The relationship between happiness and health: evidence from Italy

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Abstract

We test the relationship between happiness and self-rated health in Italy. The analysis relies on a unique dataset collected through the administration of a questionnaire to a representative sample (n = 817) of the population of the Italian Province of Trento in March 2011. Based on probit regressions, instrumental variables estimates and structural equations modelling, we find that happiness is strongly correlated with perceived good health, after controlling for a number of relevant socio-economic phenomena. Health inequalities based on income, work status and education are relatively contained in respect to the rest of Italy. As expected, this scales down the role of social capital.

Keywords: cooperative enterprises; happiness; health; instrumental variables; Italy; life satisfaction; non-profit; social capital; structural equations modelling.
JEL Codes: I12; I18; Z1

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1. Introduction

Emotional states such as happiness and attitudes towards life are seen as a key determinant of the somatization of feelings of stress and anxiety related to life events. Findings from medicine and psychology have shown that emotional reactions to life events can affect physiology in ways that are potentially damaging or beneficial for health (Ekman et al. 1983; Levenson et al. 1991; Levenson et al. 1992; Collet et al. 1997). In recent years, several studies have advanced the claim that happiness or, more generally, positive attitudes towards life can predict longevity and other indicators of physical well-being among healthy populations (Scheier and Carver 1992; Heliwell 2002; Levy et al. 2002; Lyubomirsky et al. 2005; Bjørnskov 2008)[5]. According to Veenhoven (2008), the size of the effect appears to be so strong to be comparable to that of smoking or not.

Seminal studies pointed at the autonomic nervous system (ANS) as the main channel of transmission of the effects of happiness on health (Ekman et al. 1983; Levenson et al. 1991; Levenson 1992). Unpleasant life events such as a job loss, for example, cause a negative emotional response (Clark and Oswald 1994) which can significantly influence the functioning of the ANS. Numerous studies have shown that ANS responses to emotional states may activate physiological reactions that could have cumulative effects on health (Fredrickson and Levenson 1998; Glassman and Shapiro 1998; Carney et al. 2005). For example, in individuals with intensely negative emotional responses and slow return to a tranquil baseline, the ANS could prompt cardiovascular activity that accelerates certain pathologies such as atherosclerosis (Krantz and Manuck 1984; Kubzansky and Kawachi 2000; Stewart et al. 2007). By contrast, more rare negative reactions and/or rapid returns to a calm baseline could have beneficial effects on health.

In summary, happiness and positive attitudes towards life may prevent the autonomic nervous system from activating physiological responses that could have cumulative detrimental effects on health. This mechanism may be a reason to expect "positive thinking people", who declare themselves to be happy, to exhibit better health conditions.

Besides psychosomatization, the literature has mentioned other transmission mechanisms connecting happiness to health. Happy people are more inclined to act healthy. They engage in sports more often (Rasciute and Downward 2010), and they are more likely to watch their weight (Veenhoven 2008). Moreover, happy people may be more likely to avoid unhealthy behaviours such as smoking, drinking and overeating.

In this paper, we aim to test the possible relationship between happiness and self-reported health, after controlling for the influence of a number of economic and social phenomena, such as economic well-being, work status and education. Particular attention is devoted to the role of structural and cognitive social capital, which have often been found to be strongly and positively associated with good health (Brown et al. 2006, De Silva et al. 2007; Engström et al. 2008; d'Hombres et al. 2010; Fiorillo and Sabatini 2011a, 2011b; Ronconi et al. 2011).

To reach our goal, we rely on a unique dataset collected through the administration of a questionnaire to a representative sample ($n = 817$) of the population of the Italian Province of Trento in March 2011[6]. The sample was stratified by age, gender and area of residence. The questionnaire was specifically designed for the evaluation of various aspects of well-being at the individual level.

Our choice to focus on the Province of Trento was due to results from recent empirical studies which found the territory to be characterized by contained inequalities (including health disparities), as well as by exceptional levels of well-being, social capital and entrepreneurial diversity (Degli Antoni 2006, 2009; Fiorillo 2008; Sabatini 2008a, 2009a; Villa and Zola 2008). In our view, three main reasons make this case study worthy of attention in the health economics literature. First, the low level of health inequalities and the extension of the public healthcare system allow us to carry

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[5] See Veenhoven (2008) for a comprehensive review of the literature on the topic.

[6] The questionnaire was administered through computer assisted telephone interviewing by the Technical Unit of the Department of Sociology and Social Research of the University of Trento.

out a better assessment of the behavioural determinants of health. Also, the exceptional wealth of social capital which previous studies attribute to the Province of Trento should help in isolating the possible role of happiness: if most citizens are endowed with high levels of social capital, we should be less likely to find social capital-based health disparities in the sample.

Third, since the Province of Trento hosts an exceptional number of cooperative enterprises, it is interesting to test whether there is a relationship between participation in these kinds of enterprises and individual health. Specific types of cooperatives – i.e. social cooperatives – operate in the health and social assistance sectors. Their actions have been associated with beneficial effects in terms of social cohesion and individual and collective well-being (Sabatini 2008b).

Based on a probit analysis, instrumental variables (IV) estimates and structural equations models (SEM), we find that happiness is strongly correlated with perceived good health. Health inequalities based on income, work status and education are relatively contained in respect to the rest of Italy. As expected, this scales down the role of social capital.

The empirical analysis in this paper contributes to the literature by carrying out the first econometric analysis of the relationship between health and happiness in Italy. The analysis adds to previous studies by controlling the role of important economic factors, such as measures of material well-being, work status, structural and cognitive social capital, and involvement in cooperative enterprises. Moreover, we try to shed light on causality through a complex strategy involving IV estimates and structural equations modelling. The use of a unique and very recent (March 2011) dataset collected in a region traditionally characterized by an efficient welfare system and very low health inequalities further improves the value of the analysis.

The outline of the paper is as follows: section two presents our data and the empirical strategy. Section three contains a presentation and discussion of main results. Results of the SEM analysis are reported in section four. Concluding remarks and a brief discussion of implications for further researches close the paper.

2. Data and empirical strategy

Raw data is drawn from a unique dataset collected through the administration of a questionnaire to a representative sample of the population of the Province of Trento in March 2011. The sample was stratified by age, gender and area of residence. The questionnaire was developed with the specific aim to assess the determinants of individual well-being. A strong focus was given to social capital and various aspects of life satisfaction[7].

2.1 Dependent and independent variables

Self-reported health is measured through the question "In general, would you say that your health is excellent, good, fair, poor, or very poor?". Responses are coded into a binary variable which is equal to 1 in case of good or fair health. As in most economic surveys aiming to assess subjective well-being, happiness is measured through the question "Considering all aspects of your life, how happy would you say you are?". Respondents were requested to give a score from 1 to 10, 1 meaning "Very unhappy", 10 meaning "Very happy" and the values in between representing intermediate states.

The empirical analysis accounts for a number of indicators of social capital. The measurement of social capital is a delicate and controversial issue which we prefer not to discuss here. For a comprehensive survey of methodological problems in the empirical literature on social capital, we refer the reader to the reviews in Fine (2001, chapter 10), Durlauf and Fafchamps (2005) and Sabatini (2007, 2009a, 2009c). In this paper, we attempt to account for both the "structural" and the "cognitive" dimensions of the concept. The structural dimension of social capital deals with individuals' behaviours and can take the form of relational goods consumption, participation in social networks, and volunteering activities. Cognitive social capital deals with agents' perceptions

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[7] The questionnaire is available upon request to the author.

and involves concepts such as trust, reciprocity, and shared beliefs (Uphoff 1999). Structural social capital can influence health in a number of ways. More intense social relationships may facilitate individuals' access to social support and health care, as well as the development of informal insurance arrangements (D'Hombres et al. 2010). They can promote a more rapid diffusion of health information, increase the likelihood that healthy norms of behaviour are adopted (e.g., physical activity and usage of preventive services), and exert social control over deviant health-related behaviours (Kawachi et al. 1999, Phelps 2000, Melchior et al. 2003, Brown et al. 2006, Folland 2007). Cohesive networks may exert the so-called "buffering effect", balancing the adverse consequences of stress and anxiety through the provision of affective support and by acting as a source of self-esteem and mutual respect (Kawachi et al. 1997, Greiner et al. 2004, De Silva et al. 2007). Less evidence is available about the role of cognitive social capital. While several studies find social trust to be correlated with good health, several studies find this correlation not to be robust to different specifications (Kim et al. 2006; Folland 2007; Baron-Epel et al. 2008; Mansyur et al. 2008).

In this paper, we measure structural social capital through the following indicators: 1) the frequency of meetings with friends, coded as 1 if the interviewee meets friends every day or at least twice a week. 2) The frequency of meetings with relatives, coded as above. 3) Membership in voluntary organizations, coded as 1 if the interviewee is a member of at least one organization.

Two indicators of participation in cooperative enterprises were included in the analysis: 1) membership, coded as 1 if the individual is associate in at least one cooperative enterprise. 2) Volunteering for cooperative enterprises, coded as 1 if the individual has done voluntary unpaid work for a cooperative enterprise in the 12 months before the interview.

In principle, cooperative enterprises may improve health through two channels. First, they can foster the accumulation of social capital, which is in turn considered as a major determinant of health. Second, they can act as providers of health assistance and healthcare services. Theoretically, social enterprises should have distinctive features which may positively influence the quality of services, such as the explicit aim to satisfy unmet needs and to benefit the community, the pursuit of social goals, and the stronger motivation of workers.

Cognitive social capital was measured through indicators of trust towards institutions. Namely, four indicators of trust were taken into account: trust towards local politicians, the police, the prime minister and the parliament. Interviewees were asked to score from 1 to 10 their trust towards the mentioned institutions. We followed the approach to code 1 for responses above the mean value.

Moreover, we include in the analysis a number of dummies representing the relevance of an interviewee's social contacts in relation to possible health problems. Dummies are given by responses to the question: "In case of health problems, who would you turn to for assistance?". In the administration of the questionnaire, interviewers explicitly specified that the term "assistance" meant any kind of support (e.g. transport to medical facilities, moral support, little errands such as going to the shops, etc.) beyond medical therapies. Possible (non-alternative) responses were relatives, friends, colleagues, public institutions, private institutions, cooperative enterprises, no one.

As control variables, we included: 1) other indicators of social isolation as given by the composition of the household and a number of dummy variables indicating the relationship between the interviewee and the people with whom he/she lives. 2) Education, treated as a categorical variable where each category corresponds to a degree of educational qualification. 3) Work status, a categorical variable reporting whether the interviewee is employer, employee, self-employed or not working. 4) A measure of economic well-being, given by the response to the question: "How would you place your household income in respect to the average income of Italian households?". Respondents were asked to give a score from 1 to 5, 1 meaning "Much below the average" and 5 meaning "Much above the average". Robustness checks were performed by replacing this measure with two other indicators of economic well-being. The first one is given by responses to the question: "Is your household's income sufficient to see you through to the end of the month?".

Respondents were asked to give a score from 1 to 5, with 1 meaning "With great difficulty" and 5 meaning "Very easily". The second measure of economic well-being used in robustness checks is given by responses to the question: "Overall, how much are you satisfied with your economic conditions?". Once again, interviewees were asked to give a score from 1 to 10, with 1 meaning "Not at all" and 10 meaning "Totally satisfied". 5) Usual socio-demographic controls such as gender, being in a stable relationship, age, and the area of residence (urban vs. rural).

All the variables are described in detail in Table A1 in Appendix A. Summary statistics are reported in Table 1.

2.2 Instrumental variables

As will be reported in section 3, probit estimates clearly show that happiness is the most significant predictor of good health and that this result is robust to different specifications. However, there are at least three reasons for which these results could be interpreted as the fruit of a spurious correlation between two key variables of the analysis. First, it is difficult to distinguish the effect of happiness from that of other phenomena that potentially influence health. Second, individual effects, such as individuals' exogenous shocks, are correlated with both self-reported health and happiness. Third, it is reasonable to suspect the existence of reverse causality, since healthier people could have reasons not to be happy. To address these problems, we use instrumental variables estimates, as recently done by Folland (2007), d'Hombres et al. (2010) and Ronconi et al. (2010). To further investigate the causal relationship between happiness and health, we then test a simple structural equations model and some refinements thereof.

In instrumental variables (IV) estimates, we use two individual-level instruments given by measures of the quality of friendships and social trust.

The quality of friendships is measured through individuals' reported satisfaction with relationships with friends, as given by responses to the question, "How much do you feel satisfied with your relationships with friends?". Social trust was measured through the standard trust question, "In general, do you think most people can be trusted or can't you be too careful?", conceived by Elisabeth Noelle-Neumann and introduced to large U.S. surveys by Rosenberg (1956). In both cases, respondents were asked to give a score from 1 ("Not at all") to 10 and responses were recoded as 1 if their value was above the mean.

As the tests reported in section 3 show, these variables satisfy the two necessary conditions for instrument validity, since they are both strongly correlated with happiness ("relevance" condition) and orthogonal to the disturbance term of the health equation ("orthogonality" condition).

Friendship has been claimed to be an important source of happiness. The concept can be defined as a "voluntary interdependence between two persons over time, that is intended to facilitate socio-emotional goals of the participants, and may involve varying types and degrees of companionship, intimacy, affection and mutual assistance" (Hays 1988, p. 395, retrieved in Demir et al. 2007). As the definition suggests, friendship is a qualitative concept which cannot be measured just through the frequency of meetings with friends. Following Diener and Seligman (2002), in this paper we use satisfaction with relationships with friends as a proxy for the "quality" of friendship.

The quality of relationships with friends has been found to be strongly associated with happiness (Baldassarre et al. 1984; Hussong 2000; Diener and Seligman 2002; Demir and Weitenkamp 2007; Lyubomirsky et al. 2006; Demir et al. 2007b; Fiorillo 2010). Drawing on a sample of 222 undergraduate students, Diener and Seligman (2002) find that the subjective rating of relationships with close friends is the best predictor of happiness. Demir et al. (2007) use a sample of 280 college students to analyze the role of best and close friendships in happiness. The authors find that best friendship quality – as measured by the subjective rating of respondents' relationships with their best friends – is the only significant predictor of happiness. Moreover, "individuals were happier when they experienced high quality first close friendships in conjunction with a high quality best friendship. Results also revealed that first close friendship quality buffered the negative impact of first close friendship conflict" (Demir et al. 2007, p. 243). Van Praag and Ferrer-i-Carbonell (2008)

find that overall life-satisfaction is significantly and positively correlated with single domains of satisfaction, namely satisfaction with one's own job, economic and financial conditions, family, friendships, leisure and environment.

The arguments briefly exposed above find support in the significant correlation between the quality of friendships and happiness we find in the first stage of the IV probit. Thus, it seems reasonable to conclude that the quality of friendships satisfies the relevance condition required for instrumental variables. As for the orthogonality condition, it must be stated that, drawing on pooled cross-section data for the period 1992-2000, Fiorillo and Sabatini (2011b) find a positive correlation between the quality of relationships with friends and perceived health in a representative sample of the Italian population. However, there are two reasons to argue that this finding does not apply to the sample we study in this paper. First, as shown in the empirical analysis in section 3, the extension, efficiency and inclusiveness of the public healthcare system of the Trentino region scales down the role of social relationships in accessing health information and healthcare services (see Tables 2 and 3). The analysis in Fiorillo and Sabatini (2011b) is instead conducted at the nation-wide level, thereby including Southern regions which are traditionally characterized by less efficient public healthcare systems and significant health inequalities. In these regions, social contacts are a crucial asset to access information and services. It is worth noting that Italy is currently experiencing a process of decentralization of social policies, which has led to the creation of a number of regional markets for health services. This process has resulted in marked and growing differentiation and inequalities between regions. Second, the authors do not account for measures of life satisfaction. Thus, the effect of the quality of friendships could be due to its positive correlation with happiness. In support of the hypothesis of orthogonality, probit and ordered logit regressions do not find any significant correlation between satisfaction with friendships and self-reported health in our sample.

As regards the other instrument, social trust has been found to be significantly and positively correlated with happiness in most individual-level studies on social capital and well-being (see, for example, Diener and Seligman 2004; Heliweel 2006; Bjørnskov 2008; Leung et al. 2011; Requena 2010). The correlation has been confirmed also at the cross-country level (Bjørnskov 2006). On the other hand, a significant and positive association between interpersonal mistrust and unhappiness has been found in survey-based empirical investigations (see, for example, Tokuda and Inoguchi 2008) as well as in experimental studies (see, for example, Charness and Grosskopf 2001). As mentioned above, our finding of a significant and positive correlation between social trust and happiness in the first stage of the instrumental variables probit (see section 3) supports the relevance of this instrument.

As for the orthogonality condition, it must be stated that there are studies finding a positive effect of social trust on individual health (Poortinga 2006; De Silva et al. 2007; Petrou et al. 2008; d'Hombres et al. 2010; Giordano and Lindstrom 2010), but they do not simultaneously include measures of happiness. Thus, the effect of social trust could be due to its positive correlation with happiness. Several studies do not find any correlation between social trust and perceived health (Kennelly et al. 2003; Carlson 2004; Fiorillo and Sabatini 2011a). Some studies find that the association between social trust and various measures of health is not robust to different specifications (Kim et al. 2006; Folland 2007; Baron-Epel et al. 2008; Mansyur et al. 2008). While results from the empirical literature seem to be somewhat conflicting, it is worth noting that to date we lack a theoretical explanation of the causal mechanism possibly connecting social trust with health.

In the population object of our study, probit and logit regressions and structural equations models failed to find any correlation between health and social trust[8]. In light of the arguments exposed above and of the estimates carried out within the empirical analysis, it seems reasonable to assume that, in the population under investigation, there is no direct link between social trust and health.

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[8] Logit regressions were performed using health as a categorical dependent variable. Results are not reported in this paper and are available upon request to the author.

Finally, as mentioned earlier, we test the validity of our instruments with an over-identification test. The Amemiya-Lee-Newey test statistic, which is distributed as a χ^2 with one degree of freedom, is 0.033 (p-value = 0.8568), thus we cannot reject the orthogonality of the set of instruments with a conventional error of 1%.

Table 1. Descriptive statistics			
	Observations	Mean	St. dev.
Dependent variable			
Self-perceived good health	817	.6585067	.474501
Main independent variable			
Happiness	817	.6597307	.4740899
Social capital			
Meets relatives at least twice a week	817	.7723378	.4195803
Meets friends at least twice a week	817	.5875153	.492583
Membership in associations	817	.3206854	.467026
Trust towards the parliament	817	.5410037	.4986211
Trust towards the police	817	.5275398	.4995468
Trust towards the prime minister	817	.3929009	.4886943
Trust towards local politicians	817	.4908201	.5002219
Cooperative enterprises			
Membership (association) in cooperative enterprises	817	2607099	.4392909
Volunteering for cooperative enterprises	817	.0318237	.1756381
Health-specific social isolation			
Would not turn to anyone for health assistance	817	.0159119	.1252113
Would turn to public institutions	817	.3647491	.4816546
Would turn to cooperative enterprises	817	.119951	.3251033
Would turn to friends	817	.2986536	.4579479
Would turn to relatives	817	.7906977	.4070598
Would turn to colleagues	817	.0489596	.2159158
Socio-demographic and economic characteristics			
Age 18-34	817	.2362301	.4250254
Age 35-49	817	.2949816	.4563139
Age 50-64	817	.2325581	.4227216
Age 65 and over	817	.2362301	.4250254
Gender	817	.5165239	.500033
Being in a stable relationship	817	.7172583	.4506078
No educational qualification	817	.003672	.0605225
Elementary school	817	.0893513	.2854249
Middle school	817	.2117503	.408799
High school	817	.5263158	.4996129
Bachelor degree or beyond	817	.1640147	.3705157
Not working	817	.4773562	.499793
Employee with a precarious job	817	.0110159	.104441
Employee with a permanent job	817	.4161567	.4932221
Self-employed	817	.0954712	.2940447
Lives alone	817	.122399	.3279469

Lives with parents	817	.2129743	.4096604
Lives with partner	817	.6107711	.4878741
Lives with children	817	.3671971	.4823361
Lives with siblings	817	.0856793	.2800614
Lives with other relatives	817	.002448	.0494467
Number of children	817	1.341493	1.224606
Area or residence (urban vs. rural)	817	.3561812	.479163
Economic well-being	817	.8935129	.3086491
Instrumental variables			
Quality of friendships	817	.4075887	.491687
Social trust	817	.4247246	.4946039

2.3 Structural equations models

As a final check of the robustness of our findings, we employ structural equations models (SEM) to further test the relationships connecting the main variables of interest of the analysis, i.e. the dependent variable (health), the endogenous variable (happiness), the instrumental variables (social trust and the quality of friendships) and the two most significant independent variables (economic well-being and age). Variables were included in the SEM in their original likert scale. As reported in section 4, in the best fit model (chi-square with 3 degrees of freedom = 1.84, p-value = 0.61) all the correlations found with probit and IV estimates are confirmed. In particular, the SEM analysis supports the finding of a significant and positive effect of happiness on health, as well as the assumption of exogeneity of the instruments in respect to the health equation. Accounting for a reverse effect of health on happiness causes a worsening in the model's fit.

3. Empirical analysis

Our empirical model of perceived health can be represented through the following estimation equation:

$$H^{*}_{it} = \alpha + Ha'_{it}\beta + SC'_{it}\gamma + Z'_{it}\delta + \varepsilon_{it} \tag{1}$$

where H is self-reported health for individual i at time t, Ha is happiness, SC are the social capital variables defined at the individual level, the Z vector consists of the other variables that are supposed to influence self-perceived health, and ε is a random-error term.

We do not observe the "latent" variable H^{*}_{it} in the data. Rather, we observe H_{it} as a binary choice which takes value 1 (fair or good perceived health) if H^{*}_{it} is positive and 0 otherwise. Thus, the structure of (1) makes it suitable for estimation as a probit model:

$$Pr(H_{it} = 1) = \Phi(\alpha - Ha'_{it}\beta - SC'_{it}\gamma - Z'_{it}\delta) \tag{2}$$

where $\Phi(\cdot)$ is the cumulative distribution function of a normal standard.

Table 2 presents the results of the probit estimates. To compare relative magnitudes of the effects of the independent variables, we report their marginal effects. In model 1, we principally focus on happiness, which is found to be the most significant predictor of self-rated health. As expected, economic well-being and tertiary education are significantly and positively correlated with the dependent variable, while age exhibits a significant and negative correlation.

In model 2, we introduce the dummies representing the relevance of interviewees' social contacts in relation to possible health problems. No appreciable changes occur in the probit estimates and

marginal effects. Contrary to what has been found in other samples, people living alone do not exhibit a significant probability to report bad health.

In model 3, we add the indicators of structural and cognitive social capital. Happiness remains the strongest predictor of self-rated health, exhibiting a highly significant and positive correlation with the dependent variable. The sign, significance and size of all the other independent variables remain unchanged.

Feeling happy raises the probability of reporting good health by 23.5%. Being satisfied with one's own economic conditions is related to a 14% higher probability of reporting good health.

Education is another relevant predictor of health, but only at the highest level of qualification. Having a bachelor degree (or beyond) increases the probability of good perceived health by about 20.9%.

Variables measuring the structural and cognitive aspects of social capital seem to be irrelevant. We interpret this finding as a result of the contained level of inequalities and of the inclusiveness and efficiency of the public healthcare system, which provides universal coverage for all citizens at the point of use. Since all citizens are entitled to quality healthcare services on a universal basis, it seems reasonable to expect interpersonal contacts not to have a significant role in accessing these services. Another important factor scaling down the possible role of interpersonal ties can be retrieved just in

Table 2. Probit estimates

	Model 1		Model 2		Model 3	
	Marginal effect	t stat.	Marginal effect	t stat.	Marginal effect.	t stat.
Happiness	.2338081	6.18	.230729	6.01	.233911	6.02
Social capital						
Meets relatives at least twice a week					.046254	1.04
Meets friends at least twice a week					.041779	1.10
Membership in associations					.023626	0.60
Trust towards the parliament					.029858	0.70
Trust towards the police					-.03862	-1.05
Trust towards the prime minister					-.04881	-1.14
Trust towards local politicians					-.01111	-0.30
Cooperative enterprises						
Membership (association) in coop enterprises					.011934	0.29
Volunteering for cooperative enterprises					.019619	0.20
People to whom the interviewee would turn for health assistance						
Would not turn to anyone for health assistance			-.118482	-0.79	-.10280	-0.69
Would turn to public institutions			-.045383	-1.14	-.04610	-1.16
Would turn to cooperative enterprises			.042630	0.84	.03846	0.75
Would turn to friends			-.01862	-0.46	-.03323	-0.80
Would turn to relatives			-.025118	-0.54	-.02886	-0.60
Socio-demographic and economic characteristics						
Age 35-49	-.152483	-1.85	-.156059	-1.87	-.14266	-1.73
Age 50-64	-.195322	-2.32	-.193484	-2.26	-.17307	-2.04
Age 65 and over	-.273779	-3.00	-.269458	-2.92	-.24210	-2.67
Gender	-.058547	-1.65	-.057585	-1.61	-.05102	-1.40
Being in a stable relationship	-.074812	-1.16	-.073623	-1.13	-.06996	-1.06

Elementary school	-.027403	-0.19	-.010581	-0.07	-.02987	-0.20
Low school	.107267	0.88	.12136	0.99	.09821	0.77
High school	.149206	1.13	.170600	1.27	.1387	1.02
Bachelor degree or beyond	.216389	2.26	.233507	2.51	.210317	2.12
Not working	-.039563	-0.30	-.026648	-0.20	-.04208	-0.32
Employee with a permanent job	-.006269	-0.05	.012104	0.09	-.00329	-0.03
Self-employed	-.048902	-0.33	-.028449	-0.19	-.04156	-0.28
Lives alone	-.020447	-0.23	-.014482	-0.16	-.00429	-0.05
Lives with parents	-.059061	-0.61	-.048015	-0.49	-.04710	-0.48
Lives with partner	.010525	0.12	.011011	0.12	.02949	0.33
Lives with children	.034862	0.73	.042958	0.91	.05258	1.15
Lives with siblings	.102691	1.47	.100882	1.43	.09868	1.38
Number of children	.009593	0.53	.008151	0.45	-.0048	-1.47
Area or residence (urban vs. rural)	-.045349	-1.22	-.045108	-1.21	-.04748	-1.25
Economic well-being	.146178	2.49	.150521	2.54	.140579	2.37

Omitted categories are: Age 18-34, No educational qualification, Employee with a temporary position, Lives with other relatives, Would turn to colleagues.

the exceptional endowments of social capital of the Province of Trento registered by previous studies (Sabatini 2008a, 2009b). If most citizens are endowed with high levels of social capital, it is more difficult to find social capital-based health disparities in the sample. In a society rich in participation opportunities, where people meet frequently, health information is likely to be shared with the largest number of people.

Table 3 reports the marginal effects of the second stage of the instrumental variables estimates, along with diagnostic tests of the validity of our instrumental variable estimators. The Amemiya-Lee-Newey test of over-identifying restrictions does not lead us to reject the orthogonality of our instruments with respect to the disturbance term of the health equation with p-value greater than 0.85. The F-statistics, testing the hypothesis that the coefficient of the excluded instruments are all zero in each first-stage estimate, are well above the threshold of 10 suggested by the literature as the rule of thumb criterion of instrument weakness. This latter test was carried out in the Linear Probability Model. Taken together with the non-rejection of the test of over-identification, this suggests that our set of instruments is reasonable. When we address the endogeneity of happiness in IV estimates, we find to a slight increase in its marginal effect. Overall, happiness remains the best predictor of self-reported health. On the other hand, the significance of all the other independent variables is scaled down. In summary, the instrumental variable results confirm the role of happiness as presented in Table II.

4. SEM analysis

The results presented in section 3 are supported by the findings of the SEM analysis. The advantage of SEM over separate regression models for each outcome is twofold. First, as noted by Kupek (2006), "SEM can model all regression equations simultaneously, thus providing a flexible framework for testing a range of possible relationships between the variables in the model, including mediating effects and possible latent confounding variables. Second, on a more general level, SEM parameters can quantify the contribution of each predictor to the covariance structure such as common factors model" (p. 8). Moreover, SEM allows the researcher to better account for possible causes of common bias affecting the main variables of the analysis by the estimation of possible correlations among error terms. Goldberger defines a SEM as "A stochastic model where each equation represents a causal linkage, rather than a simple empirical association" (Goldberger 1972, p. 979). SEM are composed by regression equations, which are included in the model only so

far as it is possible to interpret them as causal relationships, theoretically justifiable and not falsified by data (Garson 2011)[9]. However, it must be stated that, as other unexamined models may fit the data as well or better, an accepted model should be considered only as a ''not-disconfirmed'' model. Thus, even if the use of SEM certainly allows us to make a further step towards a better understanding of the relationship between health and happiness, the problem of causality still remains open to question, and causal ambiguities are not solved.

As mentioned in section 2, the best-fitting model is the one which accounts for the main variables of interest in the analysis (i.e. health, happiness, the instrumental variables and two of the most significant independent variables, as given by economic well-being and age) and faithfully reproduces the pattern of relationships pointed out by the instrumental variables estimates. Plus, following indications from the first stage of the IV probit, we introduce in the model: 1) a measure of institutional trust, as given by trust towards the police. 2) A relationship between age and happiness. The inclusion of further variables and/or of further linkages among the considered

Table 3. Instrumental variables estimates		
	Marginal effect	t statistic
Happiness	.4404501	2.83
Meets relatives at least twice a week	.04979	1.16
Meets friends at least twice a week	.0357306	0.92
Membership in associations	.0112679	0.28
Trust towards the parliament	.0306624	0.71
Trust towards the police	-.0559987	-1.42
Trust towards the prime minister	-.0475925	-1.08
Trust towards local politicians	-.0012596	-0.03
Membership (association) in cooperative enterprises	.0137972	0.32
Volunteering for cooperative enterprises	.0265083	0.26
Would not turn to anyone for health assistance	-.0475387	-0.31
Would turn to public institutions	-.02596	-0.62
Would turn to cooperative enterprises	.0328834	0.62
Would turn to friends	-.0492604	-1.13
Would turn to relatives	-.0399402	-0.84
Age 35-49	-.1001164	-1.22
Age 50-64	-.1405434	-1.64
Age 65 and over	-.1723438	-1.80
Gender	-.0646845	-1.68
Being in a stable relationship	-.0853556	-1.16
Elementary school	.0152156	0.08
Low school	.1219033	0.69
High school	.185989	0.96
Bachelor degree or beyond	.2360765	1.71
Not working	.0627633	0.37
Employee with a permanent job	.0960369	0.59

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[9] While designing the structural model, the researcher puts forward some hypotheses on the linkages connecting the phenomena under consideration. The consistency of these hypotheses with the pattern of variances and covariances in the data is then assessed through the goodness-of-fit tests. In practice, this approach combines exploratory and confirmatory purposes: first, a model is theorized and tested using SEM procedures. If it is found to be deficient, an alternative model is then tested based on changes suggested by modification indexes.

Self-employed	.0907256	0.59
Lives alone	-.0206704	-0.22
Lives with parents	-.0354092	-0.35
Lives with partner	.0002625	0.00
Lives with children	.0245924	0.50
Lives with siblings	.0640693	0.84
Number of children	-.0034395	-0.49
Area or residence (urban vs. rural)	-.0423224	-1.12
Economic well-being	.1184573	1.96

Omitted categories are the same as in Table 2.

Instrumental variables diagnostics

Test of over-identifying restrictions: Amemiya-Lee-Newey minimum chi-sq statistic = 0.033; Chi-sq(1) P-value = 0.8568

Joint significance coefficient F = 16.95; Prob > F = 0.0000

variables (e.g. a linkage between one or both of the instruments and health) in the analysis worsened the models' fit.

In the following equations, we follow the conventional practice of indicating endogenous variables with η and exogenous variables with ξ. Error terms are indicated with the symbol ζ.

In the best-fitting model, health, η_1, is determined by happiness, η_2, age, ξ_4, and by unknown omitted variables which influence happiness and economic well-being as well:

$$\eta_1 = \beta_{12}\eta_2 + \gamma_{14}\xi_4 + \zeta_1 \tag{3}$$

Happiness is determined by social trust, ξ_1, institutional trust, ξ_2, the quality of friendships, ξ_3, and age, ξ_4, as well as by omitted unknown variables also influencing health and economic well-being:

$$\eta_2 = \gamma_{21}\xi_1 + \gamma_{22}\xi_2 + \gamma_{23}\xi_3 + \gamma_{24}\xi_4 + \zeta_2 \tag{4}$$

Economic well-being is influenced by happiness and the above-mentioned omitted variables:

$$\eta_3 = \beta_{32}\eta_2 + \zeta_3 \tag{5}$$

The assumption of the simultaneous influence of omitted variables on each couple of endogenous variables means that errors ζ_1 and ζ_2, ζ_1 and ζ_3, ζ_2 and ζ_3 are correlated, thus implying the need to estimate, besides parameters β, also the covariances ψ_{21}, ψ_{31} and ψ_{32} between these errors[10]. Figure 1 provides a graphic representation of the model[11].

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[10] It is noteworthy that the absence of a variable from the model can arise in two possible ways: a) a relationship was a priori assumed to be insignificant for conceptual reasons: b) a relationship was hypothesized to be potentially significant but was empirically found not to be. However, to further check the robustness of our assumptions, we infringed point a) by testing the possibility of a relationship between the instruments, institutional trust and health. Thus, ξ_1, ξ_2 and ξ_3 do not appear in equation (3) because they were statistically insignificant when allowed to enter. Moreover, their inclusion dramatically worsened the goodness of fit of the model, not because they were excluded in the first place. This result provides further support to the validity of the instruments in the IV estimates.

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Parameters estimates are presented in Table 4, where blank cells represent coefficients constrained to be zero. The SEM analysis confirms the significant and positive correlation between health and happiness and suggests that this correlation can be explained as a result both of the influence of happiness on health and of a common bias affecting the two variables. Thus, caution in the interpretation of correlation as a causal relationship is needed. Still, it must be stated that the possibility of reverse causality is not supported by the best-fitting model and its refinements. Happiness exhibits a significant and positive correlation with social trust and with satisfaction with relationships with friends, thus confirming the validity of the instruments in the IV estimates. The model also finds a significant and positive association between happiness and institutional trust, and a significant and negative correlation with age. It is worth noting that the measure of institutional trust accounted for within this stage of the analysis is trust towards the police, which can also be considered as an expression of people's perceived safety within the surrounding environment. This latter variable seems to exert a weakly significant effect on health. There is evidence of a significant and positive correlation between happiness and economic well-being. However, the significance of the covariance between error terms in the two equations recommends caution in interpreting it as a causal nexus, since the two phenomena are likely to be influenced by omitted variables creating common bias.
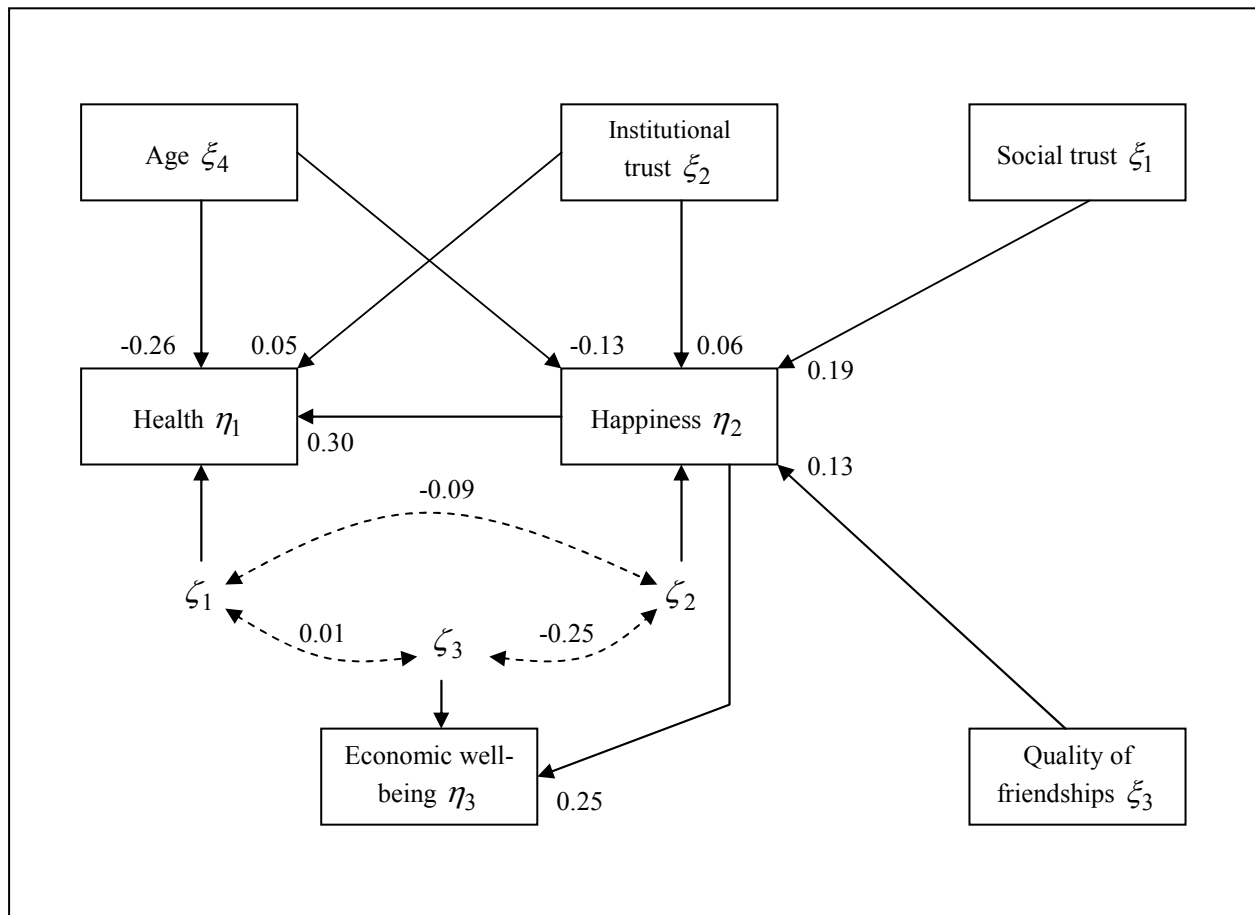

Figure 1. Best-fitting model

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 is correct, the fitting statistic follows a χ^2 with *df* degrees of freedom, where $df = \frac{1}{2}(p+q)(p+q-1)-t$, p is the number of endogenous variables, q is the number of exogenous variables, and t is the number of estimated parameters (Bonnet and Bentler 1983). Following the established approach in the SEM practice (see, for example, Raykov and Marcoulides 2000; Schumacker and Lomax 2004; Kline 2005), we 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. Since the value for this model is 0.71, thus significantly lower than the critical value for χ^2 with 4 degrees of freedom, we can state that the difference between the two variance-covariance matrixes is stochastic in nature and is not due to the inappropriateness of the theoretical model (p = 0.95). All the other goodness of fit indexes exhibit satisfactory values[12]. In all three stages of the analysis – i.e. probit regressions, IV estimates and SEM – robustness checks were performed by replacing the measure of relative economic well-being with the other indicators of satisfaction, with one's own economic conditions described at the end of section 2. No significant changes were observed in the results.

Table 4. Maximum likelihood estimates for model							
	Health	Happiness	Econ. well-being	Social trust	Institutional trust	Quality of friendships	Age
Health	-	0.30 (2.17)	-	-	0.05 (1.27)	-	-0.26 (-6.81)
Happiness	-	-	-	0.19 (5.49)	0.06 (1.86)	0.13 (3.91)	-0.13 (-3.89)
Econ. well-being	-	0.25 (2.06)	-	-	-	-	-

The second line in each cell reports the t statistic (in brackets). Chi-Square (4 *df*) = 0.71 (P = 0.95)

6. Concluding remarks

This paper has carried out an investigation into the relationship between self-reported health and happiness in a representative sample of the population of the Italian Province of Trento.

Our choice to focus on the Province of Trento was due to results from previous empirical studies which found the territory to be characterized by contained inequalities (including health disparities), as well as by exceptional levels of well-being, social capital and entrepreneurial diversity. Moreover, the region is characterized by an extensive and efficient public healthcare system. In our view, these features may allow the researcher to better isolate the behavioural determinants of health.

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[12] The adjusted goodness of fit index is equal to 0.99. The root mean squared residuals is equal to 0.0051. As further robustness checks, we tested some model's refinement. Estimates are not presented in the paper and are available upon request to the author.

The empirical strategy was based on probit regressions, instrumental variables (IV) estimates and structural equations modelling (SEM). Happiness is found to be the best predictor of health in all of the stages of the analysis.

The possible effect of happiness on health may work through two main channels of transmission. First, happiness and positive attitudes towards life prevent the autonomic nervous system from activating physiological reactions that could have cumulative detrimental effects on health. Second, happy people may be more inclined to behave healthily (e.g. engaging in sports and watching their weight) and to avoid unhealthy behaviours such as smoking, drinking and overeating.

Theoretical arguments, diagnostic tests and evidence from previous literature support the hypothesis that the instruments we accounted for within IV estimates can be reasonably excluded from the health equation. In order to avoid the risk of omitting variables that are simultaneously correlated with happiness and self-reported health, we have included many covariates in the probit and IV probit and we have carried out a SEM analysis as a further robustness check. The analysis has particularly lingered over the possible role of social capital, which the literature commonly claims to play an important role in the determination of health, and on participation in cooperative enterprises. The high diffusion of this latter type of enterprises – and, more in general, the high degree of entrepreneurial diversity – is in fact one of the most distinctive features of the local economy.

Overall, the analysis does not find significant health disparities based on education and work status. This result differentiates the Province of Trento from the rest of Italy, where health inequalities have been found by previous literature, especially in Southern regions (Atella et al. 2004; Giannoni *et al*. 2007; Masseria and Giannoni 2010), and confirms the exceptional performance of this territory in terms of indicators of well-being, as previously found by comparative studies on the Italian regions (Sabatini 2008a, 2009b). As is to be expected, the absence of health disparities markedly reduces the role of social capital which, by contrast, has been found to play a major role in other Italian regions (Fiorillo and Sabatini 2011a, 2011b). The literature has in fact shown that informal financial support and social contacts play a role in ensuring access to healthcare services mostly when public healthcare systems do not provide universal coverage for all patients. This is not the case of the population object of our study. The Trentino region is in fact characterized by an extensive and traditionally efficient public healthcare system which renders the role of interpersonal ties less relevant.

Despite all the robustness checks we carried out in the different stages of the analysis, it must be remarked that the cross-sectional design of the research dictates extreme caution in the interpretation of correlations as causal relationships. Moreover, the SEM analysis has pointed out the possible role of unknown omitted variables.

Nonetheless, the paper contributes to the literature in three substantive ways. First, we have carried out the first empirical analysis of the relationship between happiness and health in Italy. Second, we have controlled for the role of important economic factors, such as measures of material well-being, work status and participation in different types of enterprises, as well as the influence possibly exerted by various dimensions of social capital. Finally, our unique and very recent (March 2011) dataset collected in a region traditionally characterized by an efficient welfare system and very low health inequalities adds further value to the analysis.

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Appendix A

Table A1. Description of variables

Variable	Description
Dependent variable	
Self-reported health	Self-assessment of health; 1 = good and very good
Main independent (endogenous) variable	
Happiness	Subjective assessment of life satisfaction; 1 = values above the mean
Social capital	
Meets relatives at least twice a week	Frequency of meetings with relatives; 1 = twice or more a week
Meets friends at least twice a week	Frequency of meetings with friends; 1 = twice or more a week
Membership in associations	Membership in associations; 1 = the interviewee is member in one or more associations
Trust towards the parliament	Trust towards the parliament; 1 = values above the mean
Trust towards the police	Trust towards the police; 1 = values above the mean
Trust towards the prime minister	Trust towards the prime minister: 1 = values above the mean
Trust towards local politicians	Trust towards local politicians; 1 = values above the mean
Membership (association) in cooperative enterprises	Membership in cooperative enterprises; 1 = the associate of one or more cooperative enterprises
Cooperative enterprises	
Volunteering for cooperative enterprises	1 = the interviewee has done unpaid voluntary work for cooperative enterprises in the last 12 months

Health-related social contacts	
Would not turn to anyone for health assistance	1 = the interviewee would not turn to anyone for assistance in case of health problems
Would turn to public institutions	1 = the interviewee would turn to public institutions in case of health problems
Would turn to cooperative enterprises	1 = the interviewee would turn to cooperative enterprises in case of health problems
Would turn to friends	1 = the interviewee would turn to friends in case of health problems
Would turn to relatives	1 = the interviewee would turn to relatives in case of health problems
Economic and socio-demographic characteristics	
Age 35-49	Age of the respondent; 1 = age between 35 and 49
Age 50-64	Age of the respondent; 1 = age between 50 and 64
Age 65 and more	Age of the respondent; 1 = age 65 and more
Gender	1 = female
Being in a stable relationship	1 = the respondent is in a stable relationship, including marriage
Elementary school	Education of the respondent; 1 = completed elementary school (5 years)
Low school	Education of the respondent; 1 = completed junior high school (8 years)
High school	Education of the respondent; 1 = completed high school (13 years)
Bachelor degree or beyond	Education of the respondent; 1 = university degree and/or doctorate (18 years and more)
Not working	Employment status; 1 = the respondent is not in the labour market
Employee with a permanent job	Employment status; 1 = the respondent is employee with a permanent contract of employment
Self-employed	Employment status; 1 = the respondent is self-employed
Lives alone	Household composition of the respondent; 1 = the respondent lives alone
Lives with parents	Household composition of the respondent; 1 = the respondent lives with parents
Lives with partner	Household composition of the respondent; 1 = the respondent lives with her/his partner
Lives with children	Household composition of the respondent; 1 = the respondent lives with children
Lives with siblings	Household composition of the respondent; 1 = the respondent lives with siblings
Area or residence (urban vs. rural)	1 = urban area
Economic well-being 1	Subjective assessment of the respondent's income in respect to the average income of the Italian households. 1 = the respondent rates her/his income as in the average or above or much above the average.
Economic well-being 2	Subjective assessment of the sufficiency of the household income; 1 = the respondent gets through the month fairly, easily or very easily.
Economic well-being 3	Satisfaction with the household's economic conditions, assessed on a 10-points likert scale; 1 = values above the mean.
Instrumental variables	
Social trust	Trust towards strangers; 1 = values above the mean
Quality of friendships	Subjective assessment of satisfaction with relationships with friends; 1 = values above the mean