	-0.121	0.012	0.011	0.040
economic well-being 2	-0.764	0.240	0.103	0.023	0.268	0.083	-0.120	-0.059	0.017	0.251
education 1	0.219	-0.672	0.243	-0.137	0.204	0.128	0.207	0.210	-0.198	0.239
education 2	0.689	0.439	-0.176	0.398	-0.059	0.046	0.083	-0.064	-0.170	0.098
education 3	0.549	0.517	-0.278	0.421	-0.137	0.157	0.060	0.011	-0.103	0.119
education 4	-0.520	-0.308	0.343	-0.408	0.276	0.191	-0.251	-0.009	0.261	0.107
education 5	0.593	0.211	-0.425	0.232	0.316	0.072	0.067	-0.029	-0.020	0.258
environment 2	-0.504	-0.247	-0.023	0.272	-0.392	0.405	-0.062	-0.003	0.203	0.249
environment 4	-0.030	-0.283	-0.288	0.414	-0.021	-0.559	0.017	-0.273	0.275	0.201
environment 5	0.726	-0.440	-0.313	0.157	-0.201	0.131	0.028	-0.039	0.027	0.096
environment 7	0.211	-0.598	-0.257	0.147	0.133	0.161	-0.431	0.139	-0.052	0.258
environment 8	0.765	0.067	-0.190	-0.349	0.292	-0.222	0.013	0.156	-0.140	0.074
health 1	0.671	0.112	-0.418	0.092	-0.050	-0.020	0.320	0.113	0.266	0.165
health 2	0.795	-0.018	0.099	0.184	0.178	0.034	-0.148	0.294	0.124	0.167
health 5	0.687	0.090	-0.124	0.037	-0.084	-0.006	-0.036	0.070	0.255	0.425
innovation 1	0.441	0.596	0.338	-0.067	0.245	-0.094	-0.062	-0.040	0.033	0.256
innovation 2	-0.252	0.778	-0.090	0.291	0.193	0.099	-0.172	-0.106	-0.115	0.138
innovation 3	0.585	0.452	0.293	0.135	-0.005	0.228	-0.093	-0.083	0.066	0.277
labour quality 2	-0.742	-0.158	-0.048	0.289	0.236	0.120	0.036	-0.163	0.136	0.222
labour quality 3	-0.932	-0.063	-0.001	0.089	0.086	-0.059	0.188	0.050	0.006	0.070
labour quality 4	-0.920	0.102	-0.058	0.107	0.226	0.095	0.081	-0.007	-0.160	0.036
labour quality 6	-0.589	0.466	-0.441	-0.076	0.180	0.207	-0.063	-0.133	0.181	0.107
labour-occupation	0.979	0.024	0.069	0.003	-0.081	0.080	-0.040	0.025	-0.001	0.022
landscape 2	-0.873	0.020	-0.209	0.191	0.032	0.028	0.023	0.002	-0.158	0.130
landscape 3	0.587	-0.025	-0.047	0.330	0.416	0.111	0.270	0.191	0.083	0.242
politics 1	-0.318	0.194	0.425	0.589	-0.176	-0.071	-0.025	0.113	0.086	0.277
politics 2	-0.457	-0.297	0.604	0.225	0.083	0.140	-0.041	-0.092	0.148	0.229
politics 3	0.031	-0.262	0.588	0.632	0.019	-0.042	-0.007	0.096	-0.171	0.145
politics 7	0.035	-0.043	0.707	-0.120	-0.347	-0.096	0.255	0.102	-0.028	0.278
security 1	0.446	0.573	-0.020	-0.223	-0.144	0.173	0.262	0.315	0.197	0.166
security 2	0.429	0.749	0.307	-0.055	0.025	-0.027	-0.124	-0.059	0.063	0.133

(Continues...)

(...follows)

Variable	*Factor*									*Unique-ness*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	
security 3	-0.348	0.308	0.365	0.210	0.396	-0.228	0.044	0.322	0.177	0.261
security-murders	-0.624	-0.080	0.175	-0.006	0.215	0.181	0.356	-0.154	-0.106	0.333
services quality 2	0.828	0.014	0.113	0.033	-0.148	0.270	-0.147	-0.003	0.144	0.165
services quality 3	-0.878	-0.022	0.007	0.128	0.073	-0.180	0.133	-0.021	0.125	0.141
services quality 4	-0.798	-0.063	-0.066	0.007	0.085	0.371	0.247	-0.230	-0.093	0.087
services quality 5	0.400	0.478	0.358	-0.177	0.152	-0.193	0.018	-0.381	-0.101	0.236
services quality 6	0.522	-0.664	-0.210	0.081	0.084	-0.050	-0.086	0.038	-0.027	0.217
social relationship 1	0.838	-0.115	0.102	-0.081	0.185	0.159	0.267	-0.138	0.184	0.084
social relationship 2	0.835	-0.170	0.053	-0.006	0.188	0.143	0.237	-0.163	0.164	0.107
social relationship 3	0.856	-0.322	0.032	0.051	0.187	-0.098	0.004	-0.140	0.006	0.097
social relationship 4	0.876	0.166	0.057	-0.223	0.009	0.164	0.006	-0.112	-0.021	0.112
social relationship 5	0.806	-0.270	-0.098	-0.011	0.393	-0.159	0.032	-0.059	0.063	0.079
social relationship 6	0.734	-0.192	0.113	0.172	0.329	0.104	-0.248	-0.083	-0.064	0.192
subjective well-being	0.621	-0.570	0.244	0.070	0.081	0.086	0.122	-0.125	-0.057	0.177
well-being & minimum conditions 1	-0.834	0.011	-0.082	-0.039	0.078	-0.035	-0.015	0.155	0.349	0.142
well-being & minimum conditions 2	-0.490	0.194	-0.232	-0.011	0.236	0.101	0.015	0.382	-0.250	0.393
well-being & minimum conditions 3	-0.826	0.043	0.075	-0.168	0.162	0.138	-0.045	0.077	0.106	0.217
well-being & minimum conditions 4	-0.920	-0.068	-0.152	-0.046	0.124	-0.009	-0.076	-0.071	0.126	0.083

Source: Authors elaborations on ISTAT data

The greater is the uniqueness, the lower the relevance of the variable in the factor model. If uniqueness is equal to 1 we have a "perfect communality" so that variable is not important. We may also think to uniqueness as the variances of the specific factors for the variables. In our set of variables, only one has a uniqueness higher than 0.4 (Health 5)

We stress that rotation involves the "common factors", so the uniqueness is not affected by the rotation. In detail, for each variable we obtain relatively small values of uniqueness, signalling that all our 49 variables are important in the factor analysis.

The results of Table 4 are quite important. For limit of space we will comment the most significant aspects of only first Factor, considering that it accounts for the 48,4% of the WB variance.

Factor 1 is strongly positively influenced by Labour Occupation – ECO (0,979), Economic well-being 1- ECO (0,934) and five variables on Social Relationship – SOC (all of them with a score higher than 0,80). Two variables from Eco and five from Soc elements of WB.

This means that, the WB of Italian Regions between 2010 and 2015 is strongly positively influenced by the Employment rate of the population between 20 and 64 years and the average disposable income (per capita) of consumer households (economic sustainability). Relational goods are also very important (Social Relationship 1,2,4,5 and 6). In particular, the relational goods that assume more importance are related to the satisfaction of relations with family, with friend and with person to rely on (social sustainability).

Life expectancy in good health at birth is also quite important (Health 2 –0,795) as the satisfaction with the environmental situation of the area in which people live.

On the other hand, the most important factors that contributes negatively to the well-being of Italian Regions between 2010 and 2015 are some aspects of quality of Labour (Rate of incidence of employees with a low pay –0,932, the rate of incidence of non-regular employees –0,92 and Employees on temporary contracts –0,742 all variables form Eco domain), some aspects related to "minimum condition" of life (People younger than 60 living in very low labour intensive families, Eco –0,92, People living in families with severe material deprivation, Soc –0,834) and Families that signalled difficulties to access at least three essential services (–0,878). As we can see, the primary focus on sustainability is on economic and social sustainability.

Regarding environmental sustainability, municipal waste sent to landfill (environment 2) has a negative sign in Factor 1 and this is as expected. If the waste set to landfill increases, well-being undergoes a negative variation. The incidence of this variable on the Factor is even quite high (–0.504). Availability of urban green areas in the provincial capital municipalities by region and geographical

distribution (environment 4) has also a negative sign in Factor 1 and this is not as expected. For this variable, anyway, we have to consider that it is related only to the provincial capital of the region, and this probably has an effect on the sign of the eigenvalue obtained. Anyway, the incidence of this variable on Factor 1 is very small (–0.030). Persons aged 14 and over who are very or fairly satisfied with the environmental situation of the area in which they live (environment 5) has a positive sign in Factor 1, with a high incidence of 0.726. In addition, Electricity consumption covered by renewable sources (environment 7 – incidence 0.211) and Urban waste subject to separate collection (environment 8 – incidence 0.765) have the positive expected sign. The three more significant environmental variables in terms of incidence on well-being are related to Waste management. In addition, the opinion of people regarding the environmental situation of the area in which they live has a strong impact on general well-being analysed.

If we read together positive and negative aspects of labour connected to WB, we realise that to have a job matters a lot in general. This is particularly important since Italy's labour market flexibility increased since the late 1990s. The Treu Package (1997) and the Biagi Law (2003) relaxed the discipline for standard temporary contracts and introduced new forms of "atypical" non-permanent contracts while maintaining existing rules on permanent contracts. Because of these reforms, employment grew strongly until the 2008 crisis and then again in 2014, but more than half of the new jobs were temporary (Pinelli, *et al*., 2017). Average pay was also affected by these reforms while the rate of irregular employment has been unchanged. Our result, however, shows that well-being decreases if the job is temporary, non-regular and with a low pay. Italians are not yet happy with "flexibility" on job market even if it creates more employment. Sustainability on the labour market matters.

Inequality matters as well. Well-being is reduced if the rate of inequality increases (Economic Well-being 2, Eco –0,764) and this is very important considering all the implications highlighted in Section 0. Some variables in Factor 1 have not the expected sign like, for instance, Security 1 and 2. Security 1 has the expected sign in Factor 3,4 and 5 while Security 2 has the expected sign in Factor 4,6,7 and 8. This means that the total effect of these two variables on the general index of well-being (weighted for the relative importance of each factor), could not be as the logic behind them could suggest.

4.2. A territorial Analysis of Well-being and of Some Economics, Social and Environmental Issues

The result of FA, presented in Table 5, is the WB index for all the Italian Regions from 2010 until 2015. This index was built starting from the factorial points of table 4.

Table 5 – Rankings by WB Index Retrieved from the Factor Analysis

Rank	*Region*	*2010*	*Region*	*2011*	*Region*	*2012*	*Region*	*2013*	*Region*	*2014*	*Region*	*2015*
1	Trentino	1.551	Trentino	1.606	Trentino	1.521	Trentino	1.607	Trentino	1.759	Trentino	1.784
2	Friuli	1.011	Friuli	0.993	Veneto	0.961	Friuli	0.924	Friuli	1.015	Friuli	1.087
3	Emilia-Rom.	0.915	Emilia-Rom.	0.921	Friuli	0.918	Veneto	0.873	Emilia-Rom.	0.981	Lombardia	0.986
4	Lombardia	0.789	Veneto	0.872	Lombardia	0.891	Lombardia	0.830	Veneto	0.950	Emilia-Rom.	0.946
5	Veneto	0.789	Lombardia	0.807	Emilia-Rom.	0.861	Emilia-Rom.	0.824	Lombardia	0.903	Veneto	0.909
6	Toscana	0.661	Valle d'Aosta	0.653	Valle d'Aosta	0.710	Toscana	0.583	Valle d'Aosta	0.714	Valle d'Aosta	0.737
7	Valle d'Aosta	0.553	Toscana	0.587	Piemonte	0.638	Valle d'Aosta	0.561	Piemonte	0.669	Toscana	0.682
8	Piemonte	0.501	Piemonte	0.573	Toscana	0.521	Piemonte	0.529	Toscana	0.658	Piemonte	0.653
9	Umbria	0.478	Umbria	0.567	Umbria	0.438	Umbria	0.488	Umbria	0.510	Umbria	0.573
10	Marche	0.476	Liguria	0.446	Liguria	0.400	Marche	0.367	Marche	0.481	Marche	0.441
11	Liguria	0.469	Marche	0.407	Marche	0.384	Liguria	0.239	Liguria	0.342	Liguria	0.430
12	Lazio	-0.015	Lazio	-0.084	Lazio	-0.068	Lazio	-0.051	Lazio	0.107	Lazio	0.075
13	Abruzzo	-0.320	Abruzzo	-0.146	Abruzzo	-0.128	Abruzzo	-0.129	Abruzzo	-0.153	Abruzzo	-0.169
14	Sardegna	-0.326	Sardegna	-0.295	Sardegna	-0.305	Sardegna	-0.525	Sardegna	-0.472	Sardegna	-0.415
15	Molise	-0.504	Molise	-0.674	Molise	-0.467	Molise	-0.695	Molise	-0.542	Molise	-0.647
16	Basilicata	-0.877	Basilicata	-0.861	Basilicata	-0.954	Basilicata	-0.889	Basilicata	-0.871	Basilicata	-0.793
17	Puglia	-1.153	Puglia	-1.144	Puglia	-1.296	Puglia	-1.277	Puglia	-1.270	Puglia	-1.230
18	Calabria	-1.536	Calabria	-1.668	Calabria	-1.657	Campania	-1.714	Campania	-1.653	Campania	-1.735
19	Campania	-1.641	Campania	-1.709	Campania	-1.720	Calabria	-1.796	Calabria	-1.704	Calabria	-1.782
20	Sicilia	-1.672	Sicilia	-1.781	Sicilia	-1.841	Sicilia	-2.033	Sicilia	-1.818	Sicilia	-1.878

Source: Authors elaborations on ISTAT data

Trentino (Alto Adige) scores the highest value of well-being for all years considered. From 2010 until 2015, the level of well-being in Trentino increases from 1,551 to 1,784. Friuli (Venezia Giulia) is at the second place with the score that increases from 1,011 to 1.087. Lombardia, that was fourth in 2010 (0,789) is third in 2015 with an increase in the score to the final value of 0,986. Emilia Romagna was third in 2010 (0,915) and is fourth in 2015, but with its score increased to 0,946. These Regions, almost all from the North, increase all the level of well-being and their position in the rank is quite stable.

In the South, the situation is different. If we analyse the last four position of the rank, we find that all are Southern Regions and all of them observe a reduction of well-being between 2010 and 2015. In particular, Puglia moves from –1,153 to –1,230, Calabria moves from –1,536 to –1,782 loosing also a position in the rank, Campania gains a position in the rank even if its well-being moves from –1,641 to –1,735. The region with the lowest level of well-being is Sicily for all the six years with a level worsened from –1,672 to –1,878.

The divide between the advanced North and the less developed South is a pre-eminent feature of the economic development of Italy. In recent years, there have been major advances in the research about the historical pattern of regional inequality in Italy and its historical roots.

Our results are fully consistent with this dual development. The interesting part of the story is that in 2010 the distance between Trentino and Sicily was 3,223 (1,551+1,672) while in 2015 this distance increases to 3,662 (1,768+1,878). Ferrara and Nisticò (2015), found that Italian regions have tended to become more similar in terms of well-being between 2004-2010. Our results shows that, from 2010 to 2015 the territorial cohesion level between Italian Regions started to decrease again.

Table 6 shows some interesting results on environmental performances of Regions considering their ranking in WB index. Campania's result on index is not strongly influenced by environmental performance since the result achieved on Urban waste sent to waste disposal site (environment 2) and Urban waste subject to recycling (environment 8) it is similar, or in a case better than the one achieved by Regions that are top ranking (Friuli and Lombardia). Something different happens to Trentino and Emilia Romagna.

If we look at the result registered in these two Regions regarding Environment 2, we note that their score is not close to the one obtained by Friuli and Lombardia (ranked 2nd and 3rd) and it is considerably higher than the one achieved by Campania (18th). The perception of people older than 14 that are very or fairly satisfied of environmental situation where they live (environment 5) shows the "anomaly" of Lombardia that registers a value considerably lower than the one registered by Trentino and Friuli (1st and 2nd) and similar to that of Calabria (19th).

Table 6 – Some Insights about Environmental Performances

Regions	*2015 Well Being index*	*Environment 2*	*Environment 5*	*Environment 8*
1) Trentino	1.784	14,3	88,1	70,5
2) Friuli	1.087	3,5	82,3	67,1
3) Lombardia	0.986	4,2	69,7	68,1
4) Emilia-Rom.	0.946	16,3	73,4	60,7
…	…	…	…	…
17) Puglia	-1.230	47,9	62,3	34,3
18) Campania	-1.735	3,9	53,6	61,6
19) Calabria	-1.782	58,2	68,5	33,2
20) Sicilia	-1.878	79,9	61,2	15,4

Source: Authors elaborations on ISTAT data

Table 7 shows some results on Economics performances of Regions considering their ranking in WB index. Friuli performs worst of Emilia Romagna in all the three indices despite its better position on global ranking. Well-being in this Region is more depending on other factors than Economics one. Trentino instead has the best score of the four leading Regions on the three indicators. For this Region, the economic components of well-being are quite relevant to generate the overall score in the well-being ranking.

Table 7 – Some Insights about Economic Performances

Regions	*2015 Well Being index*	*Labour Occupation 1*	*Economic Well being 1*	*Labour Quality 3*
1) Trentino	1.784	74	22,49	6,5
2) Friuli	1.087	68,1	19,86	7,7
3) Lombardia	0.986	69,8	21,81	6,6
4) Emilia-Rom.	0.946	71,2	21,69	7,3
…	…	…	…	…
17) Puglia	-1.230	47	13,43	19,1
18) Campania	-1.735	43,1	13,02	19,2
19) Calabria	-1.782	42,1	12,42	21,2
20) Sicilia	-1.878	43,4	13,03	18,2

Source: Authors elaborations on ISTAT data

For the low part of the rank, all the three indicators are sensibly lower than the one observed for top ranking regions. Calabria does worse than Sicily in all three of them recording the highest value on (bad) Labour quality 3 and on Economic Well-being 1. In general, observing Labour quality 3, all the low ranking regions have values that are double of top ranking, and, in Calabria, this value is more than three times the one observed in Trentino.

Table 8 shows some results on Social performances of Regions considering their ranking in WB index. Here we do not have special results on the top rank of the list except for Social Rel 1 and 2 in which Lombardia performs better than Friuli. On the low part of the rank, Calabria and Campania do worse than Sicily – For all the indicators, the values recorded on the low rank of the list are considerably worse than the one recorded in the top list of the rank.

Table 8 – Some Insights about Social Performances

Regions	*2015 Well Being index*	*Social Rel 1*	*Social Rel 2*	*Social Rel 5*
1) Trentino	1.784	46,4	36,1	41,8
2) Friuli	1.087	41,4	29,4	30,7
3) Lombardia	0.986	43,2	29,8	26,2
4) Emilia-Rom.	0.946	39,8	28,7	26,9
…	…	…	…	…
17) Puglia	-1.230	28,1	20,0	20,9
18) Campania	-1.735	22,9	15,1	15,2
19) Calabria	-1.782	27,4	18,6	18,3
20) Sicilia	-1.878	29,2	19,1	17,9

Source: Authors elaborations on ISTAT data

5. Conclusions

Sustainability is widely seen as the ability to meet current needs of individuals or communities without damaging the capacity of future generations to meet their needs. In its three core dimensions of environmental protection, social equity, and economic vitality (Brundtland *et al*., 1987), is a significant public policy concerns of political institutions. The importance of measuring well-being at the local level has encouraged several scholars to propose their own well-being measures.

We propose an aggregate measure of objective well-being to calculate an objective overall indicator of well-being for Italian Regions and to try to highlight the relation between well-being and economic, social and environmental sustainability. This could help to reflect on which dimensions of well-being are relevant for current needs and for future generations. Furthermore, a picture offered by a composite indicator of the relative positions of regions should stimulate a thorough analysis of the dimensions for identifying best performers and design policy responses.

The choice of a statistical technique, the Factor Analysis – that aims at simplifying a complex data set in a smaller number of underlying variables just finding the correlations between large numbers of variables and grouping them around factors – guarantees the objectivity.

For what it concerns economic and social sustainability, our findings show that the most important aspects of Italian regional well-being are income and employment and some factors related to social relationships. In fact, the overall well-being of Italian Regions, between 2010 and 2015, is positively influenced by the employment rate of the population between 20 and 64 years, by the average per capita disposable income and by the satisfaction of relations with family, friends and person to rely on.

At the same time, well-being decreases if the job is temporary, non-regular and with a low pay. In few words, this happens if the quality of job does not allow for economic sustainability of a "dignified" life. Although flexibility increases employment, Italians still prefer a stable and regular job with a "decent" wage. Labour quality matters.

If we look at the regions ranking obtained, our findings confirm that between Northern and Southern Regions a divide still exists. Our results do not show any evidence on the generalised stereotype that the well-being of (people living in) Southern Regions is strongly influenced by a better environment or the extra leisure time they have to practice social relations.

The divide in well-being between the advanced Northern Regions and the less developed Southern Regions is clearly a pre-eminent feature of the "*economic*" development of Italy.

Regarding social sustainability, inequality matters as well, and, over the six years analysed, inequality in well-being has increased. In the four bigger Northern Regions, well-being has increased while the last four positions of the rank are Southern Regions that register also a reduction of well-being over the considered period.

To consider only economic indicators to measure well-being is misleading and the addition of other dimensions such as social factors, environmental aspects, health status etc., allows drawing a more realistic picture that allows also to shed some light on the well-being of future generations, i.e. on sustainability's problems.

Regarding environmental sustainability, the findings show a less dualistic framework. Campania, ranked at the 18th place, has a good performance on the level of the management of waste (waste disposal sites and level of selected waste) over the five years considered. On the other side, Trentino and Emilia Romagna have a relative lower scores on this feature considering their position in the rank. Furthermore, Lombardia registers a value of people older than 14 that are very or fairly satisfied of environmental situation where they live that is considerably lower than the one observed by Trentino and Friuli (1st and 2nd) and similar to Calabria (19th).

It seems that the link between some environmental sustainability variables and the overall level of well-being achieved is not yet fully exploited.

The historical Italian economic dualism is accompanied by disparities in many aspects that affect the overall well-being, but our analysis shows that the most important of them are labour, income and social relations. This suggests the need to analyse the quality of local and national policies, in particular that policies that have an impact in the labour market and on social capital. This will be the aim of a future research.

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Sommario

Benessere regionale e sostenibilità: il caso italiano

È ampiamente riconosciuto che è fondamentale considerare il benessere come un fenomeno multidimensionale che riguarda diverse dimensioni della vita delle persone. Molti paesi e organizzazioni hanno proposto le proprie misure di benessere e il benessere multidimensionale è stato studiato, fino a non molto tempo fa, principalmente a livello di paese. Tuttavia, il benessere delle persone che vivono nello stesso paese potrebbe differire da una regione all'altra. Il focus dell'articolo è centrato sulla possibilità di collegare il Well Being generato in tutte le Regioni Italiane nel periodo 2010 – 2015, stimato mediante una analisi fattoriale, ad alcuni aspetti di sostenibilità economica, sociale e ambientale.

Analisys of Determinants of Life Satisfaction: Regional Differences

Barbara Baldazzi, Rita De Carli*, Daniela Lo Castro*, Isabella Siciliani*, Alessandra Tinto**

Abstract

The aim of this paper is to deepen the analysis of the association between life satisfaction and some individual and contextual variables, including equivalised disposable income, by observing, through a multilevel approach, regional variations in these associations. The results confirm that there is significant regional variations in the association between equivalised disposable income and life satisfaction. In addition, an inverse relationship emerges between the magnitude of the effect linked to equivalised disposable income and the level of wealth in the area, in other words, having more disposable income would matter more in poorer areas than in richer ones.

1. Introduction

International recommendations for the study of well-being defined in the Stiglitz Report (Stiglitz *et al*., 2009) have stimulated research into the determinants of subjective well-being in the scientific literature (Stone *et al*., 2018); this is also due to the increased availability of subjective well-being measures, which are now included in the surveys of several national statistical institutes (Tinto *et al*., 2018).

Also at the international level there are several studies that aim to analyse social and economic progress from a "beyond GDP" perspective, including the United Nations World Happiness Report, published annually from 2012 (Helliwell *et al*., 2019), the report of the US National Academy of Science (Stone, Mackie, 2015), the OECD's How's Life? series (OECD, 2020). Different approaches are adopted for the analyses, however many studies which include territorial factors adopt a multilevel approach (see Aslam, Corrado, 2012; Pierewan A.C.,

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Tampubolon G., 2014; Pittau *et al*. 2010; Ballas, Tranmer, 2012), in order to capture the extent to which individual, household and territorial factors contribute to high levels of life satisfaction. The results of the implementation of multilevel models by geographic area were presented in the ISTAT Annual Report 2019, refining the contents of the in-depth analysis on "Determinants of subjective well-being in Italy" published in the 2018 issue of the Bes[1] Report with the aim of including in the analysis aspects related to the territorial and economic characteristics of the context in which people live.

Several works aim to assess the impact of "non-income related" factors on subjective well-being, considering at the same time household income as an indicator of individual economic well-being (Ng, Diener, 2018; Fleche *et al*., 2012; Sacks *et al*., 2010). In some cases, instrumented income variable has been estimated other than ordinary least squares (OLS), to take into account the effect of unobserved heterogeneity of income on individual well-being (Powdthavee, 2010). Also relative measures of income were used to capture the relevance of the context in driving individual life satisfaction (Clark, 2018). This type of approach was useful to deepen the association between subjective well-being, measured as a positive judgement of life satisfaction, and the relevant aspects that contribute to determine it, according to the BES framework and the domains identified to measure well-being.

Aim of this work, based on data from the ad hoc module on well-being of the European Union Statistics on Income and Living Conditions (EU-SILC), is integrating the analyses carried out so far by specifically including economic factors together with those already considered previously for the analysis of the determinants of life satisfaction.

This contribution has the twofold objective of deepening the analysis of the association between life satisfaction and some individual and context variables, including the equivalent disposable income, and of observing regional variations of these associations. At the individual level, the economic and non-economic determinants will thus be put on an equal footing.

The paper is organized as follows. An initial section explains the methodology used and the assumptions it is based on. Then some descriptive evidences are shown. In the third section the results from the model estimates are enlightened. Some final remarks conclude the paper.

1. Istat (Italian National Statistical Institute), together with representatives of the third sector and civil society, in 2021, has developed a multidimensional approach to measure "equitable and sustainable well-being" (Bes, in italian "Benessere Equo e Sostenibile"), in order to complement the indicators related to production and economic activity with measures of the key dimensions of well-being, together with measures of inequality and sustainability. A report is produced every year.

2. Data and Methods

Data used in this study are taken from EU-SILC 2018 survey and the ad-hoc module on well-being. Individuals aged 16 and over, who directly provided the requested information, were asked to express the degree of satisfaction with the quality of several dimensions of their life (such as job, financial situation, leisure time, personal relationships, or overall life satisfaction), measured in a scale ranging from 0 (not at all satisfied) to 10 (completely satisfied). In this study we have modelled the probability *P* of being very satisfied, that is a response score equal to or greater than 8.

The overall life satisfaction is estimated through a multilevel logistic model with random intercept and random slope, in order to take into account the hierarchical structure of our data. Data are structured in first level units (individuals), nested in second level units (household they belong to), nested in third level units (region of residence). The three-level logistic multilevel model, with random intercepts and random slopes, can be formalized in this way:

$$\log it\left(P_{ifr}\right) = \log \frac{P_{ifr}}{1-P_{ifr}} = X_{ifr}\gamma + u_{0fr} + w_{0r} + w_{1r}K_{ifr} + e_{ifr} \qquad [1]$$

where P_{ifr} is the probability for an individual i belonging to an household f belonging to a region r of being very satisfied (with value 1 meaning very satisfied, 0 not being satisfied at all), X_{ifr} is the vector for each individual of the q covariates (including possible interactions) for which the fixed effects have to be estimated and γ the vector of the q relative coefficients, u_{0fr} is the coefficient of the intercept random effect at the second level (household level), w_{0r} is the coefficient of the intercept random effect at the third level (region level), K_{ifr} the covariate for which the random effects at the third level have to be estimated and w_{1r} the relative coefficient, e_{ifr} is the level-one residual. In this study the vector X_{ifr} contains data on individual characteristics, household socio-economic status and territorial characteristics and the covariate K_{ifr} is given by the logarithm of the disposable equivalised income[2].

The multilevel models allow, under certain assumptions, to decompose the overall variability of the phenomenon under study into the three levels considered and to measure the correlation between the responses of individuals belonging to the same household or living in the same region (but in different households). When such correlation is significant at a certain level, hardly the observations can be assumed to be independent. The violation of the independence of observations assumption makes it difficult to adopt conventional models: using them

2. The equivalised income is calculated by dividing the total net household income by an appropriate correction factor (modified OECD equivalence scale), in order to take into account the effect of economies of scale and to make directly comparable income levels of households with different size and composition.

in such circumstances, generally brings to underestimate standard errors and therefore to consider results statistically significant even if they are not.

The assumption underlying this work is that units within groups are never completely independent: for example, individuals belonging to the same household, sharing many aspects related to the context that shape life satisfaction, tend to be more similar to each other in attributing meaning to the different individual components of well-being; in the same way, households living in the same area are likely to be affected in a similar way by the environmental and political characteristics they share within that specific context, as confirmed by other studies on this topic (Rampichini, Schifini D'Andrea, 1998)[3].

In order to verify the existence of a hierarchical structure, first we have estimated the "null" multilevel model, i.e. with no predictors, obtaining an estimate of how much of the overall variance is explained by between-groups variability by means of the intra-class correlation coefficient (ICC), which provides a measure of the degree of homogeneity between observations belonging to the same group.

More in details, in three-level hierarchical models, the variability of the response variable can be decomposed into two components, between-groups variability (given by σ^2_u and σ^2_w that are the variances at the second and third level respectively) and within-groups (residual) variability (given by σ^2_ε that is the variance of level-one residuals, approximated by the quantity $\pi^2/3$ in those cases where the response variable, having a logistic distribution, is obtained by the dichotomization of a quantitative dependent variable (Hox, 2002)).

The ICC is therefore defined as

$$\frac{\left(\sigma^2_u + \sigma^2_w\right)}{\left(\sigma^2_u + \sigma^2_w + \sigma^2_\varepsilon\right)} \qquad [2]$$

The higher the ICC value, the more appropriate it becomes to use an estimation procedure that takes into account the positive correlation between the first level units belonging to the same higher level unit. In the specific case, the ICC is equal to 0.427, mainly due to the similarity within the same household (0.386) and to a lesser extent to the similarity of individuals of different households within the same region (0.041). Therefore, the ICC value confirms the preference for grouping individuals into second level units, such as households, and into third level units, such as regions.

In order to identify the determinants of life satisfaction, measured as a dichotomous variable equal to 1 if the individual declares a high level of satisfaction and 0 otherwise, the probability of being very satisfied is modelled considering, as covariates, individual characteristics (gender, age, citizenship, role within the

3. The authors have noted that individuals from the same region share common socio-economic, political and culture environments, which, as well as individual characteristics, could determine their perceived satisfaction.

household, level of education, occupational status, presence of physical limitations), household socio-economic status (logarithm of the equivalised disposable income, material and housing deprivation, accommodation tenure status), territorial characteristics (type of municipality, logarithm of per capita municipal value added, per capita municipal social expenditure, soil sealing, unemployment rate and number of violent crimes reported at provincial level) (Table 1).

The selection of the covariates to be included in the final model has been the result of explorative preliminary analysis in order to reveal the presence of multicollinearity between predictors. This detection has been done through the Variance Inflation Factor (VIF), defined as:

$$VIF = \frac{1}{1 - R^2} \quad [3]$$

where R^2 is the coefficient of determination.

The specification of the model, the hierarchical levels chosen and the covariates selected have been driven and bounded by the information available. Several attempts have been made and the consequent evaluations on the goodness of the models themselves have oriented us towards the model presented below.

The quantitative variables has been previously mean centered[4].

As said before, in addition to the fixed effects of explanatory variables and to the random intercepts at household and regional levels, the model estimates also the random effect of the equivalised disposable income at regional level, in order to assess how much the effect of income varies on the degree of satisfaction across regions with respect to the expected average value for all individuals (fixed effect of income). This allows to evaluate specifically how life satisfaction reacts to the income values in a specific regional context.

3. Descriptive Evidences

Data collected on life satisfaction for individuals aged 16 and over through the EU-SILC 2018 ad hoc module on well-being, show that Italy ranks below the European average, with a mean score of 7.1 for life satisfaction (on a scale from 0 to 10), comparing to 7.3 of the EU28 population; just below Spain and France (7.3) but above the 6.7 reached in Portugal and the 6.4 in Greece (Figure 1).

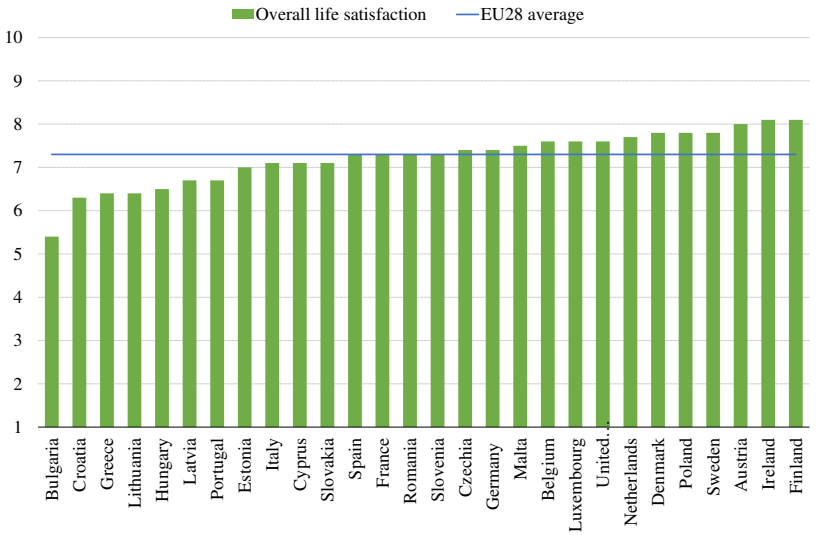
When considering Italian subnational data, a first descriptive analysis shows that overall life satisfaction presents different trends in the Italian regions. 43.9% of persons aged 16 and over declares to be very satisfied with their life (8-10 score on 0 to 10 scale). In the province of Bolzano the share is 63.4%; Toscana (50.2%), Lombardia (50.9%), Molise (51.7%), Emilia-Romagna (52.2%) and the province

4. Analyses were conducted with R programming software using package *lme4* (Bates *et al*., 2015).

Table 1 – Selected Indicators

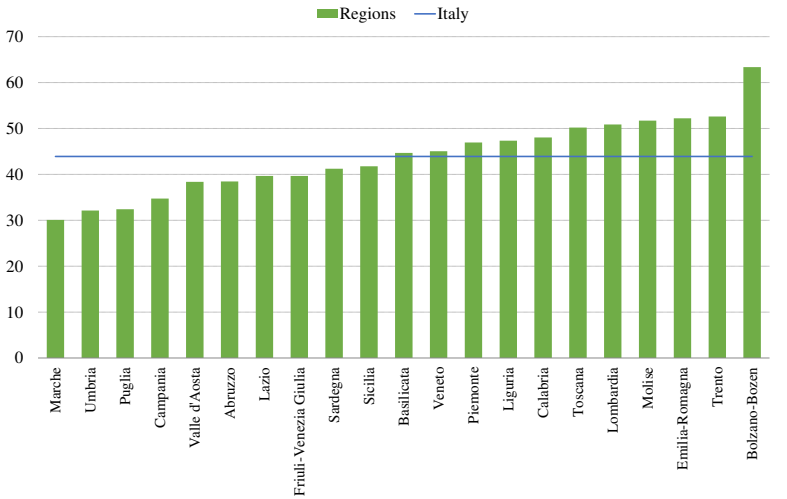
Domains	*Indicators*	*Categories*	*Source*
		Individual characteristics	
Socio-demographic characteristics	Gender	Males, females	Istat, EU-SILC, 2018
	Age	In years	Istat, EU-SILC, 2018
	Household context	In couple without children, parent in couple with children, single parent, child, living alone, other	Istat, EU-SILC, 2018
	Citizenship	Italian, foreign	Istat, EU-SILC, 2018
Education and training	Level of education	Low (Isced 0-2), Medium (Isced 3-4), High (Isced 5-8)	Istat, EU-SILC, 2018
Work and life balance	Labour status	Employed, unemployed, inactive	Istat, EU-SILC, 2018
Health	Activity limitations	No limitations, severe limitations, non severe limitations, did not reply	Istat, EU-SILC, 2018
		Household characteristics	
Economic well-being	Per capita disposable income	Net equivalised disposable income (log)	Istat, EU-SILC, 2018
	Arrangements under which the dwelling is occupied	Ownership, other	Istat, EU-SILC, 2018
	Material deprivation	Severe material deprivation, no material deprivation	Istat, EU-SILC, 2018
	Housing deprivation	Severe housing deprivation, no housing deprivation	Istat, EU-SILC, 2018
		Territorial characteristics	
Structural characteristics	Municipality classification	Urban and suburban area Up to 10,000 inhabitants (small dimension); 10,001 inhabitants or more (medium dimension)	Istat, EU-SILC, 2018
Quality of services	Social expenditure of municipalities	Per capita social expenditure of municipalities (indicator at municipal level)	Istat, Census survey on interventions and social services of single and associated municipalities, 2016
Environment	Soil sealing from artificial land cover	Percentage of soil sealed following a change from non-artificial to artificial coverage	Ispra, Soil consumption, territorial dynamics and ecosystem services, 2017
Work and life balance	Unemployment rate	Percentage of unemployed persons in relation to the corresponding labour force (indicator at province level)	Istat, Labour Force, 2018
Production system	Value added	Per capita value added (logarithm) (indicator at municipal level)	Istat, Extended register of economic variables at territorial level (Territorial Frame SBS), 2016
Safety	Violent crimes	Violent crimes reported (per 10,000 inhabitants) in the province of residence (provincial indicator)	Istat, Processing on data on crimes reported to Police Forces, 2017

Figure 1 – Overall Life Satisfaction, Mean Value (0 to 10 scale) by EU Countries. Year 2018



Source: Eurostat, EU-SILC survey

Figure 2 – Percentage of Persons Aged 16 and over Very Satisfied with their Life (8-10 score on a 0-10 scale) by Regions. Year 2018



Source: Istat, EU-SILC survey

of Trento (52.6%) are above 50%. In Marche, Umbria and Puglia less than a third of the population is very satisfied (Figure 2). As age increases, life satisfaction decreases; conversely, as education level increases, life satisfaction increases. In fact, among those aged 75 and older, 29.2% report being very satisfied; among 16-24 year olds, the rate is 55.1%. Among those who have a degree equivalent to or higher than the bachelor's level, 58.8% are satisfied versus 33.4% of those who have only a lower secondary education degree[5] (Figure 3).

According to descriptive analysis, EU-SILC data show that individuals with a higher income have higher percentages of being very satisfied (55.7% of individuals who have an equivalised disposable income in the fifth quintile of income distribution) (Figure 4).

4. Model Estimates Results

4.1. Fixed Effect Estimates

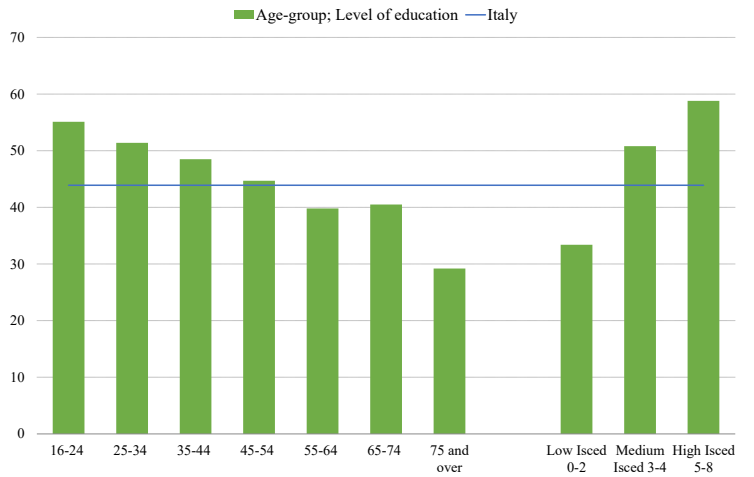
The estimated fixed effects in the model are shown in Figure 5 in terms of odds ratio (OR). These represent the ratio between the odds of those who are exposed to a given risk factor and of those belonging to the reference category. The odds are given by the probability of being very satisfied in relation to its complementary probability. In other words, the OR measures the association between the response variable and the covariate under consideration: its value is 1 in the absence of this association; it is more than 1 when the probability of being very satisfied increases in presence of risk factor; it is less than 1 when it decreases.

When analysing the model's results, referring to individual, household and context effects, among the fixed effects estimates it is worthwhile noting that positive variations in individual well-being perceptions are due to a high educational qualification: among graduates the propensity of being very satisfied with life is about three times higher than among those with a lower educational qualification (OR=3.1), almost twice higher among those with upper secondary education degree (OR=1.8). Moreover, as age increases, the proportion of very satisfied decreases, with a slight recovery among the elderly, attested by a positive odds ratio for the squared age variable.

A decisive factor that negatively affects life satisfaction at the individual level is the lack of physical and mental independence, which is included in the model

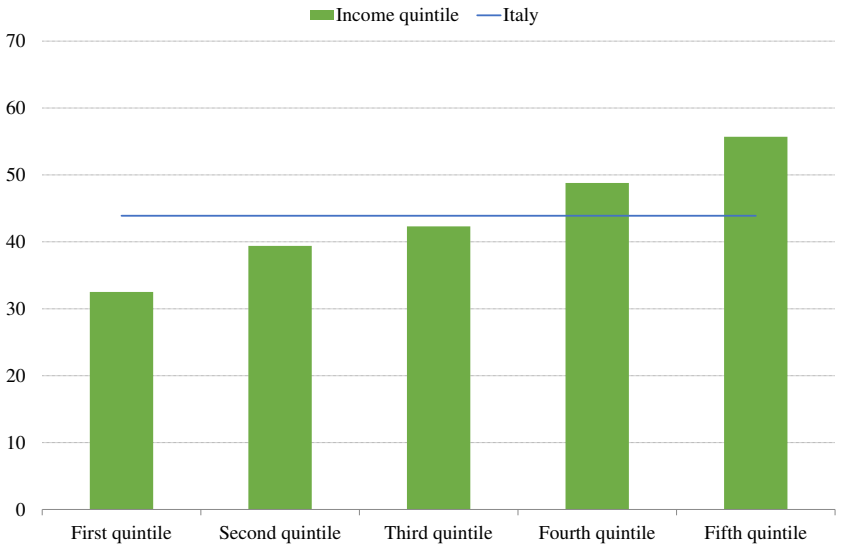
5. Levels of education are calculated according to the International Standard Classification of Education (ISCED) which is defined as follows: ISCED 1: Primary education; ISCED 2: Lower secondary education; ISCED 3: Upper secondary education; ISCED 4: Post-secondary non-tertiary education; ISCED 5: Short-cycle tertiary education; ISCED 6: Bachelor's or equivalent level; ISCED 7: Master's or equivalent level; ISCED 8: Doctoral or equivalent level.

Figure 3 – Percentage of Persons Aged 16 and over Very Satisfied with their Life (8-10 Score on a 0-10 Scale) by Age and Level of Education. Year 2018



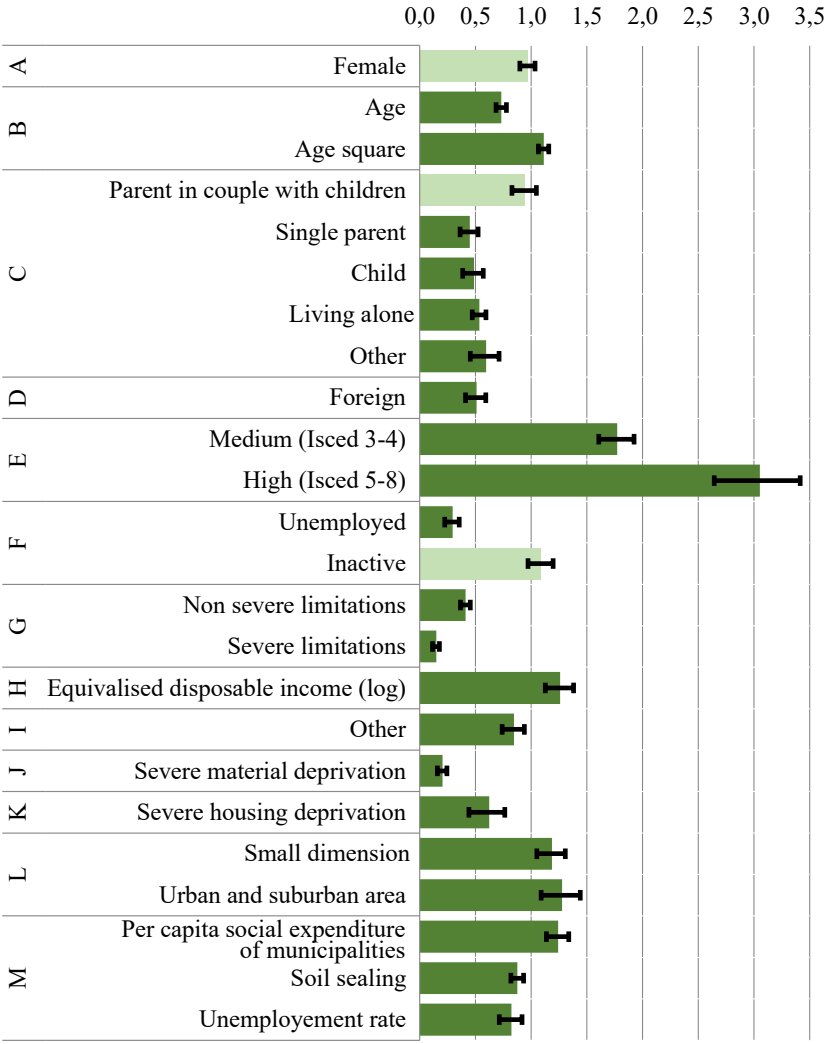
Source: Istat, EU-SILC survey

Figure 4 – Percentage of Persons Aged 16 and over Very Satisfied with their Life (8-10 Score on a 0-10 Scale) by Income Quintile. Year 2018



Source: Istat, EU-SILC survey

*Figure 5 – Estimates from the Fixed Effects Logistic Multilevel Model on the Probability of 8-10 Life Satisfaction Score. Year 2018 Odds Ratio**



Note: (*) The light coloured bars identify a value which is not significantly different from 1. A – Gender ref. "Male"; B – Age; C – Household context ref. "In couple without children"; D – Citizenship ref. "Italian"; E – Level of education ref. "Low – Isced 0-2"; F – Labour status ref. "Employed"; G – Activity limitations ref. "No limitations"; H – Equivalised disposable income; I – Arrangements under which the dwelling is occupied ref. "Ownership"; J – Severe material deprivation ref. "No severe material deprivation"; K – Severe housing deprivation ref. "No Severe housing deprivation"; L – Municipality classification ref. "Medium dimension"; M – Territorial variables.

as indicative of his or her general health status: having serious (OR=0.1) or moderate (OR=0.4) limitations in carrying out daily activities, drastically decreases the probability of attributing high scores to life satisfaction.

The role within the household can also be a relative disadvantage, especially that of a single parent or single person (OR=0.5 in both cases, comparing to those living in couple without children). At household level, the economic resources provided by the equivalised household income lead to an increase in the propensity of being very satisfied, albeit with a lower OR compared to those just mentioned (OR=1.3). Relative disadvantages are severe deprivation (OR=0.2 for material, OR=0.6 for housing deprivation). Living in a non-owned dwelling reduces the chances of household members of being very satisfied with their lives (OR=0.8).

Regarding the territorial context in which people live, living in metropolitan areas as well in small municipalities increases the probability of being very satisfied (OR=1.3 and OR=1.2 respectively compared to those living in medium-sized municipalities). The local socio-economic interventions, aimed at integrating and supporting weaker groups, have also a positive impact, with higher levels of satisfaction associated with higher levels of social spending in the municipality (OR=1.2). Living in a region with a high unemployment rate is a risk factor for satisfaction, as it reduces the probability of being very satisfied with own life (OR=0.8).

These evidences show that economic resources have an impact on well-being, even if at a minor extent compared to the other factors taken into account. As said above, in fact, the OR of the logarithm of the equivalised disposable income is 1.3. To give an idea of what this means in terms of relation between income level and life satisfaction, let us consider a baseline individual defined as the one having the characteristics of the reference category for the categorical covariates and the average values for the quantitative covariates. In other words, our baseline individual considered here is an Italian man of average age, living in a couple without children, with a low education level, employed, without physical limitations, without material or housing deprivation, owner of the accommodation he lives in, living in a medium-sized municipality and in a territory where we fictitiously assume that the unemployment rate, the per capita value added, the reported crimes, the soil sealing and the per capita social expenditure are equal to the national average value.

Ceteris paribus, the overall probability of being very satisfied plotted versus the equivalised income is shown in Figure 6. As an example, other conditions being equal, with an equivalised income of 10,000 euros per year (about equal to the at-risk-of poverty threshold) such a probability is 0.406, with an equivalised income of 20,000 euros per year the probability rises to 0.441, and at 30,000 euros it becomes 0.461; for a well-off individual, having for instance 80,000 euros, the probability of being very satisfied would reach the value of 0.512,

but the addiction of 10,000 euro to its income, i.e. bringing it to 90,000 euros, works out in a very slight increase of the probability that becomes 0.518. In more general terms, similar income increases imply a well-being growth greater in the lowest income classes and gradually minor in the upper classes.

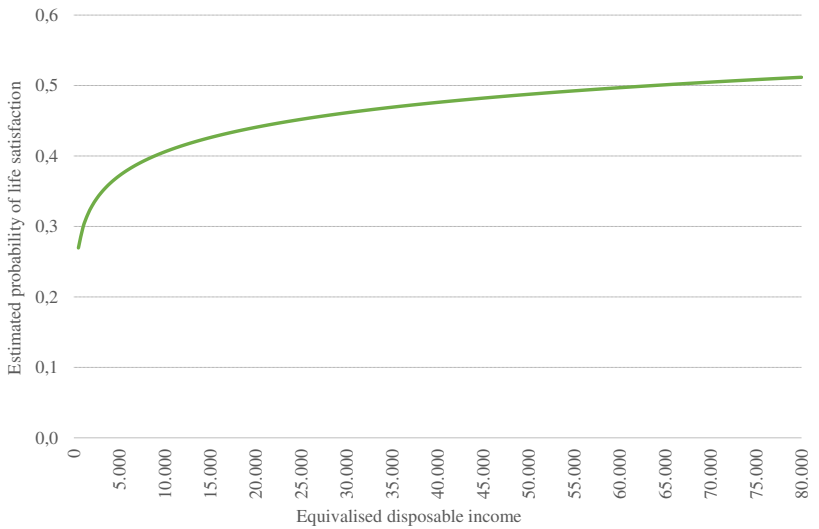
4.2. Regional Differences

As mentioned before, the multilevel model, with the region chosen as the finest level, allows highlighting if some territorial differences occur in the results obtained.

As first outcome, it is worthwhile noting that variations in the association between equivalised disposable income and life satisfaction have been found across regions. The estimated random income slopes for each region plotted versus the regional per capita value added, here used as a measure of the wealth status of the region, show that the positive effect of income on life satisfaction (represented on the vertical axis) is stronger in Sardegna, Friuli-Venezia Giulia and Molise, denoting that the same income increase has a greater impact on the probability of very high satisfaction in these regions.

On the other side, taking into account the association between the equivalised disposable income effect and the area richness level, a slight inverse relation has been found on average: having more economic resources accounts more in poorer regions

Figure 6 – Estimated Probability of Being Very Satisfied by Level of Equivalised Disposable Income. Year 2018



Source: Istat, EU-SILC survey

than in wealthier regions. The negative association, shown by the decreasing regression line, highlights that, controlling for basic socio-demographic characteristics, an individual living in a poor context is more likely to relate his subjective well-being to his own income, as confirmed by other similar studies (Pittau *et al*., 2010). In other words, disposable income is a better predictor for life satisfaction in poorer regions than in richer regions: this result does not necessarily mean that a low income person in a rich region (as Lombardia) feels less satisfied than a low income person in a less rich region (as Sardegna), but that other non-economic factors could have a greater impact on subjective satisfaction levels in less deprived areas (Figure 7).

Another question arising from the analysis is whether, once controlled for the main individual, household and area socio-economic factors, other differences do still remain across regions. Each estimated intercept at regional level can be useful in this evaluation as it can be regarded as the residual propensity for high life satisfaction still left even after controlling for observed characteristics. In our estimates, the intercept of the fixed effects part of the model has a value of -0.286, while the intercepts of the random effects part have a standard deviation of 0.586, attesting an appreciable variability across regions. Figure 8 shows the different regression intercepts by regions (fixed plus random shown in the bars), obtained adding to the intercept fixed effect (i.e. the average value across all regions) the intercept random effect specific of each region (i.e. the estimate of w_{0r} in the model [1]): the dissimilarities are still significant and range from -1.144 (Marche) to 0.874 (Calabria). This raises the need for more in-depth analyses. Once new data will be available for a set of years, it could be tested if such residual regional differences are stable across time or not in order to understand if they depend on structural or contingent factors. Furthermore, it would be desirable to expand the set of territorial indicators to be included among the covariates in order to capture possible determinants able to explain these differences.

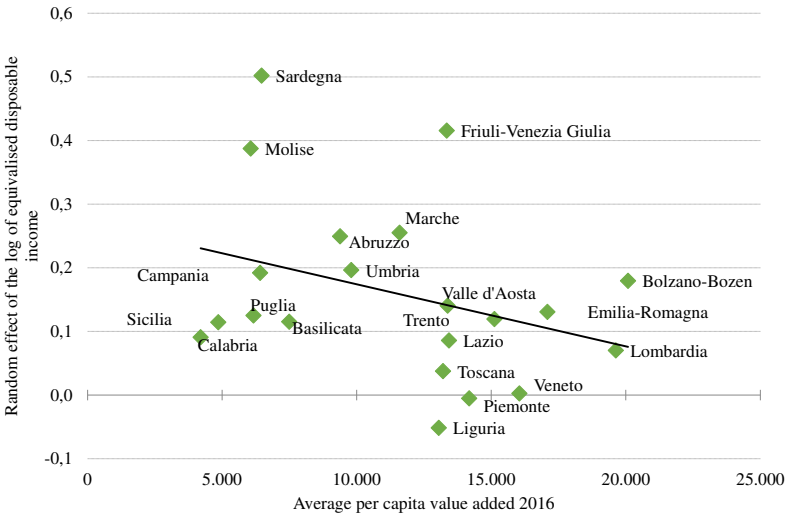
However, the model shown here, based on data available until now, seemed the most suitable among several attempts, where different approaches were adopted to highlight the territorial differences. Distinct multilevel models, one by each geographical area, were also estimated[6], whose results confirm the direction and magnitude of the associations between life satisfaction and the covariates and therefore the interpretations of our final model, providing robustness to our estimates.

5. Conclusions

Although income is confirmed as one of the factors associated with high levels of life satisfaction, a number of other characteristics are particularly relevant, including educational attainment, health, employment status and housing

6. Results are available upon request.

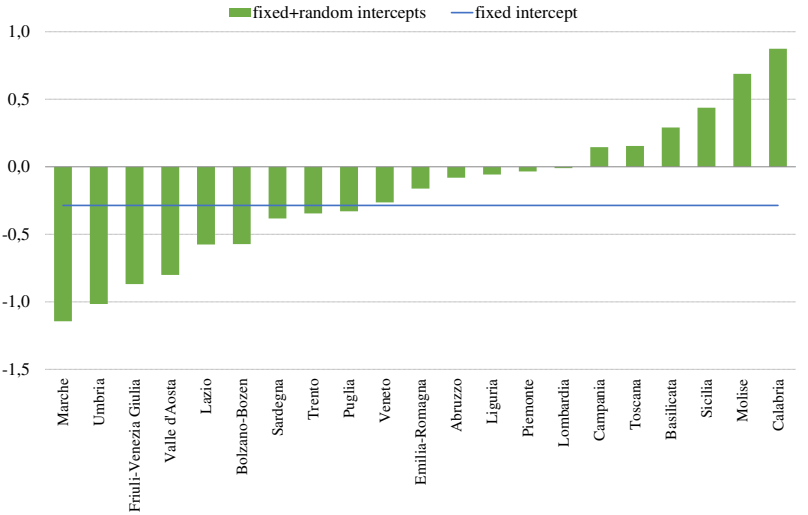
Figure 7 – Random Effect of Equivalised Disposable Income by Regional per Capita Value Added. Year 2018*



Note: (*) The random effect measures the association between equivalised disposable income and life satisfaction within each region.

Source: Istat, EU-SILC survey; Extended register of economic variables at territorial level (Territorial Frame SBS)

Figure 8 – Regression Intercepts by Regions. Year 2018



Source: Istat, EU-SILC survey

conditions. At the territorial level, living in contexts characterised by a higher level of employment, higher levels of social expenditure by the municipality, and better environmental conditions (measured by an indicator on soil sealed) brings an advantage in terms of life satisfaction.

Deepening the analysis of the impact of household income on life satisfaction, it emerges that it varies by region, with a more marked positive effect in the most economically disadvantaged territories, having more economic resources accounts more in poorer regions than in wealthier regions. Controlling for basic socio-demographic characteristics, disposable income is a better predictor for life satisfaction in less wealthy regions. Moreover, the residual propensity for high life satisfaction, after controlling for observed characteristics, varies considerably across regions. These regional variations in the effect of economic resources should be further investigated, also to take into account territorial differentials in terms of purchasing power. A possible development of the analysis could be, for example, the inclusion of estimated sub-national spatial deflators in the model. Alternatively, one could also consider, among the explanatory factors, the relative economic positioning of individuals within the territorial context, in the hypothesis that the degree of satisfaction could also be determined in part by comparison with the economic situation of the other individuals living in the same context.

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Sommario

Differenze regionali nell'analisi delle determinanti della soddisfazione per la vita

Questo contributo si pone il duplice obiettivo di approfondire l'analisi dell'associazione tra soddisfazione per la vita e alcune variabili individuali e di contesto, tra cui il reddito disponibile equivalente, osservando, attraverso un approccio multilivello, le variazioni regionali di queste associazioni. I risultati confermano che esistono significative variazioni regionali nell'associazione tra reddito disponibile equivalente e soddisfazione per la vita. Inoltre, emerge una relazione di tipo inverso tra l'entità dell'effetto legato al reddito disponibile equivalente e il livello della ricchezza del territorio, in altri termini, avere una maggiore disponibilità economica conterebbe di più, in termini di soddisfazione per la vita, nei territori più poveri rispetto a quelli più ricchi.

Occupational Insecurity and Health Wellbeing: Does the Impact Change Across Areas?

Giulia Cavrini, Evan Tedeschi**

Abstract

A growing body of scientific literature highlights the negative consequences of occupational insecurity in several domains of life. The present research project focuses on the social context of Italy, examining the relationship between precarious work and health. In particular, the study aims to improve understanding of the phenomenon by investigating the impact on perceived health through the exploration of differences between geographical areas and the role of the economic situation of the respondents. This study focuses on the Italian adult population. It employs a longitudinal panel approach, based on a sample of women and men aged 16-64 from the Italian Survey on Income and Living Conditions from European Union Statistics (2012-2015).

1. Introduction

In recent decades, Western economies have undergone social, economic, and legislative changes that have had a substantial impact on the organisation of the labour market. Modifications in employment law since the 1970s have brought essential adjustments in contractual arrangements and job security for many workers. Job insecurity has increased both because of the higher risks of unemployment and the spread of what is called atypical or flexible work. Compared to conventional forms of employment, these new labour law agreements are associated with greater insecurity, inferior working conditions, lower pay, and less social protection (Barbieri, Scherer, 2009; Esping-Andersen, Regini, 2000).

A growing literature in the social and health sciences has focused on the negative consequences of precarious jobs on workers' wellbeing and health. Existing studies tend to focus on the risk of unemployment or the experience of job loss (McKee-Ryan *et al*., 2005; Paul, Moser, 2009). The negative effect of unemployment on

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mental health is most influential in countries with low levels of economic development, unequal income distribution, or weak unemployment protection.

Increasing risks of unemployment and changes in working conditions have progressively increased job insecurity in Italy. The new "atypical" forms of work, which in most cases provide for contracts of limited duration, have become increasingly widespread, especially among the younger generations (Kretsos, 2010). While they have contributed to reducing the levels of unemployment reached during the previous period of recession, they have also been victims of this process, which has provided changing work procedures, increasing the sense of insecurity resulting from these new forms of bargaining (Patterson, 2001; Quinlan, Bohle, 2009; Smith, 1997).

Benach and Muntaner (2007, p. 9) noted that "*new types of work arrangements can be as dangerous as traditional unemployment for workers' health*". Other scholars have expressed similar views (Quinlan *et al*., 2001; Virtanen *et al*., 2005), including a shift from comparing people's health based on whether they are employed or unemployed, to comparing people's health based on whether they have a stable job, are unemployed or underemployed.

Research into the health consequences of temporary work is, in fact, relatively new. However, the number of studies on this subject has increased steadily over the last two decades due to growing concerns about the economic and social consequences of the spread of precariousness and other forms of non-standard work. The meta-analysis of 27 studies by Virtanen *et al*. (2005) found an association between temporary work and mental health risks, although the magnitude of the impact depended on the duration of job instability and its context. In particular, these relations tend to change on the basis of the territorial socio-economic context and the level of protection for precarious workers guaranteed by welfare. More recent studies have also shown that temporary contracts have been associated with negative psychological health, even after taking into account potential selection effects (Caroli, Godard, 2016; Pirani, 2017; Quesnel-Vallée *et al*., 2010).

Eurostat data[1] for 2016 show that the percentage of employees aged 15-74 with fixed-term contracts (FTC) in the EU-28, is 14.2 %. According to more recent data, levels of mental health and psychological wellbeing of the Italian population deteriorated between 2005 and 2013, with economic status, social exclusion and precariousness in the labour market being among the main causes (Alleva, 2017).

The consequences of these changes on the general wellbeing of workers and their health are increasingly crucial in the investigative process. Most scholars agree that flexible working arrangements imply unfavourable conditions for both

1. Source: www.ec.europa.eu/eurostat/statistics-explained/index.php?title=Employment_statistics/it

career prospects and private life, including health status, mainly due to increased insecurity and worsened working conditions. Moreover, this negative association is reinforced by the fact that in contemporary societies this form of employment is increasingly becoming a necessity (Benach *et al*., 2004; László *et al*., 2010; Rodriguez, 2002; Rugulies *et al*., 2008; Virtanen *et al*., 2003).

We aim to assess whether temporary work has negative effects on the perceived health of Italians – taking into account potential selection effects – and possible macro-area disparities. Specifically, we have set out to investigate the function covered by fixed-term employment contracts – in conjunction with the presence of other covariates – in modelling individual trends in perceived health over time for Italy, shedding the light on the differences between North-east, North-west, Centre, Southern Italy and the Islands (Singer, Willett, 2003). This is particularly relevant because these areas have historically been characterised by very different employment levels and socio-economic policies, and this, as we have seen, could significantly affect the health status of precarious workers (Virtanen *et al*., 2005).

In investigating these aspects, we use panel modelling with both fixed and random effects, applied to data from the Istat Living Conditions Survey "EU-SILC", covering the period from 2012 to 2015. Through the use of fixed effect models, we can keep unobservable heterogeneity under control, cancelling out that which is constant over time. Several studies suggest that in this area, the individual heterogeneity due to unobserved factors is not negligible (Kivimäki *et al*., 2003; Pirani, Salvini, 2015). The main novelties of this study are the use of longitudinal analyses to verify the role played by precarious employment status, starting from the trajectories of the subjects over time, thus keeping possible distortions in the results under control.

2. The Theoretical Context

In recent decades, substantial changes in the labour market have led to an increasing decline in the long-term relationship between employers and employees (Cappelli *et al*., 1997). The labour market has undergone dramatic changes across all European countries. Alongside the standard labour force, a wide variety of new contractual forms have been introduced to create more opportunities for labour market outsiders – i.e. the unemployed, young people and women (Ferrie *et al*., 2008; Virtanen *et al*., 2003).

These new forms of contracts have been generally labelled as atypical work (Benach, Muntaner, 2007), meaning something limited to a minority of the workforce, marked by different contract duration, working hours, job characteristics and above all, the system of rights, obligations and guarantees of the worker.

More recently, the term "precariousness" has begun to spread concerning these new forms of contracts, to highlight both their growing popularity and the consequences in terms of workers' welfare (Benach *et al*., 2014).

Precariousness, in other words, puts workers at a disadvantage for various aspects such as low wages, temporary contracts, reduced social rights and poor working conditions (Benach, Muntaner, 2007; Guest, 2004; Virtanen *et al*., 2005).

The crucial point is that precarious working conditions call into question the possibility of guaranteeing individual wellbeing, security through income and self-realisation of workers. Such conditions amplify the risk of job loss, which is inherent in the short-term nature of fixed-term contracts, and make it much more difficult for workers to plan their future private and professional lives (Gash *et al*., 2007; Vives *et al*., 2011).

In general, empirical research has shown a negative association between atypical work and health, but there are substantial variations between countries due to differences in national economic contexts, labour market policies or social protection (Benach *et al*., 2014; M. Virtanen *et al*., 2005).

Studies on factory closures since the 1970s have shown that health begins to be affected when workers, while continuing to work, perceive a situation of uncertainty due to possible closure or downsizing of the company (Bohle *et al*., 2001; Kivimäki *et al*., 2000). The threat of job losses would significantly contribute to a worsening of health, mainly due to mental and psychological disorders and consequently an increased need for medical interventions and treatment. In several longitudinal studies, people exposed to persistent and chronic job insecurity have shown a substantial deterioration in both mental and perceived health, fuelling a state of chronic stress (Ferrie *et al*., 2002).

In the United States, studies have shown the presence of more pronounced symptoms of depression in workers exposed to temporary work in the previous two years (Quesnel-Vallée *et al*., 2010) and the negative impact of job insecurity on perceived health and the presence of cardiovascular disease (Burgard *et al*., 2009; Slopen *et al*., 2012). In Europe, for example, in terms of health consequences, many studies have shown that precarious work increases the risks of mental, psychological, depression or life satisfaction-related disorders (Callea *et al*., 2012; Quesnel-Vallée *et al*., 2010; Scherer, 2009). On the contrary, P. Virtanen *et al*. (2003) did not find a significant relationship between work and health in Finns. In another Finnish study, the authors point out that compared to permanent employees, men and women on fixed-term contracts have a better health assessment, and the association between perceived safety and psychological distress is significantly stronger in permanent employees than with fixed-term employees (Virtanen *et al*., 2002). An increased risk of negative health outcomes is present in some southern European countries, especially among women in precarious work (Pirani, Salvini, 2015; Vives *et al*., 2011).

In Italy, according to ISTAT, the Italian Institute of Statistics, the increase in employment in 2014 is due in particular to the increase in atypical forms of employment and part-time work, particularly non-voluntary. The rate of atypical workers overall is around 11.9% with over 5 million workers on fixed-term contracts in the north, in the centre and in the south. Atypical work is prevalent among young people aged 15-34, for whom just over one in four people are employed in a temporary job or a collaboration. However, this form of work also affects older workers (8.8% in the 35-49 age group) and people with family responsibilities: in 2014, 42.3% of women in atypical work are mothers (Istat, 2015).

The management of flexibility in Italy – regulated by the new labour legislation, the Treu law, from the end of the 1990s onwards, in which both less productive workers (with health problems and low motivation) and motivated workers with high levels of productivity, who are hired on fixed-term contracts at the beginning of their careers has significantly strengthened the dualism between a central and a marginal labour force (Micheli, 2006). The initial aim of these measures was not only to counteract the growth in unemployment but also to encourage the entry into the labour market of those social groups whose participation in Italy had traditionally been unusually low, particularly women and low-skilled individuals. However, the results of various studies show that deregulation, though on the one hand has acted as a "springboard" and promoted the entry of categories otherwise previously excluded, on the other hand has encouraged the emergence of risks related to stability and job security (Barbieri, Scherer, 2009; Bozzon, 2008)

Interest in this issue in Italy has only recently emerged, in the light of the drastic changes in working conditions, in which permanent full-time employment – characterised by job security and a stable salary – has been increasingly replaced both in Italy and in the rest of Europe by temporary jobs, apprenticeship contracts, atypical and part-time jobs.

In this regard, Pirani and Salvini (2015) investigate whether Italian temporary workers suffer more from health problems than permanent workers. The results firstly highlight the presence of a negative causal effect of precarious work on self-perceived health, dichotomised in two categories. Atypical work then has a particularly negative impact when it continues over time. Finally, if gender differences are taken into account, this association is particularly negative for women, while for men, the association is weak and not very significant. At the same time, other research shows that the likelihood of being prescribed psychotropic drugs is higher for workers on fixed-term contracts. Also, the transition from permanent to fixed-term employment significantly increases the risk of mental illness and, symmetrically, the transition to stable employment tends to reduce this risk (Moscone *et al*., 2016). Finally, a study of the young adult workforce has shown a

strong association between employment status and mental health. Specifically, the association between job insecurity and mental health is the net of other variables, more significant and negative in men than in women. Furthermore, compared to long-term contracts, workers in all other categories are significantly more likely to be in poor mental condition; in particular, unemployed people with previous work experience reported the worst level (Fiori *et al*., 2016). This is the first study to focus on territorial differences and we aim to focus on regional differences, with the objective of testing whether poorer Italian areas are associated with a worsening of the link between employment status and health.

3. Data and Methodology

3.1. Sample Selection

The database on which the following empirical analysis is based is represented by the Eu-Silc (Statistics on Income and Living Conditions Survey) consisting of longitudinal data for the years 2012-2015 of the Italian component.

This survey – carried out by the National Italian Institute of Statistics (ISTAT) – collects detailed information on individuals and households at random, and representative samples on a national level, for all European countries (Arora *et al*., 2015). The interviewees are followed for four years, with a particular focus on their employment history and socio-demographic characteristics. In our case we will analyse the impact of fixed-term contracts on perceived health, considering a sample of women and men aged between 16 and 64 in 2012, the reference year, taking into account both transitions towards stable employment and those towards precarious employment.

Our dependent variable is the self-perceived health of individuals, according to the question suggested by the World Health Organization: "How is your health in general?"; the answers are on a scale of 1 (very good) to 5 (very bad).

Overall, this indicator – composed of 5 categories – provides a comprehensive, complete and reliable overview of the individual's general state of health and wellbeing, proving to be a valid substitute in the absence of other more specific dimensions related to employment conditions, such as mental health, depression or stress (Virtanen *et al*., 2002).

Given the categorical nature of the variable, the most suitable alternative is to implement an ordinal logistic model, which is the most appropriate alternative in the case of ordered categorical variables. In this case – concerning the implementation of a linear model (OLS) – the extent to which the results differ depends fundamentally on the level at which the OLS assumptions are severely violated (Winship, Mare, 1984).

In order to unequivocally and precisely identify the type of contract, we have included all workers with an employment contract in the analysis and removed the self-employed. This exclusion was also carried out in previous studies (Artazcoz *et al*., 2005; Virtanen *et al*., 2005) because self-employed workers have individual characteristics and attitudes that differentiate them significantly from employees; moreover, the very nature of self-employment is profoundly different from that of fixed-term contracts stipulated with an employee (Bardasi, Francesconi, 2004; Virtanen *et al*., 2003). We also took into account the differences between part-time and full-time contracts, as this is a very important aspect when analysing precarious employment (Bartoll *et al*., 2014; Bernhard-Oettel *et al*., 2005).

Marital status is a health-related element, even if the evidence is not clear; in our case, we have distinguished between single, married and separated people.

We introduce the area of residence as a covariate, distinguishing between north, centre and south[2]. We have divided the education level into primary, secondary and tertiary education. At the same time, the assessment of economic and financial situation refers both to the interviewees' opinion on the overall economic conditions of their household in the last 12 months (good or bad) and to the average annual income received.

Occupations have been classified into three groups, following Isco-88 standard guidelines: primary and elementary occupations (machine operators, fitters, artisans, agricultural and fishing workers), occupations with a medium level of skills (technicians, associate professionals and employees), and occupations involving higher levels of skills (legislators, senior officials, managers and professionals).

Finally, let us consider two confounding factors that account for state of health. The first indicates the presence/absence of a long-term chronic disease (hypertension, diabetes, heart disease, arthrosis); the second indicates the presence of severe limitation and disability in daily activities.

3.2. Fixed-effect and Random-effect Ordinary Logistic Models

In the case where the response variable is composed of orderable categories, we can estimate through the method of the maximum likelihood a longitudinal model with random effects, adapting it to the following formula:

$$\Pr\left(y_{it} > k \mid \kappa, x_{it}, \nu_i\right) = H\left(x_{it}\beta + \nu_i - \kappa_k\right) \qquad [1]$$

For i = 1,...,n, t = 1,..., n_i (survey waves), v_i are independent and distributed identically with $N(0, \sigma_v^2)$; k represents the number of ordered categories of the

2. In the case of the multivariate analysis, we carried out a more accurate analysis, dividing the areas into north-west, north-east, centre, south and islands.

dependent variable, where k is the number of possible results; finally, H(.) expresses the function of the cumulative logistic distribution.

From the formula (1), we can derive the probability from observing a k result for the response variable y_{it} as:

$$\Pr\left(y_{it} = k \mid \kappa, x_{it}, \nu_i\right) = \frac{1}{1+\exp\left(-\kappa_k + x_{it}\beta + \nu_i\right)} - \frac{1}{1+\exp\left(-\kappa_{k-1} + x_{it}\beta + \nu_i\right)} \quad [2]$$

Where k_0 is taken as $-\infty$ and k_k as $+\infty$; moreover x_{it} does not contain a basic term of reference, as this effect is absorbed within the different intercepts present in this model (Skrondal, Rabe-Hesketh, 2004).

If we consider fixed-effect models, in the case of a categorical variable y_{it} – such as perceived health, composed of 5 progressively increasing categories – the most suitable model is the ordinal logistic model with fixed effects.

In our case, we apply a fixed-effect ordinal logistic model, using the so-called "*Blow and Cluster Estimator*" (BUC) proposed by Baetschmann *et al*. (2011). Using this technique, it is possible to jointly estimate the values for the dichotomisation of all cut points, resulting in a fixed effect model consisting of a unique probability function. In this way, we use all available information in the dependent variable to evaluate the causal estimates over time.

The ordinal logistic model with fixed effects connects the latent variable y^*_{it} for the individual i to time t with a linear index of observable x_{it} and non-observable characteristics such as α_{it} and ε_{it}:

$$y^*_{it} = x'_{it}\beta + \alpha_i + \varepsilon_{it} \quad [3]$$

Where i = 1,..., N; t = 1,...,T.

The latent variable is related to the ordered (observed) variable y_{it}:

$$y_{it} = k \; if \; \tau_k < y^*_{it} \leq \tau_{k+1}, k = 1, \ldots, K \quad [4]$$

and assume there is an increase from $\tau_1 = -\infty$ to $\tau_{k+1} = +\infty$

The assumption related to the distribution of the ordinal logistic model with fixed effects is:

$$F\left(\varepsilon_{it} \left| x_{it}, \alpha_i\right.\right) = F\left(\varepsilon_{it}\right) = \frac{1}{1+\exp\left(-\varepsilon_{it}\right)} = \Lambda(\varepsilon_{it}) \quad [5]$$

Therefore, the probability of observing the k outcome for the individual i at time t is:

$$\Pr\left(y_{it} = k \left| x_{it}, \alpha_i\right.\right) = \Lambda\left(\tau_{ik+1} - x'_{it}\beta - \alpha_i\right) - \Lambda\left(\tau_{ik} - x'_{it}\beta - \alpha_i\right) \quad [6]$$

which depends not only on β ex_{it}, but also on α_i, τ_{ik}, τ_{ik+1} (Ferrer-i-Carbonell, Frijters, 2004).

Chamberlain (1980) shows that the maximisation of conditional probability is given as follows:

$$log\mathcal{L}^{k}\left(b\right)=\sum_{i=1}^{N}log\mathrm{P}_{i}^{k}\left(b\right) \qquad [7]$$

However, this estimator of β, said in this case $\hat{\beta}^{k}$, does not use all possible variations in y_{it}.

The alternative we propose consists of estimating all possible dichotomisations together using the estimator of the variance of each cluster (Baetschmann *et al*., 2011):

$$\widehat{Var}\left(\hat{\beta}\right)=\left(\sum_{i=1}^{N}\hat{h}_{i}\right)^{-1}\left(\sum_{i=1}^{N}\hat{s}_{i}\hat{s}_{i}^{'}\right)^{-1}\left(\sum_{i=1}^{N}\hat{h}_{i}\right)^{-1} \qquad [8]$$

where $\hat{s}_{i}$ represents the health score for each individual rated on $\hat{\beta},\hat{s}_{i}=\left(\hat{s}_{i}^{2'},\ldots,\hat{s}_{i}^{k'}\right)'$ and $\hat{h}_{i}$ represents the matrix of derivatives of s_{i} with respect to β, and rated on $\hat{\beta}$. Ultimately, this technique forms the basis of the BUC estimator[3].

4. Empirical Results

4.1. Preliminary Descriptive Data and Analysis

Before moving on to the panel models, we see some preliminary results that summarise the average value of perceived health within the categories of indicators that we are going to insert as control variables and predictors (Table 1).

These results refer to the data relative to the last *wave* (2015)[4]. We can observe at first glance that there are no substantial differences between men and women, while the declared perceived health of those who have an FTC is worse than that of permanent workers, both in the case of full-time and part-time work.

As far as family status is concerned, we find significant differences between single or married people compared to those separated, although it is easy to assume that age has a relevant weight in this type of outcome.

As can be expected, there are differences in perceived health between age groups: younger people report better health than older people (1.68 compared to 2.20). In the south, on average, health is declared slightly better than in the north. We can also observe that the educational qualification is significantly related to perceived wellbeing: those who declare having achieved secondary or tertiary education show overall better health.

Finally, we find that those who claim to experience overall good economic conditions and to have no chronic illnesses report better scores than those who

3. For more information: Baetschmann *et al*. (2011).
4. We treat our variable here as if it were quasi-cardinal.

experience poor economic conditions or severe conditions due to long-term chronic illnesses.

4.2. Results of Multivariate Analysis

Let us try to focus on the fixed effect model to confirm the hypothesis of the causal impact of precarious work on perceived health. Assuming that the variable related to perceived health is composed of 5 categories and is not normally

Table 1 – Average Perceived Health Values According to Different Predictors and Control Variables for the Last Wave (2015)

	Mean	*St. Err.*
Employment status		
Long-term c.-Full time	2.05	0.65
Long term c.-Part time	2.09	0.66
FTC-Full time	1.96	0.65
FTC-Part time	2.02	0.64
Area of residence		
Northern Italy	2.07	0.66
Central Italy	2.02	0.59
South Italy	1.98	0.69
Education		
Primary school	2.18	0.71
Secondary school	2.01	0.63
Tertiary school	1.96	0.59
Family status		
Single	1.94	0.62
Married	2.06	0.64
Separated	2.25	0.71
Perceived economic resources		
Good	1.99	0.58
Bad	2.08	0.68
Gender		
Men	2.02	0.68
Women	2.04	0.63
Income		
First quartile	2.04	0.66
Second quartile	2.03	0.67
Third quartile	2.06	0.65
Fourth quartile	2.02	0.60
Age		
16-25 years	1.68	0.53
26-35 years	1.83	0.57
36-45 years	1.95	0.62
46-67 years	2.20	0.66
Professions (Isco-88)		
Low level	2.12	0.68
Medium level	2.01	0.64
High level	1.99	0.61
Chronic Diseases		
No	1.92	0.54
Yes	2.72	0.81

Source: Our analysis from the EU-SILC Living Conditions Survey (Istat, 2012-2015)

distributed, it is not possible to guarantee the adherence to all the assumptions required in the case of traditional linear models. Therefore, we carry out a further analysis using the BUC technique for ordinary categorical variables as described in the previous paragraph.

In the first model we insert – in addition to control variables such as education, age and family status – the employment level of the interviewees, according to Isco-88 types, the income divided into four groups of percentiles (0-25°, 25°-50°, 50°-75°, 75°-100°) and the evaluation of the economic situation. In the second model, we include, in addition to the variables listed, the presence of severe health limitations and chronic diseases, to particularly keep critical health situations under control, which could otherwise lead to a distortion in the results of the analysis (Table 2).

The results of both models confirm the presence of a causal trend. We find that keeping variables under control such as income (objective measure) and the economic conditions perceived by individuals (subjective measure), in the first model, precarious work produces a negative[5] and significant impact on the perceived health of Italians, both in the case of full-time and part-time work. This effect also remains unchanged in the second model, only for part-time precarious workers, in which we keep those with particularly serious health conditions under control.

If we examine the Italian geographical areas separately – taking into account a differentiation in fixed-term employment contracts between full-time and part-time contracts – we can find the presence of some differences (Table 3). In the case of precarious part-time contracts, the negative impact on perceived health is more influential in South Italy and in North-West the probability is less than 10%.

With regard to full-time fixed-term contracts, there is a slight negative effect on perceived health in North-West, while there is no change in the Centre of Italy and in the Islands.

Ultimately, we can conclude that although the overall causal incidence of FTCs in our reference sample has been established, differences between Italian geographical areas are still significantly marked: citizens in South Italy – unlike the other areas – experience worse perceived health conditions, especially when it comes to part-time FTCs.

In the last part, we focus on some random effect ordinary logistic models, to highlight – more than a casual reading of the impact of fixed-term contracts on health status, carried out through the fixed effect models seen previously – the

5. Because the dependent variable (i.e, the self-perceived health of individuals) is measured on a scale of 1 (very good) to 5 (very bad), a positive parameter estimate corresponds to a negative impact of the regressor on self-perceived health.

Table 2 – Ordinary Logistic Regression with Fixed Effects: Estimation of Perceived Health Impact

		Model 1			*Model 2*		
		Coeff.	*Std. Err.*	*Sig.*	*Coeff.*	*Std. Err.*	*Sig.*
Occupation	Long-term c.-Full time	-	-		-	-	
	Long-term c.-Part time	0.140	0.130		0.193	0.138	
	Fixed-term c.-Full time	0.302	0.138	*	0.228	0.148	
	Fixed-term c.-Part time	0.555	0.206	**	0.536	0.222	*
Age		-0.032	0.019	+	-0.026	0.020	
Education	Low	-	-		-	-	
	Media	-0.166	0.176		0.152	0.176	
	High	-0.024	0.226		0.243	0.228	
Family status	Single	-	-		-	-	
	Married	0.398	0.312		0.439	0.335	
	Separated	0.389	0.385		0.386	0.414	
Occupations Isco-88	Low level	-	-		-	-	
	Medium level	-0.654	0.317	*	-0.713	0.330	*
	High level	-0.725	0.410	+	-0.960	0.458	*
Income	I quartile	-	-		-	-	
	II quartile	0.157	0.111		0.176	0.121	
	III quartile	-0.028	0.140		-0.059	0.150	
	IV quartile	-0.049	0.168		-0.033	0.177	
Economic resources	Good	-	-		-	-	
	Bad	-0.179	0.0916	+	-0.194	0.097	*
Health limitations	No				-	-	
	Yes				1.356	0.091	***
Chronic Diseases	No				-	-	
	Yes				1.349	0.101	***
	N. of observations	11,987			11,987		
	Pseudo R^2	0.004			0.126		
	Prob. > Chi^2	0.016			0.000		

Note: (+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001).

Source: Our analysis from the EU-SILC Living Conditions Survey (Istat, 2012-2015)

Table 3 – Ordinary Logistic Regression with Fixed Effects: Estimation of Perceived Health Impact; Differences between Italian Geographical Areas

Occupation	*North-West*		*North-East*		*Centre Italy*		*South Italy*		*Islands*	
	Coeff.	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*
Long-term contracts-Full time	–		–		–		–		–	
Long-term contracts-Part time	0.123		0.166		0.177		0.338		-0.198	
	(0.289)		(0.239)		(0.277)		(0.351)		(0.67)	
Fixed-term contracts-Full time	0.243		0.483	+	0.037		0.326		-0.277	
	(0.306)		(0.283)		(0.301)		(0.328)		(0.607)	
Fixed-term contracts-Part time	1.118	+	0.072		0.374		0.955	*	-0.574	
	(0.639)		(0.411)		(0.54)		(0.429)		(0.81)	
Number of observations	3,403		3,596		2,368		1,908		711	
Pseudo R^2	0.113		0.124		0.166		0.140		0.201	
Prob. > Chi^2	0.000		0.000		0.000		0.000		0.000	

Note: Standard errors in brackets; (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Source: Our analysis from the EU-SILC Living Conditions Survey (Istat, 2012-2015)

main determinants of the trend, through the inclusion of variables that do not vary over time and were therefore excluded from the previous longitudinal analysis. In Table 4, we present three different models in which, by progressively and differently inserting the independent variables, we analyse the role played by FTCs on perceived health. In the first model, the net of the controls entered, the results corroborate the negative impact of the FTC on the *outcome* variable, especially in the case of part-time workers. At the same time, we observe that the presence of chronic diseases, severe health limitations, occupational type (Isco-88) or negative evaluation of the family's financial situation, generate a significantly negative outcome on the perceived health. In the second case, the perceived health indicator is regressed, net of the previous variables, on the birth cohort of individuals and the period. The inclusion of additional controls such as cohort and period – typical in the case of longitudinal models – does not lead to substantial changes, leaving the values of the FTCs and other variables present unchanged in the case of part-time workers and making the impact even more significant in the case of full-time workers (model 2). Finally, in the third model, we try to verify whether the impact of income varies within the category of precarious individuals compared to those in stable employment.

Table 4 – Ordinary Logistic Regression to Random Effects: Estimation of Perceived Health Impact°

		Model 1			*Model 2*			*Model 3*		
		Coeff.	*S. E.*	*Sig.*	*Coeff.*	*S. E.*	*Sig.*	*Coeff.*	*S. E.*	*Sig.*
Occupation	Long-term c.-Full time	–	–		–	–		–	–	
	Long-term c.-Part time	0.008	0.075		0.010	0.076		0.140	0.102	
	Fixed-term c.-Full time	0.145	0.083	+	0.169	0.084	*	0.187	0.117	
	Fixed-term c.-Part time	0.349	0.135	**	0.366	0.136	**	0.509	0.155	**
Occupation (Isco-88)	Low level	–	–		–	–				
	Medium level	-0.257	0.061	***	-0.254	0.061	***			
	High level	-0.381	0.083	***	-0.385	0.083	***			
Economic resources	Good	–	–		–	–				
	Bad	0.217	0.048	***	0.217	0.048	***			
Health limitations	No	–	–		–	–				
	Yes	2.100	0.065	***	2.097	0.065	***			
Chronic Diseases	No	–	–		–	–				
	Yes	1.952	0.067	***	1.952	0.067	***			
Cohort	50s				–	–				
	60s				0.047	0.102				
	70s				0.104	0.172				
	80s				0.267	0.253				
	90s				-0.007	0.342				
Period	2012				–	–				
	2013				-0.142	0.060	*			
	2014				-0.145	0.060	*			
	2015				-0.263	0.063	***			
Income	I quartile	–	–		–	–		–	–	
	II quartile	0.034	0.065		0.026	0.065		0.076	0.084	
	III quartile	-0.130	0.072	+	-0.139	0.073	+	-0.156	0.087	+
	IV quartile	-0.138	0.081	+	-0.145	0.081	+	-0.323	0.093	***
Occupation # income	Long-t. c.-Part t.#1 q.							–	–	
	Long-t. c.-Part t.#2 q.							-0.122	0.174	

(follows...)

(...continue)

		Model 1			*Model 2*			*Model 3*		
		Coeff.	*S. E.*	*Sig.*	*Coeff.*	*S. E.*	*Sig.*	*Coeff.*	*S. E.*	*Sig.*
	Long-t. c.-Part t.#3 q.							-0.189	0.258	
	Long-t. c.-Part t.#4 q.							-0.555	0.353	
	Fixed-t. c.-Full t.#1 q.							–	–	
	Fixed-t. c.-Full t.#2 q.							-0.148	0.187	
	Fixed-t. c.-Full t.#3 q.							0.200	0.269	
	Fixed-t. c.-Full t.#4 q.							0.724	0.354	*
	Fixed-t. c-Part t.#1 q.							–	–	
	Fixed-t. c-Part t.#2 q.							-0.717	0.500	
	Fixed-t. c-Part t.#3 q.							0.261	0.939	
	Fixed-t. c-Part t.#4 q.							0.501	1.058	
	Intercept/Cut1	0.204	0.139		0.472	0.493		0.249	0.148	
	Intercept/Cut2	5.932	0.153	***	6.209	0.498	***	5.840	0.160	***
	Intercept/Cut3	9.042	0.169	***	9.323	0.503	***	8.474	0.172	***
	Intercept/Cut4	12.14	0.218	***	12.42	0.521	***	11.28	0.217	***
	N. of observations	23,843			23,843			23,843		
	Variance(μ)/St.Dev.(μ)	2.576	0.106		2.587	0.106		3.893	0.137	
	Wald Chi²	4,092.08			4,093.24			1,203.44		
	Prob. > Chi²	0.000			0.000			0.000		

Note: (°) The models are adjusted for: age, gender, area of residence, level of education and family status; (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Source: Our analysis from the EU-SILC Living Conditions Survey (Istat, 2012-2015)

We can firstly note that the effect of FTCs on perceived health continues to be negative and significant, for part-time workers, while income affects positively and those who receive a higher total family income than the total median income declares better perceived health. In contrast, the interaction between FTCs and income leads to a negative influence on health in the case of higher incomes (IV quartile), indicating that the positive effect is reduced within the category of people in full-time precarious jobs. In general, FTCs have a significantly different impact on perceived health than permanent contracts for the same income.

Let's look at the territorial differences (Table 5). The results merely confirm the negative impact of FTCs in the case of part-time workers mainly in the North-West and in South Italy, with a slightly negative association in the Centre of Italy, while in the North-West and Islands there is no significant difference. In the case of north-west we can even observe a significant positive impact of part-time permanent workers compared to full-time permanent workers. Similarly, there is no association in the second model, where we control for cohort and period effects. The third model – concerning the interaction effects between employment status and income – is not present in the table as there are no significant differences between the territories.

5. Conclusions

In today's labour market, inequalities in wellbeing and health no longer only concern the traditional division between the employed and the unemployed but follow a more complex occupational stratification (Benach *et al*., 2000).

Precariousness is one of the most decisive challenges of the new millennium, starting with the changes in employment law which since the 1970s – through changes and adjustments in contractual labour agreements – have produced significant structural adjustments in the public and private sectors (Lewchuk *et al*., 2008; Quinlan, Bohle, 2009).

The increase in the number of temporary workers has been constant over the last three decades, although it has occurred at different rates in industrialised countries, thus raising the question of the hidden costs of labour market flexibility: the experience of persistent precariousness can induce a process of accumulating health risks and lead to a deterioration in health, mainly due to mental and psychological disorders (Bauer, Truxillo, 2000; Burchell, 1999)

As regards employment flexibility, since the 1970s a number of studies have shown that people exposed to a persistent and chronic state of job insecurity – due to a possible closure of the company, its downsizing or the threat of job loss – have shown a sharp deterioration in both mental and perceived health, fuelling a state of chronic stress (Bohle *et al*., 2001; Ferrie *et al*., 2002; Kivimäki *et al*., 2000).

Table 5 – Ordinary Logistic Regression to Random Effects: Estimation of Perceived Health Impact: Differences between Italian Geographical Areas

		North-West		*North-East*		*Centre Italy*		*South Italy*		*Islands*	
		Coeff.	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*
						Model 1					
Occupation	Long-term c.-Full time	–		–		–		–		–	
	Long-term c.-Part time	-0.288	*	-0.014		0.279		0.329		-0.033	
		(0.140)		(0.133)		(0.176)		(0.214)		(0.289)	
	Fixed-term c.-Full time	0.189		0.168		0.017		0.087		0.276	
		(0.170)		(0.152)		(0.191)		(0.182)		(0.357)	
	Fixed-term c.-Part time	0.687	*	-0.323		0.514	+	0.642	*	0.154	
		(0.304)		(0.263)		(0.299)		(0.278)		(0.478)	
						Model 2					
Occupation	Long-term c.-Full time	–		–		–		–		–	
	Long-term c.-Part time	-0.297	*	-0.028		0.279		0.306		0.002	
		(0.140)		(0.133)		(0.176)		(0.215)		(0.291)	
	Fixed-term c.-Full time	0.249		0.213		-0.001		0.075		0.229	
		(0.173)		(0.153)		(0.192)		(0.183)		(0.368)	
	Fixed-term c.-Part time	0.740	*	-0.271		0.498	+	0.625	*	0.206	
		(0.305)		(0.264)		(0.299)		(0.281)		(0.480)	
Cohort	50s	–		–		–		–		–	
	60s	0.189		0.209		0.129		-0.382		0.264	
		(0.192)		(0.183)		(0.231)		(0.257)		(0.437)	
	70s	0.606	+	0.109		0.290		-0.841	+	0.682	
		(0.321)		(0.308)		(0.391)		(0.442)		(0.749)	
	80s	0.745		0.203		0.258		-0.407		1.277	
		(0.477)		(0.448)		(0.566)		(0.652)		(1.117)	
	90s	0.563		-0.222		0.776		-1.894	*	1.980	
		(0.639)		(0.599)		(0.799)		(0.877)		(1.511)	
Period	2012	–		–		–		–		–	
	2013	-0.234	*	-0.129		-0.041		-0.288	+	0.384	
		(0.114)		(0.112)		(0.136)		(0.149)		(0.244)	
	2014	-0.196	+	-0.088		-0.083		-0.367	*	0.266	
		(0.113)		(0.111)		(0.134)		(0.147)		(0.247)	
	2015	-0.323	**	-0.227	+	-0.106		-0.571	***	0.148	
		(0.120)		(0.117)		(0.142)		(0.155)		(0.262)	
	N. of observations	6,232		7,138		5,520		3,493		1,460	

Note: (°) The models are adjusted for: age, gender, area of residence, level of education and family status. Standard error in brackets; (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Source: Our analysis from the EU-SILC Living Conditions Survey (Istat, 2012-2015)

The introduction of temporary contracts in Italian labour market reforms has often been justified by the need to make the labour market more flexible, to facilitate the participation of younger cohorts. However, in Italy, as in other European countries, the abuse of temporary contracts is increasing the sense of insecurity in precarious workers (Campos-Serna *et al*., 2013). This condition implies the need for continuous adaptation to working conditions, contexts and expectations, also fuelling precariousness in other areas of life, including health. These consequences have very high social and economic costs. The workers with deteriorated health conditions suffer more from illnesses that limit their ability to work and lead to inferior work performance. These negative health consequences have a significant impact on the public health system.

This study focused on the relationship between health and precariousness, more precisely on self-perceived health. Through a longitudinal analysis and an ordinary logistic panel model with fixed effects, we have corroborated the hypothesis that FTCs have a negative causal impact on perceived health, modelling individual trajectories. This relationship also appears much more influential between South Italy and North-west than the other Italian geographical areas, particularly in the case of precarious part-time contracts. This fact is an important result that certainly needs further study.

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Sommario

Insicurezza lavorativa e benessere della salute: ci sono differenze di impatto tra le aree geografiche?

Un'ampia parte della letteratura scientifica evidenzia le conseguenze negative della precarietà lavorativa in diversi ambiti della vita. Il presente progetto di ricerca si focalizza sul contesto sociale italiano, esaminando la relazione tra lavoro precario e salute. In particolare, lo studio mira a migliorare la comprensione del fenomeno indagando l'impatto sulla salute percepita, esplorando le differenze tra aree geografiche e il ruolo della situazione economica degli intervistati. Questo studio si concentra sulla popolazione adulta italiana, utilizzando un approccio longitudinale, basato su un campione di donne e uomini di età compresa tra i 16 e i 64 anni, proveniente dall'indagine italiana sul reddito e le condizioni di vita (Istat, 2012-2015).

PART IV – THE ROLE OF POLICIES

 ISBN 9788835125860

Regional Policy Out of the Trade-off: Justifications and Current Challenges

*Ugo Fratesi**

Abstract

This paper reviews the main definitions and justifications for regional policy present in the literature. The trade-off between equity and efficiency has always been at their core, in the past and in more recent times, those in which place-based approaches and smart specialization should overcome this trade-off thanks to the tapping of hitherto untapped potentials. The existence of worthwhile regional policies even in the presence of a trade-off between internal and external effects is illustrated through a new classification of regional policy interventions. This paper also analyses the specific relevance of these issues for the current and future situation of lagging regions.

1. Introduction[1]

Many policy interventions fall under the wide label of "regional policy". Regional policy was originally conceived as a means to reduce regional disparities and increase aggregate efficiency and national growth, but its scope soon expanded towards the inclusion of other objectives such as quality of life and environmental protection, topics already mentioned by the 1970s. In the past, its objectives were often seen as alternatives to one another, if not conflicting, giving rise to trade-offs.

In more recent times, regional policy has been redefined, both conceptually and practically, to overcome the trade-offs by allowing all regions to fulfil their potential. This is intended to be achieved by place-based approaches and, in relation to innovation activities, smart specialization strategies.

However, disparities between regions inside countries have been on the rise, especially after the global financial crisis of 2007-2008, and increased attention

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1. The author acknowledges support from the PRIN project "A new assessment of cohesion policies' effectiveness: Macro and micro approaches".

on spending has made it necessary for countries and other bodies such as the EU to limit regional policy expenditure, on the one hand, while on the other considerably expand the objectives to be pursued.

The perfect regional policy, able to efficiently pursue many objectives at the same time with no trade-off, is highly desirable, but can such a policy exist? What justifications remain for policies addressing traditional objectives such as targeting lagging regions even when doing so does not produce aggregate growth? What objectives are genuinely required to be pursued at the regional level? What other objectives must be relinquished to other policies?

To provide some reflections in this regard, this paper discusses the existence and overcoming of trade-offs within regional policy. The next section shows that regional policy definitions are generally little developed, focusing instead on what the policies' objectives are. Section 3 discusses the trade-off between equity and efficiency and the quest to overcome it through the use of various types of place-based policies. Section 4 provides evidence that such an approach may not have been sufficient for lagging European regions, which had to face global challenges of great magnitude. Section 5 presents a new taxonomy of regional policies based on internal and external effects, efficiency and net social benefits. This taxonomy is used to show that worthwhile policies and trade-offs can co-exist. Section 6 discusses the perspectives on disparities and lagging regions. Section 7 provides a conclusion.

2. Definitions of Regional Policy in the Literature

The literature on regional policy is broad, and a large number of papers are published every month with ideas on how to implement it, how to make it more effective, and what type of regional policy is best suited to different situations. However, the concept of regional policy is articulated, comprising a large number of different policies. The distinction between these policies is rarely made explicit in the literature, where the term "regional policy" is used regardless of the analysis. The literature on regional policy is enormous and includes contributions from scholars with various backgrounds: economists, administrative scientists, political scientists, jurists. These scholars investigate different aspects of the essence, application, and effects of regional policy. They all seem to have a clear idea of what regional policy is, because no academic article spends time defining how it uses the term "regional policy"; rather, they immediately begin to address their specific points.

One might expect books to be more likely to provide definitions, because their larger size may offer greater scope for them. Even books, however, seldom provide definitions. McCrone (1969) provides an extensive investigation of the

"regional problem" but no definition of regional policy, although he devotes significant effort to presenting the case for intervention, including the fact that the case for policy intervention is not merely economic.

Stilwell (1972), too, does not provide an actual definition, but he does describe it nicely as the "establishment of the spatial framework for national development" (p. 9), which means establishing controls, incentives and so on, to "ensure that the spatial distribution of economic growth develops in accordance with specific objectives of equity and efficiency" (p. 9). According to Stilwell, there are three main types of problem areas: the underdeveloped, the depressed and the congested. In this sense, his work is already an anticipation of the forms which regional policy would have taken in more recent times, for example the depressed regions resemble those which would have later on become "Objective 2" and those which are now defined as trapped in middle income (Bourdin, 2019; Iammarino *et al*., 2020).

The need for intervention, according to Stilwell (1972), stems from the "inadequacy of free-market forces" (p. 15), and he sets out six objectives of regional policy implementation, five linked to efficiency and the last one to equity:

- Preventing resource underutilization
- Securing optimal allocation of resources between sectors
- Achieving a satisfactory rate of resource growth
- Preventing excessive inflation
- Avoiding persistent balance of payment disequilibria
- Establishing reasonable equity in the distribution of income.

Note the importance of inflation, which is also mentioned many years later in Vanhove (1999) but is now almost forgotten due to historically low inflation and interest rates.

The focus on the two objectives of equity and efficiency was important at that time, as evidenced by Friedmann and Alonso (1975), who also emphasize how the two objectives of quality of life and environmental protection had been added to the two previous ones, especially in the advanced countries. Contrary to what is commonly believed, therefore, quality of life and environmental protection are not "new" objectives of regional policy, even if the focus on them has increased in recent times.

Another way of examining regional policy through the lens of its objectives was provided by Balchin (1990), who argues that the British state began to act in the 1930s to reduce interregional imbalances in employment opportunities and growth, with motivations depending on economic efficiency, equity and also "political expedience" (p. vii).

The widely used manual by Armstrong and Taylor (2000) does not provide an explicit definition of regional policy, but the authors consider them determined

by the presence of disparities between regions. They also make the case that not all disparities are undesirable. In their approach, regional policies can also help achieve national policy objectives, such as achieving a certain growth rate or providing job opportunities to every citizen.

An actual definition of regional policy can be found in Vanhove (1999). He adopts a broad definition, which includes "all forms of public intervention intended to ameliorate the geographical distribution of economic activities" (p. 57). The use of the word "ameliorate", in particular, broadens the definition, because the meaning of "ameliorate" depends on the values under which a judgement is expressed. In practice, according to Vanhove, the two objectives of regional policy, both stemming from the need to correct some spatial consequences of the market economy, are "economic growth" and "improved social cohesion" (p. 57).

Following this line, it must be acknowledged that defining urban and regional planning is not an easy task. Hall and Tewdr-Jones (2011) spend a whole introductory chapter showing the different nuances that characterize the terms "planning" and, more specifically, "spatial planning" or "urban and regional planning".

Most recent books also do not spend time defining regional policy (e.g. McCann, 2015). The same holds for policy reports, such as the last Cohesion Report (EU, 2017).

As this limited review has shown, there has been little attention paid to the actual definitions of regional policy. Such policies are generally characterized in terms of what their objectives are rather than what the policy is. Many contributions to the literature provide reasons why regional policy should be implemented, and these reasons can, in most cases, be divided into four main groups: efficiency, equity, environment and quality of life. The first two, those of a mostly economic nature, have often been considered in opposition to each other, and a wide literature has emerged that analyses the existence and the overcoming of a trade-off between them, as will be shown in the next section.

3. The Trade-off between Equity and Efficiency and the Quest to Overcome it

All the ways of defining the objectives of economic-related regional policy can be broadly divided into two categories: (1) efficiency, competitiveness and aggregate growth; and (2) equity, cohesion and the reduction of disparities. Policies deployed in dissimilar ways at the spatial level can be intended either to correct issues that prevent lagging areas from achieving the same levels as leading ones or to correct issues that prevent the country from fully achieving its growth potential because of too wide spatial imbalances or too little agglomeration. A regional policy strategy could in fact also target the most advanced areas

of a certain country to achieve a higher growth rate, thanks to economies of scale or scope that can only be achieved by targeting the richer areas.

Is there a trade-off between the two objectives? This question has long been debated, and the answer mostly depends on the theoretical framework adopted and the assumptions that are made. For instance, if the market outcomes are intrinsically inefficient, then a policy that corrects them can improve the efficiency of a system and, at the same time, improve the spatial distribution of economic activities, making it more equitable. However, if the market forces already lead to an efficient and agglomerated equilibrium, any attempt to arrive at a different situation – for example, one that is more spatially balanced – will reduce systemic efficiency.

In a simple yet comprehensive theoretical framework, Fratesi (2008) has shown that the trade-off between the two objectives is more likely to arise under two conditions:

- The presence of strong agglomeration economies. When agglomeration economies are strong, concentrated spatial distributions are more efficient than dispersed ones, and intervening against the market forces to make the spatial landscape flatter reduces such efficiency.
- The existence of differences between regions. Regions are assumed to be originally similar in most (new) economic geography models, but in the actual world there are important regional specificities, as more empirical or qualitative studies show. If regions are different – for example, because they hold different endowments of territorial capital (as defined by Camagni, 2009) – then disparities are mostly due to these differences, and policies that are intended to achieve convergence are moving activities from places where they can take advantage of good external conditions to places where they operate under worse conditions.

The consideration of the fact that the spatial equilibrium may indeed be efficient, or that by intervening in the existing equilibrium the new situation could even be less efficient, led the World Bank (2009) to publish an influential and controversial report that advocated space-blind policies; that is, policies applied irrespectively from the place and that directly target the inhabitants. Indeed, the choice of targeting people or places is a long-standing issue in regional economics (Parr, 2015; Storper, 2011).

The conclusions by the World Bank report were immediately challenged by a number of scholars with regional science backgrounds, arguing that place-based policies are better because they are able to tap the untapped potentials of places. In short, the idea is that weak regions are not weak because they lack potential, but because they are not able to fully exploit it. If this is the case, by intervening with appropriate policies it will be possible to achieve two objectives at the same time, i.e. to further the development of lagging regions and the development of

the whole country, with a situation which could be defined of generative growth (Richardson, 1973).

For policies to work in this way, it is necessary for them to be place-based, which means setting aside the one-size-fits-all approach of traditional economic policies and adopting a fully customized one that addresses the specific weaknesses and exploits the specific potentials of each place. One of the first and most influential contributions to such an approach is the Barca (2009) report. It advocated for the EU to provide public goods using a place-based approach, with a re-orientation and increase of the cohesion policy budget. This approach would extend beyond the economic domain to include a "socialized territorial agenda" that would also involve people's well-being. The report also supported the idea of explicitly distinguishing between the interventions aimed at growth and those aimed at the reduction of inequalities. The Barca report was followed by a large number of academic articles, such as Barca *et al*. (2012), which supports the idea of abandoning convergence as the main indicator and objective of regional policy and instead focusing on policies for lagging regions based on efficiency. This approach requires providing different bundles of public goods to each region and would eventually provide an enhancement of growth at the national level.

Smart specialization strategies, which were conceived in the same years and were widely applied within European cohesion policies in the programming period 2014–2020, are fully consistent with this approach. They seek new technological opportunities through a process of entrepreneurial discovery, which leads to the development of new specializations and market niches for each place (Foray, 2015; Foray *et al*., 2009).

Camagni and Capello (2015) argue that it is possible to overcome the trade-off between equity and cohesion if a new concept of cohesion policies is implemented. In particular, focusing on the impacts of the economic crisis that started from the financial crisis, they argue that cohesion policy should have been reinforced to contain the differential impacts of the crisis itself. Moreover, starting from the consideration that any long-term development process requires a balance between the different aspects present in the territory, particularly the territorial capital, they argue for policies able to build their efforts on regional specificities, for instance in terms of the different innovation patterns characterizing the regions.

More recently, Iammarino *et al*. (2019) refined this idea of place-based development in Europe with their proposal for a "place-sensitive distributed development policy", which should avoid the standard trade-off between people-based and place-based policies. According to them, the "goal is for more and more regions to have non-routine (innovative) functions in their economic mix" (p. 289) and "that economic development policy should be both sensitive to the need for agglomeration and the need for it to occur in as many places as possible"

(ibid.). The objective is to improve quality of life and well-being for all, if not the economy too, and to have a second-best solution that is better than the status-quo. There would be a specific mix of interventions for each type of region. The key for all these processes to succeed, however, remains the quality of institutions.

4. The Trends for Lagging Regions

Has the recent place-based regional policy been able to tap potentials to a sufficient extent to achieve growth for all regions and at the same time a reduction in disparities? A positive answer to this question would seem to be quite optimistic. Although the question still needs to be investigated with complete data, which are going to be published in the coming years, there are signs that the prospects for weak regions have remained quite bleak. Disparities have been on the rise within most European countries, especially after the financial crisis of 2007–2008 (Camagni *et al*., 2020). The centripetal trends have been sizeable and have overcome any policy effort to countervail them (although in many aspects the focus on convergence in the last decade has been historically low).

The most important place-based competitive policy for lagging and advanced regions in Europe is the smart specialization strategies (S3). These strategies seem to be more difficult to implement in weak regions than in advanced ones, especially because of weaker administrative capacity (CSIL, 2019). It seems that the principles of S3 have been loosely applied or even circumvented in many places (D'Adda *et al*., 2019; Gianelle *et al*., 2020).

Policies for lagging regions have had to confront a highly complex situation. The weakest regions of European countries have been particularly affected by three major global challenges that may further jeopardize their future development. These three challenges stem from processes that do not originate in these areas but that have exercised a particularly intense and predominantly negative effect on them.

First, globalization has created substantially integrated international markets not only for final goods but also for intermediate goods and production chains, with ever smaller divisions within the global value chain (Gereffi, 2018; Grossman, Rossi-Hansberg, 2008). This integration is characterized by an increase in the mobility of services, capital, and relocation processes such that it is no longer possible for the weaker regions to survive thanks to traditional economic protections (Capello *et al*., 2011; Fratesi, Rodríguez-Pose, 2016). The second challenge is the diffusion of new technologies. Technological cycles have been shortening for some time, and there are some revolutions on the horizon concerning interaction between people, between machines and between machines and people that could change not only the production scenario but also society (Schwab,

2017). Third, the economic crisis that began more than a decade ago has, in many respects, not really ended in Italy. It has led to a collapse in investment, especially public investment, a drop in domestic demand and a drop in public demand.

An additional challenge is the new crisis of the pandemic. From a regional economics point of view, little is known so far. The first diffusion of the virus was predominantly concentrated in rich and agglomerated areas such as Madrid, New York City or Lombardy in Italy (Paez *et al*., 2020), but the economic crisis and the lockdowns now affect all regions, and it is still unclear which ones will eventually have the worst economic outcomes.

The weaker regions have suffered from various vulnerabilities, such as limited economies of agglomeration, dependence on a few large industries or specific products, and lack of synergy between their production systems and research innovation and education, with the consequence that business systems are unable to keep pace with technological evolution. Moreover, the weakest areas are weak because they have little territorial capital and therefore lack those assets that could help their development in the long term, even if some of these assets, such as natural capital, are present.

Some regions have been able to withstand the challenges of the crisis of the late 2000s and early 2010s better than others. The literature on territorial resilience identifies a long series of factors that positively influence territorial resilience. They are, however, very similar to those that influence competitiveness, such as the presence of human capital, good governance models and specialization in high phases (Di Caro, Fratesi, 2018), all of which are scarce in weak areas. Nor does it seem that an economy protected from market forces has benefited in times of crisis, further to the detriment of the weaker areas that were previously protected (Fratesi, Rodríguez-Pose, 2016).

Resilience therefore seems, above all, linked to the presence and investment in territorial capital factors that are less mobile than other factors (Fratesi, Perucca, 2018). As in the cases of globalization and technological innovation, factors that might previously have been considered not particularly mobile, such as human capital, have radically increased their mobility in space.

Given this multitude of challenges, it may not be possible to avoid all trade-offs at the same time. It is therefore useful to look past the trade-offs: instead of seeking ways to avoid a trade-off, policies could be implemented that accept its existence and yet play their role in enhancing the general situation. These policies may be difficult to implement politically, as they may not attract a general consensus, but they may be the only solution for those areas that cannot work with place-based policies alone. The next section shows how to classify regional policies based on a trade-off between internal and external impact, on efficiency and on the benefits of the policies.

5. When Overcoming the Trade-off is Not Really Necessary: A New Taxonomy of Regional Policies

In this section, a new taxonomy of regional policy is developed based on a number of aspects showing that policies can be implemented despite having to choose between different options which have a trade-off among them. The first policies presented are those with positive gross internal impact (Figure 1a). These are policies that have a positive impact in the region(s) in which they are implemented, irrespective of the costs of the policy.

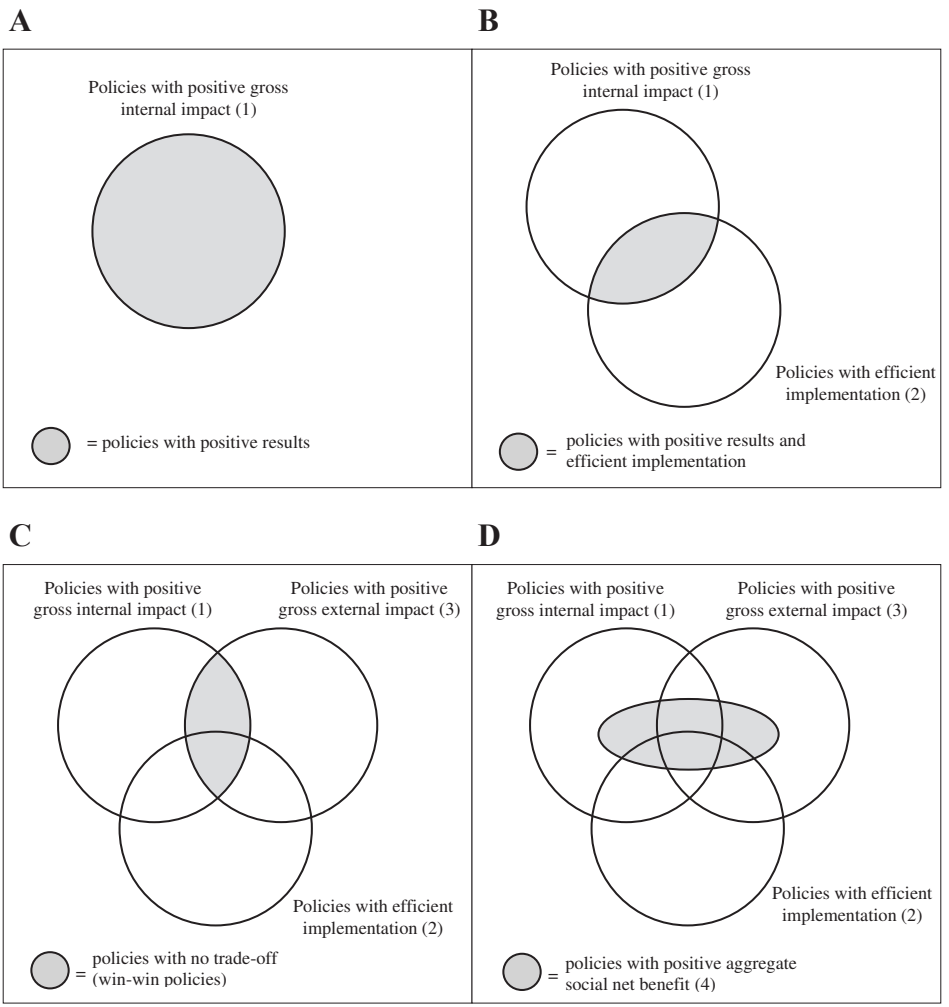
The second element presented is efficiency (Figure 1b). Efficient implementation enables policies to obtain the maximum result they can, even when this maximum is negative. There are therefore efficient policies with a positive gross internal impact (the shaded area in Figure 1b) and efficient policies without, and there are policies with a positive gross internal impact that are inefficient.

An important aspect in trade-offs is the possibility of having win-win policies (Figure 1c). Policies implemented in one region can have impacts elsewhere, and these impacts may be positive or negative. Policies with positive gross external impact are policies that produce, through positive externalities, a positive impact in regions in which they are not implemented (irrespective of the costs of the policy). Win-win policies are those that have a positive internal impact and a positive external impact are (the shaded area of Figure 1c). Such policies are generally advocated by politicians and policymakers who seek general approval for interventions targeting one region that they claim can also benefit the other regions. An example would be a policy for the Italian Mezzogiorno (southern Italy) that claims to relaunch the economy of the whole country.

There is still an element missing from the scheme: the costs of the policy. These costs are normally positive, and so even if a policy has a gross positive impact, the net impact may be negative due to a high cost of implementation. In EU cost-benefit analyses, there are two types of returns of a project: a financial rate of returns and an economic rate of return. The financial rate of returns takes into account the profitability of a project only from the private investor's point of view, whereas the economic rate of returns takes into consideration the whole society and therefore all costs and benefits (Florio *et al*., 2018). Florio *et al*. (2018) calculated that the financial rate of returns of EU cohesion policy projects has, on average, been negative, whereas the economic rate of return has been significantly positive.

In this work, policies with positive aggregate net social benefit are defined as those policies for which the total net social benefit, taking into account the total social costs of the policy, is positive (Figure 1d). Note that there is no grey area outside circles (1) and (2). This is because it is impossible to have a positive net social benefit if the internal and the external impacts are both negative.

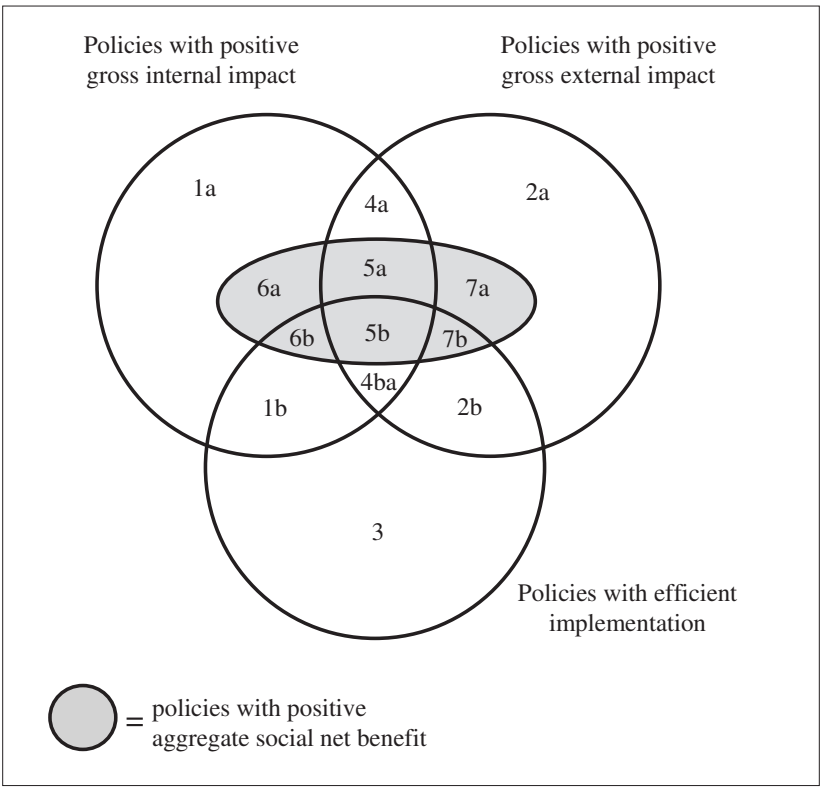
Figure 1 – The Elements Needed to Develop a Taxonomy



Given the four definitions presented above, the taxonomy distinguishes between 14 types of policy, each represented by an area in Figure 2. Many of these types of policy can be implemented even if they have to face a trade-off or an inefficiency. Each of these types of policy are discussed below:

- Area 1a represents policies that have a positive impact on the area of implementation, a negative impact elsewhere and a negative aggregate social benefit. Despite their negative effects on other regions, inefficiency and their negative social benefits, these policies are normally implemented if a regional

Figure 2 – Different Types of Regional Policy in a New Taxonomy



body receives external funds to spend and does not have to finance its own policies. In such circumstances, the region is focused only on its own benefit, and it may gain an advantage from the policy even if it is not efficient.

- Area 1b represents policies similar to those in area 1a except that they are implemented efficiently. Both areas 1a and 1b consist of policies with explicit trade-offs between the internal and the external that favour the internal.
- Area 2a represents policies that have negative effects on the place of implementation but positive effects elsewhere. These external effects, however, do not counterbalance the internal ones, and so the net social benefit is negative. Such policies are seldom implemented and generally only implemented unintentionally.
- Area 2b represents policies similar to those in area 2a except that they are implemented efficiently. The efficient implementation, however, does not guarantee a positive net social benefit.

- Area 3 represents policies that are efficiently implemented but produce negative results in both the region of implementation and elsewhere. Although such policies achieve their maximum possible result, this result is negative. For this reason, such policies should be discontinued.
- Area 4a represents win-win policies, which have positive impacts on the region of implementation (e.g. the lagging regions) and elsewhere (e.g. they increase the national aggregate growth through spillovers). The policies in this area, however, are implemented inefficiently. Thus, although they result in a win-win effect, policies of this type are not viable, because their costs exceed their benefits. They should be discontinued. More efficient implementation might produce better results and move them to area 4b or 5b.
- Area 4b represents win-win policies that are implemented efficiently but still have a negative social benefit due to their costs. Producing a win-win effect and being efficient, therefore, is not sufficient for a policy to have a net social benefit.
- Area 5a represents win-win policies (positive effects in both the region of implementation and elsewhere) that are implemented inefficiently but nevertheless have results that offsets their costs. As such, they have a positive aggregate social benefit. These policies should be implemented. It would also be wise to attempt to improve the efficiency of their implementation, which would increase their net social benefit and move them towards situation 5b.
- Area 5b represents the ideal policies. These are policies that have positive benefits in the region of implementation and positive externalities, which lead to a positive gross external impact; they are efficiently implemented; and they are cost-effective, because they have a positive net social benefit. This is the only type of policy in which there is no trade-off, but it is not the only type that may be implemented in practice.

Beyond situations 5a and 5b, four other types of policy are still worth implementing, despite having to deal with a trade-off between one region and another.

- Areas 6a and 6b represent policies in which a trade-off exists but that are still worthwhile. Despite the negative effects on other regions, the effect in the region of implementation is positive enough that it compensates for the negative externalities and the costs of the policy. The difference between the two areas is that the policies represented by area 6a are implemented inefficiently, whereas those represented by area 6b are implemented efficiently.
- Areas 7a and 7b represent the unlikely, but theoretically possible, cases in which a policy has negative impacts in the region of implementation but positive ones elsewhere that are sufficient to offset the policy costs, resulting in a positive social benefit. Area 7b represents those policies that have maximized the benefits with an efficient implementation.

From this classification, it is clear that the important criterion in choosing a policy is not whether the policy overcomes a trade-off between internal and external effect or whether the implementation is efficient (although of course it is better to increase the efficiency of the implementation). Rather, from a social point of view, the important criterion is the existence of positive social benefits. As a consequence, policy types 5, 6, and (though unlikely) 7 are all worth implementing, despite only type 5 being win-win and only type 5b being win-win and efficiently implemented. Policy types 4a and 4b, in contrast, are win-win and do not involve trade-offs between regions, but their costs are excessive, and they should therefore not be implemented.

There is, however, a case for policies of type 1a and 1b: namely, when the resources for the policy come "free" from other constituencies. Moreover, policies of type 6 are worth implementing in lagging regions, because, even if they do not overcome the trade-off, they have a positive internal effect that is larger than the external one, and they also offset the cost of the policy.

For example, policies with a positive impact or gross local benefit (e.g. successful subsidies for the attraction of firms) can have negative impacts elsewhere (in terms of displacement). If the advantage they provide offsets the cost, they are of type 6; if not, they are of type 1. Policies supporting ailing firms in lagging regions may be type 1a, as these policies will not be efficient or have a positive impact externally but could still stimulate employment and demand locally (in the absence of crowding out). Policies that efficiently stimulate the innovativeness of local firms and trigger positive and sustainable growth mechanisms that also produce external spillovers fall into category 5b. Infrastructural policies that increase production in the domestic region and in others by making it easy to move people and goods but that are very costly with respect to the additional generated income may fall into category 4a.

Most of the academic literature, as shown in the previous section, concentrates on how to make policies more effective or how to make them win-win, overcoming possible trade-offs, but it rarely mentions the costs of the policy. This is most likely due to the fact that the costs are difficult to assess.

6. Perspectives on Disparities and Lagging Regions

Having shown that overcoming trade-offs should not be the only criterion for deciding which regional policies to implement, this paper now turns to a discussion of the perspectives on lagging regions.

After many years in which growth and competitiveness seemed to be the most important objective, disparities seem to have returned to the core of regional policy justifications (e.g. Rodríguez-Pose, Wilkie, 2019). Disparities have an impact on many socially desirable objectives, from equity to efficiency, improvement

in quality of life, environmental protection and, most notably, social discontent. Currently, the most compellint argument for curbing disparities is a political one: "places that don't matter" could vote against others or against the system, even if doing so may go against their own self-interests, with strategies that Rodríguez-Pose and Wilkie (2019) label "strategies of waste". This idea has been analysed in many different situations, especially after the unexpected Brexit vote (McCann, 2020; Rodríguez-Pose, Dijkstra, 2020).

Political arguments, however, are not the only ones. Although people are more mobile than in the past, regional policies are an efficient way of reducing differences between people (equal opportunities and equal results for the same effort); they can be used to increase the efficiency in the provision of services (without the inefficiency of having to transfer them); they may avoid the disintegration of localized social tissues; they avoid the disintegration of landscapes and cultural heritage; they defend the diversity of different territories; and they guarantee the exploitation of potentials (when present).

Any development policy for weaker regions cannot be separated from an improvement, or upgrading, of the functional level in the area. This upgrading can pass through various connected stages, such as the attraction of investment from abroad, changes in specialization, the introduction of innovative processes and the shift in different functions of the value chain, which all require the presence of good territorial capital, in particular human capital, and adequate policies (Affuso *et al*., 2011; Fonseca, Fratesi, 2017).

The processes underway before the COVID-19 outbreak did not seem to proceed in a direction favourable to the weaker areas: the reshoring processes that have been set in motion in recent years have not necessarily benefited the weak areas of developed countries, and the changes linked to industry 4.0 seem to have more potential to benefit those regions with higher levels of technology and competitiveness. Foreign investment also tends to be a cumulative phenomenon: it is often easier to attract investment in those places that have already been invested in (Mariotti *et al*., 2010).

Moreover, there is evidence that the existing settlement structures may be outdated. For instance, research shows that, in Italy, some settlements were built to meet economic and political needs that no longer exist, and they may now be inefficient (Accetturo, Mocetti, 2019; Morettini, 2019). Furthermore, while new strategies, such as bringing new communities (e.g. migrants) to old places, can regenerate a region from an economic and social point of view, they can also transform the region into something different and cause it to lose its identity.

As mentioned before, the smart specialization strategies are based on assumptions (such as embeddedness, relatedness and connectivity), but these assumptions do not necessarily hold true in the weakest regions. Thus, all regions making the

most of their potential would certainly be positive from an aggregate macroeconomic point of view, but it would be unlikely to reduce disparities enough, given that the potential is different in different territories.

A more pragmatic and less deliberately optimistic approach is therefore needed to promote the development of the weakest areas, in which the exploitation of endogenous resources is hardly sufficient. This may involve, for example, policymakers accepting the idea that these areas cannot support the supply of basic services using only their endogenous resources. For example, if young people leave peripheral areas to work in urban agglomerations, it would be impossible for the elderly who remain to pay for local services with local tax revenues. Moreover, if services are cut, the crisis and out-migration would accelerate. Cuts in services and maintenance can also lead to land degradation, loss of cultural heritage and identity and deterioration of the architectural heritage. People who live in cities could therefore be asked to take some responsibility for maintaining those places where they like to spend part of their leisure time.

At the same time, services must be managed prudently, because it is not reasonable to require the system to maintain a much greater capillarity than the one of the lives of people, who spontaneously move from one place to another for entertainment and private services.

Territorial development strategies that have been highlighted in the literature can be useful to weaker areas, these strategies include the exploitation of the residential economy, including pensioners' spending, of natural, environmental and cultural resources, local products (also through the creation of brands), and the exploitation of diversity and specificities (see, among others, Torre, 2015; 2019).

However, it is unlikely that such a strong trend can be reversed with bottom-up strategies alone. An effective solution on a large scale and in the long term that does not involve technological and social development will not have real trend-reversal effects. For example, it is necessary to ensure that all areas have a fast and reliable internet connection, as this is now an essential part of many activities, but a fast and reliable internet connection is not sufficient to bridge the gaps in the use of technology.

Moreover, investment in existing technologies may be too expensive, but new technologies can make it possible to bypass the previous technology. Consider, for example, those places on the African continent where the era of fixed telephone lines has been skipped in favour of mobile telephony, which today also plays the role of payment instrument, making a traditional banking system unnecessary. Similarly, from a social point of view, it is difficult to reverse trends unless there are significant changes in the organization of the economy; for example, with the implementation of widespread and not purely experimental

teleworking models, something which the COVID-19 crisis has been forcing organizations to experiment with on a large scale.

7. Conclusions

This paper analysed some of the justifications currently put forward for the implementation of regional policies, starting from the observation that the term "regional policy" is normally not defined; rather, regional policies are usually characterized in terms of their objectives. Among these objectives, the two main economic ones are (1) efficiency, competitiveness and aggregate growth and (2) equity, cohesion and reduction of disparities. In the last decade, a broad literature has investigated ways to overcome the trade-off between these two objectives and various forms of place-based policy have been proposed. However, the situation for the lagging regions has continued to deteriorate, which is an argument for diminishing the importance of the trade-off and also implementing policies that accept it.

The new classification introduced in this paper shows that, while it is desirable to overcome the trade-off, worthwhile policies exist accepting the trade-off, which has been defined in terms of the impact in the region of implementation and the impact in other regions. Moreover, the classification also shows that efficiency is a useful but not sufficient or necessary condition for the implementation of regional policies.

Scope exists, therefore, for a large number of types of regional policy that can be supported and implemented even when they are not the optimal type (i.e. policies that are win-win and efficient and result in a positive net social value). This scope is especially important, because weak areas have been struggling and most global challenges work against them. As Iammarino *et al*. (2019) recently wrote, "the EU's low-income regions have a narrow window in the current context in which to exploit their initial advantages and move into the middle-income group; effectively, they are in a race against the clock" (p. 292).

The long-term effects of the pandemic are still difficult to foresee. Even if some aspects will work in the favour of remote areas, such as the increased resort to teleworking, other aspects may work against them. This was the case in the 2007–2008 financial crisis, which started with the financial industry but ultimately had a greater effect on the weak regions with old specializations and little endowment of territorial capital.

This issue should also be of general concern. The challenge of the weaker regions should be regarded as a challenge that goes beyond these regions, which in most cases will not be able to converge with their own strength. Countries and even supranational bodies such as the EU have a legitimate interest in conserving

assets, such as cultural heritage, the natural environment, landscapes and traditions. These are assets of collective relevance, even when localized in weak and remote regions.

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Sommario

Le politiche regionali oltre i *trade-offs*: giustificazioni e sfide attuali

Questo lavoro analizza le definizioni e le motivazioni della politica regionale e lo fa con una review delle principali definizioni e giustificazioni che è possibile trovare in letteratura. L'esistenza di un trade-off tra equità ed efficienza è sempre stata al centro di esse, in passato e, più recentemente, all'epoca degli approcci place-based e della specializzazione intelligente, che dovrebbero superarlo grazie allo sfruttamento delle potenzialità inespresse. L'esistenza di politiche regionali valide anche in presenza di un trade-off tra effetti interni ed esterni è illustrata attraverso una nuova classificazione degli interventi di politica regionale. Viene quindi analizzata la rilevanza specifica di questi temi per la situazione attuale e le prospettive delle regioni in ritardo di sviluppo.

Cohesion Policies, Labour Productivity, and Employment Rate. Evidence from the Italian Regions

Gianluigi Coppola, Sergio Destefanis**

Abstract

Using NUTS2 data for Italy we evaluate the effects of EU and national cohesion-oriented funds' effects through a control function approach based on a model of the regional allocation of funds. We estimate a multi-input multi-output distance function, separating the impact on GDP per employee (labour productivity) from that on employment rate. We find that EU funds are very significant for the determination of GDP per capita. National funds are basically not significant. When GDP per capita is decomposed in GDP per employee and employment rate, we find that funds have a stronger effect on the latter.

1. Introduction

The debate is always open on the persistence of territorial differences in Italy, in particular between the Mezzogiorno and the rest of the country, and on the effects of cohesion policies. The two issues are closely linked, because after the end of the *Intervento Straordinario* in the Mezzogiorno in 1992, EU Structural Funds[1] represent the main tool, if not the only one, to reduce these gaps. There is a rather large literature on the effectiveness of EU funds, but very little on national cohesion policies (and virtually nothing on the comparison of these policies).

In this paper we carry out a counterfactual analysis of a wide array of (EU and national) cohesion policy funds in a macroeconometric panel set-up. Our empirical framework, unlike most of the earlier work, also considers along with the EU funds different types of nationally financed funds. Indeed, counterfactual analysis thrives on the study of the relationships among different funds and of their allocation mechanism. More precisely, we estimate ATEs of cohesion policies

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1. The proper definition of these funds is European Structural and Investment Funds (ESIF's). We will refer to them, for short, as EU funds.

within an augmented Solovian growth model using a control function approach (see Coppola *et al*., 2018). The variables augmenting the Solovian model come from a study of the allocation of funds across countries, the idea being that an evaluation of the funds' effects on the basis of a model of their allocation rules, permits a better treatment of the selection bias in policy evaluation.

This paper also aims to identify effective practices and sectors of intervention. Not only we want to compare the performance of EU vs. nationally funded cohesion policies, but we want to assess the impact of cohesion policies on GDP per employee vs. employment rate. Through a multi-output multi-input transformation function (Coelli, Perelman, 1999; Kumbhakar, 2012; 2013), we jointly consider the impact of policies on GDP per employee and employment rate (both components of GDP per capita).

In order to motivate this focus, consider in Table 1 the following aspects of the territorial differences in Italy. Italian dualism, measured in terms of GDP per capita, has been characterized in the last quarter of a century by a different evolution of its components: GDP per employee, which is a measure of labour productivity, and the employment rate (the ratio between employed workers and working-age population).

Table 1 – Territorial Disparities and their Evolution

	Mezzogiorno/North-Centre Ratio		
	1995	2009	2018
GDP per capita	55.7	58.1	55.2
GDP per employee	76.6	79.9	76.8
Employment rate	75.0	73.1	72.1

Source: Svimez (2019, p. 52)

Clearly, the gap in terms of per capita GDP between the Mezzogiorno and the North-Centre increased slightly from 1995 to 2018, while the gap in labour productivity narrowed just as slightly. Both of these variations were stronger in the periods leading up to the economic crisis. On the other hand, the differential relating to the employment rate has constantly increased throughout the period. The basic question for us is whether this evolution can at least in part be ascribed to a different effectiveness of cohesion policies through time.

The paper proceeds as follows. Section 2 provides a survey of the empirical literature on cohesion policies, mostly focusing on Italian contributions. In Section 3 we present our empirical set-up, motivating in particular our approach to policy counterfactual analysis. Section 4 expounds our evidence. Section 5 concludes.

2. Literature Survey

There is a vast literature on the impact evaluation of the European regional policy. Due to diversity of methods, time and geographical span covered, outcome of interest and different regional factors, there is no common conclusion about the impact of the funds, although most studies show a positive effect. In this survey we provide some information about sources of diverse results, before focusing on studies relating to the Italian economy.

Breidenbach *et al*. (2016) maintain that there have been two main approaches to the evaluation of regional policies: structural and experimental. The structural approach applies econometric analysis to existing growth and convergence theories. In this sense there has been a shift from Barro convergence models (Boldrin, Canova, 2001; Canaleta *et al*., 2002; Fratesi, Perucca, 2014) we document the motivation for such policies, that is, the large income disparties across the regions of the EU15. Large disparities are certainly present. Second, we illustrate the various instruments adopted and discuss their underpinnings in established economic theories. Next, we look at available data, searching for three kinds of evidence: (1 to augmented conditional convergence models (Esposti, Bussoletti, 2008; Le Gallo *et al*., 2011; Maynou *et al*., 2016; Gagliardi, Percoco, 2017; Percoco, 2017), and then to more flexible neoclassical growth models (Rodríguez-Pose, Fratesi, 2004; Puigcerver-Peñalver, 2007; Mohl, Hagen, 2010; Aiello, Pupo, 2012; Rodríguez-Pose, Novak, 2013; Coppola *et al*., 2018). More recently, quasi-experimental tools such as generalised propensity score matching or regression discontinuity design have been employed for more microeconomic-oriented analyses (Becker *et al*., 2010; Pellegrini *et al*., 2013; Mitze *et al*., 2015; Crescenzi, Giua, 2016; 2019).

Since most of the reviewed studies analyse growth as a part of a neoclassical growth model, GDP growth per capita is the dependent variable considered most often. Alternative dependent variables are normally related to job creation and labour productivity (De la Fuente, Vives, 1995; Coppola, Destefanis, 2015; Crescenzi, Giua, 2016; Giua, 2017), industrial location patterns (Midelfart-Knarvik, Overman, 2002) and productivity (Esposti, Bussoletti, 2008).

We note that there may some value added to be gained by bringing together the structural and the experimental approach. A first attempt along these lines was carried out in Coppola *et al*. (2018), but only for GDP per capita. We will now focus in greater detail on some works related to Italian territorial units.

One of the first studies that takes into consideration cohesion policy in the Italian regions is Percoco (2005). GDP is regressed on private capital, social and economic infrastructures, employment and human capital for six southern regions (during the 1994-1999 programming period). The effects of EU funds on

GDP are imputed through the weight that their spending has on these regressors, finding on the whole a positive impact.

Coppola and Destefanis (2007, 2015) consider all regions from 1989 to 2006, and use a two-stage non-parametric procedure to break down the evolution of GDP per capita into various elements, measuring the impact of accredited EU funds (of RGS source) on each of these elements. They find a positive impact, which is however smaller, and diminishing in time, for capital deepening and employment.

Aiello and Pupo (2012) estimate a neoclassical convergence model augmented with the amount of paid EU funds (of CPT source) for all regions from 1996 to 2007. They find a weak impact of funds (greater in the southern regions) on GDP per capita, while, in contrast to the previous papers, they find no effect on labour productivity.

Barone *et al*. (2016) apply a counterfactual analysis aimed at demonstrating that EU funds produce effects only in the short term. They take into account the dynamics of Abruzzo's per capita GDP. This region was part of Objective 1 with all the other southern regions only until 1996. For this reason, Abruzzo no longer benefited from EU funds for convergence after 2000. The authors find that, after this date, GDP per capita in Abruzzo did not grow as in the previous period, and they interpret this result as evidence that EU funds have not activated an endogenous growth process.

Coppola *et al*. (2018) use the SSR data from RGS to jointly analyse the impact of EU funds and some national funds on GDP per capita of the 20 regions from 1994 to 2013. The authors apply a control function approach and take into account the impact of the regional socio-economic context. They find a positive impact of EU funds, and, for national funds, a minor impact for current account subsidies to businesses. The governance capacity of the regions has an impact only for the latter.

There are also some papers evaluating the impact of EU funds on sub-regional or firm-level data.

Ciani and De Blasio (2015) estimate the impact of EU funds on employment, population, and property prices in the Local Labour Systems of the Mezzogiorno for period 2007-2013. They find a somewhat limited impact of the funds.

Albanese *et al*. (2019) measure the impact of the ERDF on total factor productivity estimated at the level of individual companies (the data refer to companies in the Mezzogiorno for period 2007-2015). The results obtained show the ineffectiveness of the ERDF, with the exception of the share spent on infrastructure.

Finally, some works apply a Regression Discontinuity Design, considering as geographical discontinuity the administrative boundaries between the areas belonging to the regions under Objective 1 of the EU cohesion policy and the

neighbouring areas. Giua (2017), for whom the outcome variable is the change in employment (based on census data) between 1991 and 2001, find that EU funds have a positive effect in Objective 1 regions, with no displacement effect on employment in other regions. The impact is particularly positive for some key sectors (industry, construction, retail trade, tourism). However, in a more recent article Crescenzi and Giua (2019) find that the positive effects on employment derived from belonging to the Objective 1 regions no longer existed in Italy during the recent crisis. Using geographical discontinuities similar to the previous ones, Cerqua and Pellegrini (2018) estimate the impact of all public projects on local development for period 2007-2015. The results of cohesion policies are mostly zero for local income (data from MEF) and positive for the number of local units and their employees (data from ASIA).

Empirical studies on the effects of cohesion policy in Italy do not reach unambiguous results. Partly this happens for the general reasons that have been pointed out above. Some further reasons, which perhaps have not yet found deserved attention in the literature, concern:

1. The dynamic processing of expenditure data. In this regard, it should be noted that in Coppola *et al*. (2018), similarly to what has recently been done in the historical series of EU funds prepared by the European Commission (https://cohesiondata.ec.europa.eu/), the expenditure data for the funds are forwarded by one year, in order to better model the actual annual expenditure profile;
2. The complexity of the dynamic links between GDP and employment, as highlighted by Percoco (2005);
3. The fact that the funds intended for employment can be attributed above all to the ESF, whose governance methods differ from those of the other funds (for example in terms of large fragmentation of projects);
4. The use of relatively heterogeneous databases, both in the macro- and microeconomic context.

Below, we will take advantage from these considerations to frame our empirical analysis. It is also worth considering that modelling the allocation of funds allows a better treatment of the selection bias (linked to the fact that Funds are distributed not randomly but on the basis of observable criteria). Yet, the allocation rules of the various funds have seldom been studied, and never considered in conjunction with the analysis of the funds' impact. The existing analyses point out that funds are interrelated (see Bouvet, Dall'Erba, 2010). Kemmerling and Bodenstein (2006). There is also evidence for the political orientation of national and regional governments in affecting the amount of the allocated funds. Cyclical and sectoral factors also play a role in the allocation of funds.

More precisely, Kemmerling and Bodenstein (2006) analysed the effect of the partisan politics (through behaviour of governments and lobbying in the EU

Commission) on the allocation of regional funding. The estimates show a significant but not always robust relationship between partisanship and the ESIF policy. Bouvet and Dall'Erba (2010) studied how, besides economic and social criteria for receiving funding, also the influence of the national and regional level political data. They conclude that the left-wing and Euro-sceptical governments, as well as better alignment between national and regional governments directly influence the EU funds' distribution, although the effect varies depending on the objective of the funding.

3. The Empirical Approach and the Dataset

The analysis of the literature that we have carried out above[2] reveals that there is room for new studies that take into account the role of other policies / funds beside EU funds, the role of the fund allocation mechanism in determining their effectiveness, the identification of effective practices and sectors of intervention. The analysis of Coppola *et al*. (2017) involved an emphasis on sectors, while the analysis in Coppola *et al*. (2018) has the role of funds' allocation and the subsequent adoption of a control function approach as its most distinctive characters. In Coppola and Destefanis (2019) we combine these two lines of attack. We focus on (disaggregated) EU funds and analyse EU funds along with nationally funded policies through a control function approach. We keep the same approach in the present paper, but we switch focus from sectors to GDP per employee and employment rate. Always considering NUTS2 data for Italy we undertake an evaluation of the funds' effects on the basis of a model of their allocation rules, thus dealing with the selection bias inherent in policy evaluation, and we estimate a multi-input multi-output distance function, separating the impact on GDP per employee (labour productivity) from that on employment rate.

More in detail, we ground our approach within Solow's augmented neoclassical growth model, as was already notably done in Beugelsdijk and Eijffinger (2005), Ederveen *et al*. (2006), Aiello and Pupo (2012) and Le Gallo *et al*. (2011) for the assessment of EU funds' effectiveness. According to Wooldridge (2004, chapter 10), for the purposes of impact evaluation, it is better to rely upon a fixed-effect dynamic panel model. As a further way of dealing with the selection bias problem deriving from the non-random allocation of cohesion funds, it is useful to resort to the control function approach (Heckman, Hotz, 1989; Wooldridge, 2004; Cameron, Trivedi, 2005, chapter 25). According to this approach, we can assume that these funds are randomly allocated, once due care has been taken of a set of observable covariates. Therefore, using a standard regression analysis we estimate an average treatment effect of policies (here an average partial effect, as

2. A similar view can be easily derived from the very thorough survey provided by Fratesi (2016).

funds are continuous variables) through a 'kitchen sink' regression (Wooldridge, 2004) that includes the treatment (cohesion funds) along with other variables determining the response variable and/or policy allocation. The control function approach is particularly convenient in our application for the following reasons. First, although there have been in time some explicit rules presiding to the allocation of funds between regions (especially as far as the Convergence objective of the EU funds was concerned), these rules have never fully presided to the allocation of funds, even in the case of EU funds. An important consequence of this state of affairs (see Table 2) is that in our sample there are no regions which do not receive any kind of funding. This is true for EU funds, and all the more so for nationally financed funds. Hence a counterfactual strategy based on the creation of a control group (for instance, receiving no funding) cannot be enacted in our case. Besides, the 'kitchen sink' set-up is very convenient in our case because it is readily adapted to the modelling of multiple continuous treatments (the various policy funds, some of which we may want to jointly include in a regression).

Let us start with the following simple dynamic panel specification:

$$y_{it} = \alpha_1 y_{it-1} + \alpha_2 gfi_{it} + \alpha_{3j} SF_{jit} + \alpha_{4j} Nat_{jit} - \alpha_5 D.pop_{it} + \alpha_6 W_{it-1} + \alpha_i + \alpha_t + \varepsilon_{it} \quad [1]$$

where, y_{it} is (log) GDP per capita, $i = 1,\ldots 20$ stands for member states, $t = 1,\ldots n$ is for years, the lagged dependent variable y_{it-1} – allows for a simple dynamic structure,[3] gfi_{it} is a (log) ratio of gross fixed investment over GDP, $D.pop_{it}$ is the (log) variation of population, SF_{jit} are the EU funds (whose types are indexed by j), Nat_{jit} are nationally financed funds related to industrial and regional policies (also indexed by j). Vector W_{it-1} includes the variables presiding over the regional allocation of the funds. α_i and α_t are country and year fixed effects respectively and ε_{it}, as usual, an independent and identically distributed error term. The variables to be included in vector W_{it-1} are selected through estimation of a set of auxiliary regressions in which EU and nationally financed funds are posited to be a function of a list of potential determinants. The selection of a parsimonious specification of these equations consistent with satisfactory diagnostics provides us with the indication of the relevant set of W_{it-1} variables. Notably, vector W_{it-1} may include, besides sectoral and cyclical variables, such politically based indicators as the political orientation of each regional government, either left/liberal or right/conservative, and an alignment measure of the political orientation of each regional government and the national government. Wooldridge (2004) demonstrates that equation (1) can consistently estimate the average partial effect (that is, the average treatment effect) of the policy on the response variable, provided that funds are continuous variables, and are a linear homoscedastic function of W_{it-1} and the

3. This specification is taken purely for expositional purposes. In empirical analysis we allow for a more complex dynamic structure.

other regressors in (1). Given that we deal with continuous policy treatments, we can take continuity for granted, and test for the other conditions (functional form, homoscedasticity) when we estimate the auxiliary regressions.

EU funds are taken into account in terms of disbursements to the regions by the Rotation Fund (*Fondo di Rotazione*), the Italian governmental institution responsible for raising funds from the EU. We allow for these funds in two different specifications: with and without the national resources of the Rotation Fund (the national co-financing, to which reference was made in Section 2). A substantial proportion of EU funds are not allocated to any single region, but to multi-regional aggregates. In the following analysis, we shall assume that these funds are spread across regions proportionally to the shares of regionally allocated funds. This is the hypothesis most often maintained in the literature (see Aiello, Pupo, 2012) and that most makes sense from an a priori standpoint.

We have already noted that there is a rather large literature on the effectiveness of EU funds, but very little on national regional policies (and virtually nothing on the comparison of these policies). In order to fill this gap of the literature, among the national funds (related to regional and industrial policies) going to a given region, we include current-account subsidies to firms and to households, and capital-account expenditures split among subsidies to firms and investment expenditures. We also measure national cohesion policies through the sum of such funds as the *Fondo innovazione tecnologica*, *Fondo contributo imprese*, *Fondo solidarietà nazionale* and, when operational, the *Fondi aree depresse*. For national funds too, there exists a large component of multi-regional aggregates, with which we deal in the same manner as with SFs.

Table 2 (to which we already referred to above) provides a summing up of the policy funds included in the empirical analysis, as well as of some descriptive statistics for them.

In the reported estimates, we consider the EU funds as an aggregate, that is ERDF+ESF+alf+national cofinancing, which yields the Rotation Fund,[4] and in separation. Nationally financed policies are considered one by one.

Clearly, however, just regressing GDP per capita on funds and other variables neglects the different influence of policies on the GDP per capita components, that is GDP per employee and employment rate. Equally, just regressing either GDP per employee or employment rate separately on funds and other variables would assume away both the impact of the funds on the other variable of interest (either the employment rate or GDP per employee), as well as the impact of the other variable of interest on the variable under scrutiny. Indeed, these two variables

4. Estimates considering separately the sum ERDF+ESF+alf and national cofinancing were also carried out and are available upon request. They entailed a loss of efficiency in estimation, without bringing about any important qualitative insight.

Table 2a – The Policy Funds, Acronyms and Definitions

Funds	*Acronym*	*Definition (Name)*
	European Structural Funds	
Rotation Fund	ERDF	European Regional Development Fund (ERDF),
	ESF	European Social Fund (ESF)
	alf	European Agricultural Guidance and Guarantee Fund (EAGGF)
		European Agricultural Fund for Rural Development (EAAG)
		European Maritime and Fisheries Fund (EMFF) and other funds.
	cofin	National Cofinancing
	National Funds (Regional and Industrial Policies)	
Current account expenditures	cf	Current-account subsidies to firms
Capital-account expenditures	kf	Capital-account subsidies to firms
	ki	Capital-account expenditures (Investments)
National Cohesion Policies	nc	*Fondo innovazione tecnologica*
		Fondo contributo imprese
		Fondo solidarietà nazionale
		Fondo aree depresse

Table 2b – The Policy Funds. Year 2010 (Millions of Euros)

Funds	*North-Centre*	*Mezzo-giorno*	*Italy*
European Regional Development Fund (ERDF)	422.86	1573.66	1996.52
European Social Fund (ESF)	395.59	172.19	567.78
Other Funds (EAGGF. EAAG. EMFF and others)	813.53	85.81	899.34
National Cofinancing	1624.29	2046.41	3670.7
EU Structural Funds	3256.27	3878.07	7134.34
Current Account Subsidies to firms	1961.37	1030.5	2991.87
Capital Account Subsidies to firms	2826.54	822.15	3648.69
Capital Account (Investments)	1057.38	1496.2	2553.58
National Cohesion Policies	263.28	661.06	924.34
National funds (related to regional and industrial policies)	6108.57	4009.91	10118.48
TOTAL FUNDS	9364.84	7887.98	17252.82

Source: Author's elaborations on *Spesa statale regionalizzata* data

Table 2c – The Policy Funds. Year 2010 (Percentages)

Funds	*North-Centre*	*Mezzo-giorno*	*Italy*	*Mezzo-giorno/ Italy*
European Regional Development Fund (ERDF)	4.52	19.95	11.57	78.82
European Social Fund (ESF)	4.22	2.18	3.29	30.33
Other Funds (EAGGF, EAAG, EMFF and others)	8.69	1.09	5.21	9.54
National Cofinancing	17.34	25.94	21.28	55.75
EU Structural Funds	34.77	49.16	41.35	54.36
Current Account Subsidies to firms	20.94	13.06	17.34	34.44
Capital Account Subsidies to firms	30.18	10.42	21.15	22.53
Capital Account (Investments)	11.29	18.97	14.80	58.59
National Cohesion Policies	2.81	8.38	5.36	71.52
National funds (related to regional and industrial policies)	65.23	50.84	58.65	39.63
Total Funds	100.00	100.00	100.00	45.72

Source: own elaborations on *Spesa statale regionalizzata* data

are likely to be jointly determined, and there could be complementarity or substitution effect between them. We would also neglect that these variables are jointly determined. Simply including the employment rate in an equation for GDP per employee (or the other way around) along with the other regressors would not be a satisfactory way of modelling this nexus. In this case, we would implicitly assume that GDP per employee (or the employment rate) is not affected by the funds.

Following these considerations, and drawing upon the literature on multi-output multi-input transformation functions (see Coelli, Perelman, 1999; Kumbhakar 2012, 2013; for further details on this kind of specification), we model the relationship between GDP per employee, employment rate and policy funds as:

$$x_{it} = -a_1\left(r_{it} - x_{it}\right) + a_2 x_{it-1} + a_3\left(r_{it-1} - x_{it-1}\right) + a_4 gfi_{it} + a_5 F_{it} + \\ - a_6 D.pop_{it} + a_7 W_{it-1} + a_i + a_t + e_{it} \qquad [2]$$

where x and r are respectively GDP per employee and employment rate (whose product is GDP per capita), F is a shorthand notation for any kind of policy fund, and the other variables have been already defined.

There is a further twist. Consider the following version of (2), augmented with an interaction term between policy funds and the employment rate normalised by GDP per employee, $\left(r_{it} - x_{it}\right)$:

$$x_{it} = -a_1\left(r_{it} - x_{it}\right) + a_2 x_{it-1} + a_3\left(r_{it-1} - x_{it-1}\right) + a_4 gfi_{it} + a_{51}F_{it} + a_{52}F_{it}\left(r_{it} - x_{it}\right) + \\ -a_6 D.pop_{it} + a_7 W_{it-1} + a_i + a_t + e_{it} \quad [3]$$

Using (3) we can see whether policy funds have a stronger impact on either GDP per employee or employment rate. To see this, we provide below the long-run solutions of (3) for each variable. For the sake of simplicity, we work on a simplified version of (3), including only GDP per employee, employment rate and policy funds. The derivation is detailed in the Appendix:

$$x_i = \frac{-\left(a_1 - a_3 - a_{52}F_i\right)}{\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)} r_i + \frac{a_{51}}{\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)} F_i + \ldots \quad [4]$$

$$r_i = \frac{-\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)}{\left(a_1 - a_3 - a_{52}F_i\right)} x_i + \frac{a_{51}}{\left(a_1 - a_3 - a_{52}F_i\right)} F_i + \ldots$$

In this case, funds favour the employment rate, in the sense that a higher a_{52} increases the long-run impact of funds on this rate and dampens the long-run impact of funds on GDP per employee. Yet, things would go the other way around if a_{52} had a negative sign in (3).

Regional data for real GDP, value added, gross fixed investment and employment are taken from ISTAT's regional accounting. EU funds and national funds were taken from the *Spesa statale regionalizzata* database of the Ministry of Economy and Finance. All these series were deflated using a regional GDP deflator and divided by the regional GDP. It must be stressed that these series relate to the amounts disbursed by the various regions, as taken from the *Spesa Statale Regionalizzata*. These data are available from 1994 up to 2017. Politically based indicators are taken from the Ministry of Interior database.

4. The Main Results

In the empirical analysis, we have actually gone beyond the simple dynamic specification presented in Section 3, experimenting with various lags and leads of SF_{jit}, Nat_{jit}, and gfi_{it}. It turns out that the best dynamic fit was obtained by taking one-year forwarded EU funds (as in Coppola *et al*., 2018),[5] and one-year lagged gross fixed investment. Virtually all estimates have satisfactory diagnostics for

5. This dynamic specification describes the institutional mechanism in which regions, after having engaged in their spending decisions, demand reimbursement from the Rotation Fund. Funds from the EU are then paid out to the regions with a lag of approximately one year. This means that the Rotation Fund expenditures written down for year *t* have already been made in year *t*–1. We expect this mechanism to be valid only for EU funds, and tried out similar dynamic specifications for all other variables. No significant result was obtained, which validates our supposition.

Table 3 – The Funds' Allocation Mechanism, 1994-2017, Main Results

Regressor / Dep. Var.	*D.rf*	*D.erdf*	*D.esf*	*D.alf*	*D.nc*	*D.ki*	*D.cf*	*D.kf*
rf(-1)	-0.82***							
rf(-2)	0.11*							
erdf(-1)		-0.92***		0.08*		-0.08**		
esf(-1)		-0.09	-0.99***					
esf(-2)			-0.11**					
alf(-1)		0.08		-0.71***				
alf(-2)				0.25***				
ch(-1)								-0.24***
cf(-1)	-0.16**						-0.68***	
cf(-2)							0.27***	-0.06*
nc(-1)				0.02	-0.73***			0.04
kf(-1)	0.32***			0.02				-0.74***
kf(-2)								0.20***
ki(-1)	-0.21**	-0.21**	-0.12*	0.01	0.09	-0.76***		0.19***
gfi(-1)	-0.74**	-1.24**					0.42	0.78***
y(-1)		-5.88***	-4.50***	5.13***	-4.32***			
y(-2)							-4.27***	
ur(-2)			-0.04*		-0.05***			
agr_vsh(-1)				22.43*				-17.62**
iss_vsh(-1)				-6.77***			6.32***	
cos_vsh(-1)		15.71**						
ser_vsh(-1)	3.33*		3.23		-4.34			3.90*
iss_nsh(-1)			-5.85*		-12.07**	-4.41*		
cos_nsh(-1)	9.52**							
ser_nsh(-1)					-15.04***	-6.66***		
ser_ulc(-1)		2.94**	1.98*	1.28		1.34*		
align(-1)	-0.05		-0.08	-0.11*				
R2_a	0.44	0.49	0.48	0.36	0.34	0.38	0.35	0.37
C-W	0.96	0.75	0.21	0.63	0.48	0.11	0.62	0.15
A-B	0.80	0.83	0.98	0.15	0.65	0.12	0.67	0.17
R	0.45	0.43	0.07	0.06	0.02	0.93	0.12	0.20

Note: *** means a p-value < 0.01, ** a p-value < 0.05, * a p-value < 0.10.

Table 4 – Aggregate EU Funds, 1994-2017. Dependent Variable: log GDP per Capita (y)

Regressor/ Model	*(I)*	*(II)*	*(III)*	*(IV)*	*(V)*
y(-1)	0.8622 (22.2)	0.8345 (17.9)	0.8473 (26.7)	0.8799 (15.6)	0.8413 (28.13)
gfi(-1)	0.0298 (2.47)	0.0347 (2.06)	0.0316 (2.63)	0.0356 (2.05)	0.0315 (2.86)
D(pop)	-1.2762 (-4.25)	-1.2321 (-3.74)	-1.2074 (-4.46)	-1.1066 (-3.46)	-1.2359 (-4.32)
rf(+1)	0.0041 (2.78)	0.0037 (2.57)	0.0049 (3.57)	0.0039 (2.51)	0.0038 (2.64)
cf		0.0013 (1.17)			
nc			-0.0028 (-2.62)		
kf				-0.0017 (-0.67)	
ki					-0.0013 (-0.78)
N	420	400	420	400	420
r2_a	0.9339	0.9297	0.9351	0.9298	0.9341

Note: the bracketed values below the coefficient sare *t*-ratios

the Reset and serial correlation tests, meaning that the omission of some other variables is not likely to influence the evidence obtained. However, we present these diagnostics (also inclusive of an heteroskedasticity test) only for the auxiliary regressions presiding to the selection of the relevant W_{it-1} variables, given that obtaining good diagnostics is part of the 'kitchen sink' approach suggested in Wooldridge (2004).

The results of these auxiliary regressions are presented in Table 3. This search started including in W_{it-1} lags of SF_{jit} or Nat_{jit}, GDP per capita, rate of unemployment, population, gross fixed investment, aggregate and sectoral value added, employment, labour productivity, as well as political variables. We assume that funds react only with a one-year delay to changes in the economic environment, an assumption which is well supported by the evidence.

These auxiliary regressions show complementarity and substitution mechanisms between EU and national funds. EU funds are substitute to (nationally funded) public investments. The allocation mechanism of both EU and national funds are rather complex, and also show some reaction to cyclical influences. All equations are reasonably well specified but for the equation for national cohesion funds, a feature that was already present in Coppola *et al*. (2018).

Table 5– Separate EU Funds,1994-2017. Dependent Variable: log GDP per Capita (y)

Regressor/ Model	*(I)*	*(II)*	*(III)*	*(IV)*	*(V)*
y(-1)	0.7803 (18.37)	0.7287 (10.41)	0.7784 (15.30)	0.7923 (21.42)	0.7922 (17.55)
gfi(-1)	0.0341 (2.04)	0.0333 (2.01)	0.0323 (1.94)	0.0343 (2.06)	0.0323 (1.88)
D(pop)	-1.3653 (-5.20)	-1.4029 (-5.35)	-1.3093 (-5.13)	-1.4189 (-5.49)	-1.3639 (-5.19)
ERDF(+1)	0.003 (2.84)	0.0031 (3.02)	0.0032 (3.05)	0.0031 (3.23)	0.0032 (3.03)
ESF(+1)	-0.0027 (-1.88)	-0.0028 (-1.94)	-0.0026 (-1.78)	-0.0029 (-2.00)	-0.0029 (-1.84)
alf(+1)	-0.0006 (-0.87)	-0.0007 (-0.89)	-0.0005 (-0.68)	-0.0005 (-0.62)	-0.0006 (-0.82)
cofin(+1)	0.005 (1.20)	0.0048 (1.10)	0.0049 (1.18)	0.0047 (1.14)	0.0046 (1.15)
cf		0.0000 (0.04)			
nc			-0.002 (-1.72)		
kf				-0.0014 (-0.54)	
ki					-0.0021 (-1.43)
N	400	400	400	400	400
r2_a	0.9327	0.9323	0.9327	0.9323	0.9328

Note: the bracketed values below the coefficient sare *t*-ratios

The results from equations (1), (2) and (3) are given in Tables 4-9. All these are inclusive of the funds' allocation controls, W_{it-1}, which are not made explicit for the sake of brevity. First, we give results for equation (1) in Tables 4 and 5, respectively with aggregate and separate EU funds.

The rotation fund, *rf*, is very significant and its coefficient has a reasonable size. A doubling of the *rf*/GDP share increases the steady-state level of GDP per capita by a sizeable proportion (about a seventh) of the same proportional increase of gross fixed investment/GDP. National funds are basically never significant. When considering the EU funds in separation, it turns out that the ESF has s *negative* sign, quite close to significance levels. Most of the positive impact from EU funds comes on the other hand from the ERDF. The gist of this evidence is reiterated, at least in qualitative terms by the findings from Table 6 and

Table 6 – Aggregate EU Funds, 1994-2017. Dependent Variable: log GDP per Employee (x). Regressors Including Normalised Employment Rate

Regressor/ Model	*(I)*	*(II)*	*(III)*	*(IV)*	*(V)*
x(-1)	0.8799 (31.39)	0.8423 (20.41)	0.8697 (33.71)	0.8942 (20.14)	0.8658 (24.30)
(r–x)	-0.6136 (-26.36)	-0.6156 (-25.15)	-0.6094 (-25.86)	-0.6166 (-24.87)	-0.6134 (-25.72)
(r-x)(1)	0.5261 (17.59)	0.5296 (15.07)	0.5161 (16.32)	0.5379 (16.26)	0.5315 (17.16)
gfi(-1)	0.0125 (2.26)	0.0161 (2.12)	0.0135 (2.62)	0.0157 (1.97)	0.0118 (2.20)
D(pop)	-0.5306 (-3.91)	-0.4843 (-3.29)	-0.5116 (-4.09)	-0.4441 (-2.63)	-0.5194 (-4.06)
rf(+1)	0.0019 (2.95)	0.0017 (3.08)	0.0022 (3.82)	0.0018 (2.71)	0.0018 (2.82)
cf		0.0002 (0.34)			
nc			-0.0012 (-2.28)		
kf				-0.0007 (-0.61)	
ki					-0.0007 (-0.92)
N	420	400	420	400	420
r2_a	0.9700	0.9712	0.9704	0.9709	0.9698

Note: the bracketed values below the coefficient sare *t*-ratios

7, which relate to the estimation of equation (2), first with aggregate and then with separate EU funds.

The utilisation of the output transformation function leads to a higher fit, as expected a priori, since we are using information from a GDP capita component, *r*, to explain the other, *x*. All regressors have the a priori expected sign and, once more, the size and significance of their coefficients replicates the previous evidence. The only notable difference is that the negative coefficient of ESF is now less significant.

Finally, in Table 8, we turn to an estimate of equation (3) with aggregate EU funds.

It appears indeed that EU funds favour the employment rate in the sense stated at the end of Section 3. This can be retrieved from the positive sign and significance of the $(r - x) * rf(+1)$ coefficient. Remarkably, no other interaction term even approaches significance, with the partial exception of the term related

Table 7 – Separate EU Funds, 1994-2017. Dependent Variable: log GDP per Employee (x). Regressors Including Normalised Employment Rate

Regressor/ Model	*(I)*	*(II)*	*(III)*	*(IV)*	*(V)*
x(-1)	0.7995 (21.66)	0.7550 (16.76)	0.8613 (13.36)	0.7513 (16.58)	0.8663 (14.12)
(r-x)	-0.6047 (-24.03)	-0.6052 (-23.06)	-0.6056 (-23.28)	-0.6051 (-23.37)	-0.6070 (-24.19)
(r-x)(-1)	0.4970 (14.97)	0.4982 (14.56)	0.4931 (13.45)	0.4997 (15.04)	0.5026 (14.75)
gfi(-1)	0.0142 (1.75)	0.0145 (1.89)	0.0141 (1.86)	0.0148 (1.90)	0.0137 (1.75)
D(pop)	-0.5593 (-4.16)	-0.5601 (-4.22)	-0.5689 (-4.90)	-0.5553 (-4.04)	-0.5872 (-4.74)
ERDF(+1)	0.0014 (2.99)	0.0016 (3.38)	0.0016 (3.45)	0.0016 (3.47)	0.0016 (3.34)
ESF(+1)	-0.0010 (-1.45)	-0.0010 (-1.44)	-0.0010 (-1.54)	-0.0010 (-1.47)	-0.0011 (-1.55)
alf(+1)	-0.0001 (-0.20)	-0.0000 (-0.04)	0.0001 (0.12)	0.0001 (0.14)	0.0000 (0.05)
cofin(+1)	0.0024 (1.10)	0.0023 (1.08)	0.0022 (1.05)	0.0023 (1.09)	0.0022 (1.04)
cf		-0.0001 (-0.23)			
nc			-0.0009 (-1.43)		
kf				-0.0011 (-0.86)	
ki					-0.0011 (-1.64)
N	400	400	400	400	400
r2_a	0.9714	0.9716	0.9716	0.9717	0.9717

Note: the bracketed values below the coefficient sare *t*-ratios

to gross fixed investment. Exactly the same qualitative considerations arise if we estimate equation (3) with separate EU funds (estimates are available upon request). The ERDF is always the dominant policy variable, with a positive sign and a positive $(r - x)$ * ERDF (+1) interaction. ESF has always a negative sign, just as the $(r - x)$ * ESF (+1) interaction, although neither of them is significant. Given that the distribution of EU funds, and especially of the ERDF, favours the Mezzogiorno regions, we can draw from these results the policy implication that the employment divide between the Mezzogiorno and the rest of the country would have been even worse in the absence of EU cohesion policy.

Table 8 – Aggregate EU Funds, 1994-2017. Dependent Variable: log GDP per Employee (x). Regressors Including Normalised Employment Rate and its Interaction Terms

Regressor/ Model	*(I)*	*(II)*	*(III)*	*(IV)*	*(V)*
x(-1)	0.8654 (28.95)	0.8231 (20.50)	0.8526 (26.30)	0.8710 (19.33)	0.8482 (22.17)
(r-x)	-0.6626 (-9.21)	-0.6684 (-8.06)	-0.5999 (-7.11)	-0.6806 (-8.28)	-0.6396 (-7.55)
(r-x)(-1)	0.5103 (14.69)	0.5097 (13.09)	0.4969 (12.98)	0.5148 (13.86)	0.5162 (14.85)
gfi(-1)	-0.3094 (-1.44)	-0.3689 (-1.56)	-0.1968 (-0.93)	-0.3830 (-1.40)	-0.2891 (-1.44)
D(pop)	22.588 (0.30)	30.682 (0.42)	0.7731 (0.11)	0.5684 (0.07)	41.785 (0.52)
rf(+1)	0.0592 (2.28)	0.0495 (1.70)	0.0816 (2.32)	0.0666 (2.02)	0.0706 (2.60)
cf		0.0235 (0.99)			
nc			-0.0034 (-0.24)		
kf				0.0029 (0.06)	
ki					0.0025 (0.06)
(r-x)*rf(+1)	0.0113 (2.18)	0.0095 (1.64)	0.0157 (2.24)	0.0128 (1.96)	0.0136 (2.51)
(r-x)*cf		0.0047 (0.98)			
(r-x)*nc			-0.0004 (-0.14)		
(r-x)*kf				0.0007 (0.07)	
(r-x)*ki					0.0007 (0.08)
(r-x)*gfi(-1)	-0.0636 (-1.49)	-0.0763 (-1.62)	-0.0417 (-1.00)	-0.0791 (-1.46)	-0.0595 (-1.50)
(r-x)*D(pop)	0.5595 (0.38)	0.7164 (0.50)	0.2608 (0.19)	0.2053 (0.14)	0.9368 (0.59)
N	420	400	420	400	420
r2_a	0.9703	0.9715	0.9707	0.9713	0.9702

Note: the bracketed values below the coefficient sare *t*-ratios

5. Conclusions

In this paper we undertake an evaluation of regional funds' effects on the basis of a model of their allocation rules, thus dealing with the selection bias inherent in policy evaluation, and estimate a multi-input multi-output distance function, separating the impact on GDP per employee (labour productivity) from that on employment rate. We consider NUTS2 data for Italy from 1994 to 2017.

Our main results are that EU funds are very significant (with and without the funds' allocation controls) for the determination of GDP per capita. National funds are basically not significant. When GDP per capita is decomposed in GDP per employee and employment rate, EU funds are found to act more strongly upon the latter. More robustness checks are needed, however, before the evidence can be used to draw some robust policy implications.

Considering again what was said in Section 2 about the evidence from Percoco (2005), the existence of different dynamic structures for GDP per employee and employment rate could be explored more fully. Even more importantly, it could be asked whether the funds' impact in favour of the employment rate is a structural phenomenon, or is merely the reflection of sectoral effects, or of underlying factors of some other kind. A final thought is that one could ask whether the Solovian model is the only possible conceptual wrap-up for this kind of analysis. One could think, for instance, of the Kaldor-Verdoorn approach to growth and employment determination.

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Sommario

Politiche di coesione, produttività del lavoro e tasso di occupazione. Una stima per le regioni italiane

Utilizzando dati NUTS2 per l'Italia, valutiamo gli effetti degli effetti dei fondi UE e nazionali orientati alla coesione regionale mediante un approccio di funzione di controllo. Stimando una funzione di distanza multi-input e multi-output, è anche possibile separare l'impatto sul PIL per occupato da quello sul tasso di occupazione. I fondi UE risultano molto significativi per la determinazione del PIL pro capite, a differenza dei fondi nazionali. Quando il PIL pro capite viene scomposto in PIL per occupato e tasso di occupazione, si trova che i fondi hanno un effetto più forte su quest'ultimo

Appendix

Deriving a long-run solution from Equation [3]

In order to derive a long-run solution for Equation (3), we focus for the sake of simplicity only on GDP per employee, employment rate and policy funds:

$$x_{it} = -a_1\left(r_{it} - x_{it}\right) + a_2 x_{it-1} + a_3\left(r_{it-1} - x_{it-1}\right) + a_{51}F_{it} + a_{52}F_{it}\left(r_{it} - x_{it}\right) + \ldots \qquad [3]$$

and, as customary for long-run solutions, we take $t = t\text{-}1$, effectively suppressing the time dimension. Hence, we get:

$$x_i = -a_1\left(r_i - x_i\right) + a_2 x_i + a_3\left(r_i - x_i\right) + a_{51}F_i + a_{52}F_i\left(r_i - x_i\right) + \ldots$$

$$\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)x_i = -\left(a_1 - a_3 - a_{52}F_i\right)r_i + a_{51}F_i + \ldots$$

which can be solved either for x_i or for r_i:

$$x_i = \frac{-\left(a_1 - a_3 - a_{52}F_i\right)}{\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)}r_i + \frac{a_{51}}{\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)}F_i + \ldots$$

$$r_i = \frac{-\left(1 - a_1 - a_2 + a_3 + a_{52}F_i\right)}{\left(a_1 - a_3 - a_{52}F_i\right)}x_i + \frac{a_{51}}{\left(a_1 - a_3 - a_{52}F_i\right)}F_i + \ldots$$

These solutions imply that that a higher a_{52} increases the long-run impact of funds on the employment rate and dampens the long-run impact of funds on GDP per employee. But of course, things would go the other way around if a_{52} was negatively signed.

Legend of Tables 3-8

Region and year fixed effects are always included in the estimates, and not shown in the interest of parsimony. For all regressors, we report coefficients and t-ratios (the bracketed values below the coefficients). Standard errors are heteroskedasticity-robust. In Table 3, for the sake of a more compact presentation, we highlight coefficient significance by star number: * means a p-value <.1; ** a p-value < .05; *** a p-value < .01.

N is the number of observations, r2_a is the coefficient of determination adjusted for degrees of freedom *not* inclusive of the effect of region and year fixed effects. C-W is the Cook-Weisberg test for heteroskedasticity, A-B is the Arellano-Bond test for first-order serial correlation, R is the Reset test for functional form and omitted variables (we include quadratic and cubic terms of fitted values).

GDP per capita	y
GDP per employee	x
Employment rate	r
EU structural funds (Rotation Fund: EU funding + national cofinancing)	rf
EU structural funds (European Regional Development Fund)	ERDF
EU structural funds (European Social Fund)	ESF
EU structural funds (sum of European Agricultural Guidance and Guarantee Fund (EAGGF), European Agricultural Fund for Rural Development (EAAG), European Maritime and Fisheries Fund (EMFF), other European funds)	alf
Current-account subsidies (to firms)	cf
Current-account subsidies (to households)	ch
Capital-account expenditures (subsidies)	ks
Capital-account expenditures (investments)	ki
National cohesion funds	nc
Gross fixed investment	gfi
Population	pop
Female rate of unemployment	ur
Agriculture (value added) share	agr_vsh
Industry (value added) share	iss_vsh
Construction (value added) share	cos_vsh
Services (value added) share	ser_vsh
Industry (employment) share	iss_nsh
Construction (employment) share	cos_nsh
Services (employment) share	ser_nsh
Services (unit labour cost)	ser_ulc
Alignment between regional governments and national government (=1 if aligned)	align

Variable y is at constant prices, divided by regional population. Variable x is at constant prices, divided by regional employment. Variables eu, cofin, rf, cf, ch, ks, ki, nc, gfi, are divided by GDP.

A (-1) or (-2) termination indicates a 1- or 2-year lagged variable. A (+1) termination indicates a 1-year forwarded variable. The D. symbol stands for a first-order (logarithmic) difference.

Unless otherwise stated, all these variables are in natural logarithms.

Redistribution and Risk-sharing Effects of Intergovernmental Transfers: An Empirical Analysis Based on Italian Municipal Data

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Abstract

This paper studies the redistributive and risk-sharing effects of intergovernmental grants measured at municipal level. The empirical analysis is based on the Italian municipal equalization system reformed in 2015 by introducing formula grants to equalize the fiscal gap, yearly updated according to local social-economic factors. Italian data are particularly useful since the reform was applied only to municipalities located in standard regions territories. Instead, the allocation of grants to municipalities in special statute regions continued according to the previous system based on the equalization of historical expenditure. Thanks to this asymmetric pattern of the reform, we use difference-in-differences estimators to identify the causal relationship between formula grants and local income (used as a proxy of local GDP). Final results show that formula grants can produce more income redistribution across municipalities than the transfers based on historical expenditures. On the contrary, the new formula-based transfers continue to have very low contemporary risk-sharing effects. We show that this result critically depends on the lags of the data available to evaluate fiscal capacity and standard expenditure needs.

1. Introduction

The economic crisis following the outbreak of the Covid-19 pandemic is hitting local economies asymmetrically. This occurs both because the epidemic is spreading more severely in some areas than in others and because the mitigation and

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 ISBN 9788835125860

confinement measures affect more heavily the local economies where the sectors more exposed to the risks of contagion weigh the most (for example, tourist areas).

Given the asymmetric impact of the Covid-19 pandemic, it is natural that subnational governments have been at the forefront in implementing policies to prevent the spread of the virus (especially where public health care responsibilities are decentralized) and to provide financial support to citizens and businesses affected by the economic crisis, by trimming emergency measures to the specificities of local needs. The increase in needs and the drop in revenues have put under strain subnational governments' budgets, with a different impact across jurisdictions.

The episode of the Covid-19 crisis adds specific interest to a more general issue, that of how the fiscal arrangements can absorb idiosyncratic shocks hitting local economies and, by this way, affecting subnational governments' fiscal position. In particular, here, we investigate the role of intergovernmental equalization schemes in providing risk-sharing and stabilization across local jurisdictions by means of local budgets intervention. The ability of intergovernmental grants to shield subnational governments and local economies from the fiscal impact of an idiosyncratic shock critically depends on whether they have pro-cyclical or counter-cyclical design features, with the latter being desirable to assure smoothing effects.

The literature has long investigated the role of the public budget in redistributing income across territories and providing insurance against idiosyncratic shocks (Andersson *et al*., 2008; Bayoumi, Masson, 1995; Melitz, Zumer, 2002; Sala-i-Martin, Sachs, 1991; Feld at al., 2020). In addition to the overall impact of public policies, several studies have also analyzed the differential effects of specific items of the central government budget (public consumption, direct taxes, social insurance, and money transfers) and of intergovernmental transfers (Blochliger, Egert, 2017).

Although the results vary significantly across countries, periods and estimation methods, overall, they suggest that direct taxes, public consumption and intergovernmental transfers do contribute substantially to interregional redistribution. In contrast, the evidence on the risk-sharing effect is somewhat mixed. Some studies have found that some public budget components may amplify regional shocks on economic activity. In particular, in the case of Italy, Decressin (2002) found that fiscal revenues (and also public investment) have a risk enhancing effect on regional economic activity, while Arachi *et al*. (2010) show that vertical fiscal flows from central governments to local governments are significantly pro-cyclical (other related studied based on Italian data are: Giannola *et al*., 2016, Petraglia *et al*., 2018, Petraglia *et al*., 2020).

This paper provides new evidence on the redistributive and insurance effects of intergovernmental transfers by focusing on Italian municipalities. Italy is an interesting case study for two reasons. First, it has implemented a thorough

reform of intergovernmental transfers to local municipalities, which has replaced fixed grants based on historical expenditure with an equalization system based on a formula of the fiscal gap that considers the evolution of the difference between expenditure needs and fiscal capacity. Further, the reform has not been applied to all Italian municipalities since those located in two special statute regions (Sicily and Sardinia) keep on receiving their grants according to the previous regime. Hence, by comparing the years before and after the reform and using the municipalities in those two regions as a control group, we can identify the redistributive and risk-sharing impact of fiscal gap equalization formula grants. Second, municipalities have been subject to strict rules that limit debt financing. Consequently, any change in intergovernmental transfers had a direct impact on the net contribution of the municipalities to their respective local economies, thus providing an ideal setting for evaluating the redistributive and insurance effect of this level of government.

The paper is organized as follows. The following section sketches the main features of the Italian institutional framework with particular reference to the system of intergovernmental fiscal relations and describes the reform of fiscal equalization across municipalities. The third section presents the specification of the empirical strategy. Results are presented in sections four and five. The sixth section concludes.

2. Italian Economic and Institutional Framework

Three tiers of government characterize the Italian system of subcentral levels of governments. At the highest level, 20 regions, five of which with special statutes, manage 19% of total current public expenditure, 143 billion euros, allocating more than 80% of it to the protection of health and the remaining 20% to public transport, complementary social welfare, higher education and vocational training. At the intermediate level, 93 provinces (17 of which located in special statute regions) and 14 Metropolitan districts (4 of which in special statute regions) manage 0.8% of the total current public expenditure (6 billion euros)[1]. This government level provides services related to the management of provincial road networks, public high school buildings, environmental protection, and delegated functions by regions in local public transport and vocational training. Finally, at the lowest level, 7,903 Municipalities (1,339 of which located in special statute regions) manage 6.8% of total current public expenditure (52.2 billion euros), providing services in the following sectors: environment protection and waste management, social care, childcare and nursery schools, school-related

1. 2018 figures taken from Conti Pubblici Territoriali.

services, local police, local transport and maintenance of local roads, registry, town planning, culture and recreation and economic development.

We focus our analysis on the Italian municipalities' financing system.[2] We exclude, 571 municipalities located in the three special statute regions in the north: Friuli-Venezia Giulia, Trentino Alto Adige and Valle d'Aosta, since in these territories the special regional constitutions exclude equalization grants from the central governments. Hence, we restrict our analysis to 7,332 municipalities corresponding to 93% of the total, 6,565 located in ordinary statute regions (OR municipalities), and the remaining 767 in the special statute regions of Sicily and Sardinia (SR municipalities). In both groups, current expenditure is financed by local taxes/fees and equalization grants whose allocation follows two allotment procedures: the difference between standard expenditure needs and fiscal capacity for OR municipalities; the level of historical expenditure for the SR municipalities.

Between 2012 and 2014, the municipal equalization mechanism, known as the Municipal Solidarity Fund (MSF), was the same for all OR and SR municipalities. In particular, Law 228/2012 (art.1, par. 380) introduced the MSF mechanism to accommodate the reform of the real estate property tax (IMU) and the abolition of existing vertical transfers during the fiscal consolidation process that followed the EU sovereign debt crises. Hence, up to 2014, for each municipality *i*, the allocation of equalization grants followed the formula in equation (1):

$$MSF\ transfers_i = HR_i - IMU_i + NG_i \qquad [1]$$

where: HR_i = 2011 Historical resources; IMU_i = New real estate property tax 2013 standard revenue; NG_i = grants without equalization purpose.

Table 1 summarises the structure of the equalization system's vertical and horizontal components in place up to 2014; in particular, we observe a closed-end system with a hybrid equalization structure that combines horizontal and vertical transfers.

Starting from 2015, the MSF reform introduced with the Law 42/2009 changed the allotment criteria of equalization grants for the 6,565 OR municipalities gradually. The equalization of the gap between standard expenditure needs and fiscal capacity became the new criteria, in line with the formula reported in equation (2) for each OR municipality:

$$MSF\ transfers_i = (1-\alpha)\ (HR_i - IMU_i) + \alpha\ (SEN_i - FC_i) + NG_i \qquad [2]$$

2. For a general overview of the structure of the financing system of Italian municipalities in the aftermath of the COVID-19 crisis consider Greco and Porcelli (2021). Instead, for a detailed analysis of the Municipal Solidarity Fund mechanism consider Marchionni *et al*. (2017).

Table 1 – 2014 Structure of the Municipal Solidarity Fund

2014 MSF	*Ordinary Statute Regions ml euros*	*Special Statute Regions ml euros*
Vertical equalization component	1,091	427
Horizontal equalization component	1,570	112
Grants without equalization purpose*	1,945	60

Note: (*) Grants without equalization purpose include 2014 and 2015 transfer cuts and 2016 grants distributed to offset the municipal property tax's abolition on the owner-occupied main residence.

Source: our elaboration on data of the Italian Ministry of Interior

where: HR_i = 2011 Historical resources; IMU_i = New real estate property tax 2013 standard revenue; SEN_i = Standard expenditure needs; FC_i = Fiscal Capacity; NG_i = grants without equalization purpose; $\alpha \epsilon [0,1]$

According to Law 232/ 2016, the transitional period will end in 2030 when equalization grants will close the fiscal gap between standard expenditure and fiscal capacity exclusively. Therefore, the parameter α of equation (2) will continuously increase the fiscal gap's equalized percentage, moving from the 27,5% considered in 2020 up to 100% in 2030.

Table 2 describes how the equalization system's vertical and horizontal components will appear at the end of the transitional period (2030 when α = 1 in equation 2) according to 2020 regulations. In particular, the transition will not alter the system's structure that will remain hybrid, based on vertical and horizontal equalization. The increase of the grants with no equalization goal is due to the gradual cancelling of some spending cuts introduced in 2014.[3]

Figure 1 shows the distribution of the two components of the 2020 municipal fiscal gap: Standard expenditure needs (SEN) and Fiscal capacity (FC), both in per capita terms. SEN (reported in panel a) appears more evenly distributed over the peninsula, with municipalities above the average mainly located in inland and mountainous areas. FC, (reported in panel b), instead, shows a neat segmentation between the municipalities in the centre-north above the national average and municipalities in the centre-south below the national average.

SEN are the result of a complex econometric exercise that involves eight functions (waste management, general administration, social care, nursery service, ancillary education services, local policy, public transport and planning) and 85

3. According to new regulations, in force since the 2021 financial year, municipalities' vertical equalisation component in Ordinary statute regions will gradually grow to 1 billion in 2030 to finance social services. However, this last reform's impact is left to further analysis and is not considered here because the allotment criteria are not yet completely approved.

Table 2 – 2030 Structure of the Municipal Solidarity Fund (Simulated according to 2020 Regulations)

2030 MSF	*Ordinary Statute Regions ml euros*	*Special Statute Regions ml euros*
Vertical equalization component	1,091	427
Horizontal equalization component	1,483	112
Grants without equalization purpose*	2,355	110

Note: (*) Grants without equalization purpose include 2014 and 2015 transfer cuts and 2016 grants distributed to offset the municipal property tax's abolition on the owner-occupied main residence.
Source: our elaboration on data of the Italian Ministry of Interior

variables (the most important are: resident population, waste disposal, recycled waste, residents above 65, residents between 3-14, children served by nurseries, school meals, presence of metro/tram service, the surface area of the municipality, the altitude of the municipality). The Appendix reports a detailed representation of the formula adopted to include SEN in the computation of the fiscal gap.[4]

FC, similarly, is the result of two different statistical techniques. In particular, the evaluation of Local income tax (2.6 billion euros) and Property tax (12.2 billion euros) fiscal capacity follows the Representative Tax System approach (RTS); instead, the evaluation of fees fiscal capacity (4.1 billion euros) follows the Regression-based Fiscal Capacity Approach (RFCA).[5]

One feature common to SEN and FC's computation is that variables included in the models, although dynamically updated yearly, are lagged by three (and in some cases four) years. Therefore, the fiscal gap in year "*t*" will reflect the municipalities' socio-economic conditions in year "*t*-3" with a delay of three periods. This feature is at the centre of our analysis, as discussed in more detail in Section 4, considering the implications generated in terms of redistributive and risk-sharing effect.

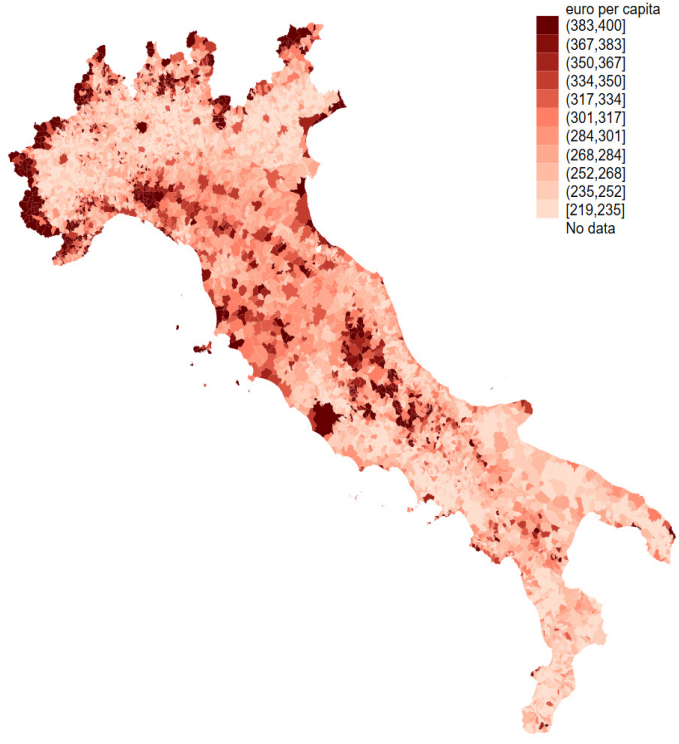
Although in 2020, SEN and FC are correlated at 65%, they orientate equalization grants in different ways given their distinct correlation with the average declared municipal income that, in the analysis, we adopt as a proxy for municipal GPD. Figure 2 shows the municipal distribution of the average municipal reported income, making evident the Italian economy's duality since most of the

4. For a detailed analysis of the models adopted for the evaluation of standard expenditure needs consider Porcelli (2015) or the methodological note reported in the following decree: "*Decreto del Presidente del Consiglio dei Ministri del 29 Dicembre 2016 (G.U. Serie Generale n.44 del 22-02-2017 – Suppl. Ordinario n. 12)".*

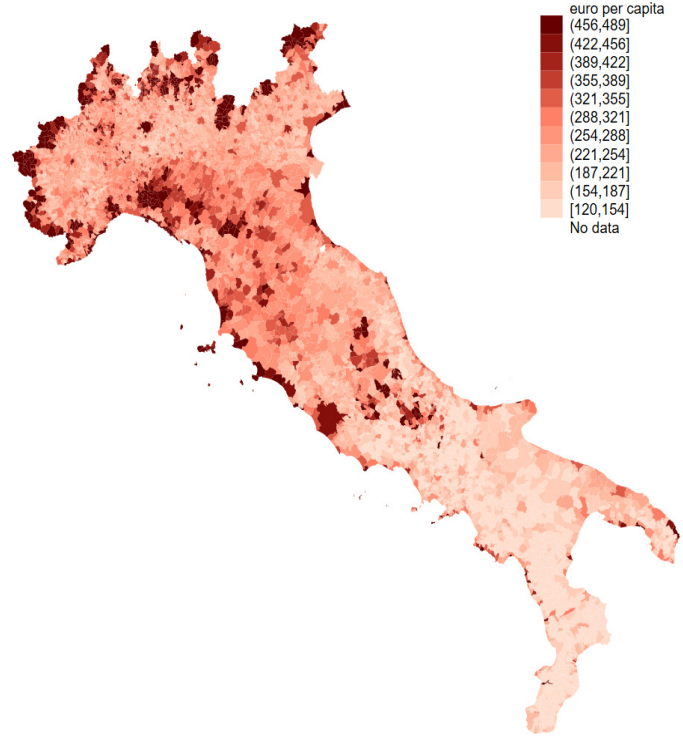
5. For a detailed analysis of the models adopted for the evaluation of fiscal capacity you can consider Di Liddo *et al*. (2016) or the methodological note reported in the following decree: *"Decreto del Ministero dell'Economia e delle Finanze del 31 dicembre 2020 – Adozione della stima della capacità fiscale per singolo comune delle regioni a statuto ordinario".*

Figure 1 – 2020 Municipal Standard Expenditure Needs and Fiscal Capacity, euro per capita

a) 2020 Standard Expenditure Needs (SEN)

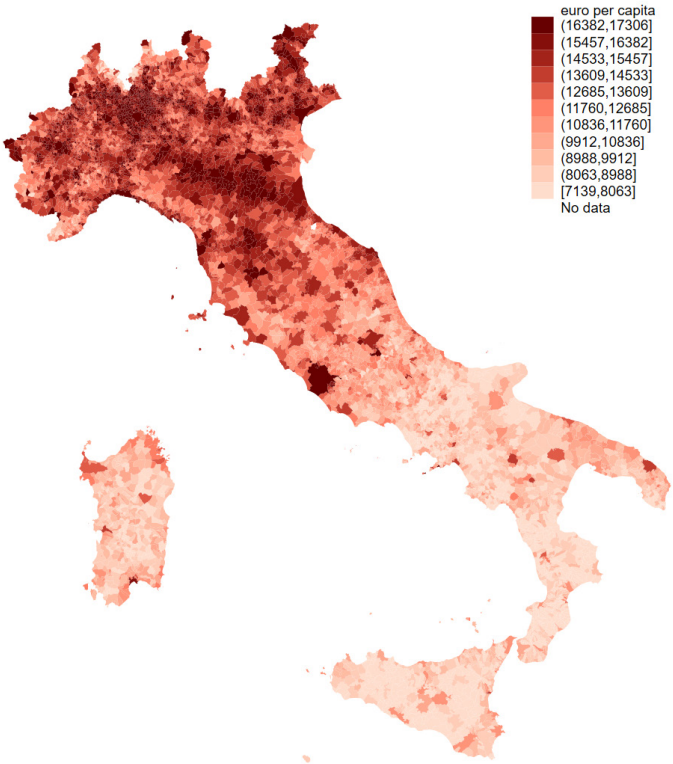


b) 2020 Fiscal Capacity (FC)



Source: Italian Ministry of Economy and Finance

Figure 2 – 2018 Reported per Capita Income, Municipal Average



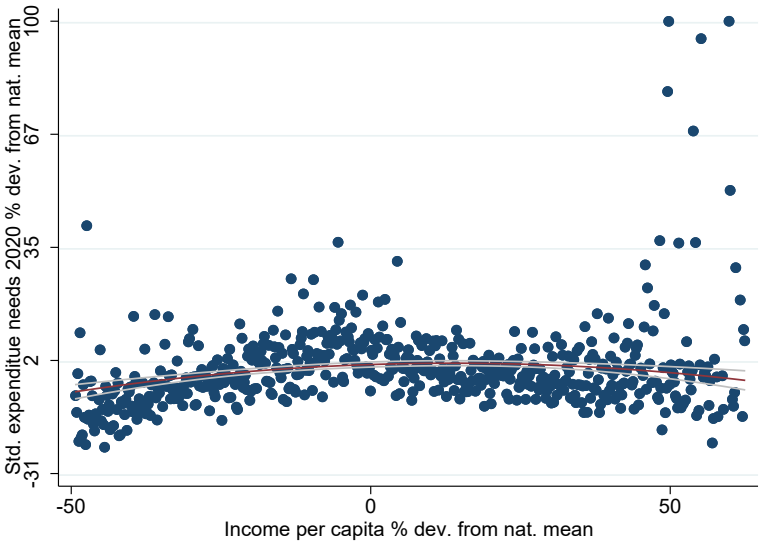
Source: Italian Ministry of Economy and Finance

municipalities located in the centre-north are above the national average, and most of the municipalities located in the south (including the main islands) are below the average.

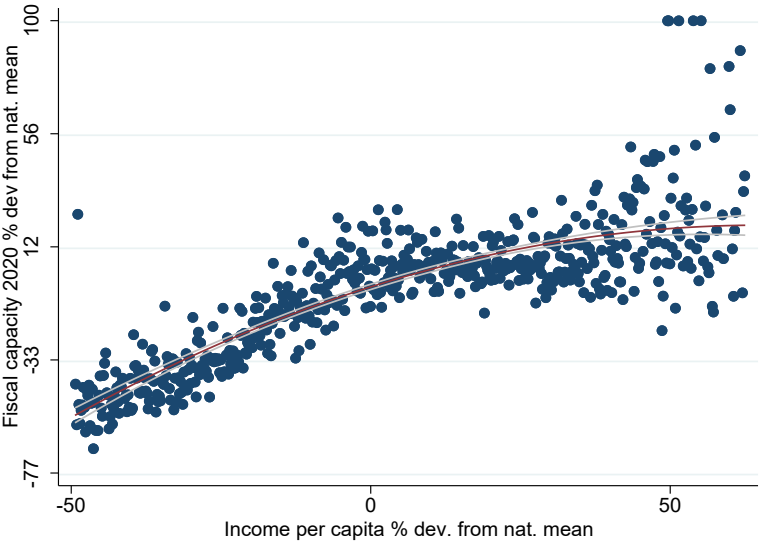
As shown in Figure 3 (panel a), SEN are not correlated with municipal income because expenditure determinants associated with local income constitute marginal components. In particular, on average, input prices explain 5.2% of standard expenditure, variables that capture the structure of the local economy 4.6%, and finally, variables related to deprivation only 1% (the source of the impact of determinants of the standard expenditure is *www.opencivitas.it*, a governmental web repository of all data used for SEN evaluation). Instead, in panel b of Figure 3, we observe a strong positive correlation between FC and income, because declared income is the tax base of the local income tax and significantly correlates with the cadastral values representing the tax base of the property tax.

Figure 3 – Correlation between Municipal Declared Income, Standard Expenditure Needs, and Fiscal Capacity

a) Income Vs Standard Expenditure Needs



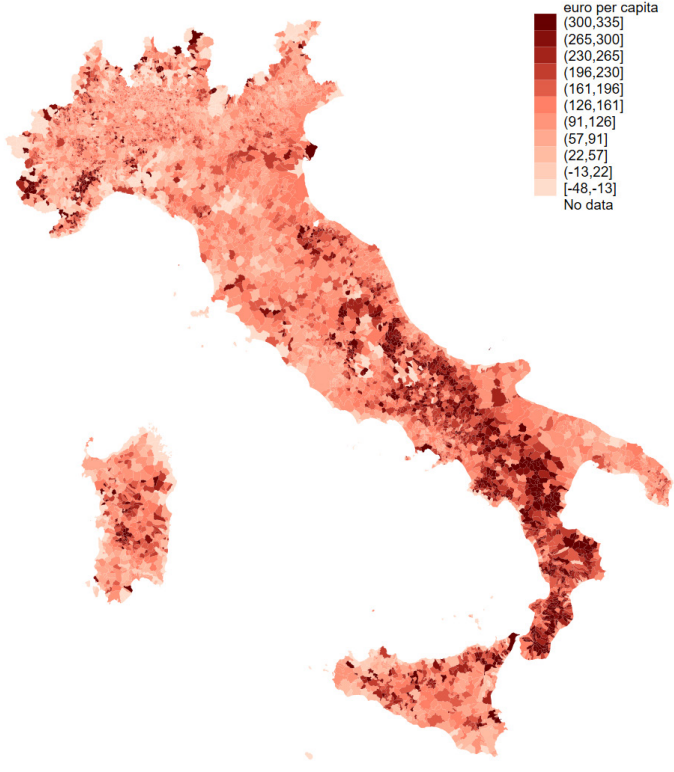
b) Income Vs Fiscal Capacity



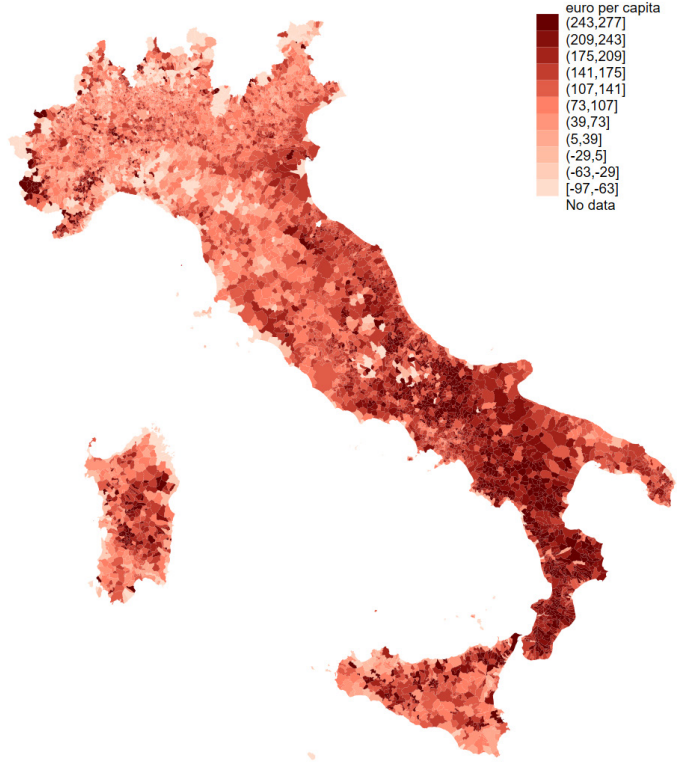
Source: our elaboration on data of the Italian Ministry of Economy and Finance

Figure 4 – Municipal Solidarity Funds Evolution of Grants Redistributions (Gross Endowment), per capita values

a) 2020 MSF Gross Endowment



b) 2030 MSF Gross Endowment Simulation



Source: our elaboration on data of the Italian Ministry of Interior

As a result, the fiscal gap will be more pronounced in municipalities located in the southern regions. Therefore, as Figure 4 shows, the flow of equalization grants will distribute in favour of municipalities located in the southern regions, especially at the end of the transition period. In particular, in panel a) of Figure 4, we report the distribution of per capita MFS equalization grants in deviation from the national mean as they appear in 2020 at the 27,5% of the transition, in panel b) we show how the distribution should change in 2030 according to 2020 regulations.

3. Empirical Strategy

Our study is based on the collection of financial and socio-economic data of the municipalities located in ordinary regions (OR municipalities) and the special statute regions of Sicily and Sardinia (SR municipalities) over nine years, from 2012, which marked the MSF, up to 2020. Therefore, the complete sample will be a balanced panel that includes 7,240 municipalities for nine years (we exclude from the dataset municipalities that underwent an amalgamation process between 2010 and 2020).

Our empirical strategy aims at identifying the impact of dynamic fiscal gap equalization on the redistributive and risk-sharing effect of intergovernmental grants. Italian data allows us to use a difference-in-difference technique, where OR municipalities will constitute the treated group and the SR municipalities the control group. Instead, the introduction of dynamic fiscal gap equalization in 2015 will represent our treatment effect. Finally, to make the municipalities in the treated and the control groups more comparable and satisfy the pre-treatment common trend conditions, our final regression sample will include only OR municipalities located in the southern regions.

Table 3 reports the descriptive statistics of the variables included in the dataset. General statistics are presented for four distinct groups: all municipalities, only municipalities in ordinary regions, municipalities in special statute regions (Sicily and Sardinia), municipalities in ordinary southern regions. Data sources are from the Ministry of Interior, the Ministry of Economy and Finance and ISTAT (the Italian Institute of National Statistics). Table 3 shows three group of variables: MFS grants, considering 2020 values and their projection at the end of the transition period; declared income (tax base of the personal income tax) that we use as a proxy of GDP at municipal level; control variables related to the structure of the resident population. Variables means are comparable between municipalities in special statute regions (Sicily and Sardinia) and municipalities in ordinary southern regions, respectively our control and treated groups.

Figure 5 reports the time series of MSF grants and municipal declared income, expressed in real per capita terms, to support the difference-in-difference

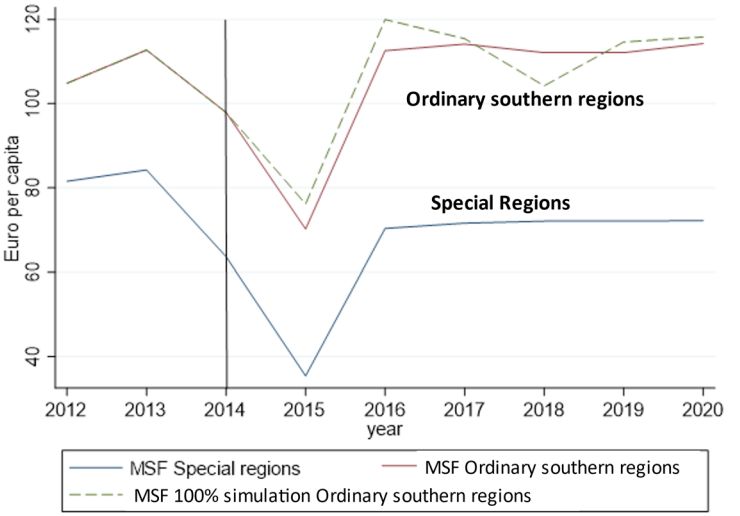
Table 3 – Descriptive Statistics for the 2012-2020 Period

	Ordinary Regions Municipalities					*Total Municipalities*				
	Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
MSF (euro per capita)	58,266	77.47	209.66	-4,439.00	2670.71	65,160	80.80	204.94	-4,439.00	2,670.71
MSF simulation 100% (euro per capita)	58,266	53.91	240.88	-5,756.76	2670.71	65,160	59.73	234.04	-5,756.76	2,670.71
Declared PIT income (euro per capita)	58,266	12,216	3,019	1,988	46,272	65,160	11,834	3,105	605	46,272
Population 0-2 (% of total pop.)	58,266	2.27	0.70	0.00	6.98	65,160	2.26	0.69	0.00	6.98
Population 3-14 (% of total pop.)	58,266	10.34	2.22	0.00	18.69	65,160	10.30	2.21	0.00	18.69
Population over 75 (% of total pop.)	58,266	12.72	4.19	2.38	46.75	65,160	12.72	4.15	2.38	46.75
Net population variation	58,266	-5.02	7.15	-80.51	37.04	65,160	-5.04	7.02	-80.51	37.04
Net migration	58,266	1.99	14.07	-202.02	243.90	65,160	1.74	13.80	-202.02	243.90
Resident population / 1000	58,266	7.823	45.509	0.029	2,873.494	65,160	7.920	44.175	0.029	2,873.494
	Special Regions Municipalities					*Southern Odinary Regions Municipalities*				
	Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
MSF (euro per capita)	6,894	108.97	156.78	-1001.47	1031.99	15,984	169.59	179.42	-1743.44	2670.71
MSF simulation 100% (euro per capita)	6,894	108.97	156.78	-1001.47	1031.99	15,984	153.92	169.23	-2390.27	2670.71
Declared PIT income (euro per capita)	6,894	8,533	1,444	605	17,002	15,984	8,735	1,572	4,446	17,409
Population 0-2 (% of total pop.)	6,894	2.13	0.62	0.00	5.22	15,984	2.20	0.67	0.00	5.87
Population 3-14 (% of total pop.)	6,894	9.93	2.03	0.62	16.84	15,984	10.10	2.34	0.79	18.69
Population over 75 (% of total pop.)	6,894	12.68	3.81	3.48	35.59	15,984	12.98	4.77	3.03	45.63
Net population variation	6,894	-5.21	5.77	-44.87	16.95	15,984	-5.29	6.84	-69.31	15.75
Net migration	6,894	-0.41	11.05	-127.60	110.22	15,984	-0.24	12.69	-120.67	133.81
Resident population / 1000	6,894	8.737	30.660	0.083	678.492	15,984	7.837	28.061	0.079	989.111

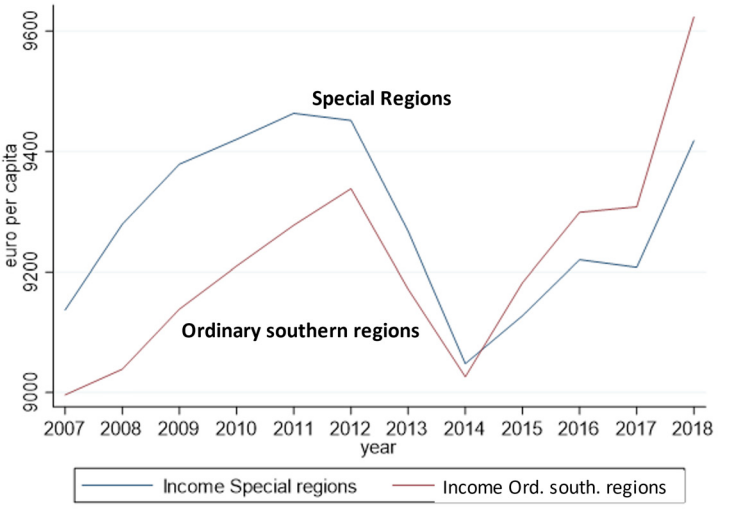
Source: Ministry of Economy and Finance, Ministry of Interior and ISTAT

Figure 5 – Time series of Intergovernmental Grants of Municipal Solidarity Fund and Average Declared Income, Comparison between the Control Group and the Treated Group. Only Municipalities Located in Southern Regions

a) Municipal Solidarity Fund (MSF)



b) Average Declared Income



Source: Ministry of Economy and Finance and Ministry of Interior

empirical strategy. We compare the average values recorded in the treated and control groups to verify the common trend assumption in the pre-treated period. The treated group is restricted only to municipalities located in southern regions. The presence of a pre-treatment common trend is particularly evident in MSF grants. After the 2015 reform, in the treated group we observe a substantial increase in grants compared to the average amount allocated to SR municipalities. Moreover, both groups show a drop in 2014 and 2015 caused by the fiscal consolidation process. Instead, in 2016, we observe an increase due to the transformation of the property tax's revenue on the owner-occupied main residence in grants from the central government. However, the fiscal consolidation process and the 2016 property tax reform do not operate as confounding factors since their effects are commonly spread in municipalities belonging to both groups. Therefore, our results did not change if we depurate MFS grants from these components and, for the sake of simplicity, we decided to consider only the gross flow of MFS grants. A more formal analysis of the pre-treatment common trend assumption is reported in the Figure A1 of the Appendix.

4. The Estimation of the Redistributive Effect of Formula Grants

The redistributive effect is estimated through OLS applied to the following two-periods linear model specified in equation (3).

$$Y_{it} = \gamma_0 + \gamma_1 X_{it} + \gamma_2 X_{it} \bullet D_{it} + \gamma_3 D_{it} + \gamma_4' Z_{it} + R_i + t + \varepsilon_{it} \qquad [3]$$

where:

- t = zero before 2015 and one from 2015;
- Y_{it} = income and equalization transfers (euro per capita), average before and after 2015;
- X_{it} = income (euro per capita), average before and after 2015;
- D_{it} = treatment dummy (one after 2015 for municipalities located in southern ordinary regions municipalities);
- Z_{it} = control variables, average before and after 2015;
- R_{it} = ordinary region dummy;
- ε_{it} = idiosyncratic error component.

In particular, the redistributive effect of historical transfers will correspond to $1-\widehat{\gamma_1}$ and the redistributive effect of formula transfers will correspond to $1-\widehat{\gamma_1}-\widehat{\gamma_2}$.

Table 4 reports the point estimates of the relationship between income and intergovernmental grants and its interaction with the treatment dummy. In

Table 4 – Point Estimates of the Relationship between Municipal Declared Income and Intergovernmental Grants (Only Southern Regions)

	(1)	*(2)*
	MFS	*MFS 100% simulation*
Income	0.95	0.96
	[0.000]***	[0.000]***
Income X Treatment	-0.00	-0.01
	[0.722]	[0.018]**
Observations	5,084	5,084
Controls	yes	yes
Estimator	OLS	OLS

Note: OLS estimates with robust std. error p-value in brackets *=p<0.10; **=p<0.05; ***=p<0.01

Table 5 – Computation of the Redistributive Effect of Intergovernmental Grants

	MSF	*MSF 100% simulation*
Redistributive effect historical grants	4.6%	4.5%
Redistributive effect formula grants	4.6%	5.7%
of which standard expenditure needs		-1.4%
of which fiscal capacity		7.1%

column (1) we report the point estimates related to the 2020 structure of grants, whereas in column (2) we simulate the level of grants that will be distributed at the end of the transitional period. We simulate the full implementation of the new equalization system computing the distribution of grants setting the parameter α of equation (2) equals one (in 2020, instead, $\alpha = 0.275$).

Subsequently, we use the point estimates reported in Table 4 to evaluate historical and formula grants' redistributive effect decomposing this effect between the contribution of standard expenditure needs and fiscal capacity contribution. These final computations are reported in Table 5. Formula grants that dynamically equalize the fiscal gap generate a stronger redistributive effect than static equalization grants based on historical expenditure. However, this divergence is visible only when we simulate formula grants at the end of the transition period. In this case, we register an increase of the redistributive effect from 4.5% to 5.7% moving from historical expenditure equalization to fiscal gap equalization. Moreover, it is interesting to notice that fiscal capacity shows a positive redistributive

effect because of the correlation with local income. Instead, standard expenditure needs show a negative redistributive effect since they aim to equalize provision costs. For the decomposition of the redistributive effect, we estimate the grants' distribution considering SEN uniform in per-capita terms to estimate the impact produced exclusively by FC. Then we obtain the impact of SEN by difference.

5. The Estimation of the Risk-sharing Effect of Formula Grants

As a second step, we estimate the income elasticity of formula grants that can then be used to evaluate the risk-sharing effect.

In this case, we specify a linear panel data model, and the point estimates of the income elasticity are obtained using the Within-the-Group estimators. The model is reported in equation (4).

$$\Delta Y_{it} = \beta_0 + \beta_{1\kappa}\Delta X_{i\kappa} + \beta_{2\kappa}\Delta X_{i\kappa} \bullet D_{it} + \beta_3 D_{it} + \beta_4' Z_{it} + \alpha_i + \tau_t + \varepsilon_{it} \quad [4]$$

where:

- k is replaced by: t, t–1, t–2, t–3, t–4, t–5;
- ΔY_{it} = % deviation of equalization transfers (euro per capita) from the national mean;
- ΔX_{it} = % deviation of income (euro per capita) from the national mean;
- D_{it} = treatment dummy (one after 2015 for municipalities located in southern ordinary regions municipalities);
- Z_{it} = control variables lagged by one period;
- α_i = municipal fixed effect;
- τ_i = year fixed effect;
- ε_i = idiosyncratic error component.

In particular $\widehat{\beta_{1\kappa}}$ corresponds to the estimated average income elasticity of equalization grants based on historical expenditure at different lags that, in turns, approximates the risk-sharing effect of historical grants. Instead, $\widehat{\beta_{1\kappa}} + \widehat{\beta_{2\kappa}}$ corresponds to the estimated average income elasticity of equalization grants based on the dynamic fiscal gap at different lags that, in turns, approximate the risk-sharing effect of formula grants.

Table 6 reports the point estimates of the average income elasticity of grants considering different income lags. In column (1) we report the point estimates related to the 2020 structure of grants. In column (2) we simulate the level of grants at the end of the transitional period. Figure 6 summarises the final estimates of the income elasticity at different intertemporal lags and its decomposition between the two components: standard expenditure and fiscal capacity.

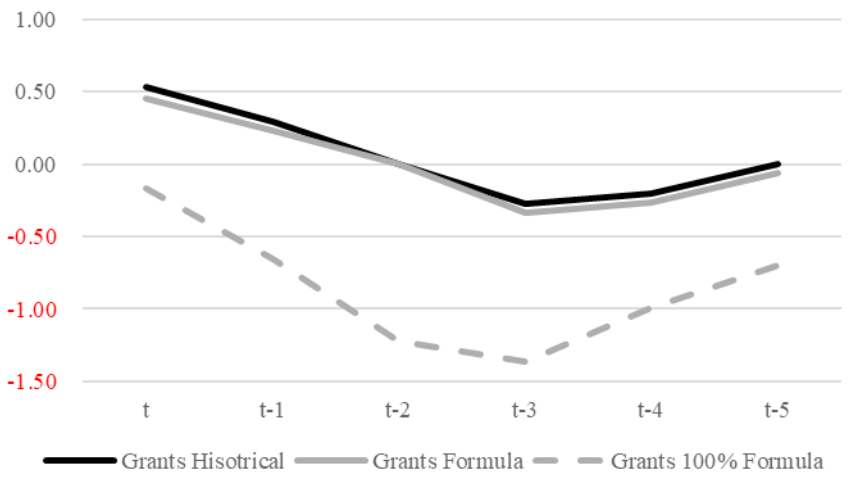
Table 6 – With-in-the Group Point Estimates of the Income Elasticity of Intergovernmental Grants

	(1)	*(2)*
	MSF	*MSF 100% simulation*
Income	0.53	0.65
	[0.000]***	[0.002]***
Income X Treatment	-0.08	-0.82
	[0.048]**	[0.000]***
Income lag 1	0.29	0.13
	[0.001]***	[0.481]
Income lag 1 X Treatment	-0.06	-0.78
	[0.096]*	[0.000]***
Income lag 2	0.00	-0.49
	[0.142]	[0.001]***
Income lag 2 X Treatment	0.00	-0.74
	[0.143]	[0.000]***
Income lag 3	-0.28	-0.64
	[0.001]***	[0.000]***
Income lag 3 X Treatment	-0.06	-0.72
	[0.087]*	[0.000]***
Income lag 4	-0.20	-0.28
	[0.020]**	[0.098]*
Income lag 4 X Treatment	-0.07	-0.72
	[0.067]*	[0.000]***
Income lag 5	0.00	0.00
	[0.160]	[0.328]
Income lag 5 X Treatment	-0.06	-0.70
	[0.080]*	[0.000]***
Observations	22,878	22,878
Municipal fixed effect	yes	yes
Time fixed effect	yes	yes
Controls	yes	yes
Estimator	Within-the-Group	Within-the-Group

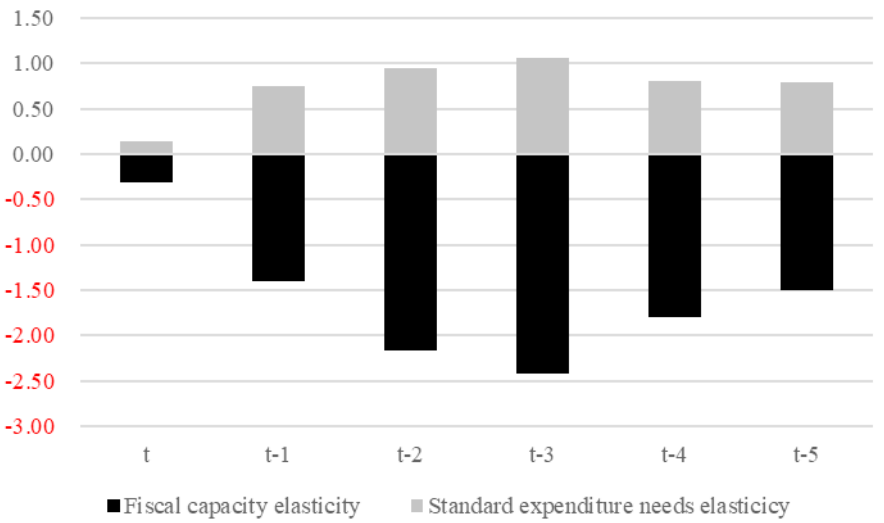
Note: Within-the-Group estimator with std. error clustered at municipal level, p-value in brackets *=p<0.10; **=p<0.05; ***=p<0.01.

Figure 6 – Point Estimates of Income Elasticity of Intergovernmental Grants and its Decomposition between Standard Expenditure and Fiscal Capacity (only municipalities in southern regions)

a) Income Elasticity of Grants



b) Decomposition of Income Elasticity



Considering income at year *t*, equalization grants based on historical expenditure are pro-cyclical with an average income elasticity of 0.5%. Instead, equalization grants based on fiscal gap equalization are moderately counter-cyclical, with an average income elasticity of –0.1%, but only at the end of the transition period. Otherwise, in 2020 we do not observe any difference between the two equalization structures. Moreover, we observe that the counter-cyclical property of fiscal gap equalization is particularly evident considering *t*–3 income values, with an average income elasticity of –1.4%, because of the time lag in the SEN ad FC variables and because of the specific trend observed in GDP growth. Finally, our results show that the counter-cyclical effect of fiscal gap equalization is entirely due to fiscal capacity because of its positive correlation with local GDP. Instead, standard expenditure needs show a pro-cyclical impact as a result of local costs' equalization. The decomposition follows the same procedure described in Section 4.

6. Conclusions

Public policies can redistribute economic resources across a country's jurisdictions through a variety of interventions of different nature. For example, public expenditure programmes can allocate resources directly on the basis of socio-geographic characteristics of territories – such as level of economic development, infrastructural endowments, economic structure and morphological conditions – and, in these cases, territorial redistributive effects are often explicitly pursued (cohesion policies and interregional equalizing schemes). But territorial redistributive effects can also turn out as an unintended by-product of policies pursuing other objectives (e.g. public provisions, social security) where the beneficiaries are individuals or households. This work focuses on the former kind of public programmes and specifically on interregional equalizing schemes as it investigates the case of the system of equalizing grants applied to Italian municipalities, which has recently been reformed.

This paper adds to the economic literature on the redistributive and stabilizing effects of public budget across jurisdictions in several ways. First of all, we measured redistribution and stabilization accomplished by the lowest tier of government, the municipalities, using very granular territorial data. Previous studies have taken into account the impact of the municipal budget but, with the exception of Rattso and Tovmo (1998) and and and Gandullia e Leporatti (2020), only across regional or state level territorial areas (Arachi *et al*., 2010).

Second, we show that the switch from transfers based on historical expenditure, which are kept constant across time, to transfers based on a formula, which is dynamically updated to take into account the evolution of the fiscal

gap between expenditure needs and fiscal capacity, has increased the territorial redistribution carried out by the public sector.

On the contrary, the new formula-based transfers appear to have very low contemporary risk-sharing effects. We show that this result critically depends on the specific institutional design of the equalizing mechanism, which involves substantial lags in the reaction of expenditure needs and (mostly) fiscal capacity indexes to changes in income fluctuations due to the time required for the collection of relevant data. As a matter of fact, if we include three-time lagged municipal incomes in the specification of the risk-sharing effects, equalizing transfers end up showing strong counter-cyclical properties.

This latter result raises the issue of how to reform the municipal transfers system in order to improve its poor stabilization performance. Yearly updating the formula on the basis of contemporaneous data seems not to be a feasible solution since the basic information underlying expenditure needs and fiscal capacity indexes cannot be collected in real-time. A more workable (but more radical) proposal is to decouple territorial redistributive function from stabilization function and to assign them to two distinct transfers mechanisms. In this alternative institutional framework, formula-based grants restrict themselves to redistributing resources while insurance against idiosyncratic shocks is provided through an alternative set of transfers. The separation between redistribution and insurance could be achieved by calculating formula grants based on estimates of structural needs and fiscal capacity, which do not vary along the business cycle, while short-run idiosyncratic fluctuations could be handled by a rainy day fund program.

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Sommario

Effetti redistributivi e di stabilizzazione macroeconomica dei trasferimenti intergovernativi: il caso dei Comuni italiani

Questo lavoro analizza gli effetti redistributivi e di stabilizzazione macroeconomica prodotti dai trasferimenti intergovernativi a livello comunale. In particolare considera sul piano empirico il caso italiano dove il meccanismo dei trasferimenti statali a favore dei Comuni è stato riformato a partire dal 2015 mediante l'introduzione di un sistema di formula grants perequativi finalizzati a colmare per ogni ente il gap tra fabbisogni standard di spesa e capacità fiscale. Il caso italiano si rivela di particolare interesse in quanto la riforma è stata applicata soltanto ai Comuni delle Regioni a statuto ordinario

lasciando invece i trasferimenti ai Comuni delle Regioni a statuto speciale ancora determinati secondo il criterio pre-rifoma della spesa storica. Grazie a questa caratterizzazione asimmetrica nell'attuazione della riforma, l'utilizzo di un approccio "difference-in-difference" consente l'identificazione di una relazione causale tra formula grants e PIL comunale approssimato dal reddito dichiarato ai fini IRPEF. I risultati mostrano come la perequazione secondo i nuovi formula grants produca un maggior effetto redistributivo rispetto ai trasferimenti secondo la spesa storica. Il nuovo sistema perequativo non evidenzia però una maggiore capacità di stabilizzazione macroeconomica rispetto a shock che colpiscano le economie locali. Questo risultato insoddisfacente sembra dipendere, principalmente, dal ritardo con cui il meccanismo di calcolo dei trasferimenti aggiorna i dati sottostanti alla misurazione dei fabbisogni standard e della capacità fiscale.

Appendix

The computation of the Standard Expenditure Needs (SEN_i) of each municipality *i* follows the procedure described in equations A1-A4:

$$SEN_i = 0.8 \bullet (FC + G) \bullet f_i + 0.2 \bullet (FC + G) \bullet p_i \quad [A1]$$

$$FC = \sum FC_i \quad [A2]$$

$$\sum f_i = 1 \quad [A3]$$

$$\sum p_i = 1 \quad [A4]$$

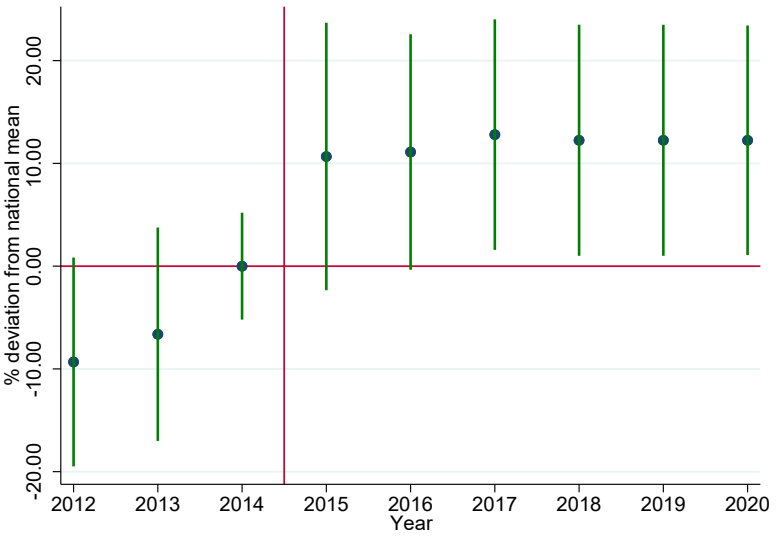
where:

- FC_i is the Fiscal Capacity of municipality *i* estimated each year by the Ministry of Finance, corresponding in 2020 to the total amount of 25.5 billion euros;
- G is the total vertical equalization component, in 2020 amounting to 1.019 million euros;
- f_i is the SEN allotment coefficient approved each year by the Standard Expenditure Needs Commission, a technical body inside the Ministry of Finance;
- p_i is the allotment coefficient of the resident population.

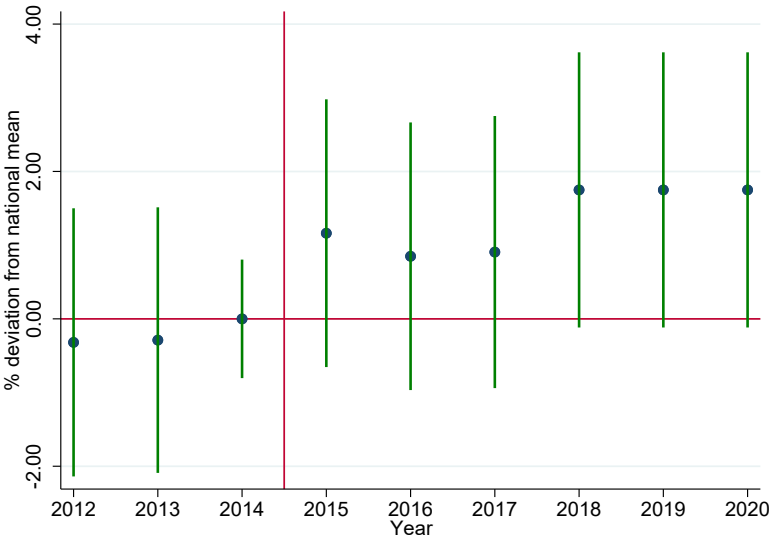
To test the validity of the local parallel trends between treatment and control units, we estimate the difference of MFS grants and income between the two groups of municipalities for each year in our analysis. In Figure A1 the vertical line indicates the moment in which the treatment kicks in. For each variable, the graphs' dots correspond to the coefficient of the treatment effect estimated with OLS in a difference-in-differences specification for each year. The regression includes year dummies and robust standard errors. For each year, we report the point estimate and the 95% confidence interval. The coefficient in the year 2014 is the omitted category, for which confidence interval is obtained as the mean of the confidence interval in the years 2013 and 2015. Evidence supporting the

Figure A1 – Pre and Post-treatment Trends Test, Comparison between the Control Group and the Treated Group. Only Municipalities Located in Southern Regions

a) Municipal Solidarity Fund (MSF)



b) Average Declared Income



parallel trend assumption requires that we do not reject the null hypothesis that the treatment effect is equal to zero in all periods between 2012 and 2014. In other words, the distance of the outcome variables between the treatment and control group should remain constant in the pre-treatment periods. This evidence is verified for MFS grants and income.

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Due to the Covid-19 pandemic, the XLI Annual Scientific Conference held on line in September 2-4, 2020. The Web Conference contributed to motivate the scientific debate on the regional challenges and opportunities in times of crisis. A large number of contributions have investigated the territorial impact of economic shocks and natural disaster and discussed possible trajectories for a sustainable regional development process. The book collects a selection of these contributions, covering different topics on the economic, social, and regional consequences of crises and recovery processes.

The first part is dedicated specifically to the impact of the Covid-19 pandemic and to the ability of a territory to react. The challenges of the new pandemic came in addition to the economic and financial crises and the natural and environmental disasters that have occurred in recent decades. The second part then gathers contributions that discuss more broadly the resilience and regional responses to natural and economic shocks. Crises have largely affected the quality of life of citizens and may have compromised sustainable regional growth. To contribute to the discussion of these issues, the third part of the volume collects some studies that aim to analyse in depth the effects of crises in terms of individual and regional wellbeing, and their relationship with sustainability. The last part is dedicated to a discussion and empirical assessment of the role of regional and national policies in supporting recovery and resilience processes for regional development.

FrancoAngeli
La passione per le conoscenze