SOCIAL CAPITAL: A NEW COMPOSITE INDEX

Angela Pepe

Abstract. The paper aims to propose a new measure of social capital by means of the construction of a composite index based on Adjusted Mazziotta-Pareto Index (AMPI) methodology, in order to study its dynamic during the period 2018-2022 at the level of Italian municipalities, giving its contribution to the limited literature on the effects of the CoViD-19 pandemic on social capital at local level. The results suggest that pandemic shock have had its impact not only on the level of social capital but also on its territorial distribution, causing, on the one hand, a reduction in municipalities with high endowments and, on the other hand, an increase in those with lower endowments.

1. Introduction

Social capital has always attracted the attention of economists and other social scientists. Such an interest is essentially motivated by the relationship between the stock of social capital and various other phenomena such as economic growth, development traps, political participation, health and so on. However, despite the immense amount of studies on it, its definition has remained complex and elusive. The reason for this is due to the multidimensional nature of the phenomenon that requires the overcoming of conceptual and definitional issues in order to measure it. A direct consequence of the multiplicity of dimensions is the diversity of variables and indicators used to analyse social capital in the empirical works such as counts of associations or associational memberships, levels of trust and civic engagement, volunteering, crime rates, voter turnout, charitable-giving, blood donors and car-pooling. In some cases, these are used individually; however, a single measure may not capture completely a concept with complex and multiple dimensions like social capital. In other cases, several individual indicators are aggregated in order to create a synthetic index of social capital. In the latter case, the generally adopted approach is that of principal component analysis (PCA) as in the works of Portela *et al.* (2013) and Gannon and Roberts (2020). However, the PCA is not suitable for analysis over time (historical series) as it cannot be applied to matrices containing the values of a set of individual indicators (columns) for different periods (rows), since the correlations between the indicators must be calculated on the basis of independent

observations (Mazziotta and Pareto, 2020). The lack of both a universal measurement method and a single indicator commonly accepted by the literature is also complicated by the chronic lack of suitable data, especially when it comes to analyse the phenomenon for more detailed territorial areas. Often it is precisely this lack of data that forces the choice of variables to be used as an expression of the social capital.

The aim of this paper is to propose a new framework for the measurement of social capital through the construction of a composite index, as well as to test it, taking into account the changes in social capital in the period 2018-2022 in the Italian municipalities.

The composite index proposed in this work presents three innovative aspects. The first of these consists in its construction methodology, that is the Adjusted Mazziotta-Pareto Index Approach (AMPI). It is a method for the construction of composite indices and the extension of Mazziotta-Pareto Index (MPI), whose peculiarity is that it allows the measurement of changes over time. This is an aspect of vital importance when it comes to analyse the evolution over time of a multidimensional phenomenon such as social capital.

The second aspect concerns the definition of a set of several indicators of social capital at the level of Italian municipalities, used for the construction of the composite index. For a phenomenon such as social capital, whose definition is linked to the relationships between individuals within a given community, the focus on detailed space level should be ideal, as it allows to grasp its local nature. In the literature on social capital, Italy has always been considered an ideal case study due to its profoundly uneven distribution between the North and the South of the country. However, few studies are based on data at municipal level (Albanese and De Blasio, 2014; Batinti *et al.*, 2019) and they take into consideration a single measure of social capital which may not be suitable for a multidimensional phenomenon such as social capital.

The last aspect concerns the possibility of studying the effects of the CoViD-19 pandemic on social capital at a local level. Since social capital is normally associated with a wide variety of positive outcomes, scholars have focused on the role it might have had in containing the spread of the virus. However, there are few studies on the impact of the pandemic crisis on social capital itself, and in particular on local communities.

The rest of the paper is organized as follows: in the next section the indicators used in the construction of the composite index are presented. In the third and fourth sections, the definition and the construction methodology of the composite index are discussed, respectively. In the fifth section, main results are presented. Finally, the paper ends with the conclusions arising from this study.

2. The indicators selection

The criteria leading to the individual indicators selection derive from the need to address two issues. The first one has a conceptual nature, as it picks individual indicators theoretically representative of phenomenon of interest. The second one has empirical nature and it is due to the availability of data on Italian municipality over those years subject of study. The indicators chosen are described below.

(A) *Volunteering*. It is the number of the voluntary association per capita built on the data taken from the list published annually by the Italian Revenue Agency on voluntary associations registered in the "elenco permanente degli Enti del Terzo Settore" and recipients of the "5 per 1000" contribution.

(B) *Electoral participation*. It is given by the percentage of registered voters (voter turnout) in the national (2018) and referendum (2020 and 2022) elections. Voter turnout is calculated on the basis of data collected by the Italian Ministry of the Interior.

(C) *Virtuousness.* It is obtained from the Revenue Agency annual lists on the contribution to be given to each municipality for participation in both the tax and the contribution assessment.

(D) *Willingness to organ donation*. The indicator is given by the ratio of the number of consents to the donation of organs and tissues expressed on the occasion of the issuance of the electronic identity card (CIE) compared to the total of declarations of intent. It is based on the data published annually by the "Sistema Informativo Trapianti" of Ministry of Health.

(E) *Educational level of political representation*. It has been constructed as the share of component of the city council that have at least a college degree. This information is available from the Registry of Local Administrators, assembled by the Italian Ministry of Interior.

(F) *Waste sorting.* It is measured by the percentage of municipal waste subject to separate collection based on data available from Waste Catalogue assembled by the Italian Institute for Environmental Protection and Research (ISPRA).

(G) *Broadband diffusion*. It is the percentage of schools in which the "Connected School" plan has been implemented out of the total number of participating schools. It is based on the data published by the Ministry for Business and Made in Italy.

(H) *Women's political representation*. It is obtained from the Registry of Local Administrators, assembled by the Italian Ministry of Interior as the ratio between the number of female members of the municipal council and the total number of members.

3. Definition of composite index

Social capital, as many social economic phenomena has a multidimensional nature. This involves that one individual indicator is not suitable to measure it accurately; therefore, a composite index is required. Composite index is based on aggregation of several indicators that represent the different components of the multidimensional phenomenon to be measured by means of an analytical method in order to obtain an overall score for each statistical unit (such as country, regions or other geographical areas). It is thus possible to use the results either to summarize the data or create a statistic unit ranking (OECD, 2008). Despite the composite index facilitates the representation of a multidimensional phenomenon, many pitfalls lie behind each stage of its construction once defined what to analyse. In fact, several methodological decisions and subjective choices need to be taken: each of them could affect the ability of the composite index to represent the phenomenon for which it was built. It should be taken into account that the composite index is not the phenomenon but the expression of a synthesis of several variables (or indicators) that contribute to define a complex phenomenon. As well explained by Mazziotta and Pareto (2020), the switch from a multidimensional phenomenon to its synthesis in a single index inevitably determines an approximation error, therefore the perfect composite index does not exist. However, several criteria can be used as a guide in the research of the best "method", such as the type of a) model (reflective/formative), b) indicators (compensatory/non-compensatory); c) aggregation (simple or complex); d) comparisons (absolute/relative); e) weights (objective or subjective). According to these criteria, given the non-compensatory (or partially compensatory) nature of indicators, the need to carry out temporal comparisons in order to capture the variations that occurred in the period taken into consideration, as well as the need to obtain an easy to read synthetic index in order to guarantee a simpler interpretation of the final results, the Adjusted Mazziotta-Pareto Index (AMPI) is the method chosen for the construction of the composite index in order to analyse the social capital dynamic in the Italian municipalities.

4. Adjusted Mazziotta - Pareto Index (AMPI): construction methodology

AMPI's composite index is based on aggregation of non-compensatory (or partially compensatory) indicators and it is an extension of the Mazziotta-Pareto Index (MPI). The difference between them is that AMPI re-scales the individual indicators by a Min-Max transformation, allowing to measure absolute comparisons over time; whereas MPI normalizes the indicators by a linear combination of z-scores, allowing only relative comparisons over time. Therefore, the AMPI is more

suitable in the dynamic analysis such as time series (Mazziotta and Pareto, 2016). More specifically, given the matrix $X = \{x_{ij}\}$ where $i = 1, \ldots, n$ are the statistical units (for instance geographical areas), and $j = 1, \ldots, m$ are the indicators, the normalized matrix $R = \{r_{ij}\}$ is calculated, whose generic element r_{ij} is defined as follows:

$$r_{ij} = \begin{cases} \dfrac{\left(x_{ij} - Min_{x_j}\right)}{\left(Max_{x_j} - Min_{x_j}\right)} * 60 + 70 \;\; iff \; indicator \; j \; has \; positive \; polarity \\ \dfrac{\left(Max_{x_j} - x_{ij}\right)}{\left(Max_{x_j} - Min_{x_j}\right)} * 60 + 70 \;\; iff \; indicator \; j \; has \; negative \; polarity \end{cases}$$

Min_{x_j} e Max_{x_j} are the goalposts of the indicator j, i. e. the values that define the variation range of the indicator j. Generally, in case of time series, the goalposts are the minimum and maximum of the indicator j in all the time periods considered. In order to facilitate the interpretation of the results, the goalposts are chosen so that 100 represents a reference value or 'benchmark' (for example, the average value of a given year). As shown, the normalization is based on a correct Min-Max transformation. This correction involves multiplying the resultant of the Min-Max method by 60 and subsequently adding the value 70, which guarantees a better reading of the composite index and therefore a simpler interpretation of the final results. To the normalized matrix $R = \{r_{ij}\}$ the aggregation function is applied, by means of which AMPI (Adjusted MPI) is obtained. Its generalized form is the following:

$$AMPI_i^{+/-} = M_i \pm S_i * cv_i$$

where and M_i, S_i and cv_i respectively, stand for the mean, the standard deviation and the coefficient of variation of normalized values of indicators for unit i. The $\pm$ sign depends on the type of phenomenon to be measured[1]. As shown, in the aggregation phase, the AMPI is characterized by the combination of an "average" effect and a "penalty" effect, the latter based on the coefficient of variation and it is equal to zero if all values are equal. The aim is to penalize statistical units such as geographical areas with unbalanced value of the individual indicators used. The

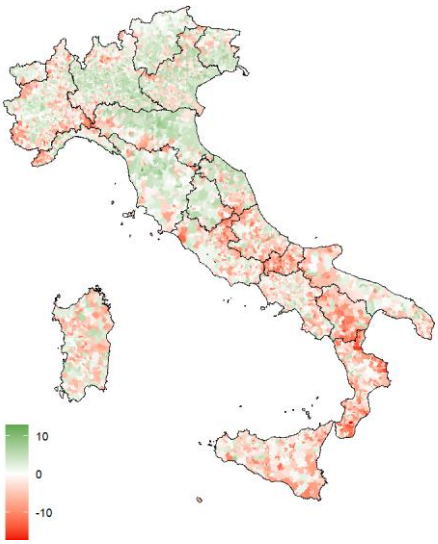
[1] If the index is positive, that is its increase corresponds to a positive variation in the phenomenon, a downward penalty is applied. On the contrary, if the index is negative, that is its increase corresponds to a negative variation in the phenomenon, an upward penalty is applied.

AMPI values vary between 70 and 130, where 100 is the reference value to which the entire measurement system is anchored.

5. The main results

This paragraph presents the results deriving from the application of the social capital index constructed by means of the AMPI method on the panel data based on the Italian municipality in the years 2018, 2020, 2022 in order to measure the endowments and the variations of social capital during the aforementioned years. Figure 1 shows the level of social capital of each municipality compared to the national one.

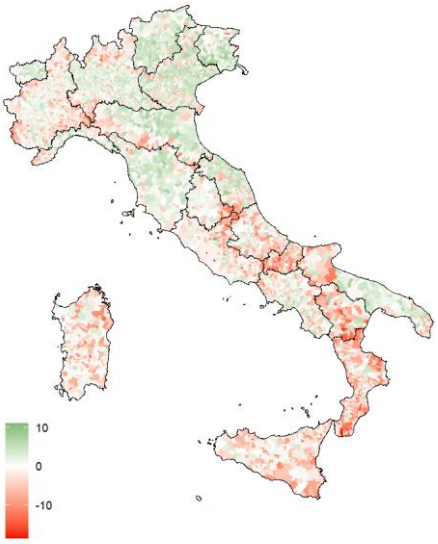
Figure 1 – *Geography of social capital at municipal level measured with AMPI - Year 2018*



In particular, the white colour centred on zero indicates that the municipality has the same level of social capital as the national one; while the red and green colours indicate, respectively, a lower and higher level than the national one. In addition to this, the intensity of the gradation of the two colours provides a measure of the distance between the social capital of the municipality and the national level: the more intense the red, the more the municipality has a lower level of social capital than the national one; at the same time, the more intense the green, the more the municipality has a higher level of social capital than the national one. The geographical distribution of the index highlights the existence of two macro-areas:

the first represented by Northern and Northern-Central Italy, where there is a prevalence of municipalities with levels of social capital higher than the national one; the second represented by Southern and Southern-Central Italy, where there is a prevalence of municipalities with lower levels of social capital compared to the rest of the country. This result is in line with the literature on social capital which, in the case of Italy, highlights this heterogeneity in the distribution of social capital such as in Putnam (1993), Guiso et al. (2004) and Durante et al. (2023). In 2018, the municipality with the highest level of social capital was Santa Maria a Monte (AMPI=112.84) in Tuscany, while the one with the lowest was Platì (AMPI=82.67) in Calabria. As regards the year 2020, there is a slight reduction (-0.67) in the level of social capital at a national level which goes from the reference value of 100 in the base year 2018 to 99.33; this evidence has been found in other economies too, such as Germany (Burrmann *et al.*, 2022), England (Borkowska and Laurence, 2021) and China (Luo *et al.*, 2022). In 2020, the municipality with the highest level of social capital was Fara in Sabina (AMPI=110.34) in Lazio, while the one with the lowest level of social capital was San Lorenzo (AMPI=80.66) in Calabria. Although the national level of social capital decreased, in 2020 the situation at the municipal level was very heterogeneous (Figure 2).

Figure 2 – *Geography of social capital at municipal level measured with AMPI - Year 2020.*



In fact, comparing the municipal geography of social capital between 2018 (Figure 1). and 2020 (Figure 2), the first evidence is that the second graph has fainter colours than the first one. In fact, a less intense shade of green can be seen in those

municipalities that in 2018 had much higher levels of social capital than the national one; on the contrary, lighter shades of red can be seen in those municipalities that had much lower levels than the national one. This means that, in 2020, on the one hand, there was a reduction in social capital in well-endowed municipalities, whereas on the other hand there was an approach to the national level in those with lower endowments. The year 2020 went down in history as that of the CoViD-19 pandemic and this shock event might have had an impact not only on the level of social capital but also on its distribution at a territorial level. The literature on the effects of CoViD-19 on social capital is not extensive and has mainly focused on the national territorial level, while no study has gone to such a detailed territorial level as the municipal one.

Before delving into the search for a possible explanation for this empirical evidence, a first consideration to make is that in Italy the areas most affected by CoViD-19 were those of Northern Italy[2], that is the area of the country most endowed in terms of social capital. The degree of spread of the virus could help explain the reduction in social capital levels of those areas that, in 2018, had high endowments, however it is not sufficient to explain the increase in social capital levels in low endowment areas. Generally speaking, the literature on social capital has highlighted how, in normal situations, the low levels of social capital of a community are attributable to the lack of civic commitment of individuals and their inclination to invest their time in individualistic activities. This tendency towards social segregation is what Putnam (2000) refers to as "bowling alone". In this sense, the pandemic has forced each of us to limit social relationships, appealing to everyone's civic responsibility.

The conditions posed by an emergency situation such as the pandemic have placed all Italian municipalities on the same level, regardless of the starting level of social capital, determining a condition of generalized bowling alone. In this circumstance, municipalities with lower endowments of social capital might have shown better abilities to withstand and react to the pandemic shock, thanks to their familiarity with the so-called bowling alone condition, maintaining or improving their levels of social capital. On the contrary, municipalities with higher endowments might have suffered a greater impact as they are more oriented towards a so-called “bowling together”. This could be an explanation of the diversified effect that the pandemic might have had at the local level.

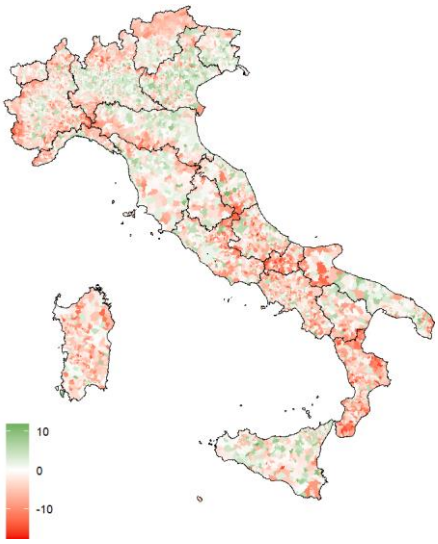
Another possible explanation could be linked to the role played by local administrations in managing the pandemic. Several studies (Lee, 2021; Carlin *et al.*,

[2] According to Istat (2020) data, the increase in deaths in March 2020, compared to the average in the same period 2015-2019, was 188% in Lombardy; it is followed by Emilia-Romagna, with an increase in March of 71%, Trentino South-Tyrol (69.5%), Aosta Valley (60.9%), Liguria (54.3%), Piedmont (51.6%) and Marche (48.9%).

2014) have highlighted that in the presence of an exceptional event such as the pandemic, if the members of a community perceive weakness or poor capacity in the political class to face the emergency, a downward spiral gets started, in which distrust towards institutions pushes the level of social capital further and further downwards.

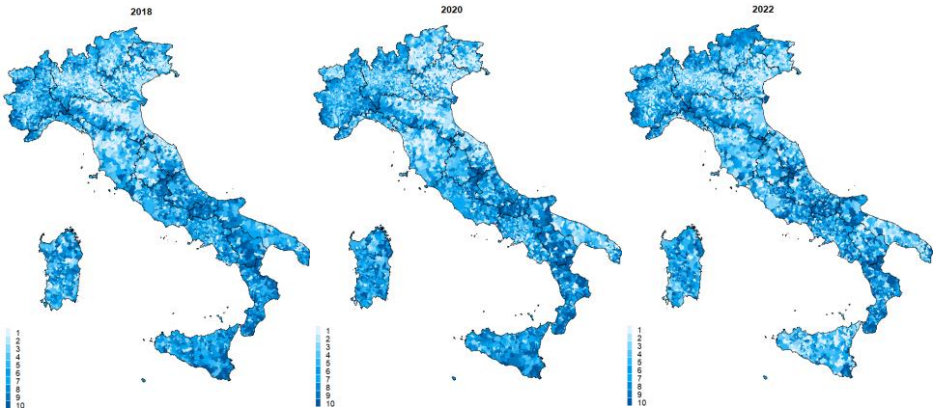
In the year 2022 (Figure 3) there is a further reduction (-0.4) in the social capital (AMPI=98.93) at national level, though slighter.

Figure 3 – *Geography of social capital at municipal level measured with AMPI - Year 2022.*



At that time, the municipality with the highest level of social capital was Sinagra (AMPI=110.80) in Sicily, while the one with the lowest level of social capital was Sant'Alessio in Aspromonte (AMPI=81.25) in Calabria. As regards the municipal geography of social capital in 2022, the reduction observed at national level results in a generalized reduction at municipal level, although it is more marked along national borders. Thus, this reduction, unlike the one already observed between the years 2018 and 2020, is not centred on high endowments municipalities, but it is more widespread among all the municipalities and therefore not linked to initial endowments. This means that the differentiated effect, based on the initial endowments of social capital, is greatly weakened, as well as a sign that the pandemic shock was being reabsorbed. In Figures 4, the ranking deciles at municipal level are graphically represented, respectively, for the years 2018, 2020 and 2022.

Figure 4 – *Ranking deciles at municipal level - Years 2018, 2020, 2022.*



A darker colour indicates a worse position in the municipal ranking and, therefore, a lower value of the composite index; on the contrary, a lighter colour is associated with those municipalities that take better positions. From these figures, comparing 2018 to 2020 and 2022, CoViD-19 has partially modified the geography of the ranking between the municipalities. In fact, several Southern municipalities have gained positions, moving from the lowest to medium-high deciles, especially in Sicily [3], Basilicata and the lower part of Apulia. On the contrary, several municipalities in the North have lost positions in the ranking, especially in South-Tyrol and those located in the Lunigiana area, that is the border territory among the regions of Liguria, Tuscany and Emilia-Romagna.

6. Conclusions

In this paper local economies have been viewed through the lens of social capital by using an innovative composite index based on the Adjusted Mazziotta-Pareto Index (AMPI), which allows to value the subtle web of connections among mutual trust, respect for rules and interpersonal relationships that regulate common life and define civic commitment. The findings confirm the existence of a clear geographical gap in the distribution of social capital in Italy: municipalities in the North Central areas generally show higher levels of social capital than those in the South. This

[3] This region, as part of the post-CoViD-19 recovery programme, launched intense regional cohesion activities aimed at relaunching the growth potential of the regional economy, boosting productivity and employment.

result leads to think that both the set of indicators and the AMPI construction methodology are suitable for measuring social capital. In addition, the results reveal important insights into the dynamics of social capital at the local level following the CoViD-19 pandemic: high-endowment municipalities in Northern Italy experienced a reduction in social capital while municipalities in the South showed signs of improvement. This phenomenon could be attributed to low endowed municipalities better ability to react to the pandemic shock, which may have made them more resilient and adaptable to the changes induced by the pandemic ("bowling alone"). Conversely, municipalities with higher initial levels of social capital, more familiar with collaborative social dynamics ("bowling together"), may have found it more challenging to adapt themselves to the limitations imposed by the pandemic. Moreover, the role of local administrations cannot be underestimated. Their effective leadership during the pandemic appears to have played a critical role in maintaining or even enhancing social capital in some municipalities. This highlights the importance of local governance in fostering social cohesion during exceptional events such as the pandemic.

As much as other capital types, such as human and physical capital, social capital is capable of influencing the well-being of citizens, the quality of their associated life, the efficiency of the economy; therefore, they would improve along with any policy aimed at strengthening social capital.

Future research could be built upon these findings by examining the long-term effects of the pandemic on social capital, exploring the role of different policy interventions, and further investigating the interplay between local governance and social capital in times of crisis, also in other countries

Acknowledgements

I would express my sincere thanks to independent referees appointed by the editor for all the helpful comments and contributions that improved this study.

References

ALBANESE G., DE BLASIO G. 2016. Civic capital and development: Italy 1951-2001, *Politica economica*, Vol. 32, No. 1 pp. 47-64.

BATINTI A., ANDRIANI L., FILIPPETTI A. 2019. Local government fiscal policy social capital and electoral payoff: evidence across Italian municipalities, *Kyklos*, Vol. 72, No. 4, pp. 503-526.

BORKOWSKA M., LAURENCE J. 2021. Coming together or coming apart? Changes in social cohesion during the Covid-19 pandemic in England, *European Societies*, Vol. 23, No. S1, pp. S618-S636.

BURRMANN U., MUTZ M. SIELSCHOTT S., BRAUN S. 2022. Social capital trends in Germany in the face of the Covid-19 pandemic: A research note, *Frontiers in Political Science*, Vol. 3, No. 1 pp. 33-40.

CARLIN R. E., LOVE G. J., ZECHMEISTER E. J. 2014. Trust shaken: Earthquake damage state capacity and interpersonal trust in comparative perspective, *Comparative Politics*, Vol. 46, No. 4, pp. 419-453.

DURANTE R. MASTROROCCO N. MINALE L. SNYDER JR J. M. 2023. Unpacking social capital. *Working Papers 31083*, National Bureau of Economic Research.

GANNON B., ROBERTS J. 2020. Social capital: exploring the theory and empirical divide, *Empirical Economics*, Vol. 58, No. 3, pp. 899-919.

GUISO L. SAPIENZA P. ZINGALES L. 2004. The role of social capital in financial development, *American economic review*, Vol. 94, No. 3, pp. 526-556.

ISTAT 2020. *RAPPORTO ANNUALE 2020. La situazione del Paese*. Roma: Istat.

LEE J. 2021. The social impact of natural hazards: A multi-level analysis of disasters and forms of trust in mainland China, *Disasters*, Vol. 45, No. 1, pp. 158-179.

LUO M., WANG Q., YANG S., JIA P. 2022. Changes in patterns of take-away food ordering among youths before and after COVID-19 lockdown in China: the COVID-19 Impact on Lifestyle Change Survey (COINLICS), *European Journal of Nutrition*, Vol.61, No.2, pp. 1121-1131.

MAZZIOTTA M., PARETO A. 2020. *Gli indici sintetici*. Torino: G. Giappichelli editore.

MAZZIOTTA M., PARETO A. 2016. On a Generalized Non-compensatory Composite Index for Measuring Socio-economic Phenomena. *Social Indicators Research*, Vol. 127, No. 3, pp. 983-1003.

OECD 2008. *Handbook on Constructing Composite Indicators. Methodology and user guide*. Paris: OECD Publications.

PORTELA, M., NEIRA, I., SALINAS-JIMÉNEZ, M. D. M. 2013. Social capital and subjective wellbeing in Europe: A new approach on social capital, *Social Indicators Research*, Vol.114, No.2, pp. 493-511.

PUTNAM R.D. 1993. *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton: Princeton University Press.

PUTNAM R.D. 2000. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.

Angela PEPE, Istat, angela.pepe@istat.it