# How Does Social Capital Matter to Health Status?

## —Evidence from China Health and Retirement Longitudinal Survey

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**Abstract:** This paper provides new empirical evidence on the causal effect of social capital on health using waves 2008 and 2012 data from the China Health and Retirement Longitudinal Survey. We use ADL index and CES-D to measure individuals' physical and mental health respectively. Our study controls for individual unobserved, time-invariant heterogeneity by using individual-level fixed effects and accounts for potential confounding effects by including community-level fixed effects. Instrumental variable (IV) estimates are also employed to overcome time-variant unobservables and reverse causality. Results show that individuals with higher social capital are significantly more likely to have better physical and mental health. There are also heterogeneous effects of social capital on health by gender, age and area of residence.
**Key words:** Social capital index; ADL index; CES-D; Fixed effects; Instrumental variable; China

### 1. Introduction

The positive relationship between social capital and health is widely acknowledged in both economic and public health literature (Kawachi et al., 1997; Folland, 2008; Scheffler et al., 2014). This relationship can be found in many countries, at different measurements of social capital and for various indicators of health. As Putnam(2000) argues, "in none is the importance of social connectedness so well established as in the case of health and well-being".However, the association between social capital and health does not necessarily reflect a causal effect of social capital on health and there is now a lively debate, especially in economics literature, on whether this association (or how much of it) is causal.

This discussion is highly relevant to policy-making because understanding this relationship is crucial for guiding policy interventions to improve population's health. If there is indeed a causal effect of social capital on health, one possible policy instrument for health promotion is the investment in social capital. Giving people more access to social capital will – in the long run – be a more successful health intervention than increasing public health care expenditures.

Therefore, the question we intend to address is: how does social capital matter to health status? Theoretically, social capital can improve health through the following mechanisms (Folland, 2008).First, it helps to form an environment that facilitates social interaction and builds mutual trust, alleviating individuals' psychological stress level; Second, social capital helps individuals to obtain information on health behavior and production, thus improving efficiency of personal health production; Third, social participation and interaction can create a sense of shared responsibility in communities, reducing the likelihood of risky behaviors.

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Despite many convincing arguments for the positive association between social capital and health, concerns regarding an interpretation of correlations as causation remain. The first challenge is the attempt to disentangle correlation, due to unobserved heterogeneity, from causality. Unobserved heterogeneity such as time preference and personal traits could drive both social capital and health in the same direction. For example, people with low discount rate are likely to engage in health-enhancing behavior, achieve better health status, and at the same time invest more time and money in their health. The second challenge for identification is related to simultaneity between social capital and health, as the people with better health are both physically and financially capable of engaging in more social activities, thus have higher social capital. The third challenge is difficulty to distinguish social capital effect from other local contextual effects that potentially influence health. Social capital may vary between locations depending on social and economic characteristics of the community, thus may confound the effect of social capital on heath status.

This paper aims to provide further evidence on the causal relationship between social capital and health by employing the China Health and Retirement Longitudinal Survey (CHARLS) data. To the best of our knowledge, this is the first paper using this data to identify the causal effect of social capital on health in China. The longitudinal nature of the CHARLS and its rich information at both individual and community levels allow us to tackle the above-mentioned challenges which commonly arise when estimating the effect of social capital on health. Our contributions are as follows: First, we use fixed effect model and instrumental variable approach to overcome the endogeneity issue; Second, we use ADL (activities of daily living) index and CES-D (Center of Epidemiological Studies Depression) to measure individuals' health status respectively, thus producing a more general picture of this relationship; Third, we investigate the heterogeneous effect of social capital on health among different sub-populations by gender, age and area of residence.

The paper is structured as follows: Section 2 reviews the background literature; Section 3 describes the data and reports some descriptive statistics; Section 4 presents the identification strategy; Section 5 reports results and discusses; Section 6 concludes.

## 2. Literature review

### *2.1 The concept and measurement of social capital*

Social capital is generally accepted as a multi-disciplinary concept, which is initially developed by Jacobs (1961), Loury (1977), Boudieu (1986) and further operationalized by Coleman (1990). Owing to its elusive nature, social capital has been defined in various ways. Despite various definitions, it is commonly understood to encompass a combination of norms, trust and social support that smooth social interaction of individuals in a community (d'Hombres et al.,2011; Goryakin et al, 2013). One strand of literature divide social capital into cognitive and structural parts. Cognitive social capital includes ethics, value systems, and religious beliefs. Structural social capital mainly refers to social structures, such as density of social network and participation (Harpham et al., 2002). Another strand of literature categorize social capital as bonding, bridging and linking according to its functionality. Bonding social capital refers to the horizontal ties between members of a network who share similar socio-demographic characteristics. It improves health by social support and trust, thus facilitating sharing of health information (Kawachi et al., 1999). Bridging social capital refers to the ties that exist between

heterogeneous people. It can contribute to better health through solidarity and collective action (Powell-Jackson et al., 2011). Linking social capital reflects the ties between groups at different hierarchical level. It can enhance health by mobilizing health-promoting resources (Habibov and Afandi, 2011).

There are several measurements of social capital. Some researchers suggest the use of composite measures to capture different conceptual components of social capital, instead of single-item indicators (Hurtado, Kawachi & Sudarsky, 2011;Harpham, 2008; Lochner, Kawachi, & Kennedy, 1999). The first frequently used statistical method is Principal Component Analysis (Akçomak & ter Weel, 2009), as it can simplify and reduce data variability by grouping several observed indicators of social capital into a new independent component or index. This approach to derive independent social capital features has been applied in studies in Chile (Sapag et al., 2008) and Colombia (Harpham, Grant, & Rodriguez, 2004). The second approach is standardized z-score index. This standardization method facilitates the interpretation of social capital by considering how different observed indicators are clustered into a new component. Sundqusit et al.(2004) use this approach to construct a single social capital index from 18 types of activity. Ronconi et al.(2010) construct z-score by using information on informal social interactions to measure individual social capital in Argentina.

*2.2 Empirical studies*

A growing body of research documents significant correlations between social capital and health but most of them are non-causal in nature. Current literature defines social capital from three levels: nation, community and individual. At the national level, most studies focus on Western developed countries and test the potential positive relationship between social capital and health. Kawachi et al. (1997) found that, in the United States, individual states' levels of social capital are negatively correlated with mortality rates. Using the World Value Survey, Helliwell and Putnam (2004) found a significantly positive relationship between residents' health status and countries' levels of social engagement and trust. However, using data from a panel of 19 OECD countries, Kennelly, O'Shea and Garvey (2003) found no relationship between social capital (measured by level of trust in others and membership in voluntary organizations) and life expectancy at the national level. At the community level, Islam (2006) and Scheffler (2007) found a positive relationship between community-level social capital and health status using data from the United States and Sweden. However, Poortinga (2006) did not find a significant association between aggregate civic participation and self-reported health status in England when various measures of social support are controlled for. At the individual level, Rose (2000) examined the relationship between social capital and health status with individual-level data, indicating a positive relationship. A similar phenomenon also exists among Finland residents (Hyyppa and Maki, 2003).

There are several studies trying to overcome the endogeneity of social capital. Folland (2007) used employment rate, geographical latitude, and state governmental contributions to colleges per capita as instrumental variables and found that social capital was highly correlated with a number of health measures. Using the 2001 Living Conditions, Lifestyles and Health (LLH) data from former Soviet Union countries, D'Hombres et al. (2011) identified the effects of individual trust, membership, and social isolation on health by employing a community's average social capital as an instrument. They found that trust and isolation were highly relevant to self-reported good health, while there lacks a significant relationship between membership and self-reported good

health. Using access to transportation as an instrumental variable for social capital, Ronconi et al. (2010) also found a significant and positive causal relationship between social capital and health status in Argentina. Kim et al. (2011) found that country-level social capital has significantly positive association with individual self-rated health status when instrumented with country-level corruption, the logarithm of population density, and religious fractionalization scores.

The large majorities of prior studies focus on western countries, much less is known about social capital and health within developing and middle-income countries. Within emerging economies, there is sparse evidence that social capital is related to better health status. Yip et al. (2007) used survey data from three rural counties in Shandong province in China to study the relationship between social capital and health status. They differentiated structural and cognitive social capital and found a significant association between social capital and self-rated health status. Wang et al. (2009) used household survey data from 22 villages in China in 2002 to test the relationship between social capital and self-reported health status of the rural population.

## 3. Data, variables and descriptive statistics

### *3.1 Data*

Our data comes from waves 2008 and 2012 of CHARLS. It is one of the few household-level panel datasets available for China. This survey is administered by the National School of Development of Peking University. Its aim is to collect detailed information on individual health status and social participation along with demographic and household characteristics from a nationally representative sample of Chinese residents age 45 and older .The first pilot survey was conducted in two provinces (Gansu and Zhejiang) in 2008 and collected data from 48 communities/villages in 16 counties/districts, covering 2,685 individuals living in 1,570 households. All the households in wave 2008 were re-interviewed in 2012. Therefore, we combine waves 2008 and 2012 data to form a longitudinal dataset.

### *3.2 Variables*

Our dependent variable is individuals' health status. Health is a multi-dimensional variable and a fairly general concept. Lack of a precise concept results in numerous health measures used in the literature on the link between social capital and health (e.g. mortality, life expectancy, self-reported health, risky behaviors). Although self-reported health is widely used in existing literature, it may be affected by reporting bias. For example, more optimistic individuals may systematically overstate their health status. As CHARLS contains detailed information on individual's health. We choose two subjective measures of individual health: Activities of Daily Living (ADL) and CES-D Scale. ADL indicators have been extensively used in economic literature by Strauss et al.(1993), Gertler and Gruber(2002), Morefield(2010) and Bratti et al.(2014). In contrast to self-reported health, ADL indicators are considered to be more objective and less likely to be affected by the differences in individual response scale (Bratti et al.,2014). In particular, ADL indicators have the advantage of recording specific facts related to an individual's daily living rather than her opinions on her physical wellbeing. This measure have been validated both in the US and East Asian countries (Andrews et al., 1986; Guralnik et al., 1989; Ju and Jones, 1989).CHARLS asked respondents nine questions on ADL[①] For each questions, there are four possible answers: "No, I don't have any

[①] These questions are: (1)Do you have any difficulty with running or jogging about 1 Km? (2)Do you have difficulty …walking 1 km…? (3)Do you have difficulty … walking 100 metres…? (4)Do you have difficulty …getting up from a chair after sitting for a long period… (5)Do you have difficulty …climbing several flights of stairs without resting…? (6) Do you have difficulty …stooping, kneeling, or crouching…? (7) Do you

difficulty" ," I have difficulty but can still do it" ," Yes, I have difficulty and need help" and "I cannot do it." Codes 1, 2, 3 and 4 are given to the first, second, third and fourth answers, respectively. The scores to the single question can be added to obtain a single health indicator, which can be labeled as ADL index (0~1) and increases with the severity of the disability (Gertler and Gruber's ,2002)[①].

The second measure of health is the CES-D Scale. Originally developed by Radloff (1977), the CES-D Scale is a widely-used measure of depressive symptomatology. CHARLS administered 10 items that typically comprise the CES-D Scale. Specifically, respondents were instructed to indicate the frequency of experiencing certain feelings or emotions during the past week[②]. Possible responses are: "rarely or none of the time" (=0); "some or a little of the time" (=1); "occasionally or a moderate amount of the time" (=2); and "most or all of the time" (=3)[③]. Following Duncan and Rees (2005), responses to the 10 items were summed to produce a score between 0 and 30, which was adjusted to correspond to the original 10-item CES-D Scale. Higher CES-D scores indicate worse mental health.

One of the main independent variable is social capital. CHARLS contained detailed information on individuals' social participation over the past month. So we construct a social capital index from individuals' informal social interaction and community involvement. Such information is collected by asking individuals the following eight questions (see table 1). We follow the approach proposed by Sundqusit et al.(2004) and Rincon et al. (2010) and combine these eight indicators to construct a standardized social capital index. If an individual participated in one activity, it is coded as 1 or 0 otherwise. Standardizing social capital can help us facilitate comparison and explanation of regression results.

**Table 1 Activities selected to measure individual's social capital index**

| Survey Questions | Definition |
|---|---|
| Did you participate in the following activities in the past month? | |
| s1: Volunteering or philanthropy activities | Yes = 1, No = 0 |
| s2: Taking care of the elderly or disabled that you don't live with free of charge | Yes = 1, No = 0 |
| s3: Offering help to relatives, friends or neighbors that you don't live with free of charge | Yes = 1, No = 0 |
| s4: Going to school or attending training courses | Yes = 1, No = 0 |
| s5: Visiting friends | Yes = 1, No = 0 |
| s6: Playing mahjoon, chess, poker and going to community activity center | Yes = 1, No = 0 |
| s7: Participating in tai chi, dancing and other group activities | Yes = 1, No = 0 |
| s8: Participating in activities organized by community organizations | Yes = 1, No = 0 |

We also control other variables in the regression: age, gender, area of residence, highest

have difficulty …reaching or extending your arms above shoulder level…? (8) Do you have difficulty …lifting or carrying weights over 10 jin(=0.5 kg), like a heavy bag of groceries… (9)Do you have difficulty …picking up a small coin from a table…?

① The formula to construct ADL index is: $ADL = \left( \frac{score - Minscore}{Maxscore - Minscore} \right)$.

② The 10 items are: I was bothered by things that don't usually bother me; I had trouble keeping my mind on what I was doing ; I felt depressed ; I felt everything I did was an effort ; I felt hopeful about the future ; I felt fearful ; My sleep was restless ; I was happy; I felt lonely; I could not get "going."

③ Among the 10 items, 2 items have the contradictory meaning with other 8 items. They are "I felt hopeful about the future" and "I was happy", therefore we code "rarely or none of the time" (=3); "some or a little of the time" (=2); "occasionally or a moderate amount of the time" (=1); and "most or all of the time" (=0) for those 2 items.

educational qualifications, marital status, insurance, health behaviors; variables related to the household's demographic structure; a set of indicators of household economic and sanitary circumstances (house ownership, logarithm of the number of rooms, availability of water, telephone and house connected to sewer). Community's characteristics such as hospital numbers, number of recreational centers, transportation conditions are also included to control contextual effect.

*3.3 Descriptive statistics*

Table 2 presents descriptive statistics of the main variables. There are 5,058 individuals in the sample. The mean ADLs index and CES-D score are 0.248 and 8.01 respectively. The mean social capital index is 0.081. The average age is 60.57 years old. 51.7% are females and 22.1% are living in the urban areas. The majority of the sample have low level of education with 42.8% illiterate and 36% primary education. 83.2% of the sample are married and 14.4% are widowed. On health insurance, 94.8% are covered by some sorts of insurance and only 5.2% with no insurance. Ever smoking rate and ever drinking rate are 35.1% and 39.7% respectively. For household characteristics, the average household size is 3.205. 78.5 % of household is connected to tap water and 44.9% is connected to sewer. 89.75% of the household own a house.

**Table 2 Descriptive statistics of main variables**

| Variables | | N.obs. | Mean | S.D. |
|---|---|---|---|---|
| Dependent variables | | | | |
| | ADL index | 5,058 | 0.247 | 0.188 |
| | CES-D score | 3,877 | 8.01 | 6.26 |
| Independent variables | | | | |
| | Social capital index | 5,058 | 0.081 | 0.118 |
| *Demographic* | | | | |
| | Age | 5,058 | 60.57 | 10.48 |
| | Female | 5,058 | 0.517 | 0.5 |
| | Dwelling in urban area | 5,058 | 0.221 | 0.415 |
| *Education* | | | | |
| | Illiterate(reference group ) | 5,058 | 0.428 | 0.495 |
| | Primary | 5,058 | 0.360 | 0.480 |
| | Secondary | 5,058 | 0.197 | 0.397 |
| | University | 5,058 | 0.013 | 0.113 |
| *Marital status* | | | | |
| | Married(reference group) | 5,058 | 0.832 | 0.374 |
| | Divorced | 5,058 | 0.013 | 0.112 |
| | Widowed | 5,058 | 0.144 | 0.351 |
| | Unmarried | 5,058 | 0.011 | 0.105 |
| *Insurance status* | | | | |
| | No medical insurance(reference group) | 5,058 | 0.052 | 0.221 |
| | Urban employee medical insurance | 5,058 | 0.104 | 0.306 |
| | Urban resident medical insurance | 5,058 | 0.048 | 0.214 |
| | New rural cooperative medical insurance | 5,058 | 0.730 | 0.446 |
| | Free medical insurance | 5,058 | 0.018 | 0.131 |
| | Medical aid | 5,058 | 0.0006 | 0.024 |
| | Commercial medical insurance | 5,058 | 0.022 | 0.148 |
| *Health behavior* | | | | |

| | | | | |
|---|---|---|---|---|
| | Ever smoke | 5,058 | 0.351 | 0.477 |
| | Ever drink | 5,058 | 0.397 | 0.489 |
| *Household characteristics* | | | | |
| | Household size | 5,058 | 3.205 | 1.613 |
| | Log of household income per capita | 5,058 | 7.851 | 2.568 |
| | Connected to running water | 5,037 | 0.785 | 0.411 |
| | Connected to sewer | 4,565 | 0.449 | 0.497 |
| | Connected to telephone | 5,058 | 0.620 | 0.486 |
| | House owned | 5,058 | 0.897 | 0.304 |
| | Log of house area | 4,730 | 4.560 | 0.681 |
| *Community characteristics* | | | | |
| | Number of community hospitals and clinics | 5,058 | 1.745 | 2.489 |
| | Number of community recreational centers | 4,501 | 6.096 | 3.419 |
| | Distance to the nearest bus station | 4,533 | 2.117 | 5.279 |
| | Has road passing through | 4,565 | 0.943 | 0.232 |

**4. Identification strategies**

In order to estimate the relationship between social capital and health, we begin with a simple regression using two waves of CHARLS data to estimate:

$$H_i = \alpha_0 + \alpha_1 SC_i + \delta X_i + \gamma C_i + \varepsilon_i \quad (1)$$

where $H_i$ measures health outcomes of individual $i$ and $SC_i$ denotes the individual's social capital. $X_i$ is a vector of individual and household-level control variables that are likely to be determinants of both social capital and health status, including age, gender, education level, marital status, insurance, health behaviors, household economic condition, and household size. $C_i$ is a vector of community-level controls reflecting local infrastructural conditions and $\varepsilon_{it}$ is a white-noise error term. $\alpha_1$ is the parameter to be estimated.

In order to control for time-invariant unobservables, we estimate a model with individual fixed effects as follows:

$$H_{it} = \alpha_0 + \alpha_1 SC_{it} + \delta X_{it} + \gamma C_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

Although equation (2) can eliminate bias caused by time-invariant unobervables, it cannot address the problems of reverse causality and time-varying unobservables. Therefore, we employ an instrumental variables (2SLS) identification strategy. The first stage can be formularized as follows:

$$SC_{it} = \beta_0 + \varphi Z_{it} + \xi X_{it} + \psi C_{it} + \nu_{it} \quad (3)$$

In the second equation, we use the predicted value of social capital in an equation similar to (1). The credibility of this strategy rests on our ability to identify a set of valid instruments $Z_{it}$,

which are excluded in the second stage.

The instrument used in this paper is the community average of individuals' social capital index. The justification for the use of this instrument was discussed in details by d' Hombres et al. (2011). The validity of instrument depends on two assumptions: First, it is correlated with the endogenous individual social capital; Second, it does not have autonomous effect on individual health. When a large set of community variables are included in the model, instrumental variable will affect the outcome only through their effect on individual social capital. The first assumption is intuitive and easily testable. It is expected that the greater the level of community's social capital, the greater the opportunities for social participation and the higher the level of individual social capital. For the second assumption, there is empirical support in the literature for the proposition that community social capital does not have an independent effect on health once individual social capital indicators are controlled for (d'Hombres et al., 2010). This is an important requirement for instrumental validity.

## 5. Results and Discussion

### *5.1 OLS regression*

Table 3 presents the OLS estimation results. Controlling for observables such as age, gender, and other individual, family and community characteristics, social capital is significantly associated with ADL index and CES-D. 10 % increase in social capital index is associated with 13.2% decrease in ADL index (better physical health) and 35.16% decrease in CES-D (better mental health).

**Table 3 OLS regression of effect of social capital on individual's health status**

| | ADL | | CES-D | |
|---|---|---|---|---|
| | Coef. | Robust S.E | Coef. | Robust S.E |
| Social capital index | -0.132*** | 0.020 | -3.516*** | 0.756 |
| Age | 0.005*** | 0.000 | 0.009 | 0.018 |
| Female | 0.050*** | 0.009 | 1.467*** | 0.323 |
| Dwelling in urban area | 0.003 | 0.009 | -0.196 | 0.391 |
| Primary | -0.019*** | 0.007 | -0.956*** | 0.272 |
| Secondary | -0.014* | 0.008 | -1.386*** | 0.403 |
| University | -0.038* | 0.022 | -2.089*** | 0.697 |
| Divorced | 0.009 | 0.019 | 1.152 | 0.773 |
| Widowed | 0.026** | 0.010 | 1.933*** | 0.453 |
| Unmarried | 0.024 | 0.032 | 6.169*** | 1.454 |
| Urban employee medical insurance | 0.016 | 0.011 | 0.878* | 0.494 |
| Urban resident medical insurance | 0.030** | 0.015 | 1.395** | 0.552 |
| New rural cooperative medical insurance | 0.005 | 0.011 | 0.264 | 0.413 |
| Free medical insurance | 0.037 | 0.023 | 0.660 | 0.721 |
| Medical aid | -0.021* | 0.012 | 2.291** | 1.084 |
| Commercial medical insurance | -0.003 | 0.015 | -1.181** | 0.481 |
| Ever smoke | 0.000 | 0.009 | 0.706** | 0.336 |
| Ever drink | -0.009 | 0.006 | -0.449* | 0.232 |
| household size | 0.008*** | 0.002 | 0.130 | 0.089 |
| Log of household income per capita | -0.003*** | 0.001 | -0.153*** | 0.048 |
| Connected to running water | -0.007 | 0.007 | 0.166 | 0.308 |
| Connected to sewer | -0.022** | 0.010 | -0.790 | 0.578 |
| Connected to telephone | -0.003 | 0.006 | -0.196 | 0.238 |
| House owned | 0.003 | 0.008 | 0.567 | 0.411 |

| | | | | |
|---|---|---|---|---|
| Log of house area | -0.015*** | 0.005 | -0.674*** | 0.221 |
| Number of community hospitals | 0.003* | 0.002 | 0.205*** | 0.074 |
| Number of community centers | -0.006*** | 0.002 | -0.314*** | 0.079 |
| Distance to the nearest bus station | 0.001 | 0.001 | 0.074** | 0.034 |
| Has road passing through | -0.045** | 0.021 | -0.474 | 0.941 |
| Year2012 | 0.122*** | 0.007 | -0.348 | 0.263 |
| Intercept | 0.006 | 0.046 | 12.825*** | 1.865 |
| *N* | | | 3215 | |

*Note: Robust standard errors corrected for clustering on communities ;*
**,**,*** represent significance at 10%, 5% and 1% levels respectively.*

*5.2 Individual fixed effects*

Table 4 reports the results from individual fixed effects estimation. For comparison, we also report the random effects estimations and Hausman test. It can be seen that the *p*-value of Hausman test is significant at 1% level, which is strong evidence in favor of the fixed effects model. In contrast to OLS results, the parameter of social capital by fixed effects estimation is much smaller, but still very significant. Specifically, 10 % increase in social capital index leads to 0.9% reduction in ADL index and 29.92% reduction in CES-D. Hence, there is evidence that social capital does cause better physical and mental health when individual fixed effects are controlled for.

However, this estimate should be interpreted cautiously. As mentioned before, the use of individual-level fixed effects does not control for time-varying unobservables, nor does it control for reverse causality. Thus, we continue to pursue an instrumental variable identification strategy to better isolate the causal effect of social capital on health.

**Table 4 Fixed effects estimates of the effect of social capital on health**

| | ADL index | | | | CES-D | | | |
|---|---|---|---|---|---|---|---|---|
| | FE | | RE | | FE | | RE | |
| | Coef. | Robust S.E | Coef. | Robust S.E | Coef. | Robust S.E | Coef. | Robust S.E |
| Social capital index | -0.090*** | 0.032 | -0.142*** | 0.023 | -2.992*** | 0.729 | -0.124 | 1.292 |
| Age | 0.027*** | 0.002 | 0.006*** | 0.000 | 1.431*** | 0.325 | 0.764 | 1.510 |
| Female | 0.233*** | 0.049 | 0.054*** | 0.009 | 0.013 | 0.017 | 0.072 | 0.121 |
| Dwelling in urban area | 0.050*** | 0.015 | 0.041*** | 0.016 | -0.143 | 0.363 | 0.578 | 0.540 |
| Primary | -0.010 | 0.012 | -0.016** | 0.007 | -1.156*** | 0.275 | -1.887*** | 0.655 |
| Secondary | -0.032 | 0.020 | -0.012 | 0.008 | -1.591*** | 0.394 | -2.318** | 1.113 |
| University | -0.040 | 0.032 | -0.033 | 0.028 | -2.353*** | 0.704 | -0.050 | 2.096 |
| Divorced | -0.005 | 0.034 | 0.001 | 0.020 | 0.867 | 0.800 | 0.748 | 1.962 |
| Widowed | 0.041 | 0.036 | 0.018* | 0.011 | 1.904*** | 0.450 | 2.462 | 1.494 |
| Unmarried | 0.063 | 0.043 | 0.013 | 0.032 | 6.219*** | 1.492 | 15.085*** | 1.976 |
| Urban employee medical insurance | -0.004 | 0.019 | 0.003 | 0.013 | 0.746 | 0.475 | 1.772** | 0.744 |
| Urban resident medical insurance | 0.011 | 0.026 | 0.027 | 0.020 | 1.213** | 0.548 | 0.749 | 1.256 |
| New rural cooperative medical insurance | 0.008 | 0.016 | 0.013 | 0.013 | 0.261 | 0.412 | 0.581 | 0.542 |
| Free medical insurance | 0.029 | 0.027 | 0.025 | 0.021 | 0.917 | 0.731 | 2.671** | 1.174 |
| Medical aid | 0.138*** | 0.027 | 0.002 | 0.040 | 2.331** | 1.089 | / | / |
| Commercial medical insurance | 0.035 | 0.024 | 0.003 | 0.017 | -1.135** | 0.498 | -1.019 | 0.912 |
| Ever smoke | 0.006 | 0.020 | -0.003 | 0.010 | 0.685** | 0.337 | -0.008 | 0.715 |
| Ever drink | 0.014 | 0.012 | -0.002 | 0.006 | -0.408* | 0.225 | 0.100 | 0.401 |
| household size | 0.007* | 0.004 | 0.008*** | 0.002 | 0.122 | 0.085 | 0.188 | 0.144 |
| Log of household income | -0.000 | 0.002 | -0.002** | 0.001 | -0.115** | 0.045 | 0.076 | 0.060 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| per capita | | | | | | | | |
| Connected to running water | -0.022*** | 0.008 | -0.058*** | 0.007 | 0.150 | 0.302 | -0.118 | 0.381 |
| Connected to sewer | 0.016 | 0.014 | 0.007 | 0.013 | -0.998* | 0.586 | -0.431 | 1.088 |
| Connected to telephone | -0.023** | 0.010 | -0.027*** | 0.008 | -0.274 | 0.233 | -0.068 | 0.469 |
| House owned | -0.028* | 0.016 | -0.004 | 0.009 | 0.331 | 0.396 | -0.628 | 0.584 |
| Log of house area | -0.005 | 0.007 | -0.013*** | 0.005 | -0.003** | 0.001 | -0.001 | 0.001 |
| Number of community hospitals | 0.003 | 0.002 | 0.002 | 0.002 | 0.219*** | 0.066 | 0.308*** | 0.056 |
| Number of community centers | -0.003 | 0.003 | -0.012*** | 0.002 | -0.266*** | 0.073 | 0.071 | 0.111 |
| Distance to the nearest bus station | -0.000 | 0.001 | 0.001 | 0.001 | 0.064** | 0.030 | 0.009 | 0.028 |
| Has road passing through | -0.015 | 0.047 | -0.034* | 0.018 | -0.666 | 0.846 | 0.754 | 1.171 |
| Year2012 | -1.456*** | 0.189 | 0.050 | 0.046 | -0.288 | 0.250 | -0.357 | 0.609 |
| Intercept | -0.090*** | 0.032 | -0.142*** | 0.023 | 9.896*** | 1.473 | 1.486 | 7.082 |
| Hausman Test[*p*-value] | | | 357.04[0.000] | | | 77.27[0.000] | | |
| N.observations | | | 3920 | | | 3215 | | |
| No.individuals | | | 2511 | | | 2211 | | |

*Note:Hausman test for fixed vs. random effects, computed on the models without robust standard errors.*
**,**,*** represent significance at 10%, 5% and 1% levels respectively.*

### *5.3 Instrumental variable results*

Tables 5 and 6 report the relevant first and second stage coefficients from our IV estimation. We use IV fixed effect and IV random effect models for estimation. Hausman test clearly rejects the null hypothesis and favors the results by IV fixed effect. As indicated by the first stage results, community average social capital has high explanatory power with respect to individual social capital. A10 % increase in community social capital leads to a 7.8% and 8.9% increase in individual social capital. From the second stage results, we find that a 10% increase social capital index leads to a 2.25% reduction in ADL index and 102.7% reduction in CES-D. The marginal effects of social capital using IV estimation is larger than those of OLS and fixed effect after controlling for the endogeneity of social capital.

**Table 5 2SLS regression of the effect of social capital on ADL**

| ***First stage*** | | | | |
|---|---|---|---|---|
| Dependent variable | social capital index | | | |
| | IV FE | | IV RE | |
| | Coef. | Robust S.E | Coef. | Robust S.E |
| Average community social capital | 0.784*** | 0.093 | 0.83*** | 0.049 |
| ***Second stage*** | | | | |
| Dependent variable | ADL index | | | |
| | IV FE | | IV RE | |
| | Coef. | Robust S.E | Coef. | Robust S.E |
| Social capital index | -0.225*** | 0.055 | -0.271*** | 0.084*** |
| Hausman Test[*p*-value] | 42.39[0.04] | | | |
| N.Obs. | 3920 | | | |
| N.groups | 2511 | | | |

*Note: we also control for the variables listed in Table 4. *,**,*** represent significance at 10%, 5% and 1% levels respectively. The same hereinafter for the following tables.*

**Table 6 2SLS regression of the effect of social capital on CES-D**

| ***First stage*** | | | | |
|---|---|---|---|---|
| Dependent variable | social capital index | | | |
| | IV FE | | IV RE | |
| | Coef. | Robust S.E | Coef. | Robust S.E |
| Average community social capital | 0.893*** | 0.055 | 0.813*** | 0.111 |
| ***Second stage*** | | | | |
| Dependent variable | CES-D | | | |
| | IV FE | | IV RE | |
| | Coef. | Robust S.E | Coef. | Robust S.E |
| Social capital index | -10.27*** | 3.11 | 3.47 | 6.21 |
| Hausman Test[*p*-value] | 392.91 [0.000] | | | |
| N.Obs. | 3215 | | | |
| N.groups | 2211 | | | |

*5.4 Heterogeneous effects of social capital on health*

We also investigate whether the relationship between social capital and health varies by gender , age and area of residence. We include the interactive terms into our regression equations and use IV models for estimation. The IV results in table 7 indicate that the relationship between social capital and ADL index varies by area of residence and age, but not by gender. Model 1 shows that there is no gender-specific difference in the relationship between social capital and ADL index. Model 2 shows that the effect of social capital on ADL index is larger for urban population than for rural population. For urban populations, a 10 % increase in social capital index results in 1.15% further reduction in ADL index. In model 3, effect of social capital on ALD is larger for older population (age 65 more) compared to younger population (age 45-age 65). Possible explanations for these differences are: social participation and activities of daily living may be complements for urban populations, but substitutes for rural populations. In urban areas, when people get older, they can retire and be freed of workload and household affairs and have time to participate in social activities. In rural areas, with younger population migrating into coastal regions, the older population have to take care of the left-behind children and do household activities, which will crowd out their social participation. The more pronounced effect for population aged 65 and older can be accounted for by the fact that the older population are more fragile and likely to suffer from chronic diseases

Table 8 shows the IV estimation of the relationship between social capital and CES-D scale. There is significant differences by gender but no difference by area of residence and age. The increase in social capital leads to more reduction in CES-D for women compared to men. Possible explanations are: First, women shoulder heavy domestic activities and they have to spend much more time on family activities than men. Once women are freed from domestic activities, health benefits from social participation will become greater; Second, there is reporting bias in CES-D score. Women and men may have different perceptions on CES-D questions. For men, worse self-rated health status is often associated with occurrence of serious diseases. However, for women, self-rated health status also depends on other negative events, such as problems with other family members (Benyamini, Leventhal, and Leventhal, 2000). Due to the differences in how male and female perceive their own mental health,

women often underestimate their health status. Hence, the impact of social capital on women's CES-D score is more significant than that of men.

Table 7 IV estimation of the Heterogeneous effects of social capital on ADL index

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | IV FE | IV RE | IV FE | IV RE | IV FE | IV RE |
| | Coef | Coef. | Coef | Coef. | Coef | Coef. |
| Social capital index | -0.079*** | -0.129*** | -0.049 | -0.149*** | -0.067** | -0.093*** |
| | (0.04) | (0.025) | (0.035) | (0.027) | (0.038) | (0.024) |
| Female*social capital index | -0.022 | -0.028 | | | | |
| | (0.051) | (0.033) | | | | |
| Urban*social capital index | | | -0.115* | 0.019 | | |
| | | | (0.062) | (0.049) | | |
| Age65*social capital index | | | | | -0.106** | -0.242*** |
| | | | | | (0.046) | (0.048) |
| Hausman Test[*p*-value] | 356.62[0.000] | | 360.91[0.000] | | 355.09[0.000] | |

Table 8 IV estimation of the Heterogeneous effects of social capital on CES-D

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | IV FE | IV RE | IV FE | IV RE | IV FE | IV RE |
| | Coef | Coef. | Coef | Coef. | Coef | Coef. |
| Social capital index | -2.438*** | -2.28 | -0.107 | -2.32*** | -2.531** | 0.3*** |
| | (0.862) | (1.501) | (1.752) | (0.872) | (0.819) | (1.485) |
| Female*social capital index | -3.389*** | -1.098 | | | | |
| | (1.082) | (1.29) | | | | |
| Urban*social capital index | | | 0.078 | -1.575 | | |
| | | | (2.6377) | (1.231) | | |
| Age65*social capital index | | | | | -2.218 | -0.259 |
| | | | | | (1.685) | (3.367) |
| Hausman Test[*p*-value] | 83.40[0.000] | | 77.16[0.000] | | 76.71[0.000] | |

**6. Conclusion**

This study contributes to the growing literature on the causal relationship between social capital and health by using China Health and Retirement Longitudinal Survey (CHARLS) data. Although numerous studies have indeed documented a strong positive empirical association between social capital and health, interpretation of correlation as causation is difficult because social capital is most likely an endogenous variable. Using waves 2008 and 2012 data from CHARLS, we exploit fixed effect and IV approach to estimate the causal effect of social capital on individual's physical and mental health. We find evidence for a strong and significant positive causal effect of social capital on individual's physical and mental health. Our IV estimates of the effect are slightly higher than OLS and fixed effect estimates. We find that social capital tends to have a larger impact on the ADL index of urban and older (age 65 and more) population than on rural and younger population. Additionally, social capital has a larger impact on the CES-D score of women than men.

A central message from this study is that social capital does serve as a key determinant of population health in China. An increase in social capital index leads to better physical and mental health. The implication of our study is that government can improve population health by investing in social capital, in addition to the ongoing healthcare reforms. This can be achieved through the following approaches: (1) directly provide funding or subsidies to

promote individuals' social capital formation, such as establishing recreational rooms, and organizing community events to facilitate social interaction and community participation; (2) create favorable policies for the establishment of a variety of NGOs and community groups to stimulate community participation and develop individuals' social capital; (3) pay attention to the impact of social capital on the health of different groups. More attentions should be paid to the investment of social capital on women, rural residents and people under the age of 65.

This study is subjected to several limitations. First, on social capital measurement, this study focuses only on structural but not cognitive social capital. Our measurement may not be comprehensive and sufficiently accurate. Future research can focus on the impact of cognitive social capital on health status. Second, our sample are confined to urban and rural residents aging 45 or higher in China. The conclusion cannot be generalized to other demographic groups. Third, this study only empirically examines the causal relationship between social capital and health status. However, the internal mechanism of this relationship is not discussed. Further analysis can potentially investigate such internal mechanisms.

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