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ABSTRACT

Recent years witnessed a growing interest in the concept of well-being and quality of life, as alternative to the Gross Domestic Product (GDP). The determinants of well-being, especially at the regional and provincial levels, is understudied in a macro perspective, as opposed to a micro perspective (individuals, survey data) that has been the dominant approach until recently. In this paper, we estimate an empirical model for the Italian NUTS-3 provinces to evaluate the role of social capital on well-being by using aggregated (provincial) data. Our findings suggest that social capital, social security programs, income, and grant-making activities by Bank Foundations, even though not uniformly distributed across Italy, positively affect well-being, thus contributing to explain the persistent dualism that characterizes the Italian economy.

1. Introduction

Over the last few decades the concept of social capital and its relationship with economic performance has attracted increasing attention from economists and other social scientists. Social capital dimensions have been used to account for cross-country differences in terms of growth of per-capita income and productivity, the propensity of firms to innovate and build physical capital, their degree of entrepreneurship and the efficiency of their political institutions [1,2].

According to the existing economic literature, the economic development of nations or regions are significantly influenced by the intrinsic value of social capital, i.e., the sum of trust, networks, and norms. Indeed, while trust is known to reduce the transaction costs of contracting by constraining opportunism, thereby promoting capital investment, norms of reciprocity may significantly reduce the presence of free riding phenomena, thereby enhancing the voluntary provision of local public goods. Finally, association networks may help to speed information transfer and strengthen the knowledge spillovers that create fast-growing innovation clusters [3].

Empirical work on the role of social capital was pioneered by Ref. [4]. In his influential paper, Putnam suggested that the quality of institutions and the level of social capital may well explain, among other reasons, the perpetuation of economic developmental differences between the Northern and Southern Italian regions. Following Putnam, researchers have also studied the interactions of social capital with

individuals' life satisfaction or well-being. Some studies looked at the aggregated level of social capital and found that generalized trust have a positive impact on well-being [5–7]. Instead, others authors were more interested in gauging individuals' stock of social capital by means of measures, such as the size of individuals social networks [8]. For instance, [9–11] use surveys data to find that social relationships and interpersonal trust are relevant dimensions of social capital that positively affect well-being.

This paper aims at investigating the interaction between social capital and well-being and extends previous literature in a threefold way.

First of all, it analyses the direct impact of social capital on well-being by using aggregated data for the Italian NUTS-3 provinces. To this end, we follow [12,13] and construct a provincial social capital index by aggregating economic and social variables that identify three different dimensions, namely trust, networks and social norms. In our paper, social capital serves as a kind of societal context in which people are embedded. Previous studies, instead, mainly used data at individual level to construct a measure of social capital, and then used an empirical model to explore its beneficial effect on subjective well-being [14–16].

Secondly, notwithstanding the existence of cross-country or individual country studies, an encompassing and detailed evaluation of how an aggregated measure of social capital may affect well-being or life satisfaction still remains to be undertaken for the Italian economy. This aggregated approach is in line with the increasing interest of

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researchers and policy-makers in providing alternative indicators to GDP as a measure of economic progress [17]. Indeed, following the Stiglitz-Sen-Fitoussi Commission [18], several studies attempted to evaluate and measure well-being at national or regional levels, while local governments in different countries developed new accounting frameworks and officially adopted new prosperity measures for understanding local well-being. An evaluation of well-being for the Italian NUTS-3 provinces, which is used in this paper, is provided by Ref. [19]. In the latter, the well-being index measures civil society's preferences in terms of what well-being and progress are. The index is constructed by aggregating key dimensions and variables that reflect various aspects of economic progress, environmental sustainability and social welfare. These variables have been selected through a consultation process with organizations active at the national level [20]. As such, this well-being index overcomes the problem of identification that arises when there is a lack of consensus on a collective vision of progress and well-being.

Finally, our analysis is carried out at provincial level rather than at regional level.¹ The provincial approach is important when one analyzes well-being and life satisfaction in Italy. Previous studies highlighted that some of the dimensions of well-being, such as the environmental quality, education, safety conditions, the dynamism of the labor market, and the cohesion and civic engagement of communities, are strongly dependent on the context in which the individual lives [21]. These dimensions are normally, especially in the case of Italy, not evenly distributed across space. [19,22] show that well-being may vary not only between Northern and Southern Italian provinces, but also between adjacent territories. The local dimension of well-being plays also an important role in the policy-making process. Indeed, Italian local governments contribute in important ways to both the design and implementation of a range of policies that directly impact on people's lives. An assessment of living standards at provincial level and their interaction with social capital can thus help to identify the policy challenges and the trade-offs faced by both regional and sub-regional policy makers.

The paper is organized as follows. Section 2 provides a definition of social capital, while Section 3 includes a review of the literature that investigates the link between social capital and well-being. Sections 4 describes the data and the variables included in the empirical model, which is described in Section 5. Model estimation results are shown and discussed in Section 6. Finally, Section 7 concludes.

2. Social capital definition

Social capital has been widely discussed since 1980s, but a precise and widely accepted definition is still not available [23]. For example, [24], p. 248) define social capital as “the aggregation of actual and potential resources within a specific network, where the network is composed of relationships that involve mutual acquaintance and mutual recognition”. Differently, for [26], p.302) “social capital is defined by its function. It is not a single entity, but a variety of different entities having two characteristics in common: They all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure”. The lack of a common definition of social capital has given rise to different measures and a variety of applied empirical works. Generally, these studies classify social capital into several dimensions, which are then reduced to a single index by means of the principal component analysis (PCA).²

The selection of data used to measure social capital is also a controversial issue [8]. On one hand, social capital is the attribute of a single person and, therefore, is measured by means of micro variables.

¹ Similar to our work is [88], which explores the relationship between economic well-being and social capital among sub-national regions in Germany.

² Attempts to draw a map of social capital for the Italian region or provinces are [15,33,35].

For instance, [26] uses an individual survey to measure how social relations influence job satisfaction, while [27] matches the Multiscopo survey from ISTAT, the Italian National Institute of Statistics, and the Bank of Italy's Household Surveys of Income and Wealth to study individual social capital determinants.

On the other hand, social capital is interpreted as an asset to the whole community and, as such, it involves averaging individuals' social capital. For instance, the level of community trust can be obtained by averaging the trust level of each resident within the community [28]. Another example is [4] who, in his study of Italian regions, aggregates survey respondents' self-report of their involvement with social or civic organizations as a measure of the community level of civic engagement. Further, other authors also measure social capital by means of territorial indicators, such as blood donation intensity, crime statistics and participation rates in referenda (see Refs. [29–35]).

The debate concerning the use of individual or aggregated data has been largely resolved by the work of [36] who begun to work with aggregated social capital. In this paper we follow [36] and construct an aggregated level of social capital as the weighted sum of provincial economic and social variables. Our definition of social capital is similar to the one provided by Ref. [37], that is, as the “features of a social organization such as norms, networks and trust that facilitate cooperation and coordination for mutual benefit”. Therefore, social capital is interpreted as a set of horizontal associations among people, i.e. networks and associated norms that have an effect on the productivity of a community.³

3. Literature review

Nowadays, it is widespread recognized that social capital affects well-being in different ways. For instance, [1,38] find that trust and norms can exert a positive effect on well-being as they reduce transaction costs and facilitate economic activities. Other social capital dimensions, such as social networks, are also viewed as important channels for conveying information and resources relevant for economic activities ([39–41]), or for generating trust ([36,42,43]). Through these different channels, social capital has a positive impact on economic activities and, therefore, on well-being.

Also, [4] shows that higher levels of social capital, as measured by residents' higher participation rates in voluntary groups, can explain the different degree of economic development between Northern and Southern Italian regions. The same author also argues that social capital, in the form of social networks, could also affect economic well-being [36].

In addition, the emphasis on one or another dimension of social capital varies across studies, with generalized trust being one of the social capital dimension that has a greater impact on well-being at the aggregated level ([5–7]). Social relationships, interpersonal trust are, instead, more important dimensions in the analysis of well-being at the individual level ([9–11]).

While over the last two decades there has been an increasing proliferation of studies that looks at the relationship between social capital and well-being, only a few analyses focus on Italy and, methodologically, they use individuals' survey data to construct a measure of social capital. For instance, [15] measures the relationships between some relational dimensions of social capital and the happiness of individuals by using the Bank of Italy survey on Household Income and Wealth. Model estimations reveal that trust, social values, and volunteering have generally positive and statistically significant coefficients, as it is the case for the coefficient of the household income variable. Further, [14] also uses the 2011 Multiscopo survey, carried out by ISTAT to analyze the link between social capital and happiness. His findings show that variables such as trust, meetings with friends and attending

³ See also [12,13].

places of worship are all positively associated with life satisfaction. Finally, [16] interviews a sample of the Italian population to find that interpersonal generalized trust is statistically significant associated with subjective well-being.

Other studies, instead of looking for its direct effects on well-being, focus on the positive effects that social capital has on firm propensity to innovate ([44,45]), firm investments [46], regional and provincial per-capita GDP growth rates [47], and individual health [48].

4. Data and variables selection

This Section describes the database used to estimate our empirical model.

4.1. Data sample

Our analysis studies the period 2003–2011, during which changes occurred in the political and geographical structure of the Italian provinces. Indeed, Italy was subdivided in 103 provinces in 2003, while in 2011 their number increased to 110.⁴ However, our final dataset covers 97 provinces, because data for some of the variables used to build the social capital index were not available for all the provinces.⁵

The dependent variable has been constructed with variables dated between 2005 and 2011. Variables used for the construction of the social capital index are mean values and refer to the 2001–2003 period, except data for the blood donations variable that are only available for 2003 and are taken from Ref. [33]. Finally, data for the remaining control variables refer to 2003.

We are aware that our variables are built on data available for different time periods. However, data show a provincial variability larger than time variability because they measure structural characteristics of local societies and economies. For instance, the time variability (i.e., the mean of the provincial coefficients of variation calculated for the 2001–2003 period) of the bike lanes variable is 0.09, while its provincial variability 1.05. Therefore, our results are not much affected by variables measured over different time spans.

More details on data used for the construction of the social capital index are available in Table A1 in Appendix 2, while variable description, the data sources, and summary statistics are respectively shown in Table A2 and in Table A3 in Appendix 2.

4.2. Dependent variable

Well-being is our model dependent variable and is obtained from Ref. [19] by following the methodology used for the construction of the Italian regional QUARS well-being index made by Ref. [49]. This is a composite index obtained by aggregating twenty-six socio-economic and political variables (shown in parentheses) into seven dimensions: 1) Environment (Population density, Water and soil pollution, Environmental illegality, Waste collection, Eco management, Organic farming, and Sustainable mobility); 2) Economy and labour (Unemployment, and Income inequality); 3) Rights and citizenship (Housing, Risk of exclusion for disabled, and Migrant integration); 4) Health (Integrated home assistance, Hospital migration, and Avoidable mortality); 5) Education and culture (School ecosystem, Secondary education, Higher education, Students migration, Libraries, and Theater and music); 6) Gender equity (Female activity rate, and Municipal creches); and 7)

⁴ The provinces of Ogliastra, Carbonia-Iglesias, Medio Campidano, and Olbia-Tempio Pausania were created in 2006, while the provinces of Monza e della Brianza, Barletta-Andria-Trani, and Fermo were created in 2009.

⁵ Data for bicycle lanes were not available for the provinces of Caltanissetta, Enna, Nuoro, Potenza, Trapani, while data for the length of first-instance ordinary court proceeding were not available for the province of Caserta. Instead of making some arbitrary assumptions, we decided to drop these observations.

Democratic Participation (the Number of Voluntary Associations, Newspaper diffusion, and Political participation).

The geographical distribution of the well-being index shows the existence of two macro areas, the first represented by the North and the Centre of Italy, while the second by the South of Italy. Provinces in the Southern part of Italy, as expected, are endowed by lower level of well-being than the rest of the country⁶ (see Fig. 1).

4.3. Independent variables

Our main independent variable is the social capital index built by combining four variables that measure the three dimensions of social capital, namely trust, social norms, and networks (see below). The variable selection has been constrained by provincial data availability. Indeed, survey data aimed at evaluating subjective well-being and individual happiness are carried out by ISTAT only at NUTS-2 regional level. More specifically, as in Ref. [34], to proxy civiness and people's propensity to cooperate we choose blood donations, which are measured as the number of blood bags per million inhabitants. For social inclusion and networks, we select the length (Km per 100 Km² of surface) of bike lanes. Indeed, [50] show that mobility helps to increase the geographical dispersion of social networks and, most importantly, active commuting, such as walking or biking, has a positive effect on social capital. Finally, following [51], we select two dimensions of generalized trust in institutions and society, namely, the length of first-instance ordinary court proceedings, and the number of car thefts.⁷ All these variables are then combined by means of the Principal Component Analysis (PCA) to obtain a measure of the provincial social capital (see Appendix 1 for more details on the PCA technique).

The geographical distribution of the obtained social capital index shows that provinces located in the North and the Centre of Italy have a greater endowment of social capital than Southern provinces and, therefore, it mimics the geographical distribution of provincial well-being (see Figs. 1 and 2). This simple graphical analysis also confirms previous empirical results (see Refs. [33,35,47,51]).

4.4. Control variables

The selection of the control variables follows previous studies. Namely, they are: income, debt, household wealth, social security programs, taxes, and a measure of philanthropy activities.

As for income, its impact on happiness or subjective well-being is a controversial issue in the literature.⁸ In his seminal paper, [52] find that at a-point-in-time happiness varies directly with income, although such correlation tends to disappear beyond certain income levels. In a more recent paper [53], Easterlin argues that the concave relationship between self-declared happiness and income is related to the concept of adaptation: individuals adapt to their conditions and get used to their circumstances, and so increasing income and consumption do not necessarily lead to enhanced well-being.⁹ Other researchers explored the relationship between social capital and well-being [16,54,55]. In these studies social capital gains new relevance in correlating people's well-

⁶ Values have been standardized, so that the well-being index is centered around the zero mean, with positive values representing a score above the provinces' average, and negative values a score below the average.

⁷ It is common in the literature to use church attendance, or donations to the church to build a social capital index. For instance, [89] show how religion shapes work habits, which influences development and well-being. Unfortunately, these or similar data are not available at Italian provincial NUTS-3 level (survey data on church attendance are carried out only at regional NUTS-2 level). Moreover, [19] use the number of voluntary associations (including religious associations) for the construction of the well-being index, which is used in our paper.

⁸ See Ref. [10] for a review of the literature.

⁹ See Refs. [90,91] on this point.

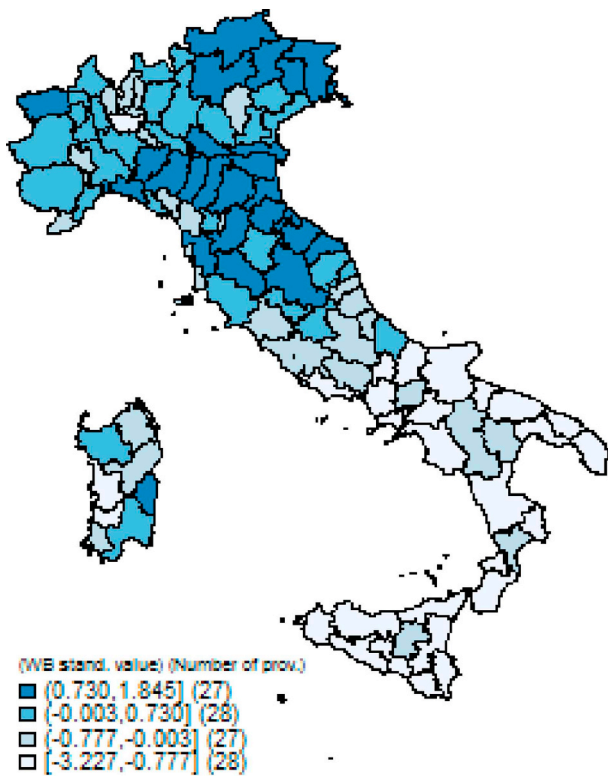


Fig. 1. Geographical distribution of the well-being (WB) index in quintiles (darker areas denote higher values of the index).

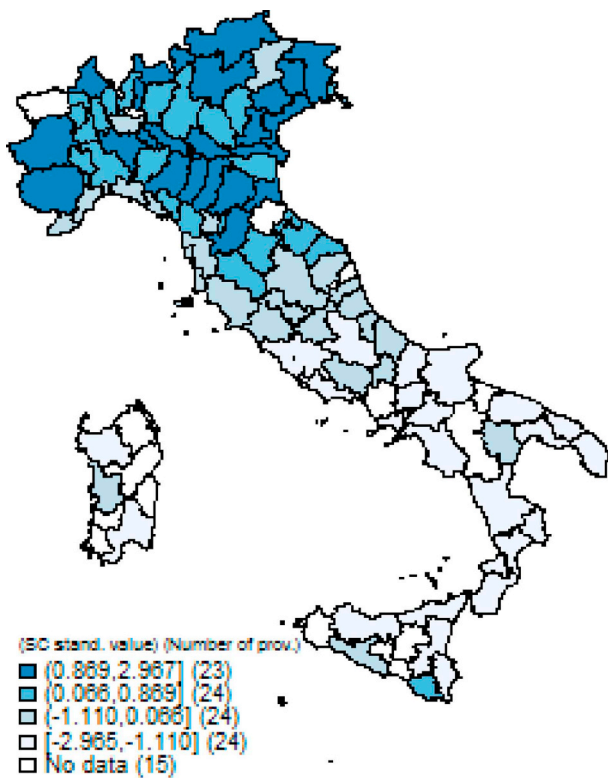


Fig. 2. Geographical distribution of the social capital (SC) index in quintiles (darker areas denote higher values of the index).

being with income and in explaining the happiness-income paradox defined by Ref. [52]. For instance, [54] uses data for the U.S. economy between 1975 and 2004 and find that well-being did not grow up

together with economic growth because the positive effect of income growth was counterbalanced by the declining availability of social capital, which negatively affects well-being.

Researchers also find that debt is an important determinant of well-being. For instance, [56] find that lower levels of debt lead to higher financial security, which is one life domain that influences a person's subjective evaluation of his/her life. A lack of financial resources can also limit the extent to which individuals fulfill life goals and fundamental needs, such as autonomy and social relations, which are key for promoting subjective well-being [57].

Some empirical studies also find that overall life satisfaction is positively related to household net wealth. For instance, [58] shows that household net wealth, which can be viewed as providing a degree of economic security, is at least as important to well-being as income.

A recent strand of the well-being literature, instead, finds that social security programs improve the overall quality of human life ([59,60]). Well-being is also affected by taxes through different channels: higher taxation might imply better provision or quality of public goods ([61]), or more redistribution and insurance through the social security system ([62]). In addition, the relationship between tax and well-being could also be influenced by the subjective rewards of acting according to the law. This latter channel was explored, for instance, by Ref. [63]. Using a 2004 cross-section of Italian household data, they find that self-reported tax morale, that is the moral obligation to pay taxes, has a positive effect on well-being. However, some studies find that taxes reduce well-being of taxpayers as they lower individual disposable income ([64]).

Finally, other studies explore the link between happiness and philanthropy activities. Results show that charitable giving can increase givers' psychological well-being [65], but giving money is also good for the receiver as it allows him/her to increased health, prosperity and strong community organizations ([66,67]). Among the latter strand of well-being determinants, there are the grant-making activities by Italian Bank Foundations (BFs). BFs were established in the early 1990s during the process of privatization of the Italian banking sector, as shareholders of the newly-privatized banks. Today, they are recognized as not-for-profit institutions with the aim to ensure that the dividends of banking activities would be reinvested in local communities in the form of grants for projects of social, charitable, and cultural interest. Over the last fifteen years, BFs provided, on average, 1 billion Euros per year to local communities, a sum of money that it is relatively small when compared to the amount of total government expenditures. However, BFs are recognized as a vital source for promoting the development of local communities and improving the quality of life [68]. Most importantly, [69] provide empirical evidence that grant-making activities by BFs have a positive and statistically significant impact on social capital and economic growth of the Italian provinces.

5. Empirical model

Following previous studies ([70]), we specified the following cross-sectional model:

$$WB_i = \alpha_0 + \alpha_1 SC_i + \alpha_k \sum_{k=1}^N X_i^k + F_i + \varepsilon_i \tag{1}$$

In equation (1) the subscript i refers to provinces; WB is the well-being index; SC is the social capital index and X_i^k is a vector of control variables, which are: the real per-capita Value Added (VA); the amount of per-capita expenditure for social security services managed by municipalities ($SocExp$), a proxy for social security programs; the amount of taxes collected by municipalities ($taxes$), which have been aggregated at NUTS-3 provincial level; the amount of BFs grants over Value Added ($BFgrants$), a proxy for philanthropy activities; the amount of household real wealth (dwellings and lands) (WR), a proxy of household wealth; and the amount of bank loans to households as a share of VA ($Loans$), a

proxy of debt.¹⁰ The expected sign of the coefficients are all positive, except for the taxes variable. According to the literature reviewed in Section 4, taxes may either positively or negatively impact on well-being.

Finally, in equation (1) F_i controls for geographical area fixed effects, and ε_i is an i.i.d. error term.¹¹

The variable correlation matrix is shown in Table 1. All coefficients are highly statistically significant at the 1% probability levels. The larger correlation coefficient occurs between provincial social capital and value added, while the smallest are between household real wealth and the amount of per-capita expenditure for social security services managed by municipalities.

6. Estimation results

Estimation results are shown in Table 2. To deal with outliers the number of observations in the model estimation is reduced to 91.¹²

In order to determine the impact of social capital on well-being, we first estimate the model without controlling for the rest of well-being determinants (Column 1). As expected, the coefficient of social capital is positive and statistically significant. More specifically, the coefficient of social capital (SC) shows that a 10% increase in social capital results in about a 1.14% increase in well-being. The result is consistent with previous research, which suggests trust ([14,70]), social networks and social norms ([1,16,71]) as the most important social capital factors that affect well-being. Most importantly, the coefficient on social capital remains positive and statistically significant across all model specifications.

In Column (2) we control for social expenditure (SocExp) and Value Added (VA). The estimated coefficient of social expenditure is positive and statistically significant, which suggests that social protection expenditures could be used as a policy instrument to fight economic strain and improve individuals' quality of life. This result is also consistent with previous studies, as discussed in Section 4 ([59,60]).

The coefficient of income (VA) is positive and statistically significant (see Column (2)). This is also the case when the model is augmented with the square of the Value Added (see Column (3)). Indeed, the statistically significant coefficient of VA^2 shows a non-linear effect of income on well-being and suggests that, beyond a certain income level, well-being is decreasing in income. This result confirms [52] findings and the analysis carried out by Ref. [72] for the Italian economy.

Columns (4) and (5) show estimated coefficients when our model is augmented with BF grants. The nonlinear relationship (showed in Column (4)), which is mainly due to measurement problems, disappears once we add 13 province dummy variables (Column (5)). The positive coefficient of BFs confirms the role of bank foundations in determining well-being, and local economic development [73].

However, household wealth (WR), debt (Loans), and taxes (Taxes) do not seem to affect well-being (column 6) as their estimated coefficients are all statistically not significant. Regarding household wealth,

¹⁰ To deflate VA we use the consumer price index (CPI), which is measured in the main cities of provinces and in regions.

¹¹ The Italian geographical areas are the North-West (which, in the estimation model, comprises 23 provinces), the North-East (21), the Centre (20), and the South (27).

¹² More specifically, we removed 6 provinces from the dataset. We have not included the province of Siena (which is an observation distant from the rest for the *BFgrants* variable), the province of Napoli (for the *WB* variable), the province of Messina (for the *SC* variable), the province of Oristano (for the *SocExp* variable), and the provinces of Milano and Rome (for the *Loans* variable). In all cases, the Walsh's non-parametric outlier test [92] indicates that all the mentioned observations are outliers at 10% significance level, the level that should be used in our case given that the number of observations in the sample is less than 220.

the result does not support the evidence found in Ref. [58], which claims that wealth confers economic security and therefore happiness. A likely explanation for this result has to do with data aggregation. As suggested by Ref. [74], at the aggregated level the evidence about the relationship between wealth and happiness is almost non-existent due to data limitations and statistical identification problems. The latter occur because it is hard to disentangle the effect of wealth versus that of other concomitant control variables.

The estimated, and not statically significant coefficient of debt is a common results in cross-sectional studies [75,76]. [80] find that unsecured debt has a negative influence on well-being, but at the same time secured debt has no significant statistical relationship with well-being. [81], instead, shows that individuals with greater level of financial resources are less affected by debt, which in turn has a smaller effect on well-being. This is the case of elderly people, who tended to have higher levels of savings and investments, with most of their debt being paid off.

As for the coefficient of taxes, this has a positive sign as suggested by most of the literature mentioned in Section 4. However, the coefficient is not statistically significant.¹³

Finally, we test our model for the presence of spatial autocorrelation. In Column (7) we use two Lagrange Multiplier tests, as well as their robust counterparts, to test for the presence of two possible forms of autocorrelation: the LM tests for an omitted spatial lag (LMlag), and an omitted spatial error (LMerr) [77]. Model specification in Column (5) is indeed our preferred one: the coefficients for all the variables are statistically significant, and both the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) show the lowest values across models.

Results shows that the Robust LMlag (RLMlag) is statistically significant at 10% level, while the RLMerr fails to detect spatial correlation in the OLS residuals. Therefore, following [77] model selection decision rule, we proceed to estimate a Spatial Autoregressive Model (SAR) which takes into account the presence of a spatially lagged dependent variable (ρW^*WB) as an additional control on the right-hand side of equation (1). ρ is the parameter of the spatial autoregressive process, and W the spatial weighting matrix, which describes the spatial configuration of the provinces in the sample, i.e., the indication of whether one province is a spatial neighbor of another.

The SAR model posits that the dependent variable also depends on the dependent variable observed in neighboring units [78]. We used 10-nearest neighbors weighting matrix and carried some robustness checks for different values of k .¹⁴ We fail to detect spatial correlation when we select $k = 5$, $k = 8$, $k = 15$. Also, the Lagrange Multiplier tests are statistically not significant when we select a weighting matrix based on 150 km centroid distances between each pair of provinces, noting that, all the 91 observations have at least one neighbor within 143 km.

Estimation results (see Column (7)) show that the coefficient on the spatial lag dependent variable (ρ), is statistically not significant, suggesting that a positive shock to a province will not spread through the provincial system. This is also confirmed by the Likelihood Ratio (LR) test, which accepts the null hypothesis $\rho = 0$.¹⁵

¹³ The "taxes" variable is computed as per-capita. We also compute it in terms of Value Added, but the coefficient is statistically not significant.

¹⁴ We select a k -nearest neighbors weighting matrix with 10 as the critical cut-off for each province, so that each province has the same number of neighbors, that is 10. The choice on the type of weighting matrix is motivated by the fact that the number of neighbors is not allowed to vary, as it might be the case with, for instance, with a simple contiguity matrix or with distance-based weight matrix. This is of particular relevance in our study as we deal with Italian provinces, which are more irregular areal units than, for instance, the US States [93]. We also apply a classical row-standardization method, so that the sum in each row of the weighting matrix equal one.

¹⁵ The LR test compares the null model (the restricted or no spatial effect, the OLS model) to the alternative (the unrestricted, the SAR in this case).

Table 1
Correlation matrix.

	WB	SC	VA	SocExp	Taxes	BFgrants	Loans
SC	0.697***						
VA	0.760***	0.782***					
SocExp	0.699***	0.507***	0.624***				
Taxes	0.495***	0.404***	0.604***	0.332***			
BFgrants	0.412***	0.440***	0.443***	0.357***	0.434***		
Loans	0.665***	0.621***	0.754***	0.575***	0.422***	0.414***	
WR	0.687***	0.693***	0.751***	0.600***	0.582***	0.336***	0.593***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.**Table 2**
Model estimation results (dependent variable: well-being (WB)).

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	OLS	OLS	OLS	SAR ^a
SC	0.179** (0.070)	0.119* (0.069)	0.123* (0.064)	0.131** (0.058)	0.146** (0.066)	0.130* (0.072)	0.127** (0.053)
VA		0.058* (0.032)	0.512*** (0.127)	0.482*** (0.124)	0.490*** (0.131)	0.488*** (0.136)	0.485*** (0.107)
VA ²			−0.012*** (0.003)	−0.012*** (0.003)	−0.012*** (0.003)	−0.012*** (0.003)	−0.000*** (−0.000)
SocExp		0.462*** (0.148)	0.463*** (0.138)	0.349*** (0.129)	0.388*** (0.145)	0.348** (0.147)	0.372*** (0.106)
BFgrants				0.638*** (0.167)	0.410*** (0.113)	0.421*** (0.127)	0.417*** (0.093)
BFgrants ²				−0.216*** (0.048)			
WR						0.002 (0.003)	
Loans						0.002 (0.004)	
Taxes						0.005 (0.055)	
W*WB							0.119 (0.199)
Constant	0.291** (0.135)	−1.206** (0.573)	−5.404*** (1.219)	−5.161*** (1.207)	−5.118*** (1.307)	−5.591*** (1.449)	−5.286*** (1.058)
Area dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummy ^b	No	No	No	No	Yes	Yes	Yes
Observations	91	91	91	91	91	91	91
Adj. R-squared	0.6628	0.7248	0.7560	0.7982	0.803	0.798	0.802
Jarque-Bera test	3.372	−4.493	−0.363	35165.062	1688.095	2091.004	
AIC	150.449	133.838	123.788	108.273	89.560	93.549	117.918
BIC	163.003	151.414	143.875	133.382	112.158	123.680	178.179
VIF	2.35	3.34	3.34	3.15	3.15	3.23	
SC elasticity	0.114	0.075	0.033	0.023	0.039	0.040	
Diagnostic for spatial dependence (numbers into brackets refer to <i>p-values</i>)							
LMerr							0.849 (0.357)
LMLag							1.669 (0.196)
RLMerr							2.354 (0.125)
RLMLag							3.173* (0.075)
LR test (OLS vs. SAR)							1.642

Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.^a With a *k*-nearest neighbors weighting matrix and 10 as the critical cut-off for each province (see footnote 15).^b Provinces are: Alessandria, Asti, Biella, Cuneo, Grosseto, Lucca, Massa Carrara, Padova, Rovigo, Torino, Venezia, and Vibo Valentia.

Finally, for all models we accept the null hypothesis of normality of the error terms and the absence of multicollinearity among the variables (the mean values of the variance inflation factor (VIF) reported in Table 2 are well below 10).¹⁶ All models are estimated with robust standard errors given that the Breusch-Pagan test reject the null hypothesis of homoskedasticity in the error terms.

7. Conclusion

Over the last two decades, individuals, communities and governments have been increasingly interested in using well-being as alternative or complement to more conventional economic measures of individual and social progress. This flowering of interest has naturally produced efforts to increase the quantity and quality of well-being data, research, and policy analyses. In recent years, there has been an increasing proliferation of initiatives also in Italy. They focus on the concept of well-being and quality of life ([15,79]). Although the

different theoretical approaches and the statistical methodologies used, these studies show the existence of well-being disparities between Northern and Southern regions. Most importantly, they document that well-being dimensions are intrinsically related with local characteristics and, as a result, well-being shows a high degree of variability even within Italian regions and among adjacent provinces ([19,22]).

The aim of this paper was to analyze the determinants of well-being for Italian provinces, an issue that is still largely understudied. More specifically, we focused on the relationship between well-being and social capital. However, unlike previous studies that use individual data, we measured social capital at the aggregated (provincial) level. To this purpose, we selected socio and economic variables that identify three social capital dimensions, namely, trust, networks and social norms. The obtained index shows the existence of an unequal distribution of social capital at provincial level, with Northern provinces endowed with a higher level of social capital than Southern provinces.

We also estimated an empirical model and its coefficients show that, once we control for other macroeconomic variables, social capital maintains a positive and statistically significant impact on well-being. Income, social expenditure, and grants by BFs also have a positive effect on the level of provincial well-being. These results adds to the existing literature that still investigates the motives behind the persisting

¹⁶ The general rule of thumb is that VIFs exceeding 5 warrant further investigation, while VIFs exceeding 10 are signs of serious multicollinearity requiring correction [94] (p.66).

economic and social backwardness of the Southern part of Italy [80,81], and suggest that local governments, which contribute in important ways to both the design and the implementation of social and economic policies, play an important role for fostering social capital and, in turn, individuals' and communities' well-being.

The use of well-being measures in policy-making processes makes the relationship between social capital and well-being at provincial level worth exploring further. Not only in Italy, local governments contribute in important ways to both the design and the implementation of policies that directly affect people's lives. Both provincial and municipality governments are responsible for implementing decentralized policies in sectors such as education, healthcare, transportation and culture [82].¹⁷ Therefore, local governments have, in addition to a direct effect on people's well-being, an impact on several dimensions of social capital that, in turn, may affect the well-being of citizens and communities. Further, the effects of socio-economic policies on well-being also depend on the quality of local governments and their capacity to co-ordinate across the different levels of government (national, regional, local). For instance, policies on land-use, transportation and housing may be designed and implemented in different ways within the same region, or even within the same province [83]. An assessment of living standards at provincial level and the existing relationships between social capital and well-being can thus help regional and sub-regional policy makers to identify the policy challenges and the trade-offs they face.

This study has some limitations that, once overcome, open the way to further developments. One of these limitations is that of a time lag

between the independent variables, especially the social capital index, and the well-being index. The time lag between social capital and its effect on measured well-being may be too large. However, as discussed in Section 4, this issue is related to data (un)availability. Survey data, and data for other socio-economic variables are either available only for a few years (i.e., at the time of a national census) or are not available at all at Italian NUTS-3 provincial level.

Further, the impact of social capital and other determinants on well-being is measured over a nine years period, but it is empirically investigated by means of a cross-section analysis rather than a panel data model. The latter might be desirable, but again is constrained by data availability. One way to get around this problem would be to reduce the number of variables used in the construction of the well-being and social capital indexes to extend the analysis over a longer time period. For instance, it would be interesting to empirically evaluate how and to what extent the financial and economic crisis that started in 2008 changed the relationship between social capital and well-being.

Finally, it is well-known that empirical studies that use a social capital index are controversial. They strongly depend on the definition and the variables used to construct the social capital index, which is a vague and intangible notion. The lack of a commonly-agreed definition of social capital may result in an unstable or statistically not significant relationship between social capital and well-being.¹⁸

Nonetheless, our findings are quite robust to different model specifications and support theories that social capital positively affect well-being. This result that can be exploited by local public authorities when designing policies aimed at increasing people's well-being.

Appendix 1

This Appendix describe the results of the PCA used for computing the social capital index described in Section 4.

PCA is a statistical approach that identify latent components underlying a large number of indicators [84]. To extract the correct number of components from the PCA, we refer to the scree plot of the eigenvalue ([85], p.134) that, in our case, shows a distinct break on the second components and suggests that only the first component is meaningful and should be retained for interpretation (see Figure A1).¹⁹ Indeed, the value of the second eigenvalue is equal to 0.93, which suggests that the second component does not provide additional information (as measured by percentage of total variance explained) that is not already captured by the first one.²⁰

Two more diagnostic tests support our PCA. The first one is the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The KMO value of 0.66 suggests that the sample is adequate [86]. The second one is the Bartlett test of Sphericity that compares the observed correlation matrix to the identity matrix. In our case, the latter test rejects the null hypothesis of no correlation at the 1% level of significance and shows that our dataset can be efficiently used to perform the PCA [87].

¹⁷ In 2014 total spending by provinces and municipalities amounted was about 73 billion Euros, that is about 4% of GDP (Ministry of Economy and Finance, Update Note on the Economic and Financial Document (DEF) 2017).

¹⁸ For robustness purposes we estimated Column (5) in Table 2 by using the social capital index constructed by Ref. [33]. Results, which are available from the authors upon request, show that the impact of social capital on well-being is statistically significant. The social capital elasticity is 0.075.

¹⁹ Our decision to select only the first component finds also support by the Kaiser rule [86].

²⁰ We also computed the accumulated proportion of variance of the first eigenvalue, which accounts for 48% of the original data variability. However, as noted by Ref. [95] (p.398) and [96] (p.44), the method of the accumulated proportion of variance is too arbitrary because the challenge lies in selecting an appropriate threshold percentage, so we do not rely on this method for selecting the correct number of components.

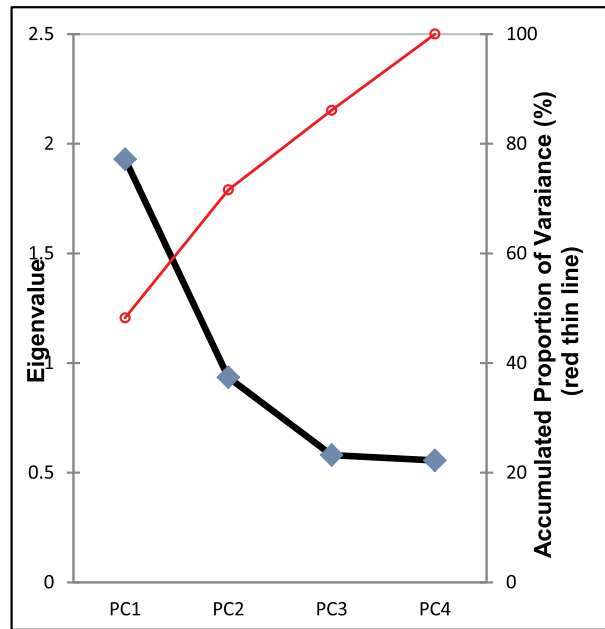


Fig. A1. Scree plot of the eigenvalue.

Appendix 2

Table A1
Variables used for the construction of the social capital (SC) index.

Variables	Variables description	Source	Years	Unit	Social capital dimension ^a
furtcarap	Number of car thefts	ISTAT	Average across years 2001-2002-2003	Per 100,000 inhabitants	trust
proccodm	Length of first-instance ordinary court proceedings	ISTAT	Average across years 2001-2002-2003	Days	trust
pis	Bike lanes	ISTAT	Average across years 2001-2002-2003	Km per 100 km ² of surface	networks
donz	Blood donations	Cartocci (2007)	2003	Numebr of blood bags per million inhabitants	social norms

^a See Section 4 for a description of the different form of social capital.

Table A2
Variables used for model estimation.

Variables	Description	Source	Years	Unit
WB	Well-being index	Calcagnini and Perugini (2018)	2005–2011	Index
SC	Social capital index	Various sources	2001–2003	Index
VA	Real per-capita Value Added	Unioncamere	2003	Million (euro)
SocExp	Per-capita expenditure for social services by municipalities security	ISTAT	2003	Hundred (euro)
Taxes	Total revenue (taxes) assessed by municipal governments (per-capita)	AIDA BvD	2003	Hundred (euro)
BFgrants	Bank Foundation grants over VA	Acri	2003	Thousand
Loans	Amount of loans to households as a share of VA	Bank of Italy	2003	Thousand
WR	Household real wealth (dwellings and land)	Unioncamere	2003	Million (euro)

Table A3
OLS Model Variables - Summary statistics.*

Variables	Obs.	min	max	mean	p50	sd
WB	91	-1.766	1.845	0.145	0.238	0.927
SC	91	-2.597	2.967	0.092	0.313	1.341
VA	91	10.141	26.131	18.393	19.257	4.031
SocExp	91	0.120	2.850	0.907	0.830	0.531
Taxes	91	1.421	10.227	4.083	4.114	1.427

(continued on next page)

Table A3 (continued)

Variables	Obs.	min	max	mean	p50	sd
BFgrants	91	0.000	3.842	0.817	0.433	0.932
Loans	91	31.484	130.030	72.226	71.174	21.205
WR	91	107.174	298.090	208.116	209.510	40.808

* Variables description: WB (Well-being index); SC (Social capital index); VA (Per-capita real Value Added); SocExp (Per-capita expenditure for social services by municipalities security); Taxes (Total revenue (taxes) assessed by municipal governments (per-capita)); BFgrants (Bank Foundation grants over VA); Loans (Amount of loans to households as a share of VA); WR (Household real wealth (dwellings and land).

* Variables unit of measure: WB (Index); SC (Index); VA (Million euro); SocExp (Hundred euro); Taxes (Hundred euro); BFgrants (Per thousands of VA); Loans (Per thousands of VA); WR (Million euro).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.seps.2018.11.005>.

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