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OLDER PEOPLE IN CHINA: THEIR HEALTH AND THE ROLES OF SOCIAL CAPITAL AND HOUSEHOLD INCOME INEQUALITY

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ABSTRACT

Demographic ageing has meant that the health of middle-aged, older and elderly people has attracted increasing attention within different disciplines, including medical science, public health, management and economics. There are also related and international public health concerns. China, the most populous country in the world with the fastest economic growth, is also undergoing a significant demographic transition from a youthful society to an ageing society. This important phenomenon demands attention from scholars and policymakers alike. However, there is limited knowledge regarding the health of middle-aged and older people in China. In particular, knowledge concerning the role of social capital in the determination of health among the older population is sparse.

This study addresses these knowledge gaps using representative national datasets from the China General Social Surveys (CGSS), and the China Health and Retirement Longitudinal Study (CHARLS). The study uses these data sets to focus on the relationship between different health outcomes and social capital at both the individual-level and community-level, among middle-aged and older people and the wider population in China. The study builds on and improves previous studies on the "health-social capital" relationship through the use of a mix of statistical analysis, a quasi-experiment to identify the causal relation between social capital and health status at the individual-level, and the application of the multilevel modelling strategy to identify the association between

community-level social capital, individual-level social capital and the health status of respondents.

Specifically, in Chapter 4, using the CGSS dataset and binary logistic regression, this study finds that individual-level social capital measured by social trust, social interaction, religious group membership, communist party membership and union membership, are significantly correlated with individual subjective health status (self-rated general health, SRH), and subjective well-being status (self-rated well-being, SRWB). Social trust and social interaction appear to have the strongest, positive and significant association with SRH and SRWB in this respect. In contrast, some of the indicators of social capital (religious group and union membership) appear to be detrimental to health to some extent. The results suggest that social capital at the individual-level can be influential in promoting the health and well-being of Chinese adults.

Chapter 5 uses the CHARLS two-year panel dataset, and a combination of Propensity Score Matching (PSM) and Difference-In-Differences (DID) estimation to provide an analysis of causality in the relationship between social capital and individual health outcomes. The empirical results show that for older people in China, some health indicators (including cognitive function and indicators of mental health and physical health) are improved through the acquisition of some forms of social capital. Specifically, cognitive components of social capital, measured by indicators of reciprocal behaviour (including economic help provided to others and received by others over the past year) significantly improve the cognitive function and physical health of older Chinese people, while social trust (measured by perceptions in relation to future help/care) significantly improves mental health and physical health outcomes. In addition, most structural components of social capital (measured by interaction with friends, engaging with charity/helping others, social entertainment activities, and participation in group/sporting activities) also significantly improve health outcomes among older people in China. However, the results of the heterogeneity analysis show that the impact of social capital on health varies for different age groups, men and women, urban and rural regions, and by *Hukou* status. Importantly, the results suggest that social capital plays a more important role in improving health outcomes among demographically and socio-economically disadvantaged groups.

Finally, in Chapter 6, the study investigates the relationship between income inequality, social capital and health status among mid and older people in China. Employing data from two waves of the CHARLS and a multilevel modelling strategy, the statistical results indicate that widening income inequality negatively affects health status (measured by SRH, SRWB, cognitive function and an index of depression symptoms) while social capital at both individual- and community-level has significant and positive effects on health outcomes. The results imply that older people are more likely to experiences health hazards if they have less social capital at either (or both) the individual- or community-level. Furthermore, the study also shows that higher levels of the cognitive component of social capital at the community-level (measured by the proportion of people participating in reciprocal activities, and the percentage of people who have social trust in the community) can mitigate the negative impact of growing income inequality on older people's mental health. The results can be interpreted to imply that rising income inequality since Mao's era can explain about a quarter of the average level of depression in China (among older people), while social capital at the community-level plays a significant role in the reduction of depressive symptoms (among older people). This part of the research additionally investigates the association between the health status of older people and a range of demographic factors (age, gender, and marital status, etc.), socio-economic factors (educational background, working status, and household income per capita, etc.), lifestyle (whether they exercise, smoke or drink, etc.) and household characteristics. The results are generally consistent with previous studies.

To summarise, this study employs social capital theory to analyse the relationship between social capital and health in the context of the Chinese cultural legacy, population transition and health-related government reforms as well as various health and income disparities across different social groups and regions in China. Specifically, it endeavours to provide new empirical evidence of the relationship between social capital, income inequality and individual health status in China, particularly for the growing proportion of middle-aged and older Chinese people.

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ABBREVIATIONS

ADL	Activities of Daily Living
AIC	Akaike Information Criterion
AME	Average Marginal Effects
ATT	Average Treatment effect on Treated
BIC	Bayesian Information Criterion
BL	Binary Logit
BMI	Body Mass Index
CCP	China Communist Party
CFPS	China Family Panel Studies
CGSS	China General Social Surveys
CHARLS	China Health and Retirement Longitudinal Study
CLDS	China Labour Force Dynamic Survey
CLHLS	Chinese Longitudinal Healthy Longevity Survey
DID	Difference-In-Difference
ELSA	English Longitudinal Survey of Ageing

FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IADL	Instrumental Activities of Daily Living
IID	Independently and identically distributed
KMO	Kaiser-Meyer-Olkin
LR	Likelihood Ratio
ML	Mixed-Effect Linear
OL	Ordered Logit
OLS	Ordinary least squares
OR	Odds Ratios
PFA	Principle Factor Analysis
PPS	Probability-Proportional to Size
PRA	Participating in Religious Activities
PS	Propensity Score
PSM	Propensity Score Matching
PSU	Primary Sample Unit
RE	Random-Effect

SC	Social Capital
SES	Socio-economic Status
SRH	Self-Rated General Health
SRWB	Self-Rated Well-being
SSU	Secondary Sampling Units
TICS	Telephone Interview of Cognitive Status
VPC	Variance Partition Coefficients

1 CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Asian countries are currently experiencing significant demographic changes which include increases in the older population (United Nations, 2015). China is recognised as one of the fastest developing countries on the world scene, accounting for a fifth of the entire global population. Demographic data in China indicates that there has been an increase in the elderly population (Lutz *et al.*, 2008; Bongaarts, 2009). An ageing population was first defined as one in which people who are above 65 years old account for more than 7 per cent of the whole population in a country/region, while those under 14 count for less than 30 per cent (United Nations, 1988). In 1982, however, reports were issued that indicated individuals over 60, rather than 65, would be considered to be elderly (United Nations, 1983). The phrase "ageing population" is now used to represent a population in which over 7% of the population are aged 65 and over, or where 10% of the population is over 60. In 2014, the China Statistics Yearbook (China Statistics Press, 2015) estimated that 10.1% of the Chinese population (with estimated total population of 1,367,820,000) was aged 65 or older. This equates to around 136,782,000 older individuals. There are further estimates that the percentage of elderly individuals in China could increase to 27.55% by 2050

(United Nations, 2015). That would equate to 371.39 million Chinese individuals being over 65 years of age. With such a high level of elderly individuals, it is important to consider the support ratio. A dependent ratio is the number of adults over 65 years old in comparison to the number of working-age adults (16-64 years). This ratio was 7.6 in 1980 and had increased to 13.7 in 2014 (China Statistics Press, 2015). Some factors have contributed to the older Chinese population expansion. For example, the “One-Child” policy has resulted in a reduction in the younger population; thereby a decreased support ratio. Similarly, medical advancements and technology are now ensuring that individuals live longer lives (Hesketh *et al.*, 2005; Poston, 2010). With the population already being the largest in the world, the elderly Chinese population is now also the largest. China is still a developing country, therefore having a large elderly population could place an unmanageable strain on the economy due to higher and higher demand of pension payments, health care requirements, reduced labour forces and the number of carers required (Hussain, 2002; Golley and Tyers, 2006).

China went through reforms in the late 1970’s, and since this time, economic growth has been expansive. China is now recognised as a significant contributor to the global economy (Lardy, 1994; Shenkar, 2006). The "demographic dividend"[1] in China has been highlighted as a key factor in China's success (Cai, 2010; Choudhry and Elhorst, 2010), and China's emphasis on exports in another factor (Zhang, 2001; Rodrik, 2006; Guo and N'Diaye, 2009). Regardless of the contributing factors, China's economic position presents a range of advantages and limitations. There has been a significant improvement in Chinese living standards due to the economic changes, and increased life expectancy (Yi *et al.*, 2001). Older people in a better financial position also bring considerable purchasing power to the Chinese and foreign markets (Bonnefond and Clément, 2014). Unfortunately, it is more difficult for older Chinese individuals to compete with the younger people in the job market, thereby making job acquisition or maintenance difficult (Cai and Wang, 2010). As individuals become more elderly, they are less likely to be employed due to either disability or retirement. This has presented an issue for both regional and central Chinese governments, as they struggle to develop a social security system that will meet the older resident needs (Golley and Tyers, 2006; Wang *et al.*, 2004; Li and Mérette, 2005). The "One-

[1] According to Lee and Mason (2006), demographic dividend is defined as the benefit from shifts in a country's age structure for the economic development, it mainly indicates the percentage of the working-age population (15 to 64) is much larger than the percentage of non-working-age population (14 years old and younger, and 65 years older and older). The large number of working population could provide a large number of labour force participating in the labour market, and result in a low level of wage rate, thus, drive the economic growth for a country. China is a typical example of benefit from the demographic dividend.

Child" policy also results in fewer younger, able-bodied individuals being capable of looking after their elderly family members, placing pressures on the government to provide alternative care (Hesketh *et al.*, 2005). The potential supply of family carers is also reduced as there is a significant level of internal migration in China, meaning child(ren) or relatives may not be nearby (Liang *et al.*, 2002). The result of this is that a greater number of older people live alone without a carer (Liu and Guo, 2007; Su *et al.*, 2012). As a developing country in its early stage of social security development, it brings significant challenges for entering an ageing society. Therefore, how to deal with the increasing ageing population, and sustaining or even enhancing the health status of older people has been becoming a major concern for both scholars and policy makers.

1.2 Objectives and Hypotheses of the Study

Most of the studies on health impact factors of older people have focused predominantly on western developed countries, especially those focusing on social capital and health relationships. Only a few have been found that reported in developing countries such as China (for example, Yip *et al.*, 2007; Wang *et al.*, 2009; Shen *et al.*, 2013; Meng and Chen, 2014; Xue *et al.*, 2016). However, most of these studies that focus on social capital and health relations in China either used a regional-level dataset (Shen *et al.*, 2014; Meng and Chen, 2014; Yip *et al.*, 2007) or only focus on a single component or a single level of social capital instead of multiple components or multilevel (Wang *et al.*, 2009; Xue *et al.*, 2016). Their findings are thus not nationally representable or generalisable.

In relation to the risks presented by an ageing population in China recently, and the relationship between individual health status and social capital, there remain unanswered questions that this thesis attempts to address[2], namely: (1) What is the relationship between social capital and health among Chinese citizens? (2) Does social capital play a more important role in this relationship for the mid and older population than for their younger counterparts? (3) Can social capital alleviate the negative effects of ageing on health? (4) Is there causality between individual-level social capital and health status among middle-aged and older people in China? (5) What are the relationships between social capital, health and household income inequality among mid and older aged adults in China? (6) Can social capital alleviate the negative effect of regional income inequality on older people' health?

To address these questions, this study seeks to determine how a range of sociological factors, conceptualised as social capital, may impact the health of mid

[2] There is only a limited body of previous research in this area. However, there is some indication that both individual and collective (neighbourhood or community) levels of social capital are potentially important for Chinese citizens (Yip et al., 2007; Shen et al., 2014; Kawachi et al., 1997)

and older aged people in China. Specifically, the objectives of the present study are:

(1) To investigate social capital effects on health at both individual[3] and collective (i.e. neighbourhood or community)[4] levels.

(2) To determine whether there is causality in the relationship between social capital and individual health outcomes.

(3) To consider whether demographic and socio-economic factors mediate the influence of social capital on individual health status.

(4) Finally, as age and income inequality have been recognised as negatively impacting health among individuals (Li and Zhu, 2006; Baker *et al.*, 2000), to explore the potentially alleviating effects of social capital.

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[3] Following the definition by Lin (2002, 2000) and Akdere (2005), the definition of individual-level social capital in this study can be considered as a capital other than human capital and cultural capital, it is a collected resource from one's formal and informal social networks and relations, which can been accumulated over time through one's social skills and social relations; it is an investable resource and can be expected to have returns to the individual in the future as a result of the history of these relationships. Variables indicating social capital include individual trust level for others, social network size, social interactions and membership of groups. For a more detailed discussion, please refer to section 3.1 in Chapter 3.

[4] Based on the definition by Kawachi (1999), besides the individual perspective, social capital can be viewed as a collective resource or a collective action in neighbourhoods or communities, which contains features of the neighbourhood or community, including trust between individuals, norms of reciprocity and membership networks within the neighbourhood or community. Variables mainly measured by the collective resources in the region (i.e. neighbourhood or community), such as social trust level, social reciprocity and social interaction rate. Detailed discussions please see section 3.2 in Chapter 3.

In line with these objectives, this study considers the following assumptions drawn from previous research and derives a series of related and testable hypotheses:

(1) Social capital at the individual-level impacts on health status particularly among older people. This assumption builds on the results of Shen *et al.* (2013). The related Hypothesis 1 (H1) is that social capital at the individual-level impacts positively on health. To test this hypothesis the empirical analysis in the present study follow previous research by distinguishing between cognitive and structural social capital. The cognitive component of social capital at the individual-level is captured by three different measures: an index measure of respondents' social trust generated using factor analysis (a continuous scale generated and used in Chapter 4); an indicator of respondents' beliefs about whether they would be able to acquire unpaid help from their relationship network (relatives and non-relatives) if needed at some point in the future (a dummy variable as a proxy of social trust used in Chapters 5 and 6); and an indicator of whether respondents engaged in reciprocity by both providing and receiving economic help over the past year (used in Chapters 5 and 6). The structural component of social capital is indicated by a number of different variables: a continuous scale of social participation generated using factor analysis (used in Chapter 4); three dummy variables indicating membership of

a social group or organisation namely a religious group, the Chinese Communist Party or Union (these two variables are only available in the CGSS dataset and are employed in the analysis of Chapter 4); and a set of dummy variables indicating whether or not respondents engaged in particular social interactions over the past month including interaction with friends, charity work or helping a non-relative (e.g. helping those who live alone, engaging in community volunteering, or engaging in charity work with an elderly or disabled adult living alone), engaging in social activities (using the Internet, attending a community club, playing chess/cards/ma-jong) and engagement in group events (participating in an educational course or skills workshop, attending a dance or exercise class, or visiting a sports club).

a. There are heterogeneous effects of social capital on health status associated with different populations with different demographic and socio-economic status. This assumption draws on the findings of Shen *et al.* (2013), and leads to Hypothesis 1-1 (H1-1) that social capital is likely to have a different bearing on health outcomes within different age groups (the thresholds modelled are; <45, >45 & <60, and ≧60), genders, regions (urban and rural) and different registered permanent residence status (agriculture *Hukou* and non-agriculture *Hukou*).

b. Social capital factors can reduce the negative effect of age on health as highlighted in the health equation proposed by Grossman (1972) which assumes an individual's health status declines with age. This leads to the sub-hypothesis: Hypothesis 1-2 (H1-2) that social capital at the individual-level could reduce the negative effects of age on health, with the magnitude of the effect of social capital greater for older people group compared with that for younger individuals.

c. There is a causal relationship between social capital and health. This assumption follows from the research of Ronconi *et al.* (2012). Ronconi *et al.* (2012) used an IV approach to identify the causal relation between social capital at the individual-level and subjective health status of individuals in Argentina. Their results confirmed the significantly and positive impact of social capital on respondent's subjective health status. In line with this evidence, this thesis investigates whether a causal relationship between social capital and health is evident among older people in China. This assumption leads to the two sub-hypotheses that at the individual-level cognitive social capital [Hypothesis 1-3 (H1-3)] and structural social capital [Hypothesis 1-4 (H1-4)] can significantly improve health outcomes among older people in China.

(2) There is an association between the degree of income inequality, community-level social capital and individual health among mid and older Chinese. Kawachi *et al.* (1997) used a cross-sectional dataset covering 39 states in the U.S.A. to examine the relationship between income inequalities, social capital at the state-level (measured by the level of social trust and per capita density of membership in voluntary groups) and mortality rates of the state. Their results demonstrated that income inequality in a state is significantly correlated with a reduction in social capital that it is in turn associated with an increased state mortality rate. Following their argument, Hypothesis 2 (H2) is that the community-level social capital, both cognitive and structural components, is positively associated with health status among mid and older Chinese.

a. This study also proposes the following sub-hypothesises, Hypothesis 2-1 (H2-1) is that the income inequality at the county-level is significantly negatively related to middle-aged and older respondents' health status.

b. Hypothesis 2-2 (H2-2) is that social capital at the community-level can reduce the negative effect of income inequality on the health status of older people. In this analysis, social capital at the community-level is measured by: the proportion of residents who trust in others in the community (a proxy of social trust at the community-level); the proportion of residents who engaged in reciprocity within the community (a proxy of the degree of reciprocity in the community); the proportion of respondents engaged in certain social interactions or social participation over the past month (a proxy of social engagement at the community-level); and the variety of amenities and associations within the community/village that are specifically designed for the community/village residents (Shen *et al.*, 2014; Shen, 2014).

(3) There is a relationship between individual-level demographic and socio-economic factors and respondents' health. The related Hypotheses 3 (H3) is that the demographic and socio-economic factors including age, gender, education, marital status, *Hukou* status, rural-urban status, individual annual income level or annual household income per capita level (specifically among the older population), and working status are strongly associated with adults' health. Previous research in this area also suggests further sub-hypotheses: that the lifestyle of an individual is strongly associated with their health status [Hypothesis 3-1 (H3-1)]; that some family and household characteristics (e.g. household size, whether living with child/children, family wealth and living condition, etc.) may also play a fundamental role in determining health in Chinese families especially for older people (Zimmer and Kwong, 2003)

[Hypothesis 3-2 (H3-2)]. However, the sign or direction of the above factors are difficult to predict. A further assumption in the literature is that more educated people may have better knowledge regarding health inputs and have better self-control over negative behaviours for health, thus, better health status [Hypothesis 3-3 (H3-3)]. Hypothesis 3-4 (H3-4) is that income (either individual income or annual household income per capita, etc.) and some household characteristics (e.g. annual household total income, living environment, and whether living with child, etc.) are positively and significantly related to health status among older Chinese people even after controlling for other socio-economic status factors. The previous literature associated with these four sub-hypotheses is summarised below:

a. Hypothesis 3-1: Carmichael, Hulme and Porcellato (2013) and Porcellato *et al.*, (2010) argue that while participating in the labour market is important for maintaining income in older-age this requires good health; ill-health is a barrier to employment. However, there is also a potential two-way causality between health and work in older-age since work can also impact on health, both positively and negatively.

b. Hypothesis 3-2: Mirowsky and Ross (1998) argued that lifestyle and personal self-control, indicated by smoking and drinking behaviours, significantly affect physical functioning and the self-reported health of older people (mediated through their educational level).

c. Hypothesis 3-3: Using the pilot version of the CHARLS data Shen et al, (2013) used the pilot version with only one wave and only 998 valid observations, and findings from Fujiwara and Kawachi (2009) who used a twin fixed-effect approach to identify the causal relation between educational status and health of individuals.

d. Hypothesis 3-4: Marmot (2002) and Frijters *et al.* (2005) indicate that the higher individual and household income and the better the home living environments, the better health status of an individual. This relationship is likely to be particularly important in less-developed countries when, as in China, where the state does not provide sufficient public goods or services to support the health of their citizens.

To summarise, the research makes use of both individual-level and multilevel statistical techniques to generate a clearer picture of the influence of social capital on the health of mid and older people in China. The study will also investigate whether social capital can reduce the negative influence on the health of age and socio-economic factors including annual household income per capita inequality. The empirical analysis uses a broad range of both subjective and objective indicators of health based on psychological and physiological measurements. Moreover, this study is the first to combine the method of Propensity Score Matching (PSM) and Difference-In-Differences (DID) to investigate the causality between social capital and health among mid and older aged adults in China.

1.3 CONTRIBUTION OF THE STUDY

The health of the older Chinese population has attracted little research and few studies that have been conducted elected to focus on subjective rather than objective measures of health (Yu *et al.*, 1998; Cheng *et al.*, 2002). This research will make use of the same self-rated general health and subject well-being measures that most previous studies have used, providing insight into mental and physical health, as well as cognitive ability. This should help to develop a more accurate picture of health in mid and older people and the social capital-health relationship. A further progression of this study in comparison to other studies is that the emphasis will not only be focused on socio-economic status, but the perspectives such as social capital theory also will be incorporated to explore new areas (Yip *et al.*, 2007; Wang *et al.*, 2009; Shen *et al.*, 2014). The health status of older individuals in China was explored within this research from a new perspective, one of social capital regarding both individual and collective or contextual influences. This study will also be the first to make use of a national representative data sample selected at random. Research on such issues which have been published by Yip *et al.* (2007), Wang *et al.* (2009) and Shen *et al.* (2013) has all focused on small samples, either specifically rural or urban, and have restricted their data to a limited number of regions, thus, no research is as representative as this research intends to be. Very little data has been published on demographic factors that influence the health of older Chinese individuals, such as age and gender (Shen *et al.*, 2014), which will further fill the gap in this study. A random sample of data will be selected for this study from a data pool including 28-32 provinces. Thus, it will be highly representative of both rural and urban China. This study will also provide an overview of the lifestyles of participants, consider their living preference (living with or without child or grandchild), and whether smoking or drinking. It is intended that this research will contribute towards current health research and influence health policies.

The relationship between individual health status and social capital first became a topic of interest around the 90s (Bourdieu, 1986; Coleman, 1988; Cattell, 2001; Kawachi *et al.*, 1997; Lin, 1999; Putnam, 1993), however, the majority of these studies have focused on more developed countries, which are not necessarily comparable with China due to differing social contexts (Shen *et al.*, 2014; Wang *et al.*, 2009; Yip *et al.*, 2007). Before exploring the relationship between elderly Chinese individuals and social capital, it is important to consider the general social environment. China has undergone some socio-economic reforms, and each of these has presented new opportunities, as well as challenges to the individuals living in China. Firstly, life expectancy has significantly increased, however, in conjunction with this, the health insurance systems are still underdeveloped. Secondary, urbanisation and globalisation in China have resulted in significant internal migrations, but have also attracted migration from outside the domestic regions. Lastly, the effect of this movement is a challenge to traditional cultural values. China has traditionally been a patriarchal society and promotes a strong family unit, whereby the younger generations respect and take care of their elders (Pei and Pillai, 1999; Cheng *et al.*, 2002; Zimmer and Kwong, 2003). The epidemiological and sociocultural developments are seen in recent years in China are reflective of many other Eastern developing countries (Ward and Kennedy, 1999). Therefore, it is possible that the findings from this study could be applied and utilised by these countries to promote the health and well-being of their elderly populations.

Throughout this period of significant change, there has been limited consideration in research towards the effects on the health of the older Chinese population (Zimmer and Kwong, 2004; Sun *et al.*, 2011). Moreover, the limited research that has been executed has focused on one specific area, namely psychological or physical health, and has consistently used self-report measures. Therefore, this study will seek to assess most aspects of health, using the self-report measures found in previous research, as well as objective measures. The health measures used will be included the subjective health and well-being scales, an assessment of cognitive ability, mental health and physical health. Furthermore, this study will move away from the focus of demographic and socio-economic factors seen in previous research.

This research will also consider both individual and collective aspects when exploring the relationship between social capital and elderly health. A further advantage of this study is that the data sample used will be a random sample covering most of the provinces in China, such a diverse sample has not been utilised before. Besides the effect of social capital variables, the relationship between elderly health and demographic and socio-economic variables will also be explored.

Previous research by Yip *et al.* (2007) and Wang *et al.* (2009) briefly explored the relationship between social capital and the health of the elderly; however, their sample was restricted to rural areas of China. Therefore, it is not possible to generalise their findings to urban areas. Moreover, there was no consideration for collective-level analysis, such as community- or village-level, a consideration this study will address. The current study will make use of data that covers 28-32 provinces and thereby encompasses both rural and urban China, helping to produce a comprehensive overview of cognitive and structural social capital at both individual- and collective-level.

The findings of this thesis will significantly contribute to current health research while creating informed awareness of the effects of social capital variables on the elderly Chinese. Thus, health promotion and a reduction in the influence of inequality on older respondents' health status could result from the findings. Health policies are derived from research, meaning this research could help to generate policies that are better tailored to the needs of elderly individuals in China and other similar socio-economic and epidemiological countries. As the ageing population increases worldwide, this research becomes invaluable in assisting governments in the promotion of welfare among their citizens.

1.4 Structure of The Study

Chapter 2 reviews the context for demographic ageing in China during the past 4.5 decades, and briefly describes the health insurance system in present day China. It covers the impact of social transition and social context in that country, and discusses the support available for elderly individuals, as well as health inequality regarding gender, rural-urban areas, and different age groups from previous studies.

Chapter 3 explores social capital theory, providing a definition and examples and summarises the historical development of the theory. It also presents findings from previous literature that has explored the relationship between social capital and health. The theoretical model of the health generation role in relation to social capital as an input is also outlined.

Chapter 4 is the first empirical chapter of the thesis and analyses the correlation between social capital and health in China. The analysis uses data from a representative sample of the Chinese adults. This data comes from the China General Social Surveys (CGSSs) 2010–2013 which provides four years cross-sectional data on the social structure and quality of life of individuals across China aged 16 and over. This analysis uses a subjective measurement of health and well-being as the dependent variable, and measures of the cognitive and structural components of social capital at the individual-level as the main independent variables. These include scales of social trust (cognitive component) and social interaction (structural component) determined using Principle Factor Analysis (PFA). Three further objective measurements of social capital capture religion, China Communist Party membership (CCP) and union membership. These were incorporated in the analysis with the intention of assessing how they relate to self-reported health and well-being in the Chinese population. The analysis uses ordinary least squares (OLS) to calculate the marginal effects of these different measures of social capital on individual subjective health and well-being status. The results of this analysis indicate that social capital can moderate the negative effects of older-age in the age-health relationship.

Chapter 5 uses a different dataset with longitudinal information (panel data), and explores the causality between individual-level social capital and objective health outcomes among mid and older people in China, that Chapter 4 was not able to investigate. The data used are from the first and second wave (2011/2012 and 2013/2014) of the China Health and Retirement Longitudinal Study (CHARLS). The CHARLS survey which is a nationally representative longitudinal survey of people 45 and over. This survey is comparable with the English Longitudinal Survey of Ageing (ELSA). CHARLS provides both demographic and socio-economic information including measures of employment status, income, assets and expenditure. Of particular importance for this research, is that the survey not only includes subjective health measurements (e.g. self-rated health and well-being), but also includes many objective health indicators, such as indicators of respondent's cognitive function (memory and cognitive ability), mental illness (depression symptoms), and physical difficulty (Activities of Daily Living [ADLs] and IADLs [Instrumental Activities of Daily Living]), which allow this study to extend the analysis of the social capital-health relationship by moving from the subjective health indicator (Chapter 4) to objective measures of health outcomes. This aims to reduce measurement error in the analysis and narrow the estimation biases. Also, as the CHARLS data set is a short panel, the analysis is also able to explore causality in the relationship between health and social capital using a quasi-experiment methodology. This approach addresses some concerns related to endogeneity (i.e. measurement errors for dependent and independent variables, or omitted key variables in the equation or reverse causality between dependent and independent variable: health outcomes could be influencing the level of social capital). This chapter employs the Propensity Score Matching (PSM) and Difference-In-Differences (DID) approach to deal with the endogeneity in the relationship between social capital and different health outcomes. By using PSM, this chapter sets the treatment variable[5] (treated group = 1 means acquired social capital while control group = 0 means does not acquire social capital) is the

[5] In a statistical experiment, a treatments variable is an exogenous explanatory variable that could be manipulated by the experimenter. In the present study, it is considered that social capital is an exogenous factor in the health equation (Grossman, 1972), and it is a treatment variable, and those participants who have received treatment were considered as treated groups, while other participants have not received (or received placebos) were considered as control groups.

cognitive and structural social capital measured by social trust, reciprocity, and social interactions which were captured by records of participants visiting friends, partaking in sports or other recreational activities and charity work. And the advantage of using the DID approach in a longitudinal dataset is the possibility to control for unobservable errors due to individual heterogeneity. For example, personality differences that could influence social capital acquisition can be controlled, to some extent. In this analysis, the moderating effects of demographic and socio-economic factors (i.e. gender, age and income level, etc.) in the relationship between individual health status and individual-level social capital are also considered. This chapter concludes by summarising the results and drawing implications for policy.

Chapter 6 uses the CHARLS dataset to investigate how the health status of older people in China is impacted by household income inequality and social capital. This analysis seeks to determine whether there is a significant relationship between different health indicators, both individual- and community-level social capital, and county-level household income inequality among older population in China. In line with previous research, a negative effect of income inequality on older people' health is expected, and the analysis explores whether community-level social capital can alleviate such effects. In this analysis, we continue to employ the subjective and objective health indicators from Chapter 5 as the dependent variable. However, in parallel with the measure of county-level income inequality, social capital is measured at a community-level in addition to the individual-level. As the analysis includes measures at both the individual- and community-level, a hierarchical regression model is used. This chapter further confirms the findings from Chapter 5, and endeavours to shed new light on the empirical evidence of the relationship among social capital at both individual- and community-level and individual health outcomes of mid and older people in the China context. It could provide insight into public health policy implications from a social capital perspective.

In the empirical analysis above, the utilisation of CGSS and CHARLS datasets with insights from social capital theory and health economic theory as well as different econometrics methodology enables comprehensive consideration of the impact of social capital and income equality on various health indicators among mid and older individuals living in China. The final chapter, Chapter 7 completes the thesis by summarising the main findings, drawing policy conclusion, and both strengths and weakness of the thesis as well as implications for future research.

2 CHAPTER TWO: DEMOGRAPHIC TRANSITION AND SOCIAL CONTEXT IN CHINA

2.1 INTRODUCTION

This chapter sets the context for the thesis. It begins by discussing changes in demography within China over recent decades using seven demographic indicators to provide a comprehensive picture of population ageing in that country (Hussain, 2002). Next, it explores the social context of ageing in this transitional period, both historically and in present day China, especially emphasising the previous support for the elderly, and the changing scenarios in the course of this transformation, together with the current situation regarding older people. Finally, this chapter also examines other related issues, including a short literature review demonstrating that previous studies already acknowledge health inequality across gender, across rural-urban residential areas, and across different age groups.

2.2 DEMOGRAPHIC TRANSITION IN THE PAST AND THE FUTURE

2.2.1 DATA

This section employs the China Statistics Yearbook (China Statistics Press, 2015) and the World Population Prospects Revision (United Nations, 2015b) to describe the demographic transition in China. [6] These two datasets provide information on demographic indicators in China for the past 45 years. This study focuses on the date before and after the implementation of a population control policy, which is from 1970 to 2014. Specifically, seven indicators are used to describe the transition, including total population and its growth rate, crude birth rate and crude death rate, total fertility rate, life expectancy and change in age structure (population pyramid).

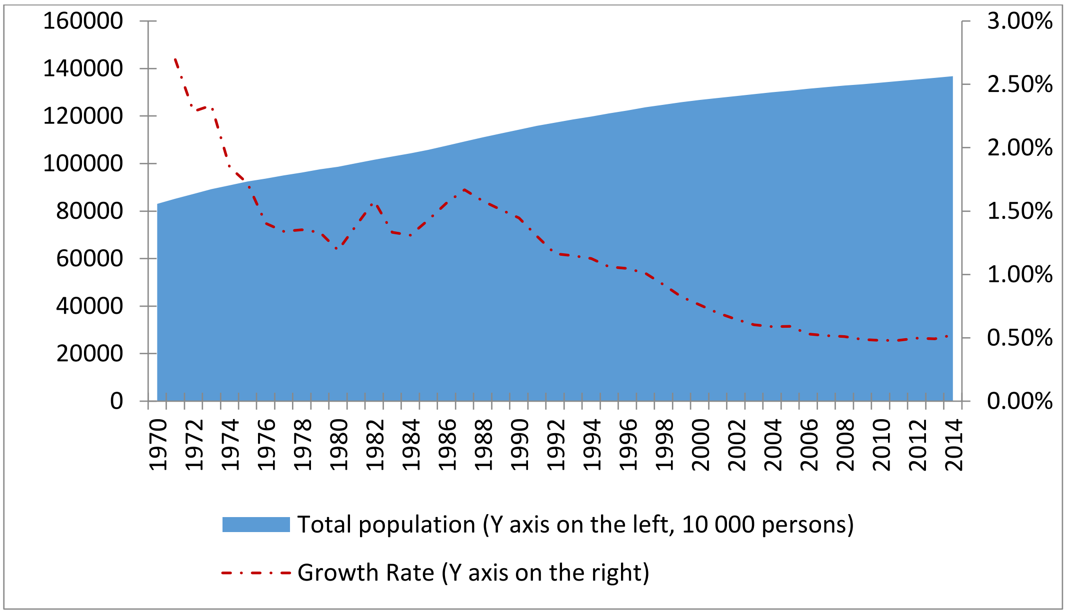
2.2.2 TOTAL POPULATION AND ITS GROWTH RATE

Figure 2.1 shows the trend of total population and the population growth rate from 1970 to 2014. On the one hand, the total population increased from 800 million in 1970 to approximately 1,400 million in 2014. On the contrary, the population growth rate dropped year on year from 2.8% in 1972 to 0.5% in 2014. Specifically, the graph shows that before implementation of the “One-Child” policy in 1982, in the period between 1970 and 1980, the population growth rate already showed a rapid decline from 2.8% to 1.2%. After this time, there is a fluctuation between 1980 and 1990, it was 1.6% in 1980, then dropped slightly to 1.4% in 1982, and again increased to around 1.8% in 1988. After 1990, the population growth rate dropped steadily to 0.5% in 2014.

[6] The reason that two datasets are used in this chapter is that some indicators are only available from the China Statistic Yearbook while others are only available from the World Population Prospects Revision.

Various factors could explain the drop in population over these decades. In addition to natural disasters, population control policies such as the “One-Child” policy were also a key factor in this decrease, and such trends may cause changes in the demographic structure (Hussain, 2002). To better understand this transition in China, the growth rate of the population in both rural and urban regions is also examined.

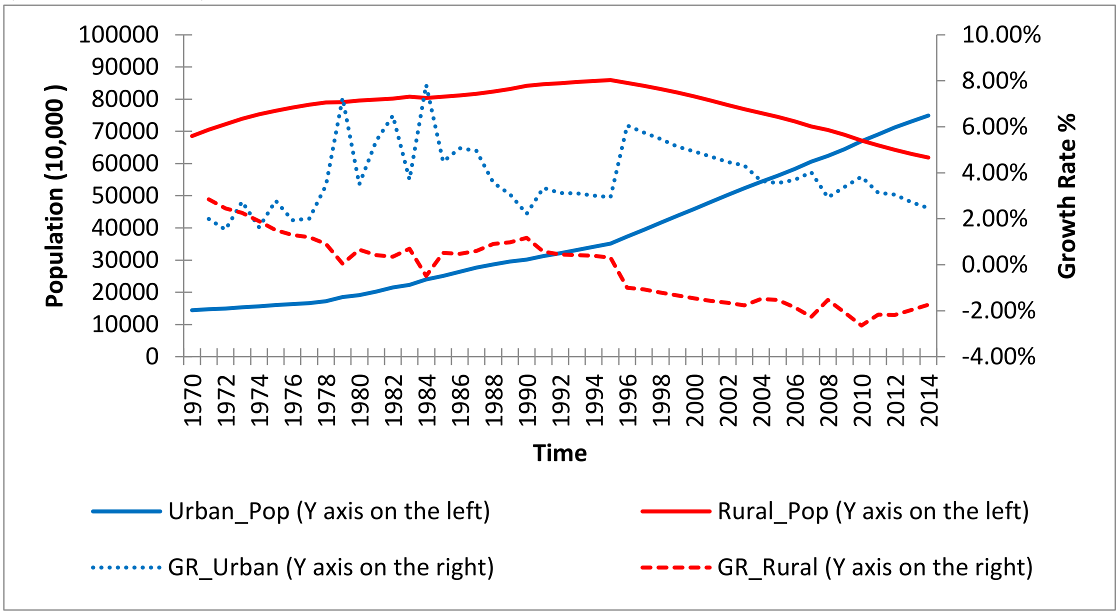
FIGURE 2.1: TOTAL POPULATION AND ITS GROWTH RATE, 1970–2011 (10, 000 PERSONS)



Source: China Statistic Yearbook 2015.
Notes: Data from China mainland only, does not include Hong Kong, Macao and Taiwan.

Figure 2.2 below describes a different picture for the rural and urban populations in China. At the beginning of the 1970s, the rural population is clearly larger than the urban population. For example, in 1970 the rural population was around six times bigger than the urban population. Before 1995, the total population of both rural and urban regions showed a continuous and steady increase. However, after 1995 the population in rural areas started to decline. The growth rate curves demonstrate that from 1970, rural's population growth rate declined every year, becoming negative from 1995. In contrast, the population growth rate in urban areas was higher than that in rural areas, and has fluctuated but overall increased during the past four decades.

FIGURE 2.2: POPULATION AND GROWTH RATE IN URBAN AND RURAL CHINA, 1970–2014 (10,000 PERSON)



Source: China Statistic Yearbook 2015.
Notes: Data from China mainland only, does not include Hong Kong, Macao and Taiwan.
1) Urban_Pop – the number of the urban population; 2) Rural_Pop – the number of the rural population; 3) GR_Urban – growth rate of the Urban population; 4) GR_Rural – growth rate of the Rural population.

Moreover, there are three peaks in the urban population growth rate between 1978 and 1985, this implies that the increasing urban population during this period may have been caused by internal migration by a large section of the rural workforce relocating to urban areas because of the "Opening Door" policy[7] introduced in 1979 (Hussain, 2002). Furthermore, Figure 2.2 shows that the rural population was equal to the urban population in 2010, yet in 2011 the town population surpassed that of the rural by around 30 million. This might suggest that besides the internal migration, the population control policy has had a greater effect in rural areas than in urban ones (Hussain, 2002). However, these figures only provide a broad picture of population transition over the past 4.5 decades in China. They do not provide information regarding whether China has entered into an ageing society. Therefore, other demographic indicators are needed.

2.2.3 Crude Birth Rate, Crude Death Rate and Natural Population Growth Rate

Figure 2.3 shows average annual crude birth rate[8], crude death rate[9] and natural population growth rate[10] from 1970 to 2015, respectively. The average annual growth rate was calculated over a five-year period (United Nations, 2015b). As we can see, the

[7] The "Opening Door" policy is an economic policy introduced by the Ex-Chairman Xiaoping Deng in the year of 1978 in order to open up China's market to the foreign investors. It is the main force and driver that promoting the economic development of China.

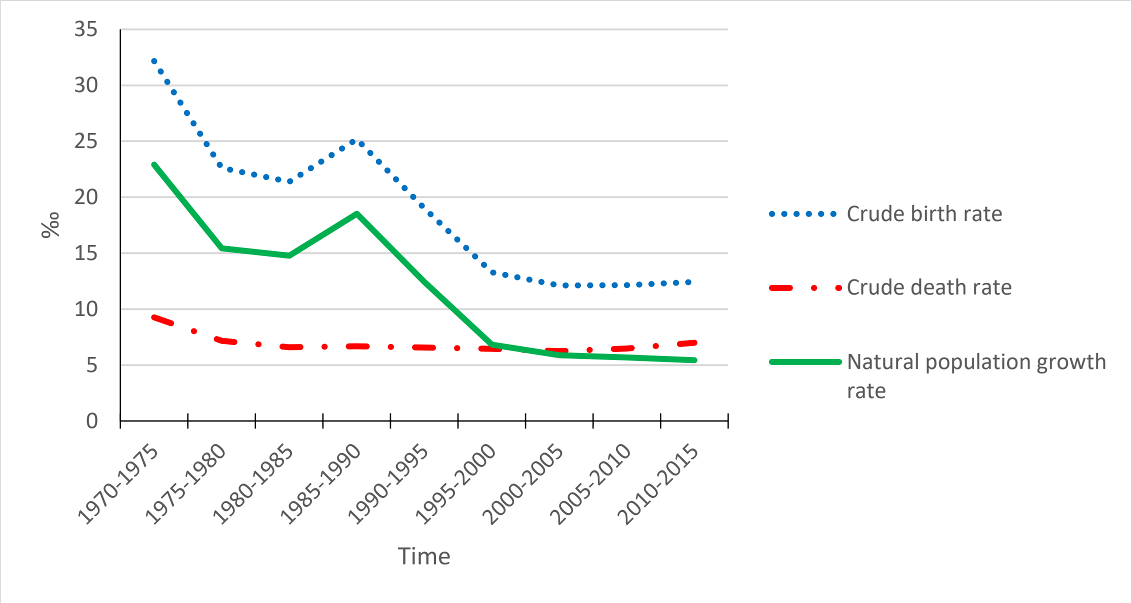
[8] "The number of registered births divided by the person-years lived of the registered population in a given period. It is expressed as an average annual number of births per 1,000 population" (United Nations, 2015b).

[9] "The number of registered deaths divided by the person-years lived of the registered population in a given period. It is expressed as an average annual number of deaths per 1,000 population" (United Nations, 2015b).

[10] "It is calculated as the crude birth rate minus the crude death rate. It is expressed per 1,000 population annually" (United Nations, 2015b).

average annual crude birth rate demonstrated a notable downward trend from 35.17‰ in 1970-1975 to 21.38‰ in 1980-1985, then it grew slightly to 25.19‰ in 1985-1990, and then it declined steadily, reaching around 12.45‰ in 2010-2015. This downward trend is partly due to the implementation of the “One-Child” policy as only one child was permitted in a family (Choudhry and Elhorst, 2010). Although the most recently “Two Child” policy has been officially imposed in some provinces in China, some believe that the effect of this new policy may be small (Feng *et al.*, 2013; Zhang *et al.*, 2014b). The crude death rate had no obvious fluctuations during this period, but it dropped from around 9.3‰ in 1970-1975 to 6.9‰ in 2010-2015. Furthermore, Figure 2.3 shows that the natural population growth rate was greater than the crude death rate before 1995. However, it has been declining steadily in the following years and has been less significant than the death rate since the 2000–2005 period. Figure 2.3 implies that China is now facing a significant population transition due to the low-level of birth rate and a decreasing natural population growth rate post the economic reform and “One-Child” policy implemented in the 1980s (Feng *et al.*, 2013; Zhang *et al.*, 2014b).

FIGURE 2.3: CRUDE BIRTH, DEATH RATE AND NATURAL POPULATION GROWTH RATE, ESTIMATED & PROJECTION, 1970–2015 (‰)



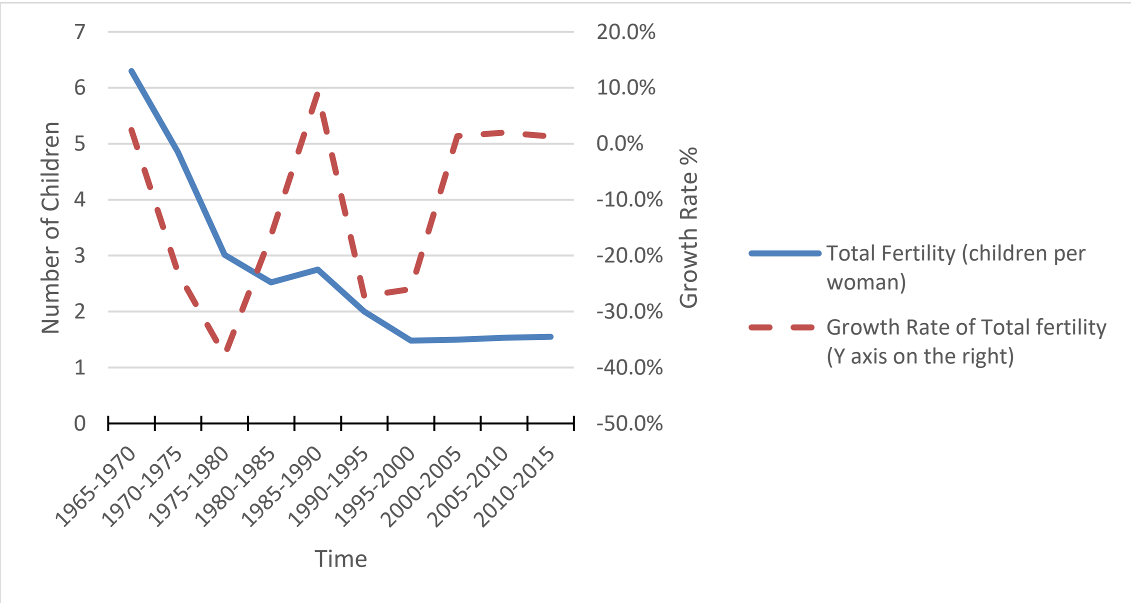
Source: World Population Prospects 2015 Revision (UN).

Figure 2.3 also reveals that over the past 40 years the death rate in China has decreased slowly (from 9.26‰ in 1970-1975 to around 6.9‰ in 2010-2015), it may imply that improvements in public health have been made in economic development, social security system and medical care system (Hussain, 2002). However, the dramatic decrease in the birth rate also exerts negative impacts on the demographic transition in China. Roughly speaking, the low birth rate will lead to an insufficient number of new babies for a nation, which will potentially cause shortages in the labour market as well as resulting in an ageing society in China (Hussain, 2002; Feng *et al.*, 2013). To investigate these predictions, the fertility rate in China from 1970 to 2015 will be discussed.

2.2.4 Total Fertility Rate

The total fertility rate is regarded as an important factor that determines the structure of the population. The United Nations (2013) defines the total fertility rate as "the average number of women in the childbearing age". Therefore, with relevance to increasing the population, if the total fertility rate is lower than 2.1 children per woman, the number of newly born children cannot compensate for the number of women capable of childbearing in terms of increasing the population (given men cannot have children).

Figure 2.4: Total Fertility Rate and Its Growth Rate, 1970–2015



Source: World Population Prospects 2015 Revision (UN).

Figure 2.4 demonstrates the estimated total fertility rate and its growth rate from 1970 to 2015. The average annual total fertility rate in 1970-1975 was approximately 5 per female, but this number declined to 1.55 per female in 2010-2015, which was much lower than the average replacement rate of 2.1. Furthermore, the growth rate of the total fertility rate dropped dramatically from around 2.4% in 1965-1970 to -37.9% in 1975-1980, the "Great Famine" and so-called "*wan xi shao*"[11] birth control campaign during this may explain the drop (Chen and Zhou, 2007; Feng *et al.*, 2013). From 1980 to 1990, the growth rate of the total fertility rate increased and reached the peak of 9.1% in 1985-1990 as the total fertility rate increased slightly from around 2.5 children per woman to around 2.9 children per woman during this period. The possible reason could be the economic development caused by the "Opening Door" policy resulting in many families being able to afford to pay the penalty[12] for breaking the "One-Child" policy to have more than one child. However, then the growth rate of total fertility rate began to drop, reaching the bottom of -27.3% in 1990-1995 as the total fertility rate decreased significantly at around 1.2 children per woman. Since then it has been increasing steadily and maintaining at approximately 1% to 2010-2015. The possible reason is that the combination effects of the implementation of "One-Child" policy and rising cost of child-rearing along with the rapid economic development in China.

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[11] The term "*wan, xi, shao*" is a Chinese slogan "*晚，稀，少*", means "later, longer, fewer". It encouraged Chinese citizens later marriage, have fewer children in a family, and longer intervals between children.

[12] Couples will be fined "$370 to $12, 800 based on the region they are living" if they have more than one child according to the "One-Child" policy. However, such amount does not affect those rich families who are self-employed or family business.

The "One-Child" policy may be one of the main factors resulting in the declining total fertility rate. However, Hesketh *et al.* (2005) point out that areas such as Hong Kong, Taiwan and Singapore also have a low total fertility rate. These regions had similar cultural backgrounds as China, but did not implement a birth control policy. Thus, their study suggests that the low total fertility rate may be related to other factors, such as a higher average educational level than in previous decades, and relatively increased daily survival outgoings, as well as the increased costs of raising a child in modern China. Nevertheless, as a developing country, it is unusual for China to have such a low total fertility rate, even lower than the average world replacement rate of 2.1, and in these circumstances, a society will age (Alkema *et al.*, 2011; Cai, 2013; Banister *et al.*, 2012).

2.2.5 AGE DEPENDENCY RATIO

According to the United Nations (2013), the population can be divided into three major age groups: children aged 0 to 14, working-age adults aged 15 to 64, and the elderly aged 65 and above. Children and the elderly are dependent on working-age adults (Harper, 2014). In addition, the elderly over 65 years old are financed and supported either by their children or by the government through social assistance or private savings or pension (Harper, 2014; Hussain, 2002). Therefore, the age dependency ratio[13], is another key

[13] It is a ratio calculated by the number of non-working-age population (≤ 15 or ≥ 64) divided by the working-age population (ages 15-64) and multiply by 100 (United Nations, 2015b).

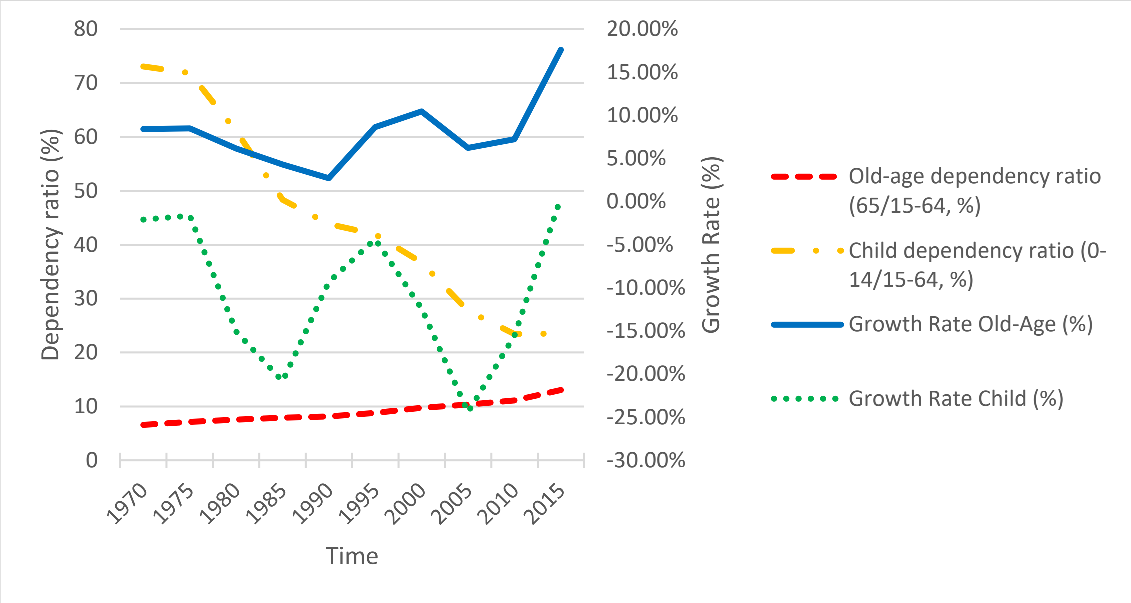
indicator of demographic transition, it incorporates the child dependency ratio[14] and old-age dependency ratio[15]. These ratios reflect the proportion of inactive labour by the age of the active labour force by age in a region.

Figure 2.5 shows that growth rates of both dependency ratios fluctuated during this time. Specifically, the child dependency ratio decreases steadily from 73.07% in 1970 to 23.53% in 2015, while the senior-age reliance ratio augmented stably from 6.57% to 13.04% in the same period. Moreover, the growth rate of the old-age dependency ratio is always greater than the child dependency growth rate, and the trend shows that the growth rate of the former was always greater than 0 while the latter was less than 0 before 2015. The above results further confirm the conclusion from Figure 2.4 that China is an ageing society because of both a lack of new-borns and also increases in the older-age population.

[14] It is a ratio calculated by the number of younger dependents population (≤ 15) divided by the working-age population (ages 15-64) and multiply by 100 (United Nations, 2015b).

[15] It is a ratio calculated by the number of older dependents population (≥ 64) divided by the working-age population (ages 15-64) and multiply by 100 (United Nations, 2015b).

FIGURE 2.5: CHILD AND OLDER-AGE DEPENDENCY RATIO AND THEIR RESPECTIVE GROWTH RATE, 1970–2015

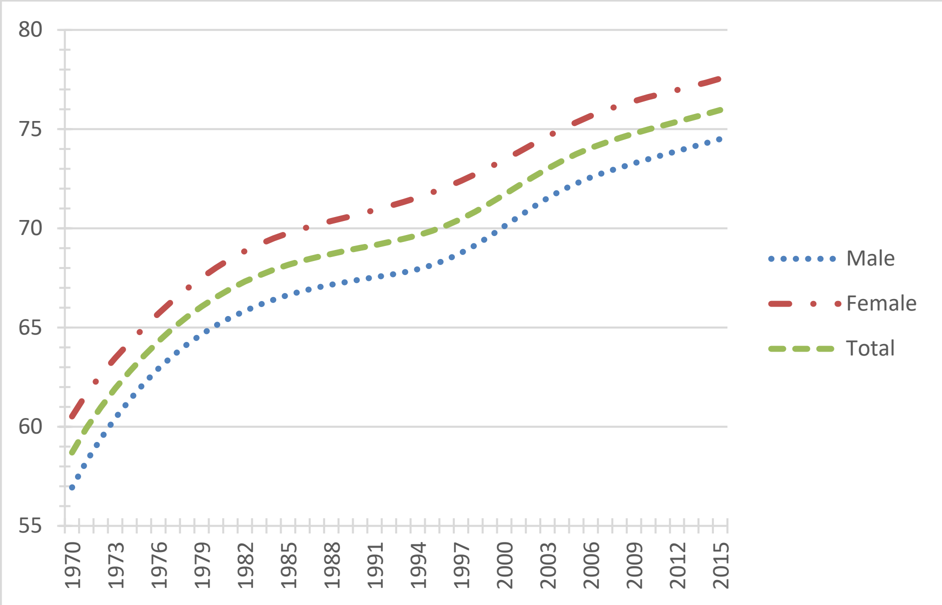


Source: World Population Prospects 2015 Revision (UN).

2.2.6 LIFE EXPECTANCY AT BIRTH

According to Coale (1989), life expectancy, as an indicator of demographic transition, refers to how many years a person can be expected to live at a given age. Figure 2.6 below shows that male life expectancy and female life expectancy are rising year by year. Moreover, females' average life expectancy is longer than that of males.

FIGURE 2.6: LIFE EXPECTANCY AT BIRTH, 1970–2015, AGE AND YEAR



Source: World Population Prospects 2015 Revision (UN).

Figure 2.6 shows that average life expectancy (total) rose from 59 in 1970 to 76 in 2015. The result means that over the past 4.5 decades, life expectancy had been prolonged by around one year in each year. During this period, female life expectancy was three to four years longer than that of males, which is a common phenomenon in China (Yi *et al.*, 2001; Gu *et al.*, 2009).

The increase of life expectancy possibly reflects gradual improvements in China's economic development and social security system. However, this lifetime extension also causes an ageing population. As noted in the United Nations (2015), in 2050, the predicted average life expectancy in China is expected to reach 81 years. With long life expectancy and lower fertility rates, China will be confronted with the significant demographic transition. To better understand demographic transition over the past 4.5 decades, the age structure of the population will be examined in the following section.

2.2.7 POPULATION PYRAMID

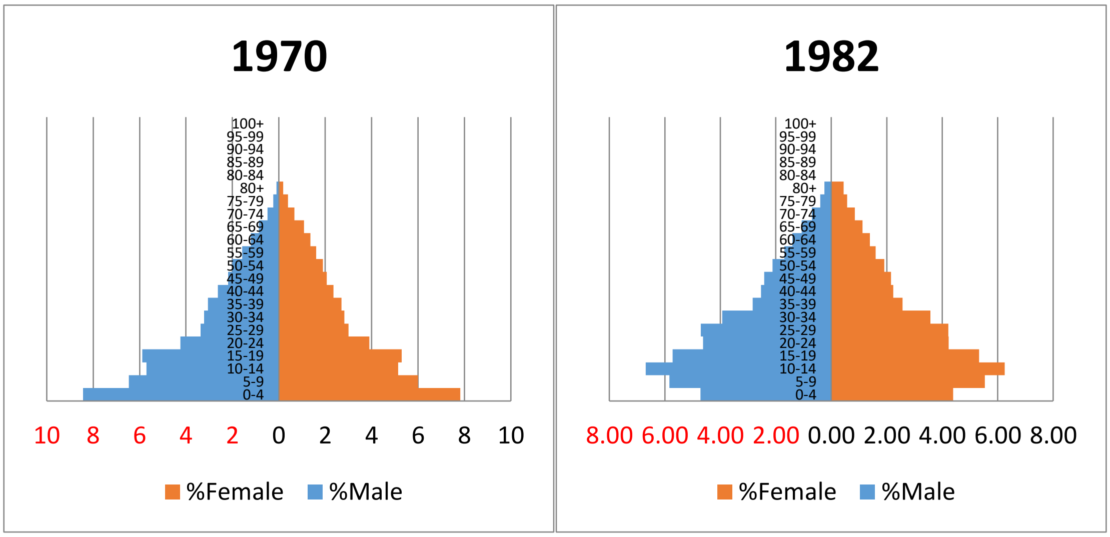
According to the United Nations (2015), age structure can be divided into three major sets for describing the change of population as the above section described. However, in China, it is not feasible to use the age of 65 because the dividing line between working adults and the older retired dependents is much lower than 65 (the mandatory age for retirement for males is 60 while for females is 50 to 55). Thus, the present study uses age 60 as the dividing line between working adults and retired population. To illustrate the changing age structure in more detail and visually, the population pyramid is provided and shown in Figure 2.7. It shows the changing male and female age structure by every 5-year group. Population pyramids provide visual information on population ageing, dependency ratios, the childbearing population, birth rate, death rate as well as the total population. Employing data from the World Population Prospects 2015 Revision, we have constructed population pyramids for China in seven specific periods: 1970, 1979, 1982, 1990, 2000, 2010 and 2015. Specifically, the population control policy was started but not yet proposed in 1970; 1979 represented the beginning of the policy of reform and the opening-up (the "Opening Door" policy) of China; in 1982, the official "One-Child" policy was implemented. 1990, 2000 and 2010 are indicative as 10 year intervals and 2015 is the most recent data.

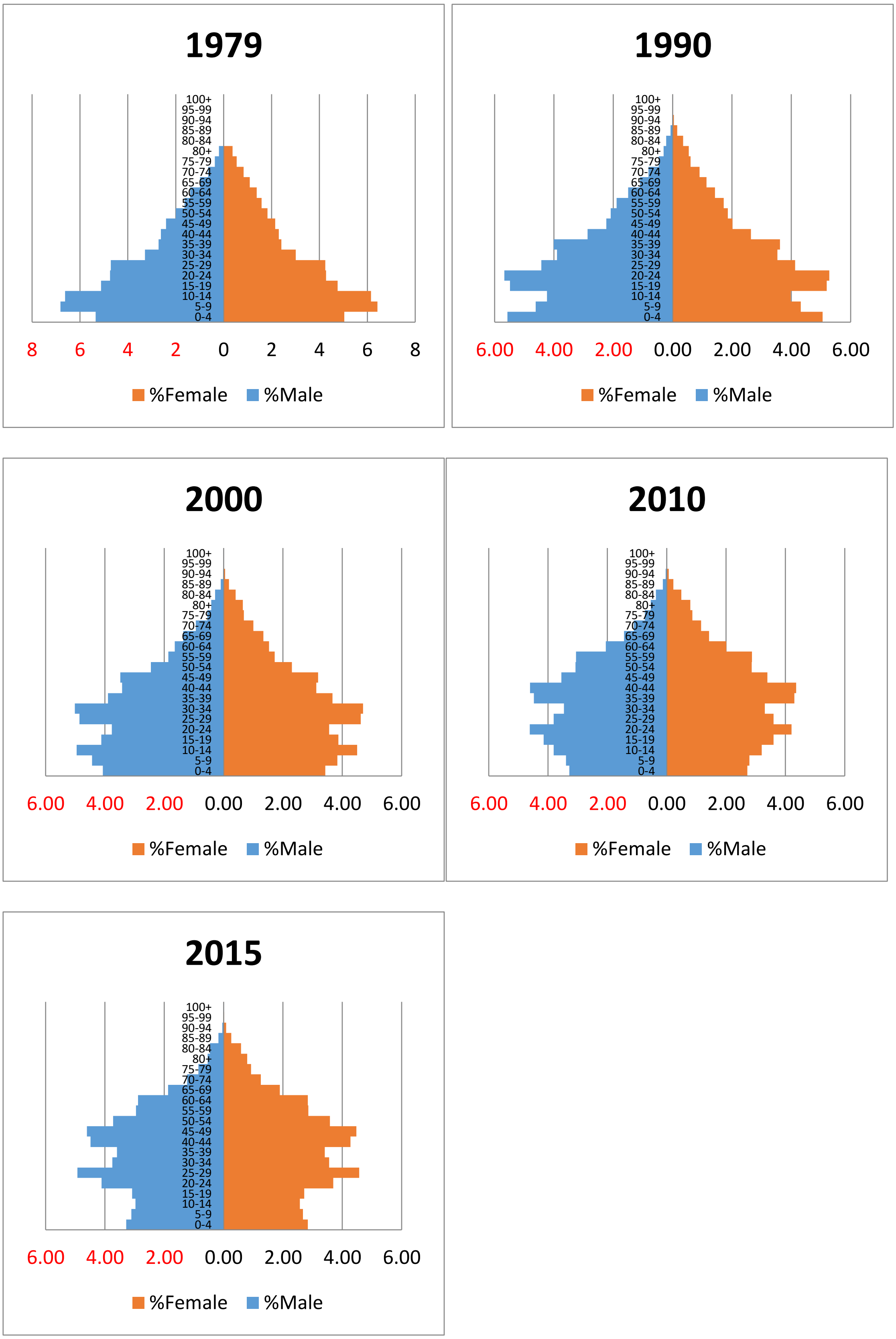
There are three basic types of population pyramids: expansive, constrictive and stationary (Richmond, 2002). Specifically, expansive pyramids, broad base and narrow top are growing and young populations, such as those of developing countries in which fertility rates are high and life expectancy low. Constrictive pyramids, typical of developed nations with access to health and education, are beehive-shaped and have smaller youth representation. Stationary pyramids are rectangular with similar age group representation and typical of states with high quality of life and low birth rates.

In 1970, the age structure in China was at the stage of an expansive pyramid with the number of young people constituting a majority. However, the population pyramid in 1979 shows that over the subsequent 9 years, the percentage of children aged from 1 to 4 decreased from 10% to 5%, under the significant influence of the so-called *'wan xi shao'* birth control campaign which started in the 1970s. In 1982 the "One-Child" policy started, and the population pyramid in 1982 is very similar to that in 1979. The number of both male and female children aged from 5 to 9 decreased, showing a more constrictive pyramid. However, by 1990, the situation was reflected by a stationary pyramid as the number of new-born children surpassed 5% of the population, especially male children.

As Figure 2.7 shows, from 2000, the age structure in China started to change, and the number of working-age adults accounted for a larger part of the whole population, with the number of both men and women aged 30-34 surpassing 5% of the overall population, thus, showing a constrictive pyramid. The change is more obvious in 2010 and 2015. The percentage of the population aged between 45 and 50 is close to 5%, and the population of 60+ is larger than that in 2000. Consequently, a constrictive pyramid is displayed. This clearly reflects that by 2010 and further in 2015, due to a low birth rate and rising life expectancy, as well as a low total fertility rate associated with guaranteed social medical facilities, China is clearly becoming a more aged society.

FIGURE 2.7: POPULATION PYRAMID OF CHINA IN SIX SPECIFIC PERIODS, MALE & FEMALE, AGE 0–100+ (%)





Source: World Population Prospects 2015 Revision (UN).

2.3 HEALTH INSURANCE SYSTEMS IN CHINA

This section describes the medical insurances system and the health system in China to provide a broad picture of this system and its relationship with public health. The medical insurance system is the core of a national health care system, and it involves the financing and payment side of medical services, which is ultimately one of the crucial components of the entire social security system. The design of the medical insurance system is closely related to the efficiency and equality of a society's medical service supply. In most countries, the government plays a role as the biggest medical insurance service provider. In many developed countries, public medical insurance is guaranteed by the government. However, the situation in China is such that only a certain sector of the population is guaranteed medical insurance by the government.

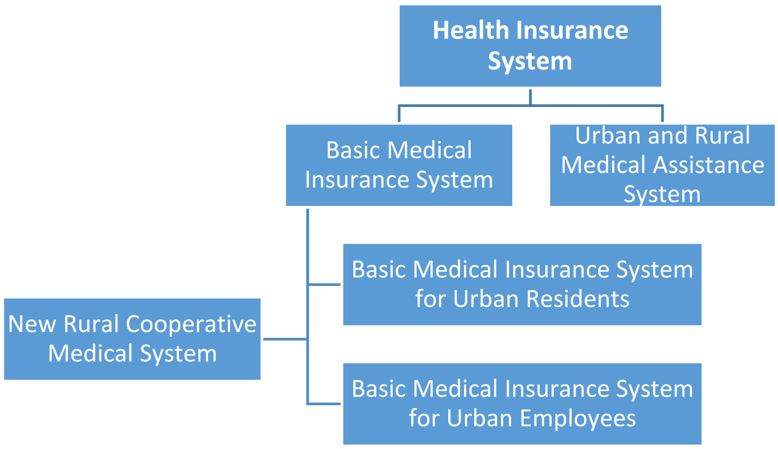
The World Health Organisation (2012) believes that the most significant role that the medical insurance system plays is sharing disease risks, especially in the case of financial implications. An optimal medical insurance system should cover all the risks, so that the insured person does not need to pay any fees if facing health risks. However, the uniqueness of the medical insurance market does not allow for such an "optimal" system. Arrow (1963) believes that an effective medical insurance market should be based on the health conditions of the insured party. Nevertheless, due to information asymmetry, it would be too expensive to verify the health condition of each insured person. Therefore, a medical insurance market based on health conditions is far from practical (Arrow,1963). To be specific, the lack of corresponding data between the insurer and the consumer makes it hard for the insurer to distinguish between consumers with different types of risks, which might lead to the "adverse selection effect" (Arrow, 1963, *p*. 964), where the population with higher risks are willing to purchase insurance while those with lower risks are unwilling (Arrow, 1963). If undertaken on a voluntary basis, most of the insured population would be those with higher risks. If undertaken on a for-profit basis, those with higher risks would be crowded out because of the insurer's desire for risk aversion (so-called "cream skimming"). Market failures would emerge within such a competitive insurance market due to adverse selection since the insurer can never verify the exact seriousness and proper treatment appropriate for each consumer (Rothschild and Stiglitz, 1992; Wilson, 1977). In addition, the probability of moral hazards would grow because lower costs for disease treatment might lead to an excessive consumption of medical services (Wilson, 1977). In other words, relatively low medical expenses may result in strain on the health services as those capable of paying more continue to use the services meant for less wealthy members of the general population. Furthermore, in cases where the insured individual can afford to shop around for medical services, this ability may lead to the over-consumption of much needed public services (Manning *et al.*, 1987).

Full coverage through medical insurance (providing the benefits of risk sharing) may however, lead to a reduction in disease-prevention behaviour in response to potential losses that would have previously been incurred by the insured person. It is also difficult to measure and assess the scale of the loss as well as its authenticity (Herring and Pauly, 2001). Assessing loss of health is a complex issue and not comparable to the loss of a tangible asset, such as property where the insurer is compensated for the damage to the asset. With health, no definite value can be set by the 'cost' of illness. What is more, life is the most fundamental condition for earnings to be accrued. Some believe that the value of life weighs as much as the total value of consumption throughout one's whole life (Johannesson and Jönsson, 1991). No one would choose death simply because of high treatment costs (Weinstein and Stason, 1977). Even if it is only a case of damage suffered, via health conditions, the marginal utility of the insured person will still fall because their damaged health makes the utility of "money" unattainable (Weinstein and Stason, 1977; Johannesson and Jönsson, 1991).

In conclusion, when one compares medical insurance with other types of insurance, more uncertainty and costs are apparent. Therefore, when designing a security plan, the government must balance the interest of risk sharing and the potential losses by moral hazards (Herring and Pauly, 2001). The optimal security level should be set at a situation where the additional value of adding a unit of insurance to reduce risks is equal to the marginal losses arising from additional moral hazards (Chernew *et al.*, 2005). To minimise the adverse impact of moral hazards, most medical insurance systems introduce a cost-sharing strategy (Selby, 1997), or the so-called “coinsurance” (Phelps and Newhouse, 1974), in which the insured person is responsible for a degree of the expense (e.g. 20% of the total expense). The “coinsurance” method can not only repress the excessive strains on the demand side, but it also encourages the supply side to come up with ways to attract more consumers, since these consumers are no longer patients with an absolute insensitivity to price (Solanki and Schauffler, 1999; Phelps and Newhouse, 1974).

As China is both a socialist and developing country, social security has its own unique characteristics, which are reflected in the health care insurance system. Unlike other nations, its health care insurance system differs between urban and rural China (Hsiao, 1995). Reformation within the Chinese national health care insurance systems coincided with economic re-orientation. Following developments over some decades (see Table I in Appendix), the current health insurance system in China contains its unique features as illustrated in Figure 2.8.

FIGURE 2.8: STRUCTURE OF CHINA'S CURRENT HEALTH CARE SYSTEM



Source: Liu (2004, 2002); edited by the author.

The health care insurance system consists of two main parts: the basic medical insurance system and urban/rural medical assistance system (Liu, 2002, 2004). Specifically, the basic medical insurance system currently operating in China is composed of three elements: first, urban employees enjoy the basic medical insurance system; and second, urban residents (non-agricultural *Hukou* holders) is able to register to the basic medical insurance system; and last, all rural residents (agricultural *Hukou* holders) can benefit from the new rural cooperative medical system (see Figure 2.8), all of which covering all urban and non-urban institutionally-based populations. By July 2012, the coverage of China's basic medical insurance system had reached a total of 1.34 billion citizens (see Figure 2.9), which is a ten-fold increase from the figure recorded in 2002, with only 100 million citizens not participating in the scheme (Meng *et al.*, 2015;

Blumenthal and Hsiao, 2015). Taking affordability into consideration for all its members, the basic medical insurance system has divided its funding commitments into different sectors including employers, organisations, families and individuals, to satisfy the requirements of both urban and non-urban dwellers. Also, in the case of low-income groups, the urban and rural medical assistance system shares a certain proportion of the associated medical expenses, as well as supporting them to join the scheme, so as to avoid impoverishment as a result of illness. Also, apart from the basic medical insurance system, China has established a supplementary medical insurance system, which includes commercial health insurance and other types of insurance, developed to satisfy the demand for higher levels of medical service cover (Meng *et al.*, 2015; Blumenthal and Hsiao, 2015). China also encourages enterprises and individuals to subscribe to these systems, so as to better address their medical service needs. However, the basic medical insurance system in China also has its limitations (Meng *et al.*, 2015; Blumenthal and Hsiao, 2015). Details of the advantages and disadvantages of this system are summarised in Table A1 in the Appendix.

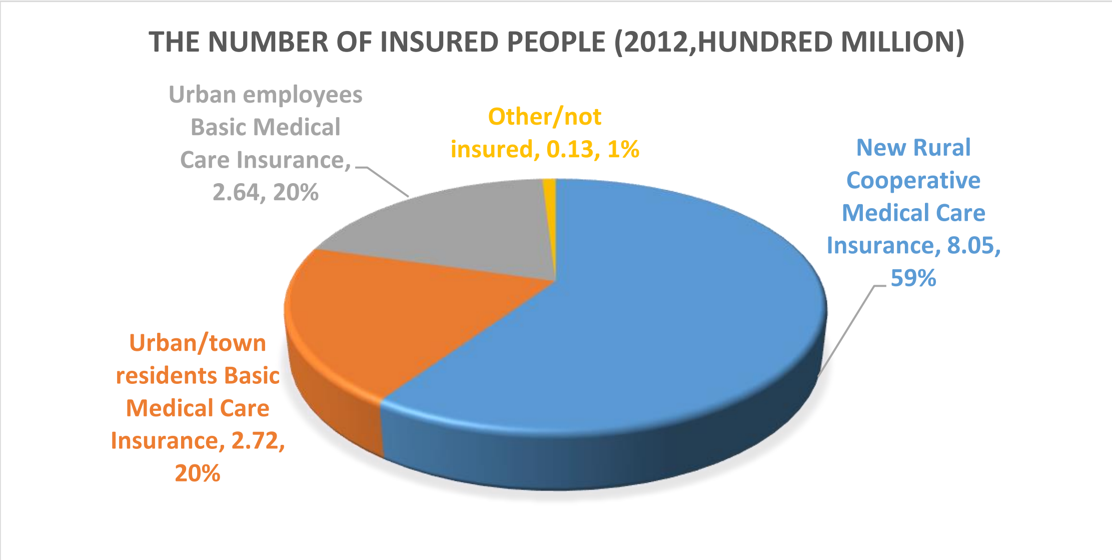
Despite China having reached full institutional health insurance cover, in reality, difficulties remain in relation to visiting a doctor and costly medical expenses (Meng *et al.*, 2015; Blumenthal and Hsiao, 2015). In 2009, to address this problem, the central government of China set out the direction and framework for medical reform in the country, highlighting that the health care system would adopt a welfare public goods approach[16] (Meng *et al.*, 2015; Blumenthal and Hsiao, 2015). This indicated that the role of the government had further shifted to become a service provider. However, as we have seen, in 2000 a new demographic began to emerge, with China entering the early stages of an ageing society. As a developing country with the largest ageing population in the world, entering an ageing society prematurely will inevitably bring about enormous challenges, with the increased need for and concomitant costs of medical services, increasing as its population grows older (Feng *et al.*, 2012a). Older people are a major consumer of medical expenses. Therefore, many developed countries have established special insurance and care systems specifically for older citizens, to reduce the proportion they spend on medical expenses (Clarfield *et al.*, 2001). Nevertheless, there is a paucity of similar health care schemes or measures in China for its ageing adult population. According to Feng *et al.* (2015) and Liu *et al.* (2014), the morbidity[17] of older people is around 3–4 times higher than that of younger adults, with the likelihood of a hospital stay being twice as long. Furthermore, more than ten million older aged Chinese cannot take care of themselves due to illness, and this group usually tend to be the main consumers of medical expenses (Feng *et al.*, 2015). Also, there is a greater proportion of the elderly

[16] Similar to the National Health Service system in the U.K., the Chinese government tried to establish a national coverage medical care system and consider it is a public good.

[17] It implies that on average, the relative incidence of disease is higher in the older aged population than those in the younger age population.

are rural and the gap between the care of urban and rural residents continues to widen (see Table 2.1). The total prevalence rate of chronic diseases among older members of the population also demonstrates an increasing annual trend, with a higher proportion of urban-dwelling older people represented than their rural counterparts (see Figure 2.10).

FIGURE 2.9: NUMBER OF INSURED PEOPLE IN 2012, BASED ON THE TOTAL POPULATION OF 13.54 (100 MILLIONS)



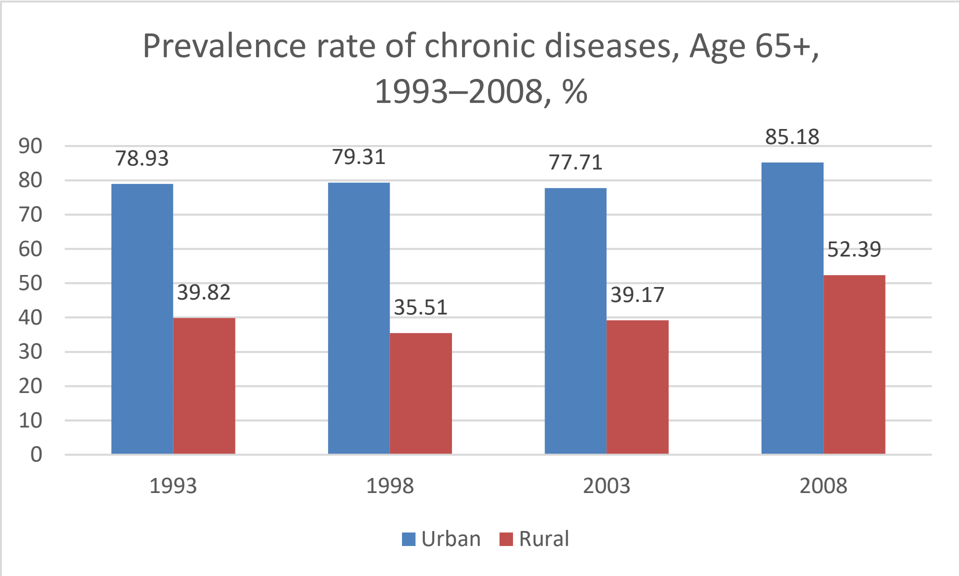
Source: China Health Statistical Yearbook (China Statistics Press, 2013)

TABLE 2.1: POPULATION AGE 60 AND ABOVE (% OF TOTAL 1.33 BILLION POPULATION), 2010

The Sixth National Census	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95+	Total
Urban	1.88%	1.30%	1.07%	0.34%	0.41%	0.17%	0.05%	0.01%	5.23%
Rural	2.47%	1.77%	1.38%	1.01%	0.58%	0.24%	0.07%	0.02%	7.53%
Total	4.35%	3.06%	2.45%	1.77%	0.99%	0.41%	0.11%	0.03%	13.18%

Source: The sixth national census (China Statistics Press, 2010); edited by the author.

FIGURE 2.10: PREVALENCE RATE OF CHRONIC DISEASES, AGE 65+, 1993–2008, %



Source: China Health Statistical Yearbook (China Statistics Press, 2013)

Moreover, the income levels for retired Chinese are relatively lower than other countries (Cai *et al.*, 2006). The rural population of farmers and self-employed suffer the consequences of not having pensions or whose pensions are not paid up to date. (Liu, 2004). In reality, the majority of older people in China are dependent on their children or relatives for their financial support (Cai *et al.*, 2006). Consequently, it is much harder for this older group to visit a doctor and/or to pay for their medical expenses (Xie *et al.*, 2012). This situation is not as apparent in urban China, as the pensions and medical care of retired workers are usually guaranteed by their employers or the local social security institution (Cai *et al.*, 2006). On the contrary, most of the older people in rural areas cannot afford to pay medical care and it is especially apparent in the poorer regions: without pension supports and advanced medical care, some older people in rural areas have to rely solely on traditional Chinese medicine treatments (informal medical care), or indeed on superstitions and traditional cures (Liu, 2004).

2.4 Social Transition and Social Context in China

2.4.1 Reform and Opening-up Policy and Social Transformation in China

This section sets and describes the social transition and social context in China during the past 4 decades to provide a broad background of Chinese society. Within the disciplines of sociology and economics, social changes achieved through a reform and opening-up policy in China are commonly known as social transformation (Bian, 2002). It is a process of both social structural transformation and institutional economic transition. The former represents the transformation from a rural agricultural economy to one that is urbanised and industrialised, while the latter refers to the transition from a planned economy to a socialist-capitalist market economy (Bian, 2002). These dual developments characterise the social transformation process currently taking place in China.

The strategic decision to introduce a reform and opening-up policy was reached at the Third "Plenary Session of the Eleventh Central Committee of the Communist Party" of China in 1978 (Tisdell, 2009). Also, it was the first fundamental state policy to be inaugurated since the official foundation of the People's Republic of China in 1949 (Tisdell, 2009). This decision resulted in China opening its doors, providing the country with an opportunity to engage with the outside world. This also coincided with a time of emerging growth in the economy. Guthrie (2012) summarises the social changes following the reforms–the opening-up policy was: from class conflict to economics, from the unified deployment of the resource allocation model to partial market exchange, from centralised to disperse approach regarding social resources. Also, social function structure went from highly integrated to equally differentiated, social class structure went from closed to more open, culture from unified to diverse and most importantly perhaps, relations with the world went from secluded isolation to incorporation

A brand new era has dawned in China, as a result of the changes created by social structural transformation and institutional economic transition. Consequently, the country and the people now encounter new difficulties and challenges generated by both the older institutions, as well as the emergence of newer ones (Guthrie, 2012). Sociology and human psychology teach that the attitudes of an individual to life are determined by previous social occurrences and incidents and dictated primarily by an amalgamation of individualities, personalities, cultural aspects as well as underlying customary factors (Mayer, 2009). Interestingly, studies have shown that as different age groups have been exposed to unique historical events and experiences, their consequent social conducts are formed accordingly, as well as the development of their emotional and physical welfare

(Chen *et al.*, 2010). Therefore, when studying, as in this thesis, the effect of social capital and related factors such as lifestyles on the health of different age groups in China, the significance of chronological events and experiences need to be factored in by recognising that all Chinese people, not just all older Chinese people share the same historical experiences. China has endured several uprisings in the recent era, such as wars, acts of rebellion, establishment of the People's Republic of China in 1949, unrestricted legislative procedures, drastic changes in the economy, all of which must be accounted for when comparing the social attitudes of different and older-age groups (i.e. for those adults born before 1949 who passed through the war who are currently aged around 80+; or for those adults born before 1959 who passed through the 'Three Years of Great Chinese Famine'[18] and the 'Great Cultural Revolution'[19] started in 1966 and ended in 1976 with currently aged around 60+), especially in the instance of individuals born prior to the formation of the People's Republic of China who were exposed to extreme volatile conditions. Berkman *et al.* (2000) proposed that incidents or occurrences in prime and delicate years of early life may mould later psychological and physiological nervous

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[18] The Three Years (from 1959 to 1961) of the Great Chinese Famine was the period of serious and prevalent famine in the People's Republic of China. It maybe cause by poor weather, dearth, and the poor policies of the Communist Party of China (the Great Leap Forward) during the three years.

[19] It was a socio-political movement between 1966 and 1976 that was caused by 'Gang of Four' occurred in the People's Republic of China. The movement significantly paralyzed Chinese politician in the central government and they persecuted intellectuals. This 10 years event has significantly negative impact on China's economy and society.

developments. Song *et al.* (2009) found that urban Chinese born during the famine increased their risk of developing schizophrenia in their early adulthood as their high pressure on their life and lack of trust in others, while the rural Chinese had even higher risk of developing schizophrenia compared to other age cohorts. Therefore, the historical context is linked to a relationship between historical experiences and their social capital, and then their health outcomes, which, as discussed further in the next chapter, incorporates factors, such as societal reliability, closeness and norm of reciprocity, all of which ultimately impact the health status of the individual. This research aims to identify the influence of such changes and disparities in mental and physical well-being dependent on different age cohorts or groups.

A related issue is that problems in transition involve aspects that are economical, political and social, and differences in this complexity may have inhibited the reform process. Guthrie (2012) identified the following causes of these difficulties: (1) economic reform was prioritised, while other institutional reforms remained stagnant; (2) efficiency was the primary focus, while fairness was ignored; and (3) the lack of comprehensiveness and sustainability during the reform process. Overall, the Chinese reform process and the direction it has taken is a double-edged sword, bringing with it both benefits and enduring challenges. Some issues, therefore, have to be addressed in relation to reform of the social security system. As the country's social structure is changing, the promotion of such reform is both imperative and inevitable.

2.4.2 SUPPORT FOR THE ELDERLY IN CHINA

China's social security and family support schemes, despite developing rapidly and accomplishing much in the past few years, still lag well behind those of the more mature systems evident in many western countries (Kumar *et al.*, 2012). Confucianism gives primacy to filial piety[20] *(xiao-dao* in Chinese) as a virtue and so it is customary in China for the younger generations (especial for sons or first sons) to accept the obligation of providing for and attending to the old. Anecdotal evidence in many guises, details that through history there has been a duty to care for the aged, who are held in the highest regard, is abundant in China (Hwang, 1999). Building on this cultural concept, on this the Chinese government promotes the idea of care for the aged and urges people to perform this perceived duty, so through the ages kinfolk have shouldered much of the burden of providing this care. Following the creation of the People's Republic of China, the central government launched its pension scheme in 1951 (Feng *et al.*, 2011). This social security system caters for civil servants and staff of public and state bodies in municipal areas by providing substantial retirement benefits (Feng *et al.*, 2011). However, in rural regions, the aged continue to depend on the land and kinfolk to provide for them (Lee and Xiao, 1998; Jiang, 1995). A government overhaul of the social security system led to the

[20] Filial piety means that younger generation has the obligation to respect for their older generations, including their parents, their relative elders, and their own ancestors.

introduction, in the 1990s, of several policies targeting the aged in developed economic regions with increased benefits. Further reform is undertaken since 2000 has made provision, through pension and insurance schemes, for benefits for the elderly. Nevertheless, to this day the pension scheme remains regional, not fully national and so supporting the aged in China requires effort from both government and family. Responsibility is divided, with the government meeting the burden of providing limited formal upkeep and family that of the majority of personal support. Currently there are six significant pension and insurance or older support elements combining to form the retirement pension scheme and older-age support patterns (Dorfman *et al.*, 2013): a government and institutions based retirement pension scheme (e.g. pension programme of the government, institutions and firms), the national or regional base retirement pension scheme (e.g. Rural pension, Residents' pension, Urban residents' pension and New Rural Social Pension Insurance); family support of old-age; a minimum standard of living assistance programme; a national scheme of allowance for living expenses and old-age pension insurance (e.g. the Old-age pension allowance); and the Five Guarantees (*Wu-bao-hu*) social assistance project. These programmes experience problems, such as low coverage rate, a small amount of support and application difficulty (Dorfman *et al.*, 2013), as well as along with social services for the aged, they have shortcomings as most of them are not focused on the older population in China but entire Chinese population. Moreover, infrastructure restrictions constrain the development of facilities for supported institutions used in caring for the aged. These shortfalls undermine the holistic provision of support to the aged in China, with the consequence of a risk to the health of the elderly. The health of the elderly is also impacted by other facets of care such as providing the interactive elements of the social environment, and entrenched cultural values and social practices also represent a challenge in the context of China's rapid modernisation. In China, care in retirement is vastly different to that found in many advanced western countries because of the twin influences of government regulation, which forces conformity, and the deep-rooted instincts and sense of duty, entrenched over the ages, from the principles of Confucianism and patriarchy (Song *et al.*, 2015). Historically, Chinese children have supported their parents to the end of their lives by providing sustenance and a safe abode. Loyalty is a characteristic much valued by Chinese people, and consequently, they invest heavily in engendering care and consideration throughout the family group. It follows therefore that, naturally, they will robustly support their parents through old-age (Zimmer and Kwong, 2003). Homes housing more than one generation of a family delivering shelter, sustenance and care are viewed as the most efficient model in supporting the elderly. Despite this, there has been the transformation of typical cultural ideals in recent years. The one-child policy and increasing workloads to facilitate business in embracing globalism has undoubtedly impacted customary family values. Moreover, internal as well as external migration since the adoption of the open-door policy has resulted in an unprecedented familial geographic spread that negatively impacts support for the aged. The result of rapidly increasing migration, and rejuvenation of economic growth, is that the typical family structure has been transformed from large multi-generational units to diminished nuclear ones.

Economic pressure to compete in global markets has increased industry and rapidly advanced construction, centred in developed areas. In rural areas people relocating to urban areas in search of opportunities has reduced the number of young generation available to care for the old one. A survey of family and marriage conducted by the All-China Women's Federation in 2003 found that approximately 69% of adults in urban areas and 59% of those in rural ones did not live with their parents (Buchanan, 2006). It is also revealed that in contemporary China younger adults mostly support the aged through economic means, but residing with them for only a short time thus resulting in loneliness among the older people (Du, 2013). Today, it seems that in China the young feel less encumbered with traditional values like filial piety and respect for elders; and that this, combined with shifting patterns in family structure, is diminishing the levels and quality of support for the aged (Du, 2013; Buchanan, 2006).

2.4.3 GENDER INEQUALITY IN CHINA

Another contextual factor of importance is gender inequality. The role of Chinese women has conventionally been restricted to the household, receiving little reverence and much subjugation; however, the establishment of the People's Republic of China facilitated the passing of legislative laws assuring the entitlements and equal opportunities of women. Although these laws have benefited the societal position of Chinese women, women still face resistance on the social level and are expected to follow custom and tradition despite the reforms. For example, Chinese women are still underprivileged regarding schooling, career development and personal wealth. This study also aims to evaluate and comprehend the role of gender within the mid and older Chinese population with respect linked to health status and social capital elements with the aim of determining whether there is a heterogeneity effect of social capital on health between male and female.

The teachings of Confucius state that honourable and worthy women remain uneducated and, furthermore, such women should be disciples as opposed to leaders (Rarick, 2007). Moreover, these teachings allude to the subservient role of women in relation to fathers, husbands and sons, resulting in women retaining inferior standings in every aspect compared to all men (Rarick, 2007). Similarly, conservative Chinese philosophies present an ostracised perception of women, where they remain perpetually menial and ancillary to men. In addition, Chinese custom pays homage to female sexual organs and women are expected to uphold their abstinent status, which further exemplifies the downgraded role of women in conventional Chinese society.

Women in Chinese society have long been attempting to overcome the teachings of Confucius and, positively, the establishment of the People's Republic of China has facilitated this through the passing of legislative laws ensuring the entitlements and equal opportunities for women (Cooke, 2001). Furthermore, since the early 1950s, the Constitution of the People's Republic of China has detailed the comparable domestic and conjugal roles of men and women in China, from which further regulations, inclusive of the Marriage Law and Law of Inheritance, were derived, aiming to further benefit the household entitlements and equal opportunities for Chinese women. Significantly, to mark the tenth anniversary of the United Nations Fourth World Conference on Women[21] (Beijing, 1995), the 1982 "Protection of Rights and Interests of Women Act" was reviewed. In recent years such regulations have enhanced the quality of life (life satisfaction) of Chinese women (Appleton and Song, 2008). The lessons of Confucius have broad implications, even in modern-day China, resulting in the portrayal of even fictitious Chinese women characters as altruistic, devoted and subservient to man and the household (Chan and Leong, 1994).

Berna (2013) found that some Chinese women in poor regions (e.g. western China) remain underprivileged with respect to access to education, career development and ownership of personal effects (due to factors such as the unavailability of funding), experience gender bias in terms of occupations and, moreover, encounter aggressive domestic behaviour, sexual abuse and possess no command over their right to reproduce.

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[21] For more details, please visit http://www.un.org/womenwatch/daw/beijing/fwcwn.html.

Therefore, gender inequality remains a serious issues in some, particularly the poorer regions of China. This study will try to discover whether there is also health inequality between females and males in China. In addition, the present study also will investigate whether social capital could alleviate any such inequality to any degree.

2.4.4 URBAN-RURAL DIVIDES AND THE *HUKOU* SYSTEM

According to Zimmer and Kwong (2004), there are wide differences between the circumstances of aged inhabitants residing in rural and urban regions. This is accentuated by the *Hukou* system (Liu, 2005). Subsequent to the establishment of the People's Republic of China in 1949, the regime front-runners developed a resident's identity or licence scheme, which divided citizens based on their rural- or urban-dwelling (Liu, 2005); this status is referred to as *Hukou*, which is a predominant deciding factor for determining the social standing of Chinese citizens. For example, it has been long-established and accepted in China that the agricultural (rural) or non-agricultural (urban) *Hukou* grade is responsible for elucidating the provision of financial assets, education, occupation and receipt of societal aid. Reports have suggested that despite economic progression and, further, acknowledged transfer of rural dwellers into urban settings in China, the *Hukou* status still dictates the provision of these benefits, with rural citizens encountering more disadvantages in comparison to urban residents (Cheng and Selden, 1994; Chen, 2002; Liu, 2005). To elaborate, non-agricultural (urban) *Hukou* holders benefit from the availability of employment opportunities in comparison to agricultural (rural) *Hukou* holders, who maintain the status of agriculturalists. Furthermore, pricing and investment strategies are skewed in favour of urbanisations and commercial enterprises instead of rural farming ventures (Chen, 2002). Overall, non-agricultural (urban) *Hukou* holders profit from supplementary state benefits that positively impact property buyers, standards of medical treatment, receipt of an annuity, redundancy payments and earnings in comparison with rural citizens. Also, rural populations tend to suffer from inferior public services, transportations and communications as well as medical care establishments (Cheng and Selden, 1994; Chen, 2002; Liu, 2005). Nevertheless, the latter part of the 1970s observed tremendous advancements in the Chinese economy, resulting in the enhancement of quality of life, regardless of rural or urban status. However, such progression was supplemented by several disadvantages and, specifically, inequalities pertaining to medical amenities (Zimmer *et al.*, 2010b). Consequently, *Hukou* status establishment is a customary practice in China that impacts the attitudes of an individual to society and its assets, although the effect of this division on social capital and alternative attributes of society remains to be elucidated.

2.5 CONCLUSION

This chapter has considered the context of demographic change in China over the past 4.5 decades. The discussion focused initially on demographic indicators, but was extended to consider the wider context of these changes that older people in China have experienced.

The first section in this chapter showed that during the 40 years from 1970 to 2015, the demography of China has gradually changed from a youthful to an ageing society. Although the total population increased steadily, the growth rate declined year by year, and even approached zero growth. The growth rate of both the rural and urban population decreased, but the urban population grew while the rural population decreased year by year. In 2015, the urban population was greater than that in rural areas, mainly due to internal-immigration. Crude birth rates clearly show that the number of new-born infants has fallen year on year, while the crude death rate has remained quite stable during the past four decades because of improvements in medical technology and social welfare. Meanwhile, the total fertility rate of 1.55 children per woman in China is currently much lower than the world average replacement rate of 2.1, which will lead to a smaller number of new-born children and a labour shortage in China in the future. Furthermore, the growth of the age dependency ratio also confirms that the old-age dependency increased steadily with a significant growth rate higher than the child dependency ratio. Moreover, the average life expectancy has increased year by year from 58 years old in 1970 to 77 years old in 2015, reflecting improved average educational and medical levels. The population pyramids in Figure 2.7 further show China is an ageing society. Within a short period (between 1970 and 2015), as a developing country, compared to developed countries, China has experienced rapid demographic change. Causal factors include the gradual improvement in average living standards, educational levels and the social security system, including medical reforms and provision of a retirement security system. In addition, the population control policy begun in 1970 and the "One-Child" policy implemented in 1982 have also played a major role.

The second part of this chapter provided a review and summary of the health insurance system in China, which underlies the social security system. Although the health care insurance coverage rate is quite high (almost 80% of total population), the health care insurance system in China is still in a developing stage. The nature of China's health care insurance system means there is inequality in access to health care between urban and rural areas, and between civil servants and workers. Also, China's health care insurance system targets younger working adults instead of older retired people. Consequently, older people do not benefit as much from the government-pooled health care insurance system, especially for those older retired people in rural areas (Cai *et al.*, 2006).

The last section of this chapter describes the social context of transition in China over several decades. This discussion indicates that a better comprehension of the underlying health of elderly Chinese citizens requires recognition of the different experiences of different age cohorts as well as an understanding of gender biases, differences in urban and rural as well as the *Hukou* system. These factors are all incorporated into the analysis in the subsequent chapters.

3 CHAPTER THREE: SOCIAL CAPITAL THEORY AND HEALTH EQUATION

3.1 INTRODUCTION

Social capital can be defined broadly as a network of associations linked to the characteristics of a socially configured society that, ultimately, benefits individuals in the community and/or the entire, collective community (Bourdieu, 1986; Coleman, 1988; Akdere, 2005; Putnam, 1993). The origination of social capital as a concept lies in archival sociology exemplified by inspiration from Hanifan (1916); however, as a theory, social capital did not contribute to the disciplines of sociology and political science until approximately thirty years ago (Putnam, 1993; Bourdieu, 1986; Coleman, 1988; Lin, 1999). This chapter discusses the concept of social capital which was used by economists, and its impact on health. It also considers the results derived from previous studies that indicate a correlation between the two. Furthermore, this hypothesised relationship has led to econometric models used by health economists to investigate the effects of social capital on the health status of the individual.

3.2 DEVELOPMENT, DEFINITION AND COMPONENTS OF SOCIAL CAPITAL

The maturity of the social capital hypothesis came about in three stages (Lin, 2002). Firstly, Bourdieu, (1986) revolutionary data on social capital, he accentuated the individual and underscored the different degrees to which individuals have entry to social arrangements; furthermore how that access is translated into the lop-sided distribution of capital and power, a "start-up" phase. Subsequently, Coleman (1988) performed comprehensive research studies on social capital and societal organisation, he emphasised that individuals can compensate for the absence of human or cultural capital from the resources or environments created by the collective groups (i.e. communities and organisations), that resources or environments is called social capital; it is the "development" stage. Ultimately, the social capital theory was advanced across various genres by the 1990s, including economics and politics (Putnam, 1993; Robison *et al.*, 2002; Putnam, 2000). The representative is Putnam (1993, 2000) who defined and emphasised the joint nature of the social capital concept and its relevance to each within the collective group (neighbourhoods or communities or organisations) or society. However, from economic point of view, Robison *et al.* (2002) does not agree that social capital is a real 'capital' as it does not contain the features and characteristics of a capital; while Rocco *et al.* (2014) believe that individuals can invest in social capital to promote their health outcomes, but individual-level social capital plays far more important role than community-level social capital on respondents' health status. This controversial stage for the concept of social capital is so-call the "expansion" phase. Correspondingly, the concept of social capital has been a focus of interest for social scientists, economists and health economists researching in the fields of sociology, economics and public health.

Although the definitions of social capital vary, it can be summarised into four basic definitions, which are dominant in the academic debate and applied in various areas of research. Bourdieu (1986) was the first one who made a significant contribution. According to Bourdieu (1986), social capital can be defined regarding collective existing or impending benefits linked to systematised long-standing social contact, respect and acknowledgement in a group or community. Furthermore, Bourdieu (1986) also indicated that the extent of accessibility to a social network reflected an individual's social capital, as did the amount of financially viable, literary or "emblematic" assets presented by persons associated with the individual. This suggests that social capital facilitates the realisation of individual aspirations by means of bridging entities to a social network. Then, the second one was Coleman (1988) perceived social capital regarding the feasibility resources for the individual, in relation to a social configuration, that this is present in beneficial socially- structural elements, and mutual relationships, providing a resourceful advantage for the individual and the community. The approach by Coleman (1990) encompasses a practical stance as the concept was based on the function of social capital, whereby social capital is also defined on a broader scale of social relationships alongside individuality. Therefore, on these terms social capital can be conceived as corresponding to the relationships, responsibilities and obligations of a community and hence is deemed an open civic resource. It is further characterised by the data systems, laws and standardised regulations that exist in typical administrations. In the late 20th century, Putnam (1993, 2000) made a significant contribution to the renewed definition of social capital. The thinking of Putnam (1993, 2000) suggests a transference of the beneficial aspects of social capital from the individual to society. Putman considered social capital regarding the qualitative dimensions of a social community, for example, dependence, regimes and structures which can enhance the social experience in a unified fashion. Putnam (2000) stated that social capital had the capacity to resolve predicaments posed by the wider community. Moreover, he was responsible for the amalgamation of social capital theory into political science, extending its relevance to operations of the state (Putnam, 2000). In summarised, all three of these researchers agreed that one of the main components of social capital is that it includes social networks and can lead to advantageous results.

World Bank (2011) embeds and combines the above definitions aiming to re-define social capital and identify its contribution to economic growth and human well-being. The World Bank (2011) claims that social capital encompasses institutions in a country, social standards in a society, organisations in a region, and relationships between individuals. According to the World Bank (2011) these elements can mould the quality and quantity of social or human interactions to create an invisible ‘capital’ that can have private or public returns for whoever is involved in these interactions. The World Bank claims there is mounting data to show that the way a society hangs together is crucial for its economic survival and growth and that social capital is not just the total of the institutions which buttress a society or a collective group, it is the cement that holds people together' (by creating a trustful social environment) and it facilitates the sharing of resources among its members (World Bank, 2011).

Beside above four basic definitions of social capital, different aspects of social capital have been summarised by the subsequent studies (Adler and Kwon, 2002; Poortinga, 2012). The relations between individuals who share comparable socio-economic and demographic features (known as "intra-group ties") is described as a 'bonding' social capital. 'Bonding' social capital is considered of particular importance in health research in relation to publishing information, developing health practices, controlling deviation and encouraging and enabling those at risk to protect one another (Woolcock and Narayan, 2000). 'Bridging' social capital, according to Adler and Kwon (2002), relates to individuals who share comparable positions, influence, and control but who are not the same in other respects (known as "heterogeneous group ties"). When considering the development of democracy, the category of social capital that is considered to be more successful is that of 'bridging' (Putnam, 2000). 'Linking', the third type of social capital, shares features with 'bridging' in that it refers to the relationships among those in disparate positions and of varying financial means, control, and influence (Woolcock and Narayan, 2000).

Combine above four basic definitions and defined aspects of social capital, subsequent research by several scholars presented papers and produced redefinitions of social capital. For example, Portes (1998) referred to social capital as the capacity to reap the "welfare of communal living" and, detailed the practical advantages and disadvantages of social capital. Fukuyama, (2002) adapted the concept of social capital to encompass the collective confidence of the community attributed to partaking in societal activities. Burt (1992) introduced the concept of "structural holes" in relation to the idea that social capital is connected with the accessibility and domination of information and assets in society. The presence of structural holes impedes individual drive and the retrieval of information and capital. Lin (2000) advocated a social resources theory which conceives social capital as an investment and returns venture whereby society invests in the development of associations in exchange for benefits. Most recently, Glaeser *et al.* (2002) defined social capital as an individual resource that mainly enables private returns which are the results from the social interaction between individuals. Finally, Kawachi *et al.*, (1997) and Kawachi and Berkman (2001) focused on higher level (i.e. states-level) social capital, such as social trust, social ties, cooperation, and respect in a society, as measures of enhancement of shared deeds; and he found that this kind of social capital significantly associated with individual health, and it could reduce income inequality and mortality as well.

Variations in the definition of social capital in accordance with the field of study are apparent as above shown. However, these definitions can be categorised into two broad perspectives based on the function of social capital (Bourdieu, 1986; Lin, 2002;

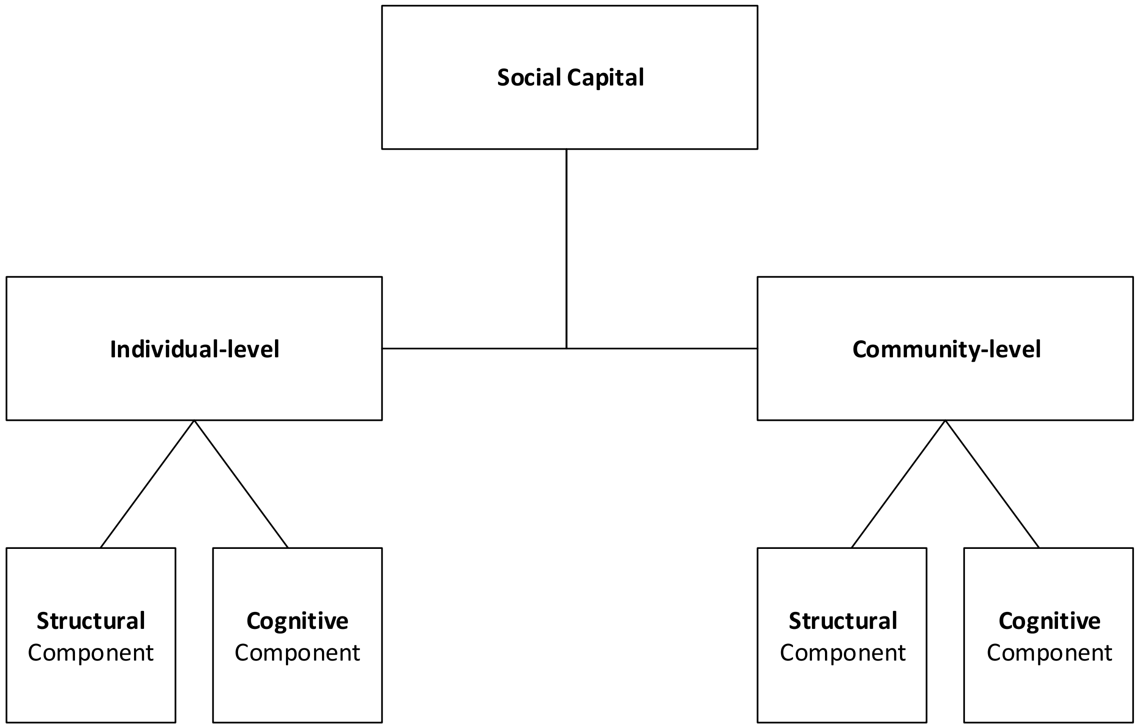
Putnam, 1993; Pescosolido, 2006; Kawachi *et al.*, 1997; Coleman, 1988). The first category focuses on social capital as a systematised network or web of relationships and the existence of aids, encouragement, and resources for individual or all people within a specific group or organisation (Bourdieu, 1986; Coleman, 1988; Lin, 1999). The second category, consistent with the social cohesion approach, refers to social capital as a collective resource built on mutual trust, reciprocity and social interactions between individual or within group or community members that is beneficial to the entire group or community and the members in it (Putnam, 1993, 2000; Pescosolido, 2006; Kawachi *et al.*, 1997). To sum up, the former relates directly to individuals relation (actual) resources within one's or group's network and, conversely, the latter refers to social conduct that stems from trust and reliability (non-actual or social atmosphere) within the entire network.

Based on above definition, Bolino *et al.* (2002) and Harpham *et al.* (2002) summarised and classified social capital into two main components: a cognitive component and structural component, both of remaining predominant in current social capital studies. The first component is the cognitive aspect that focuses on ideals such as morality, reliability, and assurance; these are derived from social interrelationships in a community. The second element was the structural aspect that relates to the manifestation of associations, organisations, membership groups, and social networks. These two elements are sometimes considered regarding qualitative and quantitative contributions (Bolino *et al.*, 2002; Harpham *et al.*, 2002).

In light of the different definitions of social capital which were based on its functions above, it is possible to conclude that social capital is an overarching concept relating to the nature and extent of the social resources that are held by the different groups within a society's hierarchical structure. Therefore, social capital as one kind of resource, depending on the part of the hierarchy that is being considered, social capital can be categorised into different levels based on the sources of social capital. Namely, the individual-level and neighbourhood- or community-level of the social capital resource (Anderson *et al.*, 2004; Glaeser *et al.*, 2002; Paldam, 2000). The former, social capital at the individual-level concerns the associations, expectations, and conventions that mediate relationships between people and related groups in localities and societies. While the later, social capital at the neighbourhood- or community-level, generally concerns interrelations on a larger scale, for example, at neighbourhood or community or even state levels, and it is created and influenced by social, civil, administrative, governmental, and financial factors. The meaning of social capital, therefore, varies depending on whether the resources from individual, collective, or national is being considered.

Specifically, social capital at individual-level encompasses the totality of human characteristics relating to social position, influence, control, personal renown, and domestic, work and other interrelationships, which a person may access to acquire financial, physical welfare, or other advantages (Paldam, 2000). Social capital at neighbourhood- or community-level, on the other hand, consists of the totality of social characteristics of a group, community, or organisation, from which participants within the group concerned may gain benefits or advantages than those without. These include the groups' standing, magnitude, and economic strength, in combination with all of its participants' interrelationships (Paldam, 2000). Based on the concept of neighbourhood- or community-level social capital, it can be further conceptualised as a state- or national-level social capital which concerns the entire inventory of a state's or nation's social resources that its governing bodies can draw on for the benefit of the entire citizens (Anderson *et al.*, 2004; Glaeser *et al.*, 2002). This consists of its global standing, financial power, governance structures, administration, and the totality of all the worldwide interrelationships possessed by its people or among others (Anderson *et al.*, 2004; Glaeser *et al.*, 2002; Paldam, 2000). However, since the present focuses on one country–China, thus, the state- or national-level social capital will not be included in this study. The tree diagram summarises the classification and components of social capital in Figure 3.1 and shows how social capital is analysed in this study.

FIGURE 3.1: CLASSIFICATION AND COMPONENTS OF SOCIAL CAPITAL



Source: based on previous literature Kawachi et al. (1999) on social capital theory and constructed by the author.

The multi-disciplinary nature of research relating to social capital (please see Figure 3.1) extends to the fields of health and gerontology studies. This, is in part because these fields are interdisciplinary in themselves, drawing on public health, social policy, sociology, economics, and political science. This relevance is also related to the multi-components (cognitive and structural) emphasis on interpersonal relation assets in the context of the multilevel (at the individual levels and their surroundings levels). The conclusion of Hawe and Shiell (2000) that social capital is one of the key factors allied with health and welfare suggests that social capital research is relevant to an understanding of disparities in wealth and health status in China. This is the underlying assumption of this thesis which uses a quantitative methodology to identify the nature and extent of the relationship between health and cognitive and structural components of social capital in both individual and community contexts. Previous research on this health-social capital relationship is considered in the next section.

3.3 LINKS BETWEEN SOCIAL CAPITAL AND HEALTH

3.3.1 COGNITIVE AND STRUCTURAL COMPONENTS OF SOCIAL CAPITAL AND HEALTH

Because of deteriorating health and correspondingly increased need for health care and/or financial support as people age, social capital could have a more important role for the older population (Shen *et al.*, 2014). Social capital theory may provide a new perspective for the scholars in public health and health economic, and it is becoming an encouraging angle that illuminates the health of mid and older people (Berry and Welsh, 2010; Norstrand and Xu, 2012; Pollack and Knesebeck, 2004; Snelgrove *et al.*, 2009; Shen *et al.*, 2014). However, the relationship between social capital and health status of mid and older aged adults varies depending on the definition of social capital, its measurement and methodological complexity, as well as the surveyed population, so that there are still controversial conclusions in terms of the relationship between social capital and older aged adults' health status.

Although the definition, components and dimensions of social capital vary between studies and disciplines, and remain controversial and unclear, its effects have been recognised in a growing number of health economics studies.

On one hand, social capital could generate such an advantage to health of individual via several mechanisms (Rocco *et al.*, 2014): Firstly, Berkman and Glass (2000) and Scheffler *et al.*, (2008) argued that, as a structural component of social capital–social interaction or social connections, may provide convenient access to pertinent health information and facilities. Their argument is that the more frequently social interaction between members in society, the more convenient and lower cost for the individual access to the health information and facilities. Secondly, reciprocity or mutual help between individuals is considered a cognitive component of social capital and has found to be significantly associated with the health status of older individuals (Shen *et al.*, 2014). In a transition economy with underdeveloped social security and public healthcare systems, as in the case of China, informal support systems play a fundamental role in covering the incidental costs of health care. Consequently, informal financial support and informal health care support by relatives, friends and neighbours play a major role in covering incidental health costs (Shen *et al.*, 2014). The informal economic and care support among children, relatives, friends and neighbours is a reflection of mutual help and mutual trust as there is no formal contract which can be prescribed to guarantee obligations (Alesina and La Ferrara, 2002; Shen *et al.*, 2014; Carmichael *et al.*, 2008, 2010; Carmichael and Charles, 2003). In addition, this cognitive component of social capital could enhance the development of informal social recourses which could in turn provide shared insurance between those involved (e.g. through health care and/or psychological support) in the case of accidents that may negatively impact on health status (Murgai *et al.*, 2002; Carmichael *et al.*, 2010; Carmichael and Charles, 2003). Thirdly, both cognitive and structural components of social capital which were measured by the weighted percentage of charitable or voluntary organisation membership and proportion of social trust as well as the election rate could increase the civil power and strengthen the social cohesion in a society or community, forcing the society or community to develop the social welfare system and rendering the involved members to enjoy more and better public good, and both of which could protect people against the stress of the unknown events (Wilkinson, 2002; Rocco and Fumagalli, 2014; Islam *et al.*, 2006a), as well as to persuade thinking people to minimise the amount of risky behaviours in order to increase the expected value of life (Folland, 2006). Fourthly, Laporte *et al.* (2008) point out that cognitive social capital measured by social trust could reduce the cost of the patient when visiting local health providers as in a society with high level of social trust could reduce the moral hazard caused by the information asymmetry.

On the other hand, however, Kawachi and Berkman (2001) and Veenstra (2005) mention that social capital could have no effect or negative impact on the health of respondents. For example, Kawachi and Berkman (2001) found that more concentrated social relationships (structural social capital) might result in a high level of imparity in health status as this could strengthen the peer effect, thus, increase the poor health condition of individuals with low-level of social capital. Veenstra (2005) investigated the relationship between social capital at the community-level and health status among Canadian citizen, and he found that structural component of social capital at the community-level (measured by the availability of public spaces) was negative and significant correlated with individual mental health, however, the public spaces was not relevant to individuals' subjective health status and long-term disease.

The above arguments are raising in the most recent decades and convincing enough to justify the broad research on the relationships of cognitive and structural components of social capital and health status of individuals, and has resulted in many theses practically evaluating the effects of social capital at both individual- and collective-level shown in the following section.

3.3.2 INDIVIDUAL-LEVEL SOCIAL CAPITAL AND HEALTH

Social capital at the individual-level indicates a social characteristic or resource of an individual that enables private returns based on one's relational networks or interaction with others (Glaeser *et al.*, 2002). Whether a person can cope with potentially damaging experiences and, following this, maintain an appropriate quality of life is mainly dependent on some factors at the individual-level. The importance of these factors is the extent and nature of emotional and practical assistance that may be provided by family, friends, associates, and other relationships (Requena, 2003). Abbott and Freeth (2008) identified a trustable relation with others at the individual-level as an important role in facilitating human interactions and, accentuated the extent to which trust could create positive relationships. They also suggest that trust may ameliorate social anxiety and provide a defence against chronic stress (Abbott and Freeth, 2008). Portes (1998) pointed out that higher individual-level social capital could reduce labour times and enhanced birth experiences of women who receive assistance and positive associations throughout their pregnancy from her social networks. Poortinga (2006) identified some possible reasons for the positive health (mental health status) effects that arise from the social interaction between individuals as a measure of social capital. Interactions between individuals in some formal or informal activities has been said to reinforce self-respect, to develop problem-solving capacities and encourage self-confidence and self-responsibility. Mohnen *et al.* (2011) suggest that greater social capital encourages the emulation of behaviour among the group's members, suggesting that it may encourage activities that may be either positive or negative with respect to health. Ziersch *et al.*, (2009) indicated that a person's sense of security is potentially associated with individual mental health. Furthermore, Lindström and Mohseni (2009) argued that social capital may enhance feelings of security in a society (subjective psychological). Combined these arguments suggest that the both the psychological and physiological health of a respondent benefit from social capital at the individual-level.

3.3.3 COMMUNITY-LEVEL SOCIAL CAPITAL AND HEALTH

Studies have also investigated the effects of the neighbourhood- or community-level social capital on individual health status. Kawachi and Berkman (2001) identified three potential mechanisms for a positive relationship: impacts on behaviour associated with health, and impacts on access to health provision, and impact on social cohesion related to health, insofar as it is affected by social and psychological factors. Community-level social capital could influence behaviour related to health as a result of the efficient communication of information and facilitate activities beneficial to health (Hendryx *et al.*, 2002; Pigg and Crank, 2004). The purpose of the information would be to encourage individuals to engage in healthy activities, such as keeping fit (healthy Body Mass Index [BMI] level). Communities in which social capital is well developed resist what they believe to be unjustified funding reductions more effectively, and they are also more likely to create groups that support the maintenance of access to health services (Sampson *et al.*, 1997). Such services include transport, health delivery organisations, and sports and leisure amenities. Social capital within a society can also influence people's health as a result of the influence on psychological factors. Tsai and Ghoshal (1998) argue that such interaction can lead to psychological reinforcement in relation to self-worth and the acceptance of others. Contrastingly, health may deteriorate as a result of prolonged psychological tension, which could lead to a response to the stress of which the individual is unaware (Kawachi and Berkman, 2001). According to Brunner and Marmot (2005) such low-level stress can stem from social seclusion and inadequate assistance. Furthermore, elevated stress-response hormones can cause increased fibrinogen levels in the blood result in hypertension for the older individuals. Also, depression, diabetes, and hypertension can result from prolonged and elevated exposure to psychological stress (Brunner and Marmot, 2005). Community-level social capital is also embodied within society, and it is argued that sociocultural expectations and standards can influence and place limitations on individual conduct (Hawe and Shiell, 2000). The principal way society can enhance health is through the provision of successful facilitation and communication avenues (Poortinga, 2012). For example, people can be encouraged to improve their health by avoiding damaging activities and substances, namely smoking and consuming alcohol. This happens through educational programmes and media information campaigns or institutions including laws and regulations (Shen *et al.*, 2014). Some social systems are likely to be capable of generating more harmonious environments which harbour social unity and reciprocated collaboration and engagement. For example, more trustable and more democratic systems may foster social cohesion through the equal rights in which individuals may engage in a political and communal activity (Islam *et al.*, 2006a; Kawachi *et al.*, 1999). It has been suggested that such conditions are essential in enabling the administration of public health that results in benefits for the entire community (Islam *et al.*, 2006a; Kawachi *et al.*, 1999; Kawachi and Berkman, 2001).

3.3.4 SOCIAL CAPITAL AND HEALTH IN CHINA

The above papers consider several health outcomes (subjective and objective health outcomes) and across many different nations, however, most of this empirical studies was taken from western industrialised nations. These countries have social features and social security system as well as old-age caring systems quite distinct from the Eastern countries, such as China.

Till now, there is a few research has investigated in the relationship between social capital and health outcomes for Chinese citizens, particularly focus on the mid and older population in the China cultural context. Although some studies stated that social capital at either individual- or community-level significantly and positively associated with individual health status, the study sample sizes were small and collected from few regions in China, thus, the results were not representative; and the mechanism between these two factors is still under-investigated as most of these studies failed to overcome the reverse causality between social capital and individual health (Wang *et al.*, 2009; Yip *et al.*, 2007; Norstrand and Xu, 2012). The most recent study done by Shen *et al.* (2013) is the first one to use a pilot data of CHARLS in 2008, measuring social capital with cognitive and structural components at both individual- and community-level, found that social capital measured by receiving help and perceived future help at individual-level, and community-level social capital measured by the number of amenities in the village or community, were significantly and positively associated with individual self-rated health. However, the empirical results from the above studies, of the relations between social capital and health, in the Chinese context, show neither national representability nor real causal relationship (did not deal with the endogenous issue). Therefore, this thesis addresses both issues in order to fill the gap of health economics literature on the relationship between social capital and health outcomes among mid and older people in the most influential Eastern country.

3.4 MODELLING HEALTH AND SOCIAL CAPITAL

For the present thesis, the original Grossman (1972) human capital-health model, also referred to as the health production function or reduced-form model, will be drawn on and adapted into facilitating the development of a health-social capital theoretical model. The adapted model will focus on the nature of potential social capital effects on health during the lifetime of an individual.

In the Grossman (1972) model, on one hand, the health of the individual as part of the human capital is accrued over the course of a lifetime by individuals who may benefit from societal conveniences to maximise this potential. This is assumed to take place in accordance with investment strategies that have formerly been identified as advantageous, and the optimum investment selection of such pathways can be modelled. In this framework, the health investment decisions of different individuals should be analogous. Nevertheless, the health outcome is assumed to be dependent not only on investment plans, but also the starting point or initial conditions of individuals regarding capacity, inclinations, hereditary influences, and general demands of life. Of particular importance are individual genetic, living environmental, individual financial status, and societal or cultural background differences. Such factors are exogenous to the individual (but perhaps endogenous to the system being studied), meaning that they are not subject to manipulation, and impact people's health directly. Conversely, in situations where individuals share comparable initial conditions and indistinguishable optimal health investment strategies, differing health outcomes can only be attributed to random shocks. Investments in health are also linked to the phase of an individual's life and the extent of exposure to different influences. Naturally, this will vary from individual to individual.

On the other hand, as the previous section described, social capital is not only considered as private resources of the individual, but also is a quality of aggregate or community resources, which is a feature of the social environment and public good for its members, including social trust, social norms, reciprocity between citizens, social interaction atmosphere, and community facilities in the society or community. Therefore, the investment of community-level social capital could benefit each within the neighbourhood or community, and the effects on individual health may be similar to each in the same community but vary across communities as community social capital differs between communities. This theoretical approach, therefore, suggests that overall health is attributed subject to a trial and error process and impacted by exogenous limitations, linked to initial conditions and phase of life (Rocco and Fumagalli, 2014).

Within this framework, the aim of the present investigation is to provide new evidence on the correlation between individual health and social capital factors as well as other fundamental influences. The health production function or health reduced-form model that will be developed is characterised by the specification of a model in which health capital is a function of the exogenous factors (Rocco and Fumagalli, 2014). This assumes, but does not specify underlying processes through which health capital is accrued and individuals confront exogenous problems such as those pertaining to access to health services. The empirical model is one in which the endogenous variable is health (or health capital) and this is subject to influence due to changes in exogenous variables including social capital. This leads to the reduced-form health model (Grossman, 1972; Rocco and Fumagalli, 2014):

$$Health_{ij} = \beta X_{ij} + \delta W_j + \alpha_1 ISC_{ij} + \alpha_2 CSC_j + \varepsilon_{ij} \qquad (3\text{-}1)$$

In (3-1) $Health_{ij}$ refers to the health of individual i in a neighbourhood or community j. The X_{ij} are the exogenous factors affecting health. W_j indicates broader exogenous factors relevant to the social environment or community j. ISC_{ij} is a vector of social capital indicators (cognitive and structural components) at the individual-level while CSC_j contains a vector of social capital at the neighbourhood or community-level (cognitive and structural components). The vector α_1 and α_2 captures the influence of the measures of social capital at individual-level and community-level, respectively. ε_{ij}

captures unexpected health outcomes that result from marginal errors or unexpected inconsistencies.

In theory, the fundamental causes are assumed to be exogenous. However, social capital factors may be endogenous if they are correlated with the error term (Rocco and Fumagalli, 2014). However, since the community-level social capital is considered as an exogenous factor, thus, the endogenous issue may appear in the individual-level social capital. If in this case, the estimated parameters α_1 would be biased since endogeneity is implied using the OLS estimation:

$$E\left(ISC_{ij}\varepsilon_{ij} \middle| X_{ij}, W_{ij} \neq 0\right) \quad (3\text{-}2)$$

When (3-2) holds the OLS parameters α_1 and the magnitude of the bias can be unsystematic and, therefore, the estimates must be regarded with caution (Rocco and Fumagalli, 2014).

Endogeneity can arise because of reverse causation, omitted variables, and measurement error categories (Rocco and Fumagalli, 2014). Reverse causation in the relationship between health and social capital may also result if health has an impact on access to personal social capital (Guiso *et al.*, 2008; Rocco and Fumagalli, 2014). This could happen if work-related networks are lost due to unemployment caused by ill-health which could underlie negative relationships found between health and unemployment (Carmichael *et al.*, 2013; Porcellato *et al.*, 2010). For example, individuals in good health are likely to be better able to socialise, communicate, and derive beneficial information from the community (Rocco *et al.*, 2014), thus, accumulate more social capital and for the betterment of their decision-making processes, and this may impact their health. Another example is that good health is fundamental to maintaining employment for older adults while the opposite is also true (Carmichael *et al.*, 2013; Porcellato *et al.*, 2010).

In the estimation of (3-1), bias also can be presented through omitted variables (Rocco and Fumagalli, 2014). For example, individual confidence, socio-economic status, and any communal contributions, is also a possible concern. Such factors may be associated with social capital and/or health and also, potentially the links between the two. For example, affluent individuals are likely to form relationships with those who are closer to them regarding social status and, such associations may influence the individual's preference for different types of social capital. Therefore, interplay may exist between individual characteristic and social capital elements, which may, in turn, serve to have a moderating effect on individual health. However, elucidating the extent of the contribution of above unobservable factors to different levels of social capital and the interactions between them is challenging (Rocco and Fumagalli, 2014).

Available measures of social capital also tend to be approximated and therefore subject to measurement error which can be a cause of endogeneity (Rocco and Fumagalli, 2014), namely classical "errors-in-variable". For example, an orthogonal normally distributed measurement error in relation to the social capital, would have a tendency to skew estimated social capital coefficients downwards (Rocco and Fumagalli, 2014). Conversely, estimates may be skewed in either direction due to non-classical "errors-in-variable" (Wooldridge, 2010, 76-82). The method by which data on social capital is collected is dependent on individual interviews. Consequently, it is entirely typified by self-evaluation and recall. For example, the individual is responsible for conveying information on subjects such as personal levels of confidence, reliance, and participation in the community. Inaccuracy in memory recall and human error may bias the results. Human error can be attributed to the tendency for individuals to overstate or understate events according to their subjectivity or opinion. Therefore, this leads to such phenomena as the "common method bias" (Fujiwara and Kawachi, 2008). The latter is dependent on the quality of the individual's response, the standard of which will determine whether errors-in-variables are produced. These errors would correspond to the specific social capital measurement resulting in a skewed regression parameter (Wooldridge, 2010). In this thesis, methods for addressing these potential endogeneity issues will be employed in Chapter 5.

3.5 CONCLUSION

In conclusion, the concept of social capital and its implications are still debated. Nevertheless, for this thesis, social capital is mainly defined in accordance with the four basic definitions by Bourdieu (1986), Coleman (1988) and Putnam (1993, 2000) and the World Bank (2011), in addition to Lin (2002), Kawachi *et al.* (1997) and Shen *et al.*

(2013), in that social capital at the individual-level is conceived as a social network of relationships anchored in trust or reliance, mutuality, reciprocity and social interaction or participation. In this context, community-level indicators of social capital would include a sense of security to the living environment (social trust in the community), involvement in the community activities (social interaction in the community), available social associations and the presence of amenities.

A defining characteristic of social capital, is that it ultimately drives exposure to a range of assets that are beneficial to both individual- and collective-level. The theoretical health production model or reduced-form health model adapted from Grossman (1972) and outlined above conceptualises a specific link between social capital and health capital of the individual. The foundations for this research are rooted in previous research that theorises and investigates the relationship between individual- and community-level social capitals, on the health of individuals. This research aims to extend this body of work by addressing the limited knowledge of how social capital impacts the health of Chinese mid and older people. However, the following chapter sets the stage for the analysis in Chapters 5 and 6 which is based on a sample of older Chinese people. Chapter 4 conducts an analysis of the correlation between individual health and social capital for a representative sample of Chinese adults of all ages. All these three chapters try to provide a broad picture of the relationship between social capital and individual health status in the Chinese context, and investigate whether this relationship differs from western countries.

4 CHAPTER FOUR: SOCIAL CAPITAL, HEALTH AND WELL-BEING IN MODERN CHINA

4.1 INTRODUCTION

The focus of this chapter is on the relationship between social capital and health among adults of all ages in China; it also examines the Hypothesis 1 and 3 proposed as well as respective sub-hypothesises in the Introduction. This research, in conjunction with a large and representative sample, utilises a broad range of social capital indicators, making it the most extensive to date.

Substantial research has been conducted on this topic, predominantly within sociology, health economics and public health academic disciplines (Kawachi *et al.*, 2008; d'Hombres *et al.*, 2010; Ronconi *et al.*, 2012; Kawachi *et al.*, 2013). Although these previous studies deployed different measures, and examined different aspects of social capital, most of the findings indicate a clear positive correlation between social capital and health: as social capital increases, health outcomes improve. However, a major limitation of previous research, is that it has predominantly focused on western countries, although a growing interest in China (there are also a few studies that focus on some regions in China: namely Meng and Chen, 2014; Shen *et al.*, 2013; Wang *et al.*, 2009;

Xue *et al.*, 2016; Yip *et al.*, 2007). Therefore, the relevance of whether these findings from western cultural settings are still applicable for Eastern countries, especial for China, is still needed to investigate.

Previous research in this area and for the Chinese population has used subjective health or well-being as health status indicators (Yip *et al.*, 2007; Wang *et al.*, 2009; Meng and Chen, 2014; Shen *et al.*, 2014; Xue *et al.*, 2016; Liu *et al.*, 2016). In the present thesis, the dependent variables are comparable measures of subjective health and well-being. This makes the results comparable with those of previous studies that consider the effects of social capital, reflected in terms of measures of social trust and social interaction or participation, on health. In the analysis, none of the dependent variables measuring health and well-being are continuous, and therefore, the regression analysis uses non-linear estimation methods. For the non-linear estimation, there are two main issues we need to be pay attention: firstly, heterogeneity effects of social capital on the health status of individuals has been reported to be an issue in previous research which has found that the relationship between health and social capital can vary across different subpopulations (Meng and Chen, 2014; Shen *et al.*, 2014; Yip *et al.*, 2007). Secondarily, the interpretation of interaction effects, as well as the discussion of social capital on some demographic or socio-economic factor is also problematic in non-linear regression models. These issues have been overlooked in the previous literature. However, the present study addresses both issues.

The structure of the chapter is as follows: first, the empirical methodology and estimation strategy are presented; section 3 describes the data and the variables that were used in the analysis; section 4 presents descriptive statistics; section 5 presents the empirical findings; the final section concludes.

4.2 METHODOLOGY AND ESTIMATION STRATEGY

4.2.1 BINARY LOGISTIC REGRESSION MODEL

The health indicators available from CGSS dataset are ordered categorical variables capturing health outcomes, specifically self-rated general health status and self-rated well-being, ranking from value 0 of "very poor health"/"very dissatisfied" to 5 of "very good health"/"very satisfied". Normally, if the dependent variable is a continuous variable with a normal distribution, the linear regression model can be employed, and ordinary least squares (OLS) can be used to estimate the social capital-health relation. However, the health outcomes are ordered categorical variables for which the distances between each category is unobservable. In order to facilitate the analysis process, this study rescaled the ranked value to binary value with 0 and 1. This specification is estimated by rescaling the ranked ordinal dependent variable into a binary variable (SRH or SRWB) for which 0 represents a score of 1 to 2 (SRH = poor general self-rated health, or SRWB = dissatisfied) while 1 represents scores of 3 to 5 (SRH = at least fair health, or SRWB = at least fair satisfied). Therefore, a binary logistic regression model is used in this study.

The estimation is based on the health equation proposed by Grossman (1972) and the underlying relationship between individual health and social capital is as expressed in the equation below:

$$H_i^* = \alpha + SC_i\beta + X_i\mu + \sigma\varepsilon_i \tag{4-1}$$

where H_i^* is the unobserved latent health outcome: self-rated general health (abbreviated to SRH) or self-rated well-being (abbreviated to SRWB); SC_i represents a set of social capital indicators at the individual-level, and X_i is a vector of variables capturing N characteristics or factors that are assumed to be determinants of health outcomes, including demographic and socio-economic variables associated with each respondent i; α is the constant term, β and μ are $N+1$ column vectors of coefficients for each variable in SC and X, ε_i is an error term and σ is its homoscedastic coefficient.

As mentioned above, the dependent variables are the binary SRH and SRWB measures taking values 0 and 1, respective. Thus, the observed binary dependent variable, H_i, takes two values (0 and 1). Thus, the link between the binary observed dependent variable, H_i, and the continuous latent variable, H_i^*, is as described below:

$$H_i = \begin{cases} 0 \Rightarrow Poor\ or\ worse\ health/Dissatisfied, if\ H_i^* \leq 0 \\ 1 \Rightarrow At\ least\ fair\ health/Satisfied, if\ H_i^* > 0 \end{cases} \quad (4\text{-}2)$$

The binary logistic regression model with social capital and other control variables is specified as:

$$\Pr(H_i = 1|SC_i, X_i) = \Pr(\varepsilon > -[\alpha + SC_i\beta + X_i\mu] \mid SC_i, X_i) \quad (4\text{-}3)$$

The distribution of ε is assumed to be a logistic distribution with $Var\ (\varepsilon) = \pi^2/3$, thus:

$$\Pr(H_i = 1|SC_i, X_i) = \frac{\exp(\alpha + SC_i\beta + X_i\mu)}{1 + \exp(\alpha + SC_i\beta + X_i\mu)} \quad (4\text{-}4)$$

Following Theil (1970, *p.*143), the log of the odds is specified as:

$$ln\Omega(SC_i, X_i) = ln\frac{\Pr(H_i = 1\ |SC_i, X_i)}{\Pr(H_i = 0\ |SC_i, X_i)} = ln\frac{\Pr(H_i = 1\ |SC_i, X_i)}{1 - \Pr(H_i = 1\ |SC_i, X_i)} \quad (4\text{-}5)$$

4.2.2 THE MARGINAL EFFECT OF SOCIAL CAPITAL ON HEALTH

To measure the change in the probability of health status for a change in social capital holding all other factors constant, the present study employs marginal effect analysis. The expression for the marginal change in a BL regression model (with the logistic probability distribution function) is given below following Long and Freese (2006, *p.* 244-246):

$$\frac{\partial \Pr(H_i = 1 \mid \mathbf{X})}{\partial SC_k} = \Pr(H_i = 1 \mid \mathbf{X})[1 - \Pr(H_i = 1 \mid \mathbf{X})]\beta_k \quad (4\text{-}6)$$

where **X** specifies values of the independent variables, for example, mean values of all independent variables ($\bar{\mathbf{X}}$). However, as discussed above, the social capital variables include both continuous and binary (dummy) scales. Accordingly, for the continuous social capital factors, the marginal effect normally refers to a discrete change or a first difference and captures the change in the predicted probability for the given change in SC_k while holding other variables constant, for example, the effect of an increase of $\boldsymbol{\delta}$ in SC_k (from the observed value *k*). Following Long and Freese (2006, *p.* 244-246) the marginal effect of the discrete change $\boldsymbol{\delta}$ in SC_k is,:

$$\frac{\Delta \Pr(H_i=1 \mid \mathbf{X})}{\Delta SC_k(SC_{i,k} \rightarrow SC_{i,k}+\delta)} = \Pr(H_i = 1 \mid \mathbf{X}, SC_k + \delta) - \Pr(H_i = 1 \mid \mathbf{X}, SC_k) \tag{4-7}$$

As explained in Long and Freese (2006, *p.* 132–140) this can be written as

$$\frac{\Delta \Pr(H_i=1 \mid \mathbf{X})}{\Delta SC_k(0 \rightarrow 1)} = \Pr\left(H_i = 1 \mid SC_k^{end} = 1, \mathbf{X}\right) - \Pr(H_i = 1 \mid SC_k^{start} = 0, \mathbf{X}) \tag{4-8}$$

However, in the non-linear logit model, the marginal effect of social capital depends on the values of all other independent factors and can therefore vary. Based on the suggestions from Long and Freese (2006, *p.* 244-246), Cameron and Trivedi (2005, *p.* 467), and Hanmer and Ozan Kalkan (2013), the present study estimates average marginal effects (AMEs). These compute the mean of the marginal effects for the observed values for all observations in the given sample and are written as:

$$mean \frac{\Delta \Pr(H_i=1 \mid \mathbf{X}_i)}{\Delta SC_k} = \frac{1}{N} \sum_{i=1}^{N} \frac{\Delta \Pr(H_i=1 \mid \mathbf{X}=\mathbf{X}_i)}{\Delta SC_k} \tag{4-9}$$

4.2.3 INTERACTION EFFECT SPECIFICATION

An interaction analysis between age and the social capital variables is used to investigate whether social capital moderates the negative effect of age on subjective health and well-being. In a linear regression the interaction term can be interpreted in terms of how much the effect of age changes for a unit change in social capital (and vice versa). However, in the non-linear models used in this analysis (binary logistics), the interpretation of the interaction effect is complex (Norton *et al.*, 2004). The approach taken follows that of Ai and Norton (2003), Karaca-Mandic *et al.* (2012), Knol *et al.* (2007) and Norton *et al.* (2004) in order to investigate the interaction effect of age and social capital on health outcomes.

The interaction effects measure the effect of any relationship between *age* and *social capital* (SC_i) that impacts on the two binary dependent variables (SRH and SRWB), H_i. It is predicted that SC_i will have an independent effect on H_i, as well as an interaction effect moderating the negative relationship between *age* and H_i. The aim of the analysis is to establish by how much the effect of age changes for a unit change in the measure of social capital. The estimating model follows Ali and Norton (2003), Karaca-Mandic *et al.* (2012), Knol *et al.* (2007) and Norton *et al.* (2004) and is specified as:

$$E[H_i|age_i, SC_i, X_i] = F[\beta_0\alpha + \beta_1 age_i + \beta_2 SC_i + \beta_{12} age_i SC_i + X_i\beta + \varepsilon_i] \quad \text{(4-10)}$$

where here $F(\cdot)$is the logistic distribution function as above, age_i represents the i-th respondent's age and SC_i is the i-th individual-level social capital factor; X_i is a row vector of other independent variables and β accounts for the coefficients. In line with Grossman (1972) the age-health relation is assumed to be negative, implying that the older a person, the less healthy they will be (or the less health capital they will have). In contrast, this study proposes that social capital has a positive effect on an individual's health status–the more social capital the person has, the healthier they are likely to be. Thus, the sign of β_1 is predicted to be negative, and the sign of β_2 is predicted to be positive. The interaction effect represented by the coefficient β_{12} does not have a direct meaning. Karaca-Mandic *et al.* (2012) and Norton *et al.* (2004)[22], suggest that the interaction effect β_{12} may be interpreted as a cross-partial derivative effect, in this case, a measure of how the partial derivative with respect to either age or social capital varies with a very small change in the other variable. In this specification, a positive sign for the interaction term β_{12}, can be interpreted as implying that higher social capital alleviates the negative effect of age on health (alternatively, age reinforces the positive effect of social capital). However, in the non-linear logit estimation the calculation and interpretation of the interaction effect depends to some extent on whether the social capital variable, SC_i is a dummy variable or continuous. When SC_i is a continuous variable, the interaction effect can be interpreted regarding the effect a one unit increase in SC_i *has* on the predicted

[22] The present study used a user-written commend '*inteff*' to calculate the interaction effect instead of using the official Stata 12 commend '*margins*' because '*margins*' only able to compute the derivative of one single variable. Please see Karaca-Mandic et al. (2012) and Norton et al. (2004) for more details.

probability holding age_i constant at different values. When SC_i is a dummy variable, the value of the interaction effect is estimated as a discrete effect by calculating the difference in the predicted value of the dependent variable for $SC_i = 0$ and $SC_i = 1$ while holding age_i constant. A larger positive interaction effect at older ages could, therefore, be interpreted as implying that social capital has a positive moderating effect on the negative effect of age.

The interaction effect is interpreted as a measure of the change in the predicted probability that $H_i = 1$ for a change in both age and social capital. Age is measured by the continuous variable age_i and the analysis uses five different indicators of social capital (SC_i). Three of these are binary variables indicating whether the individual has a membership of either a religious group, the Chinese Communist Party or a union. Since these measures of SC_i are binary the interaction term is calculated as a discrete difference following Norton *et al.* (2004, *p.* 158):

$$\frac{\Delta \frac{\partial F(H_i)}{\partial age_i}}{\Delta SC_i} = (\beta_1 + \beta_{12}) \begin{pmatrix} F\{(\beta_1 + \beta_{12})age_i + \beta_2 + X_i\beta\} \\ \times (1 - F\{(\beta_1 + \beta_{12})age_i + \beta_2 + X_i\beta\}) \end{pmatrix}$$

$$- \beta_1[F(\beta_1 age_i + X_i\beta)\{1 - F(\beta_1 age_i + X_i\beta)\}]$$

(4-11)

where $F(H_i)$ is the logit cumulative distribution function. When SC_i is captured by continuous measures then, following Norton *et al.*, (2004, *p.* 158) the interaction effect is calculated as the cross-partial derivative with respect to age_i and SC_i:

$$\frac{\partial^2 F(H_i)}{\partial age_i \partial SC_i} = \beta_{12}\{F(H_i)(1 - F(H_i))\} + (\beta_1 + \beta_{12}SC_i)(\beta_2 + \beta_{12}age_i)[F(H_i)\{1 - F(H_i)\}\{1 - 2F(H_i)\}] \tag{4-12}$$

Following Norton *et al.* (2004), when there are multiple interaction effects it is possible to these effects individually in separate models. Since the current analysis employs five different social capital variables the analysis adopts this procedure and estimates five separate models with different social capital-age interaction variables in each.

4.3 DATA AND VARIABLE CONSTRUCTION

4.3.1 DATA

The data used in this research was obtained from the China General Social Surveys (CGSSs) covering 2010 up to 2013. The CGSS was first recorded in 2003 and is recorded annually, therefore providing continuous cross-sectional data that is representative of China. The survey is the result of an academic project that was developed by the Renmin University and the Hong Kong University of Science and Technology. The CGSS focuses on both social structure and the quality of life experienced by individuals living in China. Thus far, the CGSS has consisted of two cycles. The first cycle was operational between 2003 and 2008. Following this, Cycle 2 was developed and is expected to operate until 2019. The second cycle of CGSS questions incorporated social capital questions, which the previous cycle failed to explore, as well as self-reported health and well-being, and the activities or typical behaviours that the individuals practice.

Due to the extensive nature of these surveys, they are considered to be nationally representative and provide vital information on the effects of social capital and health. The sampling strategy for selecting participants in Cycle 2 used a three-stage stratified random sampling technique consisting of the county–Primary Sample Unit (PSU), community–Secondary sampling Units (SSU's) and household. A total of 140 PSUs and 2,762 SSU's, and 25 households in each community were sampled. Only one individual over the age of 18 will take part in the survey for each household. The Chinese central government currently oversees 43 cities, municipalities, provincial capital cities and vice provincial cities. It is possible to arrange these cities into a hierarchy using different measures. If Gross Domestic Product (GDP), Foreign Direct Investment (FDI) and education level are all used in conjunction, Beijing is the highest ranked city in China, followed by Shanghai, Tianjin, Guangzhou and Shenzhen. Cycle 2 identified these cities as being self-representative, or standing alone. Therefore, 67 of the PSU's relate to these cities. The remaining 2,695 PSU's can be ranked on the basis of their GDP per capita, their rate of urbanisation, and how dense their population is. They were then classified into 50 equal strata groups. For each of the 50 strata, the probability-proportional to size (PPS) sampling method was utilised to identify 2 PSUs for sampling. The second stage was to identify four communities to be sampled. In 2010, for the top 5 countries that are allocated to self-representative strata, 80 communities were used. Within those 80 communities were 2,000 households. Across the remaining 50 strata, there were 400 communities consisting of 12,000 households.

4.3.2 HEALTH MEASURES

Individual health outcomes (the dependent variables in the regression model outlined below) were measured by self-reported health (SRH), and self-reported well-being (SRWB). To ascertain the health status of respondents, the CGSS asks "In general, how would you assess your current health status?" A five-point Likert response scale is provided with responses of: Very Poor (=1), Poor (=2), Fair (=3), Good (=4), and Excellent (=5). Similarly, to determine well-being, participants were asked: "In general, how satisfied/happy are you with your life?" They were provided with a similar 5-point response scale: Very Dissatisfied (=1), Dissatisfied (=2), Fair (=3), Satisfied (=4), and Very Satisfied (=5). However, in order to facilitate the analysis process below, the dependent variables (SRH and SRWB) were re-coded as follows. Positive responses of

‘Fair’, ‘Good’ and ‘Excellent’ in the SRH measure, and ‘Fair’, ‘Satisfied’ and ‘Very Satisfied’ for the SRWB measure, have been coded as 1. Responses of ‘Poor’ and ‘Very Poor’ have been coded as 0 for the SRH measure, while ‘‘Dissatisfied’ and ‘Very Dissatisfied’ have been coded as 0 for SRWB. The effect of this recoding is that a value of 1 represents participants have “At least fair health” on the new SRH measure, and are “At least fair satisfied” on the new SRWB measure. The reverse is true for a coding of 0 on each of these measures.Most of previous studies used SRH as the health indicator and investigated the relationship between social capital and individual’s health status (Wang *et al.*, 2009; Meng and Chen, 2014; Xue *et al.*, 2016; Shen *et al.*, 2014). Although the use of the SRWB variable as the health outcome is less common in the study of social capital and health. It has been found to be strongly and positively correlated with an individual’s social capital (Yip *et al.*, 2007). SRWD has also been found to be strongly corrected with mental health status and thus can be used as an indirect indicator of mental health status. For all this reason, it is considered a useful health measure for the present study.

4.3.3 MEASURES OF SOCIAL CAPITAL

Social capital can be defined as the composition of social norms, trusting relationships and social cohesion (Xue *et al.*, 2016; Putnam, 2001). However, there is some debate over whether social capital means something different to individuals and for communities (Kawachi *et al.*, 2008). Social capital is also recognised with cognitive and structural components. Cognitive social capital relates to the extent an individual trusts the various individuals within his/her network or where the person lives. Structural social capital relates to how an individual interacts with others within his/her informal network or a group. This structural component also can be associated with formal networks within a group or a community (Xue *et al.*, 2016).

Based on previous literature and the availability of measures in the CGSS dataset, this chapter uses answers to a variety of questions to construct indicators of social capital (see Table A4-1 in the Appendix) and employs principal factor analysis method (for details see Table A4-2 to A4-4 in the Appendix) to construct two social capital indices: a continuous scale of social trust within a village (rural areas) or community (urban areas) to represent the cognitive component of social capital, and a measure of the social interaction/participation of individuals to represent the structural component social capital. These two scales have been rescaled to range from 0 to 100, after factor analysis.

It is important to recognise that because of the subjective nature of the questions and responses, there is a risk of measurement error. Therefore, three objective social capital variables were also included in this study: being a believer and participating in religious activities (PRA, 0= otherwise; 1=Yes), membership of the China Communist Party (CCP, 0= otherwise; 1=CCP member), and a membership of a union (UNI, 0= otherwise; 1=Yes).

4.3.4 DEMOGRAPHIC AND SOCIO-ECONOMIC INDICATORS

The data set contains a wide range of demographic and socio-economic measures which are used as control variables in the empirical estimation. These include participant's age (continuous scale), gender (dummy, 0 = Male; 1 = Female); race/ethnicity (dummy, 0 = Otherwise; 1 = *Han*[23]); marital status (category, 0 = Single/Divorced/Widow/Widower; 1 = Cohabiting or Married); *Hukou* status (dummy, Agriculture = 0 and Non-agriculture = 1), immigration status (dummy, Otherwise = 0; Immigrant = 1) and educational achievement (category, 1 = Illiteracy; 2 = Primary; 3 = Secondary; 4 = College/University or above), working status (dummy, 0 = Otherwise; 1 = working); information regarding the annual income for both the individual and the household (continuous scales); individual's perception of their household socio-economic status (ranked category, 1 = Lower than average; 2 = Average or above; 3 = Much higher than average); and some household characteristics variables, such as the number of children (continues scales, son and daughter respectively).

[23] There are 56 ethnic groups in China. *Han* are the main ethnic group in China. There are some minority ethnic groups, such as Zhuang, Hui, Manchu and Miao, etc. To investigate whether ethnicity is a determinant factor of individual health status, a dummy variable race was included in the regressions, 1 = *Han* while 0 = any other minority ethnic groups.

4.4 DESCRIPTIVE STATISTICS

The mean for each variable of the full sample is presented in Table 4.1. Following data cleaning to exclude missing information (listwise deletion), the final sample consisted of 31,883 responders between 2010 and 2013.We can see that more than half respondents from CGSS dataset reported at least fair health (78%) and fair satisfied (91%). The average social trust score is close to medium (54.05) while social interaction score is less than half (35.08). It implies that most of the respondents from CGSS dataset trust in people but interact less with others. We can also find that there are small among respondents reported being a believer and participating in religious activities (PRA=9%), and being a member of the China Communist Party (CCP=13%), and a membership of a union (UNI=12%), the result is consistent with the previous results that Chinese does not like to interact with others. The average age of our sample is about 48 years old, and most of the respondent finished primary education as well as were married. In terms of socio-economic status, immigration is much less than half of the sample and their *Hukou* status is close (54% of non-agriculture versus 46% of agriculture); there are more than half respondents reported current working with average total annual income of 21,789.04. We can also find that the mean household annual income in the past year is 50,498.6 and around 60% respondents believe the socio-economic status of their family is average or above. Maybe because of the ‘One-child’ policy, the number of son and/or daughter is around 1.

To allow for a comparison of different demographic and socio-economic groups and their subsequent effect on social capital, the sample was also grouped into four categories by age, gender, resident region and *Hukou* status, and is also present in Table 4.1. The number of responders that were categorised as less than 45 years old was 13,226. This group is considered the younger age group. 10,384 responders were between 45 and 59, termed the middle age group. Finally, 8,273 responders were aged 60 and older and termed the older-age group. It was expected that SRH would decrease as respondent age increased, and this is true from the current data (89% > 75% > 63%). However, SRWB does not show a decrease in conjunction with age. Many of the social capital variables show a positive correlation in comparison to age, with the older respondents scoring higher on social capital variables (social trust). Social interaction and union membership, however, decrease in conjunction with increased age. Many of these factors have simple explanations. For example, the mean health reported in the elderly is lower than that of the middle age responder group. Therefore, it is logical that their physical activity would be less and so correspondingly less social interaction or participation. Similarly, reduced union membership would also be expected as the older individuals retired and left the union. In the older respondent group, 9% of individuals were union members, compared to 14% of the middle age group and 13% of the younger age group. While this data is informative, it does not account for the influence that other variables may be contributing, as they are only pairwise associations.

TABLE 4.1: VARIABLE STATISTICS DESCRIPTION, FULL AND AGE SUBSAMPLE, 2010-2013

Variables	Full Sample	Age Groups			Gender		Resident		Hukou Holders	
		Age <45	Age 45-59	Age 60+	Male	Female	Rural	Urban	A-Hukou	NA-Hukou
Self-rated health	0.78	0.89	0.75	0.63	0.81	0.74	0.71	0.82	0.74	0.82
	(0.42)	(0.32)	(0.43)	(0.48)	(0.39)	(0.44)	(0.45)	(0.38)	(0.44)	(0.39)
Self-rated happiness	0.91	0.92	0.9	0.92	0.91	0.91	0.9	0.92	0.9	0.93
	(0.28)	(0.27)	(0.31)	(0.28)	(0.28)	(0.29)	(0.31)	(0.27)	(0.30)	(0.26)
Social trust scale (0-100)	54.05	51.96	53.7	57.82	53.74	54.38	57.04	51.98	55.59	52.26
	(18.24)	(18.09)	(18.30)	(17.81)	(18.29)	(18.17)	(17.71)	(18.31)	(18.06)	(18.28)
Social interaction scale (0-	35.08	38.47	34.1	30.91	35.94	34.15	31.44	37.6	32.39	38.21
100)	(16.66)	(15.80)	(16.31)	(17.32)	(16.67)	(16.61)	(16.12)	(16.56)	(16.42)	(16.40)
PRA (0=Otherwise; 1=Yes)	0.09	0.09	0.09	0.11	0.08	0.11	0.1	0.09	0.1	0.08
	(0.29)	(0.28)	(0.29)	(0.31)	(0.26)	(0.32)	(0.30)	(0.29)	(0.31)	(0.28)
CCP (0=Otherwise; 1=Yes)	0.13	0.1	0.12	0.18	0.18	0.06	0.06	0.17	0.05	0.21
	(0.33)	(0.30)	(0.32)	(0.39)	(0.39)	(0.25)	(0.24)	(0.38)	(0.23)	(0.41)
UNI (0=No; 1=Yes)	0.12	0.13	0.14	0.09	0.15	0.1	0.03	0.19	0.02	0.24
	(0.33)	(0.30)	(0.32)	(0.39)	(0.39)	(0.25)	(0.24)	(0.38)	(0.23)	(0.41)
Age (18-97)	48.98	34.38	51.76	68.82	49.57	48.34	50.18	48.15	48.21	49.87
	(15.21)	(6.80)	(4.43)	(7.03)	(15.29)	(15.11)	(14.67)	(15.53)	(14.94)	(15.48)
Gender (0=Male; 1=Female)	0.48	0.5	0.48	0.45	0	1	0.48	0.48	0.49	0.47
	(0.50)	(0.50)	(0.50)	(0.50)	(0.00)	(0.00)	(0.50)	(0.50)	(0.50)	(0.50)
Race (0=otherwise; 1=Han)	0.92	0.91	0.92	0.93	0.92	0.92	0.89	0.94	0.9	0.94
	(0.27)	(0.29)	(0.27)	(0.25)	(0.27)	(0.28)	(0.31)	(0.24)	(0.30)	(0.24)
Educational attainment										
Illiteracy	0.12	0.03	0.12	0.27	0.07	0.18	0.21	0.06	0.19	0.04
	(0.33)	(0.18)	(0.32)	(0.44)	(0.25)	(0.39)	(0.41)	(0.24)	(0.39)	(0.20)
Primary	0.54	0.52	0.56	0.55	0.56	0.52	0.69	0.44	0.68	0.38
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.46)	(0.50)	(0.47)	(0.48)
Secondary	0.19	0.2	0.24	0.11	0.21	0.17	0.09	0.26	0.1	0.29
	(0.39)	(0.40)	(0.43)	(0.31)	(0.40)	(0.37)	(0.28)	(0.44)	(0.30)	(0.45)
College or above	0.15	0.25	0.09	0.07	0.16	0.13	0.02	0.24	0.02	0.29

	(0.36)	(0.43)	(0.28)	(0.25)	(0.37)	(0.34)	(0.13)	(0.43)	(0.16)	(0.45)
Marital status										
Cohabit or married	0.84	0.84	0.92	0.75	0.86	0.83	0.87	0.83	0.86	0.83
(Reference: Otherwise)	(0.36)	(0.36)	(0.27)	(0.43)	(0.35)	(0.37)	(0.34)	(0.38)	(0.35)	(0.38)
Total annual income in the	21789.04	29125.92	18433.54	14271.31	26849.41	16305.01	10471.83	29604.69	13281.9	31683.06
past year	(77570.74)	(114911.96)	(29465.54)	(28874.97)	(69339.19)	(85266.22)	(19240.03)	(98831.88)	(26655.90)	(109578.37)
Non-agriculture Hukou	0.46	0.44	0.46	0.5	0.47	0.46	0.06	0.74	0	1
(reference: Agriculture)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.24)	(0.44)	(0.00)	(0.00)
Immigrant (0=No; 1=Yes)	0.29	0.31	0.24	0.3	0.25	0.33	0.14	0.39	0.2	0.38
	(0.45)	(0.46)	(0.43)	(0.46)	(0.43)	(0.47)	(0.35)	(0.49)	(0.40)	(0.49)
Working status (0=Not	0.69	0.87	0.74	0.34	0.76	0.62	0.79	0.62	0.78	0.59
working; 1=Working)	(0.46)	(0.34)	(0.44)	(0.48)	(0.43)	(0.48)	(0.41)	(0.48)	(0.41)	(0.49)
Urban (0=No; 1=Yes)	0.59	0.64	0.56	0.56	0.59	0.59	0	1	0.29	0.94
	(0.49)	(0.48)	(0.50)	(0.50)	(0.49)	(0.49)	(0.00)	(0.00)	(0.45)	(0.23)
Household annual income in	50498.6	63760.01	44361.43	37000.84	52448	48386.01	27552.77	66344.96	34139.76	69524.36
the past year	(179336.97)	(225143.57)	(112826.90)	(162566.57)	(197354.32)	(157480.31)	(34699.66)	(230059.84)	(119196.34)	(228848.87)
Self-reported household socio-economic status (1=Low; 3=High)										
Lower than average	0.39	0.36	0.42	0.42	0.39	0.40	0.42	0.38	0.43	0.35
	(0.49)	(0.48)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.48)	(0.50)	(0.48)
Average or above	0.60	0.64	0.58	0.57	0.60	0.60	0.58	0.62	0.57	0.64
	(0.49)	(0.48)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.50)	(0.48)
Much higher than	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
average	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.05)	(0.06)	(0.05)	(0.07)
Num. of son (0-8)	0.95	0.62	0.91	1.52	0.93	0.98	1.17	0.8	1.1	0.77
	(0.86)	(0.62)	(0.69)	(1.07)	(0.85)	(0.87)	(0.90)	(0.80)	(0.89)	(0.79)
Num. of daughter (0-7)	0.84	0.54	0.81	1.35	0.81	0.86	1.03	0.7	0.96	0.69
	(0.93)	(0.67)	(0.81)	(1.17)	(0.92)	(0.93)	(1.02)	(0.83)	(0.99)	(0.82)
Observations	31,883	13,226	10,384	8,273	16,582	15,301	13,024	18,859	17,143	14,740

Data Source: CGSS pooled cross-sectional dataset, 2010-2013

Notes: Standard Deviation in parentheses.

The following section presents the results of the methodological approach taken to identify independent associations. These associations will focus on social capital and SRH and SRWB. The aim of this analysis will also try to determine whether social capital variables can reduce the diminished health seen in old-age.

4.5 RESULTS

4.5.1 REGRESSION RESULTS: BINARY LOGISTIC MODELS

The regression results of the binary logistic (BL) regression models are shown in Table 4.2. The tables present the analysis for both SRH (Model 1) and SRWB (Model 2), respectively. The third section of Table 4.2 depicts the model goodness-of-fit statistic. This includes the Pseudo-R-squared and the Chi-squared test statistics. The results from this regression analysis provide some support for the statistical results presented in Table 4.1.

TABLE 4.2: SOCIAL CAPITAL AND HEALTH INDICATORS (SELF-RATED HEALTH/SRH AND SELF-RATED WELL-BEING/SRWB), BINARY LOGISTIC (BL) ESTIMATIONS

	(Model 1) SRH	**(Model 2) SRWB**
Social Capital Variable		
Social Trust (0-100)	1.008***	1.031***
	(0.001)	(0.001)
Social Interaction (0-100)	1.012***	1.012***
	(0.001)	(0.001)
Religious activities (0=Otherwise; 1=Yes)	0.846***	0.976
	(0.048)	(0.074)
CCP (0=Otherwise; 1=Yes)	1.041	1.392***
	(0.056)	(0.123)

Union membership (0=No; 1=Yes)	0.890**	1.030
	(0.050)	(0.085)
Control variables		
Age	0.958***	0.999
	(0.002)	(0.002)
Gender (0=Male; 1=Female)	0.708***	1.038
	(0.024)	(0.048)
Race (0=otherwise; 1=Han)	0.954	1.005
	(0.077)	(0.108)
Educational attainment (reference: Illiteracy)		
Primary	1.258***	1.232***
	(0.061)	(0.082)
Secondary	1.448***	1.345***
	(0.096)	(0.122)
College/university or above	1.307***	1.469***
	(0.108)	(0.169)
Marital Status (0=Single;1=Married)	0.918*	1.781***
	(0.043)	(0.096)
Hukou (0=Agriculture; 1=Non-agriculture)	1.014	0.937
	(0.051)	(0.063)
Log total annual income	1.022***	1.005
	(0.005)	(0.006)
Immigrant (0=No; 1=Yes)	0.984	0.998
	(0.038)	(0.053)
Working status (0=Not working; 1=Working)	1.447***	1.106*
	(0.059)	(0.062)
Urban (0=No; 1=Yes)	1.382***	1.242***
	(0.065)	(0.079)
Log household annual income	1.052***	1.095***
	(0.013)	(0.014)
Self-rated Household SES (reference: Lower than average)		
Average or above	2.014***	3.487***
	(0.066)	(0.165)
Much higher than average	2.537***	1.249
	(0.895)	(0.409)
Num. of son	1.050**	1.112***
	(0.023)	(0.033)
Num. of daughter	1.029	1.045*
	(0.019)	(0.027)
Constant	3.063***	0.089***
	(0.693)	(0.025)
MODEL GOODNESS-OF-FIT		
PSU dummies	Yes	Yes
Year dummies	Yes	Yes
OBS	31,883	31,883
Pseudo-R-squared	0.210	0.160

Chi-squared *(d.f.)*	4870.32*** (158)	2654.90*** (158)
JOINT-TESTS		
Education joint-test *(d.f.)*	33.13*** (3)	14.14*** (3)
Household SES joint-test *(d.f.)*	454.38*** (2)	694.29*** (2)

Data Source: CGSS pooled cross-sectional dataset, 2010 ~ 2013.
This table consists of three sections. The first section reports odds ratio for the binary logistic models for the full sample and subsamples; the second section reports model goodness-of-fit statistics; the last section presents results of various joint hypothesis tests for some variables.
*1) Sig: * p<0.1, ** p<0.05, *** p<0.01; robust standard errors in parentheses; reported odds ratio for all variables.*
2) Various joint hypothesis tests whether the coefficients of Education variables are joint equal to 0, the reference group is illiteracy.
3) Various joint hypothesis tests whether the coefficients of Self-reported household socio-economic status variables are joint equal to 0, the reference group is lower than average SES.

This section first examines the association between social capital factors and two health outcomes, respectively. The estimated OR are presented in the Model 1 and Model 2 of Table 4.2. The results indicate that there is a significant association between four social capital variables and SRH in Model 1 (social trust, social interaction, religious activities and union membership), while only three social capital variables are associated with SRWB in the Model 2 (social trust, social interaction and CCP). As social trust scale increases, the odds ratio of reporting “at least fair” subjective health also increases, more specifically, for one single unit increase in social trust, the odds of reporting “at least fair health” are 1.008 times greater than for reporting “poor or worst health” while assumes all other variables are held constant. The same findings were reflected for subjective well-being. The odds of reporting “at least fair” subjective well-being are 1.031 times higher as responses in the full samples on the social trust scale increase (Model 2). While there was no direct association between CCP membership and subjective health (Model 1), however, there is a significant correlation between CCP and respondents’ reported well-being (Model 2).

Overall the results suggest that three social capital variables (social trust, social interaction and CCP) significantly and positively influence subjective well-being as Model 2 in Table 4.2 shows. Subjective general health, in contrast, is not positively related to membership of religious groups or union membership (see Model 1). On the one hand, the religious individuals reported “at least fair” subjective health, with the odds of 0.846 times lower for non-religious groups (Model 1). The same relationship was seen for union membership, with the odds of reporting “at least fair” subjective health in comparison to “poor or worse” health being lower by a factor of 0.890 (Model 1). On the other hand, being a member of Chinese Communist Party, reported significant (all $p<0.01$) better in SRWB than those non-membership counterparts (OB = 1.392). These findings indicate that religion and union membership perhaps not good for the health status of most Chinese individuals. The statistical results in Table 4.1 and 4.2 may reflect that the incidence and scope of religious activities and unions is quite low in China and most participators may not be able to benefit from membership as they might in other countries, and perhaps membership of these marginal groups may even harm their health status. However, the result in Table 4.2 perhaps because the measurement errors exist in the self-rated general health status or endogeneity as stated in Chapter 3 cause this plausible regression results. Generally speaking, this finding is mostly consistent with research done by Yip *et al.* (2007) who employed multilevel strategy on the rural Chinese population. They found that cognitive component social capital at the individual-level, including social trust, reciprocity and mutual help, were significantly and positively associated with self-reported general health, psychological health, and subjective well-being. In contrast, there is a little statistical association of a different pattern between structural social capital at the individual-level and that measured by organisational membership and the self-rated general health outcome variables. However, regarding the elderly population, this finding is partly consistent with the study done by Zhang (2008) with the Chinese Longitudinal Healthy Longevity Survey (CLHLS) dataset. Zhang's (2008) research suggests that religious participation is significantly associated with mortality risk among the oldest of old Chinese, and this kind of activities could offer psychosocial resources to compensate for certain vulnerable groups with the disadvantaged socio-economic conditions (i.e. women and poor health status individuals).

The second task in this section is to examine the association between SRH and SRWB and some demographic and socio-economic factors, and tests the Hypothesis 3 and its sub-hypotheses. These variables include: age, gender, race, educational attainment, marital status, working status, region (urban or rural), annual individual and household income (log), and self-rated household SES. The association, however, is not positive for all of the variables. Most of the demographic and socio-economic factors play key roles in determining better health status among CGSS respondents. For example, there is a negative correlation between health and age, gender, working status and number of daughters. For each yearly increment in age, the BL models predict that the odds that participants would report "at least fair health" were lower by a factor of 0.958 when other variables are held constant. However, age is insignificant associated with SRWB. The results also indicate that the odds of reporting "at least fair health" is 0.708 times lower for women. In contrast, women were 1.038 times more likely to report "at least satisfied" than men. *Han* is the majority ethnic group in China. There is no evidence to indicate that belonging to this major ethnicity brings any benefit to the health or well-being of individuals. We also found that the higher the educational level, the better SRH and SRWB. Married Chinese seem to report worse health (OR= 0.918, $p<0.1$) compared to their other counterparts (including single, divorced, widow and widower). The result is completely opposite regarding SRWB as married Chinese reported higher odds ratio of "at least fair satisfied" than those otherwise (OR=1.781, $p<0.01$). Individual *Hukou* status and immigration status are insignificant factors on both SRH and SRWB. Working residents reported more healthy status than their counterparts (OR=1.447, $p<0.01$) while they also have higher chance to reported enjoying "at least satisfied" than their non-working counterparts (OR=1.106, p<0.1). Residents living in urban China, reported better SRH and SRWB than their rural counterparts (OR^{SRH}=1.382, p<0.01; OR^{SRWB}=1.242, p<0.01). Regarding personal and household wealth characteristics, there was a positive effect of both individual and household income (logarithmic transformed) as well as self-rated household SES on SRH and SRWB. However, annual individual income seems insignificantly associated with SRWB. Of the last two household characteristics, only the number of sons could be positively and significantly associated with respondents' SRH and SRWB; the number of daughters does not matter for respondents' SRH but significantly associated with SRWB. The above estimated results from both SRH (Model 1) and SRWB (Model 2) show that there are a slight difference of the association from different social capital, demographic and socio-economic factors on SRH and SRWB. The foregoing imply that the mechanism between different health indicators and social capital factors are dissimilar. From above empirical results, Hypothesis 3 (H3), Hypothesis 3-2 (H3-2), Hypothesis 3-3 (H3-3) and Hypothesis 3-4 (H3-4) have almost been confirmed as the demographic and socio-economic factors, including age, gender, education, marital status, *Hukou* status, rural-urban status, and individual annual income level etc., and some family and household characteristics (i.e. number of sons or daughters, household annual income, and household self-rated SES etc.), were mostly statistical significant associated with a better ("at least fair") health status (SRH and SRWB).

To summarise, Hypothesis 1 (H1) set out in the Introduction chapter is mostly confirmed by the empirical results of Model 1 and Model 2 (Table 4.2). H1 assumed that social capital indicators at the individual-level, including both cognitive (social trust scale) and structural components (social interaction/participation), were significantly and positively associated with a better health status (SRH and SRWB). Although some structural components of social capital, such as PRA and UNI, were negatively and significantly associated with SRH, but CCP positively and significantly associated with SRWB. The mechanism behind the mixed results is unclear and needs further investigation.

The bottom of Table 4.2 presents joint hypothesis tests, which help to interpret the categorical variables indicating education status and self-rated household SES. The tests results further indicate that higher levels of education and household SES are associated with "at least fair" SRH and SRWB. Overall, from the estimated results of BLs regressions on CGSS samples, this section partly confirms the H1 and H3 as well as some of their sub-hypothesises (H1-1 and H1-2; H3, H3-2, H3-3 and H3-4), that the demographic and socio-economic as well as social capital variables are significantly associated with health status of Chinese respondents, while some of the socio-economic, especially educational level, individual and house total annual income,and household wealth, as well as two components of social capital–social trust and social interactions, are positive and significantly associated with SRH and SRWB, respectively.

4.5.2 Marginal Effect Analysis in the Binary Logistic Model

Table 4.3 presents the AMEs of the estimated BL models for one unit increase in continuous social capital variables (social trust and social interaction), and factor changes (or discrete change from 0 to 1) for binary social capital variables (PRA, CCP and UNI), respectively.

TABLE 4.3: AVERAGE MARGINAL EFFECTS (AMES) OF SOCIAL CAPITAL ON SELF-RATED HEALTH AND SELF-RATED WELL-BEING

Self-Rated Health	**Social Trust**	**Social Interaction**	**Religious (PRA)**			**China Communist Party (CCP)**			**Union Membership (UNI)**		
			Change	***From***	***To***	***Change***	***From***	***To***	***Change***	***From***	***To***
Full sample	0.002***	0.002***	-0.026***	0.556	0.530	0.001	0.554	0.555	-0.016*	0.556	0.540
Age < 45	0.002***	0.001***	-0.035**	0.712	0.677	0.003	0.709	0.712	-0.033**	0.713	0.680
Age 45-59	0.001***	0.002***	-0.049***	0.517	0.468	0.007	0.512	0.519	-0.011	0.514	0.503
Age 60+	0.001***	0.002***	0.020	0.355	0.376	-0.017	0.361	0.344	-0.004	0.358	0.354
Males	0.002***	0.002***	-0.020	0.588	0.568	0.008	0.585	0.593	-0.020*	0.589	0.569
Females	0.001***	0.002***	-0.027**	0.522	0.495	-0.023	0.520	0.498	-0.007	0.519	0.513
Rural	0.001***	0.002***	-0.027*	0.512	0.485	-0.010	0.510	0.500	-0.043*	0.510	0.467
Urban	0.002***	0.002***	-0.027**	0.587	0.561	0.005	0.584	0.588	-0.013	0.587	0.574
A-Hukou	0.001***	0.002***	-0.027**	0.541	0.514	0.018	0.537	0.554	-0.018	0.538	0.520
NA-Hukou	0.002***	0.002***	-0.024	0.573	0.55	-0.001	0.572	0.57	-0.011	0.574	0.563
Self-Rated Well-being	**Social Trust**	**Social Interaction**	**Religious (PRA)**			**China Communist Party (CCP)**			**Union membership (UNI)**		
			Change	***From***	***To***	***Change***	***From***	***To***	***Change***	***From***	***To***
Full sample	0.005***	0.002***	0.012	0.748	0.761	0.044***	0.745	0.789	0.013	0.748	0.761
Age < 45	0.004***	0.002***	0.000	0.763	0.764	0.044***	0.760	0.804	0.015	0.762	0.776
Age 45-59	0.005***	0.002***	0.017	0.717	0.734	0.033**	0.716	0.748	0.024*	0.716	0.739
Age 60+	0.005***	0.002***	0.020	0.764	0.785	0.044***	0.759	0.804	0.023	0.765	0.787
Males	0.005***	0.002***	0.023*	0.743	0.766	0.057***	0.736	0.793	0.001	0.745	0.746
Females	0.005***	0.002***	0.003	0.755	0.757	0.016	0.754	0.770	0.036***	0.752	0.788
Rural	0.004***	0.002***	0.005	0.742	0.747	0.050***	0.740	0.790	0.022	0.742	0.764
Urban	0.005***	0.002***	0.021**	0.753	0.774	0.041***	0.749	0.789	0.012	0.752	0.765
A-Hukou	0.005***	0.002***	0.005	0.736	0.741	0.056***	0.734	0.789	0.019	0.736	0.755
NA-Hukou	0.005***	0.002***	0.024*	0.763	0.787	0.038***	0.758	0.796	0.016**	0.762	0.778

Data Source: CGSS pooled cross-sectional dataset, 2010-2013.

*Notes: 1) Sig: * p<0.1, ** p<0.05, *** p<0.01; A-Hukou is abbreviated of Agriculture Hukou Holders; NA-Hukou is abbreviated of Non-Agriculture Hukou Holders.*

2) This table presents the average marginal increase of 1 unit for the continues dependent variables (scales) health outcome: SRH, and presents a discrete change from 0 to 1 for the binary dependent variables (dummies) health outcome: SRWB.

Regarding the objective measurement of binary social capital variables, the estimated AMEs results are mixed but mostly consistent with the regression results in Table 4.2. Specifically, Table 4.3 indicates that respondents who are members of religious groups and unions appear to report worse general health compare to their non-memberships counterparts, while whether being a CCP members is an insignificant determinant in good SRH. On average, being a PRA member decreases an individual's probability of reporting 'at least fair health' from 0.556 to 0.530, a change of -0.026 (p<0.001), while the effect of being a union member decreases one's probability of reporting 'at least fair health' from 0.556 to 0.540 with a change of -0.016 (p<0.1). However, these three objective social capital measures show a different pattern on SRWB as both PRA and UNI are not the key determinants of 'at least fair satisfied'. On average, we can only observe being a CCP member increases respondents' probability of reporting 'at least fair satisfied' from 0.740 to 0.789 with a change of 0.044 (p<0.001).

Table 4.3 also demonstrates the heterogeneity effects of social capital on different subpopulations, and implies that the heterogeneity effects does exist. However, the heterogeneity effects appears more obviously in the three objective binary social capital variables, PRA, CCP and UNI, while the two scales measures of social capital, social trust and social interaction or participation, were significant but slightly different (0.001 difference between groups) on both health outcomes (SRH and SRWB) in all subpopulation samples, including different age groups (<45, 45-59 and 60 & 60+), gender (males and females), regions (rural and urban) and *Hukou* holders (agriculture and non-agriculture). For example, regarding the three age groups, being religious does not matter for the elderly population (age 60 and above) even it could increase the probability of reporting 'at least fair health' by 0.02 (p>0.1), on the contrary, it seems to make the middle age and elderly populations worse off in SRH. Being a religious could decrease respondents' probability of reporting 'at least fair health' for the age groups less than 45 years old (AMEs=-0.035, p<0.05), and for the age groups between 45 and 59 (AMEs=-0.049, p<0.001). We can find a similar negative AMEs on the rest of subsamples, except insignificant in the subsample of males and non-agriculture *Hukou* holders. These findings together with those in Table 4.2 suggest that the type of social capital is clearly an important factor and heterogeneity effects exist, particularly in relation to individual's general health and well-being. In any case, the estimated results of above BLs regression and marginal effects further confirm H1 and H1-1 to H1-4. Next section will explore the interaction effect between social capital and age as discussed in section 4.5.1.

4.5.3 Interaction Effect of Social Capital and Age

The analysis above suggests that it would be useful to interpret the effects of interactions between age and the social capital variables. However, Karaca-Mandic *et al.* (2012), Knol *et al.* (2007) and Norton *et al.* (2004) pointed out that interaction effects cannot be interpreted in a straightforward way in a non-linear regression. In the general non-linear model, the interaction effect between two variables needs to be interpreted holding the values of the other included variables constant which makes the interpretation of interaction effects problematic.

Follow Karaca-Mandic *et al.* (2012) and Norton *et al.* (2004), this study can provide the computed interaction effect, standard error, and z-statistic of two interacted variables for the average value of all observations, and for each observation. These were computed following the logit estimation in Table 4.4 below with different interaction term, respectively. Table 4.4 presents the estimated mean interaction effects, mean standard error, and mean z-statistic for different interaction terms between age and various social capital variables. Figure 4.1 and Figure 4.2 provides visual representations of both the interaction effects (Panel A) and z-values (Panel B) of SRH and SRWB for each observation, respectively. This highlight the heterogeneity of individual values and the corresponding interaction effects.

TABLE 4.4: ESTIMATED INTERACTION EFFECT OF SOCIAL CAPITAL AND AGE ON SRH AND SRWB: ALLEVIATED EFFECTS OF SOCIAL CAPITAL ON THE EFFECTS OF OLDER-AGE, OBS=31,728

Estimated Effects	**Mean Social Capital Counteraction Effect**		**Mean Standard Error**		**Mean Z-value**	
Interaction Term	**SRH**	**SRWB**	**SRH**	**SRWB**	**SRH**	**SRWB**
Social Trust * Age	0.0000057	0.0000378	0.0000090	0.0000087	0.822	3.945
Social Interaction * Age	0.0000194	-0.0000065	0.0000093	0.0000085	2.381	-0.729
PRA * Age	0.0012245	0.0002627	0.0005889	0.0005537	1.965	0.476
CCP * Age	0.0002217	0.0007203	0.0005167	0.0005649	0.424	1.281
UNI * Age	0.0014104	0.0003396	0.0006054	0.0007302	2.202	0.467

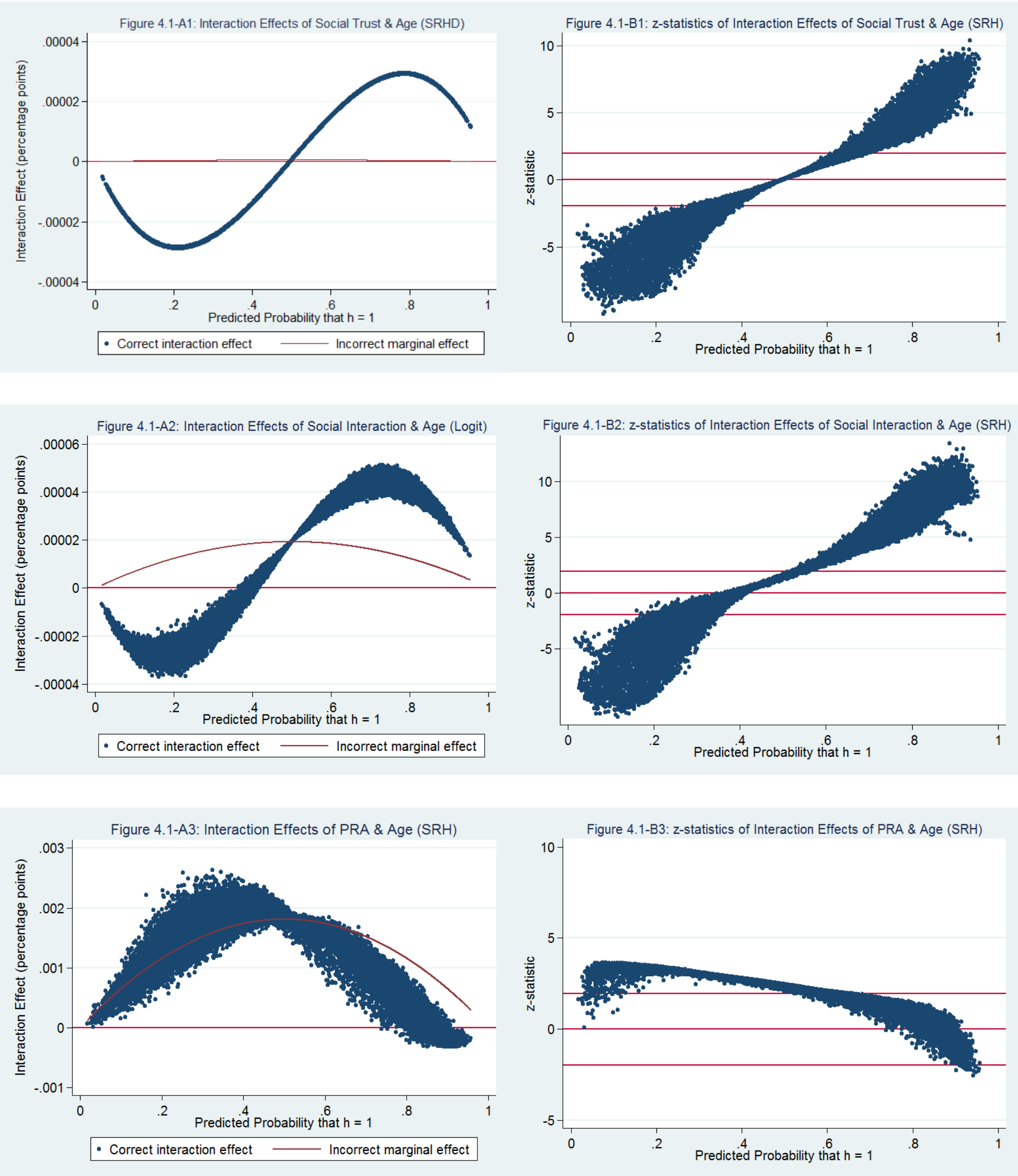
Data Source: CGSS pooled cross-sectional dataset, 2010-2013.
Notes: 1) SRH=Self-Rated Health Dummy, SRWB=Self-rated Well-being Dummy. 2) The fifth and sixth columns show average z-values for the test that the interaction effects are significantly different from 0.

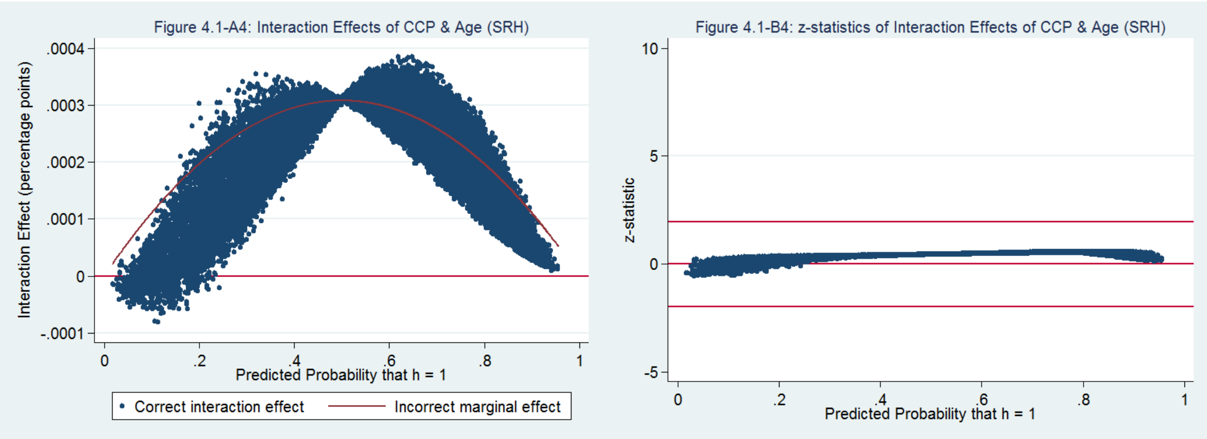
The average age and social capital interaction effects on SRH and SRWB are presented in Column 1 and 2 of Table 4.3. The results show that there is an average positive and alleviating effect of social trust on the negative relationship between age and SRH equal to 0.0000057. This compares with the marginal effect of social trust on SRH of 0.002 (see Table 4.3). However, the average z-value is only 0.8223105 (much less than ±1.96) suggesting that on average, the interaction effect between age and social trust is insignificant as most of the individual z-values are statistically insignificant. Following the discussion by Karaca-Mandic *et al.* (2012) and Norton *et al.* (2004), because of the non-linearity in the logit estimation, for different observed values of the social trust and age within the sample, the value and the sign as well as the significance of the social trust interaction effect varies. This is shown visually in Figure 4.1-A1 & Figure 4.1-B1 in Panel A and B of Figure 4.1. Figure 4.1-A1 in Panel A indicates that there is a negative interaction effect between social trust and age for about half of the individuals who had a predicted probability of reporting "at least fair health" of between 0 and 0.5, however, the effect is positive for those with a predicted probability outside this range (>0.5 & <1). In Panel B Figure 4.1-B1 shows z-values plotted against the predicted probability of reporting “at least fair health” as in Panel A. The thresholds for statistical significance are indicated on the graphs in Panel B by two solid lines with zero in the centre; individuals with *z*-values outside these two solid lines are significant. In Figure 4.1-B1 shows the majority of *z*-values are at least two standard deviations from zero. For those individuals with a predicted probability of “at least fair health” between 0 and 0.3, the interaction effect is significant. Many of the interaction effects are also significant for those with a predicted probability of 0.7 or above. However, there are insignificant effects for the small number of sample members with a predicted probability of reporting “at least fair health” between 0.4 and 0.6 as their z-value within the two solid lines. The effect on SRH of the interaction with age and social interaction (or participation) takes a comparable positive value (0.0000194) relative to the marginal effect of social interaction (0.002). The average *z*-value is larger and significant, but from Figure 4.1-A2 and Figure 4.1-B2, over the sample the value, sign and significance of the interaction exhibits a very similar pattern as shown visually in Figure 4.1-A1 and Figure 4.1-B1. However, regarding the interaction effects of above two interaction terms on SRWB, the results are completely different. The average interaction effect of age and social trust is 0.0000378 and significant (z-value is 3.945165). Figure 4.2-A1 and Table 4.2-B1 show that this interaction effect is positive on SRWB for almost all observations (see Figure 4.2-A1), and for most observations with a predicted probability of reporting “at least fair satisfied” between 0.2 and 0.9, this interaction effect is significant for them as their *z*-value without the two solid lines (Figure 4.2-B1 also shows that there are small amount observations within this range which are insignificant as their *z*-values within the two solid lines). On the contrary, the mean interaction effect between age and social interaction (or participation) is -0.00000649 and insignificant (z-value is -0.7288655). Figure 4.2-A2 and Figure 4.2-B2 can confirm the results as most observations in the sample are with negative interaction effects (see Figure 4.2-A2) and insignificant (see Figure 4.2-B2).

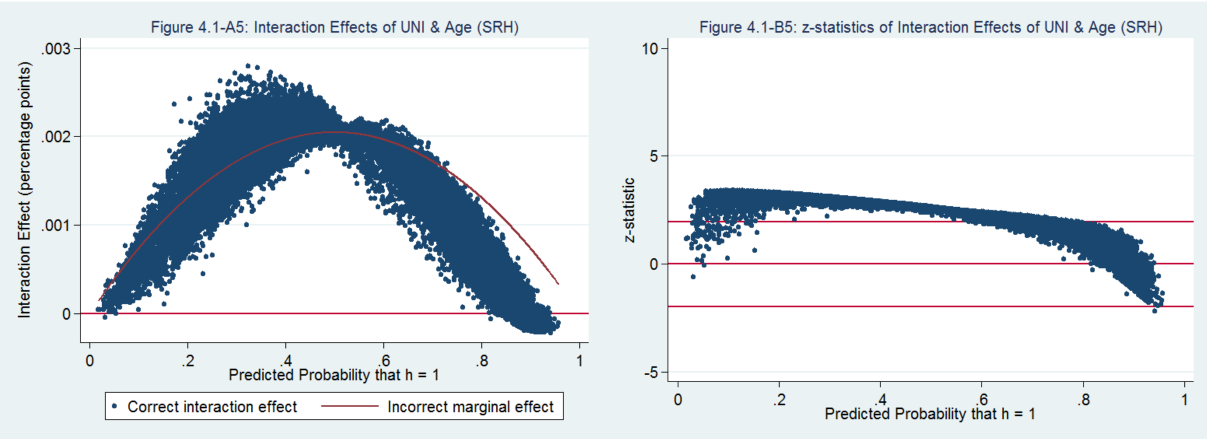
Overall, there are mixed results for the mean interaction effects between age and different social capital variables as shown in Table 4.4. Three are significant (*z*-value>±1.96): age and social interaction, age and PRA, and age and UNI on SRH, while age and social trust on SRWB. However, only looking at the results in the Table 4.4 could be misleading. Figure 4.1 and Figure 4.2 indicates that the interaction effect depends on other covariates. Thus, different observation with different demographic and socio-economic characteristics may have different interaction effect even consider the same interaction term. Fortunately, the plots in Panel B of Figure 4.1 and Figure 4.2 are partly consistent with the result in Table 4.4 as the majority of *z*-values lie outside the thresholds (two solid lines) for significance. However, the estimated interactions effects are various as for some observations, the interaction effects are negative while for some are positive, and with relatively small values (ranging between 0.003 and -0.000015).

From Table 4.2 and Table 4.3, we find that not only age of the individual, but also some social capital variables, are statistically significant at conventional levels. The main effects imply that individual who are younger (or less old) and have more social capital (either social trust or social interaction) are more likely to report 'at least fair health' or 'at least fair satisfied' in the observed period. Nevertheless, there is some evidence to suggest that some types of social capital can have an alleviating effect on the observed negative relationship between age and health, and some can accentuate the observed positive correlation between age and well-being among older Chinese citizens. Despite the relatively small size of the computed interaction effects, there is some evidence to suggest that it access to social capital can alleviate the negative relationship between age and SRH and reinforce the positive correlation between age and SRWB. In this respect, the most useful forms of social capital appear to be those related to social trust, social interaction and PRA and UNI.

FIGURE 4.1: GRAPHS OF THE INTERACTION EFFECTS OF SOCIAL CAPITAL AND AGE ON SELF-RATED HEALTH

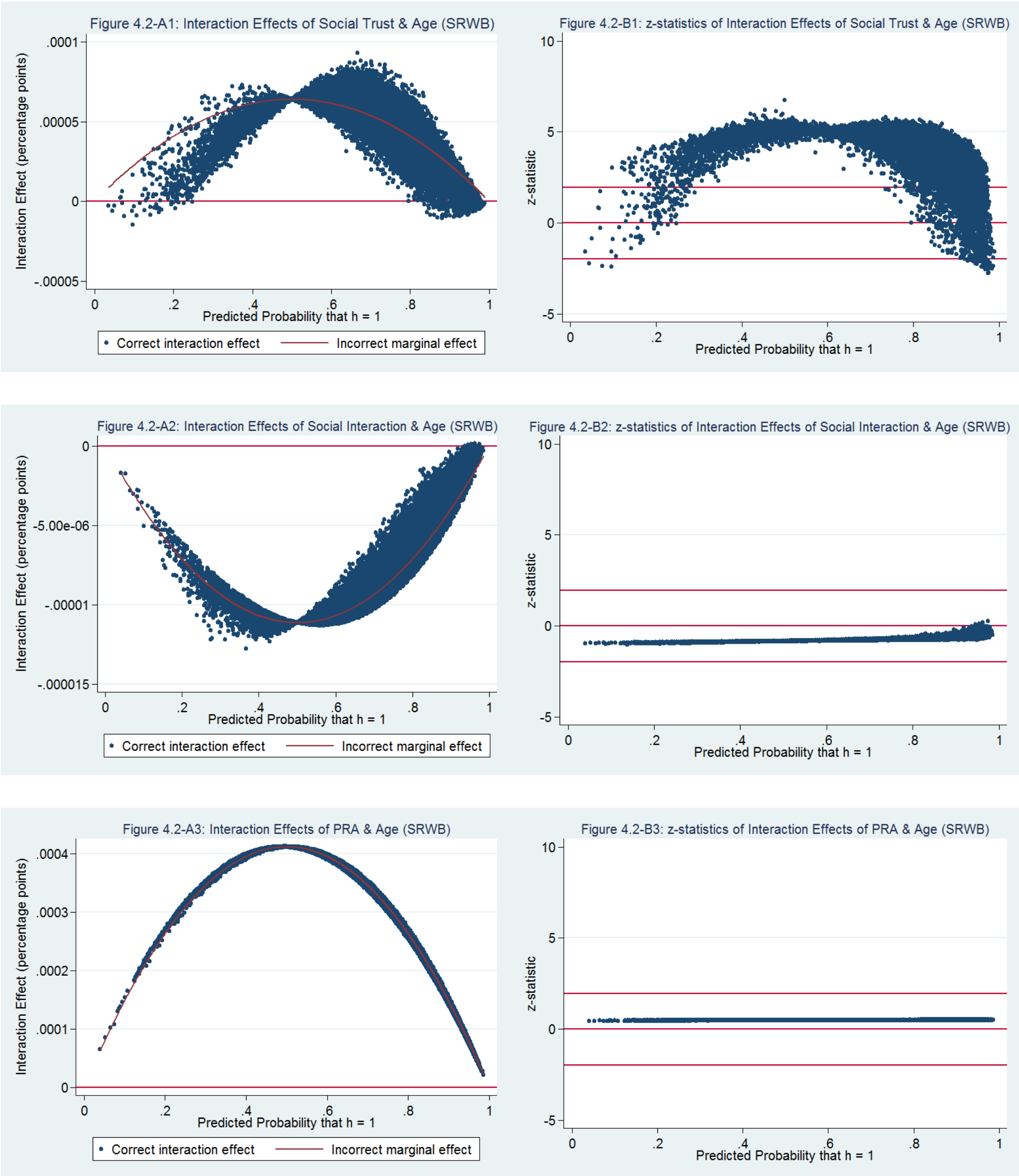


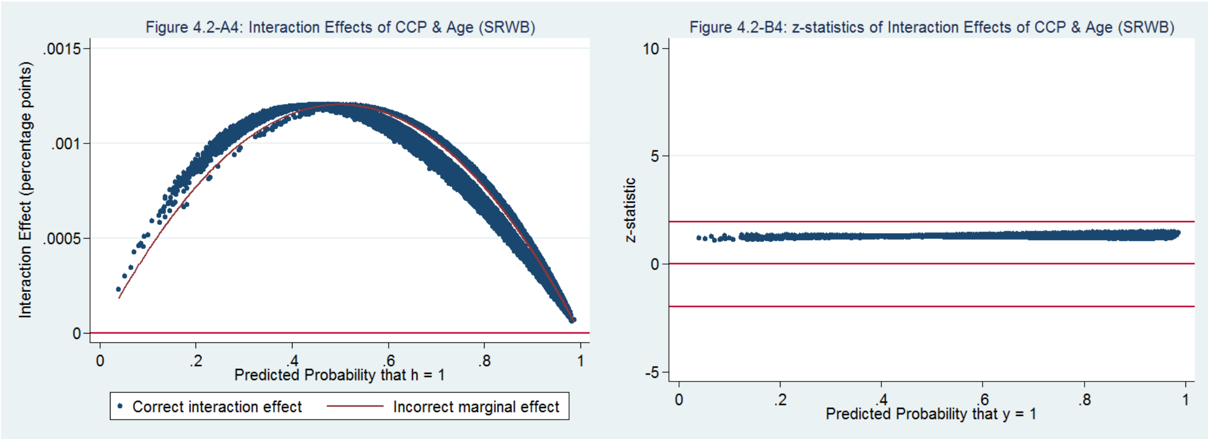


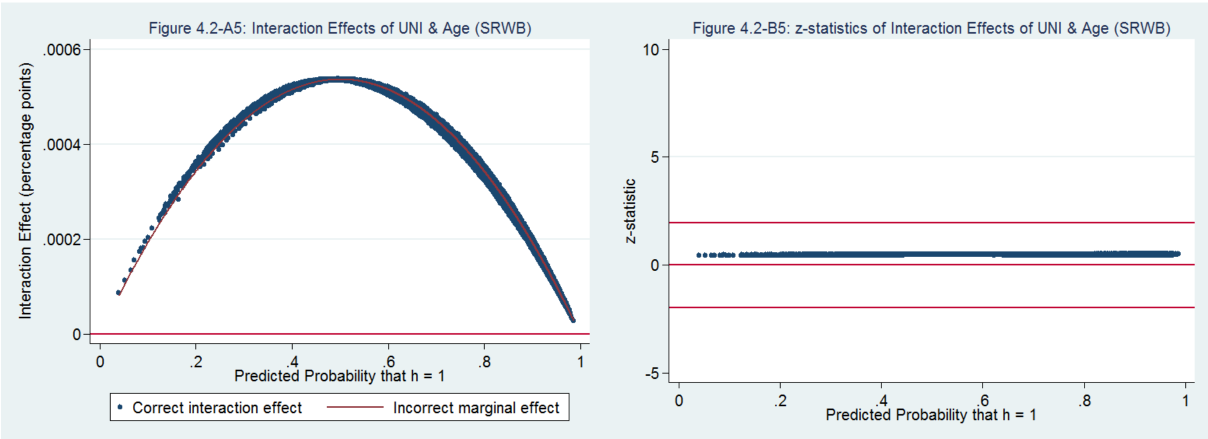


Source: CGSS pooled cross-sectional dataset, 2010-2013, by using a user-written Stata command 'inteff'.

FIGURE 4.2: GRAPHS OF THE INTERACTION EFFECTS OF SOCIAL CAPITAL AND AGE ON SELF-RATED WELL-BEING







Source: CGSS pooled cross-sectional dataset, 2010-2013, by using a user-written Stata command 'inteff'.

4.6 Summary and Conclusion

China has the world's largest population, and faces significant challenges as it continues to expand and its population ages. In this context, there has been considerable emphasis on promoting health and well-being, with the most recent President Jinping Xi emphasising that public health should underpin all government strategies (China Daily, 2016). The evidence of previous research and this chapter is that social capital is one element that should be taken into account in the related policy discussions since it has the potential to support health and well-being. However, the role of social capital in health promotion continues to be debated.

The aim of this chapter was to contribute to these debates by building an empirical model incorporating five social capital indicators (social trust, social interaction, religious group membership, communist party membership and union membership) and measuring their effect on two health/well-being outcomes (SRH and SRWB). In the models, demographic and socio-economic factors, such as age, gender, income and educational level as well as other measures were included as control variables.

The results show that there is a statistical association between select social capital indicators at the individual-level and health and well-being among Chinese citizens. Both cognitive and structural components social capital, social trust and social interaction, appear to have the strongest significant association with SRH and SRWB in this respect.

However, some of the indicators of structural social capital, (religious group/PRA and union membership/UNI) appear to be detrimental to health to some extent. The results suggest that some forms of social capital can be influential in promoting the health and well-being of older adults. Additional insight is that there is a potential alleviation effect on the negative relationship between age and health through access to some kinds of social capital (i.e. social trust, social interaction, PRA and UNI). Similarly, access to some kinds of social capital (social trust) can reinforce the positive effects of age on reported well-being.

The results also suggest that some kinds of social capital can positively moderate the negative relationship between older-age and health: while older-age typically equates to worse health (Smith and Kington, 1997), some social capital indicators could alleviate this effect. Specifically, there is a potential alleviation of the negative relationship between age and health through access to social trust, social interaction, PRA and UNI. Similarly, access to some kinds of social capital (specifically social trust) can reinforce the positive effects of age on reported well-being. As such, these results have important economic and social policy implications for China. However, in contrast to these results, membership of particular groups (religious groups, unions, and the communist party) does not appear to influence health status positively, in fact, the opposite may be true. Some of the indicators of structural social capital (religious group/PRA and union membership/UNI) appear to be detrimental to health to some extent. However, group membership is significantly and positively associated with subjective well-being.

The results also highlight other influential demographic and socio-economic factors. For example, older people have a lower probability of reporting better health status compared to their younger counterparts. Another example is that either better educational background or higher annual personal income, could increase the likelihood of reporting better health status.

Unfortunately, it is not possible to deduce causation from the correlation analysis in this chapter. Thus, the results are limited in this respect. There is a possibility that the reverse chain of events is true (Rocco *et al.*, 2014), in that when an individual has good health, they are active and, therefore, their social capital is greater. Furthermore, while it is advantageous to recognise these possible effects, it is more difficult to determine how to make use of such knowledge in relation to government policy and society more generally. The most significant social capital factors that appear to raise SRH (or SRH) and SRWB (or SRWB) are social trust and social interaction or participation. Therefore, the social trust and social interaction should be promoted. However, the question of how to develop a more trusting society and improve access to facilities that promote social interaction is difficult to answer.

This research also failed to incorporate aggregate measures of social capital within the analysis. Such measures have been incorporated into multilevel analyses in previous research (Kawachi *et al.*, 2008; Yip *et al.*, 2007; Wang *et al.*, 2009; Meng and Chen, 2014; Shen *et al.*, 2014). This was difficult in the present context due to the lack of clarity about the appropriate data in CGSS dataset at the aggregation level within the context of the Chinese population. Some studies investigate the issues within the Chinese context, but their aggregation level were different, for example, measures have been constructed at village-level or community-level (Wang *et al.*, 2009; Yip *et al.*, 2007; Shen *et al.*, 2014), and county-level (Meng and Chen, 2014). There is also the option to construct collective-level measures. Furthermore, in random-effects multilevel models the individual-level variables that are included in the first level of the analysis ultimately interact with group level variables entered into the second level. This makes calculating effect size in a non-linear model with a pooled cross-sectional dataset, such as the logistic regression model and CGSS dataset used here, difficult. The complexity of calculating effect size within a multilevel framework, therefore, limited its applicability to the estimation strategy of this chapter. However, in Chapter 6 a multilevel model is estimated by using another dataset.

China is facing demographic ageing coupled with health inequality that impacts the older population. In this context, evidence from previous research and this chapter suggests that investments in the social capital could be instrumental in promoting individual health, particularly among older adults. While the analysis of this chapter considered the effects of social capital and age within the wider population, the next chapter, Chapter 5 focuses in more detail on older adults in China by utilising the new, nationally representative panel dataset, CHARLS. The longitudinal nature of the data allows the analysis to address causality as well as the issue of endogeneity in the relationship between social capital and health as well as controlling for the effect of other socio-economic factors (e.g. working status and income level) on health (Porcellato *et al.*, 2010; Carmichael *et al.*, 2013) among older adults in China. Using the same dataset, Chapter 6 will address a further limitation of the analysis in this chapter by building a multilevel model to consider the relationship between collective-level social capital and individual health.

4.7 CONTRIBUTION OF THE ANALYSIS TO THE THESIS

While the following chapter will address endogeneity and causal issues, Chapter 4 has particular value in the context of present study. Firstly, Chapter 4 has set the scene for the rest of the thesis by using a nationally representative data for the whole population (both younger and older people). Secondly, it has verified that there is an association between social capital and health status among individuals of all ages in China, and that both health and well-being decline with age. In addition, the CGSS dataset allowed us to show that older people have different levels and different kinds of social capital, and that social capital can potentially play a more important role in the determination of the health status of older people compared with that of the younger population. For example, Table 4.1 shows that older people have more trust social capital than younger people while Table 4.1 and Table 4.2 show that health declines with age, well-being does not.

To sum up, there are three main reasons why the contributions of this chapter to the thesis are of particular value to the research overall even if the cross-section nature of the dataset means that the empirical analysis is unable to address endogeneity issues:

1) The CGSS focusses on social issues in modern China, and began in 2008. There is more information and acurate measures regarding social capital in this dataset that corresponds to the definitions of social capital in previous studies (please see Chapter 3). For example, this dataset provides a measure of social trust in the surrounding social environment and measures of the frequency of the different types of social interactions and membership of some groups (religion, CCP, unions). This kind of information is not available in the longitudinal CHARLS dataset (used in Chapters 5 and 6) which means that Chapter 5-6 can only use proxies of social capital. For example, Chapter 5 uses a measure of whether respondents believe they can get needed non-paid help in the future from their own social network or social relations as a proxy for social trust.

2) Since the CGSS dataset covers the whole adult population it allowed us to compare the older and younger population in this Chapter 4. It is not possible to make the same comparison in the next chapter using the CHARLS dataset as this only recruits from the population of age 45 and above.

3) The wide coverage of the CGSS dataset enabled detailed comparison of the relationship between social capital and health for different demographic and socio-economic groups. In particular, the analysis was able to examine whether social capital

could potentially play a more important role in determining the health status of individuals in disadvantaged groups, particularly older aged people who are likely to less less competitive power than their younger counterparts, and also females who are disadvantaged due to gender discrimination in China, residents living in rural areas who have less access to underdeveloped public and medical facilities, and agricultural *Hukou* holders who have reduced access to the Chinese social security system and public facilities (including schools for their children) than non-agricultural *Hukou* holders.

For all these reasons, this chapter has adds value to the present study. The next chapter will fill some of the knowledge gaps that this chapter cannot fill.

5 CHAPTER FIVE: DOES SOCIAL CAPITAL MATTER TO HEALTH OUTCOMES OF CHINESE MID AND OLDER-LIFE

5.1 INTRODUCTION

The relationship between health status and social capital among members of the older population is a topic of increasing interest in the transition economies (Rose, 2000). Although social capital is a relatively new topic for research in the transition economies compared to the developed economies, it has attracted particular attention in China in the context of the post-opening-up period and China's ageing society (Yip *et al.*, 2007; Wang *et al.*, 2009; Meng and Chen, 2014; Shen *et al.*, 2014; Xue *et al.*, 2016; Liu *et al.*, 2016). Chapter 4 highlighted the potential relationship between social capital and Chinese adults' health status, implying an important new pathway to improving public health, which is particularly important for the older population. On one hand, the empirical evidence from Chapter 4 demonstrates that social capital (measured by social trust and social interaction/participation) is positively associated with self-rated health (SRH) and self-rated well-being (SRWB) to some extent. On the other hand, health status and various structural component social capital factors (measured by religious group and communist party membership) were found to be negatively correlated. These contradictory results could be due to an endogeneity issue due to omitted variables (e.g. collective-level social capital) and/or reverse causality between social capital and health or between other socio-economic factors (i.e. working status and income level) and health (Porcellato *et al.*, 2010; Carmichael *et al.*, 2013), as mentioned in the conclusion of Chapter 4. Recent work in this area conducted by Shen *et al.* (2013), employing data from the initial wave (2008) of the China Health and Retirement Longitudinal Study (CHARLS) which covered only two provinces (and one year) used multilevel strategies to identify a statistically significant correlation between social capital (at both individual and community levels) and older adults' binary self-rated health outcome. This was after controlling for the influence of demographic and some human capital factors such as age, gender, socio-economic status and household income. However, this study did not use a nationwide dataset and did not try to tackle the problem of endogeneity. The existing evidence for the conclusion that social capital has a causal impact on the health of older people in China is somewhat limited (Rocco *et al.*, 2014).

This chapter contributes to this debate from an empirical perspective by examining whether social capital has significantly impacted the health status of older people in China using different health indicators and two complete waves (2011/2012) of the nationally representative CHARLS dataset. The data enables us to examine whether the significantly positive relationships between social capital and health status found in developed economies also exist in China. This chapter not only uses a range of health indicators to represent respondents' health status, but also employs a quasi-experimental approach to deal with the problem of endogeneity. The analysis also considers whether the effects of social capital differ depending on age, gender and residential as well as *Hukou* status. The rest of the chapter is organised as follows: section 5.2 outlines the empirical methodology; section 5.3 presents and describes the data and the variables used in this analysis; section 5.4 discusses the results; and the final section presents a conclusion to the chapter.

5.2 METHODOLOGY AND ESTIMATION STRATEGY

The definition of social capital given in Chapter 3 suggests potential self-selection issues linked to individual characteristics which affect both individual health and the acquisition of social capital. Given this, it is difficult to determine whether social capital has a positive impact on health or whether healthier individuals are simply more likely to accumulate social capital to a higher degree than less healthy individuals. To better understand the relationship between social capital and the health status of older adults, this chapter follows Bertrand *et al.* (2004), Jabbour *et al.* (2015), and Rosenbaum and Rubin (1983), by combining Differences-In-Differences (DID) and Propensity Score Matching (PSM) to construct a counterfactual effect model. For the purpose of the DID approach, this chapter aims to identify whether there is statistically significant difference between the health status of the treated group (with social capital) and the control group (without social capital) by controlling for observable covariates. Here, it is assumed that all respondents without social capital in both waves 1 and 2 are in the control group, all respondents with social capital during wave 2 are in the treated group. Therefore, all respondents in the control group were without social capital in both waves 1 and 2, while respondents in the treated group were without social capital in wave 1 but with social capital in wave 2.

This study focuses on the measure of the transitory effect of the social capital acquisition, those with social capital in both waves or with social capital in wave 1 but without social capital in the following wave were not included in the quasi-experiment. The main reason for this is that the social capital variables used in this chapter are recorded for both treated and control group in both waves, which means that the data do not match the exact features of an experiment and in particular the two excluded subsamples do not meet the requirements of the PSM/DID approach. Also, this chapter tries to investigate whether acquiring social capital could significant improving individual health outcomes instead of trying to capture the longer run effect of having social capital. Drawing on the potential outcome framework, we distinguish the treatment group ($SC = 1$) that experiences the transition treatment (social capital) and the control group ($SC = 0$) that does not. For each group, two potential health outcomes at each time point are defined, but only one outcome is observed; whereas the other outcome remains an unobserved counterfactual. According to the DID approach, the effect of social capital is identified by comparing the change in the health of the treatment group between period *0* and *1* to the counterfactual trend in health they would have experienced in the absence of the treatment. This counterfactual trend is approximated by the actual change in the health of the control group, according to the crucial "common trend assumption". Based on the above assumption, we can calculate the average treatment effect on the treated (ATT) as below (Sianesi, 2001):

$$ATT_{DID} = E(H_1^{\mathrm{T}} - H_0^{\mathrm{T}} | SC = 1) - E\left(H_1^{\mathrm{C}} - H_0^{\mathrm{C}} \middle| SC = 0\right)$$

$$= \beta_0 + \beta_1 SC_i + \beta_2 P_i + \beta_3 SC_i * P_i + \beta_4 X_i + \varepsilon_i \tag{5-1}$$

where *SC* is the treatment dummy variable, (*SC* = 1 represents respondents with social capital, *SC* = 0 represents respondents without social capital), *P* is the period (wave) dummy (*P* = 0 is wave 1 and *P* = 1 is wave 2), X_i represents all observable factors of the *i*-th individual, *T* is the treated group, *C* is the control group, H_0 indicates the pre-experience health status of respondents (in wave 1), and H_1 represents respondents' post-experience health status (wave 2). H^T *and* H^C indicate the treated group and the control group, respectively. The two differences on the right-hand side of the above equation eliminates the time trend variance or time invariance within the treated and control groups. The difference between the two differences, is the net treatment effect of social capital, captured by β_3 in the estimation: that is, the effect of social capital on respondents' health condition.

The advantage of the DID approach is that it can eliminate or control the effects due to unobservable factors, in particular for the effect of time-variant or time-invariant factors. These within-person comparisons allow us to eliminate unobserved individual fixed effects. However, unlike a simple fixed effects estimator, it is possible to remove common period effects that have an identical impact on both the treatment and control groups, as well as the impact of ageing over time, using the between-comparison for the control group. For example, a simple fixed effects estimator would underestimate the health effects of acquired social capital if the time-invariant factors were omitted, and uses a fixed effects with a short panel (only two waves) could be a bad idea.

However, the acquisition of social capital depends upon an individual's characteristics, and it is not randomly distributed. Therefore, whether the acquired social capital is a result of self-selection and individual characteristics could impact both an individual's health status and the acquisition of social capital. To compensate for this possibility the control and treated groups are selected by similar propensity scores in a PSM which addresses potential selection bias. The analysis in this chapter follows Rosenbaum and Rubin (1983) in calculating the propensity score (PS) using the logistic probability function as defined below:

$$Pr(SC_i = 1 \mid X_i) = \beta_0 + \beta_1 X_i + \varepsilon_i \quad (5\text{-}2)$$

where SC_i is the treatment variable (social capital variable) and the one-dimensional PS, $Pr\ (SC_i = 1 \mid X_i)$ measures the probability that the *i-th* acquires social capital, conditional on a multidimensional vector of control variables X_i. The matrix X_i contains a set of observable pre-experience characteristics: micro-level factors (e.g. age, gender, education level and income) and macro-level factors (e.g. number of types of amenities provided by the community/village). The covariates in X_i should be determined exogenously to *SC* not be affected by it (Smith *et al.*, 2005; Dehejia, 2005). The propensity score estimation represents the first step in PSM and utilises a logistic regression to explain the determinants of an individual without social capital (i.e. has not been treated) in wave 1 (2011/2012) but acquired social capital (has been treated) in wave 2 (2013/2014). An additional common support condition guarantees that only observations with 'statistical twins' are considered.

In the second step of PSM, is matching that algorithms pair 'statistical twins' that have similar propensity scores. However, before matching stage, Rosenbaum and Rubin (1983) pointed out that the share of treated groups of the total sample should much smaller than the control groups (up to 30%), so that allowing enough samples of control groups to match the treated individuals. All PSM analyses use the same procedure (Sianesi, 2001) although algorithms differ. There are several matching algorithm methods available, such as one-to-one matching, k-Nearest neighbours matching, radius matching, and Kernel matching. In principle, there should be little difference between the final results derived from these matching methods (Vandenberghe and Robin, 2004). Following Bertrand *et al.* (2004), we use the one-to-one nearest neighbours matching approach to regroup the sample: an older adult in the treated group (with social capital) is matched with the closest individual in the control group (without social capital) based on their PS. According to Carneiro *et al.* (2010), this matching method is more efficient under the common support condition[24]. Therefore, in the estimation of ATT, we use only the sample in the common support, thus ensuring sufficient overlap between treated and control groups. However, this reduces the sample size to some extent, but it also improves the matching quality.

Balancing tests were used post-matching to verify the degree of difference between the covariates and the PSs of the treated and control groups. The unconfoundedness assumption requires that all covariates and their PSs are balanced (Rosenbaum and Rubin, 1983), and that their distributions are not systematically different between the two groups. Two types of balancing test were used: (1) a two-tailed t-test for each covariate for the percentage reduction in the standard deviation before and after matching; and (2) an overall evaluation, including R^2 and the test of the significance of

[24] Either individuals with the same or very close PSs are located in both the treatment and the control groups, or respondents in the control group are sufficiently close to match with treated individuals, or there is sufficient overlap in the distribution of treated and untreated individuals.

the covariate joint distribution before and after matching. The two sets of tests indicated that the two groups are differentiated according to whether or not an individual acquires social capital. Thus, the estimation of the impact of social capital on the health outcome is simplified, and the difference in the health outcome between the two groups can be interpreted as the net effect of social capital on elderly health status.

However, PSM does not allow for the impact of unobservable factors on the decision to gain social capital, which biases the average treatment effect on the treated (Dehejia and Wahba, 2002; Dehejia, 2005). Glazerman (2002) also states that the efficiency of PSM as a nonparametric statistical method will be improved when used in conjunction with other methods such as DID. Therefore, as stated above, we combine the PSM technique with a DID approach to overcome potential biases due to unobservable variables and time-variant or time-invariant factors (Heckman *et al.*, 1997). In the PSM/DID model, the changes in the health outcomes of the treated and matched controls are compared in order to estimate the average treatment effect on the treated (ATT), that is, the health effect of social capital for those who actually experience the treatment or individuals shift from without social capital to with social capital (Smith *et al.*, 2005, *p.* 312–313) as summarised in the following equation:

$$ATT_H{}^{DID/PSM} = \frac{1}{N_{SC_1}} \sum_{i \in SC_1 \cap S} [(H_{i,1}^{\mathrm{T}} - H_{i,0}^{\mathrm{C}}) - \sum_{i \in SC_0 \cap S} w_{ij} (H_{j,1}^{\mathrm{C}} - H_{j,0}^{\mathrm{C}})] \qquad (5\text{-}3)$$

Equation 5-3, above, can be operationalised by applying the following regression analysis to the matched dataset:

$$ATT_H{}^{PSM/DID} = H_i * w_{ij} = \beta_0 + \beta_1 SC_i + \beta_2 P_i + \beta_3 SC_i * P_i + \varepsilon_i \qquad (5\text{-}4)$$

where SC_1 (SC_0) represents the treatment (control) group, the w_{ij} are the nearest neighbour matching weights (of the weights depend on the matching method used), and S is the area of common support. The DID estimator is then given by the estimated coefficient β_3 in a simple OLS regression (as before) in Eq. (5-4).

It is also possible to undertake a relatively straightforward analysis of heterogeneous effects across age groups (below or above 60), gender (male or female), region (urban or rural) and *Hukou* status (agricultural and non-agricultural) using the above Eq. (5-4) for the respective subsamples.

Essentially, PSM makes the standard DID assumption more plausible by forming 'statistical twin' pairs before performing the DID estimator (Smith *et al.*, 2005). Smith (1997) highlights three points regarding the use of PSM/DID. Firstly, compared to the alternative of controlling linearly for the X variables in a DID regression, the semi-parametric PSM/DID has the advantage that it is more flexible in avoiding misspecification of the observed factors and their measurement errors as well as controlling those unobservable factors. Secondly, PSM guarantees a more appropriate weighting of covariates and generates comparable 'statistical twins' samples. Finally, linear regressions extrapolate beyond the region of common support, making the comparisons between treated and control samples with that non-comparable sample thus avoiding sample selection problem.

5.3 DATA AND VARIABLE CONSTRUCTION

5.3.1 DATA

The data employed here are the two waves of the CHARLS (2011/2012 and 2013/2014). CHARLS is a unique national representative data source based on a biennial household survey led by the National School of Development, Peking University, which covers almost all provinces in mainland China except Tibet. The samples of the first wave (2011/2012) were randomly selected from 450 village/community-level units of the 150 county-level units across 28 provinces throughout China and involve around 17,708 people in 10,257 households whom were revisited during the second follow-up wave (2013/2014). CHARLS is specifically designed to study the ageing problem and targets Chinese people aged 45 and above. This dataset provides information on the demographic characteristics, social and economic status, and different aspects of health outcomes for aged people in China.

Descriptive statistics of all dependent and explanatory variables are presented in Table 5.1. After screening, the total valid sample with information on five health indicators, social capital variables and other demographic and socio-economic factors is 23,532 for two waves (10,571 respondents in wave 1: 2011–2012 and 12,961 respondents in wave 2: 2013–2014). There is a similar number of male (52%) and female (48%) respondents within the sample. However, respondents aged 45 and above living in the rural areas account for approximately 62% (14,590) of the entire sample. 8,942 respondents were living in urban areas. There are higher number of people 45 and over living in the rural areas may also face more severe problems due to weaker social security and fewer facilities in rural areas (Lei *et al.*, 2014).

5.3.2 VARIABLE CONSTRUCTION

5.3.2.1 Health Indicator: Dependent Variables

Along with the measures of self-rated health (SRH) and self-rated well-being (SRWB) used in Chapter 4 (0=poor or worse while 1=at least fair), this chapter additionally employs three objective health measurements: mental health (Centre for Epidemiologic Studies-Depression, CES-D score); a cognitive function index (episodic memory score and mental intactness score); and a physical health index (physical difficulty recorded in relation to Activities of Daily Living).

The measure of mental health is utilised since according to Strauss *et al.* (2010), depression can greatly damage a person's ability to live a normal life. Memory loss and impaired cognitive function are other health issues associated with ageing and impacting a large proportion of the elderly population is. Measures of physical functioning, such as Activities of Daily Living (ADLs) and instrumental activities of daily livings (IADLs), have been found to be important health indicators, particularly for the elderly. Therefore, it is informative to identify the relationship between social capital and these three additional health indicators.

Continuous scales are used to measure the three new health indicators, in contrast to the SRH and well-being measures. Specifically, the CES-D employed in this paper is a shorter modified version of the Centre for Epidemiologic Studies-Depression questionnaire, including just 10 questions. Respondents are asked to answer eight “negative” and two “positive” questions regarding their mood over the past week, each of which is an indicator of depressive symptoms. The answer choices for the CES-D are collated as a four-point scale system as suggested by Radloff (1977): 0 = never; 1 = rarely; 2 = some of the time (1-4 days); and 3 = most of the time (5-7 days). Eight “negative questions” (e.g. “Did you feel sad?” and “Did you have sleeping problems?”) are given a scale from 0 (never) to 3 (most of the time). The two “positive questions” (e.g. “Did you feel happy?”) are answered with a reversed scale from 0 (most of the time) to 3 (never). The sum of all points from the 10 questions is the CES-D ranging from 0 to 30, in which a higher score indicates a higher level of depression, indicating a higher level of ill-health (Lee and Chokkanathan, 2008).

Following Huang and Zhou (2013), Lei *et al.* (2012) and Lei *et al.* (2013a), this paper also employs an indicator derived from two scales of cognitive function as another dependent variable. Episodic memory is considered a key component of an individual’s cognitive function (McArdle *et al.*, 2007; Lei *et al.*, 2012; Huang and Zhou, 2013; Lei *et al.*, 2013) and is therefore used here. The measure is a mean score of both an immediate word recall and delayed word recall. CHARLS tests recall ability based on whether an older respondent immediately repeats any of 10 pre-selected and pre-ordered Chinese nouns only after listening to the interviewer. The correct repetition of one word gains 1 point, and so on. Following this, all correctly repeated words are totalled to reach the immediate word recall score. After four minutes, respondents are requested to repeat the same words again, and the correct words are totalled to reach the delayed word recall score. Once this is complete, an overall score is generated from the average immediate and delayed word recall scores.

The second measure captures individual's cognitive status or mental intactness. This is an important aspect of an individual's brain health, not only because it can reflect the brain function of an individual, but is also relevant in human capital, financial or economical resource accumulation over the human lifecycle (Lei *et al.*, 2012). This is especially relevant for older adults in China who live with an imperfect social security system. CHARLS includes a series of questions based on the Telephone Interview of Cognitive Status (TICS) questionnaire to capture interviewees' cognitive status or mental intactness (brain/cognitive function). The TICS has three main sections. In the first section, respondents' calculative/logical thinking ability is tested by subtracting points for every time the interviewee uses an aid (e.g. paper and pencil) or requires further explanation. Section two tests cognitive ability by asking respondents to re-draw a simple picture or figure provided by CHARLS interviewers. Section three asks interviewees to state the current date (i.e. year, month, day and season) and day of the week. The scores are aggregated into a single index of mental intactness. This chapter combines the above two scores into one single index to represent respondents' cognitive function, with a minimum score of 0 and a maximum of 24.

Follow the measurement method from Strauss *et al.* (2010), the last of the three new measures captures individuals' functional measures of disability (ADLs and IADLs) as one single indicator of physical health status. Specifically, this health measures includes two measures of physical disability (for more details, please see Strauss *et al.*, 2010). First, the ADL assessments include around 17 activities. For example, walking for 100 metres, lifting weights stuffs, and picking up a small coin, etc. Second, the IADL assessments mainly including 6 types of difficulties for activities with instrument. For example, carrying out household chores, shopping and taking medication if needed, etc. The above activities are rated based on a four-point scale, where 0 = "Cannot do it" and 3 = "Do not have any difficulty". The scores from each of the activities are then totalled to generate a single score that represents the participant's physical health status. This score ranges from 0-60, where 0 represents the worst health status, and 60 represents the best physical health status.

5.3.2.2 Social Capital Variables

Based on the conceptualisation in Chapter 3, social capital can be classified at two main levels: the individual-level and the community-level (Anderson *et al.*, 2004; Glaeser *et al.*, 2002; Paldam, 2000). In addition, it is also conceptualised into two main components: cognitive and structural (Bolino *et al.*, 2002; Harpham *et al.*, 2002). The cognitive component, on the one hand, it implies perceptions of individual, such as level of trust in others or society, reciprocity with others, and intention of sharing resources. On the other hand, the structural component indicates the extent and intensity of interaction with others, and associational network as well as social activity or participation in a region or society. Kawachi and Berkman (2001) suggested that the access to psychosocial support and the diffusion of health information is the key factors when considering the mechanisms between social capital and health. Folland (2006) and Rocco and Fumagalli (2014) argued that the utility function could be directly used to explain the social capital-health relations. For example, in Folland (2006) argument, individuals with higher level social capital will be high prone to avoid behaviours with high risks for their health conditions (e.g. smoking or drinking).

Data availability of CHARLS result in Chapter 5 and 6 of this thesis use only proxy variables of social capital, since this dataset is focused on older people's health rather than their social capital. Based on the definition of social capital given in Chapter 3, this chapter uses proxies of cognitive and structural social capital at the individual-level. As explained in Chapter 2 and Chapter 4, endogeneity may exist due to omitting important explanatory variables or reverse causality in the health equation (e.g. due to individual preference or personality). In this chapter, this possibility is addressed at the individual-level only.

Six dummy variables are used to capture social capital in this chapter. The cognitive component of social capital is measured by respondents' beliefs about whether or not that they could acquire the necessary help (without any payment) from others in the future (a proxy of social trust), and whether respondents engaged in reciprocity activities (i.e. they both provided and received economic help over the past year). The structural component of social capital was measured by whether respondents engaged in certain social interactions over the previous month. These include: interaction with friends, charity work or helping a non-relative (including helping those who live alone, engaging in community volunteering, and engaging in charity work with an elderly or disabled adult living alone); engaging in social activities (i.e. using the Internet, attending a community club, playing chess/cards/ma-jong); and engagement in group events (i.e. participating in an educational course or skills workshop, attending a dance or exercise class, or visiting a sports club). The above activities are proxies of social capital variables, as we assume that taking part in these activities can significantly affect whether individuals have or could acquire more social capital.

Trust in others, reciprocity, and social participation are likely to be endogenously determined and dependent on individual specificities. The PSM and

DID approach and the nature of the CHARLS dataset (a two-year panel) allow us to handle this endogeneity issue and distinguish the different effects of social capital factors from unobservable factors that are simultaneously correlated with individuals' health status and social capital. However, the social capital variables record both treated and control group in both waves 1 and wave 2, which does not meet the requirement of the PSM/DID approach. Therefore, the sample was restricted to conduct the PSM/DID analysis. Respondents who reported having social capital during wave 2 but not during wave 1 were assigned to the treated group, while respondents who reported having no social capital, that is, scoring 0 in both waves on all the relevant social capital measures: reciprocity (both provided and received economical with others), social trust (perceived future helps from others), friend interactions, involvement in charity work/helping other, participating social activities, and engaging in group events, were assigned to the control group. As outlined in section 5.2, respondents who reported having social capital during both wave 1 and wave 2 were removed from the sample. For comparison, the summary statistics for the social capital variables in the pre-restricted (original) and restricted samples are reported in Table 5.1.The last column shows that the full sample with around 23,105 observation in 2 waves, however, the restricted sample size varies depending on the social capital variable as you can see from Table 5.1.

5.3.2.3 Demographic and Socio-economic Factors

This chapter uses a rich set of control variables X_i that are expected to influence changes in health and possibly also changes in social capital. These variables were measured in wave 1 before the potential acquisition of social capital to avoid endogeneity problems. Following previous studies (Bukov *et al.*, 2002; Rocco *et al.*, 2014), the determinants of social capital are expected to include demographic factors (e.g. age, gender, education, and marital status), socio-economic factors (e.g. work status, household income per capita, and *Hukou* status in China), relationship and connection factors (family/household size), and lifestyle factors (i.e. average daily smoking and alcohol intake over the last year). Some macro-level factors, such as the number of different types of amenities, public facilities and a total number of medical facilities within the community/village may also determine an individual's social capital (Shen *et al.*, 2014; Shen, 2014).

Demographic and socio-economic status were measured through the following variables: age, gender, marital status, employment status, health insurance, *Hukou* status, engagement in exercise, and dummy variables for education level. Lifestyle variables include daily engagement in smoking (0 = no smoking) and drinking over the past 12 months. The analysis also controls for age in a quadratic specification to eliminate ageing effects in the DID design. Household variables include the number of people living in the household, whether living with adult child/children, the household labour participation rate (percentage of working adults within the household), household per capita income, and the value of personal assets such as cars, television sets, and so on, within the household. Household characteristics also include three more variables to control for health facilities: whether there is clean running tap water in the dwelling; the distance to the nearest health facility/hospital; and the transportation cost to this facility/hospital. Finally, the model includes community characteristics: the number of amenities provided by community/village; a dummy variable of village/community with roads passing through; and a region dummy (urban = 1, rural = 0). Also, to be assured that the results are not driven by unobservable or omitted province effect (e.g. total population, GDP per capita and local culture, etc.), fixed-effect province dummies are also controlled for.

5.3.3 DATA DESCRIPTION

Table 5.1 presents a statistical description of all dependent and independent variables included in the analysis. As can be seen, there are not many respondents reported they were with "at least fair health" (26%), but lots of respondents reported "at least fair satisfied" (85%). Cognitive function showed a mean level with a mean score of 11.63 – close to the midpoint on the scale of 12 (with a maximum value of 22). However, the average score for CES-D is much lower than the midpoint (8.14 < 15), while the average physical health score is higher than the midpoint on the scale (49.10 > 30), suggesting perhaps a low-level of both mental and physical problems among older adults in China (although without having access to comparable figures for the wider population this is speculation). Together, the five health indicators from the CHARLS dataset imply that older people in China are healthy.

For the unrestricted sample (full sample), the social capital variables (see Table 5.1) were recorded positively by less than 30% of the of respondents with the exception of interaction with friends (39%) and social trust/perceived held (64%), thus, the sample size of the control group (*SC* = 0) is much larger than the treated group (*SC* = 1). In the restricted sample which enables a focus on the transition effects of social capital[25], social capital variables were also recorded positively by less than 30% of respondents. According to Rosenbaum and Rubin (1983), the sample size of the treated group should be much smaller than the control group to ensure that there are enough counterfactual samples for matching. As shown in Table 5.1, only 26% of the valid (the restricted) sample reported that they do not have social trust capital during the first wave but they acquire social trust capital in the second wave. The remaining social capital variables also suggest quite a low-level of reciprocity, friends interaction, involvement in charity work/helping other, engaging in social activities (entertainments), and attending group

[25] As the previous section described, this chapter focuses on the transition effect of social capital on older people's health outcomes, which means that only those older respondents who are without social capital in the first wave (*SC* = 0 in wave 1), but are with (or acquired) social capital in the second wave (*SC* =1 in wave 2) were considered and set as the treated group, while those older respondents without social capital in both waves (*SC* = 0 in wave 1 & 2) were set as the control groups. This procedure has dropped observations for those with social capital in both waves (*SC* = 1 in wave 1 & 2), and with social capital in wave 1 but without in wave 2 (*SC* = 1 in wave 1 but *SC* = 0 in wave 2). Therefore, the number of observations in the restricted sample is less than the unrestricted sample, full sample, and also differs for different social capital variables (i.e. different treated variables).

events over the last month (26%, 24%, 12%, 10% and 6%, respectively). These figures indicated that the restricted sample of social capital variables are appropriate for using PSM as much less treated groups than control groups compare to the unrestricted (full) sample. Thus, it can capture treatment effects in the PSM/DID approach.

Regarding the demographic and socio-economic variables, as can be seen for the full sample, the oldest respondent was 96 years old, and the mean age of participants was around 60. The number of female and male respondents was similar (52% versus 48%), and 87% of valid respondents reported themselves to be married. Although 33% of the sample had reached at least junior high education, the illiteracy rate is still 27% and 19% of participants could only read and write. The results show that almost all respondents had some health insurance (95%), more than half of the sample were still working (67%), and many reported agricultural *Hukou* status (78%). Regarding the lifestyle variables of older residents, the average daily number of cigarettes consumed was 4.48 (with a maximum number of 100), while 34% claimed they consumed alcoholic beverages (wine, liquor or beer) over the past year, and only 36% older respondents reported exercised in the past week. Data on household characteristics show that while the average household contains 4–5 members, household labour market participation is just 29.42% on average. However, a few households reported a 100% labour participation rate, which may be the reason that the maximum household annual income per capita is 1,000,017 Yuan while the mean value is just 6034.53 Yuan, with a standard deviation of 11482.70 Yuan. This suggests a significant income disparity among Chinese families. The results also indicate a disparity in household wealth based on the total current value of long-lasting consumer goods and assets. There are 38% are urban respondents and the sample is almost a balanced panel dataset.

TABLE 5.1: VARIABLE STATISTICS AND DESCRIPTION

Variables	MEAN	SD	MIN	MAX	OBS
Health Indicators (Full Sample)					
Self-rated Health (0-5)	0.26	0.44	0	1	23096
Self-rated Well-being (0-5)	0.85	0.35	0	1	23096
Cognitive Ability Index (higher means healthier)	11.62	4.25	0	22	23096
CES-D (higher means more depressed/ill-health)	8.15	6.07	0	30	23096
Physical Health Index (higher means healthier)	49.12	8.21	0	60	23096
Unrestricted (Full) Sample: % Recording Positive Responses for the Social Capital Variables in Either or Both of Wave 1 or Wave 2 (0=No; 1=Yes)					
Social Capital Variable (restricted sample)					
Reciprocity (0=No; 1=Yes)	0.23	0.42	0	1	23096
Social Trust (0=No; 1=Yes)	0.64	0.48	0	1	23096
Interacted with Friends	0.38	0.49	0	1	23096
Charity/Helped others (0=No; 1=Yes)	0.12	0.33	0	1	23096
Social Activities (0=No; 1=Yes)	0.22	0.41	0	1	23096
Group Events (0=No; 1=Yes)	0.08	0.27	0	1	23096
Restricted Sample: % Treated: Recording Negative Responses for the Social Capital Variable in Wave 1, But A Positive Response in Wave 2 (0=Control; 1=Treated)					
Social Capital Variable (restricted sample)					
Reciprocity (0=No; 1=Yes)	0.32	0.46	0	1	21958
Social Trust (0=No; 1=Yes)	0.31	0.46	0	1	12489
Interacted with Friends (0=No; 1=Yes)	0.26	0.44	0	1	18906
Charity/Helped others (0=No; 1=Yes)	0.13	0.33	0	1	22450
Social Activities (0=No; 1=Yes)	0.11	0.31	0	1	19954
Group Events (0=No; 1=Yes)	0.06	0.24	0	1	22419
Demographic & Socio-economic Factors (Full Sample)					
Individual age	60.37	9.35	45	96	23096
Gender (0=M;1=F)	0.52	0.50	0	1	23096

Marital Status (0=Other; 1=Married)	0.87	0.34	0	1	23096
Educational Level					
Illiterate	0.27	0.44	0	1	23096
Can Read & Write	0.19	0.39	0	1	23096
Finished Primary	0.22	0.41	0	1	23096
Junior High And Above	0.33	0.47	0	1	23096
Health insurance (0=No;1=Yes)	0.95	0.22	0	1	23096
Work status (1=Working; 0=Not working)	0.67	0.47	0	1	23096
Hukou Status (0=Agricultural; 1=Others)	0.22	0.42	0	1	23096
Lifestyle					
Exercises last week (0=No;1=Yes)	0.36	0.48	0	1	23096
Number of cigarettes consume	4.48	10.11	0	100	23096
Drank last year (0=No;1=Yes)	0.34	0.47	0	1	23096
Household Characteristics					
Household size	4.59	2.12	1	17	23096
Live with child (0=No;1=Yes)	0.29	0.45	0	1	23096
Labour participation rate in household (%)	29.42	30.06	0	100	23096
Annual household income per capita (RMB)	6034.53	11482.70	0	1000017	23096
Total current value of long-lasting assets (RMB)	14254.53	162343.61	0	17121200	23096
Urban dummy (0=Rural; 1=Urban)	0.38	0.49	0	1	23096
Interview wave (0=Wave 1, 1=Wave 2)	0.48	0.50	0	1	23096

Data Source: CHARLS dataset, wave 1–wave 2.

Notes: 1) SD = Standard Deviation; 2) V/C = Village or Community.

As shown in Table 5.1, the restricted (PSM/DID) sample is significantly lower and vary (see the last column) than the full sample. Therefore, the full sample is used for preliminary association analysis rather than the restricted sample to avoid sample selection bias.

5.4 RESULTS

5.4.1 PRELIMINARY ANALYSIS

A simple random-effect (RE) regression analysis was conducted prior to the PSM-DID analysis. This analysis contains has three main purposes. Firstly, the results provide an overview of the association between social capital and the health status of mid and older aged people by using a different dataset–CHARLS to see if the significance level and the direction of association are comparable with those in Chapter 4. Secondly, since the first two health indicators are also binary subjective health and well-being measures as in the previous chapter, the estimated results from this preliminary analysis provide a clear comparison with Chapter 4, not only for the social capital variables, but also for the demographic and socio-economic variables (but for the CHARLS sample of older people only). Lastly, this preliminary analysis enables a comparison with the results before and after controlling for endogeneity to see whether the significance level and direction of the effect of social capital changes.

For the binary dependent variables, self-rated health and well-being (SRH, SRWB), the binary logit random-effect estimation (RE-BL) approach was employed. For the continuous dependent variables (objective health indicators: the cognitive function index, CES-D index and the physical health index), the random-effect ordinary least squares (RE-OLS) method was used. Summary regression results for the main variables in the analysis are reported in Table 5.2. The estimated odds ratios are presented in the RE-BL models (Model 1 and 2), while the estimated coefficients are reported in the RE-OLS models (Model 3 to 5). Also, the full sample was used in all estimations in the preliminary analysis since this section focuses on the association between social capital variables and different health indicators not the estimated treatment effects of different social capital variables.

As shown in Table 5.2, most social capital variables have a statistically significant association with most health indicators. For example, the odds ratios in estimations 1 and 2 show that odd of respondents with two social trust indicators, perceived help from others (both relatives and non-relatives), reporting better health status (OR = 1.598, $p < 0.001$) and better well-being status (OR = 2.361, $p < 0.001$) are higher than for those without social trust capital. The relationship between social trust and SRH and SRWB is echoed in the relationship with the structural component of social capital (e.g. social interaction, charity work/helping others, social activities, and group events), although an insignificant and negative relationship was found between another cognitive component of social capital (reciprocity) and SRH and SRWB. Although these are proxies of social capital and the results from the RE-BL estimation are mostly consistent with those in Chapter 4 providing support for H1 that social capital at the individual-level is significantly associated with individual health status.

In terms of other health-related dependent variables, the RE-OLS estimations in Table 5.2 shows results which largely conform to expectations. All social capital variables were positively and significantly related to the cognitive function index, indicating that respondents with different types of social capital score more highly in cognitive function than their counterparts without social capital. We also find the same pattern between one cognitive form of social capital (reciprocity), one structural form of social capital (interaction with friends) and respondents' physical health status, at a 1% significance level. However, the results for the relationship between social capital and depression are mixed. On the one hand, it was found that individuals who had experienced reciprocity had a significantly worse state of mental health than those who had not experienced reciprocity (Model 4 in Table 5.2). It is possible that economic reciprocity-based activities could result in a mental burden for some respondents, resulting in depression (higher CES-D score). On the other hand, other social capital variables (excluding charity work/helping others) were found to be associated with a significantly lower CED-S score. This implies that individuals with the other three types of social capital had significantly better mental health and lower levels of depression.

As expected, other demographic, socio-economic, household and community factors were found to be significantly related to respective health indicators. Interestingly, only one health indicator (cognitive function) significantly decreases with age and subjective well-being significantly increases with age. Females were found to be less healthy according to some measures (SRH, cognitive function, and CES-D) than males, but have better physical health than their male counterparts when measured on the index recording ADLs and IADLs. Individuals with higher education levels were healthier than their less educated counterparts across all health indicators. The remaining individual factors, such as health insurance, work status, and non-agricultural *Hukou* status, were mostly significantly and positively related to all health outcomes. Furthermore, a significant correlation was observed between weekly exercise and both cognitive function ($p < 0.1$) and physical health ($p < 0.001$). Interestingly, the findings also suggest that participants who had consumed some alcohol over the past year were significantly more likely to reported better health (SRH) and better mood/release from depression (CES-D).

Regarding household characteristics, we can see from Table 5.1 that economic status has a strong association with all health indicators. Additionally, higher annual household income per capita and the total current value of long-lasting assets were also found to be positively related to health status. However, household size does not seem to have an impact on respondents' health outcomes except it can possibly lower depression symptoms among mid and older people, while a higher household labour participation rate could give mid and older people a higher chance of being satisfied with their life and suffering less from depression. Living with adult child/children appears to have a detrimental impact on three health indicators (SRH, cognitive function and depression). This may reflect reverse causality, since it is common for elderly people to live with younger family members if they are sick, and living with a child could ensure the older people have access to care if this is needed.

The majority of the results for the included independent variables including the social capital variables are consistent with expectations regarding the direction of the effect and significance. However, causality is not proven in the RE regression. Furthermore, the RE regression does not address the issues of endogeneity noted in the previous section. To address these issues, the following analysis combines PSM and DID.

TABLE 5.2: SOCIAL CAPITAL AND FIVE HEALTH INDICATORS, BINARY LOGISTIC RANDOM-EFFECT MODELS (MODEL 1 & 2), AND LINEAR RANDOM-EFFECT MODELS (MODEL 3 TO 5)

Dependent Variable	**(Model 1) RE-BL SRH**	**(Model 2) RE-BL SRWB**	**(Model 3) RE-OLS Cognitive**	**(Model 4) RE-OLS CES-D**	**(Model 5) RE-OLS Physical**
Social Capital Variables (0=No; 1=Yes)					
Reciprocity	0.951	1.041	0.315***	0.414***	0.549***
	(0.060)	(0.076)	(0.054)	(0.095)	(0.142)
Social Trust	1.598***	2.361***	0.457***	-1.608***	0.156
	(0.079)	(0.132)	(0.043)	(0.079)	(0.114)
Interacted with Friends	1.119**	1.242***	0.314***	-0.253***	0.544***
	(0.057)	(0.071)	(0.043)	(0.075)	(0.110)
Charity/Helped Others	1.437***	0.941	0.260***	0.033	-0.014
	(0.116)	(0.080)	(0.063)	(0.106)	(0.158)
Social Activities	1.424***	1.396***	0.597***	-0.898***	0.124
	(0.097)	(0.105)	(0.054)	(0.089)	(0.138)
Group Events	1.623***	2.094***	0.531***	-0.910***	0.063
	(0.174)	(0.269)	(0.075)	(0.123)	(0.207)
Demographic & Socio-economic Factors					
Individual Age	0.995	1.051***	-0.062***	-0.009	0.013
	(0.003)	(0.004)	(0.003)	(0.006)	(0.008)
Gender (0=M;1=F)	0.969	0.833**	-0.584***	1.357***	1.394***
	(0.065)	(0.063)	(0.062)	(0.107)	(0.154)
Marital Status (0=Otherwise; 1=Married)	0.947	1.826***	0.550***	-1.203***	0.448**
	(0.076)	(0.163)	(0.077)	(0.143)	(0.190)
Educational Status (Reference: Illiterate)					
Can Read & Write	1.056	1.085	2.369***	0.276*	0.953***
	(0.083)	(0.094)	(0.083)	(0.142)	(0.182)
Finished Primary	1.242***	1.380***	3.580***	-0.481***	1.008***
	(0.100)	(0.124)	(0.081)	(0.137)	(0.186)
Junior High and Above	1.695***	1.671***	4.643***	-1.182***	0.199
	(0.147)	(0.160)	(0.082)	(0.142)	(0.193)
Health Insurance (0=No;1=Yes)	0.935	1.225*	0.288***	-0.181	0.105
	(0.101)	(0.137)	(0.090)	(0.167)	(0.238)
Work status (0=Not working; 1=Working)	2.827***	1.170**	0.340***	-0.640***	1.676***
	(0.175)	(0.082)	(0.056)	(0.099)	(0.152)
Current Hukou (0=Agricultural; 1=Otherwise)	1.750***	1.480***	0.974***	-0.964***	0.553***
	(0.153)	(0.144)	(0.073)	(0.126)	(0.194)
Lifestyle					
Exercises Las Week (0=No;1=Yes)	1.015	1.029	0.085*	-0.069	0.573***
	(0.055)	(0.061)	(0.048)	(0.085)	(0.116)
Number of Cigarettes Consume	0.996*	1.006*	0.002	0.000	-0.004
	(0.003)	(0.003)	(0.002)	(0.004)	(0.006)
Drink Last Year (0=No;1=Yes)	1.918***	1.098	-0.029	-0.083	0.061
	(0.120)	(0.075)	(0.051)	(0.091)	(0.133)
Household Characteristics					
Household Size	1.018	1.005	-0.010	-0.063**	0.020
	(0.015)	(0.017)	(0.014)	(0.025)	(0.033)
Whether Live with Child (0=No;1=Yes)	0.880**	0.962	-0.088*	0.311***	-0.073
	(0.050)	(0.062)	(0.050)	(0.086)	(0.131)

Labour Participation Rate in Household (%)	1.001	1.002^{**}	-0.001	-0.004^{***}	0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Log Household Annual Income Per Capita	1.021^{***}	1.050^{***}	0.052^{***}	-0.063^{***}	-0.039^{**}
	(0.008)	(0.008)	(0.007)	(0.012)	(0.018)
Log Total Current Value of Long-lasting Assets	1.008^{*}	1.020^{***}	0.026^{***}	-0.017^{**}	0.015
	(0.005)	(0.005)	(0.004)	(0.007)	(0.011)
Urban Dummy (0=Rural; 1=Urban)	1.744^{***}	1.200^{**}	0.560^{***}	-0.792^{***}	0.158
	(0.123)	(0.091)	(0.064)	(0.110)	(0.158)
Interview Wave (0=Wave 1, 1=Wave 2)	1.106	1.333^{***}	-0.101^{*}	-0.844^{***}	0.039
	(0.070)	(0.096)	(0.055)	(0.098)	(0.142)
Constant	0.667^{*}	-3.074^{***}	11.446^{***}	11.288^{***}	44.780^{***}
	(0.355)	(0.394)	(0.325)	(0.562)	(0.801)
Province Dummies	Yes	Yes	Yes	Yes	Yes
OBS	23096	23096	23096	23096	23096
Panel-level Variance Component					
Log of Variance $\ln(\sigma_v^2)$	1.190^{***}	1.114^{***}			
	(0.065)	(0.078)			
Standard Deviation (σ_v)	1.813	1.745	2.092	3.702	4.807
ρ (rho)	0.500	0.481	0.428	0.430	0.343
Standard Deviation of ε_{it}			2.420	4.259	6.653
Model Goodness-of-Fit					
R-squared overall model			0.435	0.136	0.026

Data Source: CHARLS dataset, wave 1 & wave 2.

*Notes: 1) Sig: * p<0.1, ** p<0.05, *** p<0.01; Cluster (ID) Standard Errors in parentheses.*

2) Dependent variable: SRH is Self-Rated Health (0, 1); SRWB is Self-Rated Well-being (0, 1); Cognitive is an index combined from episodic memory score and mental intactness score (0-24); CES-D (Centre for Epidemiologic Studies-Depression) is a depression index (0-30); Physical is a physical health index combined scores (0-60) from ADLs (Activities of Daily Livings) and IADLs (Instrumental Activities of Daily Livings).

3) This table consists of two sections. The first section reports odds ratio of BL models (Model 1 & 2) and coefficient of linear estimation models (Model 3-5); the second section reports model panel-level variance component and goodness-of-fit statistics.

5.4.2 SOCIAL CAPITAL ACQUISITION: LOGIT ESTIMATION RESULTS

The results of the logit estimation for social capital acquisition (Equation 5-2) are shown in Table 5.3. This model is estimated for the restricted sample. Each of the six social capital (treatment) variables are dependent variables in Models 1 to 6. The independent variables are the demographic, socio-economic, and household characteristics indicators as well as province and time dummies in Table 5.1, since these variables are likely to be determinants of an individual's social capital acquisition as well as their health status (Shen *et al.*, 2013).

Table 5.3 shows the estimated odds ratios for all included variables. As shown, the odds of acquiring one cognitive social capital (reciprocity) increase by 1.009 ($p < 0.001$) for each year of age but insignificant of acquiring another cognitive social capital (social trust). However, the opposite is true for the structural component social capital as age increase the odds of acquiring this kind of social capital decrease by 0.993, 0.971, 0.969 and 0.989 for interacted with friends, charity, social activities and group events, respectively. The results imply that age is positively and significantly related to reciprocity, but negatively and significantly related to all structural social capital. This may reflect evidence that participation in physical activity decreases with age, thus resulting in a negative association between age and some if not all forms of social capital.

In Table 5.3 the results also suggest a greater likelihood of gaining social capital exists among females than males, and among the more educated than the less educated.

Additionally, marital status is also a key determinant, and the odds of having social trust capital among participants with married older people are 1.295 greater than for the single, widowed/widower or never married adults. However, the odds of acquiring reciprocity and interacted with friends for unmarried older residents was respective 0.866 and 0.753 smaller than for married older residents.

Furthermore, the results indicate that working individuals are less likely to take part in certain social interactions, such as interacted with friends (OR = 0.913), social actives (OR = 0.848) and group/sporting events (OR = 0.707) than non-working older people. This could be because non-working adults have more time for interaction with others than working adults do. However, working older adults were found to have a greater likelihood of experiencing reciprocity (OR = 1.183) and engaging in charity/helping others (OR = 1.229) than non-working older adults. This may be because the health and economic status of working adults are better than that of their non-working counterparts, thus increasing the likelihood that they will acquire these two particular forms of social capital. Unlike the working status, non-agricultural *Hukou* holders (citizenship) are more likely to acquiring structural component social capital, which may be caused by the higher chance to access the public facilities (Shen *et al.*, 2014; Shen, 2014).

Interestingly, good and bad lifestyle have higher odds of acquiring both cognitive and structural social capital. For example, exercised older participants have higher odds of acquiring two cognitive (reciprocity and social trust) and one structural (charity or helped others) social capital, while the negative lifestyle, more number of daily cigarettes consume, increase the odds of acquiring social activities. A possible explanation is that (outdoor) exercising can increase the chance to interact with others, while China's cigarette smoking culture[26] also allows individuals to make friends and increase human interaction through smoking. The odds of acquiring structural social capital (interaction with friends, activity in a charity/helping others, and group events) was found to be 1.115, 1.193 and 1.149 times larger, respectively, for those who drank alcohol over the past year than those who did not. This result may be a reflection of unobservable personality factors or other factors (e.g. peer effects).

The final section of Table 5.3 shows the remaining results for household characteristics. Household size (total number of people living in a house) was found to be a significant factor in determining social capital acquisition: for each additional member of a household, the odds of reciprocity and activity for a charity decrease by a factor of 0.918 and 0.961, respectively. However, for each additional household member, the odds of social trust (perceived help or care from others) increase significantly by a factor of

[26] There is a unique cigarette smoking culture in China. It is normal to offer cigarettes to strangers or friends or colleagues when they are talking. This action is a conversation lubricant between people from the Chinese view point. Offering a cigarette represents good manners. It is impolite if one start smoking without offering one to others when Chinese are with acquaintances. In addition, the brand of cigarette smoking also represents one's social status. For example, "Zhong Hua" and "Panda" are high-end cigarette brands in China, only rich and powerful people can afford smoking them. For more details, please visit: http://www.chinadaily.com.cn/china/2014-01/09/content_17226897.htm.

1.085. The presence of children in the household appears to significantly decrease the odds of acquiring both cognitive and structural social capital. These results are consistent with children being the main source of emotional and economic support for older adults in China, and adults with children perceiving other forms of social capital as less important. For each unit increase in the household labour participation rate, the odds of acquiring both cognitive (reciprocity and social trust) and structural (friends interaction and group events) social capital were increased. Also, greater household wealth (annual household income per capita and the total current value of long-lasting assets) was mostly associated with greater odds of acquiring both cognitive and structural social capital.

In addition, the urban-social capital relationship shows mixed results: the odds of older urban residents experiencing reciprocity are 0.833 times smaller, than that for older rural adults. On the other hand, the odds of older urban adults engaging in social activities and group/sporting events with others are 1.273 and 2.171 times larger than for their rural counterparts, respectively.

TABLE 5.3: LOGIT ESTIMATION OF EQUATION (5-2), DEPENDENT VARIABLES ARE MEASURES OF SOCIAL CAPITAL (RESULTS ARE ODDS RATIOS)

Dependent Variables:	**(Model 1) Reciprocity**	**(Model 2) Social Trust**	**(Model 3) Interacted with Friends**	**(Model 4) Charity/Helped Others**	**(Model 5) Social Activities**	**(Model 6) Group Events**
Demographic & Socio-economic Factors						
Individual age	1.009^{***}	1.003	0.993^{**}	0.971^{***}	0.969^{***}	0.989^{**}
	(0.003)	(0.004)	(0.003)	(0.004)	(0.005)	(0.006)
Gender (0=M;1=F)	1.081	1.187^{***}	1.324^{***}	1.091	0.677^{***}	1.283^{**}
	(0.060)	(0.071)	(0.073)	(0.077)	(0.051)	(0.130)
Marital Status (0=Otherwise; 1=Married)	0.866^{**}	1.295^{***}	0.753^{***}	0.939	1.075	1.161
	(0.058)	(0.115)	(0.050)	(0.085)	(0.117)	(0.146)
Educational Status (reference: Illiterate)						
Can Read & Write	1.164^{**}	1.067	1.117	1.092	1.837^{***}	1.545^{***}
	(0.080)	(0.094)	(0.081)	(0.108)	(0.213)	(0.225)
Finished Primary	1.181^{**}	1.036	1.121	1.277^{***}	1.956^{***}	1.757^{***}
	(0.077)	(0.091)	(0.082)	(0.118)	(0.229)	(0.264)
Junior High and Above	1.258^{***}	1.047	1.402^{***}	1.574^{***}	2.408^{***}	2.156^{***}
	(0.092)	(0.101)	(0.107)	(0.148)	(0.286)	(0.323)
Health Insurance (0=No;1=Yes)	1.125	0.948	1.103	1.180	0.900	1.059
	(0.083)	(0.085)	(0.087)	(0.122)	(0.099)	(0.152)
Work status (0=Not working; 1=Working)	1.183^{***}	0.931	0.913^{*}	1.229^{***}	0.848^{**}	0.707^{***}
	(0.054)	(0.053)	(0.046)	(0.083)	(0.062)	(0.065)
Current Hukou (0=Agricultural; 1=Otherwise)	1.075	0.977	1.146^{*}	1.556^{***}	1.312^{***}	2.117^{***}
	(0.074)	(0.099)	(0.088)	(0.153)	(0.123)	(0.220)
Lifestyle						
Exercises Las Week (0=No;1=Yes)	1.100^{**}	1.162^{***}	1.047	1.138^{**}	0.989	1.088
	(0.045)	(0.067)	(0.048)	(0.063)	(0.062)	(0.088)
Number of Cigarettes Consume	1.002	0.999	1.002	1.000	1.010^{***}	0.997
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)
Drink Last Year (0=No;1=Yes)	1.030	1.078	1.115^{**}	1.193^{***}	1.149^{**}	0.931

	(0.044)	(0.062)	(0.056)	(0.074)	(0.080)	(0.081)
Household Characteristics						
Household Size	0.918***	1.085***	1.003	0.961**	1.004	0.959
	(0.011)	(0.019)	(0.014)	(0.018)	(0.021)	(0.029)
Whether Live with Child (0=No;1=Yes)	0.820***	1.183***	0.986	0.944	0.872**	0.913
	(0.030)	(0.065)	(0.043)	(0.049)	(0.050)	(0.066)
Labour Participation Rate in Household (%)	1.002**	1.004***	1.002*	1.001	1.000	1.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log Household Annual Income Per Capita	0.989**	0.994	1.005	1.021**	1.024**	1.007
	(0.005)	(0.007)	(0.006)	(0.008)	(0.010)	(0.012)
Log Total Current Value of Long-lasting Assets	1.198***	0.996	1.010***	1.011**	1.013***	1.009*
	(0.006)	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)
Urban Dummy (0=Rural; 1=Urban)	0.833***	0.974	0.976	0.958	1.273**	2.171***
	(0.050)	(0.102)	(0.080)	(0.084)	(0.123)	(0.273)
Interview Wave (0=Wave 1, 1=Wave 2)	2.074***	1.090*	1.251***	1.199***	1.498***	1.165**
	(0.073)	(0.050)	(0.048)	(0.059)	(0.083)	(0.087)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Total OBS	21,958	12,489	18,906	22,450	19,954	22,419
OBS Treated	6,935	3,871	4,931	2,878	2,147	1,399
OBS Control	15,023	8,618	13,975	19,572	17,807	21,020
Pseudo R-squared	0.114	0.021	0.022	0.048	0.077	0.117

Data Source: CHARLS dataset, wave 1 & wave 2.

*Sig: * p<0.1, ** p<0.05, *** p<0.01 for two-tailed t-tests; Cluster (community ID) Standard Errors in parentheses.*

Notes: 1) Respondents age less than 45 and those have been taken care by others as serious health condition were excluded from our sample; 2) V/C = Village or Community; 3) There are valid 27 province and 446 communities.

5.4.3 Matching Procedure

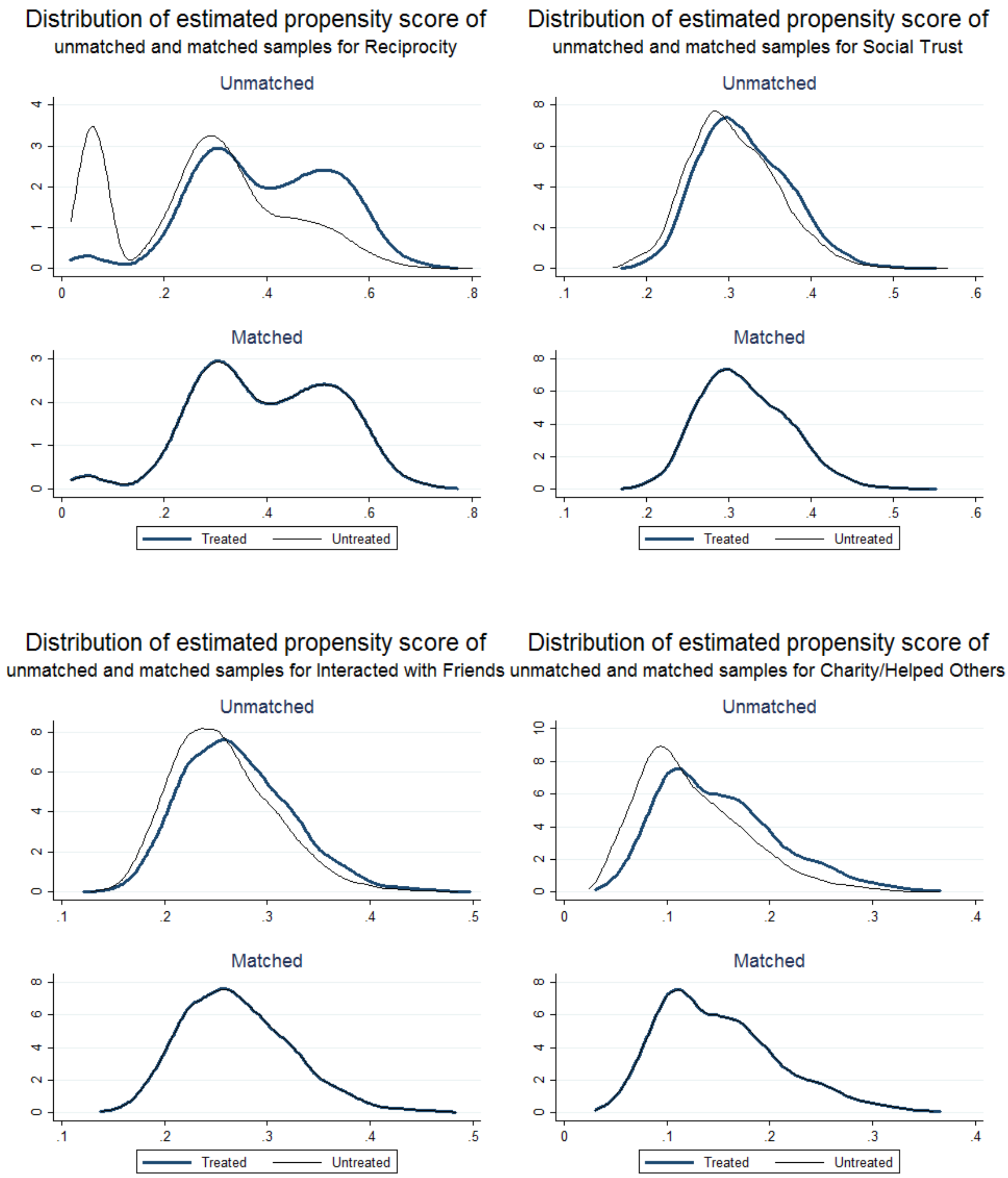
Each older adult who acquired social capital during the second wave of the study was matched with their closest 'statistical twin' who did not acquire social capital based on their PS (using 1-to-1 matching). The results of the balancing test for the matching procedure of all treatment variables are shown in the Appendix Table A5-1 to A5-6. Since the outcome variable includes different health indicators, the treated and control sample sizes are slightly different in relation to the five health outcomes. However, there is no difference between the balancing test results for the five different health outcomes. Therefore, we can use one set of results from the balancing test for one health outcome (cognitive function) to represent all other health outcomes.

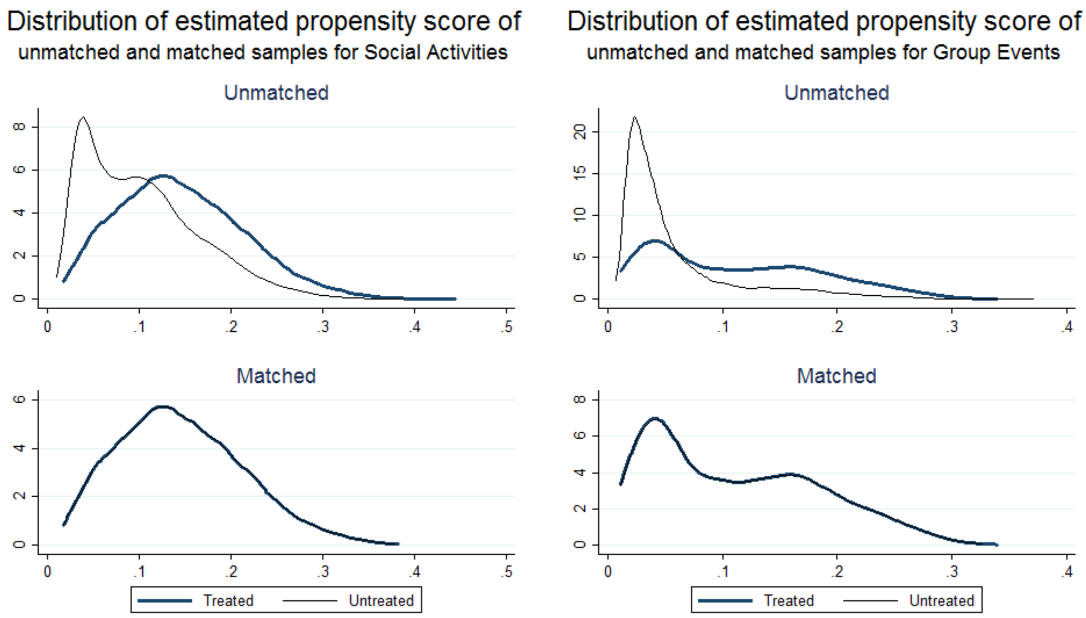
The means of the covariates for the unmatched (U) and matched (M) samples were compared between the treated and control groups using the two sample t-test (i.e. for mean differences between those with and without each type of social capital). For successful matching, the standardised differences between treated and control individuals for each covariate should be smaller in the matched sample than in the unmatched sample (Rosenbaum and Rubin, 1983). Table A5-1 to A5-5 demonstrates that the majority of variable values are insignificantly correlated and relatively equal between the treated and control groups after undergoing 1-to-1 nearest matching. This is generally found to be the case across most of the variables: for example, the age difference between treated and control individuals for reciprocity is smaller in the matched sample than in the unmatched sample, with a result of 0.799 (|T - C| = | 59.814 - 60.613|) compared to 0.262 (|T - C| = | 59.816 - 60.078|). Similar results are found for the other treatment variables (Table A5-2 to A5-6). Two-tailed t-tests confirmed insignificant differences in mean scores between the treated and control groups for most of the selected variables after matching, but significant differences prior to matching. This being said, there were a few exceptions to this rule. For instance, the marital status dummy variable showed a significant difference at the 1% level in Table A5-2 and A5-5. However, this difference is still small and on this basis of little concern according to Rosenbaum and Rubin (1983).

The percentage bias is lower in the matched sample for most of the selected variables (an exception is the 'can read and write' dummy for the treatment of reciprocity. A possible explanation is that this dummy variable was generated from a ranked category variable. However, one biased variable has little impact on the final match result according to Rosenbaum and Rubin, 1983). These results confirm the matching procedure has successfully and substantially reduced any bias arising from individual differences in the observed variables. The results of the joint significant tests in Appendix Table A5-7 indicate a significant difference before matching, but no significant difference in the matched samples for all social capital variables. The results also show that the mean and median bias of the matched sample is smaller than the unmatched sample for all cases.

Based on the results in Appendix Table A-5.1 to A-5.6, there is no significant difference in the PS of the treated and untreated groups in the matched sample: the difference in the PS of treated and control groups in the unmatched sample for reciprocity is 0.1215 (T – C = 0.39896 - 0.27746, $p < 0.01$), and 0.00001 (T – C = 0.39907 - 0.39906) in the matched sample. These results are illustrated in Figure 5.1, which depicts the overlapping PS densities for the treated and untreated (control) sample members in the matched sample compared with the unmatched sample for all treatment variables. These results provide further support that the matching procedure was successful, and the matched sample can, therefore, support a DID estimation of the treatment effect of each form of social capital on respondents' various health indicators. The DID estimation results are presented in the next section.

FIGURE 5.1: ESTIMATED PROPENSITY SCORE DENSITIES OF DIFFERENT SOCIAL CAPITAL VARIABLE FOR UNMATCHED AND MATCHED SAMPLES





Notes: Generated by the author using Stata command "psmatch2".

5.4.4 DIFFERENCE-IN-DIFFERENCES ESTIMATION

Table 5.6 shows the results from the PSM/DID estimation for the treatment effect of each social capital variable (the estimated β_3 in equation 5-4) on different health indicators. Because SRH and SRWB are value-ranked from a minimum of 1 to a maximum of 5, these two dependent variables were not modelled in the analysis. This is because the PSM/DID approach can only be used with continuous dependent variables. Since the other three health measures are on continuous scales, the respective PSM/DID results can provide stronger evidence for the treatment effects of each social capital variable. Since the sample size for each measure of social capital is different, there is a difference in the common support samples. However, for all the social capital variables the untreated/control group is larger than for the treated group (see Table 5.6). One example of this is that there were 15,022 sample members in the control group and 6,933 in the treated group in the fully matched sample in the estimation that includes the social capital measure of reciprocity and the dependent is the cognitive measure of health.

The PSM/DID results in Table 5.6 show that there is a significant relationship between most of the health outcome measures and the social capital treatment variables. For example, acquisition of reciprocal social capital in wave 2 appears to enhance an individual's cognitive function significantly. However, no evidence was found to suggest that reciprocity positively impacts depression symptoms and physical health measured by CES-D scores and ADLs/IADLs. Cognitive function is improved and depression symptoms significantly reduced for those who acquired social trust capital (perceived availability of help/care) by 0.515 and -1.183, respectively. These results can be interpreted as evidence that the net treatment effect on older adults' mental health of cognitive component social capital, captured by proxies for reciprocity and social trust, is generally positive and significant, but there is no significant impact on physical health.

TABLE 5.4: PSM/DID SOCIAL CAPITAL TREATMENT EFFECTS ON DIFFERENT HEALTH INDICATORS

Health Outcomes: / **PSM-DID Treatment Effect**	**Cognitive**	**CES-D**	**Physical**
Reciprocity	0.577^{***}	0.152	0.090
S.D.	(0.121)	(0.178)	(0.235)
Common support OBS	21,955	21,950	21,947
On support untreated	15,022	15,019	15,018
On support treated	6,933	6,931	6,929
Social Trust	0.515^{***}	-1.183^{***}	0.453
S.D.	(0.166)	(0.241)	(0.322)
Common support OBS	12,483	12,481	12,463
On support untreated	8,612	8,612	8,594
On support treated	3,871	3,869	3,869
Interacted with Friends	0.338^{**}	-0.164	0.450^{*}
S.D.	(0.140)	(0.198)	(0.267)
Common support OBS	18,903	18,895	18,893
On support untreated	13,975	13,967	13,967
On support treated	4,928	4,928	4,926
Charity/Helped Others	0.453^{***}	0.042	0.562^{*}
S.D.	(0.158)	(0.234)	(0.314)
Common support OBS	22,427	22,423	22,395
On support untreated	19,549	19,549	19,521
On support treated	2,878	2,874	2,874
Social Activities	0.599^{***}	-0.159	0.258
S.D.	(0.168)	(0.253)	(0.363)
Common support OBS	19,847	19,845	19,843
On support untreated	17,703	17,701	17,701
On support treated	2,144	2,144	2,142
Group Events	0.537^{***}	-0.613^{**}	0.402^{*}
S.D.	(0.208)	(0.295)	(0.418)
Common support OBS	22,283	22,280	22,277

On support untreated	20,884	20,882	20,880
On support treated	1,399	1,398	1,397

*Notes: Means and Standard Errors are estimated by ordinary linear regression within the common support; Robust Standard Errors in parentheses; Significance: *** p<0.01; ** p<0.05; * p<0.1.*

A significant association was also found between the measures of structural social capital and the three health outcomes, particularly for the cognitive function of mid and older people in China. Most of the structural measures of social capital also had the expected effect on the other health outcomes. For example, respondents who reported having interacted with friends during the last month recorded significantly better physical health, while those who participated in a charity or helping others or group events also have better physical health. Moreover, respondents involved in group or sports events had significantly fewer depression symptoms (CES-D) than participants who had not participated in such events over the past month.

We can calculate the simple percentage change between the treated and control group by combining the mean value from Table 5.1 and the PSM/DID treatment effects from Table 5.6. For example, given a mean score of 11.53 on the cognitive function index and 8.23 on the CES-D index (please see Table A5-8 in Appendix for chapter 5), the results indicate that cognitive function is 4.65% (0.537 ÷ 11.53) higher among those who engage in group/sporting social activities than it is among those who do not. Additionally, those who participate in group/sporting activities score 7.44% (-0.613 ÷ 8.23) lower on the CES-D depression index than those who do not.

Table 5.7 shows the results from stratifying the sample to consider whether effects of the social capital measures differ across different age groups (age 45-59 and ≧60), urban and rural regions, between men and women, and for different *Hukou* holders. The results suggest that the effects of the social capital variables vary to some extent across subsamples for some health outcomes. For example, reciprocity[27] appears to increase cognitive function among respondents of age 60 and above, but it does not have a significant impact for middle age respondents (45-59). Also this measure of the cognitive component of social capital appears to negatively impact elderly individuals' (≧60) depression symptoms (i.e. make them more depressed), which possibly reflects the economic substance of this measure in contrast to informal caring support or the provision of other mutual non-material help (Carmichael *et al.*, 2010; Carmichael and Charles, 2003). The impact of the other component of cognitive social capital, social trust, on cognitive health and depression symptoms (CES-D) appears not to differ much across

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[27] Reciprocity is measured by economic reciprocity, indicating that older people gave money or goods to another and also received money or goods from others in the past year, regardless of how many times this happened. As the sub-sample aged 60 and over is mostly retired, their income if not necessarily their wealth is likely to be less than that of the younger sub-sample. In these circumstances this kind of reciprocity may represent a burden for them that impacts on their mental health since in China, it is not polite and you will lose your friends (and the social capital linked to them) if you do not return money or anything else given to you in an informal reciprocal relationship. So it is possible that the relationship between the measure of economic reciprocity and physical and mental health is different particularly those older people who are financially constrained.

different subsamples with the exception of groups differing by *Hukou* status. It seems that social trust plays a significant role in determining cognitive function for most groups of mid and older aged respondents.

In terms of structural social capital, interaction with friends could improve the cognitive function among females and those under the age of 60, but has no apparent effect on males or those aged 60 and above. Although most of the structural social capital indicators are linked to a reduction in depression symptoms (CES-D) and improvement in physical health conditions across different subsamples, the heterogeneity effects are clear. For example, for those aged under 60 years old, females, urban residents and non-agricultural *Hukou* holders, participating in group/sports events, could significantly reduce their respective depression symptoms, but this is not true for the depression symptoms of their respective counterparts.

These results indicate that some forms of social capital can play a significant role in improving health outcomes (particularly cognitive function) of relatively disadvantaged older people; those aged 60 and above, older women, those living in rural areas, and those agricultural Hukou holders. These social capital factors include reciprocity, social trust, charity help/helping others, social activities and group events. Specifically, the impact of engaging in reciprocal activities on the cognitive function score is higher for people 60 and over. However, engaged in economic reciprocity activities is also a mental burden for the older-age groups than the younger age groups.

In addition, Table 5.5 also shows that the cognitive function score is higher in females who interacted with their friends in the past month than in the males, and same impact for the rural residents than in urban ones. Agriculture *Hukou* holders also seem to benefit more on the cognitive function and physical health if they gained social trust capital and engaged in groups events than their non-agriculture *Hukou* holder counterparts.

TABLE 5.5: PSM/DID SOCIAL CAPITAL TREATMENT EFFECTS: ANALYSIS BY AGE GROUP, GENDER AND REGION

Reciprocity	**Age<60**	**Age⩾60**	**Males**	**Females**	**Rural**	**Urban**	**A-Hukou**	**NA-Hukou**
Cognitive	-0.008	0.487^{***}	0.573^{***}	0.547^{e}	0.693^{***}	0.562^{***}	0.745^{***}	0.493^{**}
	(0.158)	(0.178)	(0.156)	(0.176)	(0.153)	(0.184)	(0.136)	(0.214)
CES-D	0.009	0.555^{**}	0.104	0.224	0.139	0.076	0.084	0.062
	(0.248)	(0.259)	(0.233)	(0.261)	(0.233)	(0.266)	(0.207)	(0.325)
Physical	-0.013	-0.010	-0.277	0.447	0.104	0.099	0.046	0.308
	(0.334)	(0.339)	(0.341)	(0.324)	(0.297)	(0.385)	(0.267)	(0.501)
Social Trust	**Age<60**	**Age⩾60**	**Males**	**Females**	**Rural**	**Urban**	**A-Hukou**	**NA-Hukou**
Cognitive	0.423^{*}	0.557^{**}	0.499^{**}	0.536^{**}	0.612^{***}	0.508^{**}	0.683^{***}	0.216
	(0.218)	(0.242)	(0.221)	(0.239)	(0.212)	(0.243)	(0.188)	(0.279)
CES-D	-0.896^{***}	-1.347^{***}	-1.252^{***}	-1.117^{***}	-1.058^{***}	-1.498^{***}	-1.341^{***}	-0.927^{**}
	(0.343)	(0.345)	(0.314)	(0.353)	(0.322)	(0.346)	(0.283)	(0.419)
Physical	-0.231	1.056^{**}	0.100	0.790^{*}	-0.120	1.302^{***}	0.384	0.712
	(0.453)	(0.471)	(0.465)	(0.445)	(0.419)	(0.502)	(0.372)	(0.644)
Interacted with Friends	**Age<60**	**Age⩾60**	**Males**	**Females**	**Rural**	**Urban**	**A-Hukou**	**NA-Hukou**
Cognitive	0.422^{**}	0.253	0.285	0.401^{**}	0.300^{*}	0.292	0.272^{*}	0.463^{*}
	(0.181)	(0.206)	(0.179)	(0.203)	(0.181)	(0.206)	(0.160)	(0.245)
CES-D	-0.371	-0.052	-0.011	-0.301	-0.245	-0.011	-0.302	0.205
	(0.277)	(0.286)	(0.258)	(0.287)	(0.264)	(0.287)	(0.232)	(0.354)
Physical	-0.029	0.589	0.538	0.387	0.527	0.297	0.505^{*}	0.199
	(0.383)	(0.382)	(0.392)	(0.362)	(0.340)	(0.429)	(0.305)	(0.554)
Charity/Helped Others	**Age<60**	**Age⩾60**	**Males**	**Females**	**Rural**	**Urban**	**A-Hukou**	**NA-Hukou**
Cognitive	0.157	0.459^{*}	0.360^{*}	0.512^{**}	0.444^{**}	0.396^{*}	0.390^{**}	0.446^{*}
	(0.196)	(0.255)	(0.201)	(0.237)	(0.208)	(0.225)	(0.187)	(0.249)
CES-D	-0.106	0.176	-0.138	0.248	0.016	0.053	0.083	-0.123
	(0.308)	(0.374)	(0.301)	(0.352)	(0.321)	(0.330)	(0.287)	(0.383)
Physical	-0.093	0.883^{*}	0.818^{*}	0.320	0.599	0.461	0.577	0.396
	(0.434)	(0.470)	(0.439)	(0.443)	(0.406)	(0.493)	(0.369)	(0.602)

Social Activities	Age<60	Age⩾60	Males	Females	Rural	Urban	A-Hukou	NA-Hukou
Cognitive	0.225	0.611**	0.569***	0.549**	0.225	0.896***	0.520***	0.508*
	(0.213)	(0.269)	(0.207)	(0.279)	(0.228)	(0.240)	(0.201)	(0.273)
CES-D	-0.316	-0.141	-0.112	-0.222	-0.064	-0.273	-0.148	-0.206
	(0.325)	(0.412)	(0.316)	(0.415)	(0.350)	(0.362)	(0.310)	(0.421)
Physical	-0.149	-0.152	0.091	0.447	-0.013	0.490	0.023	0.695
	(0.487)	(0.555)	(0.478)	(0.557)	(0.486)	(0.549)	(0.429)	(0.694)
Group Events	**Age<60**	**Age⩾60**	**Males**	**Females**	**Rural**	**Urban**	**A-Hukou**	**NA-Hukou**
Cognitive	0.153	0.692**	0.305	0.677**	0.539	0.281	0.301	0.426
	(0.262)	(0.320)	(0.280)	(0.293)	(0.374)	(0.247)	(0.299)	(0.276)
CES-D	-0.849**	-0.221	-0.363	-0.738*	-0.648	-0.724**	-0.613	-0.784*
	(0.400)	(0.440)	(0.397)	(0.418)	(0.530)	(0.357)	(0.426)	(0.412)
Physical	0.167	0.079	0.723	0.216	0.073	0.383	1.025*	-0.614
	(0.596)	(0.603)	(0.637)	(0.551)	(0.704)	(0.532)	(0.590)	(0.623)

Notes: Means and Standard Errors are estimated by ordinary linear regression within the common support;

Robust Standard Errors in parentheses;

*Significance: *** p<0.01; ** p<0.05; * p<0.1.*

NA-Hukou is an abbreviation of Non-agricultural Hukou holders, while A-Hukou is an abbreviation of agricultural Hukou holders.

5.4.5 Summary

The combined results of the PSM and DID estimations constitute a test of the hypotheses outlined in Introduction. Firstly, Hypothesis 1-3 and Hypothesis 1-4 proposed that both cognitive (H1-3) and structural social capital (H1-4) can significantly improve health status among older people in China. We find evidence of a significant positive impact of both cognitive social capital (measured by proxies for reciprocity and social trust) and structural social capital (measured by indicators of social interaction with friends, charity work/helping others, social interactions, and group/sporting activities) on three objective health outcome measures: cognitive function, depression symptoms, and physical health. Thus, the research findings support the two hypothesises. Secondly, Hypothesis H1-1 proposed that the effects of social capital on health outcomes could differ across different age groups (<60 and ≧60), men and women, urban and rural regions and agricultural and non-agricultural *Hukou* holders. We find that there are some age, gender and regional as well as *Hukou* differences in the effect of social capital on some health outcomes. For example, social trust (measured by perceived help) has a stronger effect on the physical health of older females than males, for whom no effect was found.

In the PSM matching stage, we experimented with several alternative matching algorithms such as *k*-nearest with *N* to 1 (many-to-one) matching, caliper matching, radius matching, Mahalanobis matching, and variants of a Kernel matching estimator as robustness tests for our estimation results. The results were similar to our main findings and consistent with the results shown in Tables 5.6 and 5.7. These results are not reported here. We conclude that our results are fairly robust and insensitive to the different sampling methods associated with alternative matching methods.

5.5 CONCLUSION

This chapter has investigated the relationship between individual-level cognitive and structural social capital and five health indicators (self-rated health, self-rated well-being, cognitive function index, CES-D depression symptom index, and physical health index) among older adults (age 45 and over) in China. The analysis combines the PSM and DID methods and uses a nationally representative dataset, CHARLS, to provide quasi-experimental evidence for the treatment effects of social capital on an individual's health status.

The results of the analysis indicate that some aspects of older individuals' health in China can be improved by the acquisition of various forms of social capital. In the analysis social capital was measured by indicators of reciprocal behaviour (including economic help provided to others and received by others), social trust (measured by perceptions in relation to future help/care) and structural social capital (measured by interaction with friends, engaging with charity/helping others, social entertainment activities, and participation in group/sporting activities). For example, older adults who participate in socially-interactive activities such as group/sporting events have better cognitive and physical health and fewer depressive symptoms than other older adults. Additionally, the DID results indicate that all three objective measures of health improved more among adults who acquired social capital than among those who did not (over the two years of study). This was true for all types of structural social capital and cognitive social capital.

However, there were some differences in the effect of social capital on health across different age groups (<60 and ≧60), men and women, regions (urban and rural) and *Hukou* status (agricultural and non-agricultural). For example, the results in Table 5.7 indicate that an improvement in physical health attributable to structural social capital (interaction with friends over the last month) is only evident for respondents with agricultural *Hukou* but insignificant to their counterparts. Age, gender and residential region also condition the effect of social capital in China. Our results show that engaging with a charity or helping others in other ways can improve the physical health of older adults age 60 and above and males older people; while older residents living in rural regions, their cognitive function could be enhanced by interacting with friends, but it does not affect those living in urban China.

Since the longitudinal data only spanned a single two-year period, and because the CHARLS data lacked direct measures of social capital, the analysis conducted here is limited. For instance, a proxy for social trust was adopted in this study due to the lack of appropriate measures of cognitive social capital. This could be addressed by including specific questions in the survey regarding participants' trust in friends, family and people around them. Additionally, no data are capturing other aspects of structural social capital, such as how many friends an individual might have. The lack of direct measures of cognitive social capital and other aspects of structural social capital meant that we could only investigate the treatment effect on individual health outcomes using a proxy measure of social capital. This limits the scope of the study.

In conclusion, we provide evidence that some aspects of social capital can significantly improve some health outcomes among older adults in China. However, the effect varies depending on the health outcome, the type of social capital and across different age groups, by gender and by area of residence. Part of the explanation for these differences will lie in differences between networks, relationships and social roles by age groups, gender and differences in resource allocation by regions. Since improving the health status of older residents in China is imperative in the context of demographic ageing, the findings of this chapter have significant implications for policy and practice. This being said, the above results focus on individual-level social capital instead of aggregated-level (e.g. community-level) social capital: therefore, the effect of aggregated-level social capital on older adults' health remains to be investigated. Chapter 6, therefore, builds on the analysis in this chapter by incorporating aggregate-level social capital into the analysis of the relationship between social capital and health. The following chapter also attempts to identify whether regional income inequality impacts negatively on the health of older Chinese adults and if so whether social capital can alleviate any of these negative consequences.

6 CHAPTER SIX: INCOME INEQUALITY, SOCIAL CAPITAL AND HEALTH OF OLDER PEOPLE IN CHINA

6.1 INTRODUCTION

Income inequality has become a serious social issue in the People's Republic of China since the beginning of its reform and opening-up ('Opening Door' policy) in 1978 (Li *et al.*, 2015). Using 7 nationally representative survey databases from the most recent, including China Family Panel Studies (CFPS), China Labour Force Dynamic Survey (CLDS), and the Chinese General Social Surveys (CGSS), the estimation of Gini coefficient done by Xie and Zhou (2014) shows that China's Gini coefficient had been rising to a high level between 0.545 and 0.611 from 2010 to 2012, which made China one of the most unequal countries in relation to wealth distribution on the planet. Also, the estimated poverty rate was around 8 to 15 per cent in rural China and 3 to 9 per cent in urban China, also indicating severe income inequality, especially in the rural areas (Xie and Zhou, 2014). The aggravation of income inequality induces many socio-economic problems including a potentially negative influence on people's health status (Kawachi and Kennedy, 1999; Coburn, 2004).

However, there is still a lack of consensus about whether income inequality affects the individual's health conditions, and the potential mechanism and process (Pickett and

Wilkinson, 2015). Some studies hold that worse income inequality negatively impacts the individual's health status (Kahn *et al.*, 2000), but other studies show only a little evidence of this impact on health (Lynch *et al.*, 2004b, 2004a). In the context of a large transition country like China, the relationship between income inequality and health is even more lacking in systematic studies and comparison based on representative data and quantitative analysis (Fang and Rizzo, 2012; Feng *et al.*, 2012b). This chapter, thus, endeavours to shed new light and provide empirical evidence of the association between income inequality and the health conditions of older aged individuals in China.

Income inequality may have a different impact on health conditions of young and mid and older people (Judge *et al.*, 1998; Wilkinson and Pickett, 2006). Given that China is undergoing a major demographic change fostered by the declining level of fertility, the country is now recognised as one of the fastest "growing older" countries. United Nations (2015) estimated that the number of 60+ aged Chinese, which was about 13.9 per cent of the total population in 2012, would rise to over 34 per cent in the next three decades. The aged population is expected to have a significant impact on the future cost of Chinese social care according to important by academia, policy makers and the general public (Riley, 2004). Hence, this chapter focuses on and considers the relationship between income equality and health status among mid and older-life in China.

China is a society deeply influenced by traditional Confucian culture (Bennett and Meredith, 1995; Ebrey, 2014) and ingrained with traditional thoughts such as “respect the old and love the young” and “bring up sons to provide for one’s old-age”. However, the fertility rate in China is decreasing annually owing to the impacts of family planning (i.e. the “One-Child” policy”) since the 1980s, and has resulted in a typical “1-2-4” family structure–a young couple to care and support two pairs of old parents (four mid and older-age adults) and one child (Flaherty *et al.*, 2007; Hesketh *et al.*, 2005). Moreover, because the social security system is underdeveloped, the tradition of “raising sons to provide for older generations” undoubtedly imposes enormous burdens on young couples. The empirical analysis in the previous chapters found that individual-level social capital could significantly improve some aspects of health for the older population. This chapter focusses on whether the social capital at community-level is also significantly associated with older people’s health, and if so, whether the community-level social capital could alleviate negative impacts of income inequality in middle-aged and older people’s health status.

Social capital at community-level has been regarded as a major measure of resources or social cohesion that supports the aged through the neighbourhood or community, and might play a major role in determining the better health condition of older adults (Seeman *et al.*, 2001; Cramm *et al.*, 2013; Kobayashi *et al.*, 2015). Particularly, social capital at neighbourhood- or community-level can reduce the physical difficulty or function limitations of older people (Lindström *et al.*, 2001), and improve their health conditions (Muramatsu *et al.*, 2010). Social capital at community-level also able to improve the cognitive function of the aged population (Dickinson *et al.*, 2011), and is effective in stress reduction or buffer (Yuasa *et al.*, 2014). Additionally, social capital at community-level is beneficial for the emotional conditions of mid and older people for a number of reasons, such as encouraging positive and healthy behaviours, lowering a sense of loneliness and isolation, promoting locus of control and self-efficacy, and assisting in fighting with illness (Allgöwer *et al.*, 2001; Pehlivan *et al.*, 2012; Tomaka *et al.*, 2006).

This chapter employs two waves of the CHARLS dataset–2011/2012 and 2013/2014 to investigate the effects of income inequality, community-level social capital and their interaction on health status among older people in China. This chapter also calculates the marginal effects of income inequality in various magnitudes of social capital at community-level (Friedrich, 1982; Kang, 2012; Potrafke, 2009), and shows the trends of the relations between income inequality and community-level social capital with the ranges of standard errors. This chapter sheds new light on the relationship between the economic disadvantages and health outcomes of mid and older aged citizens in China, and the possible interaction effects of social capital on the negative relationship between income inequality and health status among the older population. As far as we know, a dynamic description of the marginal effects of income inequality on the health outcomes of older people based on various levels of community-level social capital is an original contribution to public health and health economics literature. The remaining part of this chapter is organised as follows: the following section reviews previous literature and sets up hypotheses; the next section introduces the empirical method and data sources for this study, and measures the dependent and explanatory variables; the fourth section presents the descriptive statistics, and discusses the empirical results; the last section concludes.

6.2 METHODOLOGY AND MEASUREMENT

6.2.1 ECONOMETRIC MODEL

This chapter examines how income inequality, community-level social capital and their interaction influence the health outcomes of mid and older people in China by controlling other observable individual-level characteristics. The econometric analysis expects that the older individual's health status is not only dependent on individual characteristics (i.e. social capital at the individual-level), but also reliant on the neighbourhood or community characteristics (i.e. social capital at neighbourhood- or community-level and income inequality indicator: Gini coefficient) in which the respondent is living. Thus, the main concern here is that it needs to analyse the association between variables with a hierarchical structure (i.e. individual nested within community or neighbourhood) in one econometric model. This implies that individuals who are living in the same region or neighbourhood or community share the same level of income inequality and social capital at the neighbourhood- or community-level, and could have correlated individual characteristics which are not observed in the survey, meaning that the different level of factors have different variability effects on the individual's health outcomes. Consequently, the OLS estimation is biased since its assumption of independence for all observations is violated (Antweiler, 2001).

Hence, following previous studies (Islam *et al.*, 2006a; Steenbergen and Jones, 2002), a multilevel modelling strategy that takes into account individual responses in the context of a given community or village is applied in the analysis. This statistical method can examine dataset that has hierarchical (or multilevel) structure with a complex pattern of variability, and it allows an examination of the variation in the health outcomes of individuals at each level of data hierarchy (Islam *et al.*, 2006a; Steenbergen and Jones, 2002; Robinson, 1950). In other words, the multilevel modelling technique can identify and quantify the extent to which differences in the outcome factors (health outcomes) of older people are owing to the higher level (i.e. village or community in this study) in which the respondent lives. According to Islam *et al.*, (2006), the multilevel technique is able to determine whether social capital at higher levels (i.e. village- or community-level) affects respondents' health outcomes over and above the lower level factors (i.e. social capital and other characteristics at individual-level). Furthermore, this multilevel technique enables us to investigate the contribution of higher level factors (i.e. social capital at the community-level and Gini coefficient) and individual-level factors (i.e.

demographic and socio-economic factors) on the health outcomes differences between mid and older individuals. Consequently, this chapter employs a two-level multilevel modelling strategy with 22,420 observations at level 1, which were nested within 445 communities at level 2. This chapter uses six sequential models and multilevel modelling to identify the association between different health outcomes of older people and social capital at the village- or community-level, and examines the magnitude of health outcomes differences attributed to the village or community in which the respondent lives, and investigates whether social capital at the community-level affects individual health outcomes over and above social capital at individual-level and other observed characteristics. Specifically, the first step employs two-level null model (without any explanatory variables) so that health outcomes of the respondent is the function of the village or community where he or she lived. Then, the time dummy variable is included in the second sequential model to identify the time effect and time variation of older Chinese health outcomes. After that, the individual-level factors, including demographic, socio-economic and social capital variables are added in the modelling to examine the effects of individuals' characteristics on the health status of respondents. In the fourth step, community-level social capital is included in the analysis model to investigate the effect of community-level social capital on respondents' health status. Next, another main explanatory variable, income inequality at the county-level measured by the Gini coefficient is added into the fifth sequential model, to figure out whether income inequality has a negative association with individuals' health outcomes. Finally, the interaction term of social capital at the community-level and Gini coefficient is included in the analysis in the last step, to find out whether social capital could alleviate the negative relationship between income inequality and health of respondents. By comparing the values of model-fit statistics provided by the sequential analysis, one can see whether the model including community-level factors is a better fit, and how much the proportion of variance attributed to the individual and community levels are, respectively.

There are five measures of the health status for mid and older people in this chapter as same as in Chapter 5. This chapter also includes higher level factors, such as community-level and county-level factors in the analysis. The summary of variables at different level of analysis explained in the following section as shown in Table 6.1 below:

FIGURE 6.1: VARIABLES AT DIFFERENT LEVEL OF ANALYSIS

Individual-level
Health Indicators
Self-rated Health
Self-rated Well-being
Cognitive Function
Mental Health (CES-D)
Physical Health
Social Capital
Trust in Others
Reciprocity
Interaction with Friends
Engaged in Charity Work

Engaged in Social Activities
Engaged in Group Events
Demographic & Socio-economic Variables
Age
Gender
Marital Status
Educational Achievement
Health Insurance
Work Status
Current Hukou
Born in Current Place
Lifestyle
Exercises
Number of Cigarettes Consumed Per Day
Drink
Household Characteristics
Household size
Live with Child/Children
Household Labour Participation Rate
Annual Household Income Per Capita
Total Current Value of Long-Lasting Assets
Residence has Running Water
Community-level
Social Capital
Proportion of Trust in People in the Village/Community, V/C (%) †
Proportion of Reciprocity Activities in the V/C (%)
Proportion involved in Social Participation in the V/C (%)
Variety in the Number of Amenities
Confounders
V/C have Roads Passing Through
Distance to the Nearest Medical Facility (km)
Transportation Cost to nearest Medical Facility (RMB)
Variety in the Number of Public Facilities in/close to V/C†
Number of Medical Facilities
Country-level
Gini Coefficient

Consequently, a Multilevel Mixed-Effect Logistic Model (ML-LM) is employed for the dummy health outcome variables (0 or 1), while a Multilevel Mixed-Effect Linear Model (ML-LM) is employed for the continuous health outcome variables (i.e. CES-D, cognitive function index, physical health index). To test the buffering effect of community-level social capital on income inequality, this chapter expands the models with an interaction term of income inequality indicator and community-level social capital factors. Following the modelling strategic in Islam *et al.*, (2006) and Kawachi *et al.* (1997), the models of a two-level mixed logistic (random intercept and fixed slopes) model (Eq. 6.1) and mixed linear (random intercept and fixed slopes) model (Eq. 6.2) are follows:

$$HD_{ij} = \text{Logit}\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 G_j + \beta_2 CSC_j + \beta_3 G_j * CSC_j + \beta_4 ISC_{ij} + \beta_5 X_{ij} + \beta_6 T + \mu_j + \varepsilon_{ij} \tag{6.1}$$

$$HC_{ij} = \beta_0 + \beta_1 G_j + \beta_2 CSC_j + \beta_3 G_j * CSC_j + \beta_4 ISC_{ij} + \beta_5 X_{ij} + \beta_6 T + \mu_j + \varepsilon_{ij} \tag{6.2}$$

where HD_{ij} is the binary health indicator which predicts the logistical transformation odds of reporting "At least fair health/Fair Satisfied" (HD_{ij} = 1) versus reporting "Poor Health/Dissatisfied" (HD_{ij} = 0) for respondent *i* living in the community *j*, while HC_{ij} is the continuous health indicators for the same person. The right-hand side of both equations, includes fixed part and random part, for the fixed part, the coefficient β_0 is the average health status (or mean log odds ratio for dummy dependent health outcomes) of older people across all communities; G_j is the Gini coefficient of community *j*; CSC_j is the aggregative social capital at the village- or community-level; G_j*CSC_j is an interaction item to test if there is any interaction effect between income inequality and village- or community-level social capital factors; ISC_{ij} is social capital at individual-level; X_{ij} contains all observed control factors at the individual-level, including respondents' demographic and socio-economic status (SES) and other confounders; *T* is a time dummy to investigate whether there is a time variation in respondents' health status and the time effect. For the random part of the equation, μ_j is the community-specific random error term, while ε_{ij} is the remaining stochastic error term. The assumption of the error terms are 'independently and identically distributed (IID) with zero mean (Islam *et al.*, 2006a).

For analysing data with a hierarchical structure, compared with OLS regression analysis, multilevel regression analysis has the advantage of better (unbiased) coefficient estimation. In addition, according to Islam *et al.* (2006, *p.* 219), the advantage of multilevel regression analysis is that it not only enables "to partition the variance at different levels (i.e. individuals and community)", but also allows "to quantify the relative importance of individual compositional and contextual effects on individual health variations". According to Leckie (2013), we can calculate the variance partition coefficients (VPCs) to quantify the proportion of variance attributed to the community- or individual-level for better understanding individual health status differences. The general formula of VPCs at community-level (Eq. 6.3) is calculated follows (Leckie, 2013):

$$VPCs_{\mu} = \frac{\sigma_{\mu}^2}{\sigma_{\mu}^2+\sigma_{\varepsilon}^2} \tag{6.3}$$

The VPCs statistics measure the proportion of the response variance that lies at community-level or individual-level. For example, the closer the VPCs value is to 1, the greater the proportion of the total variance at the community-level and the higher the relevance of the communities for analysing individual disparities in health outcomes. However, the above equation is effective for continuous health outcomes instead of binary dependent variable. According to Steele (2010), the (standard) logistic distribution has variance $\pi^2/3 \approx 3.29$ at level 1, thus, for calculating the VPCs for the binary health outcome, level 1 variance (σ_{ε}^2) is set (equal) to 3.29.

6.2.2 DATA SOURCE

The data employed here is the two waves of the CHARLS (2011/2012 and 2013/2014). Descriptive statistics of all dependent and explanatory variables are presented in Table 6.1. After screening, the total valid samples with information on health status, income inequality and social capital are 22,420 observations for two waves. Respondents aged 45 and above in the rural areas (13,875) account for approximately 61.9 per cent over the full sample. The number of respondents in the urban areas (8,545) are about three-fifths of the rural sample, which may imply that rural areas have more severe ageing problems as the weak social security and facilities compared to the urban areas are concerned (Zeng and Wang, 2014).

6.2.3 DEPENDENT VARIABLES

The dependent variables that are used in this chapter are the same as in Chapter 5, the list of dependent variable includes the dummy subjective health indicators (0=Poor Health/Dissatisfied; 1= At least fair health/Fair Satisfied): self-rated health dummy (SRH) and self-rated well-being dummy (SRWB); and three objective health measurements: mental health (Centre for Epidemiologic Studies-Depression, CES-D index); a cognitive function index (episodic memory score and mental intactness score); and a physical health index (physical difficulty recorded in relation to Activities and Instrumental Activities of Daily Living, ADLs and IADLs).

The statistics in Table 6.1 indicate that 77% respondents reported “at least fair health” while 85% reported “fair satisfied”. The average cognitive function index is 11.66, CES-D index is around 8.13, and physical health index is approximately 49.1 for the full sample, implying that most of mid and older respondents were fairly healthy. However, on average, comparison of rural respondents and urban respondents, it can be seen that the middle to older aged residents in the rural areas have reported lower general health status (73% versus 82%) and well-being (84% versus 88%), with lower cognitive function score (10.92 versus 12.86) and have higher CES-D score (8.79) than those in the urban areas (7.05), suggesting that there may be more serious health problems, particularly brain and mental health-related (i.e. brain function or depression problem) in the rural areas than in the urban areas. Nevertheless, there are no significant differences in physical health between rural and urban mid and older respondents (49.10 versus 49.08).

TABLE 6.1: VARIABLE STATISTICS DESCRIPTION

Variables	Rang (Full sample)		Total (22,420)		Rural (13,875)		Urban (8,545)	
	MIN	MAX	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Dependent Variable								
Self-rated Health (0=Poor; 1= At least Fair)	0	1	0.77	0.42	0.73	0.44	0.82	0.39
Self-rated Well-being (0=Dissatisfied; 1=At least Fair)	0	1	0.85	0.35	0.84	0.37	0.88	0.32
Cognitive Function Index	0	22	11.66	4.23	10.92	4.23	12.86	3.96
CES-D Index (higher means more depressed)	0	30	8.13	6.04	8.79	6.22	7.04	5.56
Physical Health Index (ADLs & IADLs)	0	60	49.10	8.30	49.10	8.23	49.08	8.41
Collective Variables								
Gini Coefficient (County-level)[1]	0	1	0.58	0.07	0.60	0.06	0.54	0.08
Community-level Social Capital								
Proportion of Trust in People in the V/C (%) †	23	93	62.80	14.29	64.73	13.78	59.68	14.55
Proportion of Reciprocity Activities in the V/C (%)	0	40	18.54	5.83	19.44	5.84	17.08	5.51
Proportion of Social Participation in the V/C (%)	7	84	48.04	13.83	46.15	13.81	51.10	13.30
Variety in the Number of Amenities	0	14	3.49	3.62	1.91	2.39	6.06	3.79
Individual-level Social Capital (Dummy Variables)								
Trust in Others	0	1	0.64	0.48	0.66	0.47	0.62	0.49
Reciprocity	0	1	0.25	0.43	0.26	0.44	0.23	0.42
Interaction with Friends	0	1	0.39	0.49	0.40	0.49	0.39	0.49
Engaged in Charity Work	0	1	0.14	0.34	0.12	0.33	0.15	0.36
Engaged in Social Activities	0	1	0.23	0.42	0.19	0.39	0.30	0.46
Engaged in Group Events	0	1	0.08	0.28	0.03	0.16	0.17	0.38
Control Variables								
Interview wave (0=11/12, 1=13/14)	0	1	0.55	0.50	0.53	0.50	0.58	0.49
Demographic & Socio-economic Variables								
Age	45	99	60.12	9.45	60.17	9.33	60.03	9.63
Gender (0=M;1=F)	0	1	0.52	0.50	0.51	0.50	0.53	0.50
Marital Status (0= Otherwise; 1= Married)	0	1	0.87	0.33	0.87	0.34	0.87	0.33
Educational Achievement								

Illiterate	0	1	0.26	0.44	0.32	0.47	0.17	0.37
Can Read & Write	0	1	0.19	0.39	0.20	0.40	0.16	0.36
Finished Primary	0	1	0.22	0.42	0.23	0.42	0.21	0.41
Junior High and Above	0	1	0.33	0.47	0.24	0.43	0.46	0.50
Health Insurance (0=No;1=Yes)	0	1	0.95	0.21	0.96	0.20	0.94	0.24
Work Status (1=Working; 0=Not working)	0	1	0.68	0.47	0.78	0.42	0.53	0.50
Current Hukou (0=Agricultural; 1=Others)	0	1	0.22	0.42	0.05	0.21	0.50	0.50
Born in Current Place (0=No;1=Yes)	0	1	0.50	0.50	0.57	0.49	0.39	0.49
Lifestyle								
Exercises	0	1	0.36	0.48	0.36	0.48	0.36	0.48
Number of Cigarettes Consumed Per Day	0	100	4.58	10.15	4.63	10.24	4.50	10.00
Drink	0	1	0.34	0.47	0.34	0.48	0.34	0.47
Household Characteristics								
Household size	1	17	4.48	2.11	4.59	2.19	4.30	1.96
Live with Child/Children	0	1	0.32	0.47	0.31	0.46	0.34	0.48
Household Labour Participation Rate (%)	0	100	29.72	30.27	31.47	31.46	26.87	27.99
Annual Household Income Per Capita (*RMB*)	1	1000017	6565.23	12172.24	4357.15	7722.51	10150.61	16466.89
Total Current Value of Long-Lasting Assets (*RMB*)	0	17121200	14852.77	169386.72	11632.93	134774.36	20080.99	213883.8
Residence have Running Water (0=No;1=Yes)	0	1	0.38	0.49	0.00	0.00	1.00	0.00
Alternative Income Inequality Indexes								
Gini Coefficient 2 (Community-level)	0	1	0.55	0.10	0.59	0.07	0.49	0.11
Gini Coefficient 3 (Province-level)	0	1	0.59	0.05	0.60	0.05	0.58	0.06
PG (County-level)[2]	0	1	0.47	0.18	0.56	0.11	0.33	0.18
RMD (County-level)[3]	0	1	0.43	0.06	0.45	0.05	0.40	0.07
GE(2) (County-level)[4]	0	10	1.06	1.09	1.12	1.09	0.95	1.07
TI (County-level)[5]	0	2	0.63	0.21	0.67	0.19	0.55	0.21
Confounders for Sensitivity Analysis								
V/C have Roads Passing Through	0	1	0.94	0.25	0.91	0.28	0.97	0.16
Distance to the Nearest Medical Facility (*km*)	0	35	1.20	3.84	1.69	4.71	0.39	1.18
Transportation Cost to Medical Facility (*RMB*)	0	500	7.45	29.03	10.08	36.22	3.08	5.62
Variety Number of Public Facility in/close to V/C[†]	0	13	4.41	2.91	3.19	2.10	6.39	2.95

Number of Medical Facility	0	56	2.16	2.69	1.67	1.74	2.96	3.60
Eastern China	0	1	0.29	0.45	0.29	0.45	0.30	0.46
Central China	0	1	0.36	0.48	0.37	0.48	0.34	0.47
Western China	0	1	0.28	0.45	0.29	0.45	0.26	0.44
Northeast China	0	1	0.07	0.26	0.06	0.23	0.10	0.30

Data Source: CHARLS dataset, wave 1–wave 2.

Notes: 1) All income inequality indexes were calculated by using a Stata command "egen_inequal" which was introduced by Lokshin and Sajaia (2006).

*2) **PG** is defined as the average poverty gap in the population of a region or country as a proportion of the poverty line. It measures the intensity of poverty. According to Zhang et al. (2014) and Zhao et al. (2013), the poverty line in rural China is 2,300RMB, while in urban areas is about 3,200RMB for both waves (between 2011 and 2014).*

*3) **RMD** also referred to as relative mean absolute difference; it is a dimensionless quantity and it quantifies the mean absolute difference in comparison to the size of the mean. It was calculated by the sum of the absolute values of the differences between mean income and individual incomes divided by the total income in a county in this study.*

*4) **TI** is a special case of the generalised entropy index; it measures the maximum possible entropy of the data minus the observed entropy, for more details, please see Cowell (2003) and Lokshin and Sajaia (2006).*

† V/C is the abbreviation of Village and/or community.

6.2.4 COMMUNITY-LEVEL EXPLANATORY VARIABLES

This section first describes the explanatory variables at higher level (i.e. county- and community-level). The Gini coefficient of total household annual income per capita is computed to measure income inequality. Because the sample size within a community is sometimes too small to compute the Gini coefficient (there are only 2 respondents in some communities) and it is reasonable to assume that respondents living in a different community, but belonging to the same county experience the same effect in similar levels of income inequality. This chapter computed the Gini coefficient at the county-level instead of community-level. There are 115 counties (equivalent to counties in the U.K.) nested in 28 provinces (equivalent to regions in the U.K.) from our sample. Moreover, labour income which is usually used for Gini coefficient computation cannot accurately reflect the income status of mid and older aged people, because many of them have retired or have no formal job. Therefore, following Tao and Yang (1998) and Khan and Riskin (2005), this study used per capita household total income (all sources) for all household members living together instead of the individual income of respondents, which is arguably measure of the long-term wealth status of an individual or household in a developing country. Table 6.1 shows that the average Gini coefficient at county-level is around 0.58 and there is not much difference between the rural (0.60) and urban areas (0.54) although rural areas are more unequal. These figures are quite high, but slightly lower than findings of Xie and Zhou (2014) using other data sources (around 0.7).

Based on the definition in Chapter 3, social capital can not only be defined at the individual-level, but also at the collective-level as an aggregate capital from the individual-level social capital. Collective social capital measured at village- or community-level, is considered as an aggregate resource that individuals can access or benefit from, by being a member of the village or community. Although individual-level social capital is different to the community-level social capital, and because the latter operates exclusively on the individual-level, they both reflect trust in others, the norms of reciprocity and social interaction or participation. Previous studies provide a number of examples of the relationship between social capital at collective-level and individual's health status from different countries or regions and from China (Aida *et al.*, 2011; Islam *et al.*, 2006a; Hanibuchi *et al.*, 2012; Wu *et al.*, 2010; Cramm *et al.*, 2013; Yip *et al.*, 2007; Shen *et al.*, 2014). Some have argued that social capital at the community-level could enhance one's health, which implies that the more social capital individuals can access at the community-level, the more the health of the individual would be enhanced (Mohnen *et al.*, 2011; Aida *et al.*, 2011; Hanibuchi *et al.*, 2012). Mohnen *et al.* (2011) argued that when the individual lives in a neighbourhood or community with more social capital, the individual would be supported even without asking for help, or even without being aware that one is helped by other community members or neighbours. A typical example from Coleman (1986, 1988) is that people can safely walk around at night in a tight community with a high level of social capital (social trust) whether this person is a member or not of that neighbourhood or community, because this kind of tight social connection establishes a trustworthy environment to guarantee personal safety.

Consequently, social capital at the collective-level plays a major role in determining an individual's health outcomes. For example, if individuals spend a lot more of their leisure-time in the community or village with family or friends or neighbours who live close by. It is very likely that they are influenced by their neighbours and their community environment (Mohnen *et al.*, 2011; Aida *et al.*, 2011; Hanibuchi *et al.*, 2012). All the community-level measures of social capital used in this chapter of the research are developed on the basis of definitions of social capital and previous empirical research in the field. According to the definition by Putnam (1993, *p.* 167), social capital is "features of social organisation, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions". In his study, he also emphasises the "vibrancy of associational life" and "an informed public at the community-level". Following the definition of social capital by Putnam (1993), Kawachi *et al.* (1997, *p.* 1491) believe that 'others' goodwill and good intentions' will promote the collective action and 'mutual cooperation' within a region or community, thereby increasing the stock of community-level social capital". In addition, they have also argued that "collective action, in turn, further strengthens the community's reciprocity norms" (Kawachi *et al.*, 1997, *p.* 1491). On the basis of these definitions, Kawachi et al (1997) used the degree of civic engagement as the indicator of community-level social capital: they first measured per capita number of groups and associations (e.g., labour unions, professional or academic societies, political groups, church groups, and sports groups, etc.), and they measured the trust level of the community or neighbourhood as a second measurements of community-level social capital: this was generated by calculating the percentage of individual respondents who agreed with the ‘perceived lack of fairness’ and ‘social mistrust’ before adjusting by the post-stratification weights. Although some studies by health economists such as Poortinga (2006), Rocco and Fumagalli (2014) and Ronconi *et al.*(2012) critique these measurement methods, they argue that social capital is an individual-level characteristic rather than a community-level feature, many other studies from the social policy, social science field, such as Kawachi *et al.* (1999) and Kobayashi *et al.*, (2015) have used aggregated percentage or proportion measures adjusted by pre-stratification or post-stratification weights to capture community-level social capital. Therefore, following the definition of social capital by Putnam (1993) and others in Chapter 3, as well as the measurement approach by Kawachi *et al.* (1997; 1999), Yip *et al.* (2007) and Shen *et al.* (2013), the community-level social capital variables used in this study are not just simple aggregates, but are also adjusted by the survey weights provided by the CHARLS dataset. The method–uses the sample weights so that the aggregates are representative at the community-level (or county-level for the Gini coefficient) instead of only averaging the individual-level social capital.

Specifically, this chapter uses four measures of social capital at the community-level. Three of these collective social capital variables (community-level) were generated from the measures of individual-level social capital[28] derived in Chapter 5, and one observable objective community-level factor that is provided by CHARLS. The first indicator of social capital at the village- or community-level is the proportion of residents who trust in others in the community. It was generated by the total number of respondents who answered "I could acquire the necessary help (without any payment) from others in the future" (sum by the respondents who answered social trust = 1) over (divide by) the total number of respondents in the same community (sum the total number of respondents in the community or village), then adjusted by the population weight (pre-stratified weights adjusted by non-respondent sample) that is provided by CHARLS. By adjusting this weight variable, CHARLS allows us to estimate the 'real' population, thus, the community-level social capital use here represents the 'real' community-level social capital instead of just mean or average value of the individual-level social capital from the same community or village. Therefore, this proportion is a proxy of the trust level in a community. Using the same method, the second social capital indicator at the village-

[28] As descripted in the Chapter 5, there are six social capital variables measured at the individual-level: the cognitive component of social capital is measured by respondents' beliefs about whether or not that they could acquire the necessary help (without any payment) from others in the future (proxy of trust in others), and whether respondents engaged in reciprocity (provided and received economical health with others). The structural component of social capital was measured by whether respondents engaged in certain social interactions over the past month (i.e. interaction with friends, charity work or helping a non-relative, social activities and group events).

or community-level is the proportion of those engaging in reciprocity activities within the community (a proxy of reciprocity atmosphere in the community).The first two indicators are cognitive aspect social capital variables. From Table 6.1, the average proportion of trust in others within the community is around 62.80% while this community-level social capital in rural areas (64.73%) is slightly higher than in urban areas (59.68%). However, on average, the proportion of older people engaging in reciprocity within the community is only 18.54%, and as for the trust level in the community, rural China is score slightly higher than in urban China (19.44 versus 17.08).

The structural component of social capital at the village- or community-level also is measured by two indicators, the first one is measured by the proportion of respondents engaged in certain social interactions over the past month in the same community, including any activity of interaction with friends, charity work or helping a non-relative, social activities and group events. The second structural social capital at the village- or community-level is the variety measured by the number of different amenities available in the community/village[29], [30]. Veenstra *et al.* (2005) and Shen *et al.* (2013) have used the number of public facilities or availability of public spaces in the community to capture the structural community-level social capital. Moreover, Pei and Tang (2011) pointed out that the initial aim of providing associations and amenity facilities for the residents was mobilising mutual help and support within the community/neighbourhood. Therefore, it is plausible to expect that the greater the variety in the type of amenities and associations for residents would imply a higher chance of accessing a range of amenities facilities and associations to get the needed help or helping others, and encouraging mutual support. Moreover, these amenities, facilities and associations can provide places to exchange health-related information and rapid diffusion of information, as well as enabling the establishment and diffusion of behavioural norms within the community. Table 6.1 shows that the mean social participation rate in Chinese communities is approximately 48.04 in a range from 7% to 84%. Unlike the cognitive aspect of community-level social capital,

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[29] These amenities include 14 types of community-based facilities or organizations, including: 1) basketball courts; 2) swimming pools; 3) outdoor exercising facilities; 4) rooms for card games and chess games; 5) rooms for table tennis; 6) associations for calligraphy and painting; 7) dancing teams or other exercise organizations; 8) activity centres for the elderly; 9) elderly associations; 10) nursing homes; 11) community-based and family-based Eldercare centres; 12) organizations for helping the elderly and handicapped; 13) employment services and 14) other entertainment facilities. Each facility type is coded as a dummy variable: 1=available; 0 =unavailable, so that we can count the variety in available amenities for each community. We use the variety in amenities rather than the total number of community amenities (Shen, 2014) because of lack of data on the latter and also because the latter would be more likely to be correlated with population density.

[34] The number of respondents in each of the communities does not vary much over the sample. However, since this may be a feature of the data collection process rather than reflecting the actual population, population variation at the community level is a possibility. It would therefore be advisable in future research to weight the measure of the variety in the number of amenities by the community population where such data is available.

more urban residents (51.1%) took part in social activities than the rural residents (46.15%). The average variety in the number of amenities in the community is around 3.49 for the full sample, reflecting the needs of continuous improvement of amenity facilities in Chinese communities. However, the variety of amenities[31] in the rural areas (1.91) is much less than that in the urban areas (6.06), suggesting much less investment on amenity facilities in the rural areas. To summarise, it seems that there is more cognitive community-level social capital in rural communities or villages compared with urban areas, while there is a more structural community-level social capital in urban China than in rural areas.

6.2.5 Individual-Level Variables

The analysis in this chapter uses 6 indicators (proxy dummy variables) to measure social capital at the individual-level as in Chapter 5. These are measures of the cognitive component: trust in others[32] (64%) and reciprocity with others (25%); and the structural component: interaction with friends (39%), engaged in charity work (14%), engaged in social activities (23%) and engaged in group events (8%). There is not much difference

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[31] The measure of the variety in available amenity facilities is only available in the first wave. Because this variable can be assumed to be largely invariant over short period, we assume the second wave has the same variety of amenities in the same community.

[32] There are two indicators of social trust in Chapter 5, trust in relatives and trust in non-relative. For simplification, this chapter combines the two indicators into one variable presenting social trust in others (relatives or non-relative).

between rural and urban areas in terms of individual-level social capital except that urban residents were more engaged in social activities (30% versus 19%) and group events (16% versus 3%) than those in rural areas. This may reflect a lack of investment in amenities or public facilities in these communities, towns and villages.

This chapter uses the same control variables at the individual-level as in Chapter 5, but with a comparison between urban and rural sample. From Table 6.1, there is not much difference in the demographic characteristics of the sample across urban and rural areas. However, there is a much lower percentage of respondents with junior high and above education in rural areas (0.24<0.46) and the illiteracy ratio is also much higher in the rural subsample (0.32) than in the urban subsample (0.17); the urban subsample is more educated. The descriptive statistics in Table 6.1 also show large differences in the socio-economic characteristics of rural and urban respondents. About half of the respondents in the full sample were not born in the area of their current residency, and the internal-immigration ratio is much higher in the urban areas (0.61=1-0.39) than in rural areas (0.43=1-0.57). This is consistent with the reform process and migration and urbanisation since the 1980s (Kang and Peng, 2013). The table also shows the immigration status regarding household registration (*Hukou*)[33]. Only 22 per cent of the

[33] *Hukou* system was implemented in the early 1950s and it is designed as to control the intermigration between urban and rural, it is also connects with the social welfare system. If an individual born in a city (urban) was assigned with a non-agricultural *Hukou*, and those born in countryside (rural) was assigned with an agricultural *Hukou*. Individuals with the agricultural *Hukou* cannot benefit from the urban welfare

sample has a non-agricultural *Hukou* implying they can benefit from the urban welfare system. 50 per cent of the urban subsample have a non-agricultural *Hukou*, but only 5 per cent of respondents in the rural areas have a non-agricultural *Hukou*. Woo *et al.* (2008), Martin (2006), and Zimmer and Kwong (2004) pointed out that the imparity in the welfare system mainly result from *Hukou* system, and most of the welfare system has very low coverage among Chinese older aged people, and a gap in coverage between the rural and urban areas must have negative impacts on health status.

Interestingly, we find that the employment participation rate of older residents in the rural areas (78%) is much higher than that in the urban areas (53%) while the household labour participation ratio in rural families (31.47%) is higher than in urban families (26.87%). However, this could simply reflect the low access to social security among older residents in rural China and their insecurity in later life. Older residents in the rural areas are likely to spend more time on agriculture production and are more dependent on the land (Li and Wang, 2003). However, there is not much difference between rural and urban older people with regard to their lifestyle, such as whether they exercise, the number of cigarettes consumed per day, whether they consumed alcohol last year, household size and whether they live with their child/children. Finally, the total household income per capita and total current value of long-lasting assets in the urban

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system, even though they might work and reside in cities, and vice versa (Meng et al., 2013).

subsample (10,150.61 RMB and 20,080.99 RMB) are more than double that of the rural subsample (4,357.15 RMB and 11,632.93 RMB). This implies significant household income inequality between urban and rural areas regarding wealth as well as access to social benefits.

6.2.6 CONFOUNDERS FOR SENSITIVITY ANALYSIS

According to Islam *et al.* (2006), some alternative measures of income inequality and possible confounders are included in the sensitivity analysis in this study. The alternative measures of income inequality[34] include Gini coefficients measured at community-level and province-level, and a county-level of poverty gap index (PG)[35], the relative mean deviation index (RMD)[36], and the Theil entropy index (TI)[37]. The inclusion of these alternative income inequality indexes allows the testing of the robustness of the

[34] All income inequality indexes were calculated by using a Stata command "egen_inequal" which was introduced by Lokshin and Sajaia (2006).

[35] PGI is defined as the average poverty gap in the population of a region or country as a proportion of the poverty line. It measures the intensity of poverty. According to Zhang et al. (2014) and Yaohui Zhao et al. (2013), the poverty line in rural China is 2,300RMB, while in urban areas is about 3,200RMB for both waves (between 2011 and 2014).

[36] RMD also referred to as relative mean absolute difference, it is a dimensionless quantity and it quantifies the mean absolute difference in comparison to the size of the mean. It was calculated by the sum of the absolute values of the differences between mean income and individual incomes divided by the total income in a county in this study.

[37] TI is similar with the generalized entropy index (special case), it measures the maximum possible entropy of the data minus the observed entropy, for more details, please see Cowell (2003) and Lokshin and Sajaia (2006).

Gini coefficient at county-level. As shown in Table 6.1, all the measures of income inequality indicate that urban income inequality is less than that in the rural areas

Next, six confounders were added to the full sample and other subsamples to test the robustness of community-level explanatory variables. These are: a dummy variable for a village/community with roads passing through; the average distance to the nearest medical facility; transportation costs to this medical facility; the total number public facilities[38] in or close to the community/village; the total number of medical facilities[39] located in or around the given community; and to be assured that results are not driven by unobservable or omitted regional effects (e.g. total population, GDP per capita and local culture, etc.), regional dummies [40] are also included. Although almost all communities in China have roads passing through (94%)[41], the gap in social security coverage and social support between rural and urban China is significant: the average distance to the nearest medical facility for rural residents is around 1.69 *km* compared with 0.39 *km* for urban residents, and the related transportation cost for rural residents

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[38] These public service facilities include: kindergartens, primary schools, middle schools, post offices, libraries, police offices, banks, theatres, convenience stores, farm markets and supermarkets.

[39] Medical facilities include general hospitals, specialised hospitals, traditional Chinese medicine hospitals, pharmacy stores, community health care centres, township health clinics and village medical centres.

[40] The geographic location of the provinces covered by the CHARLS can represent the traditional four regions in China (Fleisher et al., 2010; Giles et al., 2005): Eastern, Central, Western and Northeast.

[41] Although this variable does not have much variation, it is very important because if there is road passing through the community or village implies the probability of members having contact with the outside world is much higher and this is likely to impact positively on the economic level of this community/village. It is therefore a good proxy of the economic level of a community or village according to Shen et al. (2013).

(10.08 RMB) is much higher than in urban areas (3.08 RMB). There is also a gap between rural and urban areas regarding the variety of the available public facilities (3.19 versus 6.39) and the number of medical facilities in or close to the community/village (1.67 versus 2.96). Also, the percentage of the full sample from northeast China (7%) is much less than from Eastern (29%), Central (36%) and western (28%) regions.

6.3 RESULTS

6.3.1 BASELINE ESTIMATION

6.3.1.1 Fixed-Effect Results

Table 6.2 presents the results from estimated multilevel logistic and linear model using Eq. (6.1) and Eq. (6.2) respectively. The estimated results from multilevel logistic models for the dummy dependent variables (SRH and SRWB) are presented in the first two columns in Table 6.2, while the estimated multilevel linear models for continuous dependent variables (CES-D, cognitive function index and physical health index) are presented in the columns 3-5. The estimation of the coefficients for these mixed-effect regressions are based on the Maximum Likelihood (ML) while the logistic results are converted into odd ratios (OR) in which values more (less) than 1 mean high (low) likeness of having at least fair health or being at least fairly satisfied. The fixed part of the results is shown in Panel A of the table while the random part of the results is in the bottom of Panel B. This section first interprets the fixed-effect results.

6.3.1.2 Income Inequality and Health

As expected, income inequality is negatively associated with all health indicators. However, the Gini coefficient is only significantly associated with three indicators of respondents' health status; SRH, the cognitive function index and the CES-D score. In column 1, the odds ratio of 0.320 associated with the Gini coefficient implies that an increase of 0.1 points in the Gini coefficient in a county decreases the odds of reporting 'at least fair health' by about 6.8 per cent. An alternative interpretation is that the predicted odds of reporting at least fair health when there is perfect income inequality is about 0.68 times lower than it is in a completely equal society (OR=0.32). In the context of the worsening income inequality in China where the Gini coefficient has risen to 0.58 over three decades (Xie & Zhou 2014), the results suggest that this trend has decreased the odds of reporting fair health among older people by approximately 0.40 times (=0.68*0.58, or 6.8%*5.8) over the last three decades.

Likewise, in the third column the Gini coefficient is negatively associated with the cognitive function of the sample (-1.856, $p<0.001$), while it is positively associated with the CES-D measure of depression symptoms (3.534, $p<0.001$). These results imply that if the Gini coefficient is increased by 0.1 points, the cognitive function index would decrease by around 0.19 while the CES-D score would increase by approximately 0.5. This suggests a significant impact on older people's cognitive and mental health of the change in China from an almost absolutely equal (and poor) society under Chairman Mao era to a very unequal society reflected in a Gini coefficient of over 0.58 (see Table 6.1) over only 3 decades (Xie and Zhou, 2014). It is, however, perhaps a little surprising that income inequality has no significant effect on SRWB and physical health (Physical) of older people. Nevertheless, the related Hypothesis 2-1 (H2-1) that income inequality is negatively associated with the health status of mid and older people is largely confirmed (i.e. that higher income inequality in a county leads to lower health among mid-older aged adults, particularly in relation to subjective health and cognitive and mental health). However, for other health indicators, including subjective well-being and physical health, the association is not proven.

6.3.1.3 Community-level Social Capital and Health

Next, this part invests the relationship between community-level social capital and different health indicators. The measures of social capital at the community-level capture the level of social trust in the village or community, the proportion of those engaged in reciprocal activities, the proportion of respondents involved in social interactions, and the variety in amenity facilities. Table 6.2 shows there are mixed results for the different health indicators. The community trust level has a significant effect on the odds ratio of reporting fair health (OR = 1.006, $p<0.001$), slightly increases the measure of cognitive function (0.005, $p<0.1$) and reduces the CES-D score (-0.029, $p<0.001$). However, it has an insignificant effect on SRH and physical health (but with expected sign). With regard to the cognitive component of community-level social capital, the measure of community reciprocity significantly (p<0.001) increases the CES-D mental depression score by 0.038. This suggests that reciprocity captured by this measure (economic reciprocity by both receiving and providing with others) may be actioned as an investment: if someone helps others with the finical support they expect to have return in the future. In this context receipt of economic support may be associated with psychological and economic burdens that impact on health status particularly for lower socio-economic groups among older people in China. Additionally, if an individual receives financial help from non-core relatives and they are not able to pay this back, this may be regarded as a signal of poverty which may, in turn, be associated with indignity, even if the individual sourcing the support does not automatically expect a return in the future. In this respect, older people in China are more likely to have very traditional and conservative attitudes in relation to economic dependence and reciprocity. Hence, a high level of economic reciprocity in a community or village may even be associated with dependence and impact on mental health.

Regarding the structural component of social capital at the community-level, the proportion of social interactions in the community appears to be important for increasing cognitive function of older Chinese. The results imply that a 1% increase in social interactions in the community leads to an increase in the cognitive function index by 0.016

(p<0.001). However, Table 6.2 does not show any significant associations between the other health indicators and this measure of community-level social capital. Another structural component of social capital, the variety amenities (facilities) in the community or village, is also significantly associated with older people' health status, especially SRH, cognitive function and depression symptom. The results show that the more variety in the available amenities in a community, the higher the odds ratio of reporting fair health (OR = 1.05, p<0.001), the higher the cognitive function score (0.039, p<0.001), and the lower the CES-D score (-0.118, p<0.001). These results indicate that structural social capital variables at the community-level is an important determinant of better health among mid-older-age adults, in contrast to the ineffective (even negative) effect of community-level cognitive social capital, measured by the level of economic reciprocity. A high level of reciprocity in the community seems to act as an invisible burden on older people and damages their mental health. However, the results indicate that the higher proportion of the social trust between individuals in the village or community, or the higher the proportion of residents participating in social interactions, or more variety in the available amenities, the better the health outcomes of the older people in the community.

6.3.1.4 Individual-level Social Capital and Health

Regarding individual-level social capital, there is no significant difference from the results in the previous Chapter 5. Almost all aspects of social capital significant promoting better health status for mid and older people in China. However, individual-level reciprocity still shows a mixed-effect and slightly changed (compared to the estimated results in Chapter 5) on different health indicators. For example, engaged in reciprocity last month for an older Chinese could have higher cognitive function score (0.356, $p<0.001$) and physical health score (0.779, $p<0.001$) while could make this person more depression (0.348, $p<0.001$). Similarly, the predicted odds of reporting fair health for older residents engaged in any charity in the last month is about 22 per cent higher than those not involved in (OR = 1.224, $p<0.001$), and increase the cognitive function score (0.315, $p<0.001$). However, the predicted odds of reporting fair well-being of respondents who engaged in any charity in the last month is 10.4 per cent less than those not engaged in (OR = 0.896, $p<0.1$). Among six individual-level social capital, interacted with friends plays a significant role in determinant better health. For example, the predicted odds of reporting fair SRH and SRWB of older people for who interacted with their friends in the last month is 10.8 per cent (OR = 1.108, $p<0.001$) and 16.5 per cent (1.165, $p<0.001$) higher than whom did not, while this person could have higher cognitive function score (0.289, $p<0.001$) and higher physical health score (0.476, $p<0.001$), as well as lower CES-D score (-0.358, $p<0.001$). These findings are mostly consistent with the results in Chapter 5.

TABLE 6.2: ESTIMATED RESULTS FOR THE 2-LEVEL MULTILEVEL LOGISTICS (ODDS RATIO) AND LINEAR MODELS: DEPENDENT VARIABLE IS DIFFERENT HEALTH INDICATOR, 2011/2012–2013/2014

	SRH Logistics	SRWB Logistics	Cognitive Linear	CES-D Linear	Physical Linear
Panel A: Fixed Part	**(Model 1A)**	**(Model 2A)**	**(Model 3A)**	**(Model 4A)**	**(Model 5A)**
Community-level Explanatory Variables (G_j)					
Gini Coefficient (County-level)	0.320***	0.459	-1.856***	3.534***	-1.663
	(0.129)	(0.234)	(0.654)	(1.114)	(1.124)
Community-level Social Capital (CSC_j)					
Proportion of Trust in People in the V/C (%) †	1.006***	1.004	0.005*	-0.029***	-0.003
	(0.002)	(0.003)	(0.003)	(0.005)	(0.006)
Proportion of Reciprocity Activities in the V/C (%)	0.996	1.008	-0.012	0.038***	0.016
	(0.004)	(0.006)	(0.008)	(0.013)	(0.014)
Proportion of Social Participation in the V/C (%)	1.001	1.001	0.016***	-0.005	0.006
	(0.002)	(0.003)	(0.003)	(0.006)	(0.006)
Variety in the Number of Amenities	1.050***	1.007	0.039***	-0.125***	0.028
	(0.009)	(0.013)	(0.014)	(0.024)	(0.027)
Individual-level Social Capital (ISC_{ij})					
Perceived Health Care (Non-Pain) from Others	1.479***	2.068***	0.461***	-2.007***	0.145
	(0.056)	(0.099)	(0.050)	(0.100)	(0.125)
Reciprocity	0.983	1.060	0.356***	0.348***	0.779***
	(0.047)	(0.061)	(0.061)	(0.101)	(0.147)
Interaction with Friends	1.108***	1.165***	0.289***	-0.358***	0.476***
	(0.042)	(0.055)	(0.051)	(0.089)	(0.133)
Engaged in Charity Work	1.224***	0.896*	0.315***	0.116	-0.207
	(0.071)	(0.057)	(0.072)	(0.120)	(0.174)
Engaged in Social Activities	1.274***	1.303***	0.623***	-0.870***	0.115
	(0.067)	(0.077)	(0.057)	(0.096)	(0.151)

Engaged in Group Events	1.330***	1.624***	0.519***	-0.954***	-0.089
	(0.108)	(0.166)	(0.073)	(0.136)	(0.225)
Control Variables (X_{ij})					
Interview Wave (***T***, 0=11/12, 1=13/14)	1.075	1.207***	-0.076	-0.764***	0.061
	(0.053)	(0.074)	(0.079)	(0.135)	(0.163)
Demographic & Socio-economic Variables					
Age	0.998	1.037***	-0.057***	-0.016***	0.037***
	(0.002)	(0.003)	(0.004)	(0.006)	(0.009)
Gender (0=M;1=F)	1.028	0.839***	-0.601***	1.246***	1.355***
	(0.053)	(0.052)	(0.071)	(0.115)	(0.169)
Marital Status (0=Otherwise; 1=Married)	0.929	1.553***	0.567***	-1.210***	0.448**
	(0.052)	(0.106)	(0.084)	(0.147)	(0.194)
Educational Achievement					
Can Read & Write	1.031	1.044	2.415***	0.266*	1.007***
	(0.056)	(0.066)	(0.085)	(0.145)	(0.182)
Finished Primary	1.085	1.156**	3.579***	-0.367**	0.967***
	(0.064)	(0.076)	(0.086)	(0.145)	(0.196)
Junior High and Above	1.317***	1.336***	4.603***	-0.996***	0.150
	(0.081)	(0.098)	(0.089)	(0.162)	(0.202)
Health Insurance (0=No;1=Yes)	0.883	1.222**	0.346***	-0.353*	0.132
	(0.074)	(0.106)	(0.103)	(0.197)	(0.252)
Work Status (1=Working; 0=Not Working)	2.293***	1.153**	0.455***	-0.886***	1.942***
	(0.102)	(0.071)	(0.061)	(0.111)	(0.192)
Current Hukou (0=Agricultural; 1=Others)	1.287***	1.278***	0.805***	-0.759***	0.449**
	(0.088)	(0.107)	(0.096)	(0.146)	(0.222)
Whether Born in Current Place	1.069	1.077	0.021	-0.223**	-0.189
	(0.045)	(0.054)	(0.060)	(0.094)	(0.139)
Lifestyle					
Exercises (0=No;1=Yes)	1.013	1.060	0.086*	-0.122	0.521***

	(0.041)	(0.053)	(0.048)	(0.100)	(0.124)
Cigarettes Consumed Per Day	0.997*	1.000	0.002	0.005	0.001
	(0.002)	(0.003)	(0.002)	(0.004)	(0.007)
Drink (0=No;1=Yes)	1.684***	1.041	-0.051	-0.281***	-0.131
	(0.083)	(0.053)	(0.049)	(0.103)	(0.137)
Household Characteristics					
Household Size	1.011	1.009	-0.004	-0.042	0.087***
	(0.011)	(0.015)	(0.015)	(0.028)	(0.032)
Live with Child/Children	0.922*	0.960	-0.098*	0.309***	-0.323**
	(0.041)	(0.053)	(0.059)	(0.101)	(0.138)
Household Labour Participation Rate	1.000	1.001	-0.003***	-0.002	0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Log Annual Household Income Per Capita	1.058***	1.126***	0.106***	-0.225***	-0.066*
	(0.013)	(0.016)	(0.017)	(0.030)	(0.039)
Log Value of Long-Lasting Assets	1.003	1.007*	0.028***	-0.006	0.015
	(0.003)	(0.004)	(0.004)	(0.007)	(0.012)
Urban (0=Rural; 1=Urban)	1.262***	1.044	0.363***	-0.306	0.196
	(0.089)	(0.100)	(0.118)	(0.193)	(0.204)
Constant	-0.175	-2.835***	9.724***	14.980***	43.813***
	(0.386)	(0.507)	(0.557)	(0.998)	(1.188)
Panel B: Random Part					
L2: Between Community Variance (σ_μ^2)	0.147***	0.338***	0.541***	1.723***	0.993
	(0.020)	(0.043)	(0.052)	(0.157)	(0.162)
L1: Between Individual Variance (σ_ε^2)			9.794***	29.827***	66.399***
			(0.112)	(0.487)	(0.965)
VPCs (Level 2) ††	4.26%	9.32%	5.23%	5.46%	1.47%
VPCs (Level 1)	95.74	90.68	94.77	94.54	98.53
Panel C: Model-Fit Statistics Index					
Likelihood ratio $\chi 2(df)$ test†††	$\chi^2(31)$ =	$\chi^2(31)$ =	$\chi^2(31)$ =	$\chi^2(31)$ =	$\chi^2(31)$ =

	1137.79***	976.91***	5604.85***	6807.91***	7458.72***
AIC††	22596.40	17268.73	115415.19	140397.80	158002.11
BIC††	22860.98	17533.32	115687.79	140670.40	158274.72
Num. OBS	22,420	22,420	22,420	22,420	22,420
Num. Communities	445	445	445	445	445

*Notes: Robust Standard Errors in parentheses. Sig: * p<0.1, ** p<0.05, *** p<0.01.*

† V/C is an abbreviation of Village and/or community.

†† VPCs = Variance Partition Coefficients; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

††† This test shows whether inclusion of more explanatory factor(s) is significantly different from less explanatory factor(s). For example, Null model (without any predictor) is compared with Model (1A) with one (more) predictor(s), and same for other models.

6.3.1.5 Demographic and Socio-economic Factors and Health

For those control variables, age is a significant predictor of most health outcomes of older people. The regression results from Table 6.2 are very similar to Table 5.2 in Chapter 5 even though the analysis in this chapter additionally includes county-level and community-level variables. This similarity indicates that the community-level and country-level variables are exogenous. Females are less likely to report fair well-being (OR = 0.839, p<0.001), lower cognitive function (-0.601, p<0.001), more depressed (1.246, p<0.001), however, more physically healthy than males (1.355, p<0.001). Meanwhile, Table 6.2 also shows that non-married (single/widow/widower) older people have almost the same effect (sign and significant level) on these health indicators as for females. Similar to what Lei *et al.* (2014) and Liu *et al.* (2016) discovered, the results show that the education level of the respondent can significantly improve older respondents' health status and reduce respondents' depression, especially for respondents with primary school education and above, compared with the reference groups (illiterate). Health insurance in this study includes both public and business health insurance, thus, the coverage is quite high in our sample (95% in Table 6.1), and Table 6.2 shows that it is more import to feeling related and brain aspects health indicators (i.e. SRWB, cognitive function and CES-D) instead of physical health (SRH and physical health). Working mid and older people are significantly healthier than those not working, yet, the causality between health and working status remain unsolved. Immigration between regions (whether born in current place) is important to reduce depression symptoms (-0.223, $p<0.05$), but it is irrelevant to other health indicators. Hence, the movement from one place to another and living in a place not native to one, could not decrease mid and older people' health status (except the depression symptoms), and the migration itself is not the source of health status difference, but it is the source of depression. Moreover, non-agricultural *Hukou* (representing cover by the urban welfare system) associates with the health status of older people dramatically. The problem is that only 22 per cent of mid and senior residents are covered by the urban welfare system from the sample. It could be this unfair welfare institution for rural-urban migrants that increases the health disparity of mid and older people between urban and rural China (Liu, 2005; Chan and Zhang, 1999; Liu *et al.*, 2015). Non-agricultural *Hukou* plays a dominant role in better health status for all health indicators even after controlling all observable factors. Thus, it may imply that the health status problem of mid and older people in China is basically an institutional inequality problem. Additionally, most factors of household characteristics can alleviate the depression of older people (i.e. log annual household income per capita) and improve their SRH and SRWB (log household annual income per capita and log value of long-lasting assets). The increase in household income and value of long-lasting assets in the family are significantly and positively associated with most health indicators: they can reduce the depressive symptoms among older people. The result suggests that household SES is still a key determinant of better health for mid and older people. However, household labour participation rates play insignificant roles in determining health status for the mid and older people, even harms their cognitive function (-0.003, p<0.001). The estimated coefficient of urban dummy indicators that urban senior residents have better health status than those in rural regarding the aspect of SRH and cognitive function. In a word, by controlling all above absorbable factors, Table 6.2 confirms the Hypothesis 2 (H2) and Hypothesis 2-1 (H2-1) that income inequality is negatively associated with better health status while community-level social capital plays a role of health guardian.

6.3.1.6 Random-Effects Result

The random-effects results in Panel B of Table 6.2 indicates a significant variation in most health indicators between-community (σ_μ^2) and between-individual (σ_ε^2) among 445 communities and around 22,420 observations within 2 waves[42]. However, in the case of the multilevel logistics models with binary and other discrete dependent variable, there is no variance (σ_ε^2) at level 1 because the level 1 variance is a function of the mean (Browne *et al.*, 2005). For Model 1A, we can see that significant but not much variation in reporting fair health between communities (σ_μ^2=0.147, p<0.001), however, compared with Model 1A, Model 2A shows significant and higher variation in reporting fair well-

[42] The models has been developed sequentially as shown in Appendix, thus, it is possible to examine which aspects of community variables contribute to the within and between community differences. However, it's not the focus in the main text hence the results were presented in Appendix.

being between communities (σ_μ^2=0.338, p<0.001). We can also find that there is very close or even higher variation in the health status of cognitive function score (σ_μ^2=0.541, p<0.001), CES-D score (σ_μ^2=1.723, p<0.001), yet, not including physical health score (σ_μ^2=0.993, p>0.1) between communities. However, variation at level 1 shows even higher value between individual. For example, as shown in Model 3A, the between-individual variance at level 1 is higher than between community variance at level 2 (9.794 versus 0.541, both p<0.001). In summary, community differences in the respondents' health outcomes are statistically significant. However, the magnitude is small and only to a minor extent explained by community differences in social capital.

Nevertheless, the random part of Table 6.2 also provides the VPCs statistics at both community-level and individual-level for all models. The VPCs quantify the extent of the contextual effects of higher level (i.e. communities) playing a role in determining the older individual health outcomes (Rodrıguez and Elo, 2003; Steenbergen and Jones, 2002). For example, as Model 3A shows, the VPCs at level 2 is 5.23%, suggest about 5.23 per cent of the variability in cognitive function score of mid and older people can be attributed to the difference between communities or villages in which they are living, while the VPCs of other health outcomes, but not including physical health (only 1.47%) are all greater than 5% suggesting that more than 5 per cent of the variation in SRH, SRWB, cognitive function score, and depression symptoms (CES-D) lies within communities between individuals. These results further confirm that the two-level mixed logistics and linear modelling is needed in this study even though the contribution is small of community-level (level 2) factors. The result suggests that although the differences in the health outcomes of Chinese older people are mostly affected by lower level (individual) characteristics rather than higher level (community) factors, community-level social capital and income inequality still play significant roles in respondents' health status differences between communities in China.

6.3.2 SENSITIVITY ANALYSIS

This section first used alternative income inequality indexes to replace Gini coefficient measured at the county-level to test its robustness, and the result shows in Panel I of Table 6.3. Then this section employs a number of sensitivity analyses to test the robustness of the estimated results in Table 6.2. The regression results including all six confounders are shown in Panel II of Table 6.3. In addition, the full sample is divided into separate subsamples and performed by the interview wave (wave 1=2011/2012 and wave 2=2013/2014), gender (male and female), resident region (rural and urban) and *Hukou* status (agricultural and non-agricultural) to investigate whether the heterogeneity effect of community-level social capital exists between different interview time points, males and females, urban and rural, as well as agricultural *Hukou* and non-agricultural *Hukou*. The estimated results of robust standard errors, individual-level factors, control variables and confounders and VPCs statistical indexes were not reported in Table 6.3.

The results in Table 6.3 (Panel I, Model 1B to 5B) re-estimates the baseline model with alternative income inequality index, respectively (full sample, Model 1B to 5B). Except for the estimated coefficient, the difference between these alternatives and result in Table 6.2 are not evident. Most of this income inequality is significantly associated with worse health status especial SRH, cognitive function and CES-D score.

Next, Panel II re-estimates the baseline model (Table 6.2) with all six confounders. Regarding the estimation of Gini coefficient, not much difference can be found from results of Table 6.2 except the Gini coefficient at county-level became negative and significant associated with SRWB (Model 2C) at 5% level by adding the confounders. It was also found that one of the community-level social capital, the proportion of trust in people in the community, became insignificant associated with respondents' cognitive function after controlling confounders. It seems that some community-level confounders knock off the significant impact of this cognitive component community-level social capital.

Furthermore, the results in Table 6.3 re-estimates stratified subsamples of different interview periods (Model 1D to 5D and Model 1E to 5E). Significant differences from the full sample with all six confounders cannot be found (Model 1B to 5B). However, for the proportion of trust in people in the community there are mixed results between waves. This variable is significantly and positively associated with cognitive function status, and negatively and insignificantly related to the CES-D score in wave 1, while it is insignificant and negatively associated with cognitive health, and negatively and strongly significantly associated with CES-D in wave 2. In addition, another community-level social capital, the proportion of reciprocal activities, is negatively related to the cognitive function (-0.020, $p<0.05$) and mental health (0.044, $p<0.05$) of older people in wave 1, while in wave 2 this variable is only negatively related to mental health (0.027, $p<0.1$).

Regarding the gender subsample (Model 1F to 5F and Model 1G to 5G), we still cannot find significant different from estimation results of full sample (Model 1B to 5B). However, income inequality is insignificant for SRWB of males, and significant decrease the odds ratio of reporting fair satisfied for females (0.231, $p<0.05$). We also find that income inequality could harm cognitive function status of males (-1.161, $p<0.1$) while it is not the main factor decreasing the cognitive function of females. In terms of social capital at community-level, it was found that trust level in the community/village significant and negative associated with depression symptom (males: CES-D = -0.019, $p<0.01$; female: CES-D = -0.021, $p<0.01$) and physical health index (males: Physical = -0.013, $p<0.1$; female: Physical = insignificantly and positively) for male and female respondents. In addition, male respondents live in a community or village with higher proportion of reciprocity activities, were 1.014 times higher odds of reporting fair satisfied of their life compare with those live in a lower community/village, but living in such high level of reciprocity environment also could make males' depression symptom worse off (CES-D = 0.026, $p<0.1$). Table 6.3 also shows a similar result for female respondents regard to this community-level social capital (CES-D = 0.038, $p<0.05$), but this variable positive and significantly associated with their physical health (Physical = 0.038, $p<0.05$) instead of on their SRWB. Furthermore, the social participation rate in a community/village was positive and significant associated with cognitive function index of females (0.023, $p<0.01$) but insignificant for males. Most importantly, the last social capital indicator at community-level, variety number of amenity facilities, shows significant improvement for most of the health indicators (SRH, cognitive function and CES-D) for both males and female.

After that, the results in Table 6.3 re-estimates the stratified subsamples of the resident region (Model 1H to 5H and Model 1I to 5I). The results show that income inequality plays a significant role in the determinant of SRH (OR = 0.173, $p<0.01$) and SRWB (OR = 0.058, $p<0.01$) for rural older residents instead of those in urban areas. However, Gini coefficient significant associated with cognitive function and depression symptom of urban respondents (-1.727, $p<0.05$), but insignificant for rural respondents'. For the social capital at community-level, the proportion of trust in people and proportion of reciprocity activities in the communities/villages, significant associated with SRH (OR_{trust} = 1.006, $p<0.05$), depression symptoms ($CES\text{-}D_{trust}$ = -0.029, $p<0.01$), and physical health (reciprocity = 0.047, $p<0.01$) for older people who live in rural China, but insignificant associated with any health indicators except high reciprocity environment could increase the depression symptom (0.027, p<0.1) for urban older people. The social participation rate in a community/village still plays a significant role in determinate better cognitive function for both rural (0.017, p<0.01) and urban (0.008, p<0.1) older residents. Like the estimation results of gender subsample, the variety in the number of amenities significant associated with better health status in SRH, cognitive function and mental health status for both rural and urban respondents.

Finally, the results in Table 6.3 re-estimates stratified subsamples of *Hukou* status (Model 1J to 5J and Model 1K to 5K), and income inequality plays a significant injurer in health status of older respondents with the agricultural *Hukou* (SRH, SRWB and CES-D) and the non-agricultural *Hukou* (only on the cognitive function). Regarding community-level social capital variables, we find similar results as in the rural-urban subsamples. However, the social capital at community-level plays a more important role in health status for older people with agricultural *Hukou* than those with non-agricultural *Hukou*. This may be because of the weaker social security system in rural China and the less-developed social welfare system for residents with agricultural *Hukou* are affected earlier by their living environment (income inequality), and they are heavily dependent on social resource (i.e. social capital) than those older people living in urban China or those with non-agricultural *Hukou*. These findings may be evidence of the significant effect of the unbalanced welfare system on the health status of older Chinese.

Although results in Table 6.3 show heterogeneity effects of Gini coefficient and social capital at community-level on different health indicators of full and subsamples among mid and older respondents, overall, the association of these main factors and health status remain significant with expected signs., significant differences from the estimated results in Table 6.2 cannot be found. Therefore, it can conclude that the findings above are robust and confirm the hypotheses in Chapter 1 that income inequality could harm the health status of mid and older Chinese, while social capital at community-level could help their health status better.

TABLE 6.3: SENSITIVITY ANALYSIS: DEPENDENT VARIABLE IS DIFFERENT HEALTH INDICATOR, 2011/2012–2013/2014

Panel I: Alternative Income Inequality Index	**SRH Logistics**	**SRWB Logistics**	**Cognitive Linear**	**CES-D Linear**	**Physical Linear**
Full Samples (Without Confounders)	**(Model 1B)**	**(Model 2B)**	**(Model 3B)**	**(Model 4B)**	**(Model 5B)**
Gini Coefficient 2 (Community-level)[1]	0.375***	1.005	-1.816***	1.455*	-1.254
Gini Coefficient 3 (Province-level)	0.924	6.104	-2.410***	2.532*	0.024
PG (County-level)[2]	0.365***	0.745	-2.218***	3.092***	-0.837
RMD (County-level)[3]	0.225***	0.428	-2.116***	4.578***	-1.295
TI (County-level)[4]	0.734**	0.809	-0.447*	0.665	-0.243
N	22,420	22,420	22,420	22,420	22,420
Panel II: With 6 confounders					
Full Samples	**(Model 1C)**	**(Model 2C)**	**(Model 3C)**	**(Model 4C)**	**(Model 5C)**
Gini Coefficient (County-level)	0.285***	0.312**	-1.145*	3.270***	-1.525
Proportion of Trust in People in the V/C†	1.003	1.003	0.001	-0.019***	-0.004
Proportion of Reciprocity Activities in the V/C	0.999	1.008	-0.009	0.033**	0.016
Proportion of Social Participation in the V/C	1.000	1.000	0.015***	-0.003	0.003
Variety in the Number of Amenities	1.043***	1.001	0.039**	-0.128***	0.014
N	21,995	21,995	21,995	21,995	21,995
Panel III: With 6 confounders for subsamples					
Wave 1 Samples	**(Model 1D)**	**(Model 2D)**	**(Model 3D)**	**(Model 4D)**	**(Model 5D)**
Gini Coefficient (County-level)	0.132***	0.236**	-0.487**	4.693***	-1.321
Proportion of Trust in People in the V/C	1.000	0.998	0.009*	-0.010	-0.007
Proportion of Reciprocity Activities in the V/C	1.001	1.004	-0.020**	0.044**	0.022
Proportion of Social Participation in the V/C	0.997	0.999	0.019***	-0.001	0.012
Variety in the Number of Amenities	1.058***	0.989	0.044*	-0.129***	-0.073*
N	9,979	9,979	9,979	9,979	9,979
Wave 2 Samples	**(Model 1E)**	**(Model 2E)**	**(Model 3E)**	**(Model 4E)**	**(Model 5E)**
Gini Coefficient (County-level)	0.490**	0.396**	-1.516**	2.179**	-1.413
Proportion of Trust in People in the V/C	1.005*	1.006*	-0.005	-0.025***	-0.001

Proportion of Reciprocity Activities in the V/C	0.998	1.010	0.002	0.027*	0.013
Proportion of Social Participation in the V/C	1.002	0.999	0.012***	-0.003	-0.002
Variety in the Number of Amenities	1.033***	1.008	0.028*	-0.128***	0.068*
N	12,016	12,016	12,016	12,016	12,016
Males Samples	**(Model 1F)**	**(Model 2F)**	**(Model 3F)**	**(Model 4F)**	**(Model 5F)**
Gini Coefficient (County-level)	0.370*	0.385	-1.161*	3.309***	-1.154
Proportion of Trust in People in the V/C	1.004	1.004	0.002	-0.019***	-0.013*
Proportion of Reciprocity Activities in the V/C	0.998	1.014*	-0.009	0.026*	-0.011
Proportion of Social Participation in the V/C	0.998	0.996	0.005	0.000	0.007
Variety in the Number of Amenities	1.042***	1.007	0.031**	-0.107***	-0.050
N	10,579	10,579	10,579	10,579	10,579
Females Samples	**(Model 1G)**	**(Model 2G)**	**(Model 3G)**	**(Model 4G)**	**(Model 5G)**
Gini Coefficient (County-level)	0.232***	0.231**	-0.859	3.058**	-1.989
Proportion of Trust in People in the V/C	1.003	1.002	0.002	-0.021***	0.005
Proportion of Reciprocity Activities in the V/C	1.002	1.004	-0.010	0.038**	0.038**
Proportion of Social Participation in the V/C	1.002	1.002	0.023***	-0.004	-0.001
Variety in the Number of Amenities	1.042***	0.999	0.043**	-0.152***	0.063*
N	11,416	11,416	11,416	11,416	11,416
Rural Samples	**(Model 1H)**	**(Model 2H)**	**(Model 3H)**	**(Model 4H)**	**(Model 5H)**
Gini Coefficient (County-level)	0.173***	0.058***	-0.328	2.061	-0.213
Proportion of Trust in People in the V/C	1.006**	1.004	0.004	-0.029***	-0.000
Proportion of Reciprocity Activities in the V/C	1.004	1.010	-0.003	0.032	0.047***
Proportion of Social Participation in the V/C	0.999	0.999	0.017***	-0.002	0.000
Variety in the Number of Amenities	1.055***	1.000	0.047*	-0.193***	0.039
N	13,758	13,758	13,758	13,758	13,758
Urban Samples	**(Model 1I)**	**(Model 2I)**	**(Model 3I)**	**(Model 4I)**	**(Model 5I)**
Gini Coefficient (County-level)	0.751	1.045	-1.727**	4.043***	-0.837
Proportion of Trust in People in the V/C	0.998	1.003	-0.005	-0.011	-0.003
Proportion of Reciprocity Activities in the V/C	0.992	1.002	-0.016	0.027*	-0.035

Proportion of Social Participation in the V/C	1.001	1.002	0.008*	-0.002	0.009
Variety in the Number of Amenities	1.034***	0.998	0.025	-0.075**	0.001
N	8,237	8,237	8,237	8,237	8,237
Agricultural Hukou Samples	**(Model 1J)**	**(Model 2J)**	**(Model 3J)**	**(Model 4J)**	**(Model 5J)**
Gini Coefficient (County-level)	0.133***	0.125***	-0.435	3.997***	-0.310
Proportion of Trust in People in the V/C	1.004*	1.003	0.004	-0.024***	-0.000
Proportion of Reciprocity Activities in the V/C	0.999	1.009	-0.003	0.035**	0.029*
Proportion of Social Participation in the V/C	0.999	0.999	0.017***	-0.002	0.001
Variety in the Number of Amenities	1.056***	1.003	0.051***	-0.154***	0.039
N	17,199	17,199	17,199	17,199	17,199
Non-Agricultural Hukou Samples	**(Model 1K)**	**(Model 2K)**	**(Model 3K)**	**(Model 4K)**	**(Model 5K)**
Gini Coefficient (County-level)	1.976	2.741	-1.762*	1.815	-2.758
Proportion of Trust in People in the V/C	0.996	1.003	-0.007	-0.007	-0.010
Proportion of Reciprocity Activities in the V/C	1.005	1.021	-0.015	0.002	-0.024
Proportion of Social Participation in the V/C	1.006*	1.004	0.002	0.000	0.020
Variety in the Number of Amenities	1.021	1.012	0.002	-0.052	-0.048
N	4,796	4,796	4,796	4,796	4,796

*Notes: Robust Standard Errors were omitted in the table; Sig: * p<0.1, ** p<0.05, *** p<0.01.*

1) All income inequality indexes were calculated by using a Stata command "egen_inequal" which was introduced by Lokshin and Sajaia (2006). 2) PG is defined as the average poverty gap in the population of a region or country as a proportion of the poverty line. It measures the intensity of poverty. According to Zhang et al. (2014) and Zhao et al. (2013), the poverty line in rural China is 2,300RMB, while in urban areas is about 3,200RMB for both waves (between 2011 and 2014). 3) RMD also referred to as relative mean absolute difference, it is a dimensionless quantity and it quantifies the mean absolute difference in comparison to the size of the mean. It was calculated by the sum of the absolute values of the differences between mean income and individual incomes divided by the total income in a county in this study. 4) TI is a special case of the generalised entropy index, it measures the maximum possible entropy of the data minus the observed entropy, for more details, please see Cowell (2003) and Lokshin and Sajaia (2006).

† V/C is the abbreviation of Village and/or community.

6.3.3 INTERACTION EFFECTS

To examine whether and which social capital variable at community-level plays a significant role to mitigate the negative effect of income inequality on health outcomes among mid and older people in China, this section estimates the interaction effect of different community-level social capital and county-level Gini coefficient, respectively. Results are shown in Table 6.4, and we can see that the two variables capturing the community-level cognitive components of social capital (the first two interaction terms) are significantly associated with depression symptom. Specifically, the effect of the interaction term formed by the interaction of the proportion of trust in others in the community/village and the Gini coefficient (interaction term 1) is significant and negatively associated with respondents' CES-D score (-0.179, $p<0.001$). Also, the second interaction term—the proportion of reciprocity in the community/village interacted with the Gini coefficient, is also significant and negatively associated with CES-D score (-0.311, $p<0.05$). The estimated results in Table 6.2 and Table 6.3 (Model 1C—5C in Panel II) show that the proportion of reciprocity in the community/village is insignificantly associated with most of the health indicators (except CES-D score in Model 4C). However, this community-level, cognitive component of social capital becomes significant and decreases the CES-D score for mid and older respondents after the interaction term has been added. Although we cannot find an important association with the other interaction terms between the community-level, structural component of social capital and the county-level Gini coefficient, the estimated OR and coefficients show the expected sign (direction) for most health indicators (except for physical health). The results at least confirm that cognitive social capital at the community-level could potentially mitigate the negative effect of income inequality (measured by the Gini coefficient at the county-level) on elderly people's mental health (measured by the CES-D score).

A simple simulation can show that if the average proportion of trust in the community/village increased by 1%, or the average proportion of reciprocity in the community/village increased by 1%, the interaction term would corresponding increase by around 0.58 as the income inequality is around 0.58 (Table 6.1). The average CES-D of the mid and older people would decrease by about 0.10 (=0.58*-0.179) for the former (trust), while the CES-D would decrease by approximately 0.18 (=0.58*-0.311) for the later (reciprocity). The strong policy implication here is that the investment on the community-level cognitive social capital can dramatically decrease the depression level of the older people. Moreover, 1% increase of trust level in community/village and reciprocity participation in the community/village actually can respective reduce the depression level by about 1.23% (=0.1/8.13, see Table 6.1) for the former and by around 2.21% (=0.18/8.13) for the later.

Another issue is that, with the interaction term, the coefficients of the first cognitive social capital at the community-level variable is now positive and significant associated with CES-D (Model 4I), and we can find the same results for the second cognitive community-level social capital. It is highly likely because the communities with more trust and more reciprocity activities could be the safe and rich communities, at the same time, the communities with higher income inequality. Thus, the negative effect of income inequality is also reflected in these two social capital variables after we control the interaction term, respectively. As shown in Table 6.2 and Table 6.3 without the interaction term, the income inequality has significantly negative effects on mental health (CES-D). Hence, the cognitive component social capital at the community-level can reduce the CES-D score significantly. Even considering the transferred negative effects on the variety number, we can figure out that the interaction term can overwhelm the negative effects if investment can increase the proportion of trust in others in the community/village by about 2% (0.10*2>0.179) or proportion of reciprocity activities in the community/village by approximately 2% (0.18*2>0.311). Thus, the mitigating effect of the formal social capital of Hypothesis 2-2 (H3-2) in Chapter 1 is supported by above findings.

TABLE 6.4: DIFFERENT INTERACTION EFFECTS BETWEEN COMMUNITY-LEVEL SOCIAL CAPITAL AND INCOME INEQUALITY, 2-LEVEL MULTILEVEL LOGISTICS (ODDS RATIO) AND LINEAR REGRESSION MODELS: DEPENDENT VARIABLE IS DIFFERENT HEALTH INDICATOR, 2011/2012–2013/2014

	(Model 1I) SRH Logistics	(Model 2I) SRWB Logistics	(Model 3I) Cognitive Linear	(Model 4I) CES-D Linear	(Model 5I) Physical Linear
Interaction Term 1					
Proportion of Trust * Gini	1.006	0.996	0.013	-0.179***	0.068
Community-level Explanatory Variables (*G_j*)					
Gini coefficient (county-level)	0.197	0.385	-1.936	13.888***	-5.576
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C†	1.000	1.005	-0.006	0.083**	-0.043
Proportion of Reciprocity Activities in the V/C	0.999	1.008	-0.008	0.031**	0.017
Proportion of Social Participation in the V/C	1.000	1.000	0.015***	-0.002	0.003
Variety in the Number of Amenities	1.043***	1.001	0.039**	-0.127***	0.014
Interaction Term 2	**(Model 1J)**	**(Model 2J)**	**(Model 3J)**	**(Model 4J)**	**(Model 5J)**
Proportion of Reciprocity * Gini	1.040	0.109	0.018	-0.311**	0.229
Community-level Explanatory Variables (*G_j*)					
Gini coefficient (county-level)	0.147*	-2.996*	-1.446	8.450***	-5.370*
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C†	1.003	0.003	0.001	-0.020***	-0.003
Proportion of Reciprocity Activities in the V/C	0.977	-0.055	-0.019	0.212**	-0.116
Proportion of Social Participation in the V/C	1.000	-0.000	0.015***	-0.003	0.003
Variety in the Number of Amenities	1.044***	0.002	0.040**	-0.131***	0.017
Interaction Term 3	**(Model 1K)**	**(Model 2K)**	**(Model 3K)**	**(Model 4K)**	**(Model 5K)**
Proportion of Social Participation * Gini	1.039	1.030	0.054	-0.097	-0.035
Community-level Explanatory Variables (*G_j*)					
Gini coefficient (county-level)	0.043*	0.073	-3.868*	8.188**	0.254

Community-level Social Capital (*CSC$_j$*)					
Proportion of Trust in People in the V/C†	1.003	1.003	0.001	-0.019***	-0.004
Proportion of Reciprocity Activities in the V/C	1.000	1.009	-0.008	0.033**	0.016
Proportion of Social Participation in the V/C	0.979	0.983	-0.016	0.053	0.024
Variety in the Number of Amenities	1.043***	1.001	0.038**	-0.126***	0.015
Interaction Term 4	**(Model 1L)**	**(Model 2L)**	**(Model 3L)**	**(Model 4L)**	**(Model 5L)**
Variety in the Number of Amenities * Gini	1.147	1.157	-0.013	-0.085	-0.127
Community-level Explanatory Variables (*G$_j$*)					
Gini coefficient (county-level)	0.149***	0.155**	-1.078	3.711**	-0.901
Community-level Social Capital (*CSC$_j$*)					
Proportion of Trust in People in the V/C†	1.003	1.003	0.001	-0.019***	-0.004
Proportion of Reciprocity Activities in the V/C	1.000	1.009	-0.009	0.033**	0.016
Proportion of Social Participation in the V/C	1.000	0.999	0.015***	-0.003	0.004
Variety in the Number of Amenities	0.967	0.924	0.046	-0.081	0.084
Individual-level Explanatory Variables Omitted					

*Notes: Robust Standard Errors were omitted in the table; Sig: * p<0.1, ** p<0.05, *** p<0.01.*

† V/C is the abbreviation of Village and/or community.

6.3.4 MARGINAL EFFECTS OF INCOME INEQUALITY

The coefficients of income inequality in Table 6.4 are actually its impact on health indicators when there is no social capital at the community-level ($CSC_j = 0$, Friedrich, 1982). The above results show only that higher income inequality in the poor communities without community-level cognitive social capital significantly increases the CES-D of the mid and older respondents. This section tries to investigate the marginal effects of the interaction item between income inequality and these two community-level cognitive social capital variables, respectively. The interaction variable of income inequality and cognitive social capital variables at the community-level are significantly negative for two models (Model 4I and Model 4J). However, as above two interaction terms were generated by two continues variables and used the multilevel mixed-effect estimation, which could make the interaction effect is complex to interpret. Thus, follow the suggestions from Krull and MacKinnon (2001), Potrafke (2009), and Kang and Peng (2012), this section first to fix the random-effects for both models at zero–their respective theoretical mean, in order to measure the marginal effects of various levels income inequality of the respective cognitive community-level social capital variables. Namely at the minimum (0% for both), 1st percentile (25% for trust and 5% for reciprocity), 5th percentile (37% for trust and 8% for reciprocity), 10th percentile (43% for trust and 11% for reciprocity), 25th percentile (53% for trust and 15% for reciprocity), median (63% for trust and 18% for reciprocity), 3rd quartile (73% for trust and 22% for reciprocity), 95th

percentile (85% for trust and 29% for reciprocity), and maximum (93% for trust and 40% for reciprocity) percentage of community trust and reciprocity, respectively. This method enables us to distinguish between the impact of income inequality on mental health when the respective levels of cognitive social capital at the community-level are low and high.

The marginal effects are shown in Table 6.5. At the lowest level of community-level social capital ($CSC_j = 0$) for community trust and reciprocity, we find the same result as in Table 6.4; that income inequality significantly increases depression symptoms among older Chinese. The results further indicate that if there is no community-level social capital ($CSC_j = 0$), on average, the effect of county-level income inequality (the Gini coefficient) on individual's mental health increases the CES-D score by 13.65 and this is a significant, negative effect. However, when community-level social capital increases to the first percentile, for example, if community trust increases to 25% (25% of the total community population trust in others) then the marginal effect of income inequality (the Gini coefficient) on the CES-D score decreases to about 9.27, while at the same percentile of community reciprocity (5% of the total community population participated in reciprocity) the marginal effect is approximately 6.19 (down from 7.43) on the measure of depression symptoms (CES-D score). With regard to further (percentage) increases in cognitive community-level social capital, Table 6.5 shows that both samples, for the different interaction terms, experience declining, negative marginal effects of income inequality. Furthermore, above the third quartile for community-level social capital (73% incidence for trust and 22% incidence for reciprocity), the marginal effect of income inequality becomes insignificant. Thus, the more people have confidence in others or participate in reciprocity within the community or village, the less the harmful impact of income inequality.

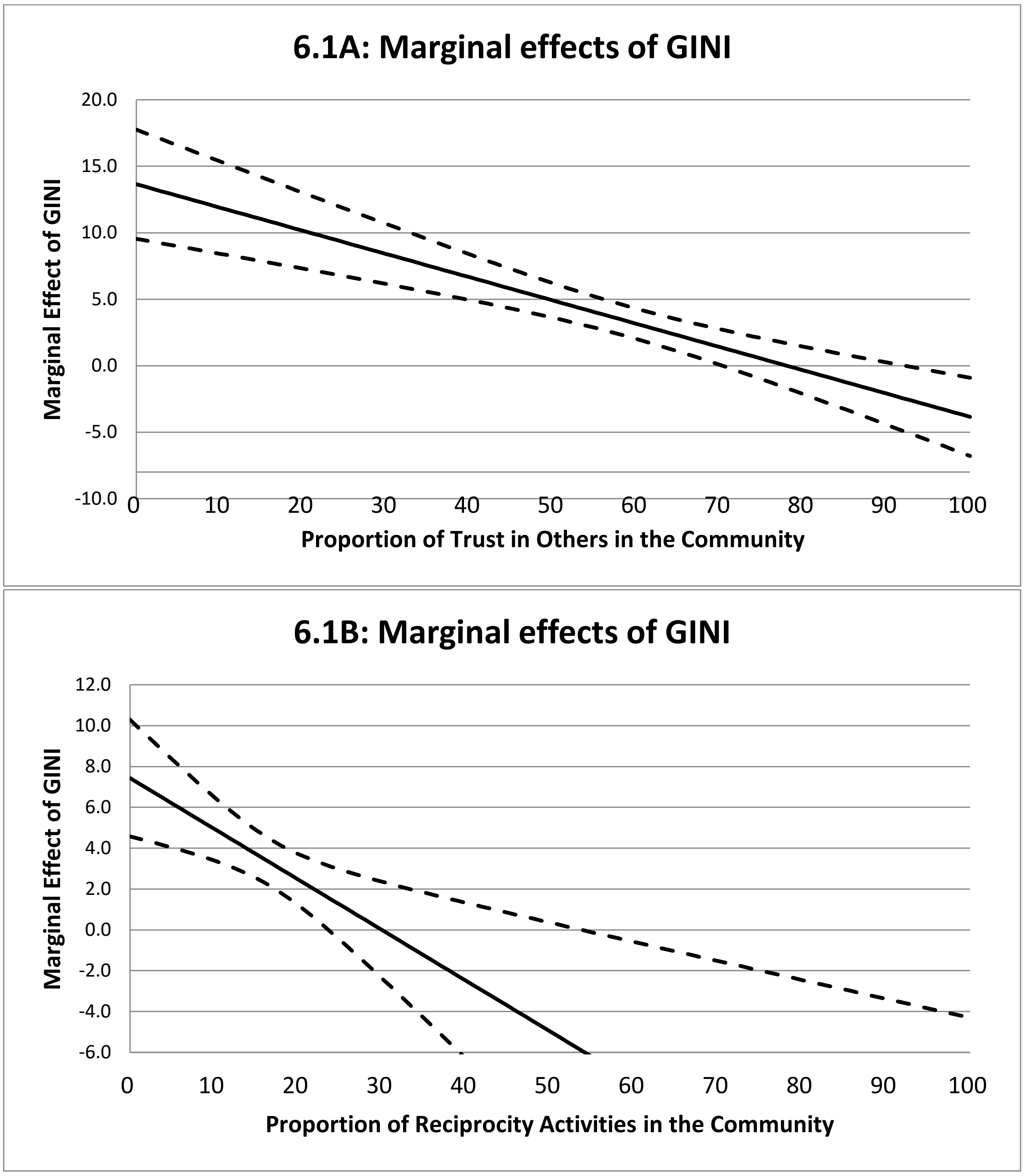
TABLE 6.5: MARGINAL EFFECTS OF INCOME INEQUALITY AT DIFFERENT LEVELS OF THE COGNITIVE SOCIAL CAPITAL (TRUST AND RECIPROCITY) AT THE COMMUNITY-LEVEL, RESPECTIVELY

Percentile CSC		**Minimum**	**1st percentile**	**5th percentile**	**10th percentile**	**25th percentile**	**Median**	**3rd quartile**	**95th percentile**	**Maximum**
Percentage CSC (%)		*0*	*25*	*37*	*43*	*53*	*63*	*73*	*85*	*93*
Trust	ME	13.65***	9.27***	7.17***	6.12***	4.37***	2.62**	0.88	-1.22	-2.62
	Std.Err.	(4.11)	(2.55)	(1.87)	(1.57)	(1.21)	(1.16)	(1.46)	(2.06)	(2.52)
Percentage CSC (%)		*0*	*5*	*8*	*11*	*15*	*18*	*22*	*29*	*40*
Reciprocity	ME	7.43***	6.19***	5.45***	4.70***	11.02***	2.97***	1.97	0.24	-2.49
	Std.Err.	(2.86)	(2.16)	(1.78)	(1.45)	(3.16)	(1.16)	(1.41)	(2.23)	(3.81)

*Notes: ME = Marginal Effect; Standard errors (Std.Err.) in parentheses, sig: * p<0.1, ** p<0.05, *** p<0.01.*

Figure 6.1A and Figure 6.1B illustrate the trends of marginal effects of income inequality with increasing cognitive community-level social capital respectively, bounded by the lower and upper limits of one standard deviation. We can find that, with the same range of the horizontal axis, the range of the vertical axis is much less in Figure 6.1B of the community reciprocity (from -6 to 12) than in the Figure 6.1A (from -10 to 20). However, the downward slope of Figure 6.1B is sharper than that in Figure 6.1A. It suggests that the proportion of reciprocity in the community can alleviate the negative impacts of the income inequality more efficient than the proportion of trust to others in the community. The standard deviations are narrower in Figure 6.1A (from 1 to 4) than in Figure 6.1B (from 1 to 13). The narrowest standard deviations of marginal effect are found around 53% of trust in others in the community, while the proportion less than 25% of the total population participated in reciprocity have much narrower standard deviation. Therefore, from Table 6.4 and Figure 6.1, the increasing cognitive community-level social capital could decrease the harmful impacts of the income inequality on the mental health of older people, but it can only work in some ranges. For the first community-level cognitive social capital, the alleviation effect of community trust is only valid less and around 66%; for the second one, the strong alleviation effect of community reciprocity is around and less than 21%. To sum up, this chapter finds evidence that community-level social capital can alleviate the negative effect of income inequality on the health status of older Chinese, however, only the effect of the cognitive component of social capital on respondents' mental health has been identified.

FIGURE 6.2: MARGINAL EFFECTS OF GINI COEFFICIENT ON DEPRESSION WITH INCREASING COGNITIVE COMMUNITY-LEVEL SOCIAL CAPITAL VARIABLES



6.4 SUMMARY AND CONCLUSIONS

This chapter uses data from two waves of the CHARLS to examine the association between income inequality, social capital and different health outcomes of the older people in China. The results show that more income inequality has a significantly negative effect on the health outcomes of older people (SRH, SRWB, cognitive function and depression symptoms), while social capital at both the individual- and community-level have significant positive effects on their health outcomes. More specifically, older residents with less social capital are more likely to suffer health problems and community-level cognitive components of social capital can mitigate the negative impact of growing income inequality on mental health measured by depression symptoms. The findings suggest that the deterioration of income inequality since Mao's era can explain about a quarter of the average level of depression in China, while both individual- and community-level social capital plays a significant role in the reduction of depressive symptoms among older people in China.

The simulation results show that the marginal effect of social capital at the community-level on mid and older people's health status is higher in relation to community-level economic reciprocity than community trust. For example, a 1 per cent increase in the trust level in a community/village can reduce the depression levels of older people by about 1.23 per cent, while a 1 per cent increase in community reciprocity can reduce the depression level of older Chinese by around 2.21 per cent. For the former, the alleviation effect of community trust is only valid for levels less than 70 per cent; for the later, the valid alleviation effect of community reciprocity is only for values less than 20 per cent. These results suggest that investment in social capital at the community-level, especially investment on cognitive components can significantly decrease depression levels directly and by mitigating the negative effect of income inequality on health status among older people in China.

To sum up, this chapter finds that widening income inequality negatively affects the health status of mid and older people in China. This chapter also finds that older people in urban China have much better health status than those living in rural areas. There is a need to improve health status among mid and older residents in China however, the evidence of this chapter is that some Chinese institutions such as the household registration (*Hukou*) and the unequal coverage of the pension system potentially have a negative effect on the health status of mid and older people. Thus, the findings of this study have several important implications for government policies aiming to support harmony in an ageing society.

7 CHAPTER SEVEN: CONCLUSIONS

Contemporary China is facing a daunting challenge in the form of its increasingly elderly population. Previous research on ageing labour markets elsewhere in the world (e.g. Börsch-Supan, 2003; Carmichael and Charles, 2003), indicates that this challenge requires the urgent attention of China's researchers and policy maker. In particular, the significant impact this will likely have on the social security system of a transition society such as China, needs to be addressed (Du, 2013). This study endeavours to suggest a new source of support for ageing societies which has particular relevance for the markedly ageing and transition society of China. The research focusses on the relationship between social capital, at both the individual- and community-level, and the health status of middle-aged, and older people in China, and also considers the impact of income inequality at the county-level. This chapter first presents a general conclusion of the findings in the present study. In addition, the strengths and weaknesses of the study, as well as the possible future direction for research on social capital and health in China, are discussed.

7.1 Research Contribution

Key issues and debates in social capital and health research include the ambiguities both in the conceptualisation and measurement of social capital, as well as the controversy in the strength and direction of the relationship between both individual-and collective-level social capital and individual health status. A considerable body of research has documented the proactive function of social capital in promoting better health (Fujisawa *et al.*, 2009; Ichida *et al.*, 2009; Kawachi *et al.*, 1999; Kim *et al.*, 2006), while others also found a negative impact of social capital on health (Veenstra, 2005). Most importantly, whether the definition and measurement of social capital in the developed western societies also applicable in the Eastern developing societies as well as the true causality between social capital and health and its effects wealth distribution in a society is still understudied.

In the field of social capital and health, there are three main studies that are important for the current study. The first, regarding the relationship between social capital and health is Kawachi and his co-authors' work "Social capital and self-rated health: a contextual analysis" (Kawachi *et al.*, 1999), by using a cross-sectional dataset–General Social Survey from the U.S.A., they found that social capital has a significant contextual effect even after adjustment for the demographic and socio-economic factors of the individuals. The second important study regarding the relationship between social capital, income inequity and health is Kawachi and his other co-authors' work "Social capital, income inequality, and mortality" (Kawachi *et al.*, 1997), also using General Social Survey they found that income inequality leads to increased mortality via disinvestment in social capital. The last and the most recent study by Shen *et al.* (2013), used the pilot data for CHARLS. Their analysis measured social capital with constructs to capture both the cognitive and structural components at both the individual- and community-level. They found that social capital measured by receiving help and perceived future help at the individual-level, and community-level social capital measured by the the variety of amenities in the village or community, were significantly and positively associated to individual self-rated health.

The first two studies have particular significance for this thesis in the way they measure social capital, however, both studies were targeted at the western developed countries–e.g. the United States. Therefore, their findings and conclusions may be not applicable to China–a country with a totally different culture and history of economic development, and thus not comparable to the present study. The most recent study by Shen *et al.* (2013) has the advantage (for this study) of using Chinese data, the pilot data for CHARLS collected in 2008. The study showed it was important to distinguish the cognitive and structural components of social capital and individual- and community-levels. However, the measures of social capital used are controversial and as the study used only one year of data it could only examine the association between social capital and older individual's health in China context and did not provide evidence of a causal relationship analysis.

Compared with the research done by Shen *et al.* (2013), the present thesis has three main advantages:

Firstly, the measures of social capital in the present study are closer to the definition in previous studies (Putnam, 1993, 1995). For example, this study measures reciprocal cognitive social capital at the individual-level by both received and provided economic supports between people over the past year, while Shen *et al.* (2013) measured this activity separately and considered it to be a structural aspect of social capital. Another example is that structural social capital is measured by whether an individual participated in social interactions, such as interactions with friends, helped others, etc., while Shen *et al.* (2013) measured older adults' family network size which is not an accepted measure of a social network. Regarding community-level social capital, this thesis uses measures based on the aggregated value of individual-level social capital variables which should provide clearer and more precise measure than the measures used by Shen *et al.* (2013).

Secondly, this research employs four additional health measures compared with Shen *et al.* (2013) which only used one self-rated general health indicator. This means that this thesis adds more detail on the relationship between social capital and different health outcomes for older people.

Thirdly, the present thesis not only focuses on the association between social capital and health status of older people, but also examines this association for younger people providing a comparison of social capital effects on individual's health status between different age groups.

Last but not the least, this study has tried to address the endogeneity issue in ther relationship between social capital at the individual-level and the health outcome of mid and older people, and provides a evidence of the causal relationship, which Shen *et al.* (2013) are unable to do.

To sum up, this thesis (1) provides new evidence on the relationship between social capital and health in China and (2) addresses issues unresolved by the limited amount of previous research that has examined this relationship using Chinese data.

7.2 HYPOTHESIS TESTING

This thesis investigated the relationship among social capital, income inequality and health status of middle and older people in China, and the result shows that social capital can significantly improve the health status of middle and older aged respondents, while it also can mitigate against the negative income inequality-health relationship, both of which provide policy implication for the increasing ageing society in China.

Specifically, using data from the China General Social Surveys (CGSSs) and the China Health and Retirement Longitudinal Study (CHARLS) dataset, this thesis focused on examining the relationship between social capital, at both the individual- and collective-levels, and individuals' health status; it assessed the role of county-level income inequality among mid and older people in China, with attention also given to the possibly different effects of social capital across gender, age groups, and rural-urban residency, as well as different *Hukou* status. Also, health in this study was measured using both subjective rankings and objective health outcomes, including self-rated health (SRH), self-rated well-being (SRWB), mental health (CES-D index), cognitive function status (episodic memory and mental intactness), and physical status (ADLs and IADLs).

The research progressed by investigating the following 13 hypothesises; a summary of the hypotheses and the related tests is shown in Table 7.1 below:

TABLE 7.1: HYPOTHESIS PROPOSED AND HYPOTHESIS TESTING

Hypothesis	Proposition	Hypothesis Testing
H1	Cognitive and structural components of social capital variables at individual-level measured by social trust, reciprocity and social interaction was significantly and positively associated with health status of Chinese individuals.	Table 4.2; Table 5.2
H1-1	Social capital is likely to have heterogeneity effects on health outcomes across different age groups, genders, regions and different registered permanent residence holders.	Table 4.3; Table 5.5
H1-2	Social capital at the individual-level could alleviate the negative age-health relation. Meanwhile the magnitude is greater in the older-age group than the younger one.	Table 4.4
H1-3	Mid and older individuals acquired cognitive component of social capital at the individual-level were significant better off than their non-acquired counterparts.	Table 5.4
H1-4	Mid and older individuals acquired structural component of social capital at the individual-level were significant better off than their non-acquired counterparts.	Table 5.4
H2	Cognitive and structural components of social capital variables at community-level measured by the proportion of social trust, reciprocity and social interaction as well as variety in the number of community amenities was significantly and positively associated with the health status of Chinese individuals.	Table 6.3 & 6.4

H2-1	Income inequality at the county-level is significantly negative in relation to mid and older respondents' health status.	Table 6.3 & 6.4
H2-2	Social capital at the community-level can alleviate the negative effect of income inequality on the health status of older people.	Table 6.5, Figure 6.1
H3	Demographic and socio-economic factors are strongly associated with Chinese adults' health.	Table 4.2; Table 5.2; Table 6.3
H3-1	The lifestyle of an individual is strongly associated with his/her health status.	Table 4.2; Table 5.2; Table 6.3
H3-2	Family and household characteristics variables play fundamental roles in determining the health status among Chinese, especial for the older people.	Table 4.2; Table 5.2; Table 6.3
H3-3	Educated people may have better knowledge regarding health input and better self-control to prevent the negative behaviour on health, thus, better health status than less educated individuals.	Table 4.2; Table 5.2; Table 6.3
H3-4	Individual income/wealth and household wealth is positive and significant related to the health status of individuals in China.	Table 4.2; Table 5.2; Table 6.3

Notes: Summarised by the author.

7.2.1 HYPOTHESIS 1 AND ITS SUB-HYPOTHESIS

The main undertaking of the research was the examination of the relationship between health and individual social capital. The first hypothesis (H1) proposed that the individual-level social capital indicators, reflecting both cognitive and structural components, were significantly associated with better health status for the respondents. Additionally, H1-2 proposed that social capital is likely to have a heterogeneous effect on health outcomes across different age groups (denoted by thresholds: <45, >45 & <60, and ≧60), gender, regions (urban and rural) and *Hukou* status (agriculture and non-agriculture). Lastly, H1-3 and H1-4 proposed that both cognitive and structural component social capital at individual-level have significant promoting effects on health outcomes among mid and older people in China, indicating that those older people who have acquired social capital are better off than their counterparts who have not.

This study provides empirical evidence to affirm H1 and its sub-hypothesis from H1-1 to H1-4 using different datasets–CGSS and CHARLS. Although the social capital variables were measured somewhat differently in the different datasets due to data limitations, all the measures used in this study reflects the definition of social capital in Chapter 3 that they distinguish between cognitive and structural aspects at both individual-level and community-level. Specifically, the individual-level cognitive component of social capital was measured by variables capturing social trust and mutual help (reciprocal activity), while the structural component of social capital was measured by whether the person has a membership of a group or organisation (including religion, the Chinese Communist Party and unions) and whether the person participated in certain social interaction activities (including interaction with friends, charity work, social activities, and any other kind of group events.

7.2.1.1 Hypothesis 1

The indicators for social capital were measured on a continuous scale in Chapter 4 using factor analysis and a set of dummy variables in Chapter 5 and 6. In Chapter 4 the indicator of the cognitive component of social capital reflects social trust and was measured on a continuous scale (the greater value, the higher level of trust in others). In Chapters 5 and 6 the comparable indicator is a binary variable (0 = not trust in others; 1= trust in others). The analysis controlled for a range of individual-level (demographic and socio-economic) factors that were found to be important in the initial analysis (Hawe and Shiell, 2000). The results show that social trust is significantly associated with good health status measured by SRH (Model 1 in Table 4.2, Model 1 in Table 5.2 and Model 1A in Table 6.3), SRWB (Model 2 in Table 4.2, Model 2 in Table 5.2 and Model 2A in Table 6.3), cognitive function (Model 3 in Table 5.2 and Model 3A in Table 6.3), mental health (Model 4 in Table 5.2 and Model 4A in Table 6.3) and physical health (Model 5 in Table 5.2 and Model 5A in Table 6.3). Social trust has been regarded as a key indicator of the cognitive component of social capital and the positive association between cognitive social capital and better health among elderly people has been recorded in western cultural settings (Kawachi *et al.*, 1999; Veenstra *et al.*, 2005). This study further confirms the importance of cognitive social capital in Chinese cultural settings.

Chapter 5 and Chapter 6 employ additional measures of social capital. These include a measure of the perception of the availability in the future of help if needed and unpaid support available from others (including relatives and non-relatives) as an additional proxy of social trust. The positive significance of this variable in the estimations testifies to the legacy of traditional cultural values – *'Yang-Er-Fang-Lao'* and *'Yuan-Qin-Bu-Ru-Jin-Lin'* in China. *'Yang-Er-Fang-Lao'* which as a concept translates as support by offspring in old-age; it is considered a vital constituent of the Confucian sense of moral duty or devotion to one's elderly kith and kin. Local and Central government benefit from the practical value of such a support system in economic terms. However, recent trends have somewhat eroded traditional moral duties. Nonetheless, the influence of Confucian values on the Chinese outlook persists and may affect perceptions of health. Especially in the poor rural areas where elderly residents have to rely on their adult children to provide economic support and informal care due to the relative lack of either government-assisted programmes or facilities for old-age support compared with their urban counterparts (Shen *et al.*, 2014; Shen and Yeatts, 2013).

Reciprocity (mutual help) measured by whether the respondent had both received and provided economic support to others in the past year was used as another indicator of individual-level cognitive social capital. This was also found to be significantly related to health status (cognitive, mental and physical health) of mid and older people health (Table 5.2, Model 3 to Model 5 or Table 6.3, Model 3A to 5A), and significant associated with cognitive function and physical health, but manifested in negative effects on their mental health (Table 5.2, Model 4 and Table 6.3, Model 4A). The direction of this association is contrary to that proposed in H2 partly. One possible explanation for this negative association is that the poorer a person's health, the more likely the person received economic help from others, while the better the relative economic status of an individual the more likely she/he provides economic help to others. Therefore, economically-based reciprocal activities could reflect poor health and also result in a subjective (health) burden for some respondents particularly those with low socio-economic status (Shen and Yeatts, 2013).

The main measure of the structural component of the social capital variable, social interaction/participation, was found to be significantly associated with respondents' health status. The continuous scale of social interaction/participation in Chapter 4 measures the frequency of respondents taking part in any social interaction activities (in the past month). This was significantly and positively associated with both SRH and SRWB: the more frequently the respondent took part in social interaction, the higher the odds ratio of them reporting a better (at least fair) SRH and SRWB. Social interaction/participation was recorded using binary variables in Chapter 5 and 6 to indicate separately the different social activities that respondents participated in during the past month, including interaction with friends, charity work, social activities, and any kind of group events. Although most of these social interactions/participation were statistically and significantly associated with better health status for most of the health outcomes (Table 5.2 and Table 6.3), the results indicated that participation in charity work was insignificantly related to SRWB, mental and physical health outcomes. Also, participation in social activities and any kind of group events was not related to the physical health of mid and older people in China.

An additional set of dummy variables recording aspects of the structural component of social capital at the individual-level were religious group membership, communist party membership and union membership. These three structural component social capital variables were found to be positively associated with respondents' SRH and SRWB. Although these three variables were all significantly positively related to respondents' SRWB (Table 4.2, Model 2), membership of a religious group, the communist party and unions were either insignificant or negatively and significantly associated with respondents' SRH (Table 4.2, Model 1). One possible explanation for this mixed association between these three structural social capital variables and the two health indicators (SRH and SRWB) is that being a member of a religious group or a union bring little benefit and perhaps even harms the health status of Chinese individuals. This may reflect that the incidence and scope of religious activities and unions is quite low in China. Therefore, participators may not be able to benefit from membership, regarding their access to social capital, as much as they might in other countries. In contrast, they could be relatively isolated so that belonging to a religious group may actually be detrimental to one's health and negatively impact one's prosperity. However, the mechanism behind the mixed results of these three structural social capital remains unclear and need further investigation (Chan, 2004; Kleinman and Good, 2004).

To summarise, social trust and social interaction/participation are regarded as key indicators of cognitive and structural social capital, and a positive association between both cognitive and structural social capital and better health among elderly people has been recognised in western cultural settings (Kawachi *et al.*, 1999; Veenstra *et al.*, 2005). This study also attests to the important role of individual-level cognitive and structural social capital in a Chinese setting in support of H1. The inherited core beliefs in social engagement and involvement are still at the heart of Confucian values in Chinese society. The concept of *Guan-xi*, 'one more friend, one more chance' underscores the positivity that friendship brings adding to one's well-being all round. Despite the potential erosion of such values through the forces of globalisation which have led to the breakup of some networks, it is still a potent stimulus for social interaction–social capital–particularly for the older members of the Chinese community who are perhaps less socially connected than if they were in paid work.

7.2.1.2 Hypothesis 1-1 to 1-4

The results of Table 4.3 in Chapter 4 and Table 5.5 in Chapter 5 also support the existence of heterogeneous effects of social capital on health outcomes across different age groups, genders, regions and *Hukou* holders. For example, the magnitude and significance of the effects on the health of cognitive social capital (social trust) and structural social capital (social participation/interaction) were higher and significant for older-age groups (row 2–4 in Table 4.3; column 1 & 2 in Table 5.5). The results also show that the positive effects of both cognitive and structural component of social capital on health status was greater and significant for females than for males (i.e. social trust, and interacted with friends, etc.). However, regarding the reciprocity and social activities, the positive effect on health was greater for Chinese males (Column 3 & 4 in Table 5.5). In terms of the heterogeneous effect of social capital on health status across different regions and *Hukou* holders, the results were mostly consistent (row 7–10 in Table 4.3; columns 5–8 in Table 5.5). For example, respondents living in urban areas benefited more from social activities (i.e. with 0.896 and significant at 1% level on the cognitive health in Column 5 of Table 5.5) relative to their rural counterparts (i.e. with 0.225 and insignificant on the cognitive health in Column 6 of Table 5.5), while respondents with a non-agricultural *Hukou* benefited less from social activates (i.e. with 0.508 and significant at 10% level on the cognitive health in Column 8 of Table 5.5) compared with their agriculture counterparts (i.e. with 0.520 and significant at 1% level on the cognitive health in Column 7 of Table 5.5).

Furthermore, to investigate whether social capital plays a more important role in the health of older people, potentially alleviating the negative effects of age on health (Grossman, 1972), interaction effects were included in the analysis. While it is clear that health decreases as peoples' age increases, and the results indicate that there is a small effect from some social capital variables (social trust, social interaction, communist party membership and union membership) on the age-health relationship (Table 4.4) that appears to reduce the negative effect of age on health (both subjective health and well-being). Thus, the empirical results are consistent with H1-2.

Finally, the causal analysis in Chapter 5 used the PSM/DID methodology (Table 5.4) to confirm that both the cognitive and structural components of social capital at the individual-level significantly enhance the health of older respondents in China, particularly the cognitive health of individuals. This was shown for three of the objective measures of health that were used in this analysis (cognitive function, depression symptoms and physical health). However, the study was not able to demonstrate that there is a causal relationship between some social capital variables and some health status (i.e. reciprocity on mental and physical health outcomes in Column 2 & 3 of Table 5.3). To sum up, the results are in the main consistent with H1-3 and H1-4.

Therefore, the above empirical results are mostly consistent with H1 and its sub-hypotheses H1-1 to H1-4. The results demonstrate that both cognitive and structural social capital at the individual-level, reflected by measures of social trust, social interaction/participation, religious group membership, communist party membership, and union membership, are not only positive and significantly associated with individual health status, but also that some forms of social capital (social trust and social interaction) can help to alleviate the effect of age on older individuals' health outcomes (SRH and SRWB), as well as to demonstrate that older people could have better health if they could acquire social capital in either cognitive or structural aspect at the individual-level (particular for the cognitive function health).

7.2.2 Hypothesis 2 and its sub-hypothesis

7.2.2.1 Hypothesis 2

The second task in this thesis was to investigate whether and how the community-level social capital variables were significantly related to health status among older people in China. The second hypothesis (H2) proposed that the community-level social capital indicators, including both cognitive and structural components, were significantly associated with better health status among older respondents even after individual-level social capital has been controlled (Table 6.3). Specifically, the former was measured by the proportion of residents who trust in others in the community/village, and the proportion of residents who engaged in the reciprocity activity within the community or village; while later was measured by the proportion of respondents who engaged in certain social interactions over the past month in the community/village, and the variety of amenities available in the community/village. This thesis uses the CHARLS dataset and a multilevel strategy to test H2 by examining whether there is a significant correlation between community-level social capital variables and five health outcomes among a sample of older Chinese respondents.

These results indicate a strong and positive correlation between community-level social capital and good health status that is separate from the effect of individual-level social capital. One key indicator of cognitive social capital at the community-level, the proportion of social trust (residents who trust in others) in the community/village, was found to be a significant predictor of good SRH (Table 6.3, Model 1A) and better cognitive function (Table 6.3, Model 3A) as well as mental health (Table 6.3, Model 4A) among the respondents in this thesis. Scholars have argued that living in a neighbourhood or community where there is a high level of trust among residents is a key indicator of social capital at the neighbourhood, community or state-level (Kawachi *et al.*, 1997; Kawachi, 1999; Shen *et al.*, 2013; Skrabski *et al.*, 2004). A higher level of trust in the living environment may influence the health of its residents by providing a safer and trusting social environment, facilitating mental health and even controlling some deviant behaviours in the neighbourhood or community (Gilson, 2003; Kawachi *et al.*, 1999; Kawachi *et al.*, 1997; Putnam, 1995; Subramanian *et al.*, 2002).

However, the second indicator of cognitive social capital at the community-level, the proportion of reciprocal activities in the village or community, was found to be a significant predictor of worse mental health status among respondents. This is in line with the results for the corresponding individual-level measure and may be because the measure of reciprocity in this research is based on economic reciprocity (both receipt and provision of economic help over the past year). As discussed in previous chapters, in this context provision as well as receipt of economic support may be associated with burdens that impact on health status, particularly mental health condition and more so among lower socio-economic groups. For example, if an individual receives financial help from non-core relatives and they are not able to pay this back, this may be regarded as a signal of poverty which may, in turn, be associated with indignity even if the individual sourcing the support does not automatically expect a return in the future. In this respect, older people in China are more likely to have very traditional and conservative attitudes in relation to economic dependence and reciprocity. Hence, a high level of economic reciprocity in a village or community may be associated negatively with dependence and impact on mental health.

The first indicator of structural social capital at the community-level, the proportion of social interactions in the community (Table 6.3, Model 3A) appears to be important for increasing the cognitive function of older Chinese people. As noted in Chapter 3, this is in line with the evidence of Islam *et al.* (2006) who use rates of voting participation as a proxy of social interaction (social capital) at the area-level. They found that social interaction is a key determinant of better health although the magnitude of the effect is quite small. Similarly, Lochner *et al.* (2003) found that the civic participation rate (as a proxy of social capital at the neighbourhood- or community-level), was significantly associated with lower neighbourhood death rates in Chicago. However, a study done by Poortinga (2006), using the European Social Survey dataset, indicated that the aggregated measures of social trust and civic engagement at state-level did not correspond well with the SRH of residents. However, Poortinga's (2006) notes that there is a complex cross-level interface effect and that trusting and socially committed respondents from states with high levels of social capital reported better health than those with lower levels of trust and community involvement. Poortinga's study suggests that there is no guarantee of uniformity of the potentially beneficial effects of social capital within a shared space. This thesis, on the whole, supports these findings. The results indicate that social interaction at the community-level is positively associated with cognitive function, a measure of the health and functioning of the brain, and therefore linking social capital and cognitive ability. This is an evidence of a significant relationship between the social environment (reflected in the social interaction/participation rate) and individual objective health outcomes and as such this evidence enhances knowledge within the field of public health and social capital-elderly health relations.

The last key indicator of the structural component of social capital at the community-level, number of different amenities available within the village or community that the residents can access, was found to be a significant predictor of good SRH (Table 6.3, Model 1A) and better cognitive function among this sample of older people (Table 6.3, Model 3A), and less depression symptoms among the respondents in this study (Table 6.3, Model 4A). Scholars have argued that neighbourhood or community-based organisation is a key determinant of a better health status for its residents because these facilities and organisations may induce more collective actions, such as social participations and interactions. Such activities may influence health status positively for some reasons including the possibility that more activities of this kid may be an indication of the availability of more social services which should facilitate health information or even control some deviant behaviours (Putnam, 1993; Pigg and Crank, 2004; Shen, 2014).

7.2.2.2 Hypothesis 2-1 & 2-2

Table 6.3 in Chapter 6 indicates that income inequality at the county-level is significantly and negatively associated with some health outcome (SRH, cognitive function and mental ill-health) among the sample of older respondents which is in line with Hypothesis 2-1 (H2-1). Complementing H2-1, Hypothesis 2-2 (H2-2) proposed that the impact of the social capital at the community-level could alleviate the negative effect of income inequality on the health status of older Chinese. However, the results indicate that only cognitive social capital at the community-level can alleviate the negative association between income inequality and mental health status (Table 6.5).

Overall, the results indicate that most of the measures of the cognitive and structural components of social capital at the community-level were significantly associated with most of the measures of the health status of respondents. This evidence is consistent with H2. The results suggest that structural social capital at community-level is an important determinant of health status among mid and older-age people. In contrast, the effect of cognitive social capital at the community-level, measured by the proportion of economic reciprocity/mutual help in the community is insignificant or negative. As discussed this suggests that a high level of economic reciprocity/mutual help in a village or community could be an indication of dependence reflecting need. This could manifests as a mental burden for mid and older Chinese people even if traditional Chinese culture emphasises that 'courtesy demands reciprocity' ('*Li-Shang-Wang-Lai'* in Chinese). The results may imply that the traditional Chinese cultural values in this respect are becoming weaker with economic development (Fukuyama, 1995). The results also indicate that the cognitive aspect social capital may reduce some negative effects of income inequality on mental ill-health. For example, the proportion of social trust in the community reflecting that people are more trusting may result in fewer depression symptoms among residents. In conclusion, the above results are largely but not completely consistent with Hypothesis H2 and its sub-hypothesis H2-1 to H2-2.

7.2.3 HYPOTHESIS 3 AND SUB-HYPOTHESES

The last aim of this study was to examine the link between demographic and socio-economic factors and individual health status. The third hypothesis (H3) of this study is that the demographic and socio-economic factors including age, gender, education, marital status, and rural-urban status are strongly associated with adults' health. While the related sub-hypothesises are that lifestyle (H3-1) and some family/household characteristics (H3-2, e.g. household size, annual household income and living condition etc.) are strongly associated with health status of respondents, as well as their educational attainment (H3-3), individual income and/or household income per capita (H3-4) is positively associated with health status among Chinese people, indicating that higher educational attainment, or higher individual and/or household income per capita, results in better health status of older Chinese.

Empirical results from Chapter 4 to Chapter 6 provides statistical evidence to evaluate H3 and its sub-hypothesis H3-1 to H3-4 affirmatively. Most of the demographic and socio-economic variables were discovered to be strongly associated with health status in the Chinese adult respondents. The statistical results from this study support the importance of demographic and socio-economic factors at the individual-level in influencing health status among Chinese adults. Specifically, statistical results in Chapter 4 to Chapter 6 using the CGSS and CHARLS datasets, and employing ordered and binary regression (Chapter 4), OLS regression (Chapter 5) and multilevel regression (Chapter 6), show that the following individual and household level variables significantly impacted different aspects of individual health (see Table 4.2 & 4.3, Table 5.2 and Table 6.3): age, gender, race (in Chapter 4); educational attainment, marital status, and health insurance (in Chapters 5 and 6); working status (0=Not working; 1=Working), *Hukou* status (agriculture and non-agriculture), total annual income (logarithmically transformed) and resident-ship (urban or rural); some lifestyle variables (in Chapter 5 and 6) captured by including a participation in physical exercise dummy variable, the number of cigarettes consumed per day, and a consumption of alcohol dummy variable; some household characteristics, such as number of sons and daughters in the household (employed in Chapter 4 as a proxy of household size), the actual household size (the total number of people within the household) and whether the respondent was living with a child (in Chapters 5 and 6); household labour participation rates (in Chapters 5 and 6); proxy measures of household wealth including annual household total income (in Chapter 4, logarithmically transformed), per capita annual household income (in Chapters 5 and 6), self-rated household socio-economic status (in Chapter 4), and the total current value of long-lasting assets (in Chapters 5 and 6, logarithmically transformed). The main results are discussed further below.

7.2.3.1 Hypothesis 3

This section discusses the demographic and socio-economic as well as other control factors in more detail. Due to the data availability, Chapter 4 examines only SRH and self-rated well-being (SRWB) for respondents in CGSS dataset, while Chapters 5 and 6 can investigate three additional health outcomes including measures of cognitive function, mental health and physical health. The results for SRH and SRWB are varied slightly for the estimations undertaken in Chapters 4 and Chapters 5 and 6 as shown in Table 4.2 and Table 5.2. This is understandable since they were estimated using different datasets. Older-age was a significant predictor of poorer SRH (Table 4.2, Model 1) and cognitive function (Table 5.2, Model 3). However, older respondents reported a higher chance to report "at least fair" SRWB (Table 4.3 or Model 2 in Table 5.2) compared to their younger counterparts.

Female respondents consistently reported worse SRH (Table 4.2, Model 1), worse cognitive function (Table 5.2, Model 3) and worse mental health (Table 5.2, Model 4), while they reported better SRWB (Table 4.2, Model 2 but insignificant) and physical health (Table 5.2, Model 5) compared to their male counterparts.

The *Han* are the main ethnic group in China. However, there are some minority ethnic groups. To investigate whether ethnicity is a determinant factor of individual health status, a dummy variable race was included in the regressions (Chapter 4, 0 = otherwise and 1 = *Han*). The results indicate that *Han* ethnicity does not bring any benefit to health and well-being among respondents in CGSS dataset. Instead, the results show that the minority ethnic groups have not significant better SRH and SRWB than the majority *Han* group (Table 4.2).

The results of this study also indicate that marital status is significantly associated with SRH (Table 4.2, Model 1), SRWB (Table 4.2, Model 2), cognitive function (Table 5.2, Model 3), and mental health (Table 5.2, Model 4). This finding is consistent with previous studies in the Chinese contexts (Subramanian *et al.*, 2002; Shen *et al.*, 2014; Xue *et al.*, 2016).

Respondents with a non-agricultural *Hukou* consistently reported better SRH and SRWB (Table 4.2, Table 5.2 and Table 6.3), cognitive function (Table 5.2, Model 3; Table 6.3, Model 3A), mental health (Table 5.2, Model 4; Table 6.3, Model 4A) and physical health (Table 5.2, Model 5; Table 6.3, Model 5A) compared to their counterparts with an agricultural *Hukou*. The results could be caused by the disparity in resource allocation resulting from the *Hukou* for agricultural and non-agricultural *Hukou* holders (Afridi *et al.*, 2015). Perhaps for the same reason, respondents in urban areas reported better SRH (Table 4.2), SRWB (Table 4.2) and cognitive function (Table 5.2, Model 3 and Table 6.3, Model 3A) compared to their counterparts in rural China. The significant impacts of *Hukou* system and rural-urban residence-ship is consistent with the findings of previous studies in a Chinese context (Zimmer *et al.*, 2010a, 2010b; Shen *et al.*, 2014).

7.2.3.2 Hypothesis 3-1 to 3-4

However, the impact of some indicators of lifestyle choice (participated in physical exercise last week, number of cigarettes consumed per day and consumption of alcoholic drinks last year) and some family and household characteristics (number of son or daughters, household size, and living with a child), were positively and significantly associated with some health indicators, while others were negative significantly or even insignificantly associated with health status. For example, living with a child seems to have no significant effect on SRH, SRWB and cognitive function, however, it was significantly and negatively associated with mental health and physical health as shown in Table 5.2 (Model 4 and Model 5) and Table 6.3 (Model 4A and Model 5A). These empirical results are only partly consistent with Hypotheses H3-1 and H3-2.

The results also show that educational attainment, work status (1 = working; 0 = not working), individual total annual income (logged), annual household income per capita (log), and household wealth (self-rated household SES, total current value of long-lasting assets), were significantly and positively associated with all five health outcomes, including SRH (Table 4.2, Table 5.2 and Table 6.3), SRWB (Table 4.2, Table 5.2 and Table 6.3), cognitive function (Table 5.2, Model 3 and Table 6.3, Model 3A), mental health (Table 5.2, Model 4 and Table 6.3, Model 4A), and physical health (Table 5.2, Model 5 and Table 6.3, Model 5A). This supports the significantly positive relationship found in previous research studies between good health status and educational level, individual income level and household income per capita level (Fujisawa *et al.*, 2009; Subramanian *et al.*, 2002; Shen *et al.*, 2014; Xue *et al.*, 2016). Thus, H3-3 to H3-4 were generally supported.

7.3 Policy and Practice Implications

Currently, China is undergoing a demographic transition–a growing ageing society, which will bring several challenges to its developing social security and health systems. To deal with the challenge caused by the increasing ageing population, China's government has introduced several policies, for example, the progressive extension of the retirement age over the following decade which was proposed by the central government in order to encourage older employees to work for longer (CCTY, 2016); and some developed regions in China have implemented a "regional and international cooperation strategy plan" specifically to address population ageing (Economic and Social Commission for Asia and the Pacific, 2003). Furthermore, the Chinese central government has officially established community-based service networks to help residents living within a certain geographical parameter of an official administration since the 1980s (Bray, 2006; Xu *et al.*, 2005; Yan and Gao, 2007; Xu and Chow, 2006). The importance of this community-based service network system for the enhancement of the quality of life and health status of mid and older aged Chinese has recently been emphasised by academics (e.g. Shen, 2014) and the Chinese central government (Li, 2016). This thesis endeavours to provide some policy implications to aid Chinese policy makers in this context and specifically in relation to the role of social capital in an increasingly ageing and transitioning society.

Four main implications for policy and practice follow from the empirical results in this thesis. Firstly, since social capital is a multidimensional concept (Woolcock and Narayan, 2000; Portes, 1998), the role of social capital in influencing individual health reflects the different dimensions of social capital and can have different and even contradictory impacts. Previous empirical evidence based on correlations between social capital and individual health finds an inconsistent relationship regarding the direction of the effect of social capital on individual health status. Different results have been found by studies that have focused on different countries, regions and different communities within different social systems including that of China (Subramanian *et al.*, 2002; Lochner *et al.*, 2003; Veenstra, 2005; Fujisawa *et al.*, 2009; Shen *et al.*, 2014). For example, on the one hand, social trust and reciprocity (or mutual help) have been recognised as significant predictors of good health in America (Subramanian *et al.*, 2002) and Japan (Fujisawa *et al.*, 2009) as well as China (Shen *et al.*, 2014). In contrast, it was found that social trust and reciprocity (or mutuality/mutual help) were insignificant regarding health status in a study of Canadians (Veenstra, 2005). Some studies have also suggested that the relationship between social capital and health in Asian societies is different from that in the western societies (Islam *et al.*, 2006b; Yip *et al.*, 2007; Shen *et al.*, 2014; Fujisawa *et al.*, 2009).

This study has tried to clarify the causal nature of the relationship between different aspects of social capital and the health of older people in the cultural context of Chinese society. The study provides empirical evidence of the link between a variety of dimensions (or aspects) of social capital and individual health status in the cultural context of China. The work additionally examined the impact of social capital at both the individual and community levels. It deployed different national datasets with the aim of providing a more complete analysis of the relationship between social capital and health status in China, for the wider population and for older people in particular. The empirical method also tested for causality in the relationship between social capital and individual health status.

In the individual-level analysis five different measures of health were used to indicate health outcomes (SRH, SRWB and measures of cognitive function, mental health and physical health). The measures of social capital captured the individual's level of trust in others (captured by perceptions about the likely receipt of unpaid health care from relatives and non-relatives in the future in Chapters 5 and 6)), mutuality of action (reciprocity) and social engagement (interactions and participation including membership of public groups or organisations such as the CCP). The main results indicated that social trust and social engagement are the aspects of social capital that are most consistently linked to health. This evidence suggests that investment in this kind of social capital could help to improve and maintain the health of older people in China. However, the mutual provision of support among people 45 and over, measured in terms of economic reciprocity (whether the respondent had received and provided any economic help from others over the past year) was found to be negatively related to health status (particularly mental health).

Second, the evidence of the study highlights the influence of cultural legacy on health. Among all the indicators of social capital at the individual-level used in this study, social trust was consistently positively and significantly associated with the five health outcomes. This is important since a majority (70%) of the CHARLS sample indicated that they had confidence (trusted) in the receipt of future care from blood relatives (largely children and grandchildren). Such faith in familial relationships suggests that the Confucian cultural legacy of filial piety in respect of adult children's duties and obligations in taking care of the older generation, is still a strong factor in Chinese people's lives. Accompanying China's economic reform and development and increasing globalisation since the 1980s, tremendous social and economic transformations have taken place over recent decades in China, including a rapid change in cultural values and lifestyles from a combination of Taoism and Confucianism to more modern and western thought (Shen *et al.*, 2014). However, "*Xiao-Dao*" (filial piety) seems to have been retained as a legacy of long-standing Chinese culture and still influences the social behaviour and expectations of Chinese people, perhaps particularly so among the older people represented in the CHARLS sample.

Thirdly, the evidence of this study suggests that investments in the community-level social capital could be a new way for Chinese policy makers to ensure better health status and a safer living environment for the older people in China. Specifically, the statistical results in Chapter 6 showed that investment in community infrastructures, such as social amenities, recreational facilities, and community-based organisations, play a fundamental role in improving health status (especially for cognitive function and mental health) among older Chinese people. Therefore, the development of community infrastructures may be especially useful for poorer communities in poorer regions. Furthermore, developing community infrastructures and community-based organisations could potentially improve the performance and enhance the role of the community or village committee, the lowest level administrative organisation in China. Thus, the community or village committee could provide more social security services for older people (including retirees, the infirm, physically challenged, widowers, widowed, and childless individuals and couples). With the changing patterns of the family structure discussed in Chapter 2, many older Chinese people have had to or may need to re-focus their traditional perspective on the informal "*Yang-Er-Fang-Lao*" support system (i.e. from their next generation) to a more modern formal support system (i.e. social support or government assistance). It maybe the legacy is just in the beliefs and expectations of older people, but in reality, their expectations may not be met. According to Tang (2007) and Shen *et al.* (2013), more and more young Chinese want the society or government to share some of the responsibilities of providing help and support for older people. Developing such community or village-based amenities and associations or organisations would provide collective resources for older people and could also assist in advocating the rights of older citizens. These amenities and associations or organisations could also help to maintain traditional Chinese cultural values such as respect for the aged and promoting mutual aid as well as mutual help.

Lastly, this study has shed some light on the complicated interrelations between the distribution of household wealth, social capital, and individual health status. The evidence of previous studies (Chen and Fleisher, 1996; Kanbur and Zhang, 1999; Zhou, 2000) and Chapter 6 in this thesis, is that there is a wide income gap between the rich and poor in China. Although China's economic growth has accelerated in recent decades, only a small proportion of the population have enjoyed the full benefits of economic growth; consequently, income inequality has become a serious social and economic issue (Chen and Fleisher, 1996; Kanbur and Zhang, 1999; Zhou, 2000). The results in Chapter 6 show that respondents with lower household income per capita reported poorer health status (specifically mental health) and less social capital than those with higher household income. Respondents living in the coastal areas of China, including the most dynamic provinces (i.e. Shanghai, Zhejiang, Jiangsu, Guangdong) have experienced rapid economic growth, manifested in the growth of private enterprises as well as significant family business and small-scale industrialisation, leading to higher household income per capita, more social capital (e.g. in terms of social amenities) and better health outcomes than in the centre and west of China. Meanwhile, most of the population in the provinces in central and western China continue to eke out a living through traditional agriculture, especially in the rural areas. These differences are reflected in the interrelationships between rural-urban resident-ship, *Hukou* status, social capital and health examined in Chapter 5 and Chapter 6.

7.4 STUDY STRENGTHS

The strengths of this thesis are fourfold. First, since social capital is difficult to measure, this research has utilised a range of simplified and objective measures in the analysis. Previous studies have used measures of social capital based on subjective values (Brehm and Rahn, 1997; Glaeser *et al.*, 2002; Veenstra, 2000) or community/neighbourhood measures (Kawachi *et al.*, 1999, 1997); a few studies have used multilevel measures of social capital on health status (Shen *et al.*, 2014; Islam *et al.*, 2006a; Hamano *et al.*, 2010). One problem with such measurements is that personal perceptions are likely to be influenced by the unobservable characteristics of the individual respondent (Poortinga, 2006), while indicators of community or neighbourhood perceptions are unlikely to include the influence of social capital at the individual-level. This thesis followed previous multilevel studies (Shen *et al.*, 2014; Islam *et al.*, 2006a; Hamano *et al.*, 2010) and avoided these issues by measuring social capital at both the individual- and community-level within an econometric model. Individual-level social capital is measured with individual-level data (social trust, mutual help and social participation/interaction) while the community-level social capital is captured by aggregating individual-level data to the community-level. Also, the concept of social capital operationalised in this research followed the definition and classification by Bourdieu (1985, p. 248) and Harpham *et al.*, (2002) in incorporating both structural and cognitive dimensions. Thus, this thesis provided empirical evidence relating to the effects of most of the recognised dimensions and levels of social capital on individual health status.

Second, this study presents a more complete picture of the health status of older people in China by measuring their health status using five health outcomes: SRH, self-rated well-being (SRWB), and measures of cognitive function, mental health, and physical health. On the one hand, findings from this study show that there are differences in the effects of social capital on different health outcomes. For example, whether an older respondent engaged in mutual help (reciprocity) is positively and significantly associated with cognitive and physical health, whereas it is negatively and significantly associated to SRH and the incidence of depression symptoms. On the other hand, there are also some similar patterns regarding the effects of social capital across the five health indicators. For example, measures of social trust and social interaction or participation at the individual-level are consistently positive and significant predictors of all five health outcomes.

Third, this study examined the causal relationship between social capital and individual health status using PSM/DID methods and found that some aspects of social capital can significantly improve some health outcomes among older Chinese people. For example, older people who participated in socially-interactive activities such as group/sporting events have a better cognitive function, fewer depressive symptoms and better physical health than those who were not participating in such activities. This thesis is the first study to employ PSM/DID to investigate the causality between social capital and health to deals with the potential endogeneity in the social capital-health relationship. In so doing it provides strong empirical evidence of the potentially positive effect of social capital on the health status of older people. Moreover, the present study also shows that most forms of social capital can play a significant role in improving health outcomes (particularly cognitive function) of relatively disadvantaged older people: those aged 60 and above, older women, rural residents, and agricultural *Hukou* holders.

Finally, this study examined the impacts of social capital at both the individual- and the community-level by employing a multilevel strategy. The fact that individuals are clustered in the same communities or villages means they may share similar health outcomes. The multilevel strategy enables this thesis to distinguish the effect of higher (community) level factors on lower (individual) level dependent variables (health outcomes) by allowing for a random-effect at the higher level. Thus, it is able to avoid a distorted correlation. Moreover, the study investigates the interrelationships between household income inequality, social capital and individual health status. The analysis finds that, among older people in China, household income inequality has a negative and significant impact on most health outcome. However, the multilevel models indicate that cognitive social capital at the community-level (captured in the analysis in section 6.3.3) can mitigate the negative effect of household income inequality on the health status of Chinese older adults. The simulation results also show that the marginal (moderating) effect of community-level social capital (on income inequality) for older people's health status is greater for communal reciprocity (captured by mutual economic help) than community trust. One policy implication is that local government could improve community health by supporting the community or village committee to establish a financial platform to enable older people in the same community/village to help each other.

7.5 STUDY WEAKNESSES

However, there are also some limitations of this study. Firstly, although the two datasets, CGSS and CHARLS, used in the thesis are nationally representative and contain significant numbers of observations (Shen *et al.*, 2014), these two datasets have their own limitations: the former focuses on social issues in China. Thus, it contains real social capital variables at the individual-level. However, it includes only a few health indicators (SRH and SRWB) and lacks measures of community-level social capital. It is also a continuous 4 years cross-sectional dataset (2010 to 2013) based on different observations. Thus, it is not possible to investigate causality (or resolve the endogeneity issue) using CGSS. In contrast, CHARLS is a short panel dataset and contains a variety of health indicators. Thus, CHARLS allows us to investigate causality between social capital and different health indicators. However, CHARLS focuses more on health-related issues than social issues. Thus, proxies of individual-level social capital (i.e. social trust) have to be employed in the empirical analysis, and these are likely to be associated with measurement errors that could bias the results. The results regarding causality between individual-level social capital and health outcomes in Chapter 5 should not, therefore, be extrapolated to unmeasured dimensions of social capital.

Secondly, and following on from the above, the availability of community as well as individual-level social capital in CHARLS is limited. Consequently while in Chapter 5, seven indicators were deployed to measure older people's social capital at the individual-level, four of these measures were used in Chapter 6 to construct measures of community-level social capital. Most of the measures used are consequently proxies for the various types of community-level social capital identified in prior literature, namely, civic or social trust, mutual help, close relationships, social interaction or participation, and affiliation with a group or organisation (Putnam, 2000; Rocco *et al.*, 2014; d'Hombres *et al.*, 2010). These proxies are likely to be associated with measurement errors that could bias the results.

Thirdly, previous studies have suggested that there may be a reverse causality between social capital and health (Subramanian *et al.*, 2002; Shen *et al.*, 2014; Rocco *et al.*, 2014). For example, worse health status may lead to a lower level of social capital or its acquisition. Although Chapter 5 tested for this possible reverse causality and endogeneity in the link between individual-level social capital and health or between individual-level socio-economic factors and health, the study does not test for possible reverse causality and endogeneity in relation to community-level social capital and individual health outcomes in the multilevel model that includes measures of both individual-level and community-level social capital. Because this thesis assumed that community-level social capital is an exogeneity factor in the social capital-health relation. Consequently, the potential existence of reverse causality and endogeneity issues should not be dismissed in relation to community-level social capital.

Finally, this study is limited as there may be some selection bias in the analysis in Chapter 5. This employed PSM/DID in order to address the possibility of reverse causality and endogeneity in the relationship between individual-level social capital or socio-economic factors and health. However, using this method meant that some observations (around 2,000) were dropped as they only available in one wave and the 'common support' assumption. The number of omitted cases may have biased the results.

7.6 FUTURE RESEARCH

There are several suggestions for future research based on the limitations of the research undertaken in this thesis. Firstly, although this study employed two large nationally representative datasets with more than 10,000 observations, neither CGSS nor CHARLS is a longitudinal dataset over a long period (CGSS is a cross-sectional dataset, and CHARLS is a short panel with only two waves of data). Consequently, it is suggested that research following on from the present study should investigate the link between social capital and health among older people in China using a longitudinal nationally representative dataset covering a longer observation period (i.e. more than two-three waves). This would generate more understanding of the dynamic relations between social capital and the health status of individuals.

Secondly, although this study included five health outcome variables, four of the measures are self-assessed: general health, subjective well-being, mental health and physical health. Only the measurement of cognitive function is objective. For the four subjective measures there is potentially more measurement error. Future study could use more objective measurements of health, for instance, by employing biomarker measures to capture the health status of an individual more precisely.

Thirdly, concerning the set of independent of social capital proxy variables, future approaches would benefit from better measures of respondents' social webs among family, friends and co-workers. This would help in developing stronger evidence in relation to the role of faith (or trust) in one's network which previous research indicates is a critical aspect of social capital, at the individual and community levels (d'Hombres *et al.*, 2010; Lindström and Mohseni, 2009; Poortinga, 2012; Putnam, 2000, 1995; Subramanian *et al.*, 2002). This thesis was only able to use proxy variables of social trust at both levels (in the analysis using CHARLS). Future research would gain substantially if it were able to access a more accurate measure of social trust rather than relying on proxies. Moreover, following some previous research (Cao *et al.*, 2015), future studies could employ a longitudinal questionnaire study specifically targeting social capital and individual health status in addition to collecting data on demographic factors and socio-economic status. The design of questionnaire could follow the kinds of questions used to obtain data on social capital in previous surveys conducted in western societies (d'Hombres *et al.*, 2010; Lindström and Mohseni, 2009; Poortinga, 2012; Putnam, 2000, 1995; Subramanian *et al.*, 2002). This would aid comparisons with studies undertaken using such surveys in western societies. Future research could also use a combination of quantitative and qualitative research methods to investigate the relationship between health and social capital. The advantage of qualitative research methods are that they could provide a more detailed description of different aspects of social capital and therefore provide a better understanding of how different kinds of social capital impact on health. For example, a future study could include a focus group study targeted at older people that focus on understanding reciprocity and mutual help with neighbours, friends and family members; moreover, the complex dynamics of reciprocity and mutual help and the relationship to health could be examined in detail. Currently, China is undergoing a demographic and socio-economic transition which may result in a misalignment between cultural traditions and practices (Shen *et al.*, 2014; Zhao *et al.*, 2013). Many older Chinese have found that their cultural values and beliefs forged in an earlier era no longer comply with the new social standards and dynamics. Qualitative research methods, such as focus groups and interviews, could provide more knowledge of the views and perceptions of older people in China in relation to such changes and how they are impacting on them.

Finally, as the present study only deals with reverse causality or endogeneity between social capital and health at the individual-level, future research should address these issues at the community-level. Future studies could follow Spencer and Fielding (2000) by using an instrumental variable to address endogeneity in multilevel models. This was beyond the scope of the present study.

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9 APPENDICES

APPENDIX FOR CHAPTER 2

TABLE A 1: DEVELOPMENT OF CHINA'S HEALTH CARE SYSTEM

Stage One: 1949 - 1980s					Payment Coverage	
Institution	**Year**	**Targets**	**Funding Mode**	**Funding Source**	**Medical**	**Personal**
Labour Protection Medicare	1951	Staffs and retirees from state-owned or collective enterprises and their family members	National finance according to the per capita quota	Employee benefits	Treatment, medicines, examination, operations, meals and travelling expenses of work-related injuries, prosthesis, etc.	Registration fees, doctor visits, meals in the hospital, family medical expenses, family hospitalisation, etc.
Free Medical Service	1952	Staffs and retirees from government departments, state organs and institutions, college students, disabled soldiers	Included in a certain proportion of salary	State budget and fiscal planning		

Rural Cooperative Medical System	1956	Rural Residents	Co-financing by production cooperatives, farmers and doctors	Public welfare funds, cooperatives income and payment from farmers		Free of charge in registration, doctor visits, injection, etc.
Stage Two: 1980s - present						
Basic Medical Insurance System for Urban Employees	1998	Urban Employees	Pooling funds and personal accounts	Enterprises: 6% of salary (70% of pooling funds and 30% of personal accounts) Individuals: 2% of salary (100% personal accounts)	Pooling funds: hospitalisation, chronic diseases and serious illness Personal: general outpatient services (including	Setting of minimum and maximum payment thresholds; personal payment takes up around

					the self-funding part of hospitalisation)	85% of total expenses
New Rural Cooperative Medical System	2003	Rural Residents	Pooling funds and family accounts (only implemented in some regions)	Personal payment (90RMB/YEAR) + government subsidy (MAX 320RMB/YEAR)	Hospitalisation and outpatient services (in some regions)	Reimbursement covers 50%-75% of total expenses
Basic Medical Insurance System for Urban Residents	2007	Urban Non-employee Residents	Pooling funds	60% of personal payment and 40% of government subsidy (total amount varies in different regions;	Hospitalisation and outpatient services of serious illness (in some regions)	Reimbursement covers 70%-85% of total expenses

				Citizens with low-income, poverty or aged over 70 are supported by 100% of government subsidy)		
Urban and Rural Medical Assistance System	2009	Patients who are unable to pay medical expenses (only implemented in some pilots)	Government funds and social donations	Government funds and social donations	Free of charge for the recipient; transactions only exist between hospital and aid agencies	

Source: The yearbook of the People's Republic of China; Summarised by the author.

TABLE A 2: ADVANTAGES AND DISADVANTAGES OF BASIC MEDICAL INSURANCE SYSTEMS IN CHINA

China's Health System	**Medical Insurance System for Urban Employees**	**Medical Insurance System for Urban Residents**	**New Rural Cooperative Medical System**
Advantages	Transition from labour protection Medicare and free medical service to social health insurance system	Inclusion of the non-employee citizens into the health insurance system	Extensive coverage of health insurance and increasing levels of funding
	Establishment of basic insurance system and cost-sharing system	Subsidies for the minors, students, practitioners and the elderly according to the local economy	Increasing proportion of reimbursement; enrichment of new rural insurance
	Preliminary establishment of the third party supervision of medical service		Increasing focus on serious illness of rural residents
	Reform and improvement of medical service system as well as pharmaceutical production and circulation system		Continuous improvement of the rural services
	Establishment of social service management system, reducing burdens for enterprises and enhancing public service functions of government		Solving serious illness in time, alleviating farmers' burden on medical expenses
	Smooth running of the system		
	Smooth running of medical funds		
	Substantial increase in the number of medical organisations, doctors and sickbeds as compared to the planned economy period		
Disadvantages	**Institutional Deficiency**		
	The design of personal accounts is contrary to the basic principles of the national health system.	Despite lower fees and higher subsidies, payments still fall on their working relatives, which adds burdens on employees	Lower level of funding

	Only covers urban employees	Inequality of subsidy level between regions	The overall proportion of reimbursement is still lower despite the fact that in some regions this proportion reached 85% in 2014. The proportion reduces as the level of hospital increases.
	Many drugs and medical services are still not included.		Reimbursement did not work well in rural areas.
	The supervision of remote medical treatment and its cost is difficult due to the limited scope.		Limited coverage for low-income farmers
	Structurally different from the other two systems, making the interaction more difficult		
	Systematic Problems		**Medicare Problems**
	Lack of public interest, becoming marketed and commercialised		Medical service is insufficient in rural areas and usually deals with minor illness only.
	Expensive drug prices because of insufficient fiscal budget for public medical services		Poorer quality and quantity of medical resources as compared to urban areas
	Lack of an effective monitoring system on the medical service providers		Huge difference of the proportion of reimbursement between regions resulted from different economic conditions.
	Insufficient supervision to hospitals, resulting in poor medical ethics		

Source: The yearbook of the People's Republic of China; Summarised by the author.

APPENDIX FOR CHAPTER 4

This section shows the steps for generating social capital indices for both the cognitive and structural components of social capital using factors analysis. Factor analysis is a statistical tool that allows us to investigate concepts that are not easily measured directly, such as social capital in the present study, by collapsing many variables into one or fewer interpretable common factor/factors (Fabrigar *et al.*, 1999). For the factor generation, following the suggestion by Fabrigar *et al.* (1999), this study uses the principal-component factor method to analyse the correlation matrix, which assumes that the communalities equal to value 1.

Table A4-1 shows the variables used in the factor analysis. There are six in total related to two main aspects: social attitudes and frequency of social interaction. These six variables in two domains are likely to be correlated. The polychoric correlation matrix (Olsson, 1979) was used to identify the correlation among the six variables and the results are shown in Table A4-2. Table A4-2 indicates a positive correlation between A3006, A3007 and A311, and similarly between A33, A34 and A35. The high and significant correlations among these two groups of variables is a possible indication of assortative matching. The principal-component factor method is one way of dealing with this possibility.

TABLE A 4 - 1: SOCIAL CAPITAL VARIABLES

Variable Code	**Definition**	**Min**	**Max**
Social Attitudes	*Agree or Disagree levels*	*Strongly Disagree*	*Strongly Agree*
A33	In general, the majority of people in current society can be trusted	1	5
A34	In general, the majority of people in current society will not take any advantage of you even they have chance	1	5
A35	In general, you live in a fair society	1	5
Social Interaction	*Frequency of engaging in the following activities in your leisure-time during the past year*	*Never*	*Everyday*
A3006	Interacted with non-cohabit relatives (i.e. physical exercise or games)	1	5
A3007	Interacted with friends (i.e. physical exercise or games)	1	5
A311	General social Interactions (any kind of social activity with others)	1	5

Data Source: CGSS pooled cross-sectional dataset, 2010 ~ 2013, translated and edited by author.

TABLE A 4 - 2: POLYCHORIC CORRELATION MATRIX FOR SOCIAL CAPITAL VARIABLES, OBS= 40,874

	A3006	A3007	A311	A33	A34	A35
A3006	1					
A3007	0.548***	1				
A311	0.299***	0.452***	1			
A33	-0.01	-0.03*	0.002***	1		
A34	0.003	-0.015**	0.011***	0.238**	1	
A35	-0.022*	-0.056	-0.013**	0.34***	0.184***	1

Data Source: CGSS pooled cross-sectional dataset, 2010 ~ 2013.
*Notes: Polychoric correlation coefficient, listwise deletion; t statistics: * p<0.1, ** p<0.05, *** p<0.01.*

Table A4-3 shows the principal-component factor analysis or correlation. The first column of eigenvalues illustrates the variances of the factors. The second column of difference shows the differences between the current and following eigenvalue. The third column indicates the proportion of variance accounted for by the factor, while the last column shows the cumulative proportion of variance accounted for by the current factor plus all the previous ones. Table A4-3 shows that the percentage of common variance explained by the first factor is almost 29% and 24% for the second one, and since the eigenvalue of the first and second factors is more than 1 then following Fabrigar *et al.* (1999), the first two factors are retained.

TABLE A 4 - 3: FACTOR ANALYSIS OR CORRELATION, PRINCIPAL-COMPONENT METHOD, OBS = 40,874

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	1.75073	0.3025	0.2918	0.2918
Factor2	1.44823	0.59159	0.2414	0.5332
Factor3	0.85664	0.1009	0.1428	0.6759
Factor4	0.75574	0.06386	0.126	0.8019
Factor5	0.69189	0.19512	0.1153	0.9172
Factor6	0.49677	.	0.0828	1

Note: LR test: independent vs. saturated: chi2(15) = 2.3e+04 Prob>chi2 = 0.0000

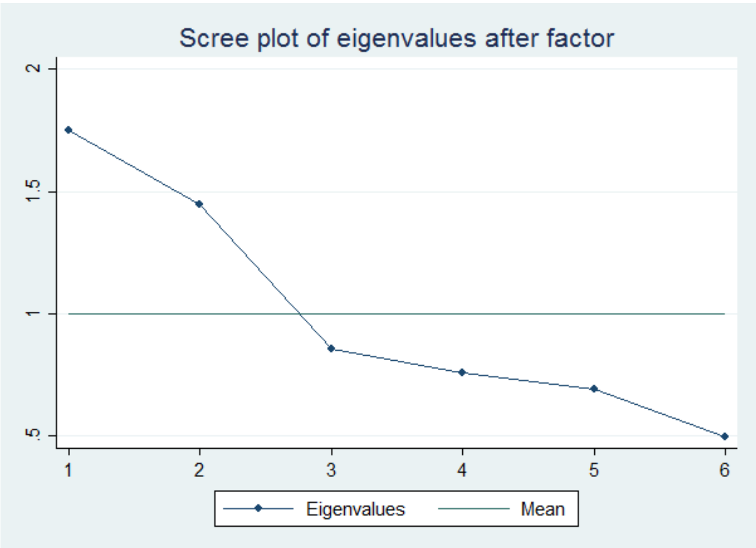
The Kaiser-Olkin (KMO) measure can be used assess whether variables share sufficient traits to merit a factor model. The KMO takes values between 0 and 1. Low value indicates that, in general, the variables share little to merit a factor analysis. Following Kaiser (1974), the KMO value in Table A4-4 is classified as mediocre as all the KMO values are more than 0.6 and the overall KMO is about 0.7. The author, therefore, concludes that overall the variables have enough common factors to warrant the factor analysis.

TABLE A 4 - 4: KAISER-MEYER-OLKIN (KMO) MEASURE OF SAMPLING ADEQUACY

Variable	KMO
a3006	0.6148
a3007	0.674
a311	0.6532
a33	0.6592
a34	0.6342
a35	0.6711
Overall	0.6978

Although there appear to be two main factors, a scree plot is constructed as a visual check. This method is commonly used as a snapshot guide to the number of factors that should be saved (Cattell, 1966). It can be seen from Figure A1 that only two factors exceed 1, and this tallies with the results in Table A3 above.

FIGURE A 4 - 1: SCREE PLOT OF EIGENVALUES AFTER FACTOR



A further check is suggested by Fabrigar *et al.* (1999)) who point out that it is possible to use the factor loadings (pattern matrix) and unique variances to decide the number of factors. The results present in Table A4-5 indicate the weights and correlations between each variable and the factor loadings. The factor loadings suggest that the three variables – A3006, A3007 and A311 – which measure social interaction, and the three variables – A33, A34 and A35 – which measure social trust define the first and second factors well, with all rounded up factor loadings greater than 0.6. These results support the generation of two factors from the six variables.

TABLE A 4 - 5: FACTOR LOADINGS (PATTERN MATRIX) AND UNIQUE VARIANCES

Variable	Factor1: social interaction	Factor2: social trust	Uniqueness
A3006	0.7432		0.4415
A3007	0.8353		0.2996
A311	0.6912		0.5111
A33		0.7524	0.4268
A34		0.5996	0.6381
A35		0.7089	0.484

Note: 1) Factor loading less than 0.3 were omitted from the table. 2) LR test: independent vs. saturated: chi2 (15) = 2.3e+04 Prob>chi2 = 0.0000.

In the last step, in order to make the two new variables comparable they were rescaled into the same value range from 0 to 100, using formula (A-1) below:

$$NV = {}^{(100-0)}\!\big/_{[(MAX - MIN)(V - MAX) + 100]} \qquad \text{(A4.1)}$$

where *NV* is the rescaled variable, *MAX* is the observed maximum value of the pre-scale variable, while *MIN* presents the observed minimum value of the same variable. *V* present the pre-scale variable or the target variable. Summary statistics for the pre-scale (original) and rescaled variables are shown in Table A4-6 below. The two rescaled variables were used in the analysis to capture different components of social capital. The first factor was used as a measure of social interaction (cognitive social capital) and the second as a measure of social trust (structural social capital).

TABLE A 4 - 6: VARIABLE DESCRIPTION

Variable	Obs	Mean	Std. Dev.	Min	Max
Factor Score					
Factor 1:Social Interaction	40,874	-1.95E-10	1.00	-2.09	3.88
Factor 2: Social Trust	40,874	-2.51E-09	1.00	-2.98	2.55
Rescaled Score					
Social Interaction	40,874	35.01	16.74	0	100
Social Trust	40,874	53.82	18.08	0	100

Appendix For Chapter 5

Table A 5 - 1: Balancing Test for the Matching Process on Reciprocity

Variable	Unmatched Matched	Mean Treated	Control	%bias	%reduct |bias|	t-test t	p>t
Individual Age	U	59.814	60.613	-8.6		-5.87	0
	M	59.816	60.078	-2.8	67.2	-1.65	0.1
Gender (0=M;1=F)	U	0.50786	0.52965	-4.4		-3.01	0.003
	M	0.50786	0.50584	0.4	90.7	0.24	0.812
Marital Status (0=Otherwise; 1=Married)	U	0.84802	0.87985	-9.3		-6.52	0
	M	0.84797	0.8347	3.9	58.3	2.14	0.032
Educational Status (reference: Illiterate)							
Can Read & Write	U	0.18313	0.18345	-0.1		-0.06	0.954
	M	0.18318	0.17092	3.2	-3695.9	1.89	0.059
Finished Primary	U	0.22552	0.21527	2.5		1.71	0.087
	M	0.22559	0.22991	-1	57.8	-0.61	0.544
Junior High and Above	U	0.35876	0.31352	9.6		6.64	0
	M	0.35872	0.3541	1	89.8	0.57	0.57
Health Insurance (0=No;1=Yes)	U	0.95616	0.94755	4		2.73	0.006
	M	0.9563	0.95774	-0.7	83.3	-0.42	0.675
Work status (0=Not Working; 1=Working)	U	0.69661	0.65473	9		6.13	0
	M	0.69681	0.67893	3.8	57.3	2.27	0.023
Current Hukou (0=Agricultural; 1=Otherwise)	U	0.22552	0.22466	0.2		0.14	0.886
	M	0.22544	0.23049	-1.2	-482.2	-0.71	0.479
Lifestyle							
Exercises Las Week (0=No;1=Yes)	U	0.37087	0.34833	4.7		3.24	0.001
	M	0.37098	0.3668	0.9	81.4	0.51	0.61

Number of Cigarettes Consume	U	4.5086	4.369	1.4		0.96	0.337
	M	4.507	4.1359	3.7	-166	2.21	0.027
Drink Last Year (0=No;1=Yes)	U	0.35184	0.32663	5.3		3.68	0
	M	0.35194	0.343	1.9	64.5	1.11	0.269
Household Characteristics							
Household Size	U	4.4422	4.6729	-10.9		-7.48	0
	M	4.4417	4.5172	-3.6	67.2	-2.16	0.031
Whether Live with Child (0=No;1=Yes)	U	0.292	0.28556	1.4		0.98	0.327
	M	0.29194	0.30521	-2.9	-106.2	-1.71	0.088
Labour Participation Rate in Household (%)	U	31.191	28.767	8		5.55	0
	M	31.191	30.102	3.6	55.1	2.12	0.034
Log Household Annual Income Per Capita	U	7.2323	7.2308	0		0.03	0.973
	M	7.2335	7.2452	-0.4	-686.8	-0.21	0.837
Log Total Current Value of Long-lasting Assets	U	7.8572	4.3568	68.6		42.25	0
	M	7.8615	8.045	-3.6	94.8	-3.68	0
Urban Dummy (0=Rural; 1=Urban)	U	0.3739	0.39486	-4.3		-2.96	0.003
	M	0.37372	0.39449	-4.3	0.9	-2.51	0.012
Interview Wave (0=Wave 1; 1=Wave 2)	U	0.52646	0.45437	14.5		9.96	0
	M	0.52661	0.50397	4.5	68.6	2.67	0.008
Propensity Score	U	0.39896	0.27746	82.4		55.29	0
	M	0.39907	0.39906	0	100	0	0.998

TABLE A 5 - 2: BALANCING TEST FOR THE MATCHING PROCESS ON SOCIAL TRUST

Variable	**Unmatched**	**Mean**		**%bias**	**%reduct**	**t-test**	
	Matched	**Treated**	**Control**		**|bias|**	**t**	**p>t**
Individual Age	U	60.12	60.493	-4		-2.07	0.038
	M	60.12	60.058	0.7	83.4	0.3	0.766
Gender (0=M;1=F)	U	0.52674	0.4899	7.4		3.81	0

	M	0.52674	0.535	-1.7	77.6	-0.73	0.466
Marital Status (0=Otherwise; 1=Married)	U	0.89331	0.86319	9.2		4.67	0
	M	0.89331	0.90519	-3.6	60.5	-1.74	0.082
Educational Status (reference: Illiterate)							
Can Read & Write	U	0.19685	0.19018	1.7		0.87	0.382
	M	0.19685	0.19272	1	38	0.46	0.646
Finished Primary	U	0.21596	0.21571	0.1		0.03	0.975
	M	0.21596	0.20279	3.2	-5095.9	1.42	0.154
Junior High and Above	U	0.34048	0.34161	-0.2		-0.12	0.902
	M	0.34048	0.34926	-1.9	-677.2	-0.81	0.416
Health Insurance (0=No;1=Yes)	U	0.9442	0.94778	-1.6		-0.82	0.41
	M	0.9442	0.93619	3.5	-123.5	1.49	0.137
Work status (0=Not Working; 1=Working)	U	0.65668	0.65189	1		0.52	0.603
	M	0.65668	0.64764	1.9	-88.9	0.84	0.404
Current Hukou (0=Agricultural; 1=Otherwise)	U	0.24412	0.25586	-2.7		-1.4	0.163
	M	0.24412	0.248	-0.9	67	-0.4	0.692
Lifestyle							
Exercises Las Week (0=No;1=Yes)	U	0.38052	0.34672	7		3.65	0
	M	0.38052	0.37303	1.6	77.8	0.68	0.496
Number of Cigarettes Consume	U	4.3996	4.8409	-4.3		-2.21	0.027
	M	4.3996	4.4319	-0.3	92.7	-0.14	0.886
Drink Last Year (0=No;1=Yes)	U	0.34022	0.34184	-0.3		-0.18	0.86
	M	0.34022	0.34229	-0.4	-27.5	-0.19	0.848
Household Characteristics							
Household Size	U	4.5965	4.2803	15.6		8.1	0
	M	4.5965	4.6107	-0.7	95.5	-0.3	0.763
Whether Live with Child (0=No;1=Yes)	U	0.29605	0.25377	9.5		4.94	0
	M	0.29605	0.29011	1.3	85.9	0.57	0.566
Labour Participation Rate in Household (%)	U	29.567	25.582	13.5		7	0

	M	29.567	28.9	2.3	83.2	0.99	0.321
Log Household Annual Income Per Capita	U	7.2099	7.203	0.2		0.12	0.906
	M	7.2099	7.2862	-2.5	-992.6	-1.14	0.255
Log Total Current Value of Long-lasting Assets	U	5.3593	5.3531	0.1		0.05	0.956
	M	5.3593	5.3578	0	75.9	0.01	0.991
Urban Dummy (0=Rural; 1=Urban)	U	0.40532	0.40218	0.6		0.33	0.741
	M	0.40532	0.39964	1.2	-81	0.51	0.61
		0.48592	0.48608	0		-0.02	0.987
		0.48592	0.47481	2.2	-7080.3	0.98	0.328
Propensity Score	U	0.31924	0.30578	25.1		12.95	0
	M	0.31924	0.31924	0	100	0	0.996

TABLE A 5 - 3: BALANCING TEST FOR THE MATCHING PROCESS ON INTERACTED WITH FRIENDS

Variable	Unmatched Matched	Mean Treated	Control	%bias	%reduct |bias|	t-test t	p>t
Individual Age	U	60.131	60.878	-8		-4.82	0
	M	60.13	60.349	-2.3	70.6	-1.16	0.245
Gender (0=M;1=F)	U	0.5437	0.49882	9		5.42	0
	M	0.54363	0.54099	0.5	94.1	0.26	0.793
Marital Status (0=Otherwise; 1=Married)	U	0.84932	0.87628	-7.8		-4.83	0
	M	0.84963	0.85207	-0.7	91	-0.34	0.734
Educational Status (reference: Illiterate)							
Can Read & Write	U	0.17664	0.19227	-4		-2.42	0.016
	M	0.17675	0.18101	-1.1	72.7	-0.55	0.581
Finished Primary	U	0.20625	0.2254	-4.7		-2.79	0.005
	M	0.20637	0.19785	2.1	55.5	1.05	0.292
Junior High and Above	U	0.37031	0.29696	15.6		9.55	0

	M	0.37013	0.37216	-0.4	97.2	-0.21	0.835
Health Insurance (0=No;1=Yes)	U	0.95234	0.94877	1.6		0.99	0.323
	M	0.95231	0.95252	-0.1	94.3	-0.05	0.962
Work status (0=Not Working; 1=Working)	U	0.65179	0.6737	-4.6		-2.81	0.005
	M	0.65199	0.65402	-0.4	90.7	-0.21	0.832
Current Hukou (0=Agricultural; 1=Otherwise)	U	0.25309	0.2103	10.2		6.23	0
	M	0.25284	0.2567	-0.9	91	-0.44	0.661
Lifestyle							
Exercises Las Week (0=No;1=Yes)	U	0.35693	0.34905	1.6		1	0.319
	M	0.35694	0.34821	1.8	-10.8	0.91	0.365
Number of Cigarettes Consume	U	4.2821	4.5119	-2.3		-1.39	0.165
	M	4.2817	4.2362	0.5	80.2	0.23	0.819
Drink Last Year (0=No;1=Yes)	U	0.33583	0.33123	1		0.59	0.556
	M	0.33584	0.34416	-1.8	-80.9	-0.87	0.383
Household Characteristics							
Household Size	U	4.58	4.6181	-1.8		-1.07	0.284
	M	4.5806	4.6065	-1.2	31.8	-0.6	0.548
Whether Live with Child (0=No;1=Yes)	U	0.29893	0.28386	3.3		2.01	0.045
	M	0.2987	0.31737	-4.1	-24	-2.01	0.045
Labour Participation Rate in Household (%)	U	30.222	28.675	5.2		3.13	0.002
	M	30.217	30.751	-1.8	65.5	-0.88	0.377
Log Household Annual Income Per Capita	U	7.2764	7.1734	3.4		2.09	0.037
	M	7.2756	7.3364	-2	41	-1	0.317
Log Total Current Value of Long-lasting Assets	U	5.658	5.3775	4.8		2.87	0.004
	M	5.6592	5.7518	-1.6	67	-0.8	0.423
Urban Dummy (0=Rural; 1=Urban)	U	0.41351	0.37767	7.3		4.44	0
	M	0.41335	0.40645	1.4	80.7	0.7	0.486
		0.50781	0.46834	7.9		4.77	0
		0.50771	0.50994	-0.4	94.3	-0.22	0.825

Propensity Score	U	0.27093	0.25725	26.4		16.17	0
	M	0.27087	0.27087	0	100	0	1

TABLE A 5 - 4: BALANCING TEST FOR THE MATCHING PROCESS ON CHARITY/HELPED OTHERS

Variable	Unmatched	Mean		%bias	%reduct	t-test	
	Matched	Treated	Control		|bias|	t	p>t
Individual Age	U	57.875	60.863	-33.9		-16.08	0
	M	57.875	57.674	2.3	93.3	0.93	0.355
Gender (0=M;1=F)	U	0.50347	0.52427	-4.2		-2.09	0.037
	M	0.50347	0.50695	-0.7	83.3	-0.26	0.792
Marital Status (0=Otherwise; 1=Married)	U	0.88916	0.86261	8.1		3.91	0
	M	0.88916	0.89159	-0.7	90.8	-0.3	0.768
Educational Status (reference: Illiterate)							
Can Read & Write	U	0.15184	0.19226	-10.7		-5.19	0
	M	0.15184	0.15427	-0.6	94	-0.26	0.798
Finished Primary	U	0.21786	0.22241	-1.1		-0.55	0.583
	M	0.21786	0.22307	-1.3	-14.5	-0.48	0.633
Junior High and Above	U	0.44997	0.30017	31.3		16.19	0
	M	0.44997	0.43885	2.3	92.6	0.85	0.396
Health Insurance (0=No;1=Yes)	U	0.95587	0.94942	3		1.49	0.137
	M	0.95587	0.95448	0.7	78.5	0.25	0.799
Work status (0=Not Working; 1=Working)	U	0.71577	0.66008	12		5.93	0
	M	0.71577	0.73836	-4.9	59.5	-1.92	0.054
Current Hukou (0=Agricultural; 1=Otherwise)	U	0.30021	0.20642	21.7		11.4	0
	M	0.30021	0.2943	1.4	93.7	0.49	0.624
Lifestyle							

Exercises Las Week (0=No;1=Yes)	U	0.38707	0.35295	7.1		3.57	0
	M	0.38707	0.38464	0.5	92.9	0.19	0.85
Number of Cigarettes Consume	U	4.7623	4.4275	3.2		1.66	0.097
	M	4.7623	4.8023	-0.4	88.1	-0.14	0.885
Drink Last Year (0=No;1=Yes)	U	0.38325	0.32465	12.3		6.24	0
	M	0.38325	0.38499	-0.4	97	-0.14	0.892
Household Characteristics							
Household Size	U	4.5115	4.6014	-4.3		-2.12	0.034
	M	4.5115	4.4781	1.6	62.9	0.62	0.533
Whether Live with Child (0=No;1=Yes)	U	0.29361	0.28582	1.7		0.86	0.388
	M	0.29361	0.28666	1.5	10.8	0.58	0.561
Labour Participation Rate in Household (%)	U	30.831	28.971	6.2		3.11	0.002
	M	30.831	31.281	-1.5	75.8	-0.56	0.575
Log Household Annual Income Per Capita	U	7.5576	7.1646	13.5		6.61	0
	M	7.5576	7.4944	2.2	83.9	0.85	0.398
Log Total Current Value of Long-lasting Assets	U	6.0733	5.4705	10.4		5.17	0
	M	6.0733	6.0481	0.4	95.8	0.17	0.865
Urban Dummy (0=Rural; 1=Urban)	U	0.42669	0.374	10.8		5.44	0
	M	0.42669	0.41696	2	81.5	0.75	0.455
		0.50174	0.47542	5.3		2.64	0.008
		0.50174	0.48332	3.7	30	1.4	0.162
Propensity Score	U	0.15093	0.12485	46.7		24.24	0
	M	0.15093	0.15092	0	100	0	0.996

TABLE A 5 - 5: BALANCING TEST FOR THE MATCHING PROCESS ON SOCIAL ACTIVITIES

Variable	Unmatched Matched	Mean Treated	Control	%bias	%reduct |bias|	t-test t	p>t

Individual Age	U	58.028	60.939	-32.3		-13.63	0
	M	58.044	57.91	1.5	95.4	0.52	0.603
Gender (0=M;1=F)	U	0.39776	0.55444	-31.8		-13.82	0
	M	0.39832	0.42397	-5.2	83.6	-1.71	0.088
Marital Status (0=Otherwise; 1=Married)	U	0.90778	0.85685	15.9		6.48	0
	M	0.90765	0.90345	1.3	91.8	0.47	0.638
Educational Status (reference: Illiterate)							
Can Read & Write	U	0.17	0.19352	-6.1		-2.62	0.009
	M	0.17024	0.17631	-1.6	74.2	-0.52	0.6
Finished Primary	U	0.23381	0.21739	3.9		1.74	0.082
	M	0.23368	0.22668	1.7	57.4	0.54	0.586
Junior High and Above	U	0.48253	0.27439	43.9		20.14	0
	M	0.48228	0.48647	-0.9	98	-0.27	0.783
Health Insurance (0=No;1=Yes)	U	0.94411	0.95058	-2.9		-1.3	0.194
	M	0.94403	0.94263	0.6	78.4	0.2	0.843
Work status (0=Not Working; 1=Working)	U	0.67163	0.6753	-0.8		-0.34	0.732
	M	0.67211	0.67677	-1	-27.4	-0.33	0.745
Current Hukou (0=Agricultural; 1=Otherwise)	U	0.30741	0.18437	28.9		13.59	0
	M	0.3069	0.31483	-1.9	93.6	-0.56	0.575
Lifestyle							
Exercises Las Week (0=No;1=Yes)	U	0.35491	0.35683	-0.4		-0.17	0.861
	M	0.35494	0.35961	-1	-143.9	-0.32	0.75
Number of Cigarettes Consume	U	6.2687	3.8675	22.5		10.8	0
	M	6.1936	5.9972	1.8	91.8	0.55	0.582
Drink Last Year (0=No;1=Yes)	U	0.41174	0.30898	21.5		9.66	0
	M	0.41138	0.41185	-0.1	99.5	-0.03	0.975
Household Characteristics							

Household Size	U	4.5491	4.6303	-3.8		-1.65	0.098
	M	4.5499	4.535	0.7	81.6	0.23	0.816
Whether Live with Child (0=No;1=Yes)	U	0.28878	0.29118	-0.5		-0.23	0.817
	M	0.28871	0.30037	-2.6	-385.3	-0.84	0.402
Labour Participation Rate in Household (%)	U	30.3	29.892	1.4		0.59	0.555
	M	30.308	30.578	-0.9	34.1	-0.3	0.767
Log Household Annual Income Per Capita	U	7.5863	7.1006	16.4		7.17	0
	M	7.585	7.534	1.7	89.5	0.56	0.572
Log Total Current Value of Long-lasting Assets	U	6.0301	5.3889	11.1		4.79	0
	M	6.0245	5.8225	3.5	68.5	1.15	0.25
Urban Dummy (0=Rural; 1=Urban)	U	0.46157	0.3502	22.8		10.17	0
	M	0.46129	0.48041	-3.9	82.8	-1.25	0.21
		0.51327	0.4747	7.7		3.38	0.001
		0.51306	0.52799	-3	61.3	-0.98	0.328
Propensity Score	U	0.14635	0.10293	66		29.9	0
	M	0.14597	0.14597	0	100	0	1

TABLE A 5 - 6: BALANCING TEST FOR THE MATCHING PROCESS ON GROUP EVENTS

Variable	**Unmatched**	**Mean**		**%bias**	**%reduct**	**t-test**	
	Matched	**Treated**	**Control**		**|bias|**	**t**	**p>t**
Individual Age	U	59.147	60.44	-14.2		-5	0
	M	59.147	59.229	-0.9	93.6	-0.24	0.809
Gender (0=M;1=F)	U	0.5604	0.51375	9.4		3.38	0.001
	M	0.5604	0.52323	7.5	20.3	1.97	0.049
Marital Status (0=Otherwise; 1=Married)	U	0.88706	0.86603	6.4		2.25	0.025
	M	0.88706	0.87777	2.8	55.8	0.76	0.446
Educational Status (reference: Illiterate)							

Can Read & Write	U	0.13939	0.19215	-14.2		-4.88	0
	M	0.13939	0.15297	-3.7	74.3	-1.02	0.309
Finished Primary	U	0.21086	0.22274	-2.9		-1.03	0.301
	M	0.21086	0.20229	2.1	27.8	0.56	0.575
Junior High and Above	U	0.5268	0.30147	47		17.68	0
	M	0.5268	0.5411	-3	93.7	-0.76	0.449
Health Insurance (0=No;1=Yes)	U	0.94425	0.95057	-2.8		-1.05	0.292
	M	0.94425	0.94282	0.6	77.4	0.16	0.87
Work status (0=Not Working; 1=Working)	U	0.52395	0.69063	-34.6		-12.99	0
	M	0.52395	0.54396	-4.2	88	-1.06	0.289
Current Hukou (0=Agricultural; 1=Otherwise)	U	0.49821	0.18649	69.5		28.42	0
	M	0.49821	0.49893	-0.2	99.8	-0.04	0.97
Lifestyle							
Exercises Las Week (0=No;1=Yes)	U	0.37455	0.3568	3.7		1.34	0.18
	M	0.37455	0.37384	0.1	96	0.04	0.969
Number of Cigarettes Consume	U	3.7856	4.5914	-8.1		-2.87	0.004
	M	3.7856	4.248	-4.6	42.6	-1.28	0.202
Drink Last Year (0=No;1=Yes)	U	0.30951	0.33739	-6		-2.14	0.032
	M	0.30951	0.33953	-6.4	-7.7	-1.7	0.09
Household Characteristics							
Household Size	U	4.4046	4.6207	-10.2		-3.68	0
	M	4.4046	4.3931	0.5	94.7	0.15	0.883
Whether Live with Child (0=No;1=Yes)	U	0.29593	0.2873	1.9		0.69	0.49
	M	0.29593	0.30665	-2.4	-24.3	-0.62	0.537
Labour Participation Rate in Household (%)	U	29.815	29.685	0.4		0.16	0.876
	M	29.815	31.1	-4.3	-886.6	-1.12	0.263
Log Household Annual Income Per Capita	U	7.7974	7.1549	21.1		7.83	0
	M	7.7974	7.788	0.3	98.5	0.08	0.935

Log Total Current Value of Long-lasting Assets	U	5.912	5.559	6		2.2	0.028
	M	5.912	5.9945	-1.4	76.6	-0.38	0.708
Urban Dummy (0=Rural; 1=Urban)	U	0.66976	0.34786	68		24.5	0
	M	0.66976	0.67548	-1.2	98.2	-0.32	0.747
		0.51394	0.4755	7.7		2.79	0.005
		0.51394	0.51823	-0.9	88.8	-0.23	0.821
Propensity Score	U	0.11224	0.05909	83.2		35.09	0
	M	0.11224	0.11222	0	100	0	0.997

Table A 5 - 7: Balancing Test of Joint Significant Tests, Before and After Matched Comparison

Reciprocity	**Ps R2**	**LR Chi2**	*p>chi2*	**Mean Bias**	**Med Bias**
Unmatched	0.1	2657.12	*0*	12.1	4.7
Matched	0.003	46.83	*0.999*	1.3	1
Social Trust	**Ps R2**	**LR chi2**	*p>chi2*	**Mean Bias**	**Med Bias**
Unmatched	0.019	284.29	*0*	5.2	2.2
Matched	0.001	10.03	*0.999*	1.5	1.4
Interacted with Friends	**Ps R2**	**LR chi2**	*p>chi2*	**Mean Bias**	**Med Bias**
Unmatched	0.011	227.34	*0*	6.5	4.7
Matched	0.001	8.87	*0.999*	1.3	1.2
Charity/Helped Others	**Ps R2**	**LR chi2**	*p>chi2*	**Mean Bias**	**Med Bias**
Unmatched	0.033	531.38	*0*	12.4	9.2
Matched	0.002	11.99	*0.994*	1.5	1.3
Social Activities	**Ps R2**	**LR chi2**	*p>chi2*	**Mean Bias**	**Med Bias**

Unmatched	0.052	667.96	*0*	17	13.5
Matched	0.002	9.83	*0.999*	1.7	1.5
Group Events	**Ps R2**	**LR chi2**	***p>chi2***	**Mean Bias**	**Med Bias**
Unmatched	0.092	889.34	*0*	20.9	8.7
Matched	0.004	13.44	*0.986*	2.4	1.7

Notes: Ps R2 is Pseudo R2 of PS; LR chi2 is Likelihood Ratio (LR) Chi-Square test.

*Significance: *** p<0.01; ** p<0.05; * p<0.1.*

TABLE A 5 - 8: MEAN OF DIFFERENT HEALTH INDICATOR FOR CALCULATE THE PERCENTAGE CHANGE BETWEEN THE TREATED AND CONTROL (RESTRICTED SAMPLE)

Health Indicators\Social Capital	**Reciprocity**	**Social Trust**	**Interacted with Friends**	**Charity**	**Social Activities**	**Group Events**
Cognitive Ability Index	11.59	11.52	11.45	11.56	11.3	11.53
CES-D	8.15	8.99	8.27	8.19	8.44	8.23
Physical Health Index	49.05	49.05	49.03	49.13	49.11	49.12
OBS	21,958	12,489	18,906	22,450	19,954	22,419

APPENDIX FOR CHAPTER 6

To figure out the importance of different level factors used in this chapter, especial the importance of community-level social capital, this part employs six sequential modelling strategy. First, this section employed two-level null model (without any explanatory variables) of 29,533 observations (level 1), total from around 14,766 individuals nested within 447 community (Level 2) in China, without any predict variables in the fixed part, but includes the intercepts in the random parts of the model. The model notation of the first sequential model shows below:

$$H_{ij} = \beta_0 + \mu_j + \epsilon_{ij} \tag{A6.1}$$

In Eq. (A6.1), H_{ij} denotes the observed health status of the i-th individual lives in the j-th community; β_0 is the average (or mean log odds ratio for dummy dependent health outcomes) health status of older people across all community. From this model, we are able to distinguish the effect of community (μ_j), the effect of individual and other unobservable factors effect (ϵ_{ij}) on health, respectively. Above model provides a baseline estimation to compare the size of variations of contextual relationship in health outcome in the following models.

Second, the time dummy (T: 0=wave 1; 1=wave 2) was then included in the fixed part of Eq. (A6.1), which allows the investigation as to whether there is a time variation of respondents' health status and time effect. The second model notation as below shown:

$$H_{ij} = \beta_0 + \beta_1 T + \mu_j + \epsilon_{ij} \tag{A6.2}$$

Third, the individual-level characteristics (including social capital at the individual-level) were then added in the fixed part of Eq. (A6.2) to investigate the effect of individual variables on their health outcomes. The model expression of the third sequential model is shown below:

$$H_{ij} = \beta_0 + \beta_1 T + \beta_2 X_{ij} + \beta_3 ISC_{ij} + \mu_j + \epsilon_{ij} \tag{A6.3}$$

where X_{ij} contains a set of control variables, including information of samples' demographic and socio-economic status (SES); ISC_{ij} is the social capital at individual-level.

Next, the main explanatory variable–social capital at the community-level (CSC_j) was then included in Eq. (A6.3), to examine the effect of community-level social capital on the health outcomes of mid and older people. The fourth sequential model as below shown:

$$H_{ij} = \beta_0 + \beta_1 T + \beta_2 X_{ij} + \beta_3 ISC_{ij} + \beta_4 CSC_j + \mu_j + \epsilon_{ij} \tag{A6.4}$$

After that, in order to examine the effect of income inequality on the health status of Chinese older residents, another main explanatory variable: county-level Gini coefficient (G_j) was then added in Eq. (A6.4). The fifth sequential model is shown below:

$$H_{ij} = \beta_0 + \beta_1 T + \beta_2 X_{ij} + \beta_3 ISC_{ij} + \beta_4 CSC_j + \beta_5 G_j + \mu_j + \epsilon_{ij} \tag{A6.5}$$

Finally, an interaction term of social capital at the community-level and Gini coefficient at the county-level (CSC_j*G_j) was included in Eq. (A6.5) to test whether social capital could mitigate the negative effect of income inequality on health outcomes of mid and older Chinese:

$$H_{ij} = \beta_0 + \beta_1 T + \beta_2 X_{ij} + \beta_3 ISC_{ij} + \beta_4 CSC_j + \beta_5 G_j + \beta_6 G_j * CSC_j + \mu_j + \epsilon_{ij} \text{(A6.8)}$$

The estimated results for different health indicators shown in Tables A1 to Table A5. Table A1 and Table A2 present the results from multilevel logistic models as the dependent variable is a dummy variable, while Table A3 to Table A5 contains the results of multilevel linear models. The coefficient of the logistic results remains and were not converted into odds ratios (OR) as it is not the focus in this section.

TABLE A 6 - 1: 2-LEVEL MULTILEVEL LOGITS ESTIMATIONS: DEPENDENT VARIABLE IS SELF-RATED HEALTH (SRH), 2011/2012 ~ 2013/2014 (2-YEAR PANEL)

	Model 1	Model 2	Model 3	Model 4	Model 5
Interview Wave (T, 0=11/12, 1=13/14)		0.011	0.071	0.066	0.072
		(0.028)	(0.046)	(0.047)	(0.049)
Individual-level Social Capital (*ISC_j*)					
Perceived Health Care (Non-Pain) from Others			0.405***	0.392***	0.391***
			(0.036)	(0.037)	(0.038)
Reciprocity			-0.023	-0.010	-0.017
			(0.045)	(0.046)	(0.048)
Interaction with Friends			0.111***	0.109***	0.103***
			(0.036)	(0.037)	(0.038)
Engaged in Charity Work			0.231***	0.214***	0.202***
			(0.056)	(0.057)	(0.058)
Engaged in Social Activities			0.255***	0.232***	0.242***
			(0.050)	(0.051)	(0.052)
Engaged in Group Events			0.334***	0.319***	0.285***
			(0.078)	(0.080)	(0.081)
Control Variables (X_{ij})					
Individual Age			-0.003	-0.003	-0.002
			(0.002)	(0.002)	(0.002)
Gender (0=M;1=F)			-0.001	0.010	0.027
			(0.049)	(0.050)	(0.052)
Marital Status (0=Married; 1=Other)			-0.044	-0.052	-0.074
			(0.054)	(0.054)	(0.056)
Educational Achievement					
Can Read & Write			0.047	0.041	0.031
			(0.052)	(0.053)	(0.054)
Finished Primary			0.098*	0.087	0.082
			(0.057)	(0.058)	(0.059)
Junior High and Above			0.303***	0.290***	0.276***
			(0.057)	(0.059)	(0.061)
Health Insurance (0=No;1=Yes)			-0.080	-0.108	-0.125
			(0.081)	(0.084)	(0.084)
Work Status (1=Working; 0=Not Working)			0.789***	0.801***	0.830***
			(0.044)	(0.044)	(0.044)
Current Hukou (0=Agricultural; 1=Others)			0.332***	0.308***	0.253***
			(0.067)	(0.069)	(0.068)
Whether Born in Current Place			0.050	0.052	0.067
			(0.039)	(0.041)	(0.042)
Lifestyle					
Exercises (0=No;1=Yes)			0.026	0.016	0.013
			(0.039)	(0.039)	(0.040)
Cigarettes Consumed Per Day			-0.004**	-0.003*	-0.003*
			(0.002)	(0.002)	(0.002)
Drink (0=No;1=Yes)			0.499***	0.521***	0.521***
			(0.046)	(0.048)	(0.049)
Household Characteristics					
Household Size			0.008	0.006	0.011

			(0.011)	(0.011)	(0.011)
Live with Child/Children			-0.087**	-0.089**	-0.081*
			(0.042)	(0.043)	(0.044)
Household Labour Participation Rate			0.000	0.000	0.000
			(0.001)	(0.001)	(0.001)
Log Annual Household Income Per Capita			0.012**	0.011**	0.056***
			(0.005)	(0.006)	(0.012)
Log Value of Long-Lasting Assets			0.006*	0.005	0.003
			(0.003)	(0.003)	(0.003)
Urban (0=Rural; 1=Urban)			0.485***	0.274***	0.232***
			(0.067)	(0.071)	(0.071)
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C[1] (%)				0.005**	0.006***
				(0.002)	(0.002)
Proportion of Reciprocity Activities in the V/C (%)				-0.005	-0.004
				(0.005)	(0.004)
Proportion of Social Participation in the V/C (%)				0.002	0.001
				(0.002)	(0.002)
Variety in the Number of Amenities				0.055***	0.049***
				(0.009)	(0.008)
Community-level Explanatory Variables (*G_j*)					
Gini Coefficient (County-level)					-1.140***
					(0.404)
Constant	1.283***	1.277***	-0.062	-0.496*	-0.175
	(0.029)	(0.034)	(0.225)	(0.284)	(0.386)
L2: Between Community Variance (σ_μ^2)	0.268***	0.269***	0.194***	0.161***	0.147***
	(0.027)	(0.027)	(0.024)	(0.021)	(0.020)
VPCs (Level 2)	7.54%	7.55%	5.58%	4.68%	4.26%
Log (Restricted) Likelihood[2]	-15678	-15678	-12556	-11834	-11265
Likelihood ratio $\chi^2(df)$ test[3]	.	$\chi^2(1)$ =	$\chi^2(27)$ =	$\chi^2(4)$ =	$\chi^2(1)$ =
		0.16	6244.1***	1443.6***	1137.8***
AIC[4]	31360	31362	25168	23732	22596
BIC[4]	31377	31387	25395	23990	22861
OBS	29533	29533	24946	23478	22420
Num. Communities	447	447	445	445	445

*Notes: Robust standard errors in parentheses, sig: * p<0.1, ** p<0.05, *** p<0.01. (1)V/C is the abbreviation of village and/or community. (2) The random intercept estimations (nested estimations) compared with non-nested estimations. (3) This test shows whether inclusion of more explanatory factor(s) is significantly different from less explanatory factor(s). For example, Null model (without any predictor) is compared with Model (1A) with one (more) predictor(s), and same for other models. (4) AIC = Akaike information criterion; BIC = Bayesian information criterion.*

TABLE A 6 - 2: 2-LEVEL MULTILEVEL LOGITS ESTIMATIONS: DEPENDENT VARIABLE IS SELF-RATED WELL-BEING (SRWB), 2011/2012 ~ 2013/2014 (2-YEAR PANEL)

	Model 1	Model 2	Model 3	Model 4	Model 5
Interview Wave (T, 0=11/12, 1=13/14)		0.158***	0.184***	0.203***	0.188***
		(0.038)	(0.062)	(0.061)	(0.061)
Individual-level Social Capital (*ISC_j*)					
Perceived Health Care (Non-Pain) from Others			0.722***	0.727***	0.727***
			(0.045)	(0.047)	(0.048)
Reciprocity			0.074	0.065	0.058
			(0.053)	(0.055)	(0.057)
Interaction with Friends			0.176***	0.164***	0.153***
			(0.045)	(0.045)	(0.047)
Engaged in Charity Work			-0.082	-0.084	-0.110*
			(0.059)	(0.061)	(0.064)
Engaged in Social Activities			0.272***	0.281***	0.264***
			(0.055)	(0.057)	(0.059)
Engaged in Group Events			0.507***	0.513***	0.485***
			(0.094)	(0.100)	(0.102)
Control Variables (X_{ij})					
Individual Age			0.036***	0.036***	0.037***
			(0.003)	(0.003)	(0.003)
Gender (0=M;1=F)			-0.150***	-0.171***	-0.175***
			(0.058)	(0.060)	(0.062)
Marital Status (0=Married; 1=Other)			0.474***	0.475***	0.440***
			(0.063)	(0.065)	(0.068)
Educational Achievement					
Can Read & Write			0.042	0.049	0.043
			(0.060)	(0.062)	(0.064)
Finished Primary			0.161***	0.154**	0.145**
			(0.062)	(0.064)	(0.065)
Junior High and Above			0.298***	0.306***	0.290***
			(0.069)	(0.072)	(0.073)
Health Insurance (0=No;1=Yes)			0.188**	0.204**	0.200**
			(0.080)	(0.082)	(0.087)
Work Status (1=Working; 0=Not Working)			0.098*	0.093	0.143**
			(0.058)	(0.059)	(0.062)
Current Hukou (0=Agricultural; 1=Others)			0.344***	0.349***	0.245***
			(0.077)	(0.079)	(0.084)
Whether Born in Current Place			0.052	0.035	0.074
			(0.047)	(0.049)	(0.050)
Lifestyle					
Exercises (0=No;1=Yes)			0.032	0.051	0.058
			(0.047)	(0.049)	(0.050)
Cigarettes Consumed Per Day			0.001	0.001	0.000
			(0.002)	(0.002)	(0.003)
Drink (0=No;1=Yes)			0.058	0.066	0.040
			(0.048)	(0.050)	(0.051)
Household Characteristics					
Household Size			0.004	0.005	0.009
			(0.014)	(0.014)	(0.014)
Live with Child/Children			-0.051	-0.050	-0.040

			(0.051)	(0.053)	(0.055)
Household Labour Participation Rate			0.001*	0.001*	0.001
			(0.001)	(0.001)	(0.001)
Log Annual Household Income Per Capita			0.039***	0.037***	0.119***
			(0.006)	(0.006)	(0.014)
Log Value of Long-Lasting Assets			0.013***	0.012***	0.007*
			(0.004)	(0.004)	(0.004)
Urban (0=Rural; 1=Urban)			0.089	0.073	0.043
			(0.076)	(0.094)	(0.096)
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C[1] (%)				0.004	0.004
				(0.003)	(0.003)
Proportion of Reciprocity Activities in the V/C (%)				0.005	0.008
				(0.006)	(0.006)
Proportion of Social Participation in the V/C (%)				0.002	0.001
				(0.003)	(0.003)
Variety in the Number of Amenities				0.010	0.007
				(0.012)	(0.012)
Community-level Explanatory Variables (*G_j*)					
Gini Coefficient (County-level)					-0.779
					(0.511)
Constant	1.879***	1.798***	-2.232***	-2.656***	-2.835***
	(0.036)	(0.042)	(0.267)	(0.349)	(0.507)
L2: Between Community Variance (σ_μ^2)	0.391***	0.393***	0.342***	0.333***	0.338***
	(0.040)	(0.040)	(0.039)	(0.040)	(0.043)
VPCs (Level 2)	10.62%	10.68%	9.42%	9.20%	9.32%
Log (Restricted) Likelihood[2]	-12045	-12034	-9652	-9090	-8601
Likelihood ratio $\chi^2(df)$ test[3]	.	$\chi^2(1)$ = 21.95***	$\chi^2(27)$ = 4764.7***	$\chi^2(4)$ = 1124.2***	$\chi^2(1)$ = 976.9***
AIC[4]	24095	24075	19360	18244	17269
BIC[4]	24111	24099	19587	18502	17533
OBS	29533	29533	24946	23478	22420
Num. Communities	447	447	445	445	445

*Notes: Robust standard errors in parentheses, sig: * p<0.1, ** p<0.05, *** p<0.01. (1)V/C is the abbreviation of village and/or community. (2) The random intercept estimations (nested estimations) compared with non-nested estimations. (3) This test shows whether inclusion of more explanatory factor(s) is significantly different from less explanatory factor(s). For example, Null model (without any predictor) is compared with Model (1A) with one (more) predictor(s), and same for other models. (4) AIC = Akaike information criterion; BIC = Bayesian information criterion.*

TABLE A 6 - 3: 2-LEVEL MULTILEVEL LINEAR ESTIMATIONS: DEPENDENT VARIABLE IS COGNITIVE FUNCTION HEALTH INDICATOR, 2011/2012 ~ 2013/2014 (2-YEAR PANEL)

	Model 1	Model 2	Model 3	Model 4	Model 5
Interview Wave (T, 0=11/12, 1=13/14)		-0.213***	-0.078	-0.077	-0.076
		(0.061)	(0.076)	(0.078)	(0.079)
Individual-level Social Capital (*ISC$_j$*)					
Perceived Health Care (Non-Pain) from Others			0.446***	0.460***	0.461***
			(0.047)	(0.049)	(0.050)
Reciprocity			0.346***	0.350***	0.356***
			(0.058)	(0.060)	(0.061)
Interaction with Friends			0.303***	0.290***	0.289***
			(0.049)	(0.051)	(0.051)
Engaged in Charity Work			0.353***	0.328***	0.315***
			(0.068)	(0.070)	(0.072)
Engaged in Social Activities			0.643***	0.639***	0.623***
			(0.054)	(0.056)	(0.057)
Engaged in Group Events			0.544***	0.527***	0.519***
			(0.068)	(0.072)	(0.073)
Control Variables (X$_{ij}$)					
Individual Age			-0.057***	-0.058***	-0.057***
			(0.003)	(0.004)	(0.004)
Gender (0=M;1=F)			-0.548***	-0.579***	-0.601***
			(0.069)	(0.070)	(0.071)
Marital Status (0=Married; 1=Other)			0.553***	0.549***	0.567***
			(0.081)	(0.082)	(0.084)
Educational Achievement					
Can Read & Write			2.439***	2.429***	2.415***
			(0.081)	(0.083)	(0.085)
Finished Primary			3.616***	3.605***	3.579***
			(0.085)	(0.086)	(0.086)
Junior High and Above			4.635***	4.627***	4.603***
			(0.087)	(0.088)	(0.089)
Health Insurance (0=No;1=Yes)			0.366***	0.348***	0.346***
			(0.098)	(0.103)	(0.103)
Work Status (1=Working; 0=Not Working)			0.421***	0.432***	0.455***
			(0.060)	(0.061)	(0.061)
Current Hukou (0=Agricultural; 1=Others)			0.891***	0.880***	0.805***
			(0.091)	(0.094)	(0.096)
Whether Born in Current Place			0.010	0.004	0.021
			(0.058)	(0.060)	(0.060)
Lifestyle					
Exercises (0=No;1=Yes)			0.095**	0.094**	0.086*
			(0.045)	(0.047)	(0.048)
Cigarettes Consumed Per Day			0.001	0.002	0.002
			(0.002)	(0.002)	(0.002)
Drink (0=No;1=Yes)			-0.033	-0.039	-0.051
			(0.047)	(0.048)	(0.049)
Household Characteristics					
Household Size			-0.003	-0.005	-0.004
			(0.015)	(0.015)	(0.015)
Live with Child/Children			-0.130**	-0.110*	-0.098*
			(0.057)	(0.058)	(0.059)

Household Labour Participation Rate			-0.002**	-0.002**	-0.003***
			(0.001)	(0.001)	(0.001)
Log Annual Household Income Per Capita			0.055***	0.053***	0.106***
			(0.008)	(0.008)	(0.017)
Log Value of Long-Lasting Assets			0.032***	0.030***	0.028***
			(0.004)	(0.004)	(0.004)
Urban (0=Rural; 1=Urban)			0.748***	0.448***	0.363***
			(0.099)	(0.118)	(0.118)
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C[1] (%)				0.004	0.005*
				(0.003)	(0.003)
Proportion of Reciprocity Activities in the V/C (%)				-0.013*	-0.012
				(0.008)	(0.008)
Proportion of Social Participation in the V/C (%)				0.017***	0.016***
				(0.003)	(0.003)
Variety in the Number of Amenities				0.051***	0.039***
				(0.014)	(0.014)
Community-level Explanatory Variables (G_j)					
Gini Coefficient (County-level)					-1.856***
					(0.654)
Constant	11.872***	11.984***	9.839***	9.012***	9.724***
	(0.089)	(0.095)	(0.320)	(0.411)	(0.557)
L2: Between Community Variance (σ_μ^2)	3.271***	3.261***	0.682***	0.570***	0.541***
	(0.217)	(0.216)	(0.062)	(0.055)	(0.052)
L1: Between Individual Variance (σ_ε^2)	15.204***	15.194***	9.801***	9.860***	9.794***
	(0.183)	(0.183)	(0.109)	(0.109)	(0.112)
VPCs (Level 2)	17.70%	17.67%	6.51%	5.47%	5.23%
Log (Restricted) Likelihood[2]	-82684	-82673	-64207	-60476	-57674
Likelihood ratio $\chi^2(df)$ test[3]	.	$\chi^2(1)$ = 21.63***	$\chi^2(27)$ = 36933***	$\chi^2(4)$ = 7462***	$\chi^2(1)$ = 5605***
AIC[4]	165374	165354	128472	121018	115415
BIC[4]	165399	165387	128707	121284	115688
OBS	29533	29533	24946	23478	22420
Num. Communities	447	447	445	445	445

*Notes: Robust standard errors in parentheses, sig: * p<0.1, ** p<0.05, *** p<0.01. (1)V/C is the abbreviation of village and/or community. (2) The random intercept estimations (nested estimations) compared with non-nested estimations. (3) This test shows whether inclusion of more explanatory factor(s) is significantly different from less explanatory factor(s). For example, Null model (without any predictor) is compared with Model (1A) with one (more) predictor(s), and same for other models. (4) AIC = Akaike information criterion; BIC = Bayesian information criterion.*

TABLE A 6 - 4: 2-LEVEL MULTILEVEL LINEAR ESTIMATIONS: DEPENDENT VARIABLE IS CES-D HEALTH INDICATOR, 2011/2012 ~ 2013/2014 (2-YEAR PANEL)

	Model 1	Model 2	Model 3	Model 4	Model 5
Interview Wave (T, 0=11/12, 1=13/14)		-0.482***	-0.766***	-0.770***	-0.764***
		(0.094)	(0.128)	(0.132)	(0.135)
Individual-level Social Capital (*ISC_j*)					
Perceived Health Care (Non-Pain) from Others			-2.022***	-2.012***	-2.007***
			(0.096)	(0.098)	(0.100)
Reciprocity			0.348***	0.347***	0.348***
			(0.094)	(0.098)	(0.101)
Interaction with Friends			-0.361***	-0.375***	-0.358***
			(0.084)	(0.087)	(0.089)
Engaged in Charity Work			0.070	0.120	0.116
			(0.114)	(0.116)	(0.120)
Engaged in Social Activities			-0.954***	-0.906***	-0.870***
			(0.091)	(0.094)	(0.096)
Engaged in Group Events			-0.961***	-0.974***	-0.954***
			(0.127)	(0.131)	(0.136)
Control Variables (X_{ij})					
Individual Age			-0.013**	-0.014**	-0.016***
			(0.006)	(0.006)	(0.006)
Gender (0=M;1=F)			1.285***	1.266***	1.246***
			(0.111)	(0.113)	(0.115)
Marital Status (0=Married; 1=Other)			-1.199***	-1.244***	-1.210***
			(0.139)	(0.141)	(0.147)
Educational Achievement					
Can Read & Write			0.212	0.226	0.266*
			(0.140)	(0.142)	(0.145)
Finished Primary			-0.447***	-0.425***	-0.367**
			(0.140)	(0.143)	(0.145)
Junior High and Above			-1.060***	-1.036***	-0.996***
			(0.151)	(0.155)	(0.162)
Health Insurance (0=No;1=Yes)			-0.303*	-0.299	-0.353*
			(0.180)	(0.189)	(0.197)
Work Status (1=Working; 0=Not Working)			-0.790***	-0.788***	-0.886***
			(0.104)	(0.106)	(0.111)
Current Hukou (0=Agricultural; 1=Others)			-0.917***	-0.913***	-0.759***
			(0.141)	(0.144)	(0.146)
Whether Born in Current Place			-0.175*	-0.183**	-0.223**
			(0.093)	(0.093)	(0.094)
Lifestyle					
Exercises (0=No;1=Yes)			-0.128	-0.118	-0.122
			(0.097)	(0.100)	(0.100)
Cigarettes Consumed Per Day			0.006	0.005	0.005
			(0.004)	(0.004)	(0.004)
Drink (0=No;1=Yes)			-0.251**	-0.287***	-0.281***
			(0.099)	(0.101)	(0.103)
Household Characteristics					
Household Size			-0.033	-0.027	-0.042
			(0.027)	(0.028)	(0.028)
Live with Child/Children			0.349***	0.328***	0.309***
			(0.095)	(0.098)	(0.101)

Household Labour Participation Rate			-0.003*	-0.003*	-0.002
			(0.002)	(0.002)	(0.002)
Log Annual Household Income Per Capita			-0.067***	-0.062***	-0.225***
			(0.013)	(0.013)	(0.030)
Log Value of Long-Lasting Assets			-0.019***	-0.016**	-0.006
			(0.007)	(0.007)	(0.007)
Urban (0=Rural; 1=Urban)			-1.112***	-0.467**	-0.306
			(0.178)	(0.192)	(0.193)
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C[1] (%)				-0.025***	-0.029***
				(0.006)	(0.005)
Proportion of Reciprocity Activities in the V/C (%)				0.042***	0.038***
				(0.013)	(0.013)
Proportion of Social Participation in the V/C (%)				-0.008	-0.005
				(0.006)	(0.006)
Variety in the Number of Amenities				-0.144***	-0.125***
				(0.024)	(0.024)
Community-level Explanatory Variables (*G_j*)					
Gini Coefficient (County-level)					3.534***
					(1.114)
Constant	7.924***	8.177***	14.050***	15.574***	14.980***
	(0.097)	(0.122)	(0.544)	(0.698)	(0.998)
L2: Between Community Variance (σ_μ^2)	3.590***	3.613***	2.253***	1.837***	1.723***
	(0.263)	(0.264)	(0.193)	(0.159)	(0.157)
L1: Between Individual Variance (σ_ε^2)	32.835***	32.774***	30.015***	30.056***	29.827***
	(0.540)	(0.534)	(0.483)	(0.486)	(0.487)
VPCs (Level 2)	9.86%	9.93%	6.98%	5.76%	5.46%
Log (Restricted) Likelihood[2]	-93918	-93893	-78180	-73569	-70165
Likelihood ratio $\chi^2(df)$ test[3]		$\chi^2(1)$ = 51.20***	$\chi^2(27)$ = 31426***	$\chi^2(4)$ = 9222***	$\chi^2(1)$ = 6808***
AIC[4]	187843	187793	156418	147204	140398
BIC[4]	187867	187827	156653	147470	140670
OBS	29533	29533	24946	23478	22420
Num. Communities	447	447	445	445	445

*Notes: Robust standard errors in parentheses, sig: * p<0.1, ** p<0.05, *** p<0.01. (1)V/C is the abbreviation of village and/or community. (2) The random intercept estimations (nested estimations) compared with non-nested estimations. (3) This test shows whether inclusion of more explanatory factor(s) is significantly different from less explanatory factor(s). For example, Null model (without any predictor) is compared with Model (1A) with one (more) predictor(s), and same for other models. (4) AIC = Akaike information criterion; BIC = Bayesian information criterion.*

TABLE A 6 - 5: 2-LEVEL MULTILEVEL LINEAR ESTIMATIONS: DEPENDENT VARIABLE IS PHYSICAL HEALTH (ADLS & IADLS), 2011/2012 ~ 2013/2014 (2-YEAR PANEL)

	Model 1	Model 2	Model 3	Model 4	Model 5
Interview Wave (T, 0=11/12, 1=13/14)		0.125	0.111	0.094	0.061
		(0.104)	(0.156)	(0.162)	(0.163)
Individual-level Social Capital (*ISC$_j$*)					
Perceived Health Care (Non-Pain) from Others			0.113	0.159	0.145
			(0.119)	(0.123)	(0.125)
Reciprocity			0.782***	0.745***	0.779***
			(0.135)	(0.140)	(0.147)
Interaction with Friends			0.525***	0.520***	0.476***
			(0.125)	(0.129)	(0.133)
Engaged in Charity Work			-0.144	-0.175	-0.207
			(0.171)	(0.173)	(0.174)
Engaged in Social Activities			0.114	0.127	0.115
			(0.142)	(0.147)	(0.151)
Engaged in Group Events			-0.037	-0.112	-0.089
			(0.214)	(0.219)	(0.225)
Control Variables (X$_{ij}$)					
Individual Age			0.033***	0.035***	0.037***
			(0.009)	(0.009)	(0.009)
Gender (0=M;1=F)			1.328***	1.324***	1.355***
			(0.166)	(0.168)	(0.169)
Marital Status (0=Married; 1=Other)			0.379**	0.434**	0.448**
			(0.183)	(0.187)	(0.194)
Educational Achievement					
Can Read & Write			0.998***	1.002***	1.007***
			(0.173)	(0.176)	(0.182)
Finished Primary			1.019***	1.041***	0.967***
			(0.190)	(0.194)	(0.196)
Junior High and Above			0.189	0.196	0.150
			(0.194)	(0.200)	(0.202)
Health Insurance (0=No;1=Yes)			0.119	0.078	0.132
			(0.230)	(0.237)	(0.252)
Work Status (1=Working; 0=Not Working)			1.842***	1.863***	1.942***
			(0.186)	(0.186)	(0.192)
Current Hukou (0=Agricultural; 1=Others)			0.553***	0.453**	0.449**
			(0.205)	(0.220)	(0.222)
Whether Born in Current Place			-0.214	-0.194	-0.189
			(0.132)	(0.134)	(0.139)
Lifestyle					
Exercises (0=No;1=Yes)			0.538***	0.540***	0.521***
			(0.118)	(0.120)	(0.124)
Cigarettes Consumed Per Day			-0.001	-0.000	0.001
			(0.006)	(0.006)	(0.007)
Drink (0=No;1=Yes)			-0.113	-0.148	-0.131
			(0.133)	(0.135)	(0.137)
Household Characteristics					
Household Size			0.080**	0.079**	0.087***
			(0.032)	(0.032)	(0.032)
Live with Child/Children			-0.359***	-0.388***	-0.323**
			(0.133)	(0.137)	(0.138)

Household Labour Participation Rate			0.001	0.001	0.000
			(0.002)	(0.002)	(0.002)
Log Annual Household Income Per Capita			-0.043**	-0.047**	-0.066*
			(0.019)	(0.019)	(0.039)
Log Value of Long-Lasting Assets			0.014	0.015	0.015
			(0.011)	(0.011)	(0.012)
Urban (0=Rural; 1=Urban)			0.274	0.201	0.196
			(0.174)	(0.200)	(0.204)
Community-level Social Capital (*CSC_j*)					
Proportion of Trust in People in the V/C[1] (%)				-0.006	-0.003
				(0.006)	(0.006)
Proportion of Reciprocity Activities in the V/C (%)				0.019	0.016
				(0.013)	(0.014)
Proportion of Social Participation in the V/C (%)				0.007	0.006
				(0.006)	(0.006)
Variety in the Number of Amenities				0.031	0.028
				(0.027)	(0.027)
Community-level Explanatory Variables (*G_j*)					
Gini Coefficient (County-level)					-1.663
					(1.124)
Constant	48.977***	48.911***	43.433***	42.969***	43.813***
	(0.070)	(0.093)	(0.785)	(0.930)	(1.188)
L2: Between Community Variance (σ_μ^2)	1.017	1.017	1.049	1.024	0.993
	(0.138)	(0.138)	(0.154)	(0.158)	(0.162)
L1: Between Individual Variance (σ_ε^2)	69.809***	69.805***	66.436***	66.407***	66.399***
	(0.963)	(0.964)	(0.928)	(0.959)	(0.965)
VPCs (Level 2)	1.44%	1.44%	1.55%	1.52%	1.47%
Log (Restricted) Likelihood[2]	-104747	-104746	-87874	-82696	-78967
Likelihood ratio $\chi^2(df)$ test[3]		$\chi^2(1)$ = 1.64	$\chi^2(27)$ = 33746***	$\chi^2(4)$ = 10355***	$\chi^2(1)$ = 7459***
AIC[4]	209501	209501	175805	165459	158002
BIC[4]	209526	209534	176041	165725	158275
OBS	29533	29533	24946	23478	22420
Num. Communities	447	447	445	445	445

*Notes: Robust standard errors in parentheses, sig: * $p<0.1$, ** $p<0.05$, *** $p<0.01$. (1)V/C is the abbreviation of village and/or community. (2) The random intercept estimations (nested estimations) compared with non-nested estimations. (3) This test shows whether inclusion of more explanatory factor(s) is significantly different from less explanatory factor(s). For example, Null model (without any predictor) is compared with Model (1A) with one (more) predictor(s), and same for other models. (4) AIC = Akaike information criterion; BIC = Bayesian information criterion.*

The null model without any explanatory variables (Model 1s in all Tables) exposed significant variation in the health outcomes of older respondents between 447 communities (σ_μ^2 of Model 1s in each table is significant at 1% level with a range from 1 to 3.6). However, a decrease in the random parameter from Model 1s to Model 2s in each table shows that some of the variations found by Model 1s were explained by differences of time variation. Although we found a further decline pattern that after more explanatory variables (i.e. individual-level variables and community-level variable) were added to the Mode 3s to Model 5s in each table, the between community variance in each model still shows significantly at 1% level. In addition, the VPCs at level 2 in each model shows that at least 4% of the total variance can be explained by the level 2 variance (except for the models of physical health dependent variable with around 1.5% level 2 VPCs). Finally, the model-fit statistics in each model from Table A6-1 to Table A6-4 indicates a decline pattern (smaller values) for Log (Restricted) Likelihood, Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), meaning that more explanatory variable added to the model better fit to each model. Furthermore, the Likelihood ratio χ^2 (*df*) test further confirms that the higher level (i.e. community-level) factors (i.e. county-level Gini coefficient and community-level social capital) have a significant improvement to the model (Model 4s and Model 5s in each table). Therefore, multilevel strategic is needed for this study.