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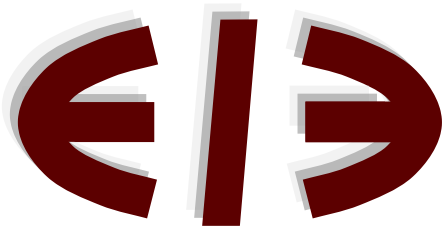

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Online networks and subjective well-being*

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June 3, 2014

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Abstract

Does Facebook make people lonely and unhappy? Empirical studies have produced conflicting results about the effect of social networking sites (SNS) use on individual welfare. We use a representative sample of the Italian population to investigate how actual and virtual networks of social relationships influence subjective well-being (SWB). We find a significantly negative correlation between online networking and self-reported happiness. We address endogeneity in online networking by exploiting technological characteristics of the pre-existing voice telecommunication infrastructures that exogenously determined the availability of broadband for high-speed Internet. We try to further disentangle the direct effect of SNS use on well-being from the indirect effect possibly caused by the impact of SNS's on trust and sociability in a SEM analysis. We find that online networking plays a positive role in SWB through its impact on physical interactions. On the other hand, SNS use is associated with lower social trust, which is in turn positively correlated with SWB. The overall effect of networking on individual welfare is significantly negative.

Keywords: social participation; online networks; Facebook; social trust; social capital; subjective well-being; hate speech; broadband; digital divide.

JEL classification codes: C36, D85, O33, Z13

1 Introduction

Recently, both the general public and the scientific community have paid increasing attention to subjective well-being, i.e. people's assessment of their own well-being. The issue of citizens' quality of life entered the agenda of governments, international institutions, and political organizations. The achievement of better living conditions is now one of the main institutional objectives of the European Union. For instance, after the organization of the conference "Beyond GDP" in 2007, the European Commission officially committed itself to the improvement of European citizens' quality of life (European Commission, 2009).

The measurement and analysis of people's well-being has a long-standing tradition grounded in social psychology. This literature started developing in the '70s and bloomed after 2000 when subjective well-being – and quality of life in general – became a recognized topic of various social sciences, including economics (Bruni and Porta, 2007). People's evaluation of their own well-being, also referred to as "happiness" or "life satisfaction", is monitored through survey questions such as: "Taking all things together, how happy would you say you are?" or "All things considered, how satisfied are you with your life as a whole these days?" (van Praag et al., 2003). A consolidated body of research proved the reliability of subjective well-being. This is why an increasing number of researchers have employed it in many fields of social research. This literature explored various determinants of individual well-being and, among these, social capital has been identified as a particularly strong predictor (Bjørnskov, 2003, 2008; Bartolini et al., 2013; Becchetti et al., 2008; Bruni and Stanca, 2008; Heliwell and Huang, 2009).

A relatively new field of research is related to the role of the Internet and the myriad of new ways of social interaction offered by web-mediated communication. Studies in the field of applied psychology suggest that people increasingly rely on Internet-mediated interaction to cultivate their real-world relationships with friends and relatives (Ellison et al., 2007; Steinfield et al., 2008; Valenzuela et al., 2009). In addition, online networking radically changed the way people develop their civic and political participation (Gil de Zúñiga et al., 2012; Campante et al., 2013).

Since the engagement in relational activities and social capital have been found to be positively correlated with happiness, it is plausible that Internet usage has a positive effect on individual well-being also. Using data from a random web survey of college students across Texas, Valenzuela et al. (2009)

find a positive relationship between intensity of Facebook use and students' life satisfaction. Drawing on the Luxemburgish sample of the European Values Survey (EVS) 2008, Pénard et al. (2013) find evidence that non-Internet users are less satisfied with their life than Internet users. Steinfield et al. (2008) proposed suggestive hints about the role that SNSs may play in reducing inequalities in well-being. The authors find that life-satisfaction and self-esteem serve to moderate the relationship between the intensity of Facebook usage and bridging social capital in a sample of undergraduate students at a Midwestern university. Those with lower self-esteem and who are less satisfied with their life gained more from their use of Facebook in terms of bridging social capital than participants with higher self-esteem.

Other works advance less optimistic claims on the role of SNSs. Based on data collected in a sample of students in a Utah university, Chou and Edge (2012) find a negative association between Facebook use and well-being. In a recent study, Kross et al. (2013) use experience sampling to show that Facebook use predicts negative shifts in subjective well-being over time in a group of 82 selected users.

The empirical literature has so far apparently produced conflicting and non-definitive results on the effect of Internet use on social capital, political participation, and subjective well-being. This lack of agreement may be due to the scarcity of suitable data, which is responsible for several weaknesses. First, those studies that specifically analyze the role of SNSs in the fields of applied psychology and communication science generally employ limited and biased samples – in most cases solely composed of college students. This problem limits the generality of results and often prevents authors from controlling for endogeneity. Secondly, the studies employing large and representative samples in the field of economics so far have suffered from a lack of information about the use of online networking sites. To address this concern, measures of the adoption of broadband Internet have been exploited to proxy online interactions (Bauernschuster et al., 2011). However, broadband can be used in a variety of ways that are not related to socialization or political participation.

The economic literature has thus so far neglected the effect of online networking on social capital and subjective well-being. Helliwell and Huang (2013) use a large Canadian survey to compare face-to-face and online social networks as sources of subjective well-being. The authors find that the number of real-life friends is positively correlated with reported happiness, while the size of online networks is largely uncorrelated with subjective well-being.

Sabatini and Sarracino (2014) explored the relationship between SNS use and social capital in a large and representative sample of the Italian population, finding that the use of SNSs is positively associated with the frequency of meetings with friends and negatively associated with trust in unknown others.

In this paper, we aim to provide an answer to the following research question: how do online interactions affect well-being? Shall we expect a growing wave of happiness due to the wide availability of SNS's and the large number of their users? Do online networks crowd out or complement face-to-face interactions in people's happiness?

To address these questions, we use pooled cross-sectional data including the waves of 2010 and 2011 of the Multipurpose Survey on Households (MHS) provided by the Italian National Institute of Statistics (Istat). This survey contains detailed information on Internet use - with special regard to participation in online networks - and the different dimensions of social capital. We use ordered probit models to check the partial correlations among our variables of interest. However, since online participation might be endogenous to subjective well-being, we also perform a set of 2SLS estimates where we instrument participation in SNSs with two indicators of the availability of technological infrastructures for fast Internet connection a few years before the collection of MHS data. The heterogeneous distribution of these infrastructures across the Italian territory was determined several decades before the advent of the Internet and it substantially depended on the orographic features of the territory. We illustrate in Section 2.1 how Italy's orography caused a significant variation in access to fast Internet across regions and how such variation is exogenous to subjective well-being and was not driven by individuals' propensity for online networking.

Our study advances the research in the field in three substantive ways. We are the first to investigate the role of the Internet in well-being and social capital by accounting for the way people actually use the Internet, with a special focus on social networking sites such as Facebook and Twitter. Unlike previous studies in the field, we use a large and nationally representative sample. We exploit the exogenous variation in individuals' access to fast Internet in their area of residence caused by the orographic heterogeneity of the Italian territory, to control for endogeneity bias through instrumental variables (IV) estimates. Secondly, we analyze the causal mechanism through which online networking affects individuals' well-being by focusing on the possibly competing role of actual and virtual networks. To deepen

our understanding of the possible causal mechanism, we employ a structural equations model and some refinements to disentangle the "direct" effect of SNS use on subjective well-being from the indirect effect possibly caused by SNSs' impact on trust and sociability.

The paper is organized as follows. In the next section, we describe the data and methods employed in the analysis. Section 3 presents and discusses the empirical findings. The conclusion summarizes some lessons on the role of online networking in subjective well-being.

2 Data and methodology

We use a pooled cross-section of data drawn from the last two waves (2010 and 2011) of the "Multipurpose Survey on Households" (MHS) provided by the Italian National Institute of Statistics (Istat). This survey investigates a wide range of social behaviors and perceptions by means of face-to-face interviews on a nationally and regionally representative sample of approximately 24,000 households, roughly corresponding to 50,000 individuals. Subjective well-being is observed through the answers to the question "How satisfied are you with your life as a whole nowadays?". Answers range on a scale from 0 (extremely dissatisfied) to 10 (extremely satisfied), which is a widely adopted scale for measuring well-being (Pavot and Diener, 1993; Krueger and Schkade, 2008).

The reliability of these measures has been corroborated by experimental evidence from several disciplines. For example, subjective well-being correlates with objective measures of well-being such as the heart rate, blood pressure, frequency of Duchenne smiles and neurological tests of brain activity (Blanchflower and Oswald, 2004; van Reekum et al., 2007). Moreover, subjective measures of well-being are strongly correlated with other proxies of subjective well-being (Schwarz and Strack, 1999; Wanous and Hudy, 2001; Schimmack et al., 2010) and with judgements about the respondent's happiness provided by friends, relatives or clinical experts (Schneider and Schimmack, 2009; Kahneman and Krueger, 2006; Layard, 2005). The fact that researchers can trust the information from self-reported assessments of well-being allowed a burgeoning body of research that involved many social sciences, including economics. For example, happiness measures have been adopted in macro- and micro-economics (see, for instance, Di Tella and MacCulloch, 2006; Di Tella et al., 2003, 2010) and in empirical literature

in the fields of poverty, unemployment and inequality (Diener et al., 2009; Clark et al., 2012, 2013). Our indicator of subjective well-being has also been extensively used in relation to non-economic aspects such as aging, gender issues, marital and employment status, childbearing as well as to the quality of political institutions (Frey and Stutzer, 2002; Powdthavee, 2007; Stutzer and Frey, 2012).

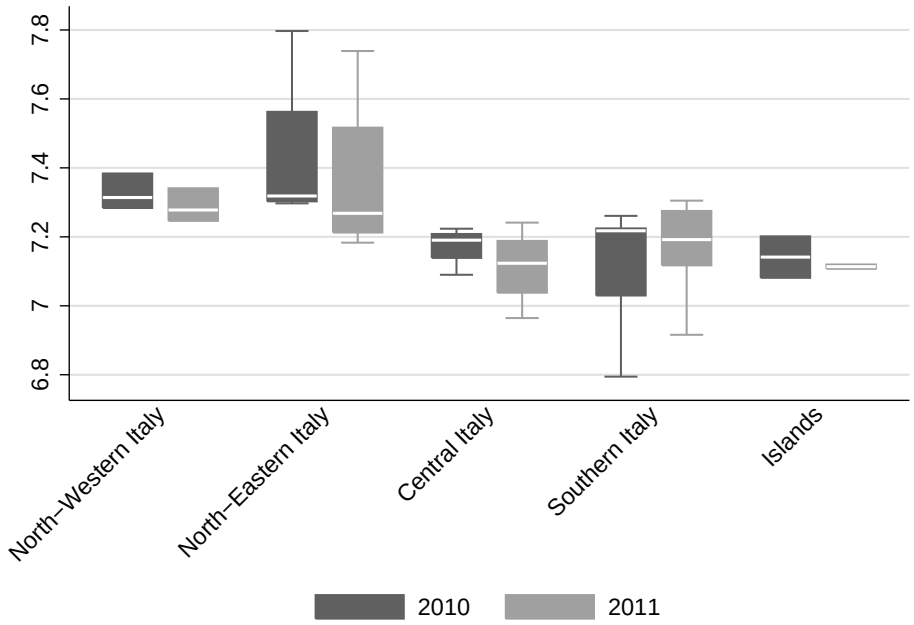

Figure 1: Distribution of average life satisfaction across regions and by year in Italy.

Figure 1 compares the distribution of life satisfaction in 2010 and 2011 across Italian regions. Two main features arise: first, well-being is on average higher in northern regions, varying between 7.25 and 7.76 in the North, 7.02 and 7.21 in the Center and 6.85 and 7.26 in the South; second, between 2010 and 2011 the average level of life satisfaction slightly decreased in almost every region.

We observe social capital through indicators of its structural and cognitive dimensions. The structural dimension is given by social interactions, as measured by the frequency of meetings with friends. Respondents were asked to report how many times they meet their friends on a scale from 1

(in case they have no friends) to 7 (if respondents meet their friends every day). Cognitive social capital is given by social trust, as measured by binary responses to the question: "Do you think that most people can be trusted, or that you can't be too careful in dealing with people?" as developed by Rosenberg (1956). We also use a further indicator of social trust drawn from the so-called "wallet question" to check the robustness of our findings. The wording is as follows: "Imagine you lost your wallet with your money, identification or address in your city/area and it was found by someone else. How likely do you think your wallet would be returned to you if it were found by a neighbor/the police/a stranger?" Possible responses were: "Very likely", "Fairly likely", "Not much likely", and "Not likely at all". The introduction of wallet questions into surveys was encouraged by experiments reported in Reader's Digest Europe in April 1996 (and subsequently discussed in the Economist, June 22, 1996). These experiments involved dropping 10 cash-bearing wallets in each of 20 cities in 14 western European countries, and in each of a dozen US cities (Helliwell and Wang, 2011). The data on the frequency of wallet returns were later used by Knack (2001) to provide some behavioral validation for the use of answers to the "Rosenberg question" on generalized trust. Knack (2001) found that at the national level the actual frequency of the returns correlated at the 0.65 ($p < 0.01$) level with national average responses to the general social or interpersonal trust question (as measured by the World Values Survey). While this provides strong validation for the meaningfulness of international differences in survey responses to social trust questions, it also suggests a way of adding more specific trust questions to surveys. Here we followed Knack (2001) and measured social trust based on the responses to the hypothesis that the wallet was found by a complete stranger. We reversed the scale, so that larger values indicate greater trust in unknown others.

Online social interactions are observed by means of a dichotomous variable capturing respondents' participation in SNS's such as Facebook and Twitter. To explore the relationship among subjective well-being, actual and virtual social capital, we adopted an ordered probit model with robust standard errors. Hence, if subjective well-being is ordered in 11 categories, then the resulting model is:

$$SWB_i = \begin{cases} 0 & \text{if } y_i \leq 0, \\ 1 & \text{if } 0 < y_i \leq c_1, \\ 2 & \text{if } c_1 < y_i \leq c_2, \\ \vdots & \\ 10 & \text{if } c_{10} < y_i. \end{cases} \quad (1)$$

where $0 < c_1 < c_2 < \ldots < c_{10}$;

the index i stands for individuals;

$SWB_i = \alpha + \beta_1 \cdot friends_i + \beta_2 \cdot trust_i + \beta_3 \cdot fb_i + \boldsymbol{\theta} \cdot \mathbf{X_i} + \epsilon_i, \epsilon_i \sim N(0,1)$

and c_{10} are unknown parameters to be estimated.

The list of control variables (X) includes the kind of technology available to the respondent to connect to the Internet along with individual's age (both in linear and squared form), gender, marital status, number of children, education, work status, and the time spent in commuting and watching television (in minutes).

As in Sabatini and Sarracino (2014), we control for commuting for two main reasons: first, the time spent on commuting may reduce the number of opportunities for social interactions; second, this measure may be considered as a proxy for spatial fragmentation which allows us to account for one of Putnam's claims on the detrimental effects of the spread of modern cities. In the author's words: "It is not simply time spent in the car itself, but also spatial fragmentation between home and workplace, that is bad for community life" (Putnam, 2000, pp. 213-214). Similarly, we included the time spent in front of the television because this can also be time in which people are distracted from social interactions. Moreover, previous studies have shown that TV watching is significantly and negatively associated with well-being (Frey et al., 2007; Bruni and Stanca, 2008), and social capital (Churchill Jr and Moschis, 1979; Kubey and Csíkszentmihályi, 1990).

Various studies have documented the importance of people's health for well-being (for a review, refer to Dolan et al., 2008). This literature documented that both physical and psychological health are strongly associated to SWB and identified various explanatory mechanisms to account for it (Shields and Price, 2005; Powdthavee, 2010). Moreover, the wide availability

of self-reported health in cross-sectional and panel data-sets fostered the analysis of the relationship with well-being and confirmed the strong correlation between health and happiness. Self-reported health is measured through the question "In general, would you say that your health is very good, good, fair, poor, or very poor?". Responses to this question have been one of the most frequently employed health indicators in economic and sociological health research since the 1950s (Maddox, 1962; Suchman et al., 1958; Garrity et al., 1978). The use of self-rated health as an indicator of objective health status spread in epidemiological and medical research when Mossey and Shapiro (1982) and Kaplan and Camacho (1983) demonstrated its strong association with mortality.

Table 1 provides a summary of descriptive statistics.

Table 1: Descriptive statistics

variable	mean	sd	min	max	obs
life satisfaction	7.190	1.680	0	10	77560
frequency of meetings with friends	5.104	1.466	1	7	78988
social trust	0.223	0.416	0	1	77723
wallet from stranger	1.623	0.726	1	4	77368
online networking	0.453	0.498	0	1	35282
women	0.521	0.500	0	1	79433
age	50.11	18.21	18	90	79433
age squared/100	28.43	19.07	3.240	81	79433
minutes spent commuting	18.67	12.32	0	57	36111
minutes spent watching TV	5.147	11.51	0	59	59924
marital status	–	–	1	4	79433
educational status	–	–	1	5	79433
occupational status	–	–	1	7	79433
number of children	1.011	1.009	0	7	79433
real GDP per capita (thousands €2005)	22.92	5.746	14.88	30.77	79433
region	–	–	10	200	79433
year	–	–	2010	2011	79433

2.1 Controlling for endogeneity

The coefficients from equation 1 indicate the sign and magnitude of partial correlations among variables. However, we cannot discard the hypothesis that our main explanatory variables are endogenous to subjective well-being. In particular, while the effect on well-being has been largely explored in the case of face-to-face interactions (Guiso et al., 2010), we do not have conclusive evidence about the endogenous relationship between online interactions and well-being. This weakness suggests extreme caution about the generality of the results so far provided by the literature. Individual effects such as personal characteristics may be correlated with both participation in SNSs and well-being. Happier people may also be more outgoing and open-minded, and may have a higher propensity for various kinds of social interaction. The inclusion of a wide set of control variables is intended to reduce the possible influence of omitted variables both at the individual and at the local level.

However, this is not enough to avoid the possible bias induced by reverse causality. For example, happy people may want to share their feelings or information about positive life events on online networks with their important persons. This is why just-married couples often upload pictures of their wedding ceremony on Facebook. On the other hand, lonely and/or unhappy individuals may want to use Facebook with the hope of improving their condition by establishing new relationships and sharing their feelings. For example, divorced people - who usually report severely low levels of happiness - may want to use online networking to find new mates and start a romantic relationship.

To deal with this problem, we turn to instrumental variables estimates using a two stage least squares (2SLS) model (Wooldridge, 2002) where, in the first stage, we instrument our two measures of online networking. A reliable instrumental variable must meet at least two criteria. The first requirement is the availability of a sound theoretical justification and of statistical evidence showing that the instrument is a good predictor of online networking ("relevance" condition), after controlling for all other exogenous regressors; the second one is that the instrument is uncorrelated with the error term of the two social capital equations ("orthogonality" condition).

We adopted two instruments that can be easily shown to be exogenous to subjective well-being (our dependent variable) and not driven by individuals' propensity for online networking (the main endogenous variable): 1) The share of the population for whom a DSL connection was available in

respondents' region of residence. DSL ("digital subscriber line", originally "digital subscriber loop") is a family of technologies that offers access to the Internet by exchanging digital data over the wires of a telephone network. Data are retrieved from the Italian Ministry of Economic Development. 2) The percentage of the region's area that is not covered by optical fiber, which represents a measure of digital divide. Optical fiber allows exchange of information over long distances and at higher bandwidths (data rates) than DSL, thus providing a fast Internet connection. Data are based on figures from the Italian Observatory on Broadband.

Both instruments were observed in 2008, two years before the first of the two waves of the Multipurpose Household Survey were collected. There are various reasons to believe that the 2008 level of regional DSL coverage is not *directly* correlated to the individual level of subjective well-being in the period 2010-11. The availability of DSL is a pre-condition for the individual choice to purchase a high-speed access and that may create room for the development of online interactions, which in turn may influence individual welfare in a variety of ways. Hence, we assume that the effect of broadband coverage on subjective well-being (and social capital) solely occurs through the use of social networking sites, chats, forums, newsgroups and similar forms of web-mediated communication.

Our assumption that the differences in the availability of DSL are exogenous to subjective well-being is derived from the environmental features of the Italian territory, which have played (and currently play) a major role in the development of Italy's infrastructures for accessing fast Internet. DSL technology is based on the transmission of data over the user's copper telephone line, i.e. over pre-existing voice telecommunications infrastructures. However, the availability of a telephone infrastructure is a necessary, but not sufficient, condition for the availability of broadband. What really matters is the so-called "local loop", i.e. the distance between final users' telephone line and the closest telecommunication exchange or "central office" (Grubesic and Horner, 2006; Grubesic, 2008; OECD, 2009; Falck et al., 2012; Czernich, 2012; Campante et al., 2013). For the supply of traditional voice services, the length of this distance does not affect the quality of the connection. This is why, before the advent of the Internet, the former state monopoly phone carrier did not pay any attention to local loops, whose length was entirely determined in accordance to the orographic features of the territory. However, this distance matters for the provision of fast Internet because the longer is the copper wire, the less bandwidth is available via this wire. In particular,

if the distance is beyond a threshold of approximately 4.2 kilometers (about 2.61 miles), then the band of the copper wires is not wide enough to allow a fast Internet connection (Grubesic, 2008; Czernich, 2012). In other words, it is impossible to implement the broadband connection through traditional copper wires. This is the case, for example, of Italian rural areas, which represent more than half of the Italian territory and comprise severely isolated and less densely populated highlands or hills. In 2007, a large part of these areas were characterized by a high length ($\geq$ 4.2 kilometers) of local loops, which ultimately is the result of the imperviousness of the territory. Therefore, in most cases, these areas lacked the necessary infrastructures for the diffusion of the DSL broadband (Ciapanna and Sabbatini, 2008; Agcom, 2011).

Hence, self-reported happiness in 2010-11 should not be correlated with the distribution of DSL infrastructures in 2008 because the latter strictly depends on local loops, whose location was determined many years before the rise of the Internet and based on the orographic features of the territory (Agcom, 2011; Campante et al., 2013). A comparison between a map illustrating the orographic characteristics of the Italian territory and a map showing broadband coverage in 2007 helps to better understand the extent to which broadband diffusion was determined by exogenous, orographic factors (see the maps in Appendix C).

To further check the validity of this instrument, we reviewed the literature and found that DSL coverage in the area of residence has never been found to be correlated with self-reported happiness. Bauernschuster et al. (2011) investigated the role of individuals' use of broadband on social interactions and cultural consumption. The availability of appropriate technological infrastructures in the area of residence was used by the authors to instrument the individual choice to purchase broadband access for connecting to the Internet. Similar instruments were used in municipality-level studies on electoral participation by Falck et al. (2012), Czernich (2012), and Campante et al. (2013). In Bauernschuster et al. (2011), broadband access was then shown to positively affect social interactions. This result is consistent with our estimates which, thanks to the wealth of our dataset, allow us to deepen our understanding of the role of the Internet in exploring how broadband availability affects subjective well-being via online networking and virtual and physical interactions (see Section 3). On the other hand, the DSL coverage in 2008 cannot of course be endogenous – in the sense of reverse causality – to individual self-reported happiness in 2010-2011.

The arguments supporting the assumption of the orthogonality of the share of the population covered by DSL are compelling for the second instrument. When, as explained above, the broadband connection cannot be implemented through pre-existing copper wires, it is necessary to turn to an optical fiber-based technology. The possibility and the costs of installing this type of infrastructure, however, even more strongly rely on the exogenous characteristics of the natural environment. Differently from DSL, in fact, optical fiber entails the need to install new cables underground. This involves excavation projects, which are much more costly and generally delay or even prohibit the provision of broadband in the area. Once again, orographic differences between regions must be considered as a "natural" cause of the digital divide which generated a variation in access to fast Internet across regions that is exogenous to people's well-being and cannot be driven by their preference for online networking. The assumption of orthogonality of the instruments is confirmed by the tests of over-identifying restrictions we run in the context of IV estimates (reported in Section 3).

For any given set of orographic characteristics of the area, the provision of broadband – whether through DSL or optical fiber technology – may also have been influenced by some socio-demographic factors that affected the expected commercial return on the provider's investment, such as population density, per capita income, the median level of education and the local endowments of social capital. To account for the eventual confounding effects of these features, we included regional GDP per capita in real euros of 2005, along with a set of regional and year fixed effects. However, we emphasize that an eventual correlation between the commercial return of the investments in fast Internet connections with well-being, on one side, and the instruments, on the other, does not raise any concern of confounding the causal interpretation. The reason is that the instruments do not determine the confounders, thus excluding the hypothesis of indirect causal mechanisms.

To perform 2SLS estimates with a dichotomous endogenous variable and a categorical dependent one, we used a multi-equation conditional mixed-process estimator as implemented by Roodman (2011). This technique allows us to adopt a probit model to correctly estimate the first step regression where SNS is regressed over the two instruments (and the control variables) and an ordered probit model to fit the second step where the dependent variable is life satisfaction.

Formally, the first step of the 2SLS model can be written as:

$$fb_i = \begin{cases} 0 & \text{if } y_i \leq 0, \\ 1 & \text{if } y_i > 0. \end{cases} \tag{2}$$

where $fb_i = \pi_1 + \pi_2 \cdot z_1 + \pi_3 \cdot z_2 + \boldsymbol{\pi_4} \cdot \mathbf{X_i} + \nu_i, \nu_i \sim N(0,1)$ and z_1 and z_2 are the two above-mentioned instruments.

The model of the second step is as follows:

$$SWB_i = \begin{cases} 0 & \text{if } y_i \leq 0, \\ 1 & \text{if } 0 < y_i \leq c_1, \\ 2 & \text{if } c_1 < y_i \leq c_2, \\ \vdots & \\ 10 & \text{if } c_{10} < y_i. \end{cases} \tag{3}$$

where $0 < c_1 < c_2 < \ldots < c_{10}$;

the index i stands for individuals;

$SWB_i = \alpha + \beta_1 \cdot friends_i + \beta_2 \cdot trust_i + \beta_3 \cdot \hat{fb}_i + \boldsymbol{\theta} \cdot \mathbf{X_i} + \epsilon_i, \epsilon_i \sim N(0,1)$

$\hat{fb}_i$ is the predicted probability of using SNS from the first step and c_{10} are unknown parameters to be estimated.

As in model 1 SWB is measured through the life satisfaction question; $\boldsymbol{\theta}$ is a vector of parameters of the control variables $\mathbf{X}$; β_3 is the coefficient of SNS use; $\hat{fb}_i$ is the instrumented SNS use and ϵ_i is the error term.

To double check the robustness of our estimates, we also test the relationship among our variables using a linear 2SLS model. Its results are reported in Appendix B.

The discussion about how the digital divide may influence SNSs is not trivial. There are, in fact, two ways in which the digital divide can influence individuals' propensity for online networking. On the one hand, it can be argued that the bigger the area covered by cable infrastructures, the higher should be the individual propensity for online networking. However, in areas where broadband access is not widely available, the use of social networking sites is a scarce commodity. In these places, the demand for broadband may be higher as consumers are keen to participate in SNSs with any available device. If this is the case, the individual propensity for networking should be positively correlated with the scarcity of the broadband.

The relevance of instruments will be further discussed in Section 4 (presenting the results of IV estimates) as it is strictly related to evidence from the first step of IV regressions.

Finally, to test for possible indirect effects of SNS on subjective well-being through actual social capital, we adopted the following structural equation model:

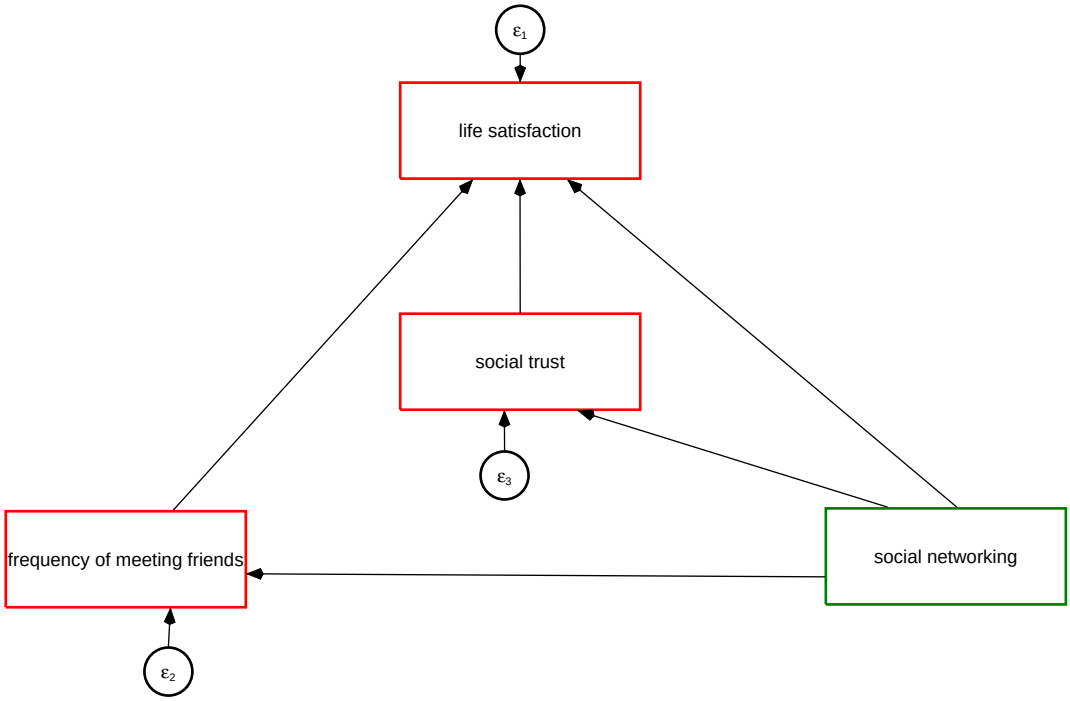

Figure 2: Structural equation model to estimate the direct and indirect effects of the use of SNS on subjective well-being.

The graphic representation of SEM follows the path analysis symbology. It reports the variables, their errors and the linkages connecting variables. These connections can be represented graphically by arrows and numerically by regression coefficients. Observed variables are inscribed in a rectangle. The causal nexus between two variables is represented by a straight arrow moving from the independent variable to the dependent variable. The absence of arrows indicates the hypothesis of the absence of linkages between

variables.

3 Partial correlations using ordered probit

We first report, in model 1, how the covariates correlate with the dependent variable. Life satisfaction is found to be significantly and negatively correlated with the time spent watching television. This result is consistent with previous studies analyzing the effect of television on individual happiness. Frey et al. (2007) interpret the negative relationship between television consumption and life satisfaction as a result of imperfect self-control and mispredicted utility. Bruni and Stanca (2008) argue that television viewing negatively affects individual well-being by harming and, to some extent, replacing relationships with other people. The relationship between life satisfaction and age follows an inverted-U shape curve. This result suggests that people's well-being decreases with age up to a minimum that, in our sample, corresponds to about 30 years. Afterwards, the relationship between well-being and age turns positive. This result is consistent with previous findings of the economic literature about the relationship between aging and well-being (Blanchflower and Oswald, 2008).

We also controlled for the kind of connection used by individuals to connect to the Internet (e.g. modem, DSL, fiber, satellite, etc.). As expected, none of them was found to have a statistically significant relationship with life satisfaction. Other socio-demographic controls, such as education, marital and work status have all the expected signs and are omitted from tables for the sake of brevity.

In model 2, we introduced the frequency of meetings with friends and social trust. Both variables are significantly and positively correlated with life satisfaction. Friendships improve life satisfaction in a number of ways, from the provision of social support in case of need to the pleasure of spending time together. This result is in line with the psychological literature considering relatedness as a basic human need (Deci and Ryan, 1991; Diener and Seligman, 2002), and with previous economic studies examining the role of relational goods in individual happiness (Becchetti et al., 2008; Bruni and Stanca, 2008; Sarracino, 2010; Bartolini et al., 2013).

The significant and positive coefficient of social trust, on the other hand, provides further support to empirical studies claiming the existence of a link between various forms of trust and life satisfaction across countries

Table 2: Relationship between SNSs and life satisfaction. Regressions with ordered probit.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
life satisfaction								
minutes spent commuting	-0.000892	-0.000632	-0.000670	-0.000907	-0.000691	-0.000665	-0.000704	-0.000680
	(-1.29)	(-0.94)	(-0.99)	(-1.29)	(-1.03)	(-0.99)	(-1.05)	(-1.01)
minutes spent watching TV	-0.00231***	-0.00251***	-0.00244***	-0.00232***	-0.00252***	-0.00240***	-0.00252***	-0.00240***
	(-3.97)	(-4.28)	(-4.15)	(-4.01)	(-4.37)	(-4.06)	(-4.36)	(-4.05)
women	0.0158	0.0290	0.0237	0.0135	0.0273	0.0224	0.0271	0.0222
	(0.89)	(1.62)	(1.32)	(0.75)	(1.47)	(1.23)	(1.47)	(1.22)
age	-0.0307***	-0.0280***	-0.0281***	-0.0319***	-0.0287***	-0.0290***	-0.0287***	-0.0290***
	(-7.32)	(-7.03)	(-6.95)	(-7.59)	(-7.23)	(-7.06)	(-7.25)	(-7.09)
age squared/100	0.0303***	0.0266***	0.0275***	0.0311***	0.0267***	0.0277***	0.0266***	0.0277***
	(5.90)	(5.49)	(5.57)	(6.13)	(5.51)	(5.51)	(5.53)	(5.53)
good health	-0.392***	-0.384***	-0.390***	-0.393***	-0.387***	-0.391***	-0.387***	-0.390***
	(-15.13)	(-14.83)	(-15.58)	(-15.18)	(-14.74)	(-15.87)	(-14.76)	(-15.89)
neither good nor bad health	-0.819***	-0.795***	-0.807***	-0.821***	-0.796***	-0.806***	-0.795***	-0.805***
	(-22.49)	(-20.93)	(-22.02)	(-22.40)	(-20.93)	(-22.34)	(-20.96)	(-22.36)
bad health	-1.187***	-1.163***	-1.176***	-1.189***	-1.168***	-1.177***	-1.167***	-1.176***
	(-12.43)	(-11.78)	(-11.63)	(-12.51)	(-11.84)	(-11.69)	(-11.84)	(-11.68)
very bad health	-0.912***	-0.873***	-0.896***	-0.917***	-0.880***	-0.900***	-0.879***	-0.898***
	(-3.82)	(-3.64)	(-3.74)	(-3.86)	(-3.70)	(-3.78)	(-3.68)	(-3.76)
modem	0.0480	0.0393	0.0426	0.0404	0.0319	0.0381	0.0325	0.0388
	(0.83)	(0.68)	(0.75)	(0.69)	(0.55)	(0.68)	(0.56)	(0.69)
dsl	-0.0126	-0.0220	-0.0203	-0.0154	-0.0249	-0.0205	-0.0241	-0.0196
	(-0.27)	(-0.47)	(-0.43)	(-0.33)	(-0.53)	(-0.43)	(-0.52)	(-0.42)
fiber	-0.0395	-0.0515	-0.0518	-0.0438	-0.0526	-0.0479	-0.0535	-0.0489
	(-0.51)	(-0.67)	(-0.65)	(-0.56)	(-0.68)	(-0.61)	(-0.69)	(-0.61)
satellite	0.0445	0.0274	0.0336	0.0417	0.0266	0.0341	0.0279	0.0356
	(0.66)	(0.41)	(0.51)	(0.63)	(0.40)	(0.51)	(0.42)	(0.54)
3G	-0.0804	-0.0878	-0.0909	-0.0823	-0.0812	-0.0889	-0.0797	-0.0873
	(-1.29)	(-1.44)	(-1.47)	(-1.33)	(-1.37)	(-1.45)	(-1.35)	(-1.42)
USB	-0.0374	-0.0486	-0.0442	-0.0418	-0.0522	-0.0456	-0.0517	-0.0451
	(-0.75)	(-0.98)	(-0.88)	(-0.84)	(-1.04)	(-0.90)	(-1.03)	(-0.89)
frequency of meetings with friends		0.0517***	0.0552***		0.0540***	0.0569***	0.0541***	0.0570***
		(8.58)	(9.27)		(8.54)	(9.36)	(8.59)	(9.42)
social trust		0.200***			0.200***		0.200***	
		(9.05)			(9.15)		(9.17)	
social trust (wallet question)			0.0873***			0.0866***		0.0866***
			(6.33)			(6.25)		(6.24)
online networking				-0.0412*	-0.0572*	-0.0492*	-0.0571*	-0.0490*
				(-1.77)	(-2.51)	(-2.12)	(-2.50)	(-2.11)
real GDP per capita (thousands €2005)							-0.0784	-0.0848
							(-1.42)	(-1.63)
cut1	-3.862***	-3.514***	-3.369***	-3.906***	-3.543***	-3.401***	-5.594***	-5.618***
	(-14.15)	(-13.85)	(-11.83)	(-14.23)	(-13.73)	(-11.87)	(-3.89)	(-4.15)
cut2	-3.718***	-3.367***	-3.223***	-3.762***	-3.397***	-3.255***	-5.447***	-5.472***
	(-14.33)	(-14.02)	(-11.84)	(-14.42)	(-13.89)	(-11.89)	(-3.80)	(-4.06)
cut3	-3.469***	-3.115***	-2.971***	-3.513***	-3.144***	-3.003***	-5.195***	-5.220***
	(-13.12)	(-12.56)	(-10.61)	(-13.22)	(-12.48)	(-10.66)	(-3.59)	(-3.83)
cut4	-3.235***	-2.879***	-2.735***	-3.279***	-2.908***	-2.768***	-4.959***	-4.985***
	(-12.28)	(-11.66)	(-9.77)	(-12.34)	(-11.55)	(-9.80)	(-3.44)	(-3.67)
cut5	-2.960***	-2.602***	-2.460***	-3.005***	-2.632***	-2.491***	-4.683**	-4.707***
	(-11.11)	(-10.38)	(-8.68)	(-11.15)	(-10.29)	(-8.74)	(-3.26)	(-3.48)
cut6	-2.403***	-2.039***	-1.898***	-2.447***	-2.069***	-1.929***	-4.120**	-4.146**
	(-9.22)	(-8.35)	(-6.84)	(-9.29)	(-8.30)	(-6.90)	(-2.87)	(-3.06)
cut7	-1.796***	-1.428***	-1.288***	-1.841***	-1.455***	-1.319***	-3.506*	-3.536**
	(-6.78)	(-5.75)	(-4.59)	(-6.89)	(-5.74)	(-4.66)	(-2.45)	(-2.62)
cut8	-0.920***	-0.546*	-0.408	-0.964***	-0.573*	-0.438	-2.624*	-2.655*
	(-3.50)	(-2.22)	(-1.47)	(-3.65)	(-2.28)	(-1.56)	(-1.84)	(-1.97)
cut9	0.121	0.500*	0.636*	0.0764	0.473*	0.606*	-1.578	-1.611
	(0.46)	(2.04)	(2.30)	(0.29)	(1.90)	(2.17)	(-1.10)	(-1.19)
cut10	0.777**	1.157***	1.293***	0.732**	1.130***	1.263***	-0.920	-0.954
	(2.99)	(4.77)	(4.71)	(2.79)	(4.56)	(4.55)	(-0.64)	(-0.71)
Observations	16965	16921	16921	16921	16976	16965	16976	16965
Pseudo R^2	0.026	0.029	0.028	0.026	0.030	0.028	0.030	0.028

t statistics in parentheses

* $p < 0.1$, ** $p < 0.01$, *** $p < 0.001$

(Bjørnskov, 2003, 2008) and at individual level (Helliwell, 2003; Helliwell et al., 2009; Helliwell and Wang, 2011). Bjørnskov (2003) suggests that the cross-country relationship between trust and well-being may be due to the higher economic growth rates generally connected to higher levels of social trust (see, for example, Knack and Keefer, 1997; Algan and Cahuc, 2010). In addition, social trust could help countries to successfully cope with external shocks, as suggested by recent studies on Japanese earthquakes (Yamamura, 2014; Yamamoto et al., 2011; Yamamoto and Sakamoto, 2012). The ability to cope successfully with external shocks could also help promote stability in the economy. This in turn may reduce economic uncertainty, further benefiting life satisfaction.

As expected, there is a significant and positive relationship between self-reported health and life satisfaction (the sign of the coefficients reported in Table 2 is negative because higher values of the health indicator correspond to worse self-reported well-being). Findings from medicine and psychology, in fact, suggest that happiness and attitudes towards life may be a key determinant of the somatization of feelings of stress and anxiety related to life events. More specifically, happiness may prevent the activation of physiological reactions to life events that could have cumulative detrimental effects on health (Frey, 2012). This claim is supported by the evidence that happy people live longer (Diener and Chan, 2011). On the other hand, health is undoubtedly an important determinant of subjective well-being. In addition to the obvious effect of poor health conditions on life satisfaction, being affected by a chronic disease may also influence subjective well-being through a reduction in the ability to meet others, to work, and to earn an income.

Models 4 to 6 show that there is a weakly significant and negative correlation between online networking and subjective well-being. This result is, per se, interesting, but it must be handled with caution due to the sources of potential endogeneity we described in the previous sections. On the one hand, the negative correlation seems to provide support to skeptical views suggesting that devoting too much time to online networking may undermine life satisfaction (e.g. Kross et al., 2013).

On the other hand, the results reported in Table 2 may be caused by the fact that individuals who are socially anxious and less satisfied with their life are more likely to use online networks to reduce their loneliness. As stressed in Kross et al. (2013), shy and socially anxious individuals tend to feel more comfortable maintaining social relationships in online settings rather than in face-to-face settings (Steinfield et al., 2008). In other terms, people may use Facebook to a larger extent when they feel bad (e.g. lonely, bored, or tired). The negative relationship between online networking and subjective well-being may thus be due to the negative feelings potentially associated with higher levels of online networking. This could be the case, for example, of hikikomori, i.e., people who chose withdrawal from social life as a way to cope with social anxiety disorders. Before the advent of online networks, hikikomori had no relevant social interaction. With the advent of the Internet, psychologists have observed resurgence in the social relationships of hikikomori, who generally tend to have numerous online interactions with others (Kato et al., 2012).[1]

In addition, other confounding factors may bias both the dependent and the independent variables in our regressions. For example, the number of Facebook friends, the perceived supportiveness of users' online and physical social environment, the presence of depressive symptoms (such as low self-esteem) may also play a role. Hence we turn to instrumental variables (IV) described in section 2 to effectively tackle endogeneity issues.

[1]The Japanese term hikikomori refers to young people who have withdrawn from social life and have had no relationships outside of the family for a period of more than six months. After its rise in Japan, this phenomenon has been increasingly observed in other developed and developing countries (Kato et al., 2012). Hikikomori do not work or participate in any form of education and frequently remain in their homes for protracted periods of time - sometimes for years. From a psychological perspective that has long dominated public thinking in Japan, hikikomori suffer from a cognitive malfunction. The sociological perspective, however, advances a more interesting interpretation of the phenomenon, as a form of anomie related to the nature of family relations and a breakdown in social and labor opportunity structures. In other words, the phenomenon can also be viewed as a reaction to the "relational poverty" of the social environment and to the lack of proper opportunities of social and labor participation (Furlong, 2008). According to Kaneko (2006), the social withdrawal of hikikomori may be understood as a reaction to time pressures and role performances in modern societies.

4 Instrumenting the use of SNS's

Our IV approach uses the percentage of the population for whom DSL connection was available in respondents' area of residence in 2008 and the percentage of the region's area that was not covered by optical fiber in 2008 as instruments for the individual propensity for online networking in the period 2010-2011. Table 3 reports IV estimates of the determinants of life satisfaction. The statistical insignificance of online networking suggests that, even if participation in SNSs is correlated with lower satisfaction, it may hardly be considered as a cause of decreasing well-being, per se. The first stage of IV estimates, along with the test of the joint significance of coefficients, confirms the relevance of instruments.

Online networking loses its significance, whereas social trust and the frequency of meetings with friends are confirmed to be strong predictors of life satisfaction. IV estimates suggest that the significant and negative correlation between online networking and life satisfaction found in ordered probit regressions was spurious and possibly dictated by confounding factors. This finding provides further support to Helliwell and Huang (2013), who found that "real-life social networks" positively contribute to self-reported happiness, while the size of online networks is not a relevant predictor of subjective well-being.

Table 3: Life satisfaction and online networking: IV estimates using CMP

	without social capital	with social capital
life satisfaction		
online networking	-0.0120	-0.0408
	(-0.20)	(-0.54)
real GDP per capita (thousands €2005)	-0.00142	-0.00116
	(-0.92)	(-0.74)
frequency of meetings with friends		0.0586***
		(6.41)
social trust		0.222***
		(12.41)
online networking		
optic fiber (%)	0.00501**	0.00502**
	(3.04)	(3.05)
broadband coverage	0.00732***	0.00732***
	(3.56)	(3.55)
women	-0.125***	-0.125***
	(-5.75)	(-5.73)
age	-0.0651***	-0.0651***
	(-8.30)	(-8.29)
age squared/100	0.0297**	0.0296**
	(3.21)	(3.21)
N	16921	16921
F_stat	14.95	14.94
J_stat	1247.8	1423.4
chi2	2971.1	3196.7

t statistics in parentheses

Regressions include socio-demographic and year controls.

Variables have been omitted for brevity and are available upon request.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

Table 4: Life satisfaction and online networking: IV estimates using CMP

	without social capital	with social capital
life satisfaction		
online networking	-0.0120	-0.0381
	(-0.20)	(-0.50)
real GDP per capita (thousands €2005)	-0.00142	-0.00127
	(-0.92)	(-0.81)
frequency of meetings with friends		0.0606***
		(6.64)
social trust (wallet question)		0.0950***
		(7.87)
online networking		
optic fiber (%)	0.00501**	0.00503**
	(3.04)	(3.05)
broadband coverage	0.00732***	0.00732***
	(3.56)	(3.56)
women	-0.125***	-0.125***
	(-5.75)	(-5.73)
age	-0.0651***	-0.0651***
	(-8.30)	(-8.27)
age squared/100	0.0297**	0.0296**
	(3.21)	(3.20)
N	16921	16921
F_stat	14.95	14.99
J_stat	1247.8	1374.0
chi2	2971.1	3091.9

t statistics in parentheses

Regressions include socio-demographic and year controls.

Variables have been omitted for brevity and are available upon request.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

5 The indirect effect of SNS's on well-being

In order to disentangle the drivers of this correlation, we estimated the structural equation model described in Figure 3:

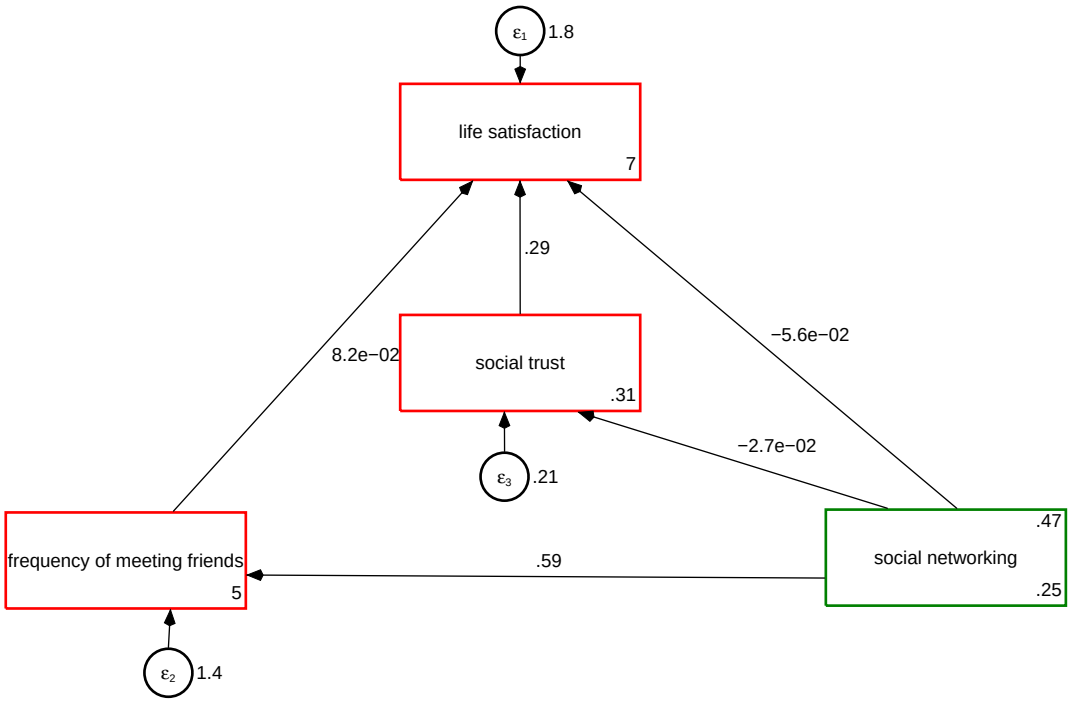

Figure 3: Direct and indirect effects of the use of SNSs on subjective well-being.

In this model, we simultaneously estimated the effect of online networking on subjective well-being, on social trust, and on the frequency of meetings with friends jointly with the effect of the latter two dimensions on happiness. This empirical strategy allows us to understand whether online networking, per se, impacts life satisfaction, or if the effect on happiness is mediated by the impact of online participation on users' social capital.

Formally, we follow the conventional practice of indicating endogenous variables with η and exogenous variables with ξ. Error terms are indicated with the symbol ζ. The subjective well-being of individual j can be expressed,

Table 5: Indirect effects of the use of SNS on life satisfaction using SEM.

frequency of meetings with friends		
online networking	0.593***	(31.86)
Constant	5.010***	(115.13)
life satisfaction		
frequency of meetings with friends	0.0821***	(9.36)
social trust	0.291***	(8.40)
online networking	-0.0561**	(-2.03)
Constant	7.022***	(137.35)
social trust		
online networking	-0.0271**	(-3.28)
Constant	0.308***	(22.69)
var(freq. of meetings with friends)	1.418***	(65.43)
var(life satisfaction)	1.782***	(52.71)
var(social trust)	0.208***	(39.92)
cov(freq. of meetings with friends, social trust)	0.00249	(0.50)
Observations	16921	
Indexes of goodness of fit		
Chi-squared	(model vs. saturated)	0.218
Size of residuals	SRMR	0.001
Baseline comparison		
CFI	1.000	Comparative fit index
TLI	1.003	Tucker-Lewis index

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

in a reduced form, as:

$$\eta_j = \alpha + B \cdot \eta_j + \Gamma \cdot \xi_j + \zeta_j \tag{4}$$

where α is an intercept vector, B is a matrix of structural parameters governing the relations among the endogenous variables, Γ a regression parameter matrix for regressions of endogenous variables on exogenous explanatory variables and ζ_j a vector of disturbances. More specifically, in the model presented in this section, we only estimate a limited number of parameters as reported in Table 5. Modification indexes were used to add or subtract parameters one at a time in order to achieve better fit to the data.

Modification indexes take all values lower than 3.84, thus confirming the goodness of current model. The estimates suggest that using SNS reduces trust in others by 2.7% and on average it increases the frequency of meetings with friends by 8.42%. Both social trust and the frequency of meetings with friends are in turn strongly and positively correlated with subjective well-being. This result suggests that the influence of online networking may indirectly affect individual welfare in two opposite ways: negatively, through a reduction in social trust, and positively, through the support of face-to-face interactions. The indirect effect of SNS on well-being mediated by social trust is about -0.07%, whereas the effect mediated by meetings with friends is about 0.68%, with a total indirect effect of about 0.57%.

However, if we also account for the direct negative effect of SNS use on life satisfaction, then the total net effect is negative and amounts to about -0.15%. Goodness of fit measures are reported at the bottom of Table 5. Measures of the model's goodness of fit are a function of the residual, i.e. the difference between the empirical variance-covariance matrix and the model created variance-covariance matrix. It is possible to show that, if the model fits the data, the fitting statistic follows a χ^2 with df degrees of freedom, where $df = \frac{1}{2} \cdot (p+q) \cdot (p+q-1) - t$, p is the number of endogenous variables, q is the number of exogenous variables, and t is the number of estimated parameters (Bonett and Bentler, 1983). Following the established approach in the SEM practice (see, for example, Raykov and Marcoulides, 2000; Schumacker and Lomax, 2010; Kline, 2005), we first evaluate the model's goodness of fit by comparing the residual function for the model with critical values reported in χ^2 distribution tables with a probability $p = 0.100$. The value for model 4 is 0.218, significantly lower than the critical value for χ^2 with 2 degrees of freedom. This suggests that the difference between the two

variance-covariance matrixes is stochastic in nature and is not due to the inappropriateness of the theoretical model. However, as according to Bollen (1989) and Kline (2005), the model chi-square may be affected by large sample size, we also report alternative model fit indexes i.e. the standardized root mean square (SRMS), the comparative fit index (CFI), and the Tucker-Lewis index (TLI), which all have satisfactory values.

Since the model chi-square is affected by sample size, following Kline (2005), we divide its value by the degrees of freedom of the model, obtaining the Normed Chi Square (NC). According to Bollen (1989), values of the NC between 2.0 and 5.0 indicate reasonable fit, and the NC does not completely correct for the influence of the sample size (Kline, 2005). In general, as the sample size gets larger, the reliability of overall fit measures is reduced. In addition, it must be noted that values of fit indexes only indicate the average or overall fit of a model, and that it is possible that some parts of the model poorly fit the data even if the value of a particular index seems favorable (Kline, 2005). It thus seems reasonable in our case to focus on the significance of estimates' coefficients.

Overall, the SEM analysis reveals that the significantly negative correlation between online networking and subjective well-being may result from the combination of three main drivers:

1. An indirect positive effect due to the positive correlation between online networking and face-to-face interactions, which in turn positively affect well-being.

2. An indirect negative effect due to the negative correlation between online networking and social trust, which in turn positively affects well-being.

3. A direct negative effect of online networking on subjective well-being.

The positive effect of online networking on face-to-face interactions is in line with previous findings from the applied psychology literature (Steinfield et al., 2008). Apparently, social networking sites play a positive role in helping Internet users to preserve their relationships against the threats posed by busyness and distance. The asynchronous interactions that take place, for example, through the exchange of Facebook messages and the publication and commenting on thoughts and photos shared by users, allow individuals to stay in touch with their important persons even when time and distance constraints prevent the arrangement of physical meetings (Antoci et al., 2013).

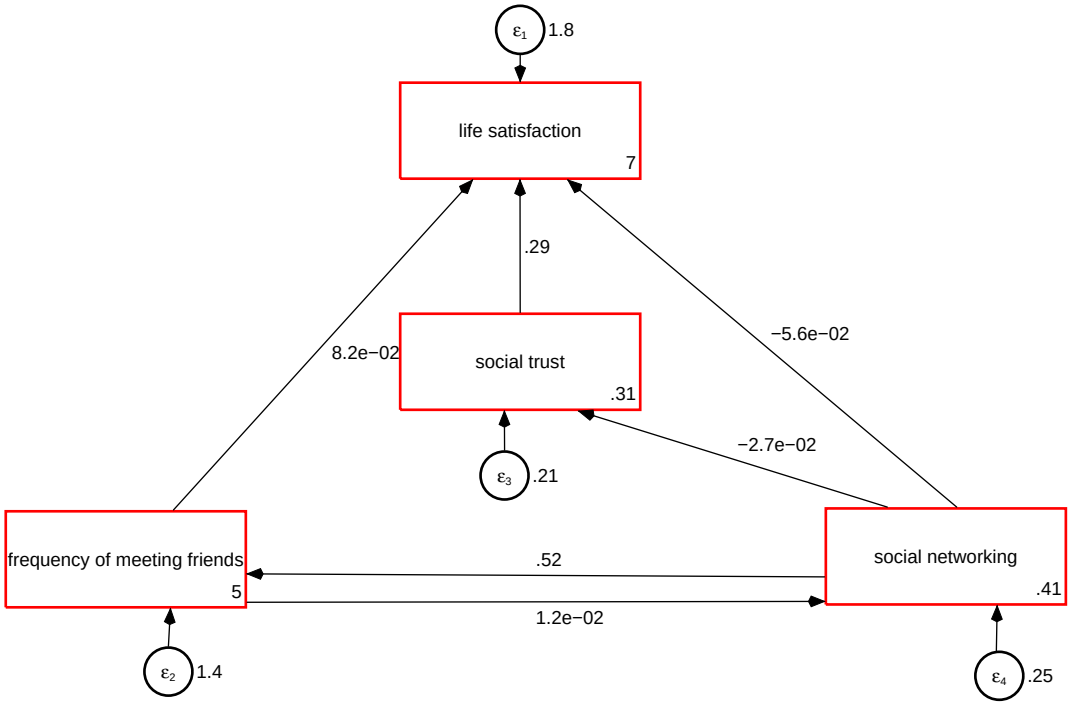

Figure 4: Direct and indirect effects of the use of SNS on subjective well-being accounting for the effect of meeting friends on the use of SNSs.

Ellison et al. (2007) suggested that Internet-mediated communication also helps to lower barriers to interaction and encourage self-disclosure, favoring the "activation" of latent ties which might otherwise remain ephemeral, for example between users' friends or acquaintances of their friends or acquaintances with whom they may have things in common.

The negative relationship of online networking with social trust, on the other hand, partly contradicts the previous literature on the topic. This may be due to the fact that empirical studies finding moderate and positive effects of Facebook use on trust in others commonly drew on very limited – and to a certain extent biased – samples, in most cases composed of small communities of undergraduate students enrolled in specific American colleges (e.g. Ellison et al., 2007; Steinfield et al., 2008). The "radius" of trust that college students may have in mind when responding to the trust question is likely to be relatively limited – and basically referred to their peers. In our study, we account for a large nationally and regionally representative sample of the Italian population, where the radius of trust is likely to be higher than that of students attending a specific college (see, for example, Welch et al., 2007; Delhey et al., 2011).

The detrimental effect on trust in others may be interpreted as a consequence of users' interaction with unknown people on Facebook, Twitter, and commenting platforms such as Disqus. These platforms, in fact, create rooms for discussion in which selection mechanisms are weak or absent, differently from what happens in face-to-face interactions where we usually select a narrow circle of well-known friends and acquaintances to discuss political and moral issues. The Facebook page of a newspaper, for example, gathers a very heterogeneous audience who can comment on news and op-ed articles without moderation. Threads in these pages often allow the development of endless online discussions – that are generally encouraged by the pages' managers and by the platform itself, as they bring more visitors and "clicks" – in which individuals are forced to "meet" strangers, and often happen to encounter a wide variety of points of view. For example, followers of a left-wing party may easily find themselves involved in a non-friendly discussion with supporters of an extreme right movement. Empirical studies have shown that, at least in the short run, diversity along ethnic, religious, age, and socio-economic status lines may be a powerful source of frustration and distrust towards unknown others (Alesina and La Ferrara, 2002; Christoforou, 2011).

In online discussions with unknown others, individuals often exhibit a higher propensity for aggressive behavior than in face-to-face interactions.

In addition, online conversations are more vulnerable to incomprehension and misunderstandings. In our Italian case study, the rising practice of hate speech, jointly with Facebook's increasing failures in identifying and removing it, suggests that unfriendly Internet-mediated communication with strangers may be an important channel of destruction of social trust (Sabatini and Sarracino, 2014).

Worries about hate speech have been recently stressed by the action of organizations advocating against gender-based discrimination (e.g. Women, Action and The Media, and The Everyday Sexism Project) and of groups which have historically faced discrimination in society - including for example representatives from the Jewish, Muslim, and LGBT communities - that prompted a rethinking of Facebook's moderation policy. In a note published on May 28, 2013, a Facebook manager stated that, even if the platform prohibits "Content deemed to be directly harmful", it intentionally allows "content that is offensive or controversial" with the aim of defending the principles of freedom of self-expression on which Facebook is founded. Harmful content is defined "as anything organising real world violence, theft, or property destruction, or that directly inflicts emotional distress on a specific private individual (e.g. bullying)", while no definition is provided for "offensive and controversial" content. To cope with hate speech issues, Facebook recently promised "to review and update guidelines, improve moderators' training, establish more formal lines of communication with advocacy groups and increase accountability of the creators of content which is cruel or insensitive but does not qualify as hate speech".

On the other hand, SEM estimates also point out that SNS use may have a direct detrimental effect on well-being. Some authors have suggested that, even if the use of Facebook and Twitter may ultimately support face-to-face encounters, the quality of Internet-mediated interactions is intrinsically lower. According to Valkenburg and Peter (2007), "Because online contacts are seen as superficial weak-tie relationships that lack feelings of affection and commitment, the Internet is believed to reduce the quality of adolescents' existing friendships and, thereby, their well-being" (p. 1170). Song et al. (2014) suggest that the Internet operates as a more attractive – but ultimately leaner and less satisfying – medium for human interaction, thereby leading users to feel an increased sense of loneliness. However, the empirical evidence has so far not provided convincing support for these claims and further investigations are needed.

6 Conclusions

In this paper, we carried out the first empirical analysis of the relationship between online networking and subjective well-being in a large and representative sample. We first analyzed the correlation among variables using ordered probit models. We found the existence of a significantly negative correlation. We then addressed endogeneity in individuals' propensity for online networking by exploiting regional technological characteristics of the preexisting voice telephony network that exogenously determined the availability of broadband for accessing high-speed Internet. We illustrated how the distribution of these technological infrastructures basically depends on the orographic features of the territory.

When we addressed causality in IV estimates, the significance of the correlation between participation in social networking sites and subjective well-being disappeared. Interestingly, ordered probit and IV estimates showed that face-to-face interactions and social trust are strongly and positively associated with well-being.

To disentangle the direct effect of SNS use from the change in well-being that may be caused by SNSs' impact on trust and sociability, we turned to a structural equations model. We found that online networking plays a positive role in subjective well-being through its impact on physical social interactions. On the other hand, SNS use is associated with lower social trust, which is in turn positively correlated with subjective well-being. The overall effect of networking on individual welfare identified by the structural equations model is significantly negative. These results are in line with Sabatini and Sarracino (2014), who found that participation in SNS might destroy social trust, and with Helliwell and Huang (2013), who found that face-to-face interactions are positively associated with happiness, while online networks are not.

The cross-sectional nature of the data employed in this study certainly suggests caution in the interpretation of findings, which may result from spurious correlations. However, the study contributes to the literature on Internet use and subjective well-being in a number of ways. This is the first empirical investigation of the relationship between Internet use and subjective well-being that explicitly accounted for the way in which the Internet is actually used, with a specific focus on social networking sites such as Facebook and Twitter. In addition, this is the first time that the role of online networks is addressed in a large nationally and regionally representative

sample. Finally, this is the first time these issues have been addressed in a Mediterranean country.

The role of online networks in the development of interpersonal relationships and in the preservation of social cohesion suggests that individuals and communities who do not have access to the Internet – due, for example, to the absence of DSL or fiber infrastructures, or to lack of the skills required to participate in SNSs – may increasingly suffer from difficulties in social integration. From this point of view, the digital divide is likely to become an increasingly important factor of social exclusion, which may exacerbate inequalities in well-being and capabilities. A straightforward policy implication of this issue is that public institutions should ensure equal opportunities for connecting to fast Internet across regions (e.g. urban vs. rural), age cohorts, and social classes.

On the other hand, online networking exposes individuals to the risk of worsening people's trust in others and therefore people's life satisfaction. This finding suggests the need to update social networking sites' policies against hate speech and aggressive behaviors, as already requested by a growing number of advocacy groups, particularly focusing on gender- or race-based hate.

A Life satisfaction across Italian regions

Table 6: Average life satisfaction in 2010 and 2011

Region	2010	2011
Abruzzo	7.208	7.119
Basilicata	7.187	7.226
Calabria	7.175	7.279
Campania	6.756	6.883
Emilia Romagna	7.280	7.208
Friuli Venezia Giulia	7.283	7.282
Lazio	7.063	6.957
Liguria	7.258	7.326
Lombardia	7.365	7.231
Marche	7.178	7.226
Molise	7.228	7.223
Piemonte-Valle d'Aosta	7.306	7.243
Puglia	6.999	7.091
Sardegna	7.165	7.097
Sicilia	7.030	7.075
Toscana	7.187	7.136
Trentino Alto Adige	7.784	7.734
Umbria	7.200	7.089
Veneto	7.313	7.161

B OLS estimates

Table 7: Relationship between SNSs and life satisfaction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
minutes spent commuting	-0.00121	-0.000870	-0.000918	-0.00123	-0.000937	-0.000908	-0.000948	-0.000920
	(-1.46)	(-1.08)	(-1.13)	(-1.46)	(-1.16)	(-1.13)	(-1.18)	(-1.15)
minutes spent watching TV	-0.00293***	-0.00317***	-0.00308***	-0.00293***	-0.00316***	-0.00304***	-0.00316***	-0.00304***
	(-4.26)	(-4.61)	(-4.45)	(-4.28)	(-4.67)	(-4.35)	(-4.67)	(-4.35)
women	0.0163	0.0333	0.0267	0.0132	0.0310	0.0251	0.0309	0.0250
	(0.72)	(1.47)	(1.18)	(0.58)	(1.33)	(1.09)	(1.33)	(1.08)
age	-0.0399***	-0.0360***	-0.0362***	-0.0414***	-0.0369***	-0.0374***	-0.0369***	-0.0374***
	(-6.53)	(-6.13)	(-6.09)	(-6.77)	(-6.26)	(-6.19)	(-6.28)	(-6.20)
age squared/100	0.0404***	0.0352***	0.0364***	0.0414***	0.0353***	0.0367***	0.0352***	0.0366***
	(5.40)	(4.96)	(5.01)	(5.58)	(4.95)	(4.97)	(4.96)	(4.98)
good health	-0.447***	-0.435***	-0.442***	-0.448***	-0.438***	-0.443***	-0.438***	-0.443***
	(-13.90)	(-13.66)	(-14.31)	(-13.89)	(-13.60)	(-14.64)	(-13.63)	(-14.67)
neither good nor bad health	-1.007***	-0.970***	-0.987***	-1.009***	-0.970***	-0.985***	-0.969***	-0.984***
	(-26.31)	(-24.26)	(-25.74)	(-26.21)	(-24.29)	(-26.20)	(-24.35)	(-26.25)
bad health	-1.599***	-1.558***	-1.577***	-1.602***	-1.563***	-1.578***	-1.562***	-1.577***
	(-10.75)	(-10.12)	(-10.05)	(-10.78)	(-10.15)	(-10.07)	(-10.14)	(-10.06)
very bad health	-1.190**	-1.133**	-1.164**	-1.196**	-1.141**	-1.168**	-1.140**	-1.167**
	(-3.82)	(-3.63)	(-3.74)	(-3.86)	(-3.71)	(-3.79)	(-3.70)	(-3.78)
modem	0.0659	0.0546	0.0589	0.0569	0.0454	0.0527	0.0459	0.0533
	(0.80)	(0.66)	(0.73)	(0.68)	(0.55)	(0.65)	(0.55)	(0.66)
dsl	-0.00315	-0.0149	-0.0130	-0.00609	-0.0182	-0.0137	-0.0176	-0.0130
	(-0.05)	(-0.22)	(-0.19)	(-0.09)	(-0.28)	(-0.21)	(-0.27)	(-0.20)
fiber	-0.0140	-0.0288	-0.0291	-0.0190	-0.0300	-0.0246	-0.0307	-0.0254
	(-0.15)	(-0.31)	(-0.31)	(-0.20)	(-0.33)	(-0.26)	(-0.33)	(-0.27)
satellite	0.0791	0.0571	0.0647	0.0761	0.0561	0.0648	0.0572	0.0660
	(0.87)	(0.63)	(0.72)	(0.85)	(0.63)	(0.72)	(0.64)	(0.73)
3G	-0.0975	-0.106	-0.110	-0.0992	-0.0980	-0.108	-0.0968	-0.107
	(-1.28)	(-1.43)	(-1.46)	(-1.30)	(-1.37)	(-1.45)	(-1.36)	(-1.43)
USB	-0.0407	-0.0548	-0.0495	-0.0459	-0.0591	-0.0516	-0.0588	-0.0512
	(-0.57)	(-0.77)	(-0.69)	(-0.64)	(-0.83)	(-0.72)	(-0.82)	(-0.71)
frequency of meetings with friends		0.0695***	0.0739***		0.0721***	0.0760***	0.0721***	0.0761***
		(8.72)	(9.36)		(8.70)	(9.44)	(8.74)	(9.48)
social trust		0.250***			0.250***		0.250***	
		(9.40)			(9.56)		(9.57)	
social trust (wallet question)			0.111***			0.110***		0.110***
			(6.68)			(6.63)		(6.62)
online networking				-0.0521*	-0.0723*	-0.0624*	-0.0721*	-0.0622*
				(-1.85)	(-2.66)	(-2.25)	(-2.65)	(-2.24)
real GDP per capita (thousands €2005)							-0.0605	-0.0686
							(-0.86)	(-1.03)
Constant	8.510***	8.004***	7.832***	8.566***	8.040***	7.871***	9.622***	9.665***
	(28.50)	(28.94)	(25.15)	(28.75)	(28.61)	(25.06)	(5.23)	(5.53)
Observations	16965	16921	16921	16921	16976	16965	16976	16965
Adjusted R^2	0.078	0.089	0.086	0.079	0.089	0.086	0.089	0.086

t statistics in parentheses

* $p < 0.1$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Causal effect of the use of SNSs on life satisfaction using 2SLS estimates.

	with trust	with wallet
online networking	-2.244	-2.299
	(-1.26)	(-1.18)
frequency of meetings with friends	0.135**	0.142**
	(2.61)	(2.48)
social trust	0.306***	
	(8.11)	
minutes spent commuting	-0.000980	-0.00107
	(-0.81)	(-0.87)
minutes spent watching TV	-0.00263**	-0.00242**
	(-2.66)	(-2.35)
women	-0.0480	-0.0572
	(-0.58)	(-0.64)
age	-0.0868**	-0.0875*
	(-2.12)	(-1.95)
age squared/100	0.0584**	0.0600**
	(2.85)	(2.64)
good health	-0.466***	-0.477***
	(-11.47)	(-11.28)
neither good nor bad health	-0.962***	-0.986***
	(-25.68)	(-27.95)
bad health	-1.623***	-1.650***
	(-9.29)	(-9.23)
very bad health	-1.291***	-1.341***
	(-4.06)	(-4.21)
modem	-0.235	-0.238
	(-0.84)	(-0.79)
dsl	-0.0802	-0.0800
	(-0.72)	(-0.68)
fiber	-0.0228	-0.0186
	(-0.20)	(-0.16)
satellite	0.0105	0.0190
	(0.08)	(0.15)
3G	-0.0954	-0.0977
	(-1.07)	(-1.07)
USB	-0.191	-0.190
	(-1.12)	(-1.04)
social trust (wallet question)		0.0862**
		(2.26)
Constant	9.505***	9.405***
	(6.87)	(5.93)
Observations	16921	16921

t statistics in parentheses

Regressions include socio-demographic and year controls.

Variables have been omitted for brevity and are available upon request.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

C Orography and broadband in Italy

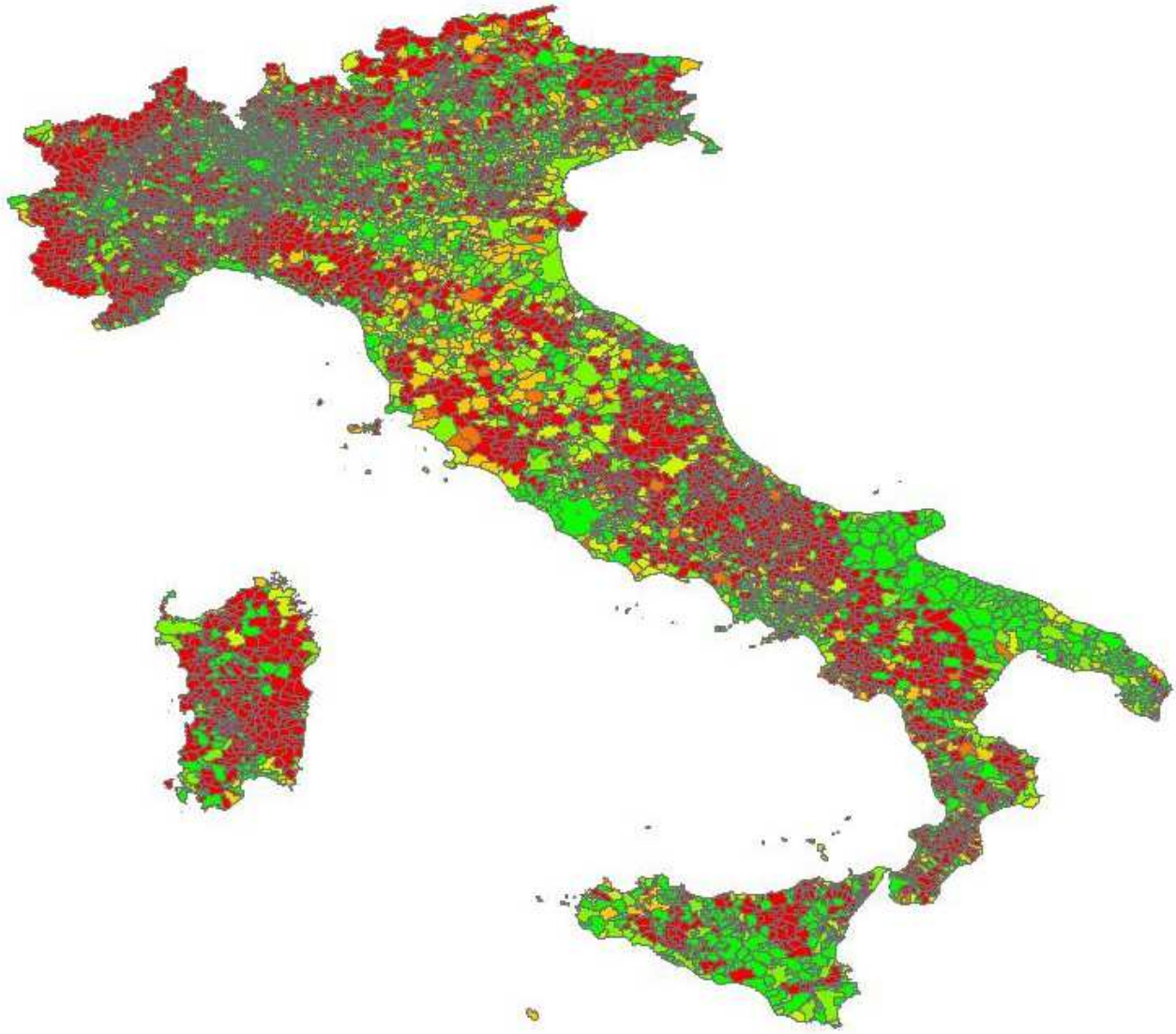

Figure 5: Percentage of the population covered by broadband in Italy. Source: Between (2006), p. 17. Darker areas are those with the worst coverage. Green areas have the best coverage.

Figure 6: Topographic map of Italy.

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