

UNIVERSITY OF BIRMINGHAM

Understanding Saving, Consumption, and Healthcare Systems in China

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A thesis submitted to University of Birmingham for the degree of DOCTOR OF PHILOSOPHY

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September 2017

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Abstract

Due to the one-child policy, population ageing has become a serious issue in China, with the potential to affect negatively economic growth. As a result, pension and healthcare reforms sit atop of the policy-agenda. This thesis aims to explain the financial behaviour of households and individuals in China, with a particular focus on the effects of the old-age dependency ratio, household composition and different types of medical insurance schemes.

Using provincial-level panel data over the period 1995-2015, the second chapter of this thesis investigates the links between the old-age dependency ratio (the ratio of the population aged 65 and over to the population aged between 15 and 64) and household savings. Our system GMM estimates show a negative association between the two variables, which is lower in areas with higher government medical expenditure, higher financial development and higher insurance density, as well as in urban areas.

We next use the 2011 and 2013 waves of the China Health and Retirement Longitudinal Study (CHARLS) to investigate the extent to which the departure of younger generations' members of a household, differentiated across different age groups, affects household consumption. Applying a range of different estimators and specifications, our results suggest that households generally exhibit a lower consumption after a member moves out. We also show that the allocation of the freed-up resources is conditional on the leaver's age: Parents save all the extra resources if the leaver is aged below 25 and even reduce their own consumption if the leaver is aged between 0 and 16. By contrast, if the leaver is aged at least 25, part of the resources freed-up by his/her departure are spent. Furthermore, we find that transfers directed out of the household do not increase after a departure.

The final chapter of this thesis evaluates and compares the performance of the main public health insurance systems in China, namely the Urban Employee Basic Medical Scheme (UEBMI) and the resident health insurance schemes (RHI). Applying a range of different estimators and specifications, our analyses, based on the 2011, 2013, and 2015 waves of the CHARLS dataset suggest that enrolment in health insurance is positively associated with household consumption and medical expenditure. In addition, we find that the UEBMI has stronger associations with household consumption and medical expenditures than the RHI. We further explore heterogeneity in these associations and find that the RHI fails to assist poor people in purchasing sufficient healthcare, whilst the UEBMI is associated with overutilization of healthcare services.

I would like to delicate this thesis to

my beloved parents, Fangmin Zhang and Yufen Pan, and

my beloved grandma, Pinrong Zhang,

for their endless love, support and encouragement.

I love you dearly.

Acknowledgement

The completion of this doctoral thesis would not have been possible without the support and help of the kind people around me. It is a pleasure to convey my heartfelt gratitude to them in my humble acknowledgement.

I would like to express my sincere thanks and appreciation to my lead supervisor, Professor Alessandra Guariglia, for her support for all stages of completing the research and writing the thesis. I appreciate all of her ideas, inspiration, guidance and encouragement which have helped to make my PhD experience as productive as possible. It is no exaggeration to say that she inspires my passion for academic research. She has been one of my greatest supporters, and I have learned so much from her enthusiasm, originality and insights.

I am also grateful to my second supervisor, Professor David Dickinson, for all of his good advice. My sincere gratitude also goes to Dr. Giovanni Calice who encouraged me to apply for funding for the PhD programme. Financial support from the Department of Economics of the University of Birmingham is very gratefully acknowledged as well. My sincere thanks and appreciation also go the examiners of the thesis, Professor Agar Brugiavini, and Mr. Nicholas Horsewood, for their time and effort, in particular their constructive suggestions and comments which help me improve the quality of the thesis.

I am grateful to Dr. Tong Zhang, Dr. Rong Huang, Dr. Peiling Liao, Martha Omolo and Charlie Rahal for sharing moments of joy and distress and for being a source of motivation and encouragement. A huge thank you goes to many friends and my PhD fellows who have encouraged, enlightened, and entertained me throughout this tortuous journey. Especially I would like to thank Shulin Deng, Dr. Liyun Zhang, Neha Prashar,

Dr. Marco Giansoldati, Dr. Bing Liu, Tong Yin, Tong Zhu, Siyao Yang, Weifeng Zhou, Mai Tran, Zuokuan Zhou, Danying Li, Chenyang Wang, Dr. Shixuan Wang, Weiqin Tang, Dr. Yuqian Zhao, and Aima Tahir.

Following this, I would like to formally acknowledge the large number of academics at the University of Birmingham for enhancing my economics education during my Master's and PhD level taught models. This list might include but is not limited to lectures given by Professor John Fender, Professor Peter Sinclair, Dr. William Pouliot, Professor Martin Jensen, Dr. Pei Kuang, and Dr. Siddhartha Bandyopadhyay. Third party editing was undertaking by Dr. Charlie Rahal.

Last, but not least, I would like to express my deepest appreciation to my family for their constant encouragement and unconditional love. Above all to my parents, who have always supported me in every possible way: words cannot express my love and gratitude for them. This thesis was only made possible because my grandmother, Pinrong Zhang, took such good care of me while growing up. She inspired me to be the most brave and wonderful lady possible, just as she was. My uncle Dongqin Pan encouraged me to take the PhD programme four years ago and he is always kind enough to spend his time giving me advice and helping to plan my future. My aunty, Yufang Pan, has been always sharing good stories with me and bringing me happiness. I am also thankful to my lovely brother, Zirui Zhangpan, who keeps company with my parents and entertains them when I am far away from home. I am so proud of him. Finally, I would like to thank everyone else who contributed to this PhD both directly or indirectly: without you it would never have finished in time.

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Lists of Abbreviations

BHPS	British Household Panel Survey
CAMS	Consumption and Activities Mail Survey
CEX	Consumer Expenditure Survey
CHARLS	China Health and Retirement Longitudinal Study
CHNS	China Health and Nutrition Survey
CMS	Cooperative Medical Scheme
EU	European Union
FES	Family Expenditure Survey
GDP	Gross Domestic Product
GEI	Government Employee's Insurance
GIS	Government Insurance System
GMM	General Methods of Moments
HRS	Health and Retirement Study
LI	Labour Insurance
LIS	Labour Insurance System
MSA	Medical Savings Accounts
MOH	Ministry of Health
NCMS	New Corporative Medical Scheme
NHI	National Health Insurance
NHS	National Health Service
NHSS	National Health Service Survey
OLS	Ordinary Least Squares
OOP	Out-of-pocket

PSID	Panel Study of Income Dynamic
PSM	Propensity Score Matching
RHI	Residents' Health Insurance
RMB	Ren Min Bi
SCF	Survey of Consumer Finance
SFIE	Survey of Family Income and Expenditure
SHARE	Survey of Health, Ageing and Retirement in Europe
SHIW	Survey on Household Income and Wealth
SIPP	Survey of Income and Programme Participation
SOE	State-owned Enterprise
SOEP	Socio-economic Panel
SPA	Social Pooling Account
U.K.	United Kingdom
U.S.	United States of America
UEBMI	Urban Employees Basic Medical Insurance
URBMI	Urban Resident Basic Medical Insurance
URRMI	Urban and Rural Resident Medical Insurance
VAR	Vector Autoregression
VLSS	Vietnam Living Standards Survey
VPHI	Voluntary Private Health Insurance

1 Introduction

This thesis consists of three empirical studies on household finance, which focus on the ageing population, household composition and the healthcare system in China. A general background for the research question is provided in Section 1.1. Section 1.2 gives the outline of the thesis and a brief introduction of the subsequent chapters. The contribution of this research to the existing knowledge base is mentioned in Section 1.3.

1.1 Background

1.1.1 Ageing population and household savings in China

Ageing population, which is caused by decreasing fertility rate and increasing life spans, has attracted global attention in recent times. In China, due to the one-child policy implemented in the 1980s, the birth rate decreased from 22.28% in 1982 to 12.07% in 2015 (2016 China Statistical Yearbook). Similarly, the young-age dependency ratio, defined as the ratio of the population aged 14 and under to the population aged between 15 and 64, declined to 22.6% in 2015 from 54.6% in 1982 (2016 China Statistical Yearbook). The old-age dependency ratio, which is defined as the ratio of the population aged 65 and over to the population aged between 15 and 64, increased to 14.3% in 2015 compared to 1982 when it was only 8.0%.

An ageing population brings substantial problems to an economy. For instance, it reduces the labour supply and asset accumulation, which can potentially lead to either economic contractions or stagnation. Previous studies, such as Modigliani (1970) and Horioka and Wan (2007), provide evidence that an ageing population has significant

negative effects on savings. When the old-age dependency ratio increases, the proportion of working people declines and that of retired people increases. In other words, a higher old-age dependency ratio represents a larger proportion of people who consume out of accumulated assets, and a smaller share of people who save for retirement. Therefore, aggregate savings are lower in areas with higher old-age dependency ratios.

At the individual level, elderly people typically have low income and high medical expenditure, and consequently lower savings ratios compared to young people. As people get older, they suffer from various physical limitations which can reduce their participation in certain economic activities. As a result, the income of elderly individuals is much lower than that of the working population. In addition, since health risks significantly increase with age, elderly people tend to pay a substantially large amount of money for medical treatment, especially in areas where patients have to pay a large proportion of medical expenditure themselves.

However, the savings ratio in China is increasing, along with the rapid ageing population. This could be due to that the effects of old-age dependency ratio on savings are small in China, or that there exist certain instruments which effectively mediate the negative effects of old-age dependency but are not recognized. The developments of public healthcare systems, as well as of the financial and insurance markets, reduce the uncertainties associated with income and medical expenditure for elderly citizens, which could in turn mediate the negative effects of ageing population on the economy. For instance, in regions where the public health system is more developed, the quality of healthcare facilities is better. Additionally, in those regions, residents tend to have better health education and the reimbursement rate of public health insurance scheme is generally higher. Therefore, the medical expenditure of elderly people is lower

and the association between old-age dependency ratio and household savings is weaker in these areas.

To the best of our knowledge, no previous studies have investigated how social welfare and financial development mediate the effects of demographic factors on household savings. Our contribution to the literature is to use annual provincial-level panel data over the period 1995-2015 to study the link between old-age dependency and household savings. We will also investigate the extent to which the Chinese government's medical expenditure and the development of financial and insurance markets weaken the negative effects of the ageing population on savings.

1.1.2 Household composition and household consumption in China

Household composition in China is very diverse given that it is the norm for different generations to reside in one household. Many adult children tend to live with their parents even after they get married and have their own offspring. In addition, caring for grandchildren is the standard way Chinese grandparents tend to spend their time in their old age. Based on the 2011 and 2013 waves of the China Health and Ageing Longitudinal Survey (CHARLS), more than 60% of the sample are households with members of at least two generations while around 25% of the sample are households with members of at least three generations and less than 24% of the households in the sample consists of only one generation.

Recently, China faced a deficit in its public pension scheme due to its ageing population. In 2014, the revenue and payment of the employee basic pension scheme

stood at 1,872.6 billion RMB and 1,904.5 billion RMB respectively (Department of Social Security Audit, 2015). Given the growing old-age population in China, this deficit is likely to further increase while the pension annuity will decrease. This implies that, rather than individuals relying on state-pensions, they currently have to save to ensure a smooth consumption pattern when they retire. Arguably, the best time for both household heads and parents to prepare for retirement is when household members move out of the family home, since the departure of household members frees up resources. The reallocation of these extra resources may considerably influence the household heads' consumption during retirement.

Rottke and Klos (2016), Coe and Webb (2010) and Dushi *et al*. (2015) carry out studies on the changes in household consumption and savings when children move out. The authors document that German, Italian and American parents tend to increase their consumption with the freed-up resources when children depart from home, raising concerns of a 'retirement saving crises' in these countries. Although the above authors' findings are alarming, they are based on western economies, and at the time of writing, no study has investigated the effects of children's departure on household consumption and savings in anything other than a western context. This is an area worth further investigation as it could provide interesting insights as to how Chinese households prepare for retirement.

1.1.3 Health insurance schemes in China

In order to provide universal health insurance coverage, the central government in China has implemented a series of health reforms since 1998. Firstly, in 1998, the government merged the Government Insurance Scheme (GIS) and Labour Insurance Scheme (LIS)

into the Urban Employment Basic Medical Insurance (UEBMI), which is a mandatory health insurance scheme run by the government. People who are formally employed in urban areas are eligible to enrol with UEBMI. Secondly, to improve the accessibility of healthcare services for residents in rural areas, the New Rural Cooperative Medical Scheme (NCMS) was launched in 2003. Therefore, residents who registered in rural areas are allowed to join NCMS. Thirdly, a public health insurance scheme for urban residents, who have no access to UEBMI or NCMS, was implemented in 2007, called the Urban Resident Basic Medical Insurance (URBMI).

UEBMI, NCMS and URBMI are the three largest health insurance programmes in China. As of 2015, 376.75 million employees had registered with UEBMI, around 670 million rural residents had joined NCMS and 288.94 million urban residents were enrolled with URBMI (China's Health and Family Planning Statistical Yearbook 2016). The total number of citizens' enrolment in these three health insurance schemes accounts for 97.17 percent of the Chinese population. This high percentage shows that the vision of universal health insurance coverage in China is almost being realized (China Statistical Yearbook 2016).

However, with regards to the insurance premium, reimbursement rate and coverage, there exist substantial differences among these three health insurance programmes. For instance, UEBMI has the most generous reimbursement rate among the three insurance schemes while the reimbursement rates of NCMS and URBMI are similar. Based on Barber and Yao (2011), the average inpatient reimbursement rate of NCMS was 41.5% in 2009 and that of URBMI was 45% in 2007 while the reimbursement rate for UEBMI was 65% in 2008. These differences lead to inequality in the accessibility of healthcare services between residents who hold different health insurance schemes. For

instance, with the same amount of out-of-pocket medical expenditure, patients covered by UEBMI are able to purchase more medical products than those who hold NCMS and URBMI.

Additional health system reforms in China are aimed at consolidating all public health insurance schemes by 2020 (Chinese Communist Party Committee and State Council, 2009). In January 2016, the Chinese central government issued documentation and guidance on merging NCMS and URBMI (State Council Policy Document 2016 No.3's guidelines). This required local and regionalized administrators to unify health insurance for residents who do not have access to UEBMI in urban and rural areas. Due to the similarity in the design of NCMS and URBMI, the merging of these two schemes had already occurred during the early periods of the implementation of URBMI. For instance, in Tianjin, Hangzhou and Ningxia, URBMI and NCMS were replaced by Urban and Rural Resident Medical Insurance (URRMI) during the period between 2007 and 2010. A further merger with UEBMI is needed to consolidate all public health insurance schemes (Pan *et al*., 2016).

Fully understanding the differences between the various public health insurance schemes, as well as the merits and disadvantages of each health insurance programme is very important. Only with this knowledge will policy makers and academics be able to design appropriate policies and effective reforms to narrow the inequality in the accessibility of healthcare services among the various insurance groups and consequently realize the consolidation of health insurance schemes. To this end, we evaluate and compare the main public health insurance programmes in China as well as exploring their limitations.

1.2 Outline of the Thesis

This thesis is organized as follows. Chapter Two examines the relationship between old-age dependency and the savings ratio in China. We emphasize the impact of government medical expenditure as well as the development of financial and insurance markets on the association between old-age dependency and the savings ratio. Taking into account that there exists inertia in the saving behaviour, we include the lagged savings ratio as an explanatory variable for the current savings behaviour. To control for endogeneity, we use the system GMM estimation technique. Our findings show that there is a negative association between old-age dependency and household savings, and this negative association is weaker in areas with higher levels of government medical expenditure, financial development and insurance density.

In Chapter Three we investigate the changes in household consumption when an offspring moves from the family home. Random-effects models are applied to show that household-level total consumption reduces when a member of a younger generation moves out. Their departure frees up resources, and parents can choose to spend a proportion of these freed-up resources to increase their personal consumption and save the remaining. The reallocation of these freed-up resources depends on the age of the younger generations who move out.

In Chapter Four, we evaluate and compare the effectiveness of the main public health insurance schemes in China, namely UEBMI and RHI. RHI represents a group of health insurance schemes for residents who have no access to UEBMI, which consists of NCMS, URBMI and URRMI. Estimates from different specifications show that the

public health insurance schemes in China encou rage non-medical household consumption as well as the utilisation of healthcare services. In addition, there exist significant differences in the financial burden and accessibility of healthcare services among people holding various types of health insurance schemes. Chapter Five summarises the results of our empirical studies, discusses the implications of the results, provides the limitations of this thesis and outlines areas worth further investigations.

1.3 Contributions of the Research

There are plenty of studies in the literature examining household savings and consumption in association with an ageing population, household composition and healthcare systems. This research contributes to the existing literature as follows. In Chapter Two, for the first time, we investigate the extent to which public medical expenditure, as well as the developments in financial and insurance markets, mediate the association between the old-age dependency ratio and household savings. Most existing studies only examine how social welfare and financial development impact savings directly (Bandiera *et al*., 2000, Guariglia and Rossi, 2004, Park and Shin, 2009). Given the high savings ratio and the rapidly growing ageing population in China, it is critical to find out the mediators for the negative association between old-age dependency ratio and household savings. This could provide useful suggestions of how to alleviate the negative effects of an ageing population on the economy.

In Chapter Three, we find evidence that the reallocation of the resources freed up when an offspring member moves out depends on their age. We contribute to the literature along the following lines. Firstly, we investigate the relationship between

household consumption and the departure of household members in the context of China. This is the first study to do so. Only a few studies have examined this relationship and most of them are based on western countries. For instance, Rottke and Klos (2016) investigate the relationship between household consumption and household members' departure in Germany and Italy, while Dushi *et al*. (2015) and Coe and Webb (2010) examine the topic in the United States. Secondly, the relevant literature listed above and our research looks at the effects of children moving out on household consumption. However, different from the above authors, we also consider the departure of grandchildren and children in-law. Lastly, we take into account the effects of the age of the offspring leavers, which is overlooked in literature.

In Chapter Four, we evaluate and compare the main health insurance schemes in China and contribute to existing literature along the following dimensions. Firstly, ours is the first research examining the associations between health insurance schemes and household consumption in mainland China. Secondly, we investigate the limitations of public health insurance schemes in China. Thirdly, for the first time, a comparison between the effectiveness of the two main types of public health insurance schemes: UEBMI and RHI, currently implemented in China, is made. Most literature either compares the designs of these public health insurance programmes (Barber and Yao, 2011), or only evaluates one of them (Huang, 2017, Wagstaff *et al*., 2009a, Lin *et al*., 2009). Further health reforms in China are focusing on consolidating the public health insurance schemes. To this end, it is critical to understand the weakness and strength of each type of health insurance scheme. Lastly, we use a panel dataset from 28 Chinese provinces, which covers nearly the entire country. The datasets analysed in most literature only cover part of China. For example, the CHNS used by Lei and Lin (2009) and Liu

and Zhao (2012) consists of households from only 8 provinces, and the URBMI Survey data analysed by Lin *et al*. (2009) includes residents from nine cities. In China, local governments are authorized to set the reimbursement rate for each public health insurance scheme. Therefore, the reimbursement rate varies across counties. In order to avoid selection bias, it is necessary to analyse data covering the whole country when evaluating the overall effectiveness of each public health insurance scheme.

2 Old-Age Dependency and Household Savings: Evidence from Chinese Provinces

Using provincial-level panel data for China over the period 1995-2015, we investigate the links between the old-age dependency ratio (the ratio of the population aged 65 and over to the population aged between 15 and 64) and household savings. Our system GMM estimates show a negative association between the two variables, which is lower in areas with higher governmental medical expenditure, higher financial development and higher insurance density, as well as in urban areas.

2.1 Introduction

The Chinese economy has attracted the world's attention with its high savings ratio, which exceeded 35% since the middle 1980s, and reached the peak at around 52% in 2007 (The Word Bank, 2017).[1] This was at a time when the average gross savings ratio of the world was only 26.68 %. In 2009, the savings ratio in China became the highest in the world, with the gross savings exceeding 18 trillion yuan (International Monetary Fund, 2017). Another feature of the Chinese economy is the rapidly ageing population triggered by the one-child policy which was implemented in 1971.[2] According to the Chinese Population and Employment Yearbook (2016), the old-age dependency ratio (the ratio of the population aged 65 and over to the population aged between 15 and 64) increased from 7.4% in 1953 to 13.7% in 2014, while the youth ratio (the ratio of the population aged 14 and below) dropped from 61.2% to 22.6% during the same period.

A large number of papers study the determinants of China's rising savings ratio (Modigliani and Cao, 2004, Horioka and Wan, 2007). At the same time, several studies look at household savings in other countries, and stress the importance of demographic factors (Bloom *et al.*, 2004), financial development (Wang *et al.*, 2012), and social welfare systems (Bloom *et al.*, 2007, Blöndal and Scarpetta, 1997). To the best of our knowledge, no study has looked at how social welfare and/or financial development mediate the effects of demographic factors on household savings. Our study fills this gap in the literature by focusing on the link between the old-age

[1] These figures are the ratios of gross savings to GDP. Gross savings are calculated as gross national income less total consumption, plus net transfers.

[2] The data of dependency ratio is only available in 1953, 1965, 1982, 1977 and the period after 1990. To test the demographic shift after the one-child policy, we plot the birth rate in China between 1962 and 2016 in the Appendix (Figure 2.A1). The structural break test (Table 2.A1) for the birth rate shows that there is a breakpoint in 1971, when the one-child policy was implemented.

dependency ratio and household savings in China. We believe this is worthy of investigation given the very high savings ratio which characterises China and the speed of population ageing discussed above.

We use a provincial-level panel data set over the period between 1995 and 2015 to investigate the links between the old-age dependency ratio and household savings. Our system GMM estimates show a negative association between the two variables, which can be explained in the light of the fact that an increase in the proportion of elderly people in an economy implies a greater proportion of population consuming without earning income, which, in turn, reduces the savings ratio (Modigliani and Cao, 2004). Moreover, the average nominal government spending on public healthcare service per capita was only 236 yuan per capita over the period 1995 - 2015 (author's calculation based the on China Statistical Yearbook). Given the inadequacy of the Chinese national health service, elderly people face significant out-of-pocket medical expenses, which is another reason for the negative association between the old-age dependency ratio and the savings rate. We next show that the negative association between the old-age dependency ratio and household savings is weaker in provinces with higher government medical expenditure, higher financial development and higher insurance density, as well as in urban areas.

In regions characterised by higher public medical expenditure, medical facilities are better, and patients' out-of-pocket medical expenses are lower. In those areas, a larger proportion of medical expenditure will be covered by public health insurance and people do not need to travel to hospitals in other provinces to get

treated.[3] Additionally, in regions characterised by higher financial development, elderly people have the option to borrow money from financial institutions to pay for treatment instead of liquidating their assets which deliver interest. Moreover, in provinces where insurance is more widespread, people's out-of-pocket medical expenditure is more likely to be shared with insurance companies. We expect that the relationship between the old-age dependency ratio and savings will be weaker in those provinces. The difference between urban and rural areas can be explained in light of the inequality between rural and urban areas including the differences in the aforementioned three mediators. As elderly people living in urban areas have access to better healthcare services and better nutrition, they are generally in better health than their rural counterparts (Liu *et al*., 2013). Urban residents will therefore face fewer medical expenses and tend to have a longer lifespan. Elderly people in urban areas also have more accesses to financial products and services, and consequently they have a higher financial income and can afford to save more.

The remainder of this chapter is organized as follows. Section 2.2 describes related literature. Section 2.3 details our hypotheses. Our baseline specification and estimation methodology are the subjects of Section 2.4. The data and descriptive statistics are discussed in Section 2.5. We describe our empirical results in Section 2.6, and Section 2.7 concludes.

[3] Local governments are authorized to design reimbursement rates and premiums of public health insurance scheme. Therefore, the proportion of medical expenditure coved by public health insurance scheme varies from province to province, and the reimbursement rate is likely higher in the areas characterised by higher public medical expenditure per person.

2.2 Literature Review

2.2.1 The life-cycle model

Household savings and consumption behaviour have been investigated for a long time. One of the most famous consumer theories suggests that saving increases with income, and there is a decreasing marginal propensity to consume (MPC) with respect to income (Keynes, 1936). However, the fact that savings in the United States have been very low while income has been ranked highest in the world since the Second World War casts doubt on this Keynesian theory. In order to explain this puzzle, the life-cycle model (Modigliani and Brumberg, 1954) and then the permanent income hypothesis (Friedman, 1957) were proposed. Both of the models assume that the utility of an agent is a function of his or her aggregate consumption in current and future periods and that the agent maximizes his or her utility subject to their lifetime resources. The permanent income hypothesis divides income into two parts: permanent (the expected long-tern average income) and transitory income. Friedman (1957) finds that a consumer's consumption pattern is determined by permanent income. Assuming smoothing consumption, any transitory changes in income will be allocated over time evenly, and consequently the effect of transitory income on consumption is zero. The permanent income model also shows that a worker will only save when current income is larger than the expected long-run average income.

The life-cycle model assumes that the agent will maximize his or her utility with respect to the lifetime resources, which are the sum of current net worth, the current earnings, and discounted future income cross his/her whole lifetime. This maximization shows that current consumption depends on resources and the rate of return on capital

with coefficients depending on the age of agent. The aggregate consumption for the whole economy is obtained by aggregating individual consumption functions. The life-cycle model highlights two key factors of consumption/savings: the growth rate of income and the importance of demographic variables.

Modigliani (1993) explains how these two variables affect household finance as follows. The life-cycle model divides a person's life into working and retirement periods and assumes that those agents in later life consume without earning any income. Also, they propose the concept of 'consumption smoothing', which assumes that people consume at constant levels according to their expected lifetime assets. When the economic growth rate increases, the income of workers will increase while the retirees consume at the same level as before, increasing aggregate savings. When there is steady population growth, the proportion of people who are working and saving for retirement increases, also raising the aggregate savings in turn.

2.2.1.1 Empirical studies on the determinants of the savings rate

2.2.1.2 Studies in countries other than China

There is a wealth of empirical literature on the determinants of saving behaviour both within and outside China. Some of this literature is based on the life-cycle model, which puts forward the idea that income growth rate and demographic variables are the two main determinants of consumption/savings. For instance, Athukorala and Sen (2004) provide mixed evidence for the life-cycle model by analysing annual (1954-1998) data in India. They find that the savings rate rises with the level and growth rate of disposable income. However, their study also shows that there is no significant

association between the savings rate and the population growth rate. One explanation is that an increase in population raises the proportion of working people related to the retirees but also increases the youth dependency ratio who consume without earning income. Modigliani and Cao (2004) believe that population growth is not the direct cause of the changes in saving, and instead argue for the importance of other socio-demographic variables which reflect the population structure, such as life expectancy and the proportion of non-working people.

Schrooten and Stephan (2003) investigate the determinants of private savings in the EU-accession ten countries with annual data covering the period 1990-2000.[4] Their estimations show a positive link between the growth rate of GDP and savings as well as a negative association between the dependency ratio (defined as the ratio of population aged 0-14 and 65 and over to the working-age population) and the savings ratio. Similarly, Loayza *et al*. (2000) provide empirical evidence in favour of the life-cycle model by analysing a large macroeconomic panel which covers 150 countries during the period 1965-1994. They find that the private savings rate increases with the level and the growth rate of real per capita income and decreases with both old and young-age dependency ratio.

In general, most literature on the relationship between demographic variables and savings investigates the roles of the dependency ratio and population growth as above. For instance, to study the effects of demographic variables on savings and current accounts, Kim and Lee (2008) use panel VAR models to analyse data from

[4] These countries are the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, and the Slovak Republic and Slovenia.

G-7 countries between 1979 and 2001.[5] They find a significant negative association between old-age dependency and savings. Other literature uses life-span as the main demographic variable. Bloom *et al*. (2004) believe that with a positive compound interest rate, a longer life will increase the elder's wealth. This will in turn reduce savings if consumption and leisure are normal goods. Population structure can be changed by the average life expectancy of the population. Analysing the World Bank's World Development Indicators 2005 dataset which covers more than 200 countries between 1960-2004, Li *et al*. (2007) find a positive effect of lifespan and a negative effect of old-age dependency on savings. An increase in life span could extend the years spent in the labour force, but less than proportionally. Therefore, people have to save more for retirement in anticipation of a longer life, which explains the positive association between life span and savings.

Except for the growth rate and demographic variables, many other factors have also been shown to be important determinants of household savings. One of them is financial development. In areas with good financial development, shifting consumption from future to present is much easier and therefore, residents save less (Muellbauer and Murphy, 1990, Jappelli and Pagano, 1989). Bandiera *et al*. (2000) examine the effect of financial liberalization on private savings in eight developing countries with 25 years of time-series data.[6] They find a negative relationship between financial development and savings.[7] On the contrary, King and Levine (1993)

[5] G-7 countries include U.S., U.K., France, German, Italy, Canada and Japan.
[6] These eight developing countries are Chile, Ghana, Indonesia, Korea, Malaysia, Mexico, Turkey and Zimbabwe.
[7] In Bandieral *et al.* (2000), financial development is measured by an index of financial liberalization. It is based on eight liberalization dummies, and each takes the value of one when the system was liberalized in the relevant dimension. Six of the dummies represent domestic financial liberalization, one for the securities market, and one for international financial liberalization.

find that financial development promotes asset accumulation by analysing a large panel of data which consists of 80 countries over the period 1960-1989.[8] A well-developed financial system mobilizes savings to the most promising entrepreneurial projects and diversifies risks associated with these activities. In turn, it promotes economic growth and capital accumulation. Park and Shin (2009) show that financial development (defined as the ratio of M2 to nominal GDP) is not significantly associated with savings. Analysing financial development and aggregate savings rates across 41 countries over the period 1960-2008, Wang *et al*. (2012) document a hump-shaped relationship between those two variables.[9] Aggregate savings may increase with financial development initially as a consequence of economic growth boosted by growing investment. Then, it reduces along with further financial development due to significant declines in precautionary saving motivations. This shows that the role of financial development in savings is very ambiguous.

De Nardi *et al*. (2015) highlight that the need to pay out-of-pocket medical expenses in the future is one of the main reasons why elderly people save. Therefore, public healthcare and insurance, which share the medical expenditures of residents, could change household saving decisions. Some literature shows that medical insurance scheme spreads the risk of unexpected medical expenses and therefore, reduces precautionary motives. Gruber and Yelowitz (1999) study public health

[8] To measure financial development, King and Levine (1993) use four different indexes. The first is a measure of the overall size of the formal financial intermediary sector, which is the ratio of liquid liabilities to GDP. The second financial development indicator is the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets. The third measurement is the credit issued to private enterprises divided by the credit issued to central and local government plus the credit issued to public and private enterprises. The last one is the credit issued to private enterprises divided by GDP.

[9] Wang *et al.* (2012) measure the financial development with the ratio of domestic credit to GDP as well as the ratio of M2 to GDP

insurance scheme and private savings in the U.S., finding that Medicaid eligibility is negatively correlated with wealth holding and positively correlated with consumption.[10] In addition, Kotlikoff (1986) finds that being insured reduces precautionary saving in the U.S.. However, Guariglia and Rossi (2004) investigate the crowding-out effect of private medical insurance scheme on savings with the 1996 to 2000 waves of the British Household Panel Survey (BHPS). They discover a positive link between private insurance and savings and show that a crowding-out effect between private insurance and savings only appear in the rural areas where the quality of the National Health Service (NHS) is rather poor, and where the risk of having to face high out-of-pocket medical expenses is high.

2.2.1.3 Studies in China

The high savings ratio in China, coupled with rapid economic growth and an ageing population, has attracted substantial discussion (Meng, 2003, Wei and Zhang, 2009, Qian, 1988, Ma and Yi, 2010, Giles and Yoo, 2007). Among the previous paper in the literature, Horioka and Wan (2007), Modigliani and Cao (2004) and Kraay (2000) are worth mentioning.

Using a panel dataset across Chinese provinces during the period 1995-2004, Horioka and Wan (2007) investigate the determinants of the household savings rate in China. The savings rate is calculated as the difference between disposable income per capita and consumption per capita divided by the disposable income per capita in each

[10] Medicaid is a social health insurance scheme in the United States, which funds medical expenditure of people whose income and resources are below a pre-specific level or insufficient to pay health care.

province. They find that the income growth rate, lagged savings ratio, real interest rate, and inflation rate are the main factors explaining the high savings ratio in China. They also examine the effects of demographic variables on savings. Some of their models incorporate both the young-age dependency ratio (defined as the population aged 0-14 to the population aged 15-64) and old-age dependency ratio (defined as the population aged 65 and above to the population aged 15-64), while the remaining models only include the total dependency ratio which is the sum of young-age and old-age dependency ratio. Considering the potential problems of endogeneity of some of their explanatory variables, they use a system GMM estimator (Blundell and Bond, 1998).

Horioka and Wan (2007) estimate their models with an urban subsample, a rural subsample and a whole sample as well as with all pooled regressions. All the results indicate that the old-age dependency ratio is not significantly associated with savings. Additionally, the results show both negative and positive signs on coefficients of the young-age dependency ratio and total dependency ratio. They do not provide any explanations for the mixed effects and advocate further investigations on the impacts of demographic variables.

Modigliani and Cao (2004) investigate what contributes to high savings in China with annual data over the period 1953-2000. In contrast, they find that China provides a powerful endorsement of the life-cycle model. The demographic variable in their work is defined as the ratio of working population (aged 20-64) to the sum of pre-working (aged 0-14) population. Considering the Chinese reform in 1978 which boosted the economy to a great extent, they estimate models with the full sample, a subsample which covers the period from 1953 to 1985, and a subsample after the

Chinese economic reform (1978-2000). Their results show that the savings ratio in China is positively and significantly associated with income growth rate and the independency ratio.

Conversely, Kraay (2000) draws totally different conclusions, analysing the variation in household savings with data covering 30 provinces from 1978 to 1989. The study documents that the savings ratio is not significantly associated with future growth of income or the dependency ratio in urban areas. The dependency rate is defined as the ratio of population to employment. The results show that the dependency ratio has a positive but not significant coefficient. He claims that a higher dependency ratio reflects a greater proportion of young age population, enhancing the bequest motivations of households, which offsets the negative effects of dependency on savings. Focusing on rural areas, the income growth expectation is negatively and significantly associated with the savings ratio. This reflects the strong precautionary saving motivations of residents living in rural areas. Kraay (2000) argues that the different sensitivity of savings to income growth rates between urban and rural areas is likely to be due to a lower coverage of pensions and other social benefits in rural areas.

2.2.2 Contribution

Focusing on the link between old-age dependency and the savings ratio in China, we make a contribution to the literature by investigating, for the first time, the extent to which public medical expenditure, financial development, and insurance involvement mediate the association between old age dependency and the savings ratio. The majority of existing literature only considers how social welfare and

financial development influence savings directly (Bandiera *et al.*, 2000, Guariglia and Rossi, 2004, Park and Shin, 2009). Given the high savings ratio in China, the ageing population and the inappropriateness of healthcare system, we believe this is worthy of investigation. Following Horioka and Wan (2007), we build a dynamic model by incorporating the first lag of the savings ratio as a control variable, and estimate our equations with both the first difference and the system General Methods of Moments (GMM) estimator (Blundell and Bond, 1998, Arellano and Bond, 1991).

2.3 Hypotheses

In this section, we introduce the five hypotheses which are tested in our work. As a substantial number of elders consume without earning any income, the savings ratio will decrease when the proportion of those people increases (Modigliani and Cao, 2004). In addition, the medical expenditure vastly increases with age, and becomes one of the main expenditure of elders (De Nardi *et al.*, 2015). This is particularly true in the Chinese case, where social security is still poorly developed and where, even if covered by the public health insurance scheme, patients face significant out-of-pocket medical expenses (Cheng *et al.*, 2015). Therefore, in those areas with a higher old-age dependency ratio, the savings ratio will be lower. This leads to the following general hypothesis:

Hypothesis 1: There is a negative association between the provincial-level old-age dependency ratio and household savings rate.

The out-of-pocket expenditure may vary significantly according to location. If a patient lives in a province where medical facilities and services are poor, he/she

may have to travel to other provinces to receive treatment, increasing medical costs. The quality of healthcare services and the reimbursement rates of public health insurance schemes are generally higher in provinces characterised by high public medical expenditure. An elderly patient, living in a province where the public health insurance scheme covers a greater proportion of medical expenditure, faces a lower out-of-pocket healthcare cost. In turn, he/she consumes their accumulated assets at a lower speed. Therefore, we have the following hypothesis:

Hypothesis 2: Differentiating provinces on the basis of public medical expenditure, the negative association between the old-age dependency ratio and household savings rate is weaker in those provinces with a higher level of public medical expenditure.

In the areas with higher financial development, elders are more likely to hold financial assets which generate returns. Also, residents in these provinces should find it easier to borrow money from financial institutions and could not need to run down their savings or other capital delivering returns in order to pay for medical bills. We make use of provincial level loan balance per capita as a proxy for financial development and hypothesize the following:

Hypothesis 3: Differentiating provinces on the basis of financial development, the negative association between the old-age dependency ratio and household savings rate is weaker in provinces with higher levels of financial development.

Following Zhou (2014), we use provincial-level insurance density (defined as the provincial-level total premium income per capita, including income from both personal life insurance and property insurance schemes) as an alternative measure of financial development. Provinces with a higher insurance density could be more

financially developed. In addition, in provinces where medical insurance is more widespread, the possibility of out-of-pocket medical expenditure being shared with insurance companies is higher. Consequently, we pose the following hypothesis:

Hypothesis 4: Differentiating provinces on the basis of insurance density, the negative association between the old-age dependency ratio and household savings rate is lower in provinces with higher insurance density.

There are substantial inequalities between rural and urban areas, such as the aforementioned quality of healthcare services, level of financial development, and insurance density. According to Liu *et al*. (2013), people living in urban areas have better nutrition, better healthcare services, and medical facilities. They, therefore, spend less on out-of-pocket medical expenses, as they are more likely to be healthier and do not need to travel to other places for better treatment. In addition, the density of financial intermediaries is much lower in rural areas, which means that rural residents have less access to financial products and services geographically.[11] Moreover, residents in rural areas are generally less educated and lack knowledge of financial instruments. Therefore, elders living in urban areas tend to have higher and more stable income, as they have better accesses to pension schemes and tend to utilise financial instruments (such as private health insurance schemes which share unexpected medical expenditure) to diversify uncertainty in income and expenditure. Due to these factors, rural elderly residents tend to dissave at a higher speed than their counterparts living in urban areas. Therefore, we have the following hypothesis:

[11] According to China's Regional Financial Operation Report 2015, there are around 221 thousand banks in China (excluding policy banks), of which only around 12 thousand are located in rural areas.

Hypothesis 5: Differentiating rural from urban areas, the negative association between the old-age dependency ratio and household savings rate is weaker in urban areas.

2.4 Baseline Model and Estimation Method

2.4.1 Baseline

To investigate the association between old-age dependency and the savings ratio, we estimate the following baseline model:

$$SR_{i,j,t} = \beta_1 OLD_{i,j,t} + \beta_2 CONTROL_{i,j,t} + \epsilon_{i,j,t} \qquad (1)$$

where *i* indicates provinces, *j* represents urban/rural area, and *t* represents years. The variables included in the model are the following: SR_{ijt} is the savings ratio of area *j* in province *i* in year *t*; OLD is the old-age dependency ratio, and β_1 indicate the associations between the old-age dependency ratio and savings ratio. If our Hypothesis 1 cannot be rejected, we will see a negative and significant sign on the β_1.

$CONTROL_{i,j,t}$ represents control variables in our model. It includes real growth rate of income (GR), the real interest rate ($RINT$), young-age dependency ratio ($YOUNG$), education ratio (ED), urban dummy (URB), year dummies ($YEAR$) and province dummies ($PROV$).[12] Several studies, (such as Pollak (1970) and Alessie

[12] To control wealth stock and uncertainty in economy, provincial deposit balance and unemployment rate were included. However, their coefficients are not significant at the 10 percent significance level. Therefore, we exclude those variables in the interest of parsimonious model.

and Lusardi (1997)), provide support to the hypothesis of habit formation of consumption and saving, which relies on the idea that an agent's past consumption might influence the utility gained from current consumption. Based on this theory, for a given level of current consumption, the larger the habit stock, the lower the utility. To test for habit formation of savings behaviour in China, we include the first lag of the savings ratio (SR_{t-1}) as per Horika and Wan (2007). The definition and calculation of each variable in our regressions can be found in Table 2.A2. (in the Appendix)

We expect a positive sign on the coefficient of SR_{t-1}. According to the life-cycle model, the growth rate of disposable income should have a positive effect on household saving. Modigliani and Brumberg (1954) show that households arrange their consumption according to their lifetime assets. When the growth rate of income is increased by higher productivity, working people will obtain higher lifetime resources, while retirees still consume at the previous level as they no longer earn any income. Therefore, the aggregate savings may increase with the real growth rate of income (Modigliani, 1993).

There are two effects of the interest rate on household savings behaviour. The first is the income effect: Higher interest rates increase households' interest payments, which in turn increases disposable income and encourages consumption. The second is the substitution effect: A higher interest payment can be seen as the cost of holding cash or spending, which drives savings. The net effect of the interest rate on savings will depend on which of the two effects prevails (Deaton, 1981). Another demographic variable likely to affect the aggregate household savings is the young-age dependency ratio, which is defined as the ratio of the population aged 14 and below to the population aged between 15 and 64. We expect this variable to be

positively associated with the savings ratio. Within Chinese culture, parents save a lot of money to buy houses for their children when they get married. Wei and Zhang (2009) document that parents save for their children to raise their competitive advantage in the marriage market. This is particularly true when they have boys. Also, considering future education expenditure, Chinese parents need to save more the more children they have.

Education has been frequently considered as an important determinant of savings (Bernheim, 1998, Bernheim *et al.*, 2001). From a theoretical viewpoint, education has unclear effects on savings. On the one hand, education improves labour efficiency (Godfrey, 1977), which in turn promotes the growth rate of GDP and then increases savings ratio (based on the life-cycle model). On the other hand, more education implies longer study time and fewer years in labour force, which reduces the labour supply and could have negative effects on savings.

In order to test whether the association between old-age dependency and the savings ratio is different in areas with higher levels of government medical expenditure, financial development, or insurance density, we estimate Equation (2):

$$SR_{i,j,t} = \partial_0 + \partial_1 CONTROLS_{i,j,t} + \partial_2 MEDIATOR_HIGH_{i,j,t} + \beta_1 UOMEDIATOR_HIGH_{i,j,t} + \beta_2 UOMEDIATOR_LOW_{i,j,t} + \theta_1 ROMEDIATOR_HIGH_{i,j,t} + \theta_2 ROMEDIATOR_LOW_{i,j,t} + \epsilon_{ijt} \quad (2)$$

$MEDIATOR_HIGH_{ijt}$ represents one of the three high mediator dummies: MED_HIGH_{ijt}, FIN_HIGH_{ijt} and INS_HIGH_{ijt}.[13] MED_HIGH_{ijt}(FIN_HIGH_{ijt} or INS_HIGH_{ijt}) is equal to 1 if the provincial public medical expenditure per person (loan balance or insurance premium per person) falls in the top 25% of the distribution, and 0 otherwise. As a robustness check, we also use the 50th percentile of those mediators to define high mediator areas.

The variables used to define high and low mediators are only available for each province as a whole. However, there exist substantial inequalities between rural and urban areas. Comparing the urban and rural areas located within a province, the qualities of healthcare services and facilities, financial development and insurance density are generally higher in urban areas. Therefore, we interact every mediator dummy with region dummies to distinguish between urban and rural areas for each province. $UOMEDIATOR_HIGH$ denotes the interaction term between the urban dummy, the old-age dependency ratio and in turn one of the high mediator dummies. Therefore, β_1 indicates the association between the old-age dependency ratio and savings in the urban areas of provinces with high mediator.

$UOMEDIATOR_LOW$ stands for the interaction term between the urban dummy, the old-age dependency ratio and one of the low mediator dummies. $ROMEDIATOR_HIGH$ depicts the interaction between the rural dummy, the old-age dependency and in turn one of the high mediator dummies. $ROMEDIATOR_LOW$

[13] As we set hypotheses that government medical expenditure, financial development and insurance involvement mediate the negative effect of old-age dependency ratio on savings, we use 'mediator' to represent for governmental medical expenditure per person, loan balance per person or insurance premium per person for simplicity.

denotes the interaction between the rural dummy, the old-age dependency and in turn one of the low mediator dummies. The region dummy is represented by the first letter of the interactions' name which is indicated as either U for an urban region or R for a rural region. The words 'HIGH and 'LOW' after underscore represents the high and low mediator dummies respectively.

Our Hypotheses 2-5 predict a negative relationship between the old-age dependency ratio and household savings, which is weaker in urban areas, as well as in the provinces with higher level of medical support, financial development and insurance density. In other words, if our hypotheses cannot be rejected, then we expect to observe: $\beta_1 > \theta_1$ and $\beta_2 > \theta_2$; $\beta_1 > \beta_2$ and $\theta_1 > \theta_2$.

Also, we specifically estimate the model below (Equation (3)) to investigate whether the relationship between old-age dependency ratio and savings ratio is weaker in urban areas:

$$SR_{i,j,t} = \beta_1 URB_OLD_{i,j,t} + \beta_2 RUR_OLD_{i,j,t} + \beta_3 CONTROL_{i,j,t} + \epsilon_{i,j,t} \quad (3)$$

URB_OLD and RUR_OLD are the interaction between the urban dummy and old-age dependency ratio, and interaction between the rural dummy and old-age dependency ratio respectively. β_1 and β_2 indicate the associations between the old-age dependency ratio and savings ratio in the urban and rural areas respectively. If our Hypothesis 1 and Hypothesis 5 are accepted, we will see negative signs on the coefficients of the two interactions, and $\beta_1 > \beta_2$.

2.4.2 Estimation method

Our dataset is an annual panel covering a total of 31 provinces and directly-controlled municipalities between 1995 and 2015. In order to control for the unobserved heterogeneity of each province as well as for the potential endogeneity of our regressors, we use a System GMM. Demeaning or first differencing are the usual methods to process panel data of this nature. However, because our panel is dynamic, demeaning will induce correlation between the lag of the dependent variable and the error term (Nickell, 1981).

To overcome this problem, the first difference GMM estimator has been developed by Arellano and Bond (1991). It uses first differences to get rid of unobserved individual effects and then makes use of lagged values of the dependent variable and any other endogenous regressors as instruments. The System GMM estimator, subsequently developed by Blundell and Bond (1998), improves on the first-difference GMM by estimating the main equation in both levels and first differences. This is particularly beneficial, especially when the instruments are weak. Equation (1) is estimated by both the first difference and the system GMM, and Equation (2) is estimated by the system GMM only.

We consider the savings ratio (*SR*), the real growth rate of income (*GR*) and the real interest rate (*RINT*) as endogenous variables and instrument them using these same variables lagged twice. Following Horioka and Wan (2007), the first lag of the real growth rate of gross provincial product per capita is used as an instrument in the level equation only. All the other variables are treated as exogenous variables. Due

to unbalanced panel data, we use an orthogonal deviation to maximize the sample size (Arellano and Bover, 1995).

2.5 Data and Descriptive Statistics

2.5.1 Data

We use data on a total of 31 provinces and direct-controlled municipalities over the period from 1995 to 2015. The China Statistical Yearbook and The China Compendium of Statistics 1949-2008 provide data on provincial income, consumption, consumer price index, governmental medical expenditure and total premium income from personal life insurance and property insurance schemes.[14] The gross provincial product per capita is collected from the Bureau of Statistics of China, and the nominal interest rate is from the World Bank. The dependency ratios, illiteracy ratios and provincial population are from the Chinese Population and Employment Yearbook . Finally, we find the loan and deposit balance in the Almanac of China's Finance and Banking.

The loan and deposit balance, government medical expenditure, insurance premium and gross provincial product per capita are only available for each province as a whole, and the nominal interest rate is for the country as a whole. On the contrary, we have data on both rural and urban areas for the remaining variables.

[14] The China Compendium of Statistics 1949-2008 is compiled by the National Bureau of Statistics of China, which contains but not limited to all the data in the Statistical Yearbook.

2.5.2 Descriptive statistics

Table 2.1 shows the average household savings ratio of each province over the period from 1995 to 2015. Separate figures are reported for the subsamples of urban and rural areas as well as the full sample for each province. The highest savings ratio is observed in Tianjin (33.4 %), while the lowest one is that of Shaanxi (14.5 %). The table also shows that in some provinces, there are huge differences in the savings ratio between rural and urban areas. For instance, Tianjin has a savings ratio of 41.7% in rural areas, and only 25.1% in urban areas. On the other hand, Shaanxi has a savings ratio of around 20.1% in urban areas, and only 8.9% in rural areas. These differences could be explained by the different levels of development in local economies, financial markets, social welfare system, and other economic and non-economic factors across rural and urban areas.

Table 2.2 reports average and median savings ratios over the period 1995-2015 in groups of provinces differentiated on the basis of governmental medical expenditure, financial development, and insurance density. Panel A classifies provinces into two groups based on governmental medical expenditure per person, loan balance per person and insurance density, spilt at 25^{th} percentile (descending order). Panel B, on the other hand, splits the sample at the median of the three mediators. Panel C differentiates provinces into three groups for each of the three variables; top 25%, bottom 25% and medium 50%. Statistics are reported for the full sample and for urban and rural subsamples separately. In addition, we report *p*-values for the *t*-tests aimed at assessing whether the average savings ratios are significantly different across groups of provinces and regions.

Comparing the means of household saving in different groups, we can see that no matter which percentile is used to define high and low public medical expenditure, financial development and insurance density, the savings ratio is higher in areas with high mediator, especially when we are comparing the urban subsamples. For example, according to the 25th percentile grouping, the savings ratio in the provinces with high financial development is around 25.67 %, while the figure in provinces with low financial development is only around 23.32 %. Our *t*-tests show that the difference between the two means is statistically significant at the one percent level. This is consistent with Wang *et al*. (2012), who argue that financial development will increase the savings ratio at the initial stage.

Additionally, in the provinces with higher levels of medical expenditure, financial development and insurance density, we find that the savings ratio is significantly greater in urban areas. This reflects the inequality between rural and urban areas. For example, there are better healthcare facilities and more financial institutions in urban areas. On the contrary, the savings ratio in provinces with lower mediators is higher in rural areas. This difference is statistically significant in Panel B and Panel C. It could be explained by that in the provinces with less public medical expenditure, lower financial development and insurance enrolment, residents have strong precautionary saving motivations, and even more so in rural areas.

Given that our data cover the period from 1995 and 2015, we perform a stationarity test for the savings ratio variable. The Fisher-type unit-root test is applied, developed by Fisher (1932) and often used to test the stationarity of unbalanced panel data. The null hypothesis of this test is that all panels contain unit roots and the alternative

hypothesis is that at least one panel is stationary. The result in Table 2.3 rejects the null hypothesis.

Table 2.4 shows the description of all variables used in our regressions. We observe that the average household savings ratio for the entire Chinese economy is around 24 % across the 21 years. The average old-age dependency ratio in the entire territory is 11.60%. It is 11.01% in urban areas and slightly higher in rural areas (12.18%). The young-age dependency ratio is also higher in rural areas. This can be explained by the fact that in China, young people born in rural areas tend to seek jobs in cities, leaving both their parents and children behind. Both household disposable income in urban areas and pure income in rural areas show an average real growth rate of 8%.

Even though free nine-year compulsory education has been implemented across the entire Chinese territory since 1986, Table 2.4 shows that the education level (measured by the participation rate in the nine-year compulsory education) in rural areas is 87.75%, while the corresponding figure for urban areas is 94.58%.

2.6 Empirical Results

2.6.1 Old-age dependency ratio and savings

Table 2.5 presents estimations of Equation (1). First, our aim is to test whether our Hypothesis 1 holds. To this end, we need to focus on the coefficients of the old-age dependency ratio. Both the System GMM and the first difference GMM estimates show a strong negative association between the old-age dependency ratio and the

savings rate with coefficients of -0.233 and -0.258 respectively. This implies that a 10 percent higher old-age dependency ratio is associated with around a 2.3% - 2.58% lower savings ratio. The first column presents that, in the long run, a one percent increase in the old-age dependency ratio is associated with a 1.71% lower savings ratio ($\frac{-0.233}{1-0.864}$). This finding is consistent with our Hypothesis 1. However, Horioka and Wan (2007) fail to find any significant relationship between old-age dependency and savings ratios, which is possibly caused by the small sample size (the observation is between 272 and 544).

Focusing on the other control variables, we observe that the coefficients associated with the real growth rate of income are not statistically significant, which contradicts the prediction of life-cycle model and the findings of Horioka and Wan (2007) but is consistent with Kraay (2000). This could be explained by liquidity constraints in China. It is very difficult for individuals to borrow money from financial institutions in China, and relatives and friends are the main sources of funding (Zhou, 2014). Shifting consumption from the future to the present is difficult at a young age due to these constraints, which causes the fact that agents cannot smooth their consumption during the life-time (as the life-cycle model assumes) and are only able to increase their consumption when their income increases. Therefore, households increase their consumption to a large extent when their income increases, and this is especially true if they expect their income to increase in the future as well. In this case, the savings ratio may not increase at the growth rate of income, as their consumption will increase more rapidly.

On the other hand, the coefficients on SR_{t-1} are statistically significant, which provides evidence towards the hypothesis that households' current savings behaviour is associated with their previous saving actions. This is consistent with Alessie and Teppa (2010), who find evidence of habit formation for saving behaviour with Dutch data. The authors conclude that habit formation theory provides a partial explanation to many empirical findings which contradict some predictions of the permanent income model, such as the "excess sensitivity" of aggregate consumption growth compared to current labour income. As there is inertia in savings behaviour, agents will save a similar proportion of their income as before and increase their consumption when their income increases. This partially explains the insensitivity of the savings ratio to current income growth.

In addition, young-age dependency ratio and education have been shown as important determinants of savings. The estimations in column 1 reveal that a 10 % increase in the young-age dependency ratio is associated with a 1.23% higher savings ratio. This is consistent with Wei and Zhang (2009), who document that Chinese parents save a lot for their children. The second column shows that the savings ratio is 1.37% higher in provinces with a 10% higher education participation. Education promotes labour's productivity, and in turn boosts economic growth and raises asset accumulation. Also, our System GMM estimations show that there is no link between the real interest rate (*RINT*) and savings ratio.

In this part, we have found that the old-age dependency ratio is negatively associated with savings ratio. Next, we will check whether this negative association is influenced by the public medical expenditure, financial development and insurance density, and whether it is weaker in urban areas.

2.6.2 Differentiating provinces on the basis of government medical expenditure

Next, we test our second hypothesis to verify whether the association between the old-age dependency ratio and the savings ratio is weaker in provinces characterised by high governmental medical expenditure, both in rural and urban areas. The results are reported in Table 2.6. Column 1 interacts the old-age dependency ratio in both rural and urban areas with dummies for high and low medical expenditure, where the threshold is set at the 75th percentile of medical expenditure (in ascending order). Focusing on urban areas, column 1 shows that the association between the old-age dependency ratio and the savings ratio is only significant in those provinces with low medical expenditures. In rural areas, a 10% increase in the old-age dependency ratio is associated with a 1.91% lower savings ratio in the provinces with high public medical expenditure and is associated with a 2.66% lower savings ratio in those with low public health expenditure. In the long run, a 1% increase in the old-age dependency ratio is linked to a 1.46% lower savings ratio in rural areas of provinces which are characterised by high public medical expenditure and is associated with a 2.03% lower savings ratio in those with low public medical expenditure. Given the level of government medical expenditure, the negative association between old-age dependency and savings ratio is generally weaker in urban areas.

We perform *F*-test to check whether the differences in the association between the old-age dependency ratio and savings are significant. It shows that, when comparing the urban subsamples, the association between the old-age dependency ratio and the savings rate is significantly weaker in provinces with higher government

medical expenses (p=0.0285). This finding is consistent with our Hypothesis 2 and can be explained, considering that residents living in an area with poor medical services needing travel to other cities for treatment, which increases their out-of-pocket medical expenses and consequently reduces their savings. Additionally, the reimbursement rate of public health insurance is generally lower in provinces where public medical expenditure is lower. Patients, living in the areas characterised by low level public medical expenditure, need pay a larger share of out-of-pocket medical expenditure by themselves. This impacts the consumption of old cohorts, for whom the medical expenditure is the largest proportion of their expenditure. Therefore, the negative association between the old age dependency rate and savings is stronger in areas with less government medical expenses.

Moreover, the F-tests for the equality of old-age dependency and savings associations in rural and urban areas delivery p-values of 0.0006 and 0.213 in the provinces with high and low public medical expenses respectively. It shows that, in the provinces with high public medical expenses, the association between the old-age dependency ratio and savings ratio is significantly weaker in urban areas, as expected.

Column 1 also shows that the savings ratio in provinces with a high government medical expenditure is 2.18% lower. This implies that in areas with higher reimbursement rates of public health insurance and better medical facilities, residents have less incentive to save. This finding is in line with Hubbard and Judd (1987), who argue that a good social welfare system reduces precautionary saving. Consistent with Table 2.5, Table 2.6 shows that the growth rate of income is not associated with the savings ratio and that previous savings behaviour is a determinant of current savings. Due to liquidity constraints and strong uncertainty in medical

expenditure, precautionary saving and habit formation theories are better at explaining high savings ratio in China when compared to the life-cycle model.

As a robustness test, we divide provinces according to government medical expenditure per capita at the median, and the results are reported in column 2. Also, we differentiate provinces into three groups in column 3: those with low government medical expenditure (lower quartile), those with medium expenditure (middle two quartiles) and those with high expenditure (top quartile). Consistent with the above, we find evidence that government medical expenditure mediates the negative association between old-age dependency rate and savings rate. In addition, the same association is weaker in urban areas when compared to that in rural areas.

2.6.3 Differentiating provinces on the basis of financial development

In this section, we test the difference in the relationship between old-age dependency and household savings between provinces characterised by high and low financial development, both in rural and urban areas. We interact the financial development dummy (high/low), regional dummy (urban/rural), and old-age dependency ratio in the same way as in the section above. The results are shown in Table 2.7.

In the first column, we use the 75^{th} percentile of loan per capita as the threshold to define the high financial development provinces. Looking at urban areas, the negative association between old-age dependency and savings is only significant in provinces with low financial development, with a coefficient of -0.225. Focusing on rural areas, a 10% increase in the old-age dependency ratio is associated with a 2.33%

lower savings ratio in the provinces with high level of financial development and associated with a 3.33% lower savings ratio in the provinces with low level of financial development. In the long run, a 1% increase in old-age dependency ratio is associated with a 1.78% lower savings ratio in the rural areas of provinces with high level of financial development and associated with a 2.54% lower savings ratio in the rural areas of provinces characterised by low level of financial development.

F-tests are performed to investigate whether differences in the old-age dependency ratio-saving associations among provinces with various levels of financial development are significant. The *p*-values of the *F*-tests are 0.0244 and 0.0967 in urban and rural subsamples respectively. It shows that, focusing on the urban subsamples, the aforementioned association is significantly weaker in areas with high financial development compared to that in areas with low financial development. This is in line with Hypothesis 3. In areas with more financial development, elderly people are more likely to pay their out-of-pocket medical expenditure with financial instruments (e.g. with personal medical loans), rather than reducing their own savings or selling their assets which deliver returns. This lowers the negative association between old-age dependency ratio and savings rate.

However, financial development in rural areas is very slow in general, even within provinces characterised by high level of financial development. The difference in financial development between rural areas in provinces with low and high financial development is very small. This leads to the difference in old-age dependency and savings between provinces with high and low level of financial development not being significant at 5% significance level when comparing the rural subsamples. Additionally, the results show that in provinces with high financial development, the

negative old-age dependency-savings association is significantly weaker in urban areas at the five percent significance level. But we do not find any significant difference in the association between rural and urban areas in provinces which are characterised by low financial development. This finding is not surprising as the inequality in financial development between rural and urban areas is much smaller in the provinces with low financial development when compared to those characterised by high financial development.

Lastly, it is worth noting the negative and significant coefficients on the high financial development dummy. This suggests that people save less in the provinces with better financial development. It is in line with Loayza *et al*. (2000) who argue that financial development promotes the intertemporal allocation of resources thus reducing people's saving motivations. For the robustness test, we apply different thresholds to categorise provinces with high and low levels of financial development. The results are listed in the columns 2-3. The median of loan balance per person is used as the critical value of high financial development in column 2. Column 3 classifies provinces based on their financial development levels into high, medium and low groups. In line with column 1, those columns also provide evidence to show that financial development mediates the negative association between the old-age dependency ratio and the savings ratio, as well as the inequality between rural and urban areas.

There may exist endogeneity between the savings ratio and this financial development dummy, as areas with high savings ratio may be capable of making more loans. Therefore, we have conducted a robustness test where the financial development dummy (***FD_HIGH***) is considered as endogenous. The second lag of the financial

development dummy is applied as an instrument. The system GMM estimates are reported in the Appendix (Table 2.A3). The results consistently show that the negative association between old-age dependency ratio and savings rate is weaker in areas with higher levels of financial development.

2.6.4 Differentiating provinces on the basis of insurance density

Finally, we test Hypothesis 4 in order to verify whether the association between old-age dependency and savings is weaker in provinces with high insurance density in rural and urban areas. Insurance density in our study is defined as the total insurance premium per capita, which counts both personal insurance and property insurance premiums. The results are reported in Table 2.8. The interaction terms between old-age dependency, the regional dummy and the insurance density dummy are defined in the same way as above.

Column 1 divides provinces according to the insurance premium per capita at the 75th percentile. Focusing on the urban areas, a 10% increase in the old-age dependency ratio is associated with a 1.11% lower savings ratio in the provinces characterised by high insurance density, and that is associated with a 1.81% lower savings ratio in provinces characterised by low insurance density. In the long run, a 1% increase in the old-age dependency ratio is associated with a 0.87% lower savings ratio in the urban areas of provinces with a high insurance density, and that is linked to a 1.41% lower savings ratio in the urban areas of provinces with a low insurance density. Comparing the rural subsamples, the coefficient of the old-age dependency ratio is also bigger in the provinces with a high insurance density in contrast to provinces with a low insurance density. Columns 2 shows the same results, where the

threshold of high insurance density is the 50th percentile of insurance premium per capita. In column 3, we classify provinces into three groups based on the 25th and 75th percentile of insurance premium per capita. All the columns show that the negative association between old-age dependency ratio and savings ratio is weaker in urban areas compared to that in rural areas, given the same level of insurance density.

We conduct *F*-tests to check whether the negative association between old-age dependency and savings is significantly weaker in urban areas and provinces with a higher insurance density. Focusing on urban areas, the results show that the association is significantly weaker in provinces with a higher insurance density. For instance, the *F*-test deliveries a *p*-value of 0.0140 for the equality of coefficients of *UOFD_HIGH* and *UOFD_LOW* in the panel B. This result provides an empirical evidence in support of our Hypothesis 4. This can be explained, considering that insurance development is closely related with financial development. A province with a higher insurance density tends to be more financially developed. Secondly, in the provinces where insurance is more widespread, the out-of-pocket medical expenditure is more likely to be shared with personal medical insurance schemes.

On the contrary, the associations are not significantly different between the rural subsamples in provinces with high and low insurance densities. This could be caused by the fact that insurance markets in rural areas are underdeveloped, regardless of provinces. In other words, the difference in insurance density between rural areas in provinces with high and low insurance density is very small. Additionally, the inequality in insurance density between rural and urban areas in the provinces with a high insurance density is larger than that in the provinces with low insurance density. Correspondingly, the *F*-test for the equality of *UOFD_HIGH* and

ROFD_HIGH shows a *p*-vale of 0.0209 in the first column, which indicates that the negative association between old-age dependency ratio and savings ratio in urban areas is significantly weaker than that in rural areas, among the provinces with high insurance density.

2.6.5 Differentiating rural and urban areas

Table 2.9 presents estimations of Equation (3). The System GMM results show that a 10% increase in the old-age dependency ratio is associated with a 1.48% lower savings ratio in urban areas and with a 2.93% lower savings ratio in rural areas. In the long run, a 1% increase in the old-age dependency ratio is associated with a 1.10% lower savings ratio in urban areas and with a 2.17% lower savings ratio in rural areas. An *F*-test, aimed at verifying whether the difference in those two coefficients is significant, delivers a *p*-value of 0.0002. It suggests that the negative association between old-age dependency ratio and household savings rate is indeed significantly weaker in urban areas.

This is in favour of our Hypothesis 5 and can be explained by the substantial inequalities between rural and urban areas. The level of the qualities of healthcare services, level of financial development, and insurance density are generally higher in urban areas than in rural areas. Based on the findings above, those factors mediate the negative effects of the old-age dependency ratio on savings, and therefore the association between the two variables is weaker in urban areas. In addition, elderly people living in urban generally have better nutrition, better knowledge on utilizations of financial instruments to diversify risks, and more choice of pension

schemes. Therefore, they have less out-of-pocket medical expenditure and more stable income compared to their counterparts living in rural areas, which reduce the negative association between old-age dependency and savings in urban areas.

In summary, we find a strongly negative association between old-age dependency ratio and the savings ratio. This negative association is weaker in urban areas, as well as in provinces with higher government medical expenditure, better financial development, and higher insurance density. Similar conclusions are reached in the results Tables 2.A5-2.A7 in the Appendix, where we interact the old-age dependency ratio by one of the three mediator variables, without further interacting by rural/urban dummies.

2.6.6 Robustness test

To investigate whether the insignificant coefficient of income growth rate is caused by the inclusion of the lagged savings ratio ($\boldsymbol{SR_{t-1}}$), we exclude $\boldsymbol{SR_{t-1}}$ from the equation. As there is no Nickell bias in the modified equation, we estimate the static equation with a fixed-effects model, and the results are reported in Table 2.10. Consistent with our findings in Tables 2.5 – 2.9, we find no significant association between the savings ratio and income growth rate at the 5% significance level. Only column 3 shows that a 10% income growth rate is associated with a 0.64% higher savings ratio (at the 10% significance level).

On the other hand, provinces with high mediator (government medical expenditure, financial development, or insurance density) are linked to a lower

savings ratio, compared to those with low mediator. For instance, column 1 shows that provinces characterised by high government medical expenditure are associated with a 9.638% lower savings ratio compared to provinces with low government medical expenditure. Our results with Chinese data indicate that there is no evidence for a positive relationship between the income growth rate and household savings as predicted by the life-cycle model. Instead, our results provide evidence for the precautionary savings and habit formation, as we find lower savings ratio in provinces with higher mediators (less uncertainty) and that current savings behaviour largely depends on previous saving actions.

2.7 Conclusion and Discussion

In this study, we have used provincial panel data across a total of 31 Chinese provinces and directly-controlled municipalities over the period 1995-2015 to look at the determinants of household savings ratio, paying attention to the effects of the old-age dependency ratio. This is an important research question in light of the fact that the Chinese population is ageing rapidly (Banister *et al*., 2012). In line with Loayza *et al*. (2000), we have found a negative relationship between the old-age dependency ratio and household savings rate. This can be explained, considering the fact that elders have low income and high medical expenditure. However, this negative association is weaker in those areas where governmental medical expenditure is high, as well as in regions with good financial development and high insurance density. In regions with high governmental medical expenditure, the reimbursement ratio of public health insurance is likely to be higher and healthcare

facilities and services are generally better, and consequently patients' out-of-pocket medical expenses tend to be lower. Similarly, in regions characterised as highly-developed financially with extensive financial instruments on offer, elderly people have the option of taking medical loans to pay for medical treatments without dipping into their life savings or liquidating their assets. Finally, in provinces where insurance is more widespread, people's out-of-pocket medical expenditure is more likely to be shared with the insurance company.

We also find that the negative relationship between household savings and old-age dependency is weaker in urban areas. This can be explained by the substantial inequalities between urban and rural areas. People living in urban areas are generally in better health condition and likely to live longer than their rural counterparts (Shi, 1993). In addition, they have better access to healthcare services and financial markets. Urban residents will therefore face lower personal medical costs than their rural counterparts and can afford to save more in anticipation of a longer life.

Despite the old-age dependency ratio increasing, currently the savings ratio in China is still very high. Our results show that the real growth rate of income is not significantly associated with the savings ratio. This implies that the life-cycle model fails to explain the high savings rate in China. Instead, the precautionary saving and habit formation theories provide better explanations for it. The traditional and conservative Chinese culture could be another possible explanation. For instance, Wei and Zhang (2009) document that preparing for children's marriage is one of main reasons for parents' saving.

Our findings have significant policy implications. We provide evidence that an increase in the old-age dependency ratio is associated with a reduction in the savings ratio, and that developments in social welfare systems and financial markets are able to mediate significantly the negative association between old-age dependency and savings. Therefore, we recommend further development of these institutional structures in countries where the ageing population negatively impacts savings to a large extent. Possible approaches include implementing more generous healthcare schemes for elders, increasing financial literacy through education, and extending credit to the private sector. In addition, our results show that the association between old-age dependency and savings is significantly weaker in urban areas. Thus, we recommend actions to reduce inequality between rural and urban areas in China, especially in the financing of social welfare systems, education, and financial development.

Although this study provides interesting insight, the main limitation is that it is based on aggregate data. Future research will therefore look at saving behaviour of elderly Chinese people at a micro-level, focusing on the role of out-of-pocket medical expenditure.

Table 2.1: Savings ratio by province

	Full sample		Urban		Rural	
Province	Mean	Obs.	Mean	Obs.	Mean	Obs.
Tianjin	33.40	42	25.07	21	41.73	21
Hebei	32.17	42	28.43	21	35.91	21
Shandong	29.98	42	29.78	21	30.18	21
Henan	29.53	42	27.60	21	31.45	21
Hainan	29.38	42	25.46	21	33.31	21
Tibet	29.18	39	26.44	18	31.54	21
Shanxi	28.76	42	28.64	21	28.87	21
Jiangsu	28.59	42	28.89	21	28.29	21
Jiangxi	27.43	42	29.68	21	25.18	21
Beijing	26.16	42	25.26	21	27.06	21
Heilongjiang	26.09	42	24.19	21	27.99	21
Liaoning	25.61	42	21.62	21	29.59	21
Fujian	25.32	42	26.64	21	24.01	21
Zhejiang	24.97	42	27.29	21	22.65	21
Jilin	24.86	42	22.30	21	27.43	21
Anhui	24.30	42	25.39	21	23.22	21
Shanghai	23.74	42	25.65	21	21.83	21
Hubei	23.45	42	23.02	21	23.88	21
Guangxi	23.02	42	26.70	21	19.34	21
Guangdong	22.91	42	21.50	21	24.32	21
Guizhou	21.60	42	24.96	21	18.24	21
Chongqing	21.53	38	18.17	19	24.89	19
Xinjiang	20.90	42	23.08	21	18.72	21
Inner Mongolia	19.43	42	23.56	21	15.31	21
Sichuan	19.11	42	20.09	21	18.12	21
Ningxia	18.71	42	21.51	21	15.92	21
Yunnan	18.37	42	25.56	21	11.17	21
Hunan	18.34	42	23.57	21	13.10	21
Gansu	17.73	42	21.47	21	14.00	21
Qinghai	15.04	42	22.38	21	7.71	21
Shaanxi	14.51	42	20.15	21	8.87	21

Source: Author's calculation based on China Statistical Yearbook

Table 2.2: Summary statistics for the savings ratio in provinces grouped according to government medical expenditure, financial development and insurance density

			Medical Expenditure by Government				Financial Development				Insurance Density			
			All	Urban	Rural	*T*-test	All	Urban	Rural	*T*-test	All	Urban	Rural	*T*-test
Panel A	Top 25%	Median	26.96723	29.86617	21.73508		26.45053	27.83326	23.3155		26.50907	27.52143	24.9164	
		Mean	25.66462	29.89899	21.43026	0	25.67272	28.59068	22.75476	0	26.12565	27.83398	24.41732	0
	Bottom 75%	Median	22.97587	22.39552	24.12577		23.19407	22.85957	23.82077		22.97213	22.95917	23.09791	
		Mean	23.32783	22.53815	24.11238	0.0029	23.32456	23.06717	23.58029	0.3387	22.98552	23.13835	22.83373	0.5958
	T-test	*P*-Value	0	0	0.0025		0	0	0.3544		0	0	0.0661	
Panel B	Top 50%	Median	26.13593	27.94335	23.28434		26.36309	27.41467	24.79185		26.20481	27.29521	24.55984	
		Mean	25.47747	28.20626	22.75672	0	25.7871	27.68345	23.89074	0	25.74979	27.56679	23.93278	0
	Bottom 50%	Median	21.68684	20.04098	23.9636		21.65338	20.77809	22.56867		21.19883	20.2603	22.37857	
		Mean	22.36951	20.7389	23.98957	0	22.02211	21.29539	22.74177	0.027	21.86102	21.08616	22.62795	0.025
	T-test	*P*-Value	0	0	0.1264		0	0	0.1543		0	0	0.1069	
Panel C	Top 75%	Median	25.19319	26.11846	23.86531		25.39743	26.10827	24.39935		25.28117	26.08539	24.22062	
		Mean	24.87532	26.31525	23.44412	0	25.13725	26.2547	24.01979	0	25.03515	26.21054	23.85976	0
	Bottom 25%	Median	20.22247	19.00363	22.99701		19.81701	19.07833	21.16992		19.56679	18.67403	21.07423	
		Mean	21.19117	19.36142	23.02091	0.0001	20.30476	19.42178	21.17053	0.0559	20.392	19.19483	21.56577	0.0183
	T-test	*P*-Value	0	0	0.6552		0	0	0.0026		0	0	0.0173	
Panel D	25%-75%	Median	25.20656	26.1283	23.89646		25.39743	26.10844	24.39075		25.28117	26.0966	24.16102	
		Mean	24.88792	26.33348	23.45114	0	25.11714	26.25733	23.97695	0	25.02885	26.21838	23.83933	0
	Test U&M	*P*-Value	0.1393	0	0.0231		0.2845	0	0.1728		0.0211	0.0005	0.4782	
	Test M&L	*P*-Value	0	0	0.6342		0	0	0.0049		0	0	0.0228	
	Test U&L	*P*-Value	0	0	0.1819		0	0	0.222		0	0	0.0124	

Source: Author's calculations based on China Statistical Yearbook, Chinese Population Yearbook, and the Almanc of China's Finance and Banking.
Note: *T*-tests on the column are to test the equality of means in areas with different levels of government medical expenditure, financial development and insurance density. *T*-tests on the row are to test the equality of means in rural and urban areas. 'Test U&M' represents the *T*-tests for the equality of the savings ratios between the provinces with high (with top 25 percent) and medium (between 25% to 75 %) levels of public medical expenditure, financial development and insurance density; 'Test M& L' represents the *T*-tests for the equality of the savings ratios between provinces with medium and low (bottom 25 percent) public medical expenditure, financial development and insurance density. 'Test U& L' are *T*-tests for the equality of the savings ratios between the provinces with high and low medical expenditure, financial development and insurance density.

Table 2.3: Unit root test for saving ratio (SR)

Fisher-type unit-root test for SR Based on Phillips-Perron tests			
Ho: All panels contain unit roots Ha: At least one panel is stationary			Number of panels = 62 Avg. number of periods = 20.89
AR parameter: Panel-specific Panel means: Included Time trend: Not included Newey-West lags: 5 lags			Asymptotics: T -> Infinity
		Statistic	*p*-value
Inverse chi-squared (124)	P	195.5	0
Inverse normal	Z	-1.678	0.0467
Inverse logit t (314)	L*	-2.303	0.0110
Modified inv. chi-squared	Pm	4.543	0
P statistic requires number of panels to be finite. Other statistics are suitable for finite or infinite number of panels.			

Table 2.4: Descriptive Statistics

	All		Urban		Rural	
Variable	Obs.	Mean	Obs.	Mean	Obs.	Mean
Nominal income	1,295	8974.82	646	13127.68	649	4841.15
Nominal consumption	1,295	6608.43	646	9536.66	649	3693.73
Savings Ratio (***SR***)	1,295	24.00	646	24.66	649	23.34
Old-dependency ratio (***OD***)	1,297	11.60	648	11.01	649	12.18
Young-dependency ratio (***YOUNG***)	1,296	26.37	647	20.78	649	31.95
Total dependency ratio	1,294	38.48	647	31.76	647	45.20
Inflation (by region)	1,186	3.06	623	2.89	563	3.24
Education ratio (***ED***)	1,230	91.18	617	94.58	613	87.75
Real interest rate (***RINT***)	1,302	0.29	651	0.29	651	0.29
Real growth rate of income (GR)	1,232	8.09	614	8.02	618	8.16
Real growth rate of per capita gross regional product	1,301	5.02	650	5.09	651	4.95
Population	1,298	4178.66				
Provincial CPI	1,302	3.08				
Real government medical expenditure	1,298	698035.40				
Real loan balance	1,302	7424.74				
Real insurance premium income	1,240	1774740.00				
Real loan balance per capita	1,298	19847.44				
Real government medical expenditure per capita	1,298	190.50				
Real insurance premium per capita	1,236	450.29				
Real deposit balance	1,302	10399.68				
Unemployment rate	1,258	3.45				

Source: Author's calculation based on China Statistical Yearbook, Chinese population and employment Yearbook, the World Bank, Bureau of Statistics of China and Almanac of China's Finance and Banking

Table 2.5: Old-age dependency ratio and savings rate

Variables	(1) Model 1	(2) Model 2
SR_{t-1}	0.864***	0.817***
	(0.068)	(0.104)
GR	0.044	-0.146
	(0.147)	(0.197)
RINT	0.455	0.172
	(0.454)	(0.568)
YOUNG	0.123***	0.184***
	(0.032)	(0.055)
ED	0.129***	0.137***
	(0.045)	(0.044)
URBAN	0.867**	
	(0.354)	
OD	-0.233***	-0.258***
	(0.058)	(0.068)
YEAR	Yes	Yes
PROVINCE ID	Yes	No
Observations	1,223	1,161
Number of ID	62	62
AR(1)	0	0
AR(2)	0.866	0.826

Notes: Model 1 is estimated by System GMM. Model 2 is estimated by first difference GMM. Robust standard errors in parentheses; ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. Instruments only for first difference equation: the second lag of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies and the *OR*. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.6: Old-age dependency ratio and the savings rate: Differentiating provinces according to the level of public medical expenditure

Variables	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.869***	0.842***	0.841***
	(0.058)	(0.071)	(0.067)
GR	0.135	0.102	0.062
	(0.156)	(0.158)	(0.175)
RINT	0.298	0.323	0.184
	(0.434)	(0.440)	(0.402)
YOUNG	0.090***	0.080***	0.079***
	(0.030)	(0.027)	(0.030)
ED	0.125***	0.116***	0.123***
	(0.042)	(0.043)	(0.040)
URBAN	-0.702	-0.416	-0.445
	(0.759)	(0.856)	(0.843)
MED_HIGH	-2.180*	-3.476**	-1.246
	(1.284)	(1.551)	(1.367)
UOMED_HIGH	0.067	-0.049	0.193*
	(0.084)	(0.075)	(0.115)
UOMED_LOW	-0.199**	-0.380***	-0.363***
	(0.078)	(0.104)	(0.129)
ROMED_HIGH	-0.191***	-0.209***	0.031
	(0.066)	(0.060)	(0.088)
ROMED_LOW	-0.266***	-0.373***	-0.286**
	(0.065)	(0.092)	(0.114)
MED_MEDIUM			-1.330
			(1.359)
UOMED_MEDIUM			-0.114
			(0.081)
ROMED_MEDUIUM			-0.192***
			(0.064)
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	0	0	0
AR(2)	0.751	0.851	0.809

Notes: These coefficients are the system GMM estimates, with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of government medical expenditures per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of government medical expenditure per capita. Instruments only for first difference equation: the second lags of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, MED_HIGH (or MED_HIGH and MED_MEDIUM in Panel C) and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.7: Old-age dependency ratio and the savings rate: Differentiating provinces according to the level of financial development

Variables	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.869***	0.861***	0.867***
	(0.064)	(0.066)	(0.063)
GR	0.096	0.075	0.099
	(0.145)	(0.141)	(0.144)
RINT	0.357	0.346	0.392
	(0.462)	(0.442)	(0.447)
YOUNG	0.102***	0.096***	0.081***
	(0.030)	(0.029)	(0.026)
ED	0.118***	0.123***	0.106**
	(0.045)	(0.045)	(0.043)
URBAN	-0.729	-0.349	-0.450
	(0.849)	(0.858)	(0.970)
FD_HIGH	-2.004**	-1.373	-0.986
	(0.910)	(1.124)	(0.783)
UOFD_HIGH	-0.052	-0.084	0.085
	(0.065)	(0.065)	(0.068)
UOFD_LOW	-0.225***	-0.247**	-0.419***
	(0.084)	(0.097)	(0.118)
ROFD_HIGH	-0.233***	-0.227***	0.028
	(0.063)	(0.062)	(0.053)
ROFD_LOW	-0.333***	-0.270***	-0.396***
	(0.076)	(0.090)	(0.148)
FD_MEDIUM			-2.195
			(1.536)
UOFD_MEDIUM			-0.132*
			(0.073)
ROFD_MEDIUM			-0.238***
			(0.069)
YEAR	Yes	Yes	Yes
PROVINCE ID	Yes	Yes	Yes
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	4.01e-09	4.78e-09	5.08e-09
AR(2)	0.808	0.842	0.798

Notes: These coefficients are the system GMM estimates, with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of loan balance per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of loan balance per capita. Instruments only for first difference equation: the second lags of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, *FD_HIGH* (or *FD_HIGH* and *FD_MEDIUM* in Panel C) and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.8: Old-age dependency ratio and the savings rate: Differentiating provinces according to the level of insurance density

Variable	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.872***	0.865***	0.869***
	(0.065)	(0.063)	(0.065)
GR	0.087	0.097	0.075
	(0.150)	(0.148)	(0.151)
RINT	0.302	0.376	0.322
	(0.456)	(0.444)	(0.468)
YOUNG	0.118***	0.088***	0.091***
	(0.032)	(0.032)	(0.030)
ED	0.126***	0.121***	0.107**
	(0.043)	(0.046)	(0.044)
URBAN	-0.749	-0.470	0.002
	(0.880)	(0.864)	(0.902)
INS_HIGH	-0.070	-1.864*	0.826
	(0.940)	(0.964)	(0.918)
UOINS_HIGH	-0.111*	-0.087	-0.019
	(0.065)	(0.061)	(0.071)
UOINS_LOW	-0.181**	-0.301***	-0.346**
	(0.082)	(0.102)	(0.148)
ROINS_HIGH	-0.268***	-0.230***	-0.026
	(0.068)	(0.059)	(0.062)
ROINS_LOW	-0.310***	-0.325***	-0.255*
	(0.080)	(0.087)	(0.142)
INS_MEDIUM			-1.528
			(1.459)
UOINS_MEDIUM			-0.104
			(0.068)
ROINS_MEDIUM			-0.199***
			(0.070)
YEAR	Yes	Yes	Yes
PROVINCE ID	Yes	Yes	Yes
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	0	0	0
AR(2)	0.797	0.808	0.783

Notes: These coefficients are the system GMM estimates, with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of insurance premium per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of insurance premium per capita. Instruments only for first difference equation: the second lags of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, *INS_HIGH* (or *INS_HIGH* and *INS_MEDIUM* in Panel C) and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.9: Old-age dependency ratio and savings rate: Differentiating rural and urban areas

Variables	(1) Model 1	(2) Model 2
SR_{t-1}	0.865***	0.815***
	(0.066)	(0.101)
GR	0.063	-0.106
	(0.144)	(0.190)
RINT	0.396	0.030
	(0.447)	(0.551)
YOUNG	0.116***	0.186***
	(0.031)	(0.054)
ED	0.126***	0.125***
	(0.043)	(0.040)
URBAN	-0.860	
	(0.884)	
URB_OLD	-0.148**	-0.103
	(0.064)	(0.073)
RUR_OLD	-0.293***	-0.408***
	(0.070)	(0.107)
YEAR	Yes	Yes
PROVINCE ID	Yes	No
Observations	1,223	1,161
Number of ID	62	62
AR(1)	0	0
AR(2)	0.865	0.854

Notes: Model 1 is estimated by System GMM, and Model 2 is estimated by first difference GMM. Robust standard errors in parentheses; ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. Instruments only for first difference equation: the second lag of *SR*, *GR, DEP,* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies *URB_OLD* and *RUR_OLD*. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

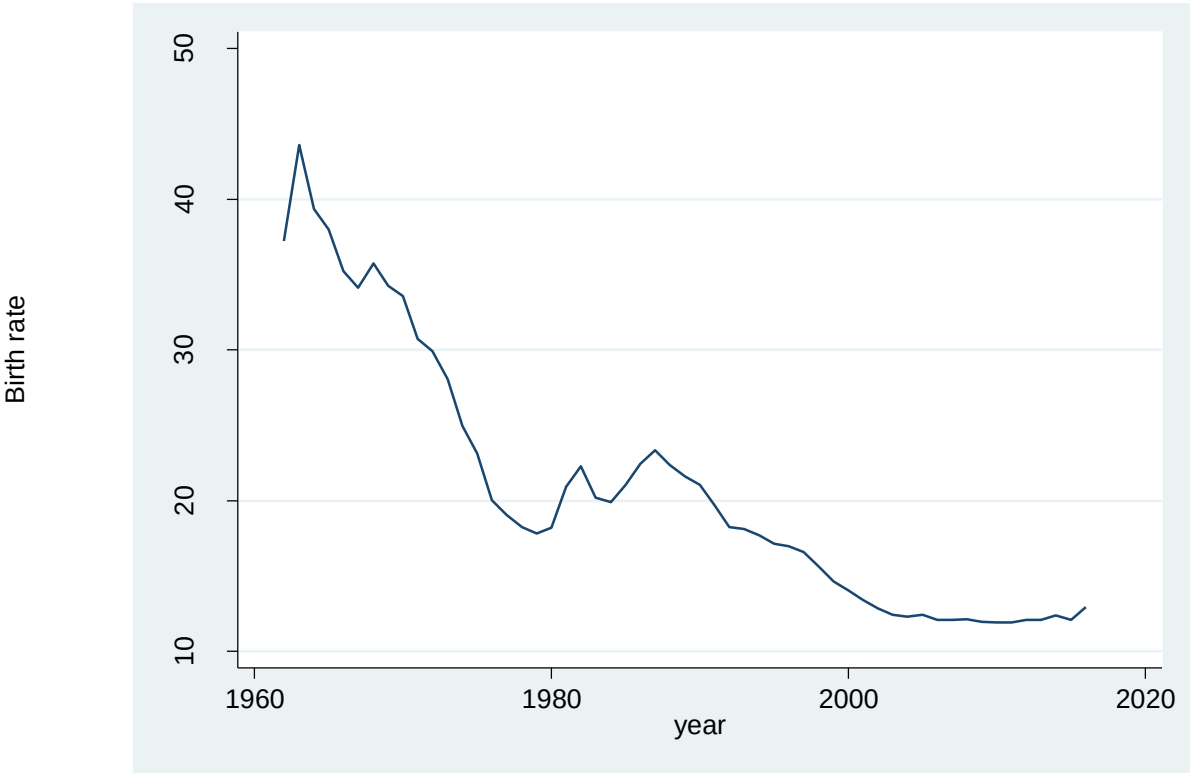
Table 2.10: Robustness test: fixed-effect estimators for the association between old-age dependency and savings rate

Variables	(1) Panel A	(2) Panel B	(3) Panel C
GR	-0.033	-0.061	-0.064*
	(0.037)	(0.038)	(0.038)
RINT	0.101	0.076	0.093
	(0.152)	(0.156)	(0.156)
YOUNG	0.257***	0.342***	0.363***
	(0.050)	(0.050)	(0.051)
ED	0.161***	0.148***	0.150***
	(0.044)	(0.045)	(0.046)
Mediator_HIGH	-9.638***	-6.998***	-6.622***
	(1.450)	(1.405)	(1.394)
UOMediator_HIGH	0.141	0.170	0.057
	(0.101)	(0.106)	(0.104)
UOMediator_LOW	-0.860***	-0.702***	-0.803***
	(0.124)	(0.119)	(0.126)
ROMediator_HIGH	-0.762***	-0.909***	-1.001***
	(0.099)	(0.099)	(0.098)
ROMediator_LOW	-1.113***	-1.241***	-1.414***
	(0.149)	(0.154)	(0.151)
Constant	5.741	3.728	4.181
	(4.765)	(4.815)	(4.872)
Observations	1,223	1,223	1,223
Number of ID	62	62	62

Notes: These coefficients are the fixed-effects estimates with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. We divide provinces according to the level of government medical expenditure per capita, loan balance per capita, and insurance premium per capita at the 50^{th} percentile in Panel A, Panel B, and Panel C respectively.

Appendix

Figure 2A.1 Birth rate in China



Source: National Bureau of Statistics of China

Table 2.A1: Structural break test for birth rate in China

Test for a structural break: Unknown break date

	Number of obs. = 55
Full sample:	1962-2016
Trimmed sample:	1971-2018
Estimated break date:	1971
H_o: No structural break	

Test	Statistic	*p*-value
swald	225.9137	0

Coefficients included in test: _cons

Table 2.A2: Data source and description

Variable	Source	Description
Income	China Statistical Yearbook - Chapter on People's Living Condition	Pure income per capita in rural area & disposable income per capita in urban area
Real growth rate of income (GR)	Authors' calculation	Current income minus previous income divided by pervious income and deflated by (rural/urban) CPI
Consumption	China Statistical Yearbook - Chapter on People's Living Condition	Expenditure on food, clothing, residence, household facilities, articles and service, health care, medical service, education, culture and recreation services
Savings ratio (***SR***)	Authors' calculation	Income less consumption divided by income
Price index	China Statistical Yearbook – Chapter on price index; China Compendium of Statistics 1949-2008	CPI for rural, urban and whole province respectively
Nominal interest rate	The World Bank	Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits
Real interest rate (***RINT***)	Authors' calculation	Nominal interest rate minus (rural/urban) inflation
Per capita gross regional product	Bureau of Statistics of China	Gross regional products for both rural and urban area
Real growth rate of per capita gross regional product	Authors' calculation	Current per capita gross regional product minus pervious value, divided by previous value and minus (rural/urban) inflation
Illiterate ratio	Chinese population and employment-Chapter on data from household registration in each year	Ratio of illiterate population aged over 15 to the population aged over 15
Young dependency ratio (***YOUNG***)	Chinese population and employment-Chapter on data from household registration in each year	The ratio of population aged 0-14 to the population aged between 15 and 64
Old-age dependency ratio (***OD***)	Chinese population and employment-Chapter on data from household registration in each year	The ratio of population aged 65 and over to the population aged between 15 and 64
Education ratio (***ED***)	Authors' calculation	100 minus illiterate ratio (the unit of illiterate ratio is %)
Provincial population	Chinese population and employment-General survey	Population for whole province; Unit: millions
Provincial loan balance	Almanac of China's Finance and Banking	Unit: 100 million yuan
Medical expenditure by government	China Statistical Yearbook	Medical expenditure by government for whole province; Unit: 10,000 yuan
Insurance premium	China Statistical Yearbook; China Compendium of Statistics 1949-2008	Insurance premium of both property and life insurance; Unit: 10,000 yuan
Provincial loan balance per capita	Authors' calculation	Ratio of provincial loan balance to population
Medical expenditure by government per capita	Authors' calculation	Ratio of medical expenditure by government to population
Insurance premium per capita	Authors' calculation	Ratio of insurance premium per capita to population

Table 2.A3: Old-age dependency ratio and the savings rate: Financial development dummy as endogenous

Variables	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.904***	0.890***	0.891***
	(0.058)	(0.060)	(0.061)
GR	0.262**	0.154	0.151
	(0.124)	(0.144)	(0.142)
RINT	0.782	0.592	0.581
	(0.506)	(0.466)	(0.447)
YOUNG	0.086***	0.090***	0.077***
	(0.025)	(0.028)	(0.026)
DEP	-0.257	-3.390	-1.976
	(2.018)	(3.153)	(2.822)
ED	0.093**	0.122***	0.102**
	(0.043)	(0.043)	(0.041)
URBAN	-0.565	0.237	-0.257
	(0.917)	(0.964)	(1.184)
FD_HIGH	-2.988	-0.259	-0.849
	(2.283)	(2.421)	(1.763)
UOFD_HIGH	-0.056	-0.146	0.084
	(0.115)	(0.108)	(0.144)
UOFD_LOW	-0.294***	-0.237**	-0.429*
	(0.109)	(0.115)	(0.255)
ROFD_HIGH	-0.232***	-0.230***	0.029
	(0.086)	(0.072)	(0.121)
ROFD_LOW	-0.382***	-0.202	-0.391
	(0.105)	(0.144)	(0.337)
FD_MEDIUM			-2.055
			(4.106)
UOFD_MEDIUM			-0.148
			(0.134)
ROFD_MEDIUM			-0.234**
			(0.093)
YEAR	Yes	Yes	Yes
PROVINCE ID	Yes	Yes	Yes
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	0	0	0
AR(2)	0.892	0.882	0.848

Notes: These coefficients are the system GMM estimates with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of loan balance per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of loan balance per capita. Instruments only for first difference equation: the second lags of *SR*, *GR, RINT, DEP* and FD_HIGH (or *FD_HIGH* and *FD_MEDIUM* in Panel C). Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.A4: Old-age dependency ratio and the savings rate: Differentiating provinces according to the level of public medical expenditure

Variables	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.865***	0.862***	0.855***
	(0.067)	(0.071)	(0.067)
GR	0.046	0.022	0.040
	(0.146)	(0.154)	(0.142)
RINT	0.449	0.457	0.352
	(0.458)	(0.456)	(0.460)
YOUNG	0.122***	0.120***	0.098***
	(0.033)	(0.032)	(0.031)
ED	0.129***	0.126***	0.125***
	(0.045)	(0.045)	(0.042)
URBAN	0.859**	0.898**	-0.457
	(0.357)	(0.359)	(0.482)
MED_HIGH	-0.370	-2.381	2.283**
	(1.079)	(1.543)	(0.896)
OMED_HIGH	-0.228***	-0.191***	-0.167**
	(0.071)	(0.061)	(0.070)
OMED_LOW	-0.243***	-0.356***	-0.244**
	(0.070)	(0.097)	(0.111)
MED_MEDIUM			-2.890**
			(1.367)
OMED_ MEDIUM			0.138***
			(0.042)
YEAR	Yes	Yes	Yes
PROVINCE ID	Yes	Yes	Yes
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	0	0	0
AR(2)	0.850	0.882	0.981

Notes: These coefficients are the system GMM estimates with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of government medical expenditures per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of government medical expenditure per capita. Instruments only for first difference equation: the second lags of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, *MED_HIGH* (or *MED_HIGH and MED_MEDIUM* in Panel C) and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.A5: Old-age dependency ratio and the savings rate: Differentiating provinces according to the level of financial development

Variables	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.868***	0.864***	0.864***
	(0.068)	(0.068)	(0.067)
GR	0.060	0.042	0.054
	(0.147)	(0.141)	(0.141)
RINT	0.445	0.425	0.387
	(0.470)	(0.452)	(0.452)
YOUNG	0.120***	0.123***	0.086***
	(0.032)	(0.032)	(0.031)
ED	0.124***	0.129***	0.124***
	(0.046)	(0.045)	(0.041)
URBAN	0.883**	0.889**	-0.410
	(0.359)	(0.366)	(0.490)
FD_HIGH	-1.192	-0.588	1.840**
	(0.874)	(1.098)	(0.747)
OFD_HIGH	-0.208***	-0.222***	-0.165***
	(0.058)	(0.056)	(0.049)
OFD_LOW	-0.276***	-0.265***	-0.310***
	(0.074)	(0.094)	(0.120)
FD_MEDIUM			-3.823***
			(1.483)
OFD_MEDIUM			0.121***
			(0.037)
YEAR	Yes	Yes	Yes
PROVINCE ID	Yes	Yes	Yes
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	0	0	0
AR(2)	0.835	0.853	0.897

Notes: These coefficients are the system GMM estimates with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of loan balance per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of loan balance per capita. Instruments only for first difference equation: the second lags of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, *FD_HIGH* (or *FD_HIGH* and *FD_MEDIUM* in Panel C) and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

Table 2.A6: Old-age dependency ratio and the savings rate: Differentiating provinces according to the level of insurance density

Variables	(1) Panel A	(2) Panel B	(3) Panel C
SR_{t-1}	0.872***	0.866***	0.870***
	(0.068)	(0.068)	(0.067)
GR	0.062	0.044	0.066
	(0.151)	(0.147)	(0.145)
RINT	0.363	0.462	0.299
	(0.462)	(0.453)	(0.474)
YOUNG	0.127***	0.123***	0.092***
	(0.032)	(0.033)	(0.034)
ED	0.129***	0.127***	0.124***
	(0.046)	(0.047)	(0.042)
URBAN	0.916***	0.911**	-0.467
	(0.355)	(0.359)	(0.503)
INS_HIGH	0.394	-1.114	2.890***
	(0.875)	(0.986)	(0.745)
OINS_HIGH	-0.228***	-0.212***	-0.191***
	(0.059)	(0.055)	(0.052)
OINS_LOW	-0.244***	-0.311***	-0.237*
	(0.074)	(0.094)	(0.132)
INS_MEDIUM			-3.258**
			(1.553)
OINS_MEDIUM			0.130***
			(0.037)
YEAR	Yes	Yes	Yes
PROVINCE ID	Yes	Yes	Yes
Observations	1,223	1,223	1,223
Number of ID	62	62	62
AR(1)	0	0	0
AR(2)	0.796	0.860	0.814

Notes: These coefficients are the system GMM estimates with robust standard errors in parentheses. ***, **, * denote significant at the 1%, 5% and 10% levels, respectively. In Panel A and Panel B, we divide provinces according to the level of insurance premium per capita at the 75th percentile and the median respectively. In Panel C, provinces are categorized into three groups based on the 75th and the 25th percentile of insurance premium per capita. Instruments only for first difference equation: the second lags of *SR*, *GR* and *RINT*. Instruments for both first difference and level equation: *ED*, *URBAN*, *YOUNG*, Year dummies, Province dummies, *INS_HIGH* (or *INS_HIGH* and *INS_MEDIUM* in Panel C) and interactions of the old-age dependency ratio. Instrument only for the level equation: the first lag of real growth rate of per capita gross provincial product.

3 To What Extent Do Changes in Household Composition Affect Consumption? Microeconomic Evidence from China

Using the 2011 and 2013 waves of the China Health and Retirement Longitudinal Study (CHARLS), we investigate the extent to which the departure of younger generation members of a household, differentiated across different age groups, affects household consumption. Applying a range of different estimators and specifications, our results with around 12,000 observations suggest that households generally exhibit a lower consumption after a member moves out. Also, we show that the allocation of the freed-up resources is conditional on the leaver's age: Parents save all the extra resources if the leaver is aged below 25 and even reduce their own consumption if the leaver is aged between 0 and 16. By contrast, if the leaver is aged at least 25, part of the resources freed-up by his/her departure are spend. Furthermore, we find that transfers directed out of the household do not increase after a departure of younger generation member.

3.1 Introduction

Due to an ageing population, Chinese residents face a significant deficit within the public pension scheme. Currently, individuals must undertake savings to ensure a smooth consumption pattern into retirement, instead of relying on state-pensions. When offspring obtain financial independence and/or move out from their family home, resources are freed, and parents need to decide which fraction of these resources to consume and which to save in view of their retirement. This consideration motivates the analysis undertaken in this paper.

Specifically, we investigate the extent to which the departure of children, grandchildren and spouses of children, from the family home affects household consumption.[15] Chinese parents are very generous: They invest both time and money for their children and grandchildren. Many mature dependents still reside with their parents, even after they get married and have their own offspring. Caring for grandchildren is the pastime of most Chinese grandparents. This leads to a high variance in household consumption in China, heavily conditional on family composition.

Firstly, we use a random-effects linear model to analyse the determinants of household consumption, focusing on the initial household size and the total number of household leavers. The sum of the coefficients associated with these two variables shows the reallocation of resources after a member moves out. We then assess the extent to which the ages of the leavers affect the reallocation of resources. To this end, we divide the younger generation members into four age groups: 0-16, 17-24, 25-30 and 31 – 71.[16] Subsequently, we also investigate whether households with a younger generation member

[15] Hereafter, we will refer to children, grandchildren and spouses of children as younger generations' household members.
[16] The eldest younger generation member in our regression sample is aged 71 in 2013.

who moves out are characterised by an increase in out-transfers.[17] This can inform us as to whether the extra resources freed up from a departing household member are transferred to the 'moving out' offspring, rather than being consumed or saved within the household.

We contribute to the existing literature along the following dimensions. Firstly, for the first time in a Chinese context, we test the effects of younger generations' household members moving out of a household on consumption. A number of theoretical and empirical studies (e.g. Modigliani and Brumberg, 1954; and Deaton *et al.*, 1989, amongst others) emphasise the role of demographics on household financial behaviour. However, only a few studies focus on how parents allocate resources when a child moves out, and the majority of these focus on western countries (Coe and Webb, 2010, Rottke and Klos, 2016, Munnell *et al.*, 2015). Secondly, our study explicitly takes the age of leavers into consideration by grouping younger generations' members into different age groups. This has been largely ignored by the literature. Finally, considering the diverse Chinese family composition, not only do we examine the effects of the departure of children on consumption, but also the influence associated with the departure of grandchildren and children-in-law.

Based on our specification and estimation methods, we document that consumption is reduced in households in which any member moves out. Furthermore, our results show that the allocation of extra resources is conditional on the leaver's age. When the leaver is aged below 25, the freed-up resources are saved, and the remaining household members even reduce their own consumption if the leaver is aged between 0 and 16. By contrast,

[17] Out-transfer is defined as the transfer directed outside the household.

households with a leaver aged above 25 have less motivation to save and spend a proportion of the freed-up resources. Finally, our results show that households with younger generations' leavers do not increase transfers to their non-resident offspring. It confirms that instead of providing further financial support to the offspring members who just move out with the freed-up resources, parents/grandparents save them.

The remainder of the chapter proceeds as follows. Section 3.2 reviews the literature on household consumption and how it is affected by changes in household composition. Section 3.3 introduces our hypotheses. Section 3.4 illustrates our dataset and presents various descriptive statistics. Section 3.5 describes our models and estimation methodology. Our main empirical results are presented in Section 3.6, while Section 3.7 describes our robustness tests. Finally, Section 3.8 concludes.

3.2 Literature Review

3.2.1 The determinants of household consumption

3.2.1.1 Theoretical literature

Income is naturally the most important component when considering household consumption. One famous consumption theory postulates a diminishing marginal propensity to consume (Keynes, 1936). Poor people need to spend most of their extra income on basic human needs, while people who have high income are able to save a large proportion of the extra income. This Keynesian theory also emphasizes that consumption varies with real income, but not by an equivalent amount. In other words, people increase (reduce) consumption with a multiplier impact lower than 1 when real

income increases (decreases). The difference between the increases in income and consumption is used to invest to maintain a high income, and the gap between the decreases in income and consumption is filled with savings.

The life-cycle model (Modigliani and Brumberg, 1954) and the permanent income hypothesis model (Friedman, 1957) assume agents smooth consumption based on their lifetime resources in order to maximise utility. According to these theories, consumption depends on long-run average income and therefore, factors which could change the current and future income impact household consumption decisions. Those models highlight the roles of income growth rate and demographic variables: An increase in the income growth rate will raise the lifetime resources and in turn expand consumption. A larger proportion of elders implies a lower percentage of working people in the population, which will slow down economic growth and reduce consumption.

The literature documents that household consumption is hump-shaped over the life-cycle rather than smooth. Thurow (1969) argues that this is because shifting consumption from the future to the present is difficult at a young age due to liquidity constraints. Agents are only able to increase their consumption when their income increases during the middle age. Other studies consider household size as the main explanation for the observed hump shape of household consumption over the life-cycle. Among them, Irvine (1978) is one of the first who put forward this idea. He develops a theoretical model which incorporates family size and simulates it with data from Statistics Canada in 1971, showing a hump-shaped pattern of consumption over time. This is in line with the actual consumption pattern, based on the 1960-1961 Survey of Consumer Expenditures, in the U.S..

Attanasio *et al.* (1999) extend the life-cycle model by adding uncertainty and time-varying demographic variables. Their simulation, with data from the Consumer Expenditure Survey in the U.S. over the period 1982-1990, also displays a hump-shaped consumption pattern over the life-cycle, which can be explained by family events along with agents' ages. As agents get married and have children, their family size increases along with corresponding expenditures (e.g. costs of children's education). Then, with the moving out of children or the departure of a partner later in the life-cycle, family units reduce their consumption.

3.2.1.2 Empirical literature on demographic variables

Demographic variables, including age, gender, education, marital status, health status and household size, have been found to be important determinants of household consumption. For instance, several empirical studies have investigated the relationship between consumption and age. Danziger *et al.* (1982) study the consumption of elders using 9,480 observations from the 1972-1973 Consumer Expenditure Survey (CEX) in the United States. Firstly, they summarize consumption data grouped by quintiles of income and age groups of the household head.[18] Given these quintiles, they find that expenditure by the elderly is decreasing with age. Next, they regress both total consumption and its logarithm on age dummies of household heads, total net household income, and household size. They find a strong negative effect of age on consumption. As a robustness test, they add interactions between age and income to the model. The results show that the households with older heads spend less given the same income level. Additionally, they use different

[18] The age groups are: less than 35, 35-54, 55-61, 62-64, 65-71 and older than 71.

categories of consumption as dependent variables and investigate whether the reduction in consumption of older people is caused by lower work expenditure after retirement. The results show that elders cut back spending of every category, not only expenditure related to work.

Li *et al.* (2015) reach opposite conclusions by analysing the Urban Household Survey in China over the period 2002-2009. They provide empirical evidence of the smoothing of consumption among Chinese retirees. This study mainly focuses on non-durable goods which are divided into work-related spending, food at home, entertainment and remaining non-durable goods. People aged 60 have been removed from the sample in order to distinguish the consumption between pre-retirement (people aged between 50-59) and post-retirement (people aged between 61-70) groups.[19] Based on a regression discontinuity method, the results show a 20 percent lower non-durable consumption associated with retirement, which is mainly due to the reduction in work-related spending.

Children are an important determinant of household size. They play therefore a driving role in explaining the effect of family size on consumption. To study the effects of children on household consumption, Browning and Ejrnæs (2009) develop a consumption model which incorporates the age and the number of children in the household. Making use of the 1968-1999 waves of the UK Family Expenditure Survey (FES), they find that the hump-shaped consumption over the life-cycle can be fully explained by the household composition. Before the arrival of an infant, households save for future expenditure and possible decreases in income caused by having babies. As

[19] A mandatory retirement age (55 for women and 60 for men) in China is imposed on workers in the government, public sector, state-owned, and collective sectors. The work status of the household in this study is defined by the work status of husbands, whose mandatory retirement age is 60.

children grow, they need more food and require higher expenditure on recreation, clothing and education. Therefore, household consumption increases with the age of children and drops when children move out.

According to Deaton *et al.* (1989), " a concept of demographic separability is proposed that formalizes the notion that there are groups of goods (adult goods) that have little or no relationship specific classes of household demographics (the numbers or ages of children)" (p.1). They analyse the Spanish Encuestas de Presupuestors Familisres data, which covers the period between April 1980 and March 1981 to test the theory of demographic separability. They define people aged between 0 and 13 as children and use the number of people which fall into various age groups - 0-4, 5-8, 9-13, 14-17, 18-23, 24-60 and 60+ - as demographic indicators. To test the separability of demography, they conduct an *F*-test on the coefficients of the child demographic variables. However, they are unable to accept the demographical separability hypothesis, which implies that consumption on adult goods is affected by children. Children will not consume adult goods directly but influence the consumption through other mechanisms. For example, having a baby increases the new parents' pressure, which makes them smoke more for relaxing. The authors also document that particular age groups are associated with specific goods. Specifically, young adults aged between 18 and 23 generate consumption on tobacco, education, entertainment and alcohol. Teenagers consume mainly on clothing, education and entertainment.

Focusing on the effects of children's gender on household savings, Wei and Zhang (2009) analyse both Chinese households and regional data.[20] Their results show

[20] The household survey data used in this paper is the 2002 wave of Chinese Household Income Project (CHIP). The regional data comprises Chinese provincial-level data over the period 1980-2007, collected

that households with a boy save more than households with a daughter, and the savings of otherwise identical families with a boy are higher in regions with a greater sex ratio.[21] Also, in areas with a more serious imbalance of the sex ratio (more boys), households with a daughter save a lot as well, to maintain the bargaining power of their girls in the marriage market. Consistently, the authors' analysis based on provincial data concludes that the savings ratio is higher in the regions and years where the sex ratio is higher. In summary, this study provides empirical evidence for the fact that the gender imbalance motivates parents to save, in order to raise the bargaining power of their children in the marriage market, and this is especially true for households with a boy.

In conclusion, there is a large literature looking at the effects of children on consumption. Yet, only a few studies investigate how the moving out of children affects household consumption behaviour. The next section will review those studies.

3.2.2 Literature on the effects of children moving out on household consumption/saving decisions

The most relevant paper to our work is Rottke and Klos (2016), which studies household consumption and savings when a child moves out. Two datasets are examined in their research: The first is the 1995-2010 waves of Italian Survey on Household Income and Wealth (Italian SHIW), and the second is the 1995-2008 waves of German Socio-economic Panel (German SOEP). The authors create dummies for the total number of

from Comprehensive Statistical Data and Materials on 50 Years of New China, China Statistic Yearbook, China Population Census and National Bureau of Statistics.

[21] The sex ratio is defined as the ratio of male population to female population in a specific age cohort (e.g. 12-21 in 2002, when analysing the CHIP data).

children (both resident and non-resident children) and for each child moving out. The basic model they estimate is the following:

$$\log(C_{it}) = \partial_i + \beta_{11}Move1_1 + \beta_{21}Move2_1 + \beta_{22}Move\ 2_2 + \beta_{31}Move3_1 + \beta_{32}Move3_2 + \beta_{33}Move3_3 + \beta_{44}Move4_4 + \gamma_1 Children_one + \gamma_2 Children_two + \gamma_3 Children_three + \gamma_4 Children_four + \delta Controls + \varepsilon_{i,t} \quad (1)$$

C represents for household consumption, or adult equivalent consumption (similar with consumption per capita).[22] The change in household consumption associated with a child moving out shows whether parents save some freed-up resources, and that of consumption per capita indicates if parents spend some of the resources to increase their own consumption. $Controls$ include the difference between the age of the oldest child and 18 which ranges from 0 to 18 (if the oldest child is aged 18 or over, the difference is defined as zero), dummies for widowed, married, separated, or divorced, a dummy for single female, a dummy for college education, dummies for unemployed, self-employed, or retired, a dummy for homeownership, the number of adults living in the household, parents' and children's income, wealth, and year dummies.

Children_one to *Children_four* are dummy variables, indicating the total number of children a family has. If a household has one child, *Children_one* is equal to 1 and otherwise zero. If a household has four or more children, the dummy *Children_four* is equal to 1 and otherwise zero. To investigate the influence of the sequence of departures, the authors also create dummies for children moving out. These are labelled *Move1_1* to

[22] Adult equivalent consumption is calculated as dividing household consumption by the equivalence scale. The equivalence scale is calculated as follow: EQS = (No. of Adults + $\frac{\min(\text{Age of oldest child},18)}{18}$ * No. of Children)$^{\gamma}$, where γ indicates economies of scale in consumption. Their baseline scale coefficient γ is equal to 0.8

Move 4_4. *Move1_1* is equal to 1, when the only child in the family moves out and zero otherwise. *Move2_1* is equal to 1 when the first of two children in the household moves out and zero otherwise, and so on. The dummy variables *Move1_1* to *Move 4_4* are equal to 1 and remain at 1 after the relevant child has moved out. It should be noted that if a child moves out from one household, the number of children (*Children_one* to *Children_four*) will not be downgraded as the corresponding effects are reflected by the moving out dummies.

γ_1 represents the difference in consumption between households with one child and households without any child. β_{11} represents the change of the consumption of the household with only one child moving out. Therefore, the sum of γ_1 and β_{11} shows the difference in consumption between households who never had a child and households with only one child who has moved out. The authors focus on $(\beta_{11} + \gamma_1)$, $(\beta_{21} + \beta_{22} + \gamma_2)$ and $(\beta_{31} + \beta_{32} + \beta_{33} + \gamma_3)$ to examine how the households with all children moving out allocate their freed-up resources. They use fixed-effects models to estimate the equations based on the SHIW data to control the unobservable heterogeneity. Consumption in the SOEP is calculated as income minus financial savings and some other spending including payments to non-household-residents, utilities, mortgage payments and rent. According to the design of the SOEP, the questions on financial savings do not include negative amounts, which implies that the sample of people borrowing to consume is unobservable. Therefore, consumption in SOEP is right censored, and the random-effects Tobit model is used to estimate the consumption equations.

On the adult-equivalent level, the results show that parents personally consume less than their childless peers when their children are living at home ($\gamma < 0$). After each

child moves out, they raise their personal consumption ($\beta > 0$). After all the children depart from the household, parents consume nearly at the same level as their peers without any child (($\beta_{11} + \gamma_1$), ($\beta_{21} + \beta_{22} + \gamma_2$) and ($\beta_{31} + \beta_{32} + \beta_{33} + \gamma_3$) are not significantly different from zero). Those results are found in both the Italian and German samples. They suggest that parents increase consumption with the spare resources which are freed up when their children move out, catching up with their peers without children. In addition, focusing on total household consumption, the authors find that some of the resources freed up by the leaving children are saved, as the results show that the moving out of each child is associated with a reduction in total household consumption.

Considering that the causality between the moving out of children and household consumption could potentially operate in either direction, the authors also apply fixed effects IV estimation and difference-in-difference with propensity score matching to cope with a situation where the explanatory variables could be correlated with the error term. They obtain consistent findings as above. Specifically, Italian and German parents spend a large amount on their children during the earlier life and therefore have less resources to save for their retirement, compared to their childless counterparts. If parents consume the resources freed up when children move out to catch up to their peers without children, it is hard for them to maintain the same consumption after retirement as resources will be limited in their later life.

Using the Health and Retirement Study (HRS) and Consumption and Activities Mail Survey (CAMS) covering the period 2000-2008, Coe and Webb (2010) undertake a similar study as Rottke and Klos (2016).[23] They categorise three groups of households.

[23] The consumption data in this study is collected from the bi-annual CAMS data between 2001 and 2007, while the household characteristics including the information on resident children are obtained from the

If a household had zero resident children over the period from 2000 to 2008, it is defined as having no resident children. A household is defined as always having resident children if it had a constant and positive number of resident children from 2000 through 2008. As the data on household consumption and household size are not collected in the same year, a household having children who moved out is defined as follows: households who had zero resident children in both 2006 and 2008 and had a constant and positive number of resident children between 2000 and 2002. In other words, all the resident children in those households moved out between 2003-2005. The authors compare household and per capita consumption of durables, non-durables and housing, and non-discretionary spending among those three groups.

To this end, they include a dummy for households with children who move out and a dummy for households with a constant number of children into an equation where the dependent variable is household or per capita consumption. The results show that total household consumption remains constant after children move out, whilst non-durable consumption per capita increases. This could be explained by behavioural economic theories. For instance, people get used to spending a certain amount of money on food and keep spending similar amounts on it even if they are shopping for less people (Thaler, 1985). For robustness, the authors categorise households according to location, age of children and work status of household heads, and examine the association between non-durable consumption and moving out of children among those subsamples. The findings are consistent with the previous ones. The paper also investigates the impact of children

2002- 2008 waves of the HRS. Those two datasets are not collected at the same time. The CAMS is sent to 5,000 potential respondents who are picked at random among the HRS participants. After matching the CAMS and HRS data, keeping the households with available consumption data over the period 2000-2008 and preserving the three defined household groups, only 833 households remain in the sample.

moving out on household wealth and finds that there is no significant association between those two variables. The results confirm that American parents with children moving out increase their own consumption with all the resources freed up by the departure of the children. These findings raise the concern that households with children face a high risk of not having sufficient wealth to maintain their current standard of living for retirement. However, this study lacks precision and credibility due to the small sample size in the empirical work (only 2,880 observations for 833 households).

Dushi *et al.* (2015) analyse the response of American parents' savings to the moving out of children. They use the 1992 – 2010 waves of the HRS and the 1992 – 2008 panels of the Survey of Income and Programme Participation (SIPP) data.[24] They adopt three definitions of resident children within the HRS data: First, children who reside at home physically; second, the children in the first definition plus children in college; and thirdly, children in the second definition excluding the ones neither attending school nor physically residing at home in the previous interview. To examine the association between the savings and departures of children, the authors create a dummy which is equal to 1 if all children in the households moved out and otherwise zero. In order to distinguish households who never have a child and households of which all the children had moved out before 1992, the authors set a dummy equal to 1 if the households never have a child and zero otherwise. They investigate whether savings in 401(k) accounts increase with the moving out of children. No matter how resident children are defined, the results show that households increase the savings in 401 (k) by around 0.5-1 percent when children depart from the family home.

[24] The SIPP data incorporates the information of younger parents, while the respondents of the HRS are at least 50 years old.

To supplement their main study, the authors also analyse the SIPP data which include both young and elder respondents. However, the information on children is very limited in the SIPP data, which only contains the age of the youngest child in each household. Then, the authors set a dummy for the households whose youngest child is aged between 19-22, a dummy for the households whose youngest child is aged 23 and over, and a dummy for households without any child. Consistent with the finding obtained with the HRS data, the results show that the 401(k) savings in households whose youngest child is aged 23 and over (children in these households are older and more likely to move out) are 0.3%-0.8% higher than those in households whose youngest child is aged 18 and under.

Both analyses based on the HRS and SIPP show that 401(k) savings increase by a very small amount after children move out. To find out whether households save money elsewhere, the authors examine the changes in non-401(k) financial assets and repayment mortgage when children depart from the family home. There is no evidence that the non-401(k) wealth increases after children move out. Yet, the results suggest that the likelihood of the households whose children moved out having a mortgage is lower, which implies that those households could pay off mortgage with the freed-up resources. This paper provides evidence of a retirement savings crisis that is looming in the U.S.. Parents are barely able to save sufficiently for retirement before the moving out of children because of their parental obligation. If parents still do not increase their savings after children move out, it is hard for them to maintain their current living standards into retirement

3.2.3 Contributions

Our work contributes to filling various gaps in the literature. Firstly, it is the first research studying the relationship between household consumption and the moving out of offspring in a Chinese context. Only a few papers have studied this topic, and most of them focus on western countries (Rottke and Klos (2016) study the Italian and German case, whilst Dushi *et al.* (2015) and Coe and Webb (2010) study the U.S. case). Secondly, the relevant literature listed above, along with our research, look at the effect of children moving out on household consumption, but we also consider the departure of grandchildren and children-in-law. Our interest is triggered by the diverse household composition in China, where it is the norm for different generations to live together, with parents always providing financial support to their children and grandchildren.

Finally, and most importantly, we take into account the effects of the ages of offspring leavers, which is overlooked in existing literature. This is important for the following two reasons: (1) the amount of extra resources left by leavers varies depending on their age. The departure of children who are financially dependent on their parents (younger children) leaves in fact a large amount of extra resources for their parents to spend. By contrast, the departure of children who offer financial support to the household (independent resident children) may even reduce their parents' disposable income and consequently may lead to a reduction in the parents' consumption. (2) The income uncertainty faced by Chinese parents falls with the children's age. Parents with high income uncertainty are more likely to save a larger proportion of the resources freed up by a departing child than their peers with less uncertainty, in order to keep a sufficiently

high 'buffer stock' of savings.[25] Within the traditional Chinese culture, children are responsible to support financially and physically their parents when they become financially independent, and therefore children can be regarded as one type of insurance. As income increases with age in the early working period (Gourinchas and Parker, 2002), elder children are more able to financially assist their parents. In other words, the coverage and reimbursement of the special insurance (children) increase with children's age, and correspondingly parents' income uncertainty decreases with their children's ages.

3.3 Hypotheses

3.3.1 General hypothesis

Household size has been found to have a direct effect on household consumption (Irvine, 1978). In particular, expenditure on food, education, local transportation and personal toiletries has been found to change with the number of household members (Deaton and Paxson, 1998, Deaton *et al.*, 1989). Therefore, we set the first hypothesis as:

Hypothesis 1: A departure from a household leads to a drop in total household consumption.

[25] People consume less when they face higher income uncertainty, as they have to save more to face unexpected economic shocks (Carroll, 1994)

3.3.2 Leaver's age

According to the 2011 and 2013 waves of CHARLS, the age interval of children leavers ranges from 8 to 71 years. Fernández-Villaverde and Krueger (2007) argue that consumption varies with age, and it is hump-shaped during an individual's life-cycle. Consequently, the changes in consumption could be different depending on the ages of leavers. Therefore, we set the following hypotheses:

Hypothesis 2(a): The change in household consumption is significantly different between households whose leavers are from different age groups.

According to Chinese culture, children are responsible for providing financial supports to their parents. Children are especially important when their parents have to pay unexpected large amounts of money, such as medical expenses. Therefore, children can be regarded as one form of insurance. Gourinchas and Parker (2002) provide empirical evidence that income increases with age during the early working life. In the Chinese context, this implies that the older the children are, the stronger is their financial capability and their subsequent ability to assist financially their parents. In other words, the reimbursement rate of the special insurance (children) is increasing with children's age. Thus, parents with older and independent children face less income uncertainty and tend to consume a larger proportion of the resources freed up by the leaver. Taking into account that the average age of Chinese students at which they finish undergraduate education is approximately 22-24, we expect households with leavers aged 25 years and above, to spend a larger share of the freed-up resources, compared to those households that have leavers aged below 25. Consequently, this leads to our final hypothesis:

Hypothesis 2(b): Households with a younger generation leaver aged over 25 will tend to consume a larger proportion of these extra resources than those with the leaver aged under 25.

3.4 Data and Summary Statistics

3.4.1 Sample construction

Our study uses the 2011 and 2013 waves of the China Health and Retirement Longitudinal Study (CHARLS). 10,026 households took part in the 2011 wave and 10,624 households in the 2013 wave.[26] The survey collects high quality data for residents aged 45 and above. In order to compare the consumption changes between 2011 and 2013 in households with and without leavers, we only consider 8,786 households who participated in both waves. As the age structure of the household members is a key factor in our analysis, we exclude additional 1,726 households who did not provide the age information of all members. Furthermore, the CHARLS survey focuses on the respondents aged 45 and over, and therefore we drop households whose heads are aged under 45. This leaves 6,843 households. Next, in order to deal with outliers, for the variables of total consumption,

[26] In the 2013 wave of CHARLS, the question CM003_W2_1 provides the detailed information on the moving out of household members (e.g. if a household member moved out or passed away during 2011 and 2013). However, in the 2015 wave, this question has been excluded. If we define the household member who lived in the household in 2013 but did not in 2015 as a leaver, there are more than 4,000 leavers out of 9,448 children (if we use the household member ID as the index to match household members, the number is more than 6,000 leavers out of 9,448 children), over 4,000 leavers out of 5,521 grandchildren, and more than 2,000 leavers out of 3,000 spouses of children during 2013 and 2015. It is very likely that the ID of those household members are not consistent in different waves. In contrast, in total, only around 3,600 household members moved out from the family home during 2011 and 2013, based on the question CM003_W2_1. There are non-negligible differences in the number of household leavers between the periods 2011-2013 and 2013-2015 due to inconsistent definitions. Therefore, we do not use the 2015 CHARLS survey.

non-durable expenditure, non-education expenditure, household income and household wealth, we replace the top and bottom 1 percent of the observations with missing values.

3.4.2 Summary statistics

3.4.2.1 Household members and leavers

As per the 2011 wave of the CHARLS questionnaire, household members include the following groups of people:

(1) People who had lived in the household for more than 6 months in the past year. This includes people who attended school or worked far away from home but returned to the house nearly every week. Non-family members who lived in the house for work or school but returned to their own home every week are not counted.

(2) People who lived in the household for less than 6 months in the past year and joined this household because they were new born or adopted, got married to one household member, or divorced with someone from other households and moved back.

(3) People who lived in the household less than 6 months in the past year as they also lived in other households but spent most of their time living in the household. This category includes elders and people who may need to be looked after by others.

(4) People who went to school, joined the army or worked away from home, and lived in dormitories or workplaces.

Our sample is composed of 6,843 households and there are 23,395 household members in total. Figure 3.1 shows that more than 51 percent of them are household heads and their spouses. Children and grandchildren account for 21.4% and 15.82% of aggregate household members respectively. If we also take account of children's spouses, the younger generations' members account for 45.73% of the total.

Figure 3.2 shows that 6,657 out of 10,253 households (around 64.05 percent) in the CHARLS dataset have members of at least two generations within the family home. There are 2,539 households (around 24.76 percent) which have at least three generations who reside within the family home, and 3,470 households (23.71 percent) which have members of one generation only. These statistics illustrate the diverse composition of Chinese households.

Figure 3.3 shows the age distributions of the household members: 94.18 percent of household heads and their spouses are aged between 45 and 80, and 94.72 percent of other household members are aged between 0 and 50 (more than 93% of other household members are the younger generations). In our regression sample, 2,909 leavers are reported from within 1,585 households. The majority of the leavers are the household heads' children, grandchildren and children-in-law. Figure 3.4 shows the distribution of household members moving out of the household. From the figure, we can see that 45.34 % of the leavers are children of the household heads, and 86.83% of them belong to younger generations (i.e. children, grandchildren, or spouses of the children of household heads).

Figure 3.5 presents the ages of leavers in different categories. We can see that the leaver's age ranges from 0 to 111, and the leaver aged 111 is the mother-in-law of one household head. This household member is no longer part of the household because she

died. About 85% of the child leavers are aged between 20 and 40 and the mean age is 28. Grandchild leavers aged between 0 and 20 count for 92.27 percent of the total leavers in this category, with a mean age of 10. Meanwhile, 96.06 percent of children's spouses who move out are aged between 20 and 45, and the mean age of leavers in this category is 32.

Most offspring household members who move out at the age between 0 and 16 are the grandchildren of household heads. It is normal in China for grandparents to look after their grandchildren. Working in a place far away from home is a common reason for the moving out of adult children. Also, younger generations' members move out when they start their own family or when they purchase their own house. The adult children who move out have a higher possibility of owning a house compared to those who still reside with their parents after working for a while. This implies that the adult children who depart from the family home have more wealth than those residing with their parents and are more capable of sharing risks for their parents. Financially independent children are responsible for providing financial and physical support to their parents in China. Parents with wealthier children tend to face less uncertainty in income and consumption and, therefore they have less of a precautionary savings motivate and consume more.

3.4.2.2 Descriptive statistics

Table 3.1 shows consumer expenditure of different categories, which are home expenditure, food, durables, health (out-of-pocket), recreation, clothing, education and others. The elements in each category are listed in the Appendix. The table shows that expenditure on food is the biggest consumption category, covering more than 53 percent of the total consumption. Health (out-of-pocket) is the second largest consumption

category, which accounts for around 13.28% of the aggregate expenditure. The third largest consumption component is home expenditures, with a share of 11.9 percent of total household expenses.

Table 3.2 displays the consumption change of households with leavers between 2011 and 2013. We find an expansion of food consumption, and recreation, along with a slight and insignificant increase in annual total consumption over those years. The average annual food consumption increased by around 1,723 yuan (inflation adjusted). During the periods between the civil war and the reform and opening-up of the Chinese economy, the majority of the Chinese residents were in poverty and barely able to meet their basic needs. Following the rapid growth rate of the economy, residents' income increased significantly. Meanwhile, people have been improving the quality of their food, which largely increased the expenditure on food (Gu *et al.*, 2015). In addition, parents whose children or grandchildren moved out have more time to enjoy themselves and consequently, spend a greater amount of money on recreation. Also, the table shows that household consumption in all other categories, especially education, declines as a result of the decreased household size. It is common for children to move out from their parents' houses to somewhere near their workplace as soon as they finish education and find a job, which can explain the significant decline in education expenditure.

Table 3.3 provides means and standard deviations of other variables used in our models for the two waves of CHARLS pooled together. We observe that the average household size in our sample is 3.4, and around 38 percent of households are from urban areas. In addition, the average age of household heads in our sample is around 61.56 and 77.74 percent of them are married. We use the attainment of primary education as an education indicator in our study, because the average education level of household heads

in our sample is very low. Only around 51.12 percent of household heads finished primary school. This low education level of household heads is caused by the 10-year Cultural Revolution, which discouraged people from attaining education. This political movement began in 1966, when most of the household heads were of school age.

3.5 Models and Methodology

3.5.1 Baseline models

We investigate the association between younger generations' departures and household consumption. In particular, we explore whether the association between leavers and consumption varies dependent on the leaver's age. On the left-hand side of our equation, we put the logarithm of real total and non-durable consumption. Then, following Klos and Rottke (2013), on the right hand side of our equation, we control for the household head's age, gender, education level and marital status, total household income as well as wealth. In addition, we also include year and provincial dummies as well as an indicator for whether the household is in the urban or rural area.

We estimate a range of different models to test our hypotheses. First, we study the general responses of consumption to a household member's departure. Due to missing information on children and other household members who had moved out before 2011, we modify Klos and Rottle's model (2013) by replacing the dummies for children moving

out with a variable ($Totalmove_{j,t}$) indicating the total number of household members who moved out between 2011 and 2013.[27] Therefore, we estimate the following model:

$$log\mathrm{C}_{j,t} = \partial_{0i} + \beta HHsize2011_j + \gamma Totalmove_{j,t} + \theta Controls_{j,t} + u_j + u_t + \varepsilon_{jt} \quad (2)$$

where $C_{j,t}$ represents the real total or non-durable consumption for household j in year t. $HHsize2011_j$ is the initial number of members in household j. $Totalmove_{jt}$ is the total number of leavers in household j in year t.[28] $Controls_{jt}$ are the control variables listed above.[29] u_j is the unobserved individual heterogeneity, while ε_{jt} stands for an idiosyncratic error term.

γ represents the average change in household consumption when a member moves out from a household. According to our Hypothesis 1, a reduction in family size will cause a decline in household-level consumption. Therefore, a negative sign on the coefficient γ is expected for all consumption groups. β reflects the average change in consumption associated with an additional household member. The sum of β and γ indicates the change in the remaining household members' consumption, when a member moves out.[30] A positive sign of the sum implies that they spend part of the freed-up resources to increase their own consumption

[27] See Equation (1). The dummies for children moving out and for the total number of children in Rottle and Klos (2013) are explained in detail in the Literature Review.

[28] Given we use the information of household members in 2011 as the baseline, we do not consider people moving out of a household in that year. Therefore, $Totalmove_{jt}$ reflect the number of members who moved out of the household between 2011 and 2013.

[29] To test the hump-shaped consumption pattern, we controlled for age-squared in the model. However, the coefficient was not significant at the 10 percent significance level. We have excluded it in order to keep a parsimonious model.

[30] To simplify our explanation, we assume all the other control variables are equal to zero. A household has *X* members in 2011, and *Y* of these members move out in 2013. The consumption of the remaining *(X-Y)* household members in 2013 is ($\beta * X + \gamma * Y$). The consumption of the remaining (X-Y) members in 2011

As Danziger *et al.* (1982) document that consumption demand decreases with age, we expect the sign on the coefficient of the household head's age to be negative. Additionally, we expect to observe a positive sign on the coefficient of the education of the household head. People with education tend to invest more on their offspring than the illiterate. For instance, parents who received proper education understand fully the importance of education and are more likely to spend a greater amount of money on their children's education. Also, educated people are more likely to use financial instruments to diversify their uncertainty in consumption and income.

The wealth effects states that people increase their spending when the value of their assets increases, and therefore a positive sign on the coefficient of total household wealth is anticipated. Compared with singles, married people face less uncertainty in their income and consumption, as their partners will support them when they encounter financial problems. Thus marriage can be regarded as one form of insurance which diversifies the risk of income and health (De Nardi and Yang, 2015). We therefore expect a positive association between the marital status of the household head and household consumption. Furthermore, females are generally more risk averse than male (Borghans *et al.*, 2009). If the household head is a female, she is likely to have a stronger precautionary motivate to save and spend less. We therefore expect to observe a positive sign on the gender dummy, which is equal to 1 if the household head is a male and zero otherwise.

is $\beta * (X - Y)$. Therefore, we can calculate the change of their consumption as $\beta * X + \gamma * Y - \beta * (X - Y)$, which is equal to $(\gamma + \beta) * Y$. $(\gamma + \beta)$ represents therefore the average change in the consumption of the remaining household members when one of initial household members moves out between 2001 and 2013.

We next examine the extent to which expenditure on various consumption groups changes according to the age of the leavers. To this end, we estimate the following model:

$$
\begin{aligned}
log\mathrm{C}_{j,t} = \; & \partial_0 + \beta_1 YoungDemo0_16_{j,t} + \beta_2 YoungDemo17_24_{j,t} \\
& + \beta_3 YoungDemo25_30_{j,t} + \beta_4 YoungDemo31_71_{j,t} \\
& + \gamma_1 YoungMove0_16_{j,t} + \gamma_2 YoungMove17_24_{j,t} \\
& + \gamma_3 YoungMove25_30_{j,t} + \gamma_4 YoungMove31_71_{j,t} + \delta Controls_{jt} \\
& + u_j + \varepsilon_{j,t} \quad (3)
\end{aligned}
$$

Our model includes $YoungDemo0_16_{jt}$ to $YoungDemo31_71_{jt}$ which refers to the number of initial resident children, grandchildren and spouses of children aged 0-16, 17-24, 25-30 and 31-71 in household *j* in year *t*.[31] Following Rottke and Klos (2016), the total number of initial younger generation members is the same in both 2011 and 2013, and the effects of the younger generation leavers on consumption are captured by the moving out variable.[32] These are $YoungMove0_16_{jt}$ to $oungMove31_71_{jt}$, which represent the number of younger generation members who left the households *j* in year *t* in each age group. Given the fact that our sample consists of two waves of data and we can only observe the departure of household members in the second wave, $YoungMove0_16_{j2011}$ to $YoungMove31_71_{j2011}$ are equal to zero. Finally, Equation (3) includes the same control variables as Equation (2), which are household head's age, gender, education level and marital status, household income, total household wealth, as

[31] Initial resident member represents the people lived in the household in 2001, when the survey was launched.
[32] See explanations for Equation (1).

well as urban, year, and provincial dummies. In addition, we control for the number of non-offspring household members.

The coefficients, β_1 - β_4, reflect the average change in household consumption associated with an additional younger generations' member in each age group. The coefficients γ_1 - γ_4 indicate the average change in consumption which follows the departure of a person in every age group. Based on Hypothesis 1, we expect γ_1 - γ_4 to have a negative sign. If γ_1 - γ_4 are significantly different from each other, then Hypothesis 2(a) cannot be rejected.

The corresponding sums of β and γ show how the extra resources are allocated depending on the leaver's age: A positive sum means the extra resources will be used to increase consumption, while a negative sum suggests they will be saved and the remaining members even reduce their own consumption. Finally, if the sum is not statistically different from zero, this means all of the extra resources are saved, and the remaining members in the household maintain the same consumption level as before. If Hypothesis 2(b) holds, then households with younger generation leavers aged 25 and over spend a larger proportion of the freed-up resources than those with offspring leavers aged under 25. In this case, $(\beta_3 + \gamma_3)$ and $(\beta_4 + \gamma_4)$ will be bigger than $(\beta_1 + \gamma_1)$ and $(\beta_2 + \gamma_2)$

3.5.2 Estimation methodology

Analysing a two wave panel data, we use a random-effects linear model to estimate our Equation (2) and (3). This enables us to account for unobserved household-specific

heterogeneity. We choose a random-effects model rather than a fixed-effects one because the latter omits certain important variables, through differencing.[33] Specifically, the initial household size (*HHsize2011* in Equation (2)) is time invariant and vital for analysing how extra resources freed up after the departure of household members are allocated. If the fixed-effects model was applied to Equation (3), one of the four younger generations' demographic variables would be omitted because of collinearity (see Appendix). However, those demographic variables are critical to investigate the allocation of freed-up resources.

3.6 Empirical Results

3.6.1 How does household-level consumption change following a member's departure?

Table 3.4 shows the random-effects estimates of Equation (2). If the coefficient associated with the '*Totalmove'* variable is negative and significant, this implies that households with a member leaving reduce their consumption and Hypothesis 1 is accepted.

Consistent with our Hypothesis 1, the results show that consumption is negatively and significantly associated with departures of household members. A household member moving out is associated with an 11.4 percent lower total consumption and an 11.2 percent lower non-durable consumption respectively. An additional household member is associated with an 11.9 percent higher total household consumption and an 11.4 percent higher non-durable consumption. The sum of the coefficients associated with

[33] The fixed effects estimator for a 2-year panel is in fact equivalent to a first-difference estimation.

'*HHsize2011*' and '*Totalmove'* indicates how the resources which are freed up when a household member moves out are reallocated: A zero sum indicates that, when a household member moves out, the remaining household members consume at the same level as before, which implies that all the freed-up resources are saved. A positive sum indicates that the remaining household members use some of the freed-up resources to increase their own consumption. Finally, a negative sum represents that the remaining household members reduce their own consumption after one household member moves out.

At the bottom of Table 3.4, we report the sums of the coefficients for '*HHsize2011*' and '*Totalmove*' and the *p*-values for the significance tests of those sums. In the first column, the sum of γ and β is 0.005 and insignificant. This suggests the remaining household members do not change their own consumption when a household member leaves home. This finding is different from Rottke and Klos (2016), Coe and Webb (2010) and Dushi *et al*. (2015) who document that parents increase their consumption after children move out. The public pension scheme and financial market in China are less developed compared to those in Germany, Italy as well as the U.S.. Therefore, Chinese parents have a stronger saving motivation and tend to consume less of the freed-up resources.

In regards to the control variables, age is negatively associated with both total and non-durable consumption, which is consistent with Danziger *et al*. (1982).[34] When people get older, they have less energy and undertake less shopping activities. Also, we observe that both total and non-durable consumption is around 15% higher in households where

[34] Age-squared is not significant and therefore, we do not include it in our regression for parsimony.

the head has obtained primary education than households with an illiterate head. Compared with illiterate household heads, household heads who attained at least primary education have a higher probability of using financial markets to diversify income uncertainty and therefore tend to consume more (Cull *et al*., 2016).

Moreover, in line with Paiella and Pistaferri (2014), our results show a positive relationship between household wealth and consumption. A ten percent increase in household wealth is positively associated with a 1.14 percent higher total consumption and a 1.06 percent higher non-durable consumption. In addition, a ten percent increase in real income is associated with a 0.985 percent increase in total consumption and a 0.912 percent increase in non-durable consumption. There also exists a strong relationship between the marital status of the household head and consumption. Compared with households whose head is single or divorced, households with a married head have a 28 percent higher total consumption and a 27.1 percent higher non-durable consumption.

3.6.2 How does household consumption change after a member's departure? Does the age of the leaver make a difference?

In the existing literature which studies how parents allocate newly freed-up resources following a child leaving the home (Rottke and Klos, 2016; Coe and Webb, 2010), the age of the leaver is not taken into account. We advance this literature by investigating whether the changes in consumption are different depending on the age of the leaver. Given the wide range of leavers' ages (Figure 3.5), we believe it is necessary to take it into consideration when studying the link between people moving out of a household and household consumption.

To test Hypothesis 2a-2b, we estimate Equation (3), with the results reported in Table 3.5. The coefficient for the number of initial younger generations' members from an age group X, *YoungDemoX*, represents the average change in consumption associated with one additional younger generations' member from that age group. Consistent with Browning and Ejrnæs (2009) who show that the consumption of children is increasing with age in the U.S., our results show that an offspring member from an older age group is linked to higher household consumption. Focusing on the first column of Table 3.5, one additional younger generations' household member aged between 0 and 16 is associated with a 9.27% higher total household consumption, that an additional member aged between 17 and 24 is associated with a 14.6% higher total household consumption, an additional member aged between 25-30 is linked to a 5.85% higher total household consumption and an additional member aged between 31-71 is associated with a 16.3% higher total household consumption.

The coefficients of the *YoungMoveX* indicate the change in household consumption associated with the moving out of an offspring household member in age group *X* (*X* could be 0-16, 17-24, 25-30 and 30-75). The results show that an offspring leaver is negatively associated with household consumption, which is consistent with Rottke and Klos (2016). In the first column, an offspring leaver aged between 0 and 24 is associated with about a 17% lower total household consumption, and an offspring leaver aged between 31 and 71 is associated with around an 11.4% lower total consumption. The *p*-values of the *F*-tests for the equality of coefficients for the moving out variables (*YoungMove0_16* - *YoungMove25_71*) are reported at the bottom of Table 3.5. The *F*-tests show that the reduction in household consumption linked to the departure of a younger generations' member significantly varies across the leaver's age. The

Hypothesis 2a is not rejected, and this highlights the importance of taking the leaver's age into consideration when studying the association between household consumption and the departure of household member from the family residence.

Younger generations' members who are aged between 25 and 30 have the least impact on household consumption, when compared to those from other age groups. One additional offspring household member aged between 25 and 30 is linked to only a 5.85 percent increase in household consumption, and the moving out of younger generations' members in this age group is not related to any change in consumption. Based on the Figure 3.5, the probability of children moving out peaks when they are aged between 25 and 30. Therefore, offspring household members in this age group tend to spend less time in the family home than those in other age groups, because they are mostly preparing to depart from the household.

The sum of the coefficients for the number of initial younger generations' members (*YoungDemo*) and the moving out variables (*YoungMove*) reveals the allocation of the freed-up resources as well as the consumption of the remaining household members. These sums, ($\beta + \gamma$), are reported in Table 3.6. Based on the first column in Table 3.5, the coefficient of *YoungDemo0_16* shows that the departure of one younger generations' member aged between 0-16 is associated with a 9.27% higher household consumption on average. The coefficient of *YoungMove0_16* implies that after one member aged between 0 and 16 moves out, the household will show a 17.6% lower consumption. The first column in Table 3.6 indicates that the remaining members, in a household with an offspring leaver aged between 0 and 16, consume 8.33% less (9.27 minus 17.6) ex post.

This implies that parents/grandparents with an offspring aged 0-16 who is moving out will save all of the corresponding freed-up resources and reduce their own consumption level ex-post. If the leaver is aged between 17 and 24, the remaining members will not change their consumption. However, if the leaver is aged 25 or over, the remaining household members will display about a five percent higher total consumption. The second column, where the dependent variable is non-durable consumption, shows similar results.

These findings indicate that Chinese households save at least part of the extra resources freed up from a household member moving out. If the younger generation's leavers are of schooling age, parents/grandparents even reduce their previous consumption level. The age distribution of leavers (Figure 3.5) shows that most offspring who move out between the ages of 0 and 16 years are grandchildren of household heads. Grandparents living with grandchildren invest a lot in the education and up-bringing of their children in the past, and they also have to spend for their resident grandchildren. As a result, those grandparents have a very strong motivation to consume less when their grandchildren move out, in order to smooth their consumption when they become older.

In line with Hypothesis 2b, we find that the remaining members in households with an offspring leaver aged between 25 and 71 increase their consumption with the newly freed-up resources by around 5%, but not those in households with leavers in the younger age groups. This can be explained by considering that working children are more likely to provide risk sharing compared to the children who are attending school or university. Children play an important role in financially supporting their parents in China. Gourinchas and Parker (2002) find evidence that income increases with age during the early working life. If we regard children as one type of insurance, of which the

reimbursement rate is increasing with the child's age, parents with a child over 25 and moving out will face less uncertainty in income and expenditure compared to the counterparts with an offspring leaver under 25. Therefore, parents with a child aged 25 or over moving out have less of a precautionary saving motive and tend to spend a greater proportion of the freed-up resources.

To make sure the non-positive sums of β and γ for the two youngest age cohorts are not caused by a reduction in education consumption, total household consumption net of education is set as the dependent variable in the third column of Table 3.5 and Table 3.6. The results show that the remaining household members change their total consumption (net of education expenditure) by -9.48%, -4.99%, 5.43% and 7.04%, when the leaver is aged 0-16, 17-25, 26-30 and 30-71 respectively. The change in the consumption associated with a leaver aged between 17 and 25 is statistically insignificant. These results are consistent with the above findings.

In summary, the leaver's age is taken into consideration when household heads allocate the resources freed-up by the leaver, as independent children could provide risk sharing and their ages are closely related to their financial capability. This important feature has been ignored in Rottke and Klos (2016), Coe and Webb (2010) and Dushi *et al.* (2015). We find that if the leaver is aged under 25, the remaining household members save all the extra resources, and some of them even reduce their previous consumption. In contrast, if the leaver is financially independent (generally aged 25 or over), some of those freed-up resources will be spent.

3.6.3 Will out-transfer increase in the household with a member moving out?

The total household consumption analysed in the above sections does not include households' out-transfer to non-resident relatives and friends. To provide continually financial assistance to the offspring who departed from home, rather than either save for retirement or consume the freed-up resources, the household heads may opt to transfer these freed-up resources to their offspring leavers especially in the early stage of their departure. This could be one contributing factor to our finding that households with offspring leavers aged under 25 consume the same amount as before the offspring member moved out. Next, we therefore examine whether household out-transfers towards non-resident family members increase after a member moves out from the family home. The results are reported in the Table 3.7. The dependent variables in columns 1 and 2 is the logarithm of real household out-transfer towards non-resident children and grandchildren, and in the column 3 it is the logarithm of real total household out-transfer. We control the age, primary education, gender and marital status of household head, household income, household wealth, urban dummy, year dummy, provincial dummies and the number of non-offspring household members.

The first column indicates that the moving out of a younger generations' member is not significantly associated with any change in household out-transfers towards non-resident children and grandchildren across all age groups. In the second column, we no longer differentiate offspring leavers based on their age, and instead we use the total number of younger generations' members who move out (*Totalmove_young*) as the key explanatory variable. As before, the results show that households do not increase their transfers to non-resident younger generations after an offspring member departs from the family home. Our finding suggests that parents keep the extra resources when the children

move out, rather than transferring these resources to the leavers as a type of further financial support.

In the third column, we use the total number of household members who move out (including leavers of all generations) as the explanatory variable. The results show that the departure of a household member from the family residence is associated with a 22.6 % higher total household transfer. This can be explained, considering the fact that within the Chinese tradition, children are responsible for the care of their parents and grandparents. When parents or parents-in-law move out from the households, household heads will regularly provide financial assistance to them through transfers.

Columns 1-2 also show an inverse U-shaped relationship between the age of the household head and the amount of out-transfer to the younger generations. There is a strong positive relationship between education and household out-transfer, which implies that residents who have attained education to the primary school level support non-resident relatives to a greater extent when compared to their counterparts who did not attend primary school. This could be explained, considering that the Chinese children are taught in primary school to care about other people's well-beings. Compared with single people, married people tend to have a larger extended family, leading to a positive relationship between marital status and household out-transfers. In addition, our results show that household income and wealth is positively related to the household out-transfers. In China, relatives and friends are the main sources of funding, and households with high wealth typically provide financial assistance to those with lower wealth (Zhou, 2014).

3.7 Robustness Test

The changes in consumption at the household level show whether parents save a proportion of the resources freed up when the offspring members move out. Our previous results indicate that, if the offspring leaver is aged under 25, the households will keep all the freed-up resources. In addition, parents will spend some of the freed-up resources to increase their own consumption if the offspring is aged 25 or above. In other words, the consumption per capita will increase in the latter case but not in the former. To check the robustness of our results, we then examine the association between consumption per capita and the moving out of younger generations' members at different age groups. The results are reported in the Table 3.8.

The dependent variables in columns 1-3 are total household consumption per capita, non-durable consumption per capita, and non-education consumption per capita respectively. Those are calculated as dividing total, non-durable, and non-education consumption by household size. Following Council (1995) and Rottke and Klos (2016), the dependent variables in columns 4 - 6 are total, non-durable, and non-education consumption divided by equivalent scale (EQS).[35]

Focusing on the first column, households with an offspring leaver aged under 25 keep constant consumption per capita following the departure of younger generations' members. This is consistent with the results in Table 3.6, suggesting that households save all the freed-up resources if the leaver is 24 or under. In addition, an offspring leaver

[35] EQS is calculated as n^{β} in our study, where n is the total number of household members, and β represents the economies of scale in consumption. Following Rottke and Klos (2016), we set β =0.8. Council (1995) assumes that one child is equal to 0.7 adult, and the EQS in his study is calculated as follow: EQS = (No. of Adults + 0.7 * No. of Children) $^{\beta}$. Our dataset focuses on the household heads aged 45 and over, and around 84% household members are aged 18 and over. Instead of putting a weight smaller than 1 to a child member, we assume that children consume at the same level as adults.

aged between 25-30 is associated with a 13.3% increase in the consumption per capita, and an offspring leaver aged 31 or above is linked to a 11.8% growth. Consistent with the above findings and Hypothesis 2b, households with an offspring leaver aged 25 or above tend to increase their consumption from the freed-up resources, but not the households with an offspring leaver aged 24 or under. Columns 2 - 6 imply the same results as column 1, which shows that our results are robust.

3.8 Discussion and Conclusion

Since Modigliani and Brumberg (1954) proposed demographics and income growth as the two key explanatory factors of household consumption, the empirical effects of demographic characteristics on household consumption have received substantial attention. Recently, the literature on the effect of household composition on consumption has looked at how resources are re-allocated in a household with a child moving out (Rottke and Klos, 2016, Coe and Webb, 2010, Munnell *et al.*, 2015). However, all these studies fail to take the leaver's age into consideration and only focus on the departure of children. Our research contributes to this literature by focusing on the departure of children, grandchildren or children-in-law and by analysing whether the impact of a leaver on household consumption varies with the leaver's age. Also, to the best of our knowledge, we are the first to test the effects of younger generations moving out of a household on consumption in a Chinese context.

We use the 2011 and 2013 waves of the CHARLS, which consists of more than 10,000 households from 28 provinces in each wave. Based on our random-effects linear and random-effects Tobit estimations, we document the following findings. First, households with a member moving out reduce consumption, and the effect of a household

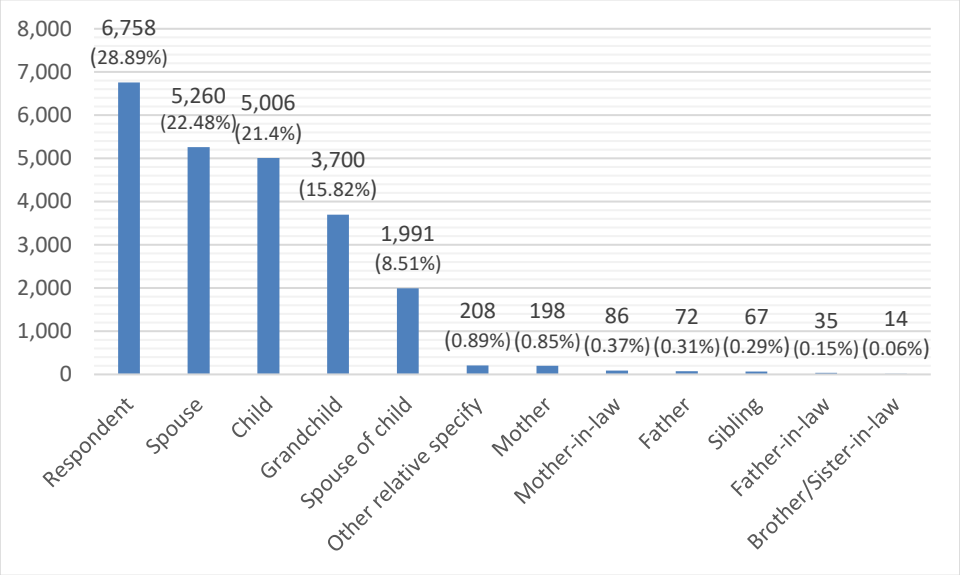
member moving out on household consumption varies depending on the leaver's age. Second, we find that Chinese households have a strong saving motivation and save at least part of the resources freed up when a member moves out of the family home. The reallocation of the freed-up resources closely depends on the leaver's age. If the leaver is aged below 25, the household saves all the extra resources. If the offspring leaver is 25 or above, the household tends to spend a small fraction of the extra resources.

Our finding shows that Chinese households tend to save the resources freed up when a household member moves out, rather than using a large part of these resources to increase their consumption. This reveals the strong saving motivations of Chinese households. It could be caused by low levels of social welfare benefits and a lack of development in the financial markets which is required to appropriately diversify income and consumption risks. Along with an ageing population, the pension scheme deficit will increase, and governments could have to reduce their expenditure on the public pension schemes. This issue puts extra stress on Chinese residents and increases their saving motivations. To alleviate the need for such high levels of precautionary savings and encourage consumption, the government should put in place mechanisms which reduce households' uncertainty. This can be achieved by further developing and diversifying the pension system and incentivising financial institutions to provide more diversified products. Also, the government could endeavour to improve financial literacy amongst its citizens and advise households on how to utilise financial markets appropriately, especially with respect to private pension schemes or other financial instruments which could be used to supplement the insufficient state pension.

This study focuses exclusively on how offspring moving out of a household affects household consumption. It suffers from the following limitations. First, since our

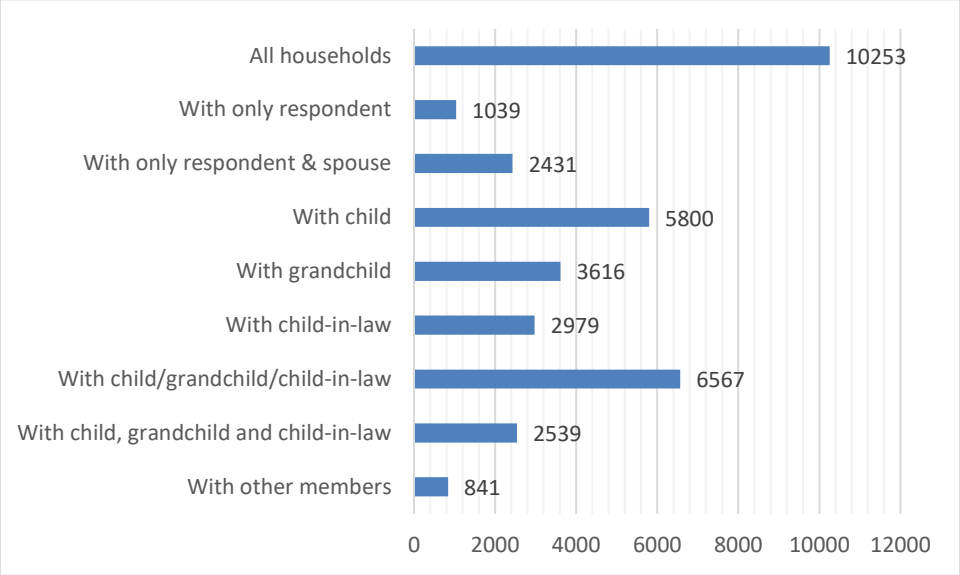
dataset consists of only 2 years, we are unable to apply a dynamic model to test the effects of departures on household consumption over time, as in Rottke and Klos (2016). Second, we do not consider the potential endogeneity between consumption and the moving out of a child, and therefore our results cannot reflect causality. In addition, to deal with these limitations, further research might investigate whether similar results apply in other countries.

Figure 3.1: Distribution of household members in CHARLS (2011)



Note: The data are based on the sample where household heads were aged 45 and above in both 2011 and 2013, and households participated in both the 2011 and 2013 waves of the survey and provided age information for every household member.
Source: Author's calculation based on the CHARLS data

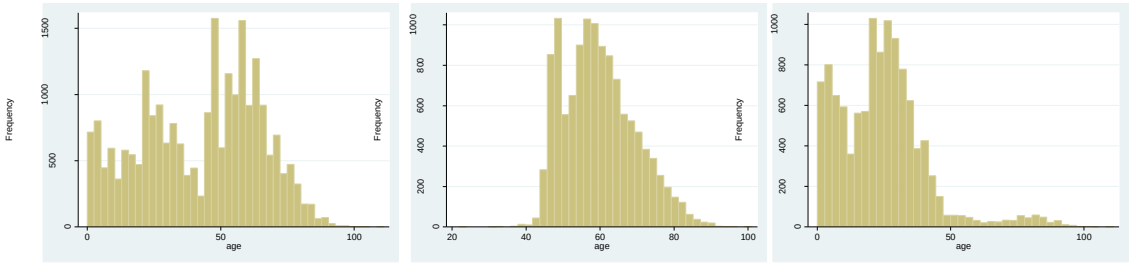
Figure 3.2: Number of households by composition in CHARLS (2011)



Note: 'All Households' are the households who joined in the 2011 wave of the CHARLS. 'With only respondent' represents the households with only one member. 'With only respondents & spouses' are the households composed of only respondent and his/her spouse. 'With child' represents the households with at least one child in residence. 'With grandchild' stands for the households with at least one grandchild in residence. 'With child-in-law' stands for the households with at least one child-in-law in residence. 'With child/grandchild/child-in-law' stands for the households with at least one younger generation member in residence. 'With child, grandchild and child-in-law' represents the households who have at least three generations in residence. 'With other members' stands for the households with at least one other household member (except for child, grandchild and child-in-law) in residence. There are overlaps between certain groups.
Source: Author's calculation based on the CHARLS data

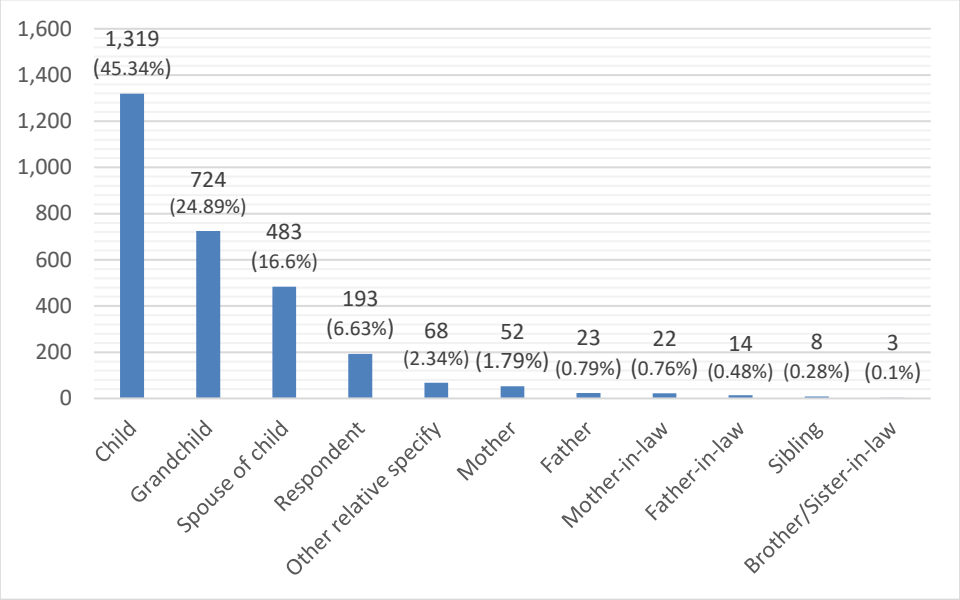
Figure 3.3: Age distribution in CHARLS (2011)

(a)All people (b) Respondents and spouses (c) Other household members



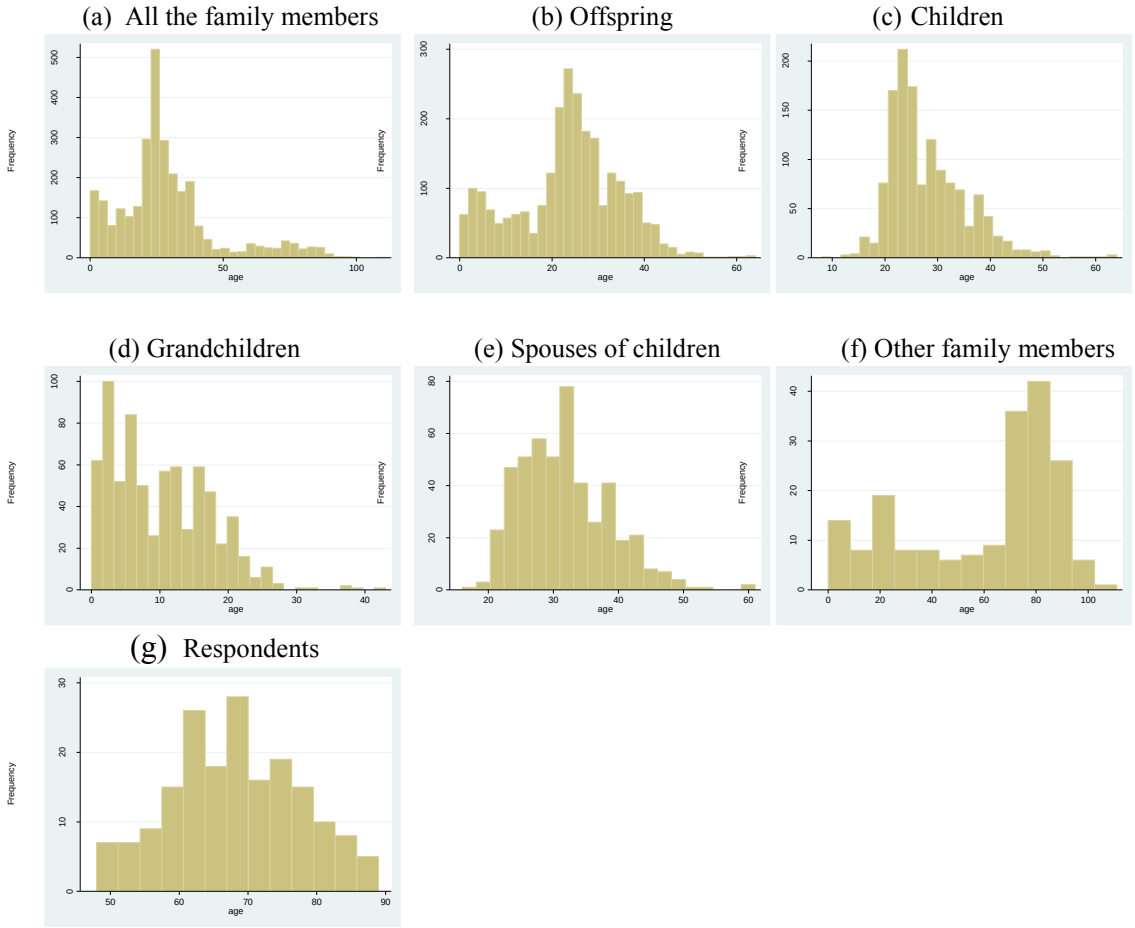
Note: The data are based on the sample where household heads were aged 45 and above in both 2011 and 2013, and households participated in both the 2011 and 2013 waves of the survey and provided age information for every household member. 'Other household members' represents all the household members apart from respondents and their spouses.
Source: Author's calculation based on the CHARLS data.

Figure 3.4: Frequency of different types of family leavers in CHARLS



Note: The data are based on the sample where household heads were aged 45 and above in both 2011 and 2013, and households participated in both the 2011 and 2013 waves of the survey and provided age information for every household member.
Source: Author's calculation based on the CHARLS data.

Figure 3.5: Age distribution of family leavers in CHARLS (2011)



Note: The data are based on the sample where household heads were aged 45 and above in both 2011 and 2013, and households participated in both the 2011 and 2013 waves of the survey and provided age information for every household member.
Source: Author's calculation based on the CHARLS data.

Table 3.1: Consumption for the two waves of CHARLS

	Absolute		Relative share		Logarithm		
Variables	Mean	S.D.	Mean.	S.D.	Mean.	S.D.	Obs.
Home expenditure	2,562	2,354	0.1188	0.0009	7.411	1.037	12,769
Food	11,397	10,660	0.5364	0.0027	8.91	1.016	12,335
Durables	1,304	4,304	0.0626	0.0019	2.774	3.619	13,035
Health (out-of-pocket)	2,749	5,002	0.1328	0.0021	6.058	2.926	12,974
Recreation	683.7	1,304	0.0320	0.0005	5.035	2.4	13,119
Clothing	848.1	1,142	0.0408	0.0005	5.036	2.841	12,193
Education	1,159	3,268	0.0557	0.0014	1.992	3.43	12,874
Others	445.1	1,087	0.0209	0.0004	2.808	3.176	13,085
Total consumption	22,419	21,722	1	0	9.599	0.995	13,128
Consumption without education	21,099	20,772			9.543	0.991	12,740
Non-durables Consumption	20,235	17,768			9.552	0.977	13,094

Note: Data are calculated based on pooled cross sections with 13,129 observations. The sample includes households who participated in both the 2011 and 2013 waves of the survey and provided age information for every household member and of which household heads were aged 45 and above in both 2011 and 2013. Means of the absolute values are expressed in RMB. We set the CPI in 2011 as 100 and deflate the consumption in 2013 with the CPI.
Source: Author's calculation based on the CHARLS data and China Statistical Yearbook.

Table 3.2: Consumption for two waves of CHARLS for households with leavers

	Year 2011			Year 2013			Difference		
Variables	Obs.	Mean	Relative share	Obs.	Mean	Relative share	Obs.	Mean	S.E.
Home expenditure	1,556	2,674	0.1260	1,447	2,546	0.1158	1,421	-114.5438**	62.4723
Food	1,523	10,309	0.4934	1,376	11,953	0.5503	1,318	1723.339***	328.148
Durables	1,557	1,375	0.0687	1,486	1,479	0.0708	1,453	89.51949	165.1186
Health (out-of-pocket)	1,548	2,921	0.1376	1,473	2,713	0.1305	1,436	-135.4636	173.5655
Recreation	1,571	580.9	0.0278	1,490	695.2	0.0337	1,472	98.88535***	35.90015
Clothing	1,460	1,048	0.0510	1,388	763.4	0.0349	1,282	-287.923***	36.10915
Education	1,545	1,504	0.0729	1,469	962.2	0.0442	1,428	-549.1851***	98.01945
Others	1,562	503.2	0.0226	1,489	436	0.0198	1,463	-47.14206	35.83048
Total consumption	1,582	22,921	1	1,483	22,966	1	1,473	160.6011	648.8098
Consumption without education	1,539	21,201		1,446	21,885		1,401	1540.783**	645.8663
Non-durables Consumption	1,578	20,301		1,479	20,759		1,467	747.7732	514.3871

Note: The sample includes households who participated in both the 2011 and 2013 waves of the survey and provided age information for every household member and of which household heads were aged 45 and above in both 2011 and 2013. Means are expressed in RMB. We set the CPI in 2011 as 100 and deflate the consumption in 2013 with the CPI. Significance is indicated to the one percent level (***), five percent level (**) and 10 percent level (*).

Source: Author's calculation based on the CHARLS data and China Statistical Yearbook.

Table 3.3: Household characteristics

VARIABLES	Obs.	Mean	S.D.	Min.	Max.
Household head characteristics					
Age	13,312	61.5606	10.1380	45	102
Gender	13,312	0.4662	0.4989	0	1
Primary education	13,307	0.5112	0.4999	0	1
Married	13,331	0.7774	0.4160	0	1
Widowed	13,311	0.1871	0.3900	0	1
Single female	13,309	0.1455	0.3527	0	1
Urban	13,686	0.3811	0.4857	0	1
Financial status (logarithm)					
Income	13,134	9.5869	1.7039	-0.6931	12.4435
Wealth	13,133	5.8887	4.9775	-0.5021	14.4187
Household transfers (logarithm)					
Transfer to younger generations	11,047	2.1575	3.3004	0	10.6455
Household demography					
HHsize2011	13,686	3.4194	1.7902	1	14
Totalmove	13,686	0.2119	0.7199	0	9
No. of non-offspring members	13,686	1.8289	0.5734	1	10
YoungDemo0_16	13,686	0.4954	0.8099	0	8
YoungDemo17_24	13,686	0.3184	0.6234	0	5
YoungDemo25_30	13,686	0.2971	0.6415	0	7
YoungDemo31_71	13,686	0.4523	0.8170	0	6
YoungMove0_16	13,686	0.0384	0.2452	0	5
YoungMove17_24	13,686	0.0353	0.2118	0	3
YoungMove25_30	13,686	0.0504	0.2726	0	4
YoungMove31_71	13,686	0.0605	0.3271	0	4

Note: The sample includes households who participated in both the 2011 and 2013 waves of the survey and provided age information for every household member and of which household heads were aged 45 and above in both 2011 and 2013. We set the CPI in 2011 as 100 and deflate the household income, wealth and transfer in 2013 with CPI. See the Appendix for complete definitions of all variables.

Source: Author's calculation based on the CHARLS data and China Statistical Yearbook.

Table 3.4: Leavers and household consumption

	Total consumption	Non-durable consumption
Age	-0.0122***	-0.0114***
	(0.000994)	(0.000994)
Primary Ed.	0.150***	0.149***
	(0.0191)	(0.0190)
Gender	0.0268	0.0262
	(0.0175)	(0.0174)
Married	0.280***	0.271***
	(0.0491)	(0.0484)
Widowed	0.117**	0.102*
	(0.0536)	(0.0533)
Income (log)	0.0985***	0.0912***
	(0.00604)	(0.00587)
Wealth (log)	0.114***	0.106***
	(0.00621)	(0.00612)
HHsize2011	0.119***	0.114***
	(0.00560)	(0.00548)
Totalmove	-0.114***	-0.112***
	(0.0123)	(0.0130)
Urban	0.239***	0.251***
	(0.0193)	(0.0192)
Constant	7.217***	7.286***
	(0.116)	(0.114)
$\gamma+\beta$	0.005	0.002
***P*-value**	0.661	0.903
Obs.	12,102	12,070
Number of households	6,634	6,634

Note: Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Robust standard errors are in parentheses. We use a random-effects linear model. Year and provincial dummies are included in all models, but their coefficients are not reported for brevity. The sum, $\gamma+\beta$, represents the sum of coefficients on 'HHsize2011' and 'Totalmove'. See the Appendix for complete definitions of all variables

Table 3.5: Younger generation leavers and household consumption

	(1) Total consumption	(2) Non-durable consumption	(3) Non-education consumption
Age	-0.0135***	-0.0128***	-0.0118***
	(0.00110)	(0.00110)	(0.00112)
Primary Ed.	0.145***	0.144***	0.147***
	(0.0191)	(0.0190)	(0.0195)
Gender	0.0306*	0.0305*	0.0255
	(0.0175)	(0.0174)	(0.0179)
Married	0.272***	0.263***	0.252***
	(0.0502)	(0.0494)	(0.0501)
Widowed	0.121**	0.107**	0.0983*
	(0.0540)	(0.0536)	(0.0543)
Income (log)	0.0982***	0.0910***	0.0977***
	(0.00605)	(0.00589)	(0.00635)
Wealth (log)	0.114***	0.105***	0.115***
	(0.00620)	(0.00611)	(0.00627)
Urban	0.239***	0.251***	0.237***
	(0.0192)	(0.0191)	(0.0194)
YoungDemo0_16	0.0927***	0.0875***	0.0656***
	(0.0123)	(0.0120)	(0.0132)
YoungDemo17_24	0.146***	0.136***	0.0801***
	(0.0139)	(0.0135)	(0.0145)
YoungDemo25_30	0.0585***	0.0480***	0.0782***
	(0.0146)	(0.0142)	(0.0147)
YoungDemo31_71	0.163***	0.162***	0.169***
	(0.0132)	(0.0131)	(0.0137)
YoungMove0_16	-0.176***	-0.179***	-0.164***
	(0.0400)	(0.0441)	(0.0401)
YoungMove17_24	-0.173***	-0.172***	-0.130***
	(0.0404)	(0.0389)	(0.0400)
YoungMove25_30	-0.00971	-0.00772	-0.0239
	(0.0306)	(0.0311)	(0.0305)
YoungMove31_71	-0.114***	-0.108***	-0.0986***
	(0.0292)	(0.0297)	(0.0293)
No. of non-offspring member	0.144***	0.139***	0.144***
	(0.0209)	(0.0200)	(0.0203)
Constant	7.275***	7.356***	7.156***
	(0.124)	(0.122)	(0.126)
Obs.	12,102	12,070	11,756
Number of households	6,634	6,634	6,582
$\gamma_1=\gamma_2=\gamma_3=\gamma_4$ (***p*-value**)	0.00216	0.00185	0.0358

Note: Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Robust standard errors are in parentheses. We use a random-effects model. Year and provincial dummies are included in all models, but their coefficients are not reported for brevity. See the Appendix for complete definitions of all variables.

Table 3.6: Sum of coefficients on 'HHsize2011' and 'Totalmove' by leavers' age

	(1) Total consumption	(2) Non-durable consumption	(3) Non-education consumption
$(\gamma+\beta)_{0_16}$	-0.0833**	-0.0915**	-0.0984**
***P*-value**	0.0335	0.0334	0.0122
$(\gamma+\beta)_{17_24}$	-0.027	-0.036	-0.0499
***P*-value**	0.483	0.335	0.192
$(\gamma+\beta)_{25_30}$	0.04879*	0.04028	0.0543*
***P*-value**	0.0865	0.170	0.0567
$(\gamma+\beta)_{31_71}$	0.049*	0.054*	0.0704**
***P*-value**	0.0800	0.0613	0.0133

Note: Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Robust standard errors are in parentheses. We use a random-effects linear model. Year and provincial dummies are included in all models, but their coefficients are not reported for brevity. See the Appendix for complete definitions of all variables.

Table 3.7: Leavers and household out-transfer

	(1) Transfer to younger generation	(2) Transfer to younger generation	(3) Total transfer
Age	0.120***	0.126***	-0.0133
	(0.0420)	(0.0416)	(0.0399)
Age^2	-0.00110***	-0.00114***	-0.000529*
	(0.000326)	(0.000323)	(0.000317)
Primary Ed.	0.341***	0.339***	0.373***
	(0.0766)	(0.0765)	(0.0793)
Gender	-0.0106	-0.0105	0.0594
	(0.0724)	(0.0724)	(0.0734)
Married	0.159	0.158	2.075***
	(0.296)	(0.296)	(0.221)
Widowed	-0.308	-0.308	1.514***
	(0.294)	(0.294)	(0.238)
Income (log)	0.296***	0.296***	0.445***
	(0.0259)	(0.0258)	(0.0252)
Wealth (log)	0.0850***	0.0859***	0.161***
	(0.0308)	(0.0308)	(0.0290)
Urban	0.0168	0.0172	-0.0357
	(0.0788)	(0.0788)	(0.0788)
YoungMove0_16	0.0156		
	(0.135)		
YoungMove17_24	-0.0292		
	(0.137)		
YoungMove25_30	-0.0373		
	(0.111)		
YoungMove31_71	0.118		
	(0.0994)		
No. of non-offspring member	-0.0558	-0.0567	
	(0.103)	(0.103)	
Totalmove_young		0.0366	
		(0.0438)	
Totalmove			0.226***
			(0.0448)
Obs.	10,043	10,043	12,274
Number of households	5,746	5,746	6,651

Note: The dependent variable in columns 1 and 2 is the out-transfer to offspring outside the household and the dependent variable in the column 3 is the total household out-transfer. The equation is estimated using the random-effects Tobit model, and marginal effects are reported. Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Year and provincial dummies are included in all models, but their coefficients are not reported for brevity. See the Appendix for complete definitions of all variables.

Table 3.8: Younger generation leavers and household consumption per capita

	(1) Total consumption	(2) Non-durables consumption	(3) Non-education consumption	(4) Total consumption EQS	(5) Non-education consumption EQS	(6) Non-education consumption EQS
Age	-0.00658***	-0.00564***	-0.00370***	-0.00811***	-0.00717***	-0.00523***
	(0.00105)	(0.00105)	(0.00107)	(0.00101)	(0.00102)	(0.00103)
Primary Ed.	0.196***	0.196***	0.198***	0.180***	0.180***	0.182***
	(0.0206)	(0.0205)	(0.0212)	(0.0197)	(0.0197)	(0.0203)
Gender	0.0314*	0.0303	0.0224	0.0305*	0.0296	0.0218
	(0.0189)	(0.0188)	(0.0194)	(0.0181)	(0.0180)	(0.0187)
Married	0.00344	-0.00819	-0.0279	0.0626	0.0507	0.0306
	(0.0544)	(0.0541)	(0.0548)	(0.0521)	(0.0516)	(0.0524)
Widowed	-0.108*	-0.126**	-0.144**	-0.0424	-0.0610	-0.0812
	(0.0572)	(0.0572)	(0.0578)	(0.0549)	(0.0548)	(0.0555)
Income (log)	0.0628***	0.0545***	0.0598***	0.0740***	0.0657***	0.0712***
	(0.00569)	(0.00560)	(0.00584)	(0.00568)	(0.00557)	(0.00585)
Wealth (log)	0.0807***	0.0721***	0.0781***	0.0919***	0.0829***	0.0899***
	(0.00623)	(0.00614)	(0.00637)	(0.00613)	(0.00604)	(0.00626)
Urban	0.283***	0.296***	0.291***	0.267***	0.280***	0.274***
	(0.0205)	(0.0205)	(0.0209)	(0.0197)	(0.0197)	(0.0201)
YoungMove0_16	0.0132	0.00802	0.00957	-0.0184	-0.0240	-0.0217
	(0.0394)	(0.0433)	(0.0400)	(0.0389)	(0.0430)	(0.0394)
YoungMove17_24	0.0480	0.0427	0.0433	0.0182	0.0127	0.0128
	(0.0387)	(0.0370)	(0.0389)	(0.0382)	(0.0367)	(0.0383)
YoungMove25_30	0.133***	0.131***	0.146***	0.103***	0.0993***	0.115***
	(0.0289)	(0.0300)	(0.0289)	(0.0285)	(0.0295)	(0.0284)
YoungMove31_71	0.118***	0.124***	0.133***	0.0884***	0.0939***	0.103***
	(0.0290)	(0.0294)	(0.0292)	(0.0285)	(0.0289)	(0.0287)
No. of non-offspring member	-0.166***	-0.171***	-0.167***	-0.102***	-0.107***	-0.103***
	(0.0241)	(0.0237)	(0.0239)	(0.0228)	(0.0223)	(0.0226)
Constant	7.416***	7.484***	7.272***	7.339***	7.412***	7.189***
	(0.124)	(0.123)	(0.127)	(0.120)	(0.119)	(0.123)
Obs.	12,102	12,070	11,756	12,102	12,070	11,756
Number of households	6,634	6,634	6,582	6,634	6,634	6,582

Note: Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Robust standard errors are in parentheses. Models are estimated with a random-effects linear model. Year and provincial dummies are included in all models, but their coefficients are not reported for brevity. See the Appendix for complete definitions of all variables. Consumption per capita in columns 1 -3 is calculated as dividing consumption (total, non-durable, and non-education consumption) by the number of household members (*c/n*). Consumption per capita in columns 4 - 6 is calculated as dividing total household consumption by equivalent scale ($n^{0.8}$).

Appendix

Table 3.A1: Consumption categories

Consumption category	2011 Code	2013 Code	Expenditure
Home Expenses	GE009_1	GE009_1	Communication (including post, internet usage, telephone and cell phone usage)
	GE009_2	GE009_2	Water and electricity
	GE009_3	GE009_3	Fuels (including gas, coal, etc.)
	GE010_3	GE010_3	Heating (central heating)
	GE010_13	GE010_11	Property management fees (including the parking fees)
Food	GE006		Expenditure on food including both purchased and food eaten from own production (consumed at home)
		GE006	Expenditure on food (consumed at home)
		GE006_w2_1	Consumption of food grown by the household
	GE007	GE007	Expenditure on food consumed outside of the house
	GE008	GE008	Alcohol, cigarettes, cigars and tobacco.
Durables	GE010_11	GE010_9	Automobiles
	GE010_7	GE010_10	Purchase, maintenance and repair of transportation vehicles, appliances, communication products, etc.
	GE010_4		Furniture and durable goods, including refrigerator, washing machine, TVs, and expensive instruments like pianos.
	GE010_12		Electronics (laptops, computers and accessories, video games, etc.)
Health (out-of-pocket)	GE010_10	GE010_6	Medical expenditure
	GE010_5	GE010_7	Fitness expenditure
Recreation	GE009_7	GE009_7	Entertainment (DVDs, newspapers, books, cinema and bars)
	GE010_2	GE010_2	Long distance travelling expenses
	GE010_6	GE010_8	Beauty (make-ups, facials, massages, etc.)
	GE009_6	GE009_6	Household items and personal toiletries
Clothing	GE010_1	GE010_1	Clothing and bedding
Education	GE010_9	GE010_5	Education and training
Others	GE009_5	GE009_5	Local transportation
	GE009_4	GE009_4	Matrons, housekeepers and servants
	GE010_8	GE010_12	Taxes and fees turned over to the government
	GE010_14	GE010_13	Donations to the society

Note: This table shows different consumption categories following Meyer (2013).
Source: 2011 and 2013 waves of CHARLS

Table 3.A2: Variable Definitions

Variables	Definition
Age	Age of household head
Gender	Gender of household head
Primary Ed.	Education level of household head, which is equal to 1 if the household head attained primary education, and zero otherwise
Marital status	Dummy variable equal to one if resident is married, and zero otherwise.
Widowed	Dummy variable equal to one if resident is widowed, and zero otherwise.
Urban	Dummy variable equal to 1 if the household lives in an urban area, and zero otherwise
Wealth (log)	Logarithm of total household wealth which includes housing, durables, fixed capita assets, irrigable land, livestock & fishers, and financial wealth.
Income (log)	Logarithm of total household income
Transfers to younger generations	Logarithm of household transfers to non-resident members of younger generation
HHsize2011	Household size in 2011
Totalmove	Total number of household members who moved out during the period 2011-2013
No. of non-offspring members	Total number of non-offspring household members
YoungDemo0_16	Total number of members of the younger generation aged between 0 and 16
YoungDemo17_24	Total number of members of the younger generation aged between 17 and 24
YoungDemo25_30	Total number of members of the younger generation aged between 25 and 30
YoungDemo31_71	Total number of members of the younger generation aged between 31 and 71
YoungMove0_16	Total number of members of the younger generation aged between 0 and 16, who moved out of the household between 2011 and 2013
YoungMove17_24	Total number of members of the younger generation aged between 17 and 24, who moved out of the household between 2011 and 2013
YoungMove25_30	Total number of members of the younger generation aged between 25 and 30, who moved out of the household between 2011 and 2013
YoungMove31_71	Total number of members of the younger generation aged between 31 and 71, who moved out of the household between 2011 and 2013

Why Not Use a Fixed Effects Model?

The fixed effects estimator for a 2-year panel is equivalent to the first-difference estimation. Therefore, the first difference of the variables on the right-hand side of the equation would be the actual regressors when applying fixed-effects to Equation (3). The regressors include the first difference of the number of initial younger generations' members in each age group ($\Delta YoungDemon0_16_{j2013}$, $\Delta YoungDemon17_24_{j2013}$, $\Delta YoungDemon25_30_{j2013}$ and $\Delta YoungDemon31_71_{j2013}$).

The ages of household members increase by 2 years between 2011 and 2013, and correspondingly the number of initial offspring in each age group are adjusted. For example, a household member aged 16 in 2011 belongs to the first age group ($YoungDemo0_16_{j2011}$), but transfers to the second group when they become 18 in 2013 ($YoungDemo17_24_{j2013}$). Since the (total) number of initial offspring members (the younger generations' members who lived in the household in 2011) is a constant, the sum of the changes in the number of initial younger generation members across all age groups should be zero. In other words, $\Delta YoungDemo0_16_{j2013} + \Delta YoungDemo17_24_{j2013} + \Delta YoungDemo25_30_{j2013} + \Delta YoungDemo31_71_{j2013} = 0$. Due to collinearity, a fixed-effects model will omit one of the four younger generations' demographic variables. However, all those variables are very important to investigate the allocation of extra resources freed up after the moving out of younger generation's members. Therefore, we choose the random-effects model.

4 Comparing the Effectiveness of Public Health Insurance Schemes in China

Using the 2011 and 2013 waves of the China Health and Retirement Longitudinal Study (CHARLS), we evaluate and compare the effectiveness of the main public health insurance systems in China, namely the Urban Employee Basic Medical Insurance (UEBMI) and the resident health insurance schemes (RHI), which comprises the Urban Resident Basic Medical Insurance (URBMI), the New Corporative Medical Scheme (NCMS) and the Urban and Rural Resident Medical Insurance (URRMI). Applying a range of different estimators and specifications, our results suggest that enrolment in health insurance scheme is positively associated with household consumption, the utilisation of healthcare services, and medical expenditure. In addition, we find that the UEBMI has stronger associations with household consumption, utilization of healthcare services and medical expenditures than the RHI. We further find that RHI fails to ease the financial burden for poor people, whilst the UEBMI is associated with overutilization of healthcare services.

4.1 Introduction

The Urban Employee Basic Medical Insurance (UEBMI), the Urban Residents Basic Medical Insurance (URBMI), and the New Rural Cooperative Medical Scheme (NCMS) are the three largest health insurance programmes in China. Until 2015, around 670 million rural residents participated in the NCMS, 376.75 million urban employments in the UEBMI, and 288.94 million urban residents enrolled in the URBMI. This accounted for around 97.17 percent of the total Chinese population (China's Health and Family Planning Statistical Yearbook 2016, China Statistical Yearbook 2016). UEBMI is a workplace health insurance scheme which is compulsory for most formal workers in urban areas. Those who are not formally employed or do not have access to the UEBMI are eligible to enrol in either the URBMI if they are registered in the urban area, or in the NCMS if they are registered in a rural area. Each individual is allowed to participate in only one public health insurance scheme. Compared to the UEBMI, both the NCMS and the URBMI provide less financial support for insured patients. Barber and Yao (2011) show, for example, that the average inpatient reimbursement rate was around 41.5% in 2009 for residents with the NCMS, whilst the corresponding figure for urban residents insured with the URBMI was 45% in 2007, and that for employees insured with the UEBMI was 65% in 2008.

The URBMI and the NCMS are very similar in funding, reimbursement rate and refund. In January 2016, the Chinese central government issued documentation and guidance on merging these two health insurance schemes. This required local and regionalized administrators to unify health insurance schemes for residents (who do not

have access to the UEBMI) in urban and rural areas.[36] This has already occurred, for instance, in regions such as Tianjin, Hangzhou and Ningxia, where the URBMI and the NCMS were replaced by the Urban and Rural Resident Medical Insurance (URRMI).

One of the main targets in the agenda of China's health system reform is to consolidate all public health insurance schemes by 2020 (Chinese Communist Party Committee and State Council, 2009). Merging the URBMI and the NCMS is an important step, and a further merger with the UEBMI will be needed to achieve the goal of providing a unified health insurance programme (Pan *et al.*, 2016). This highlights the importance of understanding the merits and drawbacks of each health insurance programme. Only based on this knowledge can policy makers deliver appropriate and effective reforms which will narrow the inequality of access to healthcare and financial protection, which currently characterises people with different health insurance schemes.

To this end, we evaluate and compare the effectiveness of the main health insurance systems in China, namely the UEBMI, on the one hand, and the resident health insurance schemes (RHI), which comprise URBMI, NCMS and URRMI, on the other.[37] Specifically, we investigate the associations of those health insurance schemes with household non-medical consumption and medical expenditure. We further explore the heterogeneity in those associations between relatively poorer and richer people, with the aim of determining whether different public health insurance schemes provide sufficient financial assistance to poor people and/or lead to the overutilization of healthcare services by rich people.

[36] State Council Policy Document 2016 No.3 guidelines.
[37] The RHI is not a specific health insurance scheme in China. It is a group of public health insurance schemes designed for residents who are not eligible to enrol in the UEBMI. Hereafter, when mentioning resident health insurance (RHI), we refer to the URBMI, NCMS, and URRMI.

We contribute to the literature across several dimensions. Firstly, this is the first time that a study examines the association between public health insurance schemes and household consumption within a mainland China context. Secondly, we investigate the limitations of public health insurance programmes in China. In particular, we investigate whether the reimbursement rate of public health insurance is large enough to support poor people in obtaining sufficient medical care, and/or whether it is overly generous to rich people which leads to their overutilization of healthcare services.

Third, to the best of our knowledge, this is the first work to compare the effectiveness of various public health insurance schemes in China. Most previous studies merely evaluated one scheme at a time (Huang, 2017, Wagstaff *et al*., 2009a, Lin *et al.*, 2009), or simply compare the designs of different public health insurance programmes (Barber and Yao, 2011). Finally, our analysis is based on a rich database, China Household Longitudinal Retirement Survey (CHARLS), which consists of more than 17,000 respondents aged 45 and over from 28 provinces in each wave. Middle-aged and elderly people are the main groups who need access to healthcare services and therefore, it is critical to examine whether public health insurance schemes improve their quality of life and the accessibility to healthcare services.

Using a range of specifications and estimation methods, we document that enrolment in health insurance is positively associated with household consumption. People with the UEBMI and the RHI have less uncertainty with regard future medical expenditure compared to their uninsured peers, and consequently, have less precautionary saving motivation and consume more. This is consistent with the findings of Gruber and Yelowitz (1999) and Wagstaff and Pradhan (2005), who provide evidence that public health insurance reduces savings and increases consumption in the U.S. and in Vietnam

respectively. We also find that people with health insurance schemes have larger total and out-of-pocket medical expenditure compared to their uninsured counterparts, and overutilization of healthcare services could contribute to the positive association between medical expenditure and participation in health insurance schemes. This finding, based on a database consisting of twenty eight provinces, concurs with Chou *et al*. (2003), Babiarz *et al.* (2010), Wagstaff *et al*. (2009a) and Liu and Zhao (2012) who only use data that cover between one and nine Chinese provinces.

Our results show that compared to the RHI, being enrolled in the UEBMI is associated with a higher household non-medical consumption as well as a larger amount of medical expenditure. This suggests that there exists a significant difference in the accessibility to healthcare services between residents who hold UEBMI and RHI. Our study also provides evidence that RHI fails to help poor people in purchasing enough medical treatment and that the UEBMI is associated with the overutilization of healthcare services. It reveals that the gap between UEBMI and RHI is non-negligible, and that there is still a long way to go before realising the goal of consolidating public health insurances in China. The ideal scheme should enable poor people to get a sufficient treatment, whilst preventing rich people from overusing healthcare.

The reminder of the chapter proceeds as follows. Section 4.2 describes the development of the healthcare system in China. Section 4.3 reviews the literature on assessing the effectiveness of health insurance schemes within and outside of China. Section 4.4 describes our dataset and provides summary statistics. Section 4.5 presents our hypotheses, and Section 4.6 puts forward our model and methodology. Our empirical results are discussed in Section 4.7. Section 4.8 concludes.

4.2 The Development of Health Insurance in China

The development of health insurance in China is well documented in Wagstaff *et al.* (2009b) and Barber and Yao (2011). There have been formal public health insurance programmes in China, since the founding of the new People's Republic of China in 1949. The Labour Insurance System (LIS), the Government Insurance System (GIS) and the Cooperative Medical Scheme (CMS) are the predecessors of the current system in China. The Labour Insurance System (LIS) was designed in 1951 for workers of state-owned enterprises (SOEs) and collectively-owned enterprise as well as their immediate families. Under law, it was compulsory for SOEs and collectively-owned enterprises to pay most of treatment expenditure for their employees. The GIS was founded in 1952 with only government staff eligible to enrol. The GIS covered nearly all medical expenditures of its insured patients with funding from tax revenue, and the insured government staff did not pay any premium.

During the same period, the agricultural communes established the Cooperative Medical Scheme, which was aimed at pooling medical expenditures for rural populations.[38] The Cooperative Medical Scheme was neither compulsory nor supported by the government. Its funding was from the revenues of communes and the premiums paid by individuals who voluntarily joined in this programme. Its insured patients only needed to pay a minimum out-of-pocket fee. The public health insurance systems established in the 1950s can be seen as very generous, covering most of the health expenditures of the insured patients.

[38] The agricultural commune was one type of multipurpose organization in rural areas. It was an amalgamation of collective farms. Residents in one commune engaged in agricultural, economic and social activities together.

Along with the opening up and reform of the Chinese economy in 1978, government control on markets was reduced as the market economy gradually replaced the centrally planned one. With the collapse of agricultural communes, the Cooperative Medical Scheme for rural residents was dissolved. Moreover, the increase in market competition led to the privatization of many SOEs. Consequently, plenty of employees in SOEs subsequently lost their jobs as well as their health insurance (LIS). From 1978 to 1998, the ratio of healthcare expenditures paid by individuals to the aggregate healthcare expenditures increased from 20.43% to 54.85% (China's Health and Family Planning Statistical Yearbook 2016). Then, inequality in access to healthcare services in China gradually became a serious issue.

This motivated the first reform in the Chinese health sector in 1998. This involved the merger of GIS and LIS systems, which led to the creation of the Urban Employee Basic Medical Insurance (UEBMI). The UEBMI is a mandatory insurance scheme run by the government and is designed for those formally employed in urban areas. According to Huang (2017), the LIS was completely replaced by the UEBMI, but a few local governments still keep the GIS because it is the most generous public health insurance scheme. Compared with the GIS and LIS systems, the UEBMI covers a greater number of urban employees with a lower reimbursement rate (around 70%). Up until 2002, 69.3 million employees had joined the UEMBI which accounted for 96% of the total number of employees in the public and enterprise sectors in urban areas (Huang, 2017).

The revenue of UEBMI comes from both employees and enterprises. The insurance premium is 8% of the employee's gross wage, paid through payroll taxes. Employees pay 2% of their wages for the UEBMI, and their employers contribute the remaining part (which is equal to 6% of the employees' wage). This premium is divided

into two types of accounts. The first is the Individual Medical Savings Accounts (MSA), where 2% of the wages paid by employees and 30% of the employers' contribution are deposited. The second is the Social Pooling Account (SPA), where the remaining premium (70% employers' contribution) is deposited.

The MSA (with around 47.5% of the premium) is used to pay for outpatient services or medicines from the cooperative medical institutions.[39] Local governments administer the SPA, which is mainly used to pay for the treatments for serious diseases (e.g. lung cancer) and inpatient services. Patients are responsible for paying the deductible (around 10% of the average annual wage of local employees) and coinsurance (approximately 20-30% of the total medical expenditure). Initially, there was a reimbursement cap, which was around four times the average annual local wage (Barber and Yao, 2011). Most local governments have gradually raised the cap to six times the average annual local salary since 2010. When patients run out of their MSA or their treatment fees are beyond the reimbursement cap, they should pay the remainder by themselves. Central government authorizes each county to set the deductible amount, coinsurance rate and reimbursement cap. This leads to considerable variation in the implementation of the UEBMI across regions.

To improve the utilization of healthcare services and reduce treatment costs for residents in rural areas, the pilot programme of the New Rural Cooperative Medical Scheme (NCMS) was launched in 2003. This new public insurance scheme is voluntary and at the household level. More than 91% of the target population had enrolled in this

[39] In total, the insurance premium is 8% of the worker's wage. Employees pay 25% of the total premium, and the remainder is paid by enterprises. The MSA includes the contribution made by worker which is 25% of the total premium and 30% of the amount paid by enterprises which is 22.5% (75%*30%) of the total premium. Therefore, 47.5% of the total insurance premium is deposited in the MSA.

programme by 2008 (China's Health and Family Planning Statistical Yearbook 2013). The funding of the NCMS is from participants, central and local governments, and residents only pay a small proportion of the fee.

In 2014, the annual insurance premium per person was around 410 RMB on average. According to the State Council Policy Document 2014 No.24, residents who voluntarily joined the programme needed to pay 90 RMB of the premium, and the remaining 320 RMB was subsidized by central and local governments. The central government subsidized each participant with 220 RMB (about 70 percent of the total subsidy) in western provinces and 180 RMB (approximately 60 percent of the total subsidy) in central provinces. In coastal areas, central government gave lower subsidies to participants in the NCMS and the subsidies varied across provinces. Local governments fund the NCMS more in coastal areas, whilst the central government tends to contribute more in western and central provinces. This is because local governments in western provinces have a lower amount of tax revenue in general, and they are not able to fund the programme as much as local governments in coastal provinces do. Therefore, the central government has to provide more financial support to the NCMS in western areas.

The NCMS has four reimbursement models, which are well described in the existing literature (Lei and Lin, 2009, Barber and Yao, 2011). In the first model, the NCMS participants have Medical Saving Accounts, similar to those of the UEBMI. These are used to pay for outpatient services and preventive care. The reimbursement for inpatient services is based on the deductible, reimbursement rate and the ceiling. These differ across multiple dimensions such as treatment, disease, and medical centre. For example, the reimbursement rate for healthcare services in township hospitals is around

60%-70%. In county hospitals, it is around 45%-55%, and in provincial hospitals, it is only around 35%-40% (Chen and Jin, 2012).[40]

The second model has the same reimbursement process for inpatient services, but there is no MSA. Both the outpatient and inpatient expenditures are reimbursed from the SPA. The third model focuses on serious diseases. Expenditure on inpatient and outpatient services for serious disease is reimbursed with separate deductibles and ceilings. The last model only reimburses the expenditures on inpatient services. Of 2,176 counties, 47% applied the first and 41% used the second model in 2009. Only 8% of counties used the third model and 4% utilized the fourth model (Barber and Yao, 2011). The choice of model is dependent on the government budget and the demand of healthcare services.

Public health insurance for urban unemployed residents was launched in 2007, with a scheme called the Urban Resident Basic Medical Insurance (URBMI). The funding for the URBMI is very similar to that of the NCMS, but participants contribute to a greater share of the premium. Students, children aged under 18, people aged 60 and over, unemployed disables and soldiers with disability can get a 55%-75% discount on the insurance premium. On average, local and central governments subsidize around 36% of the adults' insurance premium (Lin *et al.*, 2009). The reimbursement of the URBMI is akin to that of the NCMS, based on deductibles, reimbursement rates, and reimbursement caps set by local governments. Due to the similarities between the NCMS and the

[40] Hospitals in China are classified by location, facilities, functions and so on. Specifically, township hospitals are located in the township and focus on providing cheap and basic services for local patients. County hospitals are bigger than township ones and equipped with better medical facilities. They provide services for residents in the county. When the township and county hospitals cannot provide appropriate treatments for a patient with a catastrophic disease, they will transfer the patient to a provincial hospital, which is equipped with more advanced medical facilities and services.

URBMI, they have been merged in some areas during the early period of implementation of URBMI (such as Fujian and Hangzhou), and the resulting scheme is called the Urban and Rural Resident Medical Insurance (URRMI). The State Council Policy Document 2016 No.3 guidelines officially enforced the merger of these two insurance schemes across all areas. To date, the merger is still in progress. This is a very important step towards the unification of all Chinese public health insurance schemes.

4.3 Literature Review

4.3.1 Health insurance and Consumption

Leland (1968) first proposed the concept of precautionary saving as preparation for unexpected shocks to income and expenditure. If there is a precautionary saving motivation, wealth accumulation will decline with a reduction in uncertainty. Among the literature testing this theory, the majority focuses on the relationship between uncertainty in income and saving/consumption, and no unambiguous conclusion can be drawn on the existence of a precautionary saving motive. For instance, *Guiso et al.* (1992) have not found any evidence for prudential saving behaviour with Italian data, while Kazarosian (1997) provides strong support for it with U.S. data.

Several theoretical studies investigate the effects of unexpected medical expenditure or health insurance on wealth accumulation. For instance, Hubbard *et al*. (1995) extend the basic life-cycle model by incorporating an asset-based and means-tested social insurance programme as well as uncertainty in income and medical expenditure. They simulate wealth holding using the 1984 wave of the Panel Study of

Income Dynamic (PSID) data, documenting that asset-based and means-tested social insurance programmes discourage savings of households with low expected lifetime income. However, they are not able to distinguish from the negative effect of the insurance programme on precautionary savings and people with low incomes reducing wealth deliberately in order to become eligible for the programme. To investigate the effects of uncertainty in medical expenses on saving and consumption, Kotlikoff (1986) develops a simple two period model, which includes uncertainty in medical expenditure and different types of health insurance, finding that the uncertainty of medical expenditure is the main reason for precautionary saving. The simulations of a 55-period life-cycle model in Kotlikoff (1986) indicate that introducing fair health insurance reduces the wealth in the economy by 12 percent in the steady state.

There are also multiple empirical studies which investigate the effects of health insurance on precautionary saving. Guariglia and Rossi (2004) study the crowding out effect of private medical insurance on savings in the United Kingdom, using the British household Panel Survey (BHPS) over the period 1996-2000. They show that households with private insurance save more in general. Yet, they also find some evidence of the crowding out effect of private health insurance in areas where the quality of medical services and facilities provided by National Health Service (NHS) is poor. In the U.K., the NHS provides free health services to all individuals, and therefore residents in the U.K. face little uncertainty in medical expenses. As a consequence, private health insurance in the U.K. has little impact on the precautionary saving for medical expenditure.

However, due to the high demand for free healthcare services, the waiting lists are always very long. By contrast, patients who purchase private health insurance are able to

receive appropriate treatments in private medical centres within a shorter period, and thus they face a lower amount of income loss. Moreover, patients have to pay a greater amount for healthcare services provided by private hospitals, if they have not purchased private health insurance. As per these aspects, private health insurance may reduce the uncertainty in medical expenditure and precautionary saving, especially in areas where the quality and quantity of publicly provided healthcare is not satisfactory. On the other hand, private health insurance may increase savings in areas where the NHS provides reliable healthcare services. In those areas, residents have zero uncertainty in medical expenditure, and participation in private health insurance reduces their income loss and medical expenditure, which in turn increases their savings.

Analysing the 1989 wave of Survey of Consumer Finance (SCF) in the United States, Starr-McCluer (1996) also finds a strong and positive association between private health insurance and wealth. Factors which contribute to the positive relationship could be any of the following. First, uninsured people who are very poor may tend to keep their savings very low in order to remain eligible for Medicaid.[41] Second, companies providing private health insurance to their employees tend to be more generous to their employees, who can then afford to save more.

In contrast, using the 2006 wave of the China Health and Nutrition Survey (CHNS), Cheung and Padieu (2015) find a negative relationship between the New Cooperative Medical Scheme (NCMS) and savings in the middle-income group, which supports the existence of precautionary savings. However, the authors do not find any evidence for the negative relationship in the low-income and high-income groups. Poor

[41] Medicaid is a social health insurance scheme in the United States, which funds medical expenditure of people whose income and resources are below a pre-specific level or insufficient to pay health care.

people with NCMS still encounter problems to purchase enough treatment especially when they fall ill with a serious disease, which means they still face strong uncertainty in medical expenditure. This is the main reason why savings of poor people are not reduced by NCMS. On the other hand, rich people are able to afford healthcare services even without a health programme, and thus the NCMS has no impact on the uncertainty in medical expenditure or precautionary saving among this cohort.

Few empirical studies specifically examine the impact of health insurance on consumption, and most of them investigate consumption in conjunction with savings. Analysing data from the Survey of Income and Programme Participation (SIPP) over the period 1984-1993 as well as the Consumer Expenditure Survey (CES) between 1983 and 1993, Gruber and Yelowitz (1999) find that in the U.S., Medicaid eligibility is negatively associated with wealth holdings and positively linked to nondurable and nonmedical consumption. Moreover, those associations are much stronger when and where Medicaid eligibility depends on asset tests. Considering the endogeneity between saving/consumption and Medicaid eligibility, their models are estimated with instrumental variables. The results show that Medicaid reduced the wealth holding of eligible households by 16.3 percent in 1999, and that the expansion of Medicaid eligibility between 1984 and 1993 lowered wealth holding of this population by 7.3 percent. The negative relationship between wealth holdings and Medicaid eligibility is confirmed by the positive association between consumption and Medicaid eligibility.

To investigate the impact of the National Health Insurance (NHI) on precautionary saving and consumption behaviour in Taiwan, Chou *et al.* (2003) analyse the 1991- 1998 waves of the Survey of Family Income and Expenditure (SFIE) with difference-in-difference estimators. Consistent with the precautionary saving theory, they

find that NHI reduces savings and increases household consumption. Once a household member participates in the NHI, the spouse, parents and children of the participants were covered by the insurance as well.

Before 1995, there were two public insurance schemes in Taiwan: the Government Employee's Insurance (GEI) and the Labour Insurance (LI). In 1995, people who were insured by those two schemes were automatically transferred to the NHI. The benefit package of the GEI was very similar to that of the NHI and therefore the cohort insured by GEI was set as a control group. LI did not provide coverage to the insured's family members, and its insured members were defined as the treatment group. The effect of NHI is measured by the difference in the change of the savings/consumption before and after 1995 between the residents who were insured by GEI and who were insured by the LI. As participation in NHI was compulsory for people insured by GEI and LI, there is no endogeneity problem caused by selection bias (e.g. only people who are more likely to fall ill participate in the health insurance scheme) with this methodology. To test the heterogeneity in the impacts of public health insurance, those authors also differentiate people based on saving distribution. The results indicate that the impact of health insurance on savings/consumption is smaller in groups at the top of the saving distribution compared to those at the bottom. This finding can be explained by the fact that the precautionary saving motivate declines with wealth (Kimball, 1990).

Wagstaff and Pradhan (2005) investigate the impact of the Vietnam Health Insurance (VHI) — introduced in 1993 — on health, utilization of medical centres and household consumption. Their data are the 1992/1993 and 1997/1998 waves of the Vietnam Living Standards Survey (VLSS), providing information before and after the implementation of the VHI. To eliminate the selection bias caused by time-invariant

unobservable heterogeneity, they apply the difference-in-difference estimators with propensity score matching (PSM). The treatment group consists of individuals who enrolled in the VHI after it was introduced, while the control group is those who did not participate in the VHI during the entire sample period. The treatment effect is measured by the difference in the change of the aforementioned variables before and after the introduction of the VHI between the treatment and control groups. The results show that the introduction of the VHI increased household non-medical consumption in categories such as food, education and durables.

The above literature finds a strong link between health insurance and household consumption/savings. However, most previous work has focused on the United States (Starr-McCluer, 1996, Hubbard *et al.*, 1995, Kotlikoff, 1986, Palumbo, 1999). Only a few empirical papers have investigated the topic in other regions: Guariglia and Rossi (2004) study it in U.K., Chou *et al.* (2003) conduct the research in Taiwan and Wagstaff and Pradhan (2005) examine the case of Vietnam. Until now, there exists no work which analyses health insurance and consumption in mainland China. The most related study is Cheung and Padieu (2015) which investigates the savings and NCMS in 8 provinces in China.

4.3.2 Performance of different public health insurance schemes in China

A large body of literature evaluates the performance of various types of health insurance individually. Among them, Chen and Jin (2012), Huang (2017), Lei and Lin (2009) investigate the effect of health insurance on health outcomes, while *Babiarz et al*. (2010), Paccagnella *et al.* (2013), Liu and Zhao (2012) and Wagstaff *et al.* (2009a) examine its

influences on the utilization of healthcare services and medical expenditures. In this section, we review the studies which look at the effectiveness of different public health insurance schemes in China.

4.3.2.1 Performance of the Urban Employee Basic Medical Insurance

The purpose of public health insurance is to improve people's health and reduce the poverty caused by catastrophic medical expenditure via sharing costs. This in turn, reduces health and income inequality. To investigate the effects of the Urban Employee Basic Medical Insurance on the utilizations of healthcare, health expenditure and health status, Huang (2017) analyses the 1991 - 2006 waves of the China Health and Nutrition Survey (CHNS), making use of a difference-in-difference approach. As mentioned above, the UEBMI was introduced in 1998, by merging the Government Insurance Scheme (GIS) and the Labour Insurance Scheme (LIS). It was mandatory for people covered by GIS/LIS to enrol in the UEBMI. Yet, the UEBMI is less generous than the GIS and LIS. Huang (2017) documents that people insured by the GIS and LIS used outpatient services 7% less after the health system reform, and that their outpatient expenditure was reduced by 35.2%. In addition, they find that changes in medical expenditure and utilisation associated with the health reform were larger in subsamples of population with low and medium income. In particular, these groups of the population reduced their use of outpatient services and showed lower outpatient costs. However, the authors did not find any evidence of an improvement of people's self-reported health after the health reform. This is explained by considering that health status cannot be improved in a short time.

Using data from the annual survey of the pilot experiment of UEBMI in Zhenjiang, collected by the Chinese Ministry of Health Department of Health Policy and Law, Liu and Zhao (2006) compare the inequalities in cost-sharing of medical expenditures before and after the implementations of the UEBMI. The inequality is defined as the difference in cost-sharing among groups of people classified by income, education, job, and chronic disease. The pilot experiment of UEBMI was conducted in Zhenjiang from 1994 onwards, and the sample period of this study covers 1993 to 1996. The authors conclude that out-of-pocket medical expenditure increased after the implementation of UEBMI. In addition, disadvantaged groups (low income group, low education group, group with chronic disease and nongovernment staff group) paid a greater proportion of medical expenditures compared to their more advantaged counterparts (high income group, high education group, group without chronic disease, and government staff group) before the insurance reform when the GIS and LIS were operating. One reason is that only certain types of people are eligible for GIS and LIS, as introduced in Section 4.2. However, the gap narrowed after the introduction of UEBMI, as the new scheme covered a wider population compared to the GIS and LIS.

4.3.2.2 Performance of the New Cooperative Medical Scheme

The New Cooperative Medical Scheme (NCMS) was implemented in 2003 and covers a proportion of medical expenditure for residents living in the rural areas. Wagstaff *et al.* (2009a) evaluate the performance of NCMS, making use of the 2003 and 2005 waves of the National Health Service Survey (NHSS) and data of healthcare providers taken from the Ministry of Health (MOH) administrative database. To control for unobserved heterogeneity, they use difference-in-difference estimators with PSM. The population

who were living in NCMS counties but did not enrol in the programme are set as a control group, when analysing the survey data. The counties where the NCMS was not implemented are set as a control group, when analysing the data of healthcare providers. With a range of specifications, the authors document that the NCMS encouraged residents to use outpatient and inpatient services and reduced the costs of delivery. However, out-of-pocket expenditures were not reduced by the NCMS. One possible explanation is that the NCMS encourages patients to use more healthcare services, and the other is that NCMS drives healthcare providers to give unnecessary therapies purely through a misaligned profit motive.

The analysis of the data on health-care providers shows that the NCMS increases the number of items of equipment costing more than 10,000 RMB in the central township health centres. However, it did not increase the cost per case (the total costs divided by the total number of cases) in those medical institutions, which implies that they had an increasing number of visits. To test the heterogeneity of the influence of NCMS, subsamples are categorized based on counties and incomes of households. In China, hospitals are classified into three levels based on the scale of the hospital, medical equipment, techniques, quality of doctors, and managements. The best hospitals are ranked at Level 3. The authors document that in the low-income subsample, NCMS increased the utilization of higher level facilities (e.g. healthcare services in county hospitals which were ranked as Level 2) less compared to the extent to which it increased the usage of lower level facilities (e.g. healthcare services in village clinics which were ranked at level 1). This occurs because the reimbursement rate designed by the NCMS decreases with the level of the medical centre. In addition, the authors find that the impacts of the NCMS on utilization of inpatient services and out-of-pocket spending are

stronger in richer groups. This can be explained, considering that the co-payment required in the NCMS group is high and that poor people cannot afford many healthcare services even after enrolment, leading to a smaller positive influence in this group.

To explore the effect of the New Cooperative Medical Scheme on out-of-pocket expenses, health status and formal medical utilization, Lei and Lin (2009) analyse the 2002, 2004 and 2006 waves of the CHNS using OLS, Fixed-Effects, IV and difference-in-difference estimators with PSM. They find that joining the NCMS significantly reduces the frequency of visits to traditional Chinese folk doctors and increases the utilization of general physical examinations. However, they do not find any evidence that the NCMS reduces out-of-pocket healthcare expenditure, increases the utilization of formal healthcare services or improves health status overall. The deductibles set by the NCMS are generally high, which implies that the impact of this insurance on encouraging people to use formal healthcare services is limited. In addition, residents in some counties have medical savings accounts to pay for outpatient and preventive services, but the accounts are not sufficient to pay outpatient expenditure and only cover preventive services. Since there is no increase in the utilization of healthcare services, it is not surprising that no significant improvement in health status has been found.

An altogether different conclusion is drawn in Babiarz *et al.* (2010), who examine whether the NCMS and the individual policy attribute of the NCMS has an impact on the operation and utilization of village health clinics.[42] The individual level and village clinic data were collected in 2004 and 2007, which covers 100 villages in 25 rural counties of

[42] The policy attributes in this paper include the implementation of the NCMS, clinic eligibility for reimbursement, outpatient reimbursement available at township health centre and household medical savings account requirements.

five provinces in China. They show that NCMS increases the weekly patient flow (26%) and the subsequent monthly gross revenue (29%) in village clinics, but not their net annual revenue. This can be explained by considering that the expenditure on administrating the NCMS, which is not reimbursed by the programme, raises the costs in village clinics. The results also show that NCMS decreases the ratio of drug revenues to the total revenue, which implies that NCMS reduces the oversupply of prescription drugs. Regarding its effect on individuals, the NCMS is found to reduce the out-of-pocket expenses by around 19%. In order to examine the effects of NCMS on the financial burden of patients, they define two financial risks dummies. One is equal to one if the net out-of-pocket health expenditure is above the 90th percentile of individual's total spending, and zero otherwise. The other is equal to one if an individual finances healthcare services through borrowing or selling assets, and zero otherwise. The authors document that the NCMS decreases financial risks of patients by 24-63%.

From the above, there is no evidence of a clear-cut effect of the NCMS on out-of-pocket medical expenditure. Babiarz *et al*. (2010) find that the NCMS reduces out-of-pocket medical expenses; Lei and Lin (2009) document that there is no significant relationship between those two variables and Wagstaff *et al*. (2009a) show that participation in the NCMS is positively associated with medical expenditure. Regarding the effects on the utilization of healthcare, both Babiarz *et al.* (2010) and Wagstaff *et al.* (2009a) provide evidence that the NCMS encourages residents to use more healthcare services, but Lei and Lin (2009) find no such evidence. Except for the difference in the methodology used and the time frame of the studies, the main contributor to the different conclusions reached in these studies could be that the data analysed were from different provinces. Lei and Lin (2009) examine the data across Liaoning, Shangdong, Jiangsu,

Henan, Hunan, Hubei, Guangxi and Guizhou. Wagstaff *et al*. (2009a) use the data from Chongqing, Guangdong, Heilongjiang, Inner Mongolia, Qinghai, Shandong, Shanghai, Shanxi and Zhejiang. Babiarz *et al.* (2010) analyse the data from Jilin, Hebei, Shaanxi, Sichuan and Jiangsu. There exist significant differences in the design of the NCMS among the various Chinese provinces, and therefore the effectiveness of the NCMS varies across regions.

4.3.2.3 Performance of the Urban Resident Basic Medical Insurance

Few previous studies focus on the Urban Resident Basic Medical Insurance (URBMI). In 2007, the URBMI was implemented, which extended public health insurance to residents living in urban areas and not covered by any other public health insurance. Chen and Yan (2012) investigate the demand for URBMI using the 2007 and 2008 waves of Urban Resident Basic Medical Insurance Survey (URBMI survey). The results show that income, risky health behaviours, age, and health status are the determinants of participation in the URBMI. They also document the fact that poor people were less likely to enrol in the new insurance policy, but poor people with additional subsidies from the government tended to join the URBMI. In addition, the authors find that better educated or retired household heads are more likely to buy health insurance for their children. Therefore, to expand the insurance coverage of children, making efforts to give health education or health promotions to household heads could be helpful. Finally, the results indicate that households with chronic diseases are more likely to participate in the URBMI, which provides the evidence for the existence of adverse selection.

Following the guideline in the State Council Policy Document 2007 No. 20, the URBMI was piloted in seventy nine cities within the same year. Lin *et al*. (2009) provide an initial evaluation of this new policy, using the 2007 wave of the URBMI survey data collected from nine of those cities. They compare eligibility, financing and benefit packages of the new insurance scheme among the nine representative cities, documenting that there is a U-shape relationship between income and enrolment in URBMI. Consistent with Chen and Yan (2012), they find strong evidence of adverse selection: people who had inpatient treatment before or have chronic diseases are more likely to enrol in the URBMI. Moreover, the results show that participation in the URBMI is significantly and positively associated with a reduction in the financial burden of medical expenditure, with poor people as well as people who used inpatient services last year benefiting most from it.[43] Furthermore, the authors find that poor people are more satisfied with the URBMI than their rich peers. Due to the limitations of the dataset, they are unable to analyse out-of-pocket spending, nor are they able to investigate the casual effects of URBMI on other variables of interests.

Liu and Zhao (2012) study the impact of the URBMI on utilization of healthcare services and medical expenditure using the 2006 - 2009 waves of CHNS. They document that enrolment in the URBMI increases the utilization of formal medical services but does not reduce out-of-pocket expenditure. Instead, the authors find evidence that residents covered by the URBMI show a greater amount of total healthcare expenditure. The effects of the URBMI on the above variables are also investigated among different groups classified by age, income, region and gender. The authors conclude that participation in

[43] The financial burden of medical expenditure is a dummy variable, which is equal to one if the individual feels that his/her financial burden is relieved after the enrolment in the URBMI.

the URBMI is associated with a higher utilization of healthcare services, particularly among the elderly, low-income group, and urban residents living in western areas. Both of Liu and Zhao (2012) and Lin *et al.* (2009) show that low-income groups benefit a lot from participation in the URBMI.

Analysing the 2011 and 2013 waves of the CHARLS dataset, Zhang *et al*. (2017a) investigate the association of China's health insurance with out-of-pocket medical expenditure and utilisation of healthcare services. Instead of focusing on one specific health insurance as in above literature, they examine the whole health system in China, which include UEBMI, URBMI, NCMS, URRMI, GIS, Medical Aid, private medical insurance schemes, and other medical insurance schemes. Among them, the GIS and Medical Aid cover nearly all the medical expenditure for its members, but Medical Aid is only eligible for individuals who are terminally sick. The authors focus on out-of-pocket costs and the utilisation of inpatient and outpatient services, and the empirical analyses on the out-of-pocket medical expenditure are restricted to individuals who have positive medical expenditure only. The authors investigate the difference in those above-mentioned variables between people who hold any health insurance and the uninsured residents. Also, they break down the insurance into NCMS, URBMI, UEBMI and others in order to further investigate the associations between the key variables and those health insurance categories.

The authors show that China's health system reduces out-of-pocket inpatient expenditure but not out-of-pocket outpatient costs. This can be explained, considering that the designs of health insurance schemes in China give priority to the coverage of inpatient services, while the reimbursement for outpatient services is either low or not available. In addition, they find that the low-income and medium-income people benefit

the most from those health insurance schemes. The results also show that the NCMS fails to ease the financial burden of patients whose medical expenditure is very high. The authors put forward several problems with the current healthcare system in China. First, it is hard for the migrants to get reimbursement if they receive treatment outside the regions where they are registered as local residents. The health systems are in fact separately managed by local governments, which makes the benefits of the health insurance not portable. Second, hospitals remain the main providers of healthcare services, and the primary healthcare facilities are not fully utilised. The reimbursement of inpatient service is always higher than that of outpatient service, even for the same products and treatment. Therefore, patients prefer inpatient services in hospitals, rather than outpatient services in primary healthcare centres, when they have the choice.

4.3.3 Performance of health insurance in other countries

Some literature evaluates health insurance programmes in other parts of the world. For instance, using the 2004 wave of the Survey of Health, Ageing and Retirement in Europe (SHARE), Paccagnella *et al*. (2013) examine the determinants and performance of voluntary private health insurance (VPHI) for people aged 50 and over in 11 European countries, focusing on whether it reduces insured patients' out-of-pocket medical expenses. There may exist, however, endogeneity between out-of-pocket medical expenditure and VPHI holding: People who spend more on healthcare services may be more likely to hold a VPHI (self-selection). Therefore, a simultaneous equation estimator is undertaken. The authors document that education levels and cognitive abilities are the main determinants of holding VPHI in most countries. Among the eleven countries

studied, evidence that out-of-pocket medical expenditure is significantly reduced by VPHI is only found in the Netherlands. On the other hand, the authors find a positive association between OOP and VPHI in Italy, Spain, Denmark and Austria. This is explained by the fact that VPHI increases the choice of health services, in turn raising the utilization of healthcare services as well as total medical costs.

Wagstaff and Pradhan (2005) document that Vietnam Health Insurance (VHI) encourages young children (under 4) to use primary care facilities and reduces the utilization of pharmacists as a source of advice and non-prescribed medicines. This insurance also motivates older children and adults to use hospital services. Finally, the authors find that the VHI reduces the annual total out-of-pocket medical expenditures but increases inpatient expenditures which is likely due to a high price elasticity of inpatient services.

4.3.4 Contribution

Our work builds on Zhang *et al*. (2017a). The similarities and differences between our work and theirs are as follows. First, both studies use the CHARLS, but we use different samples. Zhang *et al*. (2017a) examines the entire health system in China, and their sample includes individuals who hold all types of public and private health insurance schemes. In contrast, in order to provide suggestions for further healthcare reform — merging UEBMI and RHI — our study only investigates these large public health insurance schemes. Therefore, our sample only includes individuals who hold UEBMI and RHI as well as uninsured residents. In addition, Zhang *et al*. (2017a)'s empirical analysis on out-of-pocket expenditure is restricted to individuals who have positive

medical expenditure (3,119 to 5,889 observations). However, our sample includes residents whose medical expenditure is either zero or positive with around 24,600 observations, and we use the random-effects Tobit model to deal with the selection bias.

Second, our work not only investigates the out-of-pocket expenditure as in Zhang *et al.* (2017a), but also examines the total treatment expenditure of various healthcare services. We believe that the total treatment expenditure is the value of healthcare services and goods purchased by patients and is a better proxy for the demand of healthcare than out-of-pocket medical expenditure and utilization of healthcare services. Thirdly, we examine the effects of public health insurance on household consumption, and this was not investigated in Zhang *et al*. (2017a).

Lastly, Zhang *et al*. (2017a) investigate the whole health system in China, and break down health insurance into UEBMI, NCMS, URBMI and others to further investigate the impact of health insurance schemes on out-of-pocket expenditure. They only focus on whether the public health insurance schemes are significantly associated with a lower medical expenditure, without further comparing the impact on out-of-pocket medical expenditure among different insurance groups. Considering the similarities among NCMS, URBMI, and URRMI and the fact that the Chinese government has started a reform aimed at replacing NCMS and URBMI with URRMI since 2016, our work categorises those three schemes as one insurance group (RHI). We then evaluate and compare the effectiveness between UEBMI and RHI, which could provide practical implications on the further merger of UEBMI and RHI.

We contribute to the literature along the following dimensions. Firstly, for the first time in the mainland China context, we examine the effects of various types of health

insurance schemes on consumption. Pervious literature mainly studies this issue in other regions. For instance, Gruber and Yelowitz (1999) conduct a similar research on the U.S., Wagstaff and Pradhan (2005) look at Vietnamese case, and Chou *et al*. (2003) investigate the issue in Taiwan. Secondly, our study investigates the limitations of public health insurance schemes in China. In particular, for the first time, we study whether the reimbursement rate of public health insurance is sufficiently large to support poor people in obtaining adequate medical care, and/or whether it is overly generous to rich people leading to their overutilization of healthcare services.

Thirdly, we compare the effectiveness of two main types of public health insurance schemes (the UEBMI and the RHI), which are currently implemented in China. Except for Zhang *et al*. (2017a), other literature only investigates the performance of one public health insurance scheme (Huang, 2017, Wagstaff *et al*., 2009a, Lin *et al*., 2009), or compares the designs of various public health insurance programmes (Barber and Yao, 2011). Before the next healthcare reform, which involves merging UEBMI and RHI, it is very important for policy makers to understand the weakness and strengths of each type of programme. Only based on that understanding, will it be possible to implement effective health reforms.

Finally, in order to investigate the associations of public health insurance with the utilization of healthcare services and medical expenditure, we use data from 28 Chinese provinces which cover nearly the entire country. The data in previous literature, with the exception of Zhang *et al*. (2017a), only covers some parts of China. For example, the CHNS used by Lei and Lin (2009) and Liu and Zhao (2012) consists of households from 8 provinces, and the URBMI Survey data analysed in Lin *et al*. (2009) includes residents from nine cities. There exist substantial heterogeneities among different provinces. For

instance, the reimbursement rates designed for the public health insurance schemes vary across provinces. Therefore, it is critical to analyse data from all provinces to avoid selection bias when we evaluate the overall effectiveness of health insurance schemes.

4.4 Hypotheses

4.4.1 Consumption

There are two possible mechanisms through which health insurance might impact household consumption. First, based on the precautionary saving theory proposed by Leland (1968), enrolment in health insurance will discourage saving as health insurance reduces uncertainty regarding future medical expenditures faced by the insurees through sharing medical costs. Furthermore, due to an income effect, households will increase their consumption after enrolling in health insurance schemes. Gruber and Yelowitz (1999), Wagstaff and Pradhan (2005) and Chou *et al*. (2003) provide evidence in favour of a positive association between health insurance and consumption in the United States, Vietnam, and Taiwan respectively. In line with this literature, our first hypothesis reads:

Hypothesis 1a: Households whose heads participate in UEBMI or RHI show a higher level of consumption than their counterparts whose heads are not covered by any type of health insurance.

Considering that UEBMI is more generous than RHI, it further reduces uncertainty in medical costs and further increases the potential disposable income. This leads to the following hypothesis:

Hypothesis 1b: Households whose heads participate in UEBMI exhibit a higher level of consumption compared to their counterparts whose heads are covered by RHI.

4.4.2 Medical expenditure

As public health insurance in China shares a proportion of medical expenditure with the insured patients, it reduces their out-of-pocket treatment costs. However, public health insurance could have positive influences on out-of-pocket expenditures as well. Health insurance raises the insured patients' disposable income by paying some medical costs, and health services are a normal good as healthcare consumption increases with disposable income.[44] This implies that the demand for healthcare will increase with enrolment in health insurance schemes. As Chinese health insurance only covers some parts of medical costs (around 40%-65%), the out-of-pocket medical expenditure of the insured patients is likely to increase along with the intensive increase in the demand of health services. Wagstaff *et al*. (2009a) find a positive association between health insurance and out-of-pocket medical expenditure in China, and they give two possible explantations for it: Healthcare service centres provide excessive and expensive treatments to insured groups for the purpose of making profit, and health insurance encourages the utlization of healthcare services. This leads to the following hypothesis:

Hypothesis 2a: People who participate in UEBMI or RHI exhibit a higher level of out-of-pocket (total) treatment expenditure when compared to people without any type of health insurance.

[44] Koenig *et al*. (2003) find evidence that healthcare is a normal good in the United States, as it increases with disposable income.

The UEBMI provides a higher reimbursement rate than the residents' health insurance schemes (Barber and Yao, 2011). Therefore, we expect that the UEBMI to have a stronger positive influence on medical expenditure compared to the RHI. This leads to our next hypothesis:

Hypothesis 2b: People who participate in UEBMI show a higher level of out-of-pocket (total) treatment expenditure when compared to people covered by RHI.

4.4.3 Limitations of UEBMI and RHI

4.4.3.1 Failure of relieving financial burden for poor people

One concern regarding the public health insurance schemes is that they could fail to ease the financial burden of people with low household wealth. Both UEBMI and RHI set deductibles and feature a reimbursement cap, which is around 6 times the average local annual wage. On average, RHI shares between 41.5% and 45% of the treatment costs considering the co-payments, deductibles and ceilings, and the UEBMI pays around 65% - 70% (Barber and Yao, 2011). If the insured people become terminally ill, out-of-pocket medical expenditure (which is 30%-58.5% of the total medical expenditure) remain a challenge to the people with low wealth.

Existing literature shows evidence that public health insurance scheme provides limited financial assistance to people with low wealth. Wagstaff *et al*. (2009a) document that the co-payment required in the NCMS group is high and poor people cannot afford many healthcare services even after enrolment, leading to smaller positive influences of NCMS on the utilisation of healthcare services and out-of-pocket medical expenditure in

the poor group compared to the rich group. Consistently, Lei and Lin (2009) argue that the high deductibles of NCMS prevent people from using formal healthcare services and that the low reimbursement rate fails to reduce out-of-pocket expenditure. If the UEBMI and RHI fail to ease the financial burden of patients from poor households, the insured members with low wealth face substantial uncertainty in medical expenditure and will not change their non-medical expenditure after participation in those public health insurance schemes. This leads to the following hypothesis:

Hypothesis 3: People with low wealth who participate in UEBMI or RHI will not exhibit a higher level of non-medical expenditure when compared to people without any type of health insurance.

4.4.3.2 Overutilization of healthcare service

An effective health insurance should not change the utilization of healthcare services of people who are able to afford necessary and sufficient medical treatment without efforts by themselves. Yet, one potential problem of public health insurance schemes is that insured members tend to purchase excess medical products and services, which may lead to a waste of resources and a reduction in social utility. Moreover, in order to generate profit, medical centres could provide more expensive and unnecessary excess treatments to insured patients than would otherwise be required (Huang, 2017). To discourage healthcare centres from providing excess drugs to patients, the Chinese government launched a public hospital reform in 2009, which adjusted medicine prices and removed the mark-up on medicine.[45] Before this reform, drug sales contributed to the largest share

[45] The medicine prices in public hospitals are set by government in China.

of the revenue of the healthcare providers (Zhao et al., 2013), with about 45.5% in 2011 (National Health and Family Planning Commission of the People's Republic of China, 2012). Zhang *et al*. (2017b) find evidence that patients spend less on the inpatient medication after the public hospital reform, but their total out-of-pocket expenditure is increased, primarily due to a higher expenditure on therapeutic services.

Those who have substantial purchasing power are more likely to overuse healthcare services and become the targets of healthcare institutions for making profit. If UEBMI and RHI drive those wealthy people to overuse healthcare services, there will be a significant difference in the medical expenditure between wealthy people who hold public health insurance schemes and those who are uninsured. In line with these arguments, we propose the final hypothesis:

Hypothesis 4: Wealthy people who participate in UEBMI or RHI will exhibit a higher level of medical expenditure when compared to their counterparts without any type of health insurance.

4.5 Data and Summary Statistics

4.5.1 Sample construction

The database we use is the China Health and Retirement Longitudinal Study (CHARLS), which covers 28 Chinese provinces. 10,026 households took parts in the 2011 wave, 10,624 households in the 2013 wave, and 12,061 households in the 2015 wave respectively. To distinguish the effect of every type of public health insurance scheme from that of other types of health insurance programmes, we drop 5,675 observations of

the respondents who have more than one health insurance scheme. In order to compare the effectiveness of UEBMI and RHI, we include people who only participate in UEBMI, NCMS, URBMI, and URRMI, as well as residents without any health insurance. We exclude 1,252 observations of respondents who hold GIS, 208 observations of respondents who hold medical aid, 1,452 observations of respondents who hold private health insurance, and 776 observations of respondents who hold other health insurance.

Residents are only allowed to participate in public health insurance schemes in districts where their Hukous are.[46] At the early stage of healthcare reform, patients were only able to get reimbursement of medical expenditure when they purchased medical treatment within the villages or towns where their Hukous were. Since 2010, patients who received medical services in hospitals outside Hukou villages or towns but within their Hukou counties have been eligible for the reimbursement of medical expenditure. One year later, public health insurance schemes extended to cover the medical services provided by any hospitals in the Hukou province. Considering that migrants whose Hukou is not in the province where they are living cannot use public health insurance scheme to pay medical services received in their living areas, we exclude 4,908 observations of those people and individuals whose Hukou information is missing.

To deal with outliers, we replace the upper and lower 1% of the observations of consumption, household income and household wealth with missing ('N/A') values. However, due to a large number of zero observations, we only replace the top 1 percent of the observations of the treatment expenditure with missing. Our final sample contains 11,565 households, which corresponds to 43,290 observations. About 80% of those

[46] Hukou is the system of household registration in China.

households participated in at least two waves of CHARLS, and 50.7% of them involved in all three waves.

4.5.2 Summary statistics

Figure 4.1 plots the distribution of total household consumption differentiating households according to the types of health insurance in which the household head is enrolled. Subfigure (a) shows a larger share of households whose heads hold RHI are allocated at the at the left of the intersection between the consumption distributions of households whose heads hold the UEBMI and the RHI. It implies that a larger proportion of the group with RHI consume at a relatively low level, and a larger proportion of the group with UEBMI consume at a relatively high level. This implies the average consumption of the sample with UEBMI is higher than that of the sample with RHI, which is consistent with our Hypothesis 1(b). Health insurance in fact reduces uncertainty in medical expenditure by paying a proportion of medical costs for patients, and in turn reduces their precautionary saving and increases consumption. Compared with RHI, UEBMI lowers uncertainty in medical expenditure to a larger extent due to its higher reimbursement rate, and therefore people participating in UEBMI exhibit a higher level of consumption.

The low, medium and high wealth subsamples are categorized, based on the mean of the households' real wealth over the periods 2011 and 2015. First, households whose average wealth falls in the lowest quartile are classified as the low wealth group. Second, the medium wealth group consists of households whose wealth ranges within the middle two quartiles. The last group of households is made up by those whose wealth is within

the top quartile and these are categorised as the high wealth group. Subfigures (b) to (d) plot the distribution of total household consumption according to the type of health insurance held by the household head for the three wealth subsamples respectively. The difference in consumption between the two insurance groups is the largest among the low wealth group and the lowest in the high wealth group. This can be explained, considering that prudence declines with wealth (Kimball, 1990). Chou *et al*. (2003) provide evidence that the association between NHI and consumption/savings is weaker in wealthier groups.

Figure 4.2 plots the total treatment expenditures of the last inpatient services used within the year before the interview. The full sample includes people who had visited medical centres for inpatient services and people who needed inpatient services but did not have any due to poverty. Subfigure (a) shows that a greater proportion of sick people with RHI have zero treatment fees, compared with the group with UEBMI. On the other hand, subfigure (a) shows that a larger proportion of patients with UEBMI are distributed at the right-hand side of the intersection between the medical expenditure distributions of people insured by UEBMI and RHI. It means that the average treatment expenditure of the last inpatient services in the sample with UEBMI is higher than that in the group with RHI. This is in line with our Hypothesis 2b. It can be explained considering that UEBMI provides a higher reimbursement rate than RHI, and therefore encourages insured patients to purchase more medical products and services.

Subfigures (b) - (d) plot the medical expenditure in the subsamples grouped by household wealth. They consistently show that patients with UEBMI have a larger amount of total treatment expenses on the last inpatient services, compared to the patients with RHI. Moreover, the difference in the treatment expenditure between UEBMI and RHI groups declines with household wealth. Rich people were able to afford advanced

treatment, even before they purchased health insurance. Thus, the effect of health insurance on medical expenditure will be smaller in the wealthy group, compared with that in the poor sample. This narrows the difference in the treatment expenditure between UEBMI and RHI groups in the subsample of population with high wealth.

In order to compare the associations of household consumption with various health insurance schemes, the UEBMI, RHI, and 'No Insurance' subsamples are categorized according to the health insurance schemes held by the heads. Table 4.1 displays household consumption and wealth of the subsamples. We observe that consumption in all columns is the highest in the UEBMI sample with RHI next and the uninsured subsample consuming the least. Specifically, based on the first column of the table, the average annual total household consumption in the UEBMI sample is 36,474 RMB (valued at 2011 prices), followed by RHI group with 23,549 RMB. The uninsured group consumes the least, with 21,297 RMB. According to *p*-values of the *t*-tests reported at the bottom of the first column, the total consumption of households with heads holding UEBMI, RHI and no insurance is significantly different from each other.

This is consistent with Hypotheses 1a and 1b. Health insurance reduces uncertainty in medical expenditure, and therefore cuts precautionary saving motivations and encourages consumption. Additionally, the more generous a health insurance scheme is, the more it reduces uncertainty in medical expenditure, promoting consumption to a greater extent. Comparing the three subsamples, the wealth of the households where the heads hold UEBMI is the largest with around 337,242 RMB, while the household wealth in RHI and uninsured subsamples are 114,925 and 130,600 RMB respectively.

Table 4.2 summarizes the utilization of healthcare services by health insurance status. Given that the utilisation of healthcare services and expenditure is measured at the individual level, the UEBMI, RHI and 'No insurance' subsamples are categorized according to the type of health insurance held by individuals. We find that the insured groups which utilise healthcare services more often than the uninsured group. Focusing on the first column of Table 4.2, we observe that the utilization of outpatient services is similar between the residents with UEBMI and RHI. Around 20 percent of people with health insurance visited medical centres for outpatient services within 4 weeks before the interview, whilst the visiting rate of the uninsured group was 14.75 percent. Table 4.2 also reveals further differences in the utilization of other healthcare services between the sample with UEBMI and RHI. For instance, individuals with UEBMI stayed on average around 2.15 nights in hospital during their last inpatient services, while residents with RHI stayed only 1.33 nights. The *p*-value of the *t*-test at the end of column 5 shows that people insured by UEBMI stayed in hospital during their latest inpatient a significantly higher number of nights than those holding RHI.

These findings can be explained, considering that health insurance encourages people to utilize healthcare services by sharing medical expenses. The more generous the health insurance is, the more it encourages people to use healthcare services. The last column of Table 4.2 displays the proportion of people who gave up seeking medical treatment or were prematurely discharged from hospitals due to budget constraints. This occcurs the most within the uninsured group, where 4.5 percent of the sample had difficulties with purchasing enough treatment. They are followed by the RHI sample, of which 3.87 percent encountered financial difficulties in buying healthcare services. However, the *t*-test shows that there is no significant difference in the likelihood of this

happening between the RHI and uninsured groups. This is consistent with our Hypothesis 3, indicating that the RHI fails to help poor patients in purchasing sufficient medical treatment, due to its low reimbursement rate. In contrast, only 1.39 percent of the population with UEBMI confronted this problem, and the difference in this figure between UEBMI and uninsured groups is statistically significant.

Summary statistics of total and out-of-pocket medical expenditure on outpatient services, inpatient services and self-treatment can be found in the Table 4.3. Consistent with Table 4.2, the insured groups show a greater amount of treatment expenditure than the sample without any health insurance. Additionally, the sample covered by more generous health insurance (UEBMI) shows the largest amount of treatment expenditure. The fourth column of the table shows that the latest out-of-pocket inpatient expenditure of people holding UEBMI is 341.54 RMB, while the corresponding figures for people holding RHI and no insurance are 247.11 RMB and 164.60 respectively.[47] The *p*-values of *t*-tests for the equality of the means, listed at the bottom of column 4, indicate that out-of-pocket inpatient expenses are significantly different between people holding UEBMI, RHI, and no health insurance. This is in line with our Hypothesis 2a and 2b. One possible explanation is that enrolment in health insurance encourages patients to pursue more treatment. Meanwhile, due to the profit incentive, medical centres tend to prescribe excessive and more expensive treatments to insured patients than would otherwise be required (Huang, 2017).

[47] The samples for the total medical expenditure and out-of-pocket medical expenditure are different as respondents could only report one of them. Therefore, the out-of-pocket expenditure is different from the total expenditure in the sample of uninsured people in the data description. Table 4.3 shows that the out-of-pocket medical expenditure is smaller than the total medical costs in the uninsured group. This can be explained through considering that uninsured people could be too poor to pay all the treatment they had received.

Other variables which will be used in the remaining part of this chapter are summarized in the Table 4.4. We can see that 10.63% of residents in our sample hold UEBMI, and 82.95 percent voluntarily participate in RHI. The large number of participants in RHI enables RHI to diversify effectively the medical expenditure risks among its insured members. In addition, the selection bias problem — whereby only people with higher health risks enrol in the voluntary RHI — can be ignored (Wagstaff *et al.*, 2009a). In contrast, only 6.07 percent of the people in our sample are not insured, and 30% of the uninsured residents report that they have no knowledge about the public health insurance schemes. There are substantial differences in education attainments amongst the three groups. The average education level of people with UEBMI is the highest: 72.04 percent of the subsample have at least attained secondary education and 22.99 percent have bachelor's degrees. In contrast, the education level of people holding RHI is much lower: only 26.71 percent of this sample have completed secondary school, and less than 1 percent attended university. Moreover, more than 31% of the uninsured and RHI groups are illiterate. These figures imply that people with more education have a higher probability of being formally employed and joining the UEBMI.

According to the self-reported health status and the Activity of Daily Living index (ADL), the health status in the UEBMI group is the highest: [48] 55.05 percent of the population in this group report fair health, only 17.21 percent think their health is poor and the ADL index in this group is the lowest at around 0.18. There is no significant difference in health status between residents in the RHI and the uninsured groups: around 30 percent of respondents in these groups report poor health. In addition, the table shows

[48] This index is used to measure the difficulties someone encounters with activities of daily living. The higher the index, the more difficulties a person has in activities of daily living. See the Appendix for details relative to its construction.

that around 70 percent of people hold UEBMI and RHI have at least one chronic disease, while the figure for the uninsured groups is 62.18 percent. Those figures are significantly different and can be explained by the fact that insured residents are more likely to self-diagnose any signs of chronic disease. As discussed above, the education level of residents in the UEBMI group is higher than that in the uninsured group, and therefore they have better knowledge of disease, which they can recognise more easily than people in the uninsured group. As for residents who enrol in the voluntary health insurance scheme (RHI), they probably pay more attention to health condition than uninsured people. As introduced in Section 4.2, UEBMI and RHI are designed for different types of people. Correspondingly, about 90 percent of participations in the UEBMI scheme are living in urban areas, and around 70% of residents in the RHI group reside in rural areas.

These initial summary statistics show that the insured groups consume at a higher level, utilize healthcare services more, and experience a larger amount of medical expenses when compared with the uninsured subsample. Moreover, the statistical analysis reflects the fact that people with UEBMI show a higher level of consumption, utilization of healthcare services and medical expenditure than the group with RHI. This is consistent with our Hypotheses 1a-2b. However, the differences in household consumption and medical expenditure between these two insured samples decline with household wealth. This is in line with Chou *et al.* (2003) who provide evidence that the association between NHI and consumption/savings is weaker in the rich group, and can be explained considering that prudence declines with wealth (Kimball, 1990). These findings are, however, only indicative as they do not control for other variables. The section that follows aims at estimating models of household consumption and medical expenditure as

a function of an individual/household head insurance status, controlling for a wide range of variables.

4.6 Models and Methodology

4.6.1 Baseline models

Following Lei and Lin (2009), Zhang *et al*. (2017a) and Huang (2017), we include dummy variables for participation in public health insurance schemes to examine the effectiveness of those programmes as following:

$$Y_{i,j,t} = \partial_{0i} + \beta_{1i} UEBMI_{j,t} + \beta_{2i} RHI_{j,t} + \theta_i Controls_{j,t} + u_t + u_p + u_j + \varepsilon_{jt} \quad (1)$$

where $Y_{i,j,t}$ is one of the following: (1) the logarithm of real consumption of category *i* for household *j* in year *t* (valued at 2011 prices). We focus on total household consumption, non-medical consumption, non-durable consumption, and non-medical consumption excluding durables; (2) logarithm of the total or the out-of-pocket treatment expenditure (valued at 2011 prices) on service *i* for respondent *j* in year *t*. In this case, healthcare services include outpatient services, inpatient services and self-treatment.

$UEBMI_{j,t}$ is a dummy variable taking a value of one if the respondent *j* participates in UEBMI in year *t*, and zero otherwise. $RHI_{j,t}$ stands for a binary variable equal to one if the respondent *j* participates in NCMS, URBMI, or URRMI in year *t*, and zero otherwise. Following Lei and Lin (2009), Huang (2017) and the majority of the existing literature, our $Controls_{j,t}$ include age, gender, secondary education attainment,

marital status, health status, working status, household size and regional dummies.[49] Based on Paccagnella *et al*. (2013), we use self-reported health status and chronic illnesses to control for an individual's physical health status, and choose total household wealth and household income as proxies for household financial and economic status.[50] u_t and u_p, represent for the time specific effects and province effects respectively. To control for these, we include year and province dummies. u_i is an individual specific effect and ε_{jt} is an idiosyncratic error term.

Huang (2017) shows that health status is reducing in age, implying that the likelihood of being sick is increasing with age. Therefore, we expect age to be positively associated with medical expenditure. In general, people with more education and those living in urban areas have a better understanding of healthcare. They are more likely to ensure disease preventions and visit medical centres for healthcare services. Compared with singles, married people tend to have a larger amount of consumption as their spouses share income and consumption risks with them. So, we anticipate a positive relationship between marital status and household consumption as in Rottke and Klos (2016). Households with a greater amount of wealth or income can afford a higher level of consumption and healthcare services, and we expect positive signs on the coefficients of household wealth in the equations of consumption and healthcare expenditure.

Working status is a trustable indicator for activities of daily living, especially for older people. Elders only continue working if they are healthy and have enough energy. Those people are less likely to use healthcare services than people with physical

[49] Definitions of all variables are presented in the Appendix
[50] Due to CHARLS only issuing the total household income for 2011 and 2013, I have used a revised household income calculated by aggregating earnings, pension, transfer and capital income.

limitations, and we expect that both health and work status are negatively linked to the utilization of healthcare services and healthcare expenditure. Previous studies show that women use healthcare services more often than men. This can be explained by the fact that females have a higher morbidity and they are more likely to seek help for illness and prevention (Bertakis *et al.*, 2000). As a result, a negative sign on the coefficient of gender is expected in the equation healthcare expenditure.

If participation in health insurance is associated with a higher level of household consumption (Hypothesis 1a) and medical expenditure (Hypothesis 2a) we will see positive signs on β_{1i} and β_{2i}. If people enrolled in UEBMI exhibit a higher level of household consumption (Hypothesis 1b) and medical expenditure (Hypothesis 2b) than people insured by RHI, we will find that $\beta_{1i} > \beta_{2i}$.

In order to test Hypothesis 3 — that the reimbursement rate of public health insurance scheme is too low to help poor people in purchasing sufficient treatment, we estimate the following equation:

$$\begin{aligned} lnc_{i,j,t} = \partial_{0i} + \theta_i Control_{j,t} &+ \beta_{1i} UEBMI_{j,t} * Low_{j,t} \\ &+ \beta_{2i} UEBMI_{j,t} * (1 - Low)_{j,t} + \beta_{3i} RHI_{j,t} * Low_{j,t} \\ &+ \beta_{4i} RHI_{j,t} * (1 - Low)_{j,t} + \beta_{5i} Low_{j,t} + u_t + u_p + u_j + \varepsilon_{jt} \quad (2) \end{aligned}$$

$lnc_{i,j,t}$ is the logarithm of consumption of category *i* for household *j* in year *t*, and $Controls_{j,t}$ are those in Equation (1). Based on the mean of the households' real wealth over the period 2011 to 2015, *Low* is equal to 1 if the household wealth falls into the bottom decile of the distribution, and zero otherwise. $UEBMI * Low$ ($RHI * Low$) represents the interaction between *UEBMI* (*RHI*) and the dummy for low household

wealth. Correspondingly, $UEBMI * (1 - Low)$ ($RHI * (1 - low)$) is the interaction between *UEBMI* (*RHI*) and the dummy for households whose wealth is not in the lowest decile.

Assuming all the residuals are equal to zero and all control variables are constant, the total consumption of households whose heads hold UEBMI and low wealth on good category i is equal to $(\partial_0 + \beta_1 + \beta_5 + \theta_i Controls)$. The total consumption of households with low wealth and uninsured heads is equal to $(\partial_0 + \beta_5 + \theta_i Controls)$. β_1 represents the difference in consumption between low wealth households whose heads are with UEBMI and without any health insurance. Similarly, the total consumer expnditure of households whose heads participate in RHI and have low wealth on good category i is equal to $(\partial_0 + \beta_3 + \beta_5 + \theta_i Controls)$. β_3 represents the difference in consumption between the low wealth households whose heads hold RHI and have no health insurance scheme.

If public health insurance fails to ease the financial burden for patients with low wealth, we will find there is no significant difference in the non-medical consumption between the poor households whose heads are with and without public health insurance. Given the fact that the reimbursement rate of UEBMI is higher than that of RHI, RHI is more likely to encounter this failure. If our Hypothesis 3 holds, we will see that β_1 and β_3 are not significantly different from zero in the regressions aimed at analysing the determinants of non-medical consumption.

To verify Hypothesis 4 — public health insurance scheme encourages rich people to overuse healthcare services, we estimate the subsequent equation:

$$Y_{i,j,t} = \partial_{0i} + \theta_i Controls_{j,t} + \beta_{1i} UEBMI_{j,t} * High_{j,t} + \beta_{2i} UEBMI_{j,t} * (1 - High)_{j,t} + \beta_{3i} RHI_{j,t} * High_{j,t} + \beta_{4i} RHI_{j,t-}(1 - High)_{j,t} + \beta_{5i} High_{j,t} + u_t + u_p + u_j + \varepsilon_{jt} \quad (3)$$

$Y_{i,j,t}$ is either total or out-of-pocket medical expenditure on different healthcare services, and the control variables are the same as in Equations (1) and (2). *High* is equal to 1 if the household wealth is within the top decile and zero otherwise. $UEBMI * High$ *(*$RHI * High$ *)* represents the interaction between *UEBMI* (*RHI*) and the dummy for high household wealth. Correspondingly, $UEBMI * (1 - High)$ ($RHI * (1 - High)$) is the interaction between *UEBMI* (*RHI*) and the dummy for households whose wealth is not in the top decile.

The medical expenditure of households whose heads hold UEBMI and high wealth is equal to $(\partial_0 + \beta_1 + \beta_5 + \theta_i Controls)$. That of households with high wealth and uninsured heads is equal to $(\partial_0 + \beta_5 + \theta_i Controls)$. β_1 represents the difference in medical expenditure between high wealth households whose heads are with UEBMI and without any health insurance. Similarly, the medical expenditure of households whose heads participate in RHI and have high wealth is equal to $(\partial_0 + \beta_3 + \beta_5 + \theta_i Controls)$. β_3 represents the difference in the key variables between the high wealth households whose heads hold RHI and have no health insurance.

As discussed above, it is very easy for rich people to afford enough advanced medical treatment regardless of if they participate in any health insurance. Therefore, effective insurance schemes should trivially affect the utilization of healthcare services and medical expenditure for individuals with strong purchasing power. If current public health insurance schemes drive rich people to overuse healthcare services (Hypothesis 4),

then the difference in the medical expenditure between rich individuals in the uninsured and insured subsamples will be significant. This suggests positive and significant signs on β_1 and β_3 in the regressions aimed at analysing the determinants of medical expenditures.

4.6.2 Estimation methodology

When we estimate the equations for consumption, our sample only includes household heads (around 23,055 observations). When estimating other equations, we include both household heads and their spouses in the sample (around 43,290 observations). One feature of our data is that a large proportion of people in our sample did not visit medical centres during the periods in question. An individual either received treatment (in which case $Totalfee_{i,j,t} > 0$ and $OOPfee_{i,j,t} > 0$), or he/she did not (in which case $Totalfee_{i,j,t} = 0$ and $OOPfee_{i,j,t} = 0$). In other words, those dependent variables can only be partially observed and the OLS estimators will be biased and inconsistent (Wooldridge, 2010). Therefore, we utilize the Tobit estimators for the equations of total and out-of-pocket treatment expenditure (Tobin, 1958).

The data analysed in our study is a three-year panel. Given the fact that our key independent variables – enrolments in public health insurances - remain almost constant during the sample period 2011 and 2015, we use the random-effects estimator to account for unobserved individual-specific heterogeneity. More specifically, we use random-effects estimations with robust standard errors in the estimations for the determinants of household consumption and apply random-effects Tobit estimations for the equations

aimed at explaining the determinants of total and out-of-pocket treatment expenditure. Marginal effects will be presented and discussed for the random-effects Tobit models.

4.7 Results and Discussion

4.7.1 Consumption and health insurance

Table 4.5 displays the random-effects estimations of the equations aimed at investigating the association between household consumption and public health insurance schemes (Equation 1). The dependent variables in columns 1-4 are total household consumption, non-medical consumption, non-durable consumption, and non-medical consumption excluding durables respectively. We focus on the coefficients associated with the UEBMI and RHI. Looking at the first column, the household head's enrolment in the UEBMI is associated with a 39.6 percent higher total household consumption, and the household head's participation in RHI is linked to a 11.2 percent higher household consumption. The *p*-value of the *F*-test for the equality of the coefficients on UEMBI and RHI is reported at the end of the first column. It shows that the total consumption of households whose heads hold UEBMI is significantly higher than that of households whose heads hold RHI.

Our results (columns 1–4) consistently show that households with heads holding UEBMI or RHI exhibit a higher level of consumption compared with households with uninsured heads. This is consistent with Gruber and Yelowitz (1999), Chou *et al.* (2003), and Wagstaff and Pradhan (2005), who study precautionary saving in the U.S., Taiwan and Vietnam respectively. Our findings suggest that, in line with our Hypothesis 1a,

UEBMI and RHI share medical expenditure with patients, which in turn reduces uncertainty in medical expenditure and encourages household consumption. Another possible reason is that health insurance increases disposable income through cost sharing, which leads to higher consumption (an income effect). The results also consistently show that the UEBMI group is characterised by a larger amount of household consumption than the RHI group. This supports our Hypothesis 1b and implies that a more generous health insurance is associated with a higher level of consumption. This can be understood, considering that a health insurance scheme sharing a larger proportion of medical expenditure will reduce precautionary saving motivation and encourage consumption to a greater extent.

With regards to the coefficients of other explanatory variables, the results show a negative relationship between the household head's age and total household consumption, which is consistent with Danziger *et al*. (1982). When people get older, they have less energy and therefore undertake less retail activities. Consistent with the income and wealth effect, columns 1-4 display positive associations of consumption with household income and wealth. The gender of the household head is not significantly related to total consumption, but it is associated with around a 2.46-2.56 percent higher non-medical consumption (columns 2 and 4). Moreover, the consumption of households whose heads have secondary education is higher than that of households whose heads have no secondary education. This could be explained by the fact that people with secondary or further education are more likely to use financial instruments to reduce their uncertainty in income and consumption when compared to those without any secondary education, and therefore they have less precautionary saving motivation and consume at a higher level.

Compared to households whose heads have poor health, households whose heads report either good or fair health, have higher non-medical expenditure (column 2) but less total household consumption (column 1). This implies that households with unhealthy heads spend a greater amount of money on medical treatment than their counterparts with healthy heads, which drags their total household consumption up. The strong uncertainty in income and consumption could drive people to work when old. Those uncertainties could be caused by their adult children not being able to become financially independent. In that case, older people might have to support their children and even their children's family. Given that the CHARLS survey focuses on the respondents aged 45 and over (the average age of household heads is 62), households with employed or farming heads may face higher uncertainty in income and consumption when compared to households with retired or unemployed heads. Consistently, the results show that households with employed or farming heads undertake less household consumption. Consistent with the findings in Chapter 3, we find that household size is positively linked to household consumption.

4.7.2 Medical expenditure and health insurance

Tables 4.6 shows the results of random-effects Tobit estimations for treatment expenditure. Columns 1 to 6 provide estimates for total and out-of-pocket treatment expenditure on the latest outpatient services used within 4 weeks before the interview, the latest inpatient services within one year before the interview and self-treatment within 4 weeks before the interview.

Focusing on the first column of the Table, enrolment in UEBMI is associated with a 34.7 percent higher outpatient expenditure, and participation in RHI is linked to a 24.2 percent higher expenditure. The *F*-test indicates that the difference in the outpatient expenditure between the people holding UEBMI and RHI is statistically significant. The third column reports that participation in a public health insurance scheme is associated with a 35.1-48.6 percent higher inpatient expenditure. The associations of enrolment in public health insurance schemes with inpatient expenditure are much stronger than those with outpatient expenditure. Our results also present that participation in UEBMI and RHI are linked to a 53.2 and a 22.8 higher self-treatment expenditure respectively (column 5).

Columns 1-6 consistently show that individuals covered by public health insurance spend more on medical treatment compared to their uninsured counterparts. This finding, which supports Hypothesis 2a, suggests that health insurance encourages insured patients to pursue better and more treatments, which in turn increases both the total and the out-of-pocket medical expenditure. The results imply an expansion in the demand for healthcare services after enrolment in public health insurance. The disposable income of the insured members is increased by health insurance. As a normal good, the demand for healthcare goods and services goes up with disposable income. Yet, Wagstaff *et al*. (2009a) argue that another important contributor to the positive association between health insurance and medical expenditure is that medical centres provide excessive and expensive treatments to insured patients with the aim of making profit.

Our results consistently show that individuals enrolled in UEBMI purchase significantly more healthcare products and services than those with RHI (except for column 2), which is in line with Hypothesis 2b and can be explained by that the UEBMI provides a higher level of reimbursement than the RHI. We also find that after enrolment in the public insurance schemes inpatient expenditure is increased by a larger proportion than outpatient expenditure. Moreover, there is no significant difference in out-of-pocket outpatient expenditure between individuals who hold UEBMI and RHI. Those findings are consistent with the designs of these public health programmes. Due to limited funding, public health insurance schemes in China give priority to the coverage of inpatient services, and both UEBMI and RHI set low reimbursement rates for outpatient services (Zhang *et al.*, 2017a).

Our results on medical expenditure are in line with Liu and Zhao (2012) and Wagstaff *et al.* (2009a) who also study public health insurance schemes in China, but different from Zhang *et al.* (2017a) and Babiarz *et al.* (2010). The differences in methodology and data could be the reasons for the inconsistent findings. Zhang *et al*. (2017a) use the same data as we do in this paper — CHARLS dataset — to evaluate the whole health system in China. However, it is worth noting that their selected sample is totally different from ours. The sample period in Zhang *et al.* (2017a) covers between 2011 and 2013, and our analysis is based on 2011, 2013, and 2015 waves of CHARLS survey. Their sample includes people who are covered by Medical Aid, GIS and any other types of health insurance schemes in China, which accounts for 7% of their total sample. In addition, their estimations for out-of-pocket expenditure are restricted to people with positive out-of-pocket expenditure only. Medical Aid and GIS are two types of public health insurance schemes, which provide nearly free medical treatments to the insured

members. Moreover, Medical Aid is only eligible for people with serious disease. Therefore, it is no surprise that they document a negative association between China's health system and out-of-pocket expenditure.

Focusing on other regressors, there is a negative relationship between the medical expenditure and health status. Work status reflects the physical limitations of elderly people, as they only keep working if they do not suffer from serious physical problems and have enough energy. Accordingly, our results show a negative association between work status and medical expenditure. As the probability of being sick increases with age, the results show a positive association between the inpatient medical expenditure and age. The attainment of secondary education is associated with a 11.8% (column 5) and a 9.5% (column 6) higher total and out-of-pocket self-treatment expenditure. People who have attained secondary education have better general knowledge regarding healthcare compared to their counterparts who never attended secondary school. Therefore, they are more confident in self-diagnosis and treatment.

The results also show that males are associated with a lower outpatient expenditure (column 1-2) and self-treatment expenditure (column 5-6) but a higher inpatient expenditure (column 3-4) compared to their female counterparts. Females are more risk averse and tend to seek help for illness and prevention, like outpatient service and self-treatment (Bertakis *et al.*, 2000). Therefore, males are more likely to get serious diseases compared to females, as they are less risk averse and indulge in more unhealthy behaviours (Courtenay, 2000, Walker *et al.*, 1988, Verbrugge *et al.*, 1987). Considering that the self-reported health status could be biased, we use the activities of daily living index (ADL) as a health indicator. The results are reported in Appendix (Table 4.A3 and Table 4.A4), which are consistent with Tables 4.5 and 4.6.

4.7.3 Limitation of RHI and UEBMI

4.7.3.1 Failure of relieving financial burden for poor people

UEBMI and RHI only cover between approximately 40 to 65 percent of the medical expenditure for their insured members. This implies that up to 60 percent of the medical costs must be borne by the insured patients. Therefore, if these patients become seriously ill, the out-of-pocket expenditure may still be a challenge to them, especially if they have little wealth. To find the extent to which UEBMI and RHI fail to reduce the financial burden of people with low wealth, we focus on the coefficients of *UEBMI*Low* and *RHI*Low*, in Equation (2). If patients become able to afford enough healthcare after enrolment within a public health insurance scheme, their uncertainties in medical expenditure will be reduced. This will cut their need for precautionary saving and increase their consumption. On the contrary, if a patient is not able to purchase necessary healthcare services after participating in one of the public health insurance scheme, he/she will still be confronted with substantial risks in medical expenses. In this case, health insurance will not increase their non-medical expenditure significantly.

Table 4.7 displays the random-effects estimates of Equation 2. We differentiate households based both on the health insurance held by the head and by household wealth. The first row shows that participation in UEBMI is associated with a 72.2 percent higher total consumption, a 60.8 percent higher non-medical consumption, a 68.6 percent higher non-durable consumption and a 54.8 percent higher non-medical consumption excluding durables, in the subsample of poor households, respectively. In contrast, columns 1 to 4 display that there is no significant difference in consumer expenditure between households with low wealth in the RHI and uninured subsamples.

These findings can be explained, considering the difference in the reimbursement rate between RHI and UEBMI. The reimbursement rate of RHI is lower than that of UEBMI (as mentioned above), and RHI is not able to support patients with low wealth to purchase sufficient and necessary treatments. RHI members with low wealth still face great uncertainty in medical expenses and maintain a strong precautionary saving motivation. Therefore, poor residents enrolled in RHI do not show higher levels of non-medical consumption. This finding partially supports our hypothesis 3 and reflects that the reimbursement of RHI is too low to ease the financial burden of poor people. It is consistent with Cheung and Padieu (2015), who document that there is no significant negative association between precautionary saving and participation in NCMS among the poor people. In contrast, low wealth households whose heads hold UEBMI consume significantly more non-medical goods and services than their counterparts with uninsured heads, which implies that UEBMI performs better than RHI at financially assisting people with low wealth in purchasing enough healthcare products and services.

4.7.3.2 Overutilization of healthcare service

The significantly higher out-of-pocket medical expenditure of people enrolled in UEBMI and RHI raises concerns that public health insurance may lead to the overutilization of healthcare services. To examine whether this is the case, we focus on the coefficients of the interactions, *UEBMI*High* and *RHI*High*, in Equation (3). Those who have substantial purchasing power are more likely to overuse healthcare services and become the targets of healthcare institutions wishing to make profits. Wealthy people can afford sufficient advanced medical products and services without any efforts. If their utilisation of healthcare services and medical expenditure increases once they enrol in one of the public

health insurance schemes, this may indicate that the scheme is associated with the overutilization of healthcare services.

Table 4.8 shows the random-effects estimations for the determinants of medical expenditure (Equation (3)). We differentiate between individuals based on their health insurance status and household wealth. Columns 1 to 6 display that in the subsample of people with high household wealth, participation in UEBMI is associated with a 48.43 percent higher outpatient expenditure (column 1), a 31.56 percent higher out-of-pocket outpatient expenditure (column 2), a 48.61 percent higher inpatient expenditure (column 3), a 35.46 percent higher out-of-pocket inpatient expenditure (column 4), a 38.47 percent higher self- treatment expenditure (column 5), and a 30.53 percent higher out-of-pocket self-treatment expenditure (column 6). These results indicate that wealthy people with UEBMI tend to overuse healthcare services.

In contrast, the fourth row shows that rich people who hold RHI and who are uninsured have similar expenditure on outpatient services, inpatient services, and self-treatment. These results imply that rich people holding RHI do not spend more on outpatient services, inpatient services, and self-treatment, than rich people who are uninsured. The reimbursement rate of RHI is low, and its insured patients must pay a great proportion of the excessive treatment expenditure by themselves. This discourages the overutilization of healthcare services, especially inpatient services which generally cost a significant amount of money.

Table 4.8 partially supports hypothesis 4 and provides evidence that the UEBMI is associated with the overutilization of outpatient services, inpatient services and self-treatment, but the RHI is not as its reimbursement rate is lower. An effective health

insurance should be able to prevent overutilization and allocate the limited funding to the people who need it the most.

4.8 Conclusion

Using a large dataset which includes 43,290 observations of 11,565 households from 28 Chinese provinces over the years 2011 and 2015, we investigate the extent to which the UEBMI and the RHI relate to household consumption and medical expenditure. We also study whether public health insurance manages to ease the financial burden of people with low wealth without leading to the overutilization of healthcare services of people with high wealth. We contribute to the literature in the following ways. First, for the first time in the Chinese context, we investigate the association between health insurance and household consumption. Second, we examine the limitations of public health insurance schemes in China. Third, we compare the effectiveness of different health insurance schemes which are currently implemented in China. Finally, our dataset covers 28 provinces, which incorporates observations across almost the entire Chinese territory.

Based on a wide range of specifications and estimation methodologies, we show that participation in public health insurance is associated with a greater amount of household consumption and larger total and out-of-pocket medical expenses. These findings are consistent with Gruber and Yelowitz (1999), Chou *et al*. (2003), Wagstaff and Pradhan (2005), Wagstaff *et al.* (2009a), Liu and Zhao (2012) and Babiarz *et al*. (2010), which study health insurance schemes in the U.S., Taiwan, Vietnam and mainland China respectively. We also find that, compared to RHI, UEBMI has a stronger association with household consumption and medical expenditure.

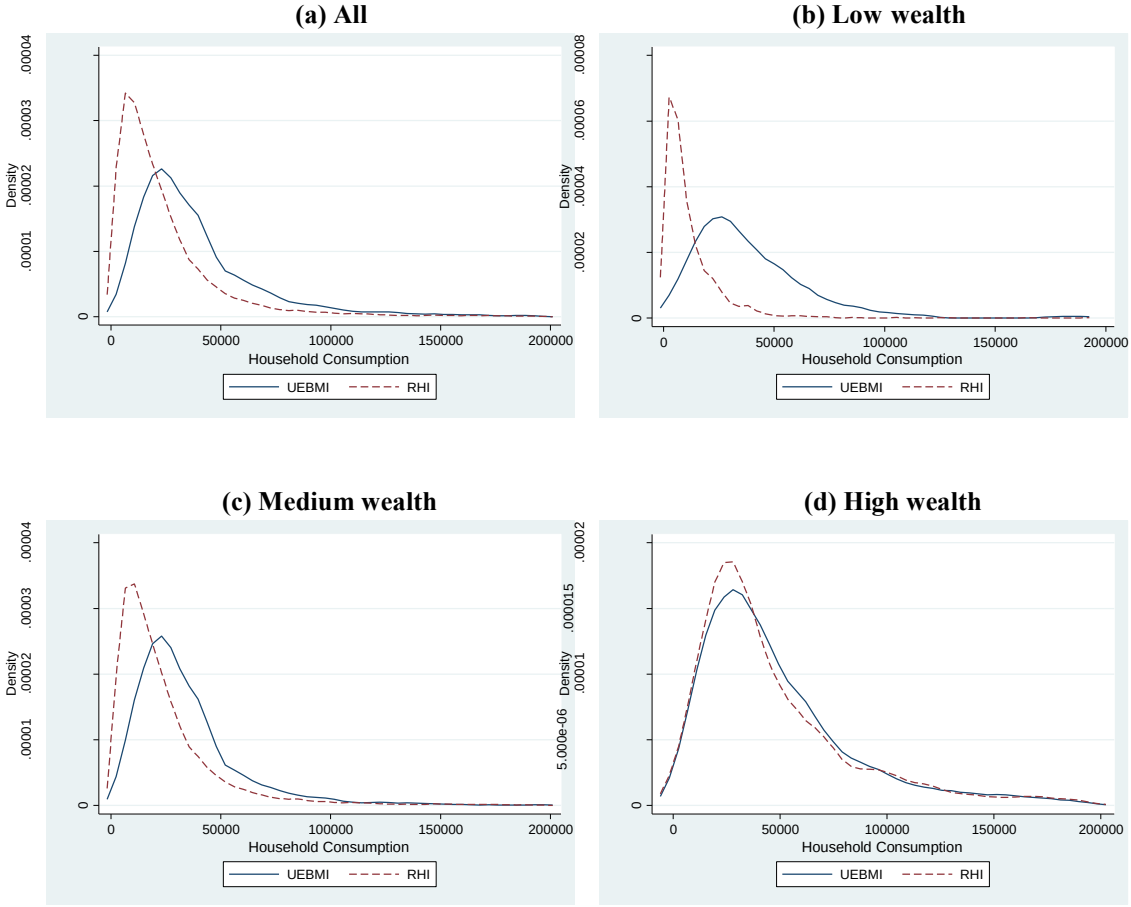
Differentiating our sample according to the level of household wealth, we also show that UEBMI is associated with a higher non-medical consumption in the subsample with low wealth. In the same subsample there is no difference in non-medical consumption between households whose heads are uninsured and households whose heads are covered by RHI. This suggests that the reimbursement rate of RHI is not sufficient to assist residents with low wealth in purchasing enough treatment, whilst UEBMI is better at reducing the uncertainty in medical expenses for people with low wealth. In addition, rich people holding UEBMI tend to overutilize healthcare services, whilst RHI is more efficient at restricting people with sufficient purchasing power from overusing healthcare services.

Health insurance is very important to the society, as it improves residents' living standards and helps patients purchase necessary medical treatment. However, there exist significant differences in the financial burden and the accessibility to healthcare services between residents who hold different health insurance schemes in China. To consolidate all health insurance schemes in China, the government must put more effort in reducing those inequalities. One key step is to unify the reimbursement rates of those health insurance schemes. Since the government budget is not sufficient to provide totally free healthcare services, our results recommend a national healthcare security system where reimbursement rates are asset-based and means-tested. This would provide a generous reimbursement plan (like the one in the current UEBMI programme) to poor members of society and a smaller reimbursement rate (like the one in the current RHI programme) to the rich. This health insurance programme would improve the utilization of resources by allocating funding to those who need it the most, reducing waste. What is more, it is

necessary for governments to enhance supervisions on healthcare providers, especially discouraging them from giving excess treatments to patients for profit-making.

The limitations of our study are as follows. First, it is possible that there are endogeneities between enrolments in health insurance schemes and our key dependent variables, which are not considered in our study. Therefore, we cannot interpret our results as causality. Secondly, the data we analyse only consist of individuals aged 45 and over and is therefore not representative. Further research needs to be undertaken in the following directions. As medical expenditure data are only available for the people who received healthcare services, we apply the random-effects Tobit model. Future work could apply more advanced methodologies to eliminate selection bias. In addition, it would be interesting to study this topic in other countries where there is more than one public health insurance scheme, such as India. Furthermore, we are going to examine insurance effects considering the insurance status of other household members.

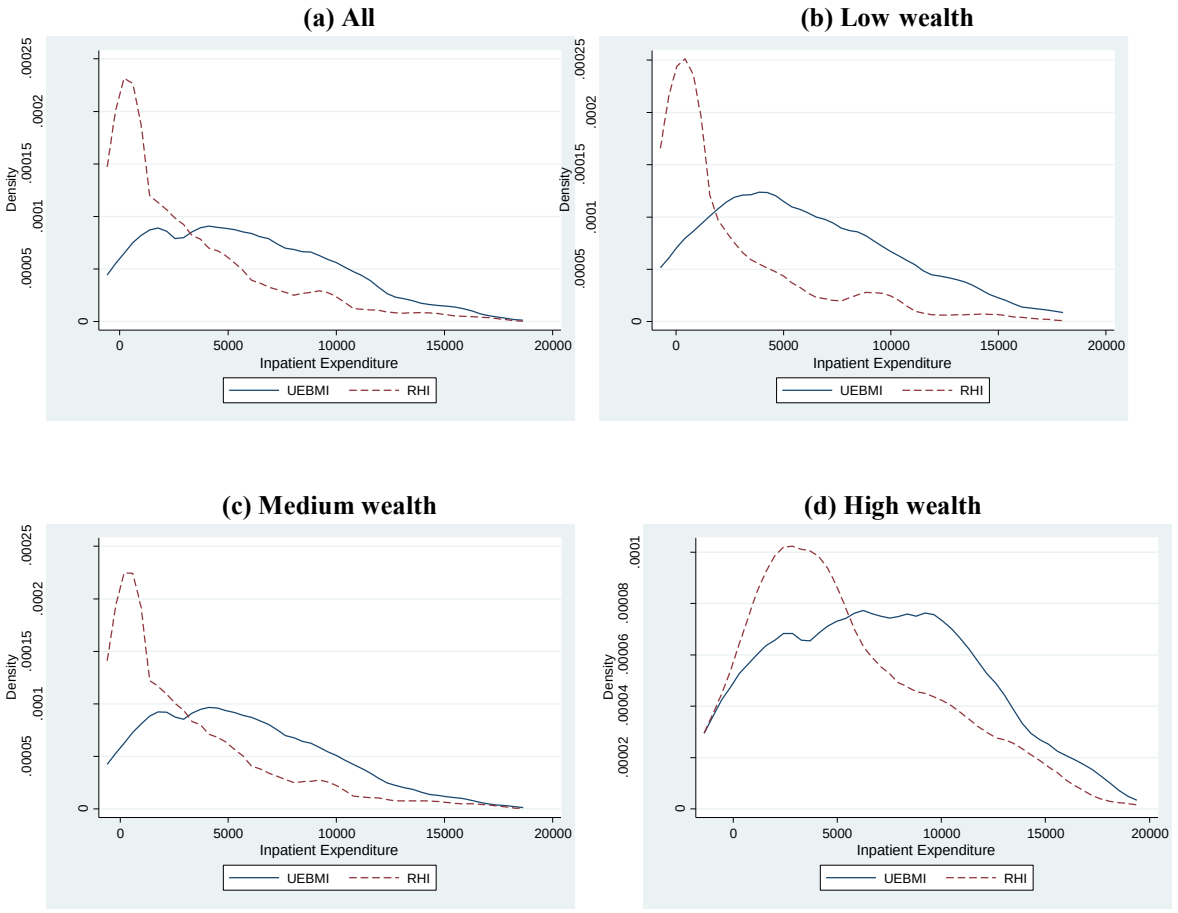
Figure 4.1: **Total consumption and health insurance schemes grouped by household wealth**



Note: The low, medium, and high wealth subsamples are categorised as follows, based on the mean of the households' real wealth over the period 2011 to 2015. First, households whose wealth falls in the lowest decile are classified as the low wealth group. Second, the medium wealth group consists of households whose wealth ranges within the middle eight deciles. The last group of households is made up by those whose wealth is within the top decile and these are categorised as the high wealth group. UEBMI represents the subsample of households whose heads participate in UEBMI, and RHI represents the subsample of households whose heads enrol in NCMS, URBMI or URRMI. Consumption is evaluated at 2011 prices.

Source: 2011, 2013 and 2015 waves of the China Health and Retirement Longitudinal Survey data; National Bureau of Statistics

Figure 4.2: **Total treatment expenditure of last inpatient service and health insurance schemes grouped by household wealth**



Note: The low, medium, and high wealth subsamples are categorised as follows, based on the mean of the households' real wealth over the period 2011 to 2015. First, households whose wealth falls in the lowest decile are classified as the low wealth group. Second, the medium wealth group consists of households whose wealth ranges within the middle eight deciles. The last group of households is made up by those whose wealth is within the top decile and these are categorised as the high wealth group. UEBMI represents the sample of population who participate in UEBMI, and RHI represents the sample of population who enrol in NCMS, URBMI or URRMI. Consumption is evaluated at 2011 prices.

Source: 2011, 2013 and 2015 waves of the China Health and Retirement Longitudinal Survey data; National Bureau of Statistics

Table 4.1: Household consumption and wealth by health insurance status

		Total consumption	Non-medical consumption	Non-durable consumption	Non-medical consumption excluding durables	Wealth	Wealth without durables
Full	**Mean**	24741.38	21165.87	22120.42	18616.44	139032.4	130240.7
	Std. Dev.	24964.1	22299.28	20082.4	17205.9	226818.5	218132.3
	Obs.	23,055	23,053	23,040	23,047	23,422	23,424
UEBMI	**Mean**	36473.67	31382.27	33042.11	27991.48	337242.1	321372.1
	Std. Dev.	28455.85	25408	23028.32	19539.56	370226.3	357979.1
	Obs.	2,403	2,404	2,398	2,398	2,442	2,442
RHI	**Mean**	23548.73	20078.77	20976.76	17586.59	114924.7	106947.6
	Std. Dev.	24203.03	21631.52	19303.01	16551.17	188642.6	180840.7
	Obs.	19,150	19,150	19,130	19,141	19,413	19,414
No insurance	**Mean**	21297.39	18785.18	19353.34	16863.1	130599.9	122636.1
	Std. Dev.	23695.4	21269.63	19562.05	16949.57	213688.3	205557.8
	Obs.	1,422	1,420	1,432	1,429	1,478	1,479
Diff. UEBMI vs. No		0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Diff. RHI vs. No		0.000***	0.123	0.030**	0.002***	0.112	0.002***
Diff. UEBMI vs. RHI		0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Note: All variables are expressed in RMB. Consumption is evaluated at 2011 prices. See the Appendix for complete definitions of all variables. **Diff. UEBMI vs. No** repents the *p*-value associated with the *t*-test for the equality of means of consumption and household wealth between groups with UEBMI and no insurance. **Diff. RHI vs. No** represents the *p*-value associated with the *t*-test for the equality of means of consumptions and household wealth between groups with RHI and no insurance. **Diff. UEBMI vs. RHI** indicates the *p*-value associated with the *t*-test for the equality of means of consumptions and household wealth between groups with UEBMI and RHI. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Source: 2011, 2013, and 2015 waves of the China Health and Retirement Longitudinal Survey data; National Bureau of Statistics

Table 4.2: Utilisation of Healthcare services grouped by health insurance

		Outpatient		Inpatient			Self-treatment	Physical-ex	Poverty
		Visiting	Times	Visiting	Times	Nights	Visiting	Times	Visiting
Full	**Mean**	0.2070	0.4537	0.1198	0.1728	1.4013	0.5324	0.2816	0.0365
	Std. Dev.	0.4052	1.4618	0.3247	0.6300	6.0538	0.4990	0.4498	0.1876
	Obs.	43,151	43,290	43,263	43,247	43,290	43,290	43,290	42,458
UEBMI	**Mean**	0.2027	0.4397	0.1534	0.2337	2.1584	0.6068	0.3728	0.0139
	Std. Dev.	0.4021	1.7226	0.3604	0.7648	8.2871	0.4885	0.4836	0.1170
	Obs.	4,598	4,603	4,602	4,600	4,603	4,603	4,603	4,541
RHI	**Mean**	0.2121	0.4634	0.1184	0.1694	1.3319	0.5268	0.2754	0.0387
	Std. Dev.	0.4088	1.4309	0.3231	0.6141	5.4951	0.4993	0.4467	0.1930
	Obs.	35,789	35,907	35,889	35,876	35,907	35,907	35,907	35,178
No insurance	**Mean**	0.1475	0.3534	0.0788	0.1137	1.0156	0.4817	0.2130	0.0450
	Std. Dev.	0.3547	1.4010	0.2695	0.5849	8.2449	0.4998	0.4095	0.2073
	Obs.	2,610	2,620	2,613	2,612	2,620	2,620	2,620	2,580
Diff. UEBMI vs. No		0.000***	0.029**	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Diff. RHI vs. No		0.000***	0.000***	0.000***	0.000***	0.006***	0.000***	0.000***	0.116
Diff. UEBMI vs. RHI		0.141	0.303	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Note: See the Appendix for complete definitions of all variables. **Diff. UEBMI vs. No** repents the *p*-value associated with the *t*-test for the equality of means of utilisation of each healthcare service between groups with UEBMI and no insurance. **Diff. RHI vs. No** represents the *p*-value associated with the *t*-test for the equality of means of utilisation of each healthcare service between groups with RHI and no insurance. **Diff. UEBMI vs. RHI** indicates the *p*-value associated with the *t*-test for the equality of means of utilisation of each healthcare service between groups with UEBMI and RHI. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Source: 2011, 2013, and 2015 waves of the China Health and Retirement Longitudinal Survey data; National Bureau of Statistics

Table 4.3: Healthcare expenditure grouped by health insurance

		Outpatient		Inpatient		Self-treatment	
		Total	**OOP**	**Total**	**OOP**	**Total**	**OOP**
Full	**Mean**	63.1697	45.4915	456.7814	251.9387	76.5019	68.5734
	Std. Dev.	273.1246	183.8071	1792.7330	1085.7900	176.5396	160.3384
	Obs.	42,850	42,843	42,810	42,863	42,902	42,886
UEBMI	**Mean**	82.1560	53.1764	775.6643	341.5378	116.4974	90.9353
	Std. Dev.	322.5989	210.3399	2405.1750	1192.8080	229.5419	195.3710
	Obs.	4,526	4,541	4,502	4,553	4,500	4,495
RHI	**Mean**	62.0765	45.3009	431.5502	247.1124	71.9087	66.3156
	Std. Dev.	269.1592	181.2796	1730.4080	1085.0420	167.5753	155.3004
	Obs.	35,558	35,538	35,551	35,549	35,650	35,642
No insurance	**Mean**	44.7965	34.7532	262.4841	164.5959	71.5707	61.7778
	Std. Dev.	222.3107	165.5654	1300.6020	891.4626	182.8940	158.1168
	Obs.	2,606	2,605	2,599	2,601	2,595	2,592
Diff. UEBMI vs. No		0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Diff. RHI vs. No		0.001***	0.004***	0.000***	0.000***	0.922	0.151
Diff. UEBMI vs. RHI		0.000***	0.007***	0.000***	0.000***	0.000***	0.000***

Note: All variables are expressed in RMB. Expenditure is evaluated at 2011 prices. See the Appendix for complete definitions of all variables. **Diff. UEBMI vs. No** repents the *p*-value associated with the *t*-test for the equality of means of both total and out-of-pocket medical expenditure on each healthcare service between groups with UEBMI and no insurance. **Diff. RHI vs. No** represents the *p*-value associated with the *t*-test for the equality of means of both total and out-of-pocket medical expenditure on each healthcare service between groups with RHI and no insurance. **Diff. UEBMI vs. RHI** indicates the *p*-value associated with the *t*-test for the equality of means of both total and out-of-pocket medical expenditure on each healthcare service between groups with UEBMI and RHI. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Source: 2011, 2013, and 2015 waves of the China Health and Retirement Longitudinal Survey data; National Bureau of Statistics

Table 4.4: Data description

	Full		UEBMI		RHI		No insurance		Diff. UEBMI vs. No	Diff. RHI vs. No	Diff. UEBMI vs. RHI
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.			
Insurance status											
UEBMI	0.1063	0.3083									
RHI	0.8295	0.3761									
No Ins.	0.0607	0.2389									
Demographic Variable											
Age	59.8035	9.8133	61.2299	9.8145	59.5591	9.6874	60.3874	11.0587	0.000***	0.000***	0.000***
Gender	0.4707	0.4991	0.5744	0.4945	0.4603	0.4984	0.4359	0.4960	0.000***	0.016**	0.000***
HHsize	3.2824	3.5448	3.0541	1.8195	3.3232	3.7957	3.1458	2.0124	0.048**	0.018**	0.000***
Urban	0.3712	0.4831	0.8903	0.3126	0.2995	0.4581	0.4397	0.4964	0.000***	0.000***	0.000***
Married	0.8763	0.3293	0.8975	0.3034	0.8795	0.3255	0.8050	0.3963	0.000***	0.000***	0.000***
Widowed	0.1049	0.3065	0.0815	0.2736	0.1042	0.3055	0.1473	0.3545	0.000***	0.000***	0.000***
Location											
Western	0.2985	0.4576	0.2125	0.4091	0.3095	0.4623	0.2943	0.4558	0.000***	0.102	0.000***
Central	0.3313	0.4707	0.3652	0.4815	0.3285	0.4697	0.3168	0.4653	0.000***	0.218	0.000***
Coastal	0.3702	0.4829	0.4223	0.4940	0.3620	0.4806	0.3889	0.4876	0.006***	0.006***	0.000***
Education attainment											
Secondary education	0.3158	0.4648	0.7204	0.4489	0.2671	0.4425	0.2786	0.4484	0.000***	0.199	0.000***
Illiterate	0.2696	0.4438	0.0493	0.2165	0.2930	0.4551	0.3195	0.4664	0.000***	0.004***	0.000***
U.G.	0.0337	0.1805	0.2299	0.4208	0.0091	0.0950	0.0263	0.1602	0.000***	0.000***	0.000***
Work status											
Farm	0.5440	0.4981	0.1045	0.3059	0.6107	0.4876	0.4122	0.4923	0.000***	0.000***	0.000***
Employed	0.0915	0.2883	0.2481	0.4320	0.0701	0.2554	0.1073	0.3095	0.000***	0.000***	0.000***

Other work	0.0480	0.2137	0.0356	0.1854	0.0474	0.2125	0.0786	0.2692	0.000***	0.000***	0.000***
Self-employed	0.0402	0.1965	0.0280	0.1651	0.0399	0.1957	0.0668	0.2497	0.000***	0.000***	0.000***
Family-business	0.0078	0.0878	0.0076	0.0869	0.0075	0.0864	0.0118	0.1082	0.069*	0.016**	0.950
Self-reported health											
Great	0.0913	0.2881	0.1108	0.3139	0.0873	0.2823	0.1126	0.3162	0.815	0.000***	0.000***
Good	0.1366	0.3434	0.1666	0.3727	0.1315	0.3379	0.1534	0.3605	0.143	0.001***	0.000***
Fair	0.4878	0.4999	0.5505	0.4975	0.4832	0.4997	0.4454	0.4971	0.000***	0.000***	0.000***
Poor	0.2842	0.4510	0.1721	0.3775	0.2980	0.4574	0.2885	0.4532	0.000***	0.3060	0.000***
ADL[a]	0.2152	0.1886	0.1780	0.1762	0.2174	0.1882	0.2365	0.2015	0.000***	0.000***	0.000***
Chronic disease	0.6757	0.4681	0.6885	0.4632	0.6781	0.4672	0.6218	0.4850	0.000***	0.000***	0.158
Obs.	43,290		4,603		35,907		2,620				

***Note**:* a. The observations of ADL in the four subsamples are 27,577, 2,533, 23,313, and 1,634 respectively.
Source: 2011, 2013, and 2015 waves of the China Health and Retirement Longitudinal Survey data, National Bureau of Statistics

Table 4.5: Consumption and health insurance

	(1) Total consumption	(2) Non-medical consumption	(3) Non-durable consumption	(4) Non-medical consumption excluding durables
UEBMI	0.396***	0.371***	0.387***	0.358***
	(0.0305)	(0.0325)	(0.0294)	(0.0311)
RHI	0.112***	0.0657**	0.111***	0.0630**
	(0.0248)	(0.0267)	(0.0239)	(0.0256)
Age	-0.0246***	-0.0286***	-0.0280***	-0.0310***
	(0.00677)	(0.00739)	(0.00648)	(0.00707)
Age^2	0.0000654	0.00006.50	0.000113**	0.000105*
	(0.0000549)	(0.0000604)	(0.0000525)	(0.0000577)
Gender	0.0154	0.0246*	0.0180	0.0256*
	(0.0132)	(0.0140)	(0.0127)	(0.0134)
Secondary School	0.0856***	0.0867***	0.0767***	0.0782***
	(0.0152)	(0.0159)	(0.0147)	(0.0153)
Married	0.363***	0.318***	0.325***	0.264***
	(0.0394)	(0.0421)	(0.0377)	(0.0402)
Widowed	0.156***	0.168***	0.114***	0.109***
	(0.0403)	(0.0431)	(0.0395)	(0.0419)
Income	0.0439***	0.0486***	0.0368***	0.0408***
	(0.00256)	(0.00271)	(0.00241)	(0.00258)
Wealth without durables	0.100***	0.112***		
	(0.00336)	(0.00366)		
Wealth			0.133***	0.150***
			(0.00395)	(0.00431)
Great	0.0208	0.135***	-0.0231	0.0905***
	(0.0228)	(0.0238)	(0.0218)	(0.0227)
Good	-0.0462**	0.0667***	-0.0702***	0.0409**
	(0.0193)	(0.0202)	(0.0187)	(0.0195)
Fair	-0.0347**	0.0484***	-0.0528***	0.0335**
	(0.0139)	(0.0149)	(0.0135)	(0.0144)
Chronic	0.0648***	0.0313**	0.0671***	0.0297**
	(0.0138)	(0.0144)	(0.0132)	(0.0139)
Urban	0.0777***	0.0948***	0.0686***	0.0833***
	(0.0157)	(0.0167)	(0.0151)	(0.0160)
Farming	-0.114***	-0.0531***	-0.105***	-0.0494***
	(0.0156)	(0.0166)	(0.0149)	(0.0160)
Employed	-0.108***	-0.0544**	-0.0974***	-0.0500**
	(0.0224)	(0.0237)	(0.0216)	(0.0229)
Other work	-0.0179	0.0241	-0.0177	0.0141
	(0.0291)	(0.0314)	(0.0275)	(0.0294)
HHsize	0.0360**	0.0413**	0.0324**	0.0372**
	(0.0158)	(0.0177)	(0.0138)	(0.0154)
Constant	8.849***	8.721***	8.565***	8.359***
	(0.211)	(0.229)	(0.204)	(0.221)
Obs.	23,055	23,053	23,564	23,571
Number of ID	10,845	10,841	10,933	10,931
Prob. > F	0.000***	0.000***	0.000***	0.000***

Note: Equations are estimated with a random-effects model. Provincial and time dummies are included, but the coefficients are not reported for brevity. Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Standard errors are in parentheses. The *p*-values of *F*-tests for the equality of the coefficients associated with UEBMI and RHI are reported at the end of the table. See the Appendix for complete definitions of all variables.

Table 4.6: Medical expenditure and health insurance

	Outpatient		Inpatient		Self-treatment	
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	OOP	Total	OOP	Total	OOP
UEBMI	0.347***	0.248***	0.486***	0.479***	0.532***	0.141**
	(0.0550)	(0.0523)	(0.0680)	(0.0611)	(0.0621)	(0.0617)
RHI	0.242***	0.237***	0.351***	0.319***	0.228***	0.246***
	(0.0429)	(0.0406)	(0.0551)	(0.0504)	(0.0479)	(0.0471)
Age	0.0107	0.0159	0.0262**	0.0239**	0.0585***	0.0602***
	(0.0104)	(0.00987)	(0.0130)	(0.0116)	(0.0124)	(0.0122)
Age^2	-0.000116	-0.000165**	-0.000131	-0.000127	-0.000455***	-0.000486***
	(8.36e-05)	(7.96e-05)	(0.000103)	(9.21e-05)	(9.98e-05)	(9.85e-05)
Gender	-0.179***	-0.157***	0.0782***	0.0737***	-0.139***	-0.122***
	(0.0219)	(0.0207)	(0.0268)	(0.0238)	(0.0265)	(0.0261)
Secondary School	0.0435*	0.0398	-0.00539	0.00531	0.118***	0.0950***
	(0.0257)	(0.0243)	(0.0320)	(0.0283)	(0.0309)	(0.0305)
Married	-0.00890	0.0149	0.152*	0.168**	0.150*	0.155*
	(0.0738)	(0.0702)	(0.0922)	(0.0838)	(0.0896)	(0.0883)
Widowed	0.0509	0.0690	0.131	0.122	0.0936	0.0915
	(0.0799)	(0.0759)	(0.0991)	(0.0899)	(0.0973)	(0.0959)
Income	0.0179***	0.0169***	0.00289	0.00502	0.0324***	0.0309***
	(0.00401)	(0.00379)	(0.00478)	(0.00434)	(0.00467)	(0.00458)
Wealth	0.00510	0.00268	0.00834	0.0114*	0.0193***	0.0144**
	(0.00557)	(0.00526)	(0.00670)	(0.00603)	(0.00667)	(0.00656)
Great	-0.984***	-0.947***	-0.981***	-0.865***	-1.392***	-1.357***
	(0.0463)	(0.0443)	(0.0593)	(0.0538)	(0.0488)	(0.0482)
Good	-0.883***	-0.836***	-0.940***	-0.844***	-1.160***	-1.135***
	(0.0372)	(0.0353)	(0.0486)	(0.0444)	(0.0404)	(0.0398)
Fair	-0.528***	-0.503***	-0.627***	-0.534***	-0.601***	-0.595***
	(0.0228)	(0.0215)	(0.0287)	(0.0257)	(0.0274)	(0.0268)
Chronic	0.361***	0.324***	0.320***	0.273***	0.832***	0.788***
	(0.0245)	(0.0231)	(0.0313)	(0.0279)	(0.0282)	(0.0278)
Urban	-0.0265	-0.0324	0.0496	0.0531*	0.195***	0.175***
	(0.0254)	(0.0239)	(0.0310)	(0.0276)	(0.0310)	(0.0305)
Farming	0.0128	0.0260	-0.345***	-0.290***	-0.0712**	-0.0468
	(0.0252)	(0.0238)	(0.0304)	(0.0273)	(0.0307)	(0.0301)
Employed	-0.133***	-0.109***	-0.358***	-0.314***	-0.201***	-0.178***
	(0.0418)	(0.0396)	(0.0535)	(0.0478)	(0.0481)	(0.0475)
Other work	-0.0694	-0.0461	-0.257***	-0.234***	-0.0157	0.00754
	(0.0515)	(0.0486)	(0.0639)	(0.0574)	(0.0595)	(0.0584)
HHsize	0.000145	0.000870	0.00275	0.00209	0.00478	0.00259
	(0.00297)	(0.00269)	(0.00274)	(0.00251)	(0.00308)	(0.00330)
Obs.	42,850	42,843	42,810	42,863	42,902	42,886
Number of ID	19,741	19,734	19,722	19,737	19,744	19,740
Prob. > F	0.007***	0.767	0.003***	0.000***	0.000***	0.022**

Note: The equations are estimated with a random-effects Tobit model, and the marginal effects are reported. Provincial and time dummies are included, but the coefficients are not reported for brevity. Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Standard errors are in parentheses. The *p*-values of *F*-tests for the equality of the coefficients associated with UEBMI and RHI are reported at the end of the table. See the Appendix for complete definitions of all variables.

Table 4.7: Consumption and health insurance: differentiating households based on health insurance status and household wealth

	(1) Total consumption	(2) Non-medical consumption	(3) Non-durable consumption	(4) Non-medical consumption excluding durables
UEBMI*Low	0.722***	0.608***	0.686***	0.548***
	(0.102)	(0.132)	(0.107)	(0.126)
UEBMI*(1-Low)	0.383***	0.365***	0.375***	0.356***
	(0.0318)	(0.0336)	(0.0306)	(0.0323)
RHI*Low	0.0604	-0.0171	0.0625	-0.0372
	(0.0732)	(0.0811)	(0.0712)	(0.0773)
RHI*(1-Low)	0.114***	0.0715**	0.115***	0.0745***
	(0.0263)	(0.0282)	(0.0253)	(0.0270)
Low	-0.185**	-0.190**	-0.0805	-0.0526
	(0.0759)	(0.0828)	(0.0739)	(0.0791)
Age	-0.0257***	-0.0301***	-0.0285***	-0.0318***
	(0.00673)	(0.00735)	(0.00646)	(0.00706)
Age^2	8.03e-05	8.31e-05	0.000120**	0.000114**
	(5.46e-05)	(6.00e-05)	(5.24e-05)	(5.75e-05)
Gender	0.0123	0.0211	0.0162	0.0235*
	(0.0132)	(0.0140)	(0.0127)	(0.0135)
Secondary School	0.0885***	0.0896***	0.0794***	0.0808***
	(0.0152)	(0.0158)	(0.0147)	(0.0153)
Married	0.341***	0.292***	0.316***	0.252***
	(0.0388)	(0.0416)	(0.0374)	(0.0401)
Widowed	0.143***	0.151***	0.109***	0.103**
	(0.0400)	(0.0429)	(0.0393)	(0.0419)
Income	0.0431***	0.0477***	0.0363***	0.0403***
	(0.00255)	(0.00270)	(0.00240)	(0.00257)
Wealth without durables	0.0913***	0.101***		
	(0.00347)	(0.00374)		
Wealth			0.127***	0.143***
			(0.00414)	(0.00450)
Great	0.0171	0.131***	-0.0251	0.0883***
	(0.0228)	(0.0237)	(0.0217)	(0.0227)
Good	-0.0506***	0.0618***	-0.0722***	0.0387**
	(0.0193)	(0.0202)	(0.0187)	(0.0195)
Fair	-0.0382***	0.0444***	-0.0547***	0.0313**
	(0.0138)	(0.0148)	(0.0135)	(0.0144)
Chronic	0.0659***	0.0327**	0.0675***	0.0303**
	(0.0138)	(0.0144)	(0.0132)	(0.0139)
Urban	0.0787***	0.0963***	0.0694***	0.0849***
	(0.0157)	(0.0167)	(0.0151)	(0.0160)
Farming	-0.117***	-0.0569***	-0.107***	-0.0521***
	(0.0156)	(0.0166)	(0.0149)	(0.0160)
Employed	-0.105***	-0.0503**	-0.0954***	-0.0479**
	(0.0224)	(0.0236)	(0.0216)	(0.0229)
Other work	-0.0175	0.0246	-0.0173	0.0147
	(0.0291)	(0.0314)	(0.0275)	(0.0294)
HHsize	0.0354**	0.0406**	0.0321**	0.0368**
	(0.0156)	(0.0175)	(0.0136)	(0.0153)
Constant	9.001***	8.905***	8.646***	8.462***
	(0.212)	(0.230)	(0.205)	(0.223)
Obs.	23,055	23,053	23,564	23,571
Number of ID	10,845	10,841	10,933	10,931

Note: Equations are estimated with a random-effects model. Provincial and time dummies are included. Based on the mean of the households' real wealth over the period 2011 to 2015, the dummy *Low* equal to 1 if households whose wealth falls in the lowest decile and zero otherwise. Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Standard errors are in parentheses. See the Appendix for complete definitions of all variables.

Table 4.8: Medical expenditure and health insurance: differentiating individuals based on health insurance status and household wealth

	Outpatient		Inpatient		Self-treatment	
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	OOP	Total	OOP	Total	OOP
UEBMI*(1-High)	0.2841***	0.2061***	0.4819***	0.4810***	0.5665***	0.2425***
	(0.0591)	(0.0564)	(0.0728)	(0.0656)	(0.0670)	(0.0488)
UEBMI_High	0.4843***	0.3156**	0.4861**	0.3546**	0.3847**	0.3053*
	(0.1697)	(0.1580)	(0.2018)	(0.1678)	(0.1839)	(0.180)
RHI_*(1-High)	0. 2445***	0.2406***	0.3527***	0.3321***	0.2318***	0.1492**
	(0.0440)	(0.0418)	(0.0571)	(0.0524)	(0.0497)	(0.0666)
RHI_High	0.1929	0.1683	0.3027	0.1223	0.2004	0.138
	(0.1700)	(0. 1575)	(0.2051)	(0.1701)	(0.1814)	(0.1835)
High	0.300***	0.254***	0.281***	0.264***	0.292***	0.251***
	(0.0660)	(0.0628)	(0.0846)	(0.0762)	(0.0762)	(0.0755)
Age	0.00986	0.0154	0.0260**	0.0236**	0.0588***	0.0604***
	(0.0104)	(0.00987)	(0.0130)	(0.0116)	(0.0124)	(0.0122)
Age^2	-0.000110	-0.000160**	-0.000130	-0.000125	-0.000458***	-0.000488***
	(8.36e-05)	(7.96e-05)	(0.000103)	(9.21e-05)	(9.98e-05)	(9.85e-05)
Gender	-0.176***	-0.155***	0.0785***	0.0743***	-0.140***	-0.123***
	(0.0219)	(0.0207)	(0.0268)	(0.0239)	(0.0265)	(0.0261)
Secondary School	0.0407	0.0382	-0.00503	0.00517	0.119***	0.0951***
	(0.0257)	(0.0243)	(0.0320)	(0.0283)	(0.0310)	(0.0305)
Married	-0.00683	0.0165	0.152*	0.168**	0.149*	0.154*
	(0.0738)	(0.0702)	(0.0922)	(0.0838)	(0.0896)	(0.0883)
Widowed	0.0525	0.0704	0.131	0.122	0.0934	0.0912
	(0.0799)	(0.0759)	(0.0991)	(0.0899)	(0.0973)	(0.0959)
Income	0.0182***	0.0170***	0.00298	0.00511	0.0322***	0.0309***
	(0.00402)	(0.00379)	(0.00479)	(0.00434)	(0.00467)	(0.00458)
Wealth	0.00107	0.000359	0.0102	0.0129**	0.0191***	0.0138**
	(0.00578)	(0.00546)	(0.00695)	(0.00627)	(0.00691)	(0.00680)
Great	-0.985***	-0.947***	-0.979***	-0.863***	-1.392***	-1.357***
	(0.0463)	(0.0443)	(0.0593)	(0.0538)	(0.0488)	(0.0482)
Good	-0.884***	-0.837***	-0.940***	-0.844***	-1.160***	-1.135***
	(0.0372)	(0.0353)	(0.0486)	(0.0444)	(0.0404)	(0.0398)
Fair	-0.529***	-0.503***	-0.626***	-0.534***	-0.602***	-0.595***
	(0.0228)	(0.0215)	(0.0287)	(0.0257)	(0.0274)	(0.0268)
Chronic	0.362***	0.324***	0.320***	0.273***	0.831***	0.788***
	(0.0245)	(0.0231)	(0.0313)	(0.0279)	(0.0282)	(0.0278)
Urban	-0.0296	-0.0341	0.0524*	0.0558**	0.194***	0.174***
	(0.0255)	(0.0240)	(0.0311)	(0.0277)	(0.0311)	(0.0306)
Farming	0.0158	0.0275	-0.347***	-0.292***	-0.0695**	-0.0456
	(0.0253)	(0.0239)	(0.0305)	(0.0274)	(0.0308)	(0.0302)
Employed	-0.137***	-0.111***	-0.358***	-0.313***	-0.200***	-0.177***
	(0.0418)	(0.0396)	(0.0536)	(0.0478)	(0.0481)	(0.0475)
Other work	-0.0664	-0.0436	-0.255***	-0.230***	-0.0186	0.00563
	(0.0516)	(0.0486)	(0.0639)	(0.0574)	(0.0595)	(0.0585)
HHsize	0.000127	0.000873	0.00279	0.00213	0.00473	0.00255
	(0.00297)	(0.00269)	(0.00274)	(0.00251)	(0.00309)	(0.00330)
Obs.	42,850	42,843	42,810	42,863	42,902	42,886
Number of ID	19,741	19,734	19,722	19,737	19,744	19,740

Note: Equations are estimated with a random-effects Tobit model, and the marginal effects are reported. Provincial and time dummies are included. Based on the mean of the households' real wealth over the period 2011 to 2015, the dummy *High* equal to 1 if households whose wealth falls in the top decile and zero otherwise. Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Standard errors are in parentheses. See the Appendix for complete definitions of all variables.

Appendix

Table 4.A1: Definitions of variables

Consumption	
Total Household consumption	Total household consumption of home products, food, durables, recreation, clothing, healthcare, education and transportation, donations and taxes.
Non-medical consumption	Total consumption excluding healthcare expenditure.
Non-durable consumption	Total consumption excluding expenditure on durables.
Non-medical consumption without durables	Total consumption excluding expenditure on healthcare services and products as well as durables.
Utilization of healthcare	
Outpatient	
Visiting	Dummy variable equal to one if the respondent visited a medical centre for outpatient services within one month before interview, and zero otherwise.
Times	The total number of visits for outpatient services in the 4 weeks before the interview
Inpatient	
Visiting	Dummy variable equal to one if the respondent visited a medical centre for inpatient services within one year before interview, and zero otherwise.
Times	The total number of visit for inpatient services within one year before interview
Nights	The total number of nights spent in hospital for respondent's last inpatient visit within one year before interview.
Self-treatment	
treated	Dummy variable equal to one if respondent made use of any self-treatment service within one month before interview, and zero otherwise.
Physical-ex	
Visiting	Dummy variable equal to one if the respondent visited a medical centre for physical examination within one year before interview, and zero otherwise.
Poverty	
No visiting	Dummy variable equal to one, if respondent is too poor to visit a medical centre for either outpatient or inpatient services or to afford more necessary treatment, and 0 otherwise.
Expenditure of healthcare	
Outpatient	
Total	Total expenditure on the respondent's last visit for outpatient services within one month of the interview, including both treatment and medication costs.
OOP	Total out-of-pocket expenditure on the last visit for outpatient services within one month of the interview, including both treatment and medication costs.
Inpatient	

Total	Total expenditure on the respondent's last visit for inpatient services within one year of the interview.
OOP	Total out-of-pocket expenditure on the last visit for inpatient services within one year of the interview.
Self-treatment	
Total	Total spending on self-treatment within one month of the interview.
OOP	Total out-of-pocket spending on self-treatment within one month of the interview.
Household wealth	
Wealth	Logarithm of total household wealth which includes housing, durables, fixed capita assets, irrigable land, livestock & fishers, and financial wealth.
Wealth without durables	Logarithm of total household wealth which includes housing, fixed capita assets, irrigable land, livestock & fishers, and financial wealth.
Income	Logarithm of total household income which includes earning, pension, transfer, and capital income.
Low	Dummy variable equal to one if the household wealth of the respondent falls in the bottom decile, and zero otherwise
High	Dummy variable equal to one if the household wealth of the respondent falls in the top decile, and zero otherwise
Interaction	
UEBMI*Low	The interaction between UEBMI and the dummy for low household wealth
UEBMI*High	The interaction between UEBMI and the dummy for high household wealth
RHI*Low	The interaction between RHI and the dummy for low household wealth
RHI*High	The interaction between RHI and the dummy for high household wealth
Insurance status	
UEBMI	Dummy variable equal to one if respondent only participates in the Urban Employee Medical Insurance, and zero otherwise
RHI	Dummy variable equal to one if respondent only participates in the Urban Resident Medical Insurance (URMI), New Cooperative Medical Insurance (NCMI) or Urban and Rural Resident Medical Insurance (URRMI), and zero otherwise
No Ins.	Dummy variable equal to one if respondent does not participate in any health insurance scheme, and zero otherwise
Demographic variable	
Age	Age of respondent
Gender	Gender of respondent
HHsize	Total number of household members
Wealth	Logarithm of total household wealth
Urban	Dummy variable equal to one if resident lives in urban area, and zero otherwise
Marital status	Dummy variable equal to one if resident is married, and zero otherwise.
Widowed	Dummy variable equal to one if resident is widowed, and zero otherwise.
Location	

Western	Dummy variable equal to 1, if respondent lives in Chongqing, Gansu, Guizhou, Inner Mongolia, Qinghai, Shaanxi, Sichuan, Xinjiang or Yunnan, and zero otherwise
Central	Dummy variable equal to 1, if respondent lives in Anhui, Henan, Heilongjiang, Hubei, Hunan, Jilin, Jiangxi, or Shanxi provinces, and zero otherwise.
Coastal	Dummy variable equal to 1, if respondent lives in Hebei, Guangdong, Guangxi, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, Zhejiang, Beijing or Fujian provinces, and zero otherwise.
Education attainment	
Secondary education	Dummy variable equal to one, if respondent attained the secondary education, and zero otherwise.
Illiterate	Dummy variable equal to one, if respondent is illiterate, and zero otherwise.
U.G.	Dummy variable equal to one, if respondent attained undergraduate education or more, and zero otherwise.
Work status	
Farm	Dummy variable equal to one, if respondent engaged in agricultural work for more than 10 days in the past year and did not engage in any other work, and zero otherwise.
Employed	Dummy variable equal to one, if respondent is employed, and zero otherwise.
Self-employed	Dummy variable equal to one, if respondent is self-employed, and zero otherwise.
Family-business	Dummy variable equal to one, if respondent's main work is for family business, and zero otherwise.
Other work	Dummy variable equal to one, if respondent is self-employed or work for family business, and zero otherwise.
Work	Dummy variable equal to one, if respondent is employed or self-employed, engages in agricultural work, or works for family business, and zero otherwise
Self-reported health	
Great	Dummy variable equal to one if respondent reported that his/her health status was excellent or very good, and zero otherwise
Good	Dummy variable equal to one if respondent reported that his/her health status was good, and zero otherwise
Fair	Dummy variable equal to one if respondent reported that his/her health status was fair, and zero otherwise
Poor	Dummy variable equal to one if respondent reported that his/her health status was poor or very poor, and zero otherwise
ADL	An index of activities of daily living, ranging from 0 to 1. See details about its construction in the appendix
Chronic disease	It is equal to one, if respondent has hypertension, dyslipidaemia, diabetes, cancer, a malignant tumour, chronic lung disease, liver disease, heart attack, coronary heart disease, stroke, kidney disease, digestive disease, emotional problems, memory-related disease, arthritis, rheumatism or asthma, and zero otherwise.

Table 4.A2: Activities of daily living indexes in CHARLS

Category	Code	Difficulty
ADL Mobility	DB001	Running or jogging for about 1km
	DB005	Climbing several flights of stair without resting
ADL Agility	DB004	Getting up from a chair after sitting for a long period
	BD006	Stooping, kneeling or crouching
	BD007	Reaching or extending arms above shoulder level
	BD008	Lifting or carrying weights over 10 pounds
	BD009	Picking up a small coin
ADL Basic	DB010	Dressing
	DB011	Bathing or showering
	DB012	Eating
	DB013	Getting into or out of bed
	DB014	Using toilet
	DB015	Controlling urination and defecation
Instrumental ADL	DB016	Doing housework
	DB017	Preparing hot meals
	DB018	Shopping for groceries
	DB019	Managing money
	DB020	Taking medicines

Note: According to Meyer (2013), we assign one point to every difficulty. The ADL index is the points scored by the respondent divided by 18.
Source: 2011, 2013 and 2015 waves of CHARLS data.

Table 4.A3: Consumption and health insurance

	(1) Total consumption	(2) Non-medical consumption	(3) Non-durable consumption	(4) Non-medical consumption excluding durables
UEBMI	0.417***	0.376***	0.408***	0.363***
	(0.0388)	(0.0418)	(0.0373)	(0.0400)
RHI	0.130***	0.0728**	0.123***	0.0650**
	(0.0313)	(0.0339)	(0.0301)	(0.0324)
Age	-0.0246***	-0.0314***	-0.0266***	-0.0322***
	(0.00826)	(0.00903)	(0.00785)	(0.00861)
Age^2	6.79e-05	9.60e-05	0.000101	0.000121*
	(6.57e-05)	(7.23e-05)	(6.23e-05)	(6.88e-05)
Gender	0.0237	0.0240	0.0295*	0.0269
	(0.0164)	(0.0176)	(0.0158)	(0.0169)
Secondary School	0.0984***	0.0928***	0.0939***	0.0896***
	(0.0194)	(0.0204)	(0.0188)	(0.0198)
Married	0.370***	0.330***	0.340***	0.290***
	(0.0491)	(0.0535)	(0.0469)	(0.0513)
Widowed	0.169***	0.189***	0.131***	0.144***
	(0.0504)	(0.0548)	(0.0489)	(0.0532)
Income	0.0432***	0.0508***	0.0359***	0.0423***
	(0.00311)	(0.00337)	(0.00291)	(0.00316)
Wealth without durables	0.106***	0.120***		
	(0.00410)	(0.00456)		
Wealth			0.137***	0.156***
			(0.00474)	(0.00529)
ADL	0.170***	0.0180	0.194***	0.0345
	(0.0451)	(0.0483)	(0.0428)	(0.0460)
Chronic	0.0591***	0.0141	0.0638***	0.0178
	(0.0179)	(0.0188)	(0.0172)	(0.0183)
Urban	0.0724***	0.0891***	0.0602***	0.0721***
	(0.0192)	(0.0207)	(0.0185)	(0.0199)
Farming	-0.106***	-0.0458**	-0.0971***	-0.0452**
	(0.0187)	(0.0201)	(0.0180)	(0.0194)
Employed	-0.120***	-0.0586*	-0.0997***	-0.0550*
	(0.0309)	(0.0329)	(0.0299)	(0.0320)
Other work	-0.0351	0.00611	-0.0428	-0.00466
	(0.0379)	(0.0419)	(0.0367)	(0.0394)
HHsize	0.0314*	0.0372*	0.0279*	0.0331**
	(0.0169)	(0.0195)	(0.0144)	(0.0166)
Constant	8.710***	8.693***	8.379***	8.285***
	(0.264)	(0.288)	(0.253)	(0.276)
Obs.	15,066	15,066	15,424	15,426
Number of ID	8,487	8,481	8,572	8,570
Prob. > F	0.000	0.000	0.000	0.000

Note: Equations are estimated with a random-effects model. Provincial and time dummies are included, but the coefficients are not reported for brevity. Significance is indicated to the one percent level (***), five percent level (**) and ten percent level (*). Standard errors are in parentheses. The *p*-values of *F*-tests for the equality of the coefficients associated with UEBMI and RHI are reported at the end of the table. See the Appendix for complete definitions of all variables.

Table 4.A4: Medical expenditure and health insurance

	Outpatient		Inpatient		Self-treatment	
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	OOP	Total	OOP	Total	OOP
UEBMI	0.396***	0.297***	0.607***	0.602***	0.663***	0.294***
	(0.0769)	(0.0734)	(0.0956)	(0.0857)	(0.0848)	(0.0845)
RHI	0.260***	0.254***	0.432***	0.393***	0.282***	0.308***
	(0.0584)	(0.0554)	(0.0757)	(0.0690)	(0.0637)	(0.0629)
Age	0.0218	0.0263**	0.0547***	0.0479***	0.0683***	0.0711***
	(0.0141)	(0.0134)	(0.0184)	(0.0164)	(0.0161)	(0.0160)
Age^2	-0.000264**	-0.000304***	-0.000381***	-0.000338***	-0.000618***	-0.000651***
	(0.000112)	(0.000107)	(0.000144)	(0.000128)	(0.000128)	(0.000127)
Gender	-0.154***	-0.135***	0.129***	0.114***	-0.0242	-0.0183
	(0.0302)	(0.0286)	(0.0377)	(0.0335)	(0.0353)	(0.0350)
Secondary School	0.0258	0.0295	0.000787	0.0124	0.137***	0.109***
	(0.0366)	(0.0347)	(0.0463)	(0.0410)	(0.0426)	(0.0422)
Married	-0.124	-0.0858	0.107	0.112	0.149	0.146
	(0.0998)	(0.0949)	(0.127)	(0.114)	(0.119)	(0.118)
Widowed	-0.0591	-0.0393	-0.0235	-0.0439	0.0792	0.0648
	(0.107)	(0.102)	(0.136)	(0.122)	(0.127)	(0.126)
Income	0.0196***	0.0173***	0.00429	0.00622	0.0343***	0.0316***
	(0.00546)	(0.00517)	(0.00665)	(0.00601)	(0.00616)	(0.00607)
Wealth	-0.00508	-0.00642	-0.00367	-0.000461	0.0119	0.00742
	(0.00750)	(0.00710)	(0.00915)	(0.00822)	(0.00865)	(0.00856)
ADL	0.856***	0.828***	1.196***	0.967***	1.105***	1.105***
	(0.0753)	(0.0713)	(0.0889)	(0.0794)	(0.0882)	(0.0872)
Chronic	0.490***	0.444***	0.529***	0.440***	0.949***	0.912***
	(0.0357)	(0.0338)	(0.0474)	(0.0422)	(0.0394)	(0.0391)
Urban	-0.0170	-0.0301	0.0243	0.0325	0.177***	0.160***
	(0.0347)	(0.0328)	(0.0435)	(0.0387)	(0.0409)	(0.0405)
Farming	0.0290	0.0387	-0.421***	-0.357***	-0.0849**	-0.0473
	(0.0338)	(0.0319)	(0.0420)	(0.0377)	(0.0395)	(0.0390)
Employed	-0.249***	-0.197***	-0.475***	-0.408***	-0.233***	-0.192***
	(0.0648)	(0.0611)	(0.0848)	(0.0753)	(0.0714)	(0.0707)
Other work	-0.139*	-0.115	-0.273***	-0.245***	-0.0818	-0.0438
	(0.0758)	(0.0718)	(0.0938)	(0.0839)	(0.0842)	(0.0831)
HHsize	-0.00308	-0.00208	0.00400	0.00318	0.00133	0.000292
	(0.00464)	(0.00426)	(0.00363)	(0.00331)	(0.00429)	(0.00455)
Obs.	27,457	27,453	27,430	27,469	27,503	27,480
Number of ID	15,155	15,153	15,151	15,163	15,717	15,163
Prob. > F	0.015	0.422	0.008	0.000	0.000	0.825

Note: The equations are estimated with a random-effects Tobit model, and the marginal effects are reported. Provincial and time dummies are included, but the coefficients are not reported for brevity. Significance is indicated to the one percent level (***), five percent level (**) and 10 percent level (*). Standard errors are in parentheses. The *p*-values of *F*-tests for the equality of the coefficients associated with UEBMI and RHI are reported at the end of the table. See the Appendix for complete definitions of all variables.

5 Conclusion

This chapter concludes the thesis. A summary of the empirical results presented in Chapters Two, Three and Four is provided in Section 5.1, and we outline the implications of our findings in Section 5.2. In Section 5.3, we discuss the limitations of our research and provide suggestions on future research related to the topics we covered.

5.1 Summary of the Findings

This thesis consists of three empirical studies on the financial behaviour of Chinese households in relation to population ageing, household composition and health insurance. The key findings are as follows.

Chapter Two uses provincial panel data on a total of 31 Chinese provinces and directly-controlled municipalities over the period 1995-2015 to examine the determinants of household savings ratio. We focus on the effects of the old-age dependency ratio. We find a negative relationship between the old-age dependency ratio and household savings. We also find that the negative association between old-age dependency ratio and household savings is weaker in areas where government expenditure is high, as well as in regions with good financial development and high insurance density.

In Chapter Three, we use the 2011 and 2013 waves of the CHARLS, which consists of more than 10,000 households from 28 provinces in each wave, in order to study household consumption when offspring members move out. Using a range of specifications and estimation methodologies, we document the following findings. First, households reduce their total consumption when a member moves out from the family

home. Second, the effects of a member moving out on household consumption depend on the leaver's age. Lastly, Chinese households save a large proportion of resources freed up when an offspring member moves out, which shows that residents in China have a strong saving motivation. The results show that the reallocation of the freed-up resources closely depends on the leaver's age. If the leaver is aged under 25, the household saves all the extra resources. In contrast, if the leaver is aged 25 and over, parents spend a small proportion of the freed-up resources to increase their personal consumption.

Chapter Four uses the 2011, 2013 and 2015 waves of CHARLS to evaluate and compare the main types of public health insurance schemes in China. We document the following findings. First, both UEBMI and RHI are positively associated with household consumption and medical expenditure. Second, residents who hold UEBMI tend to consume more and spend a larger amount of money on healthcare services than their counterparts who hold RHI. Moreover, our study finds that low income group who hold RHI cannot purchase sufficient medical treatment while wealthier residents who hold UEBMI tend to overuse healthcare services.

5.2 Implications of the Study

The findings in Chapter Two confirm that there is a negative association between old-age dependency ratio and household savings. Given the rapidly ageing population, declines in labour supply and savings are expected, along with corresponding contractions in economic growth. Our study in the second Chapter shows that developments in the social welfare system and financial markets alleviate the negative effects of the old-age dependency ratio on savings. Therefore, we recommend countries, where the

ageing population negatively impacts savings to a large extent, to further develop these institutional structures and encourage participation in financial and insurance markets. Possible approaches could include implementing more effective healthcare schemes, increasing financial literacy through education, and extending credit to the private sector. In addition, our results show that the association between old-age dependency and savings is significantly weaker in urban areas. Thus, we highly recommend Chinese government to take actions to reduce inequality between rural and urban areas, especially in the social welfare systems, education, and financial development.

Our findings in Chapter Three show that Chinese households tend to save the resources freed up when a household member moves out, rather than use these resources to increase their consumption. This reveals strong saving motivations of Chinese households. This could be caused by the low level of social welfare benefits and the lack of development in the financial markets, which are required to appropriately diversify income and consumption risks. Along with an ageing population, the pension scheme deficit will increase, and the government may have to reduce their expenditure on the public pension schemes. This issue puts extra stress on Chinese residents and further increases their saving motivations.

Relevant policies should be established to reduce households' income and consumption uncertainties to alleviate the need for such high levels of precautionary saving among households and consequently encourage consumption. This can be achieved by further diversifying the pension system in China and incentivising financial institutions to offer new products. Also, the government could endeavour to improve financial literacy among its citizens and advise households on how to utilise the financial

markets appropriately, especially with regard to private pension schemes or other similar financial instruments in order to supplement the insufficient state pension schemes.

The findings in Chapter Four show that there exist substantial differences in the accessibility of healthcare services between residents who hold UEBMI and those who hold RHI. To consolidate health insurance in China, the Chinese government must put significant efforts into reducing those inequalities. One important step is to unify the benefit packages of the different public health insurance schemes. Our results show that RHI fails to provide enough financial assistance for the poor people and that rich people with UEBMI tend to overuse healthcare services. Considering that the government faces a fiscal constraint, providing totally free healthcare services may be impractical. We therefore propose a national healthcare security system where reimbursement rates are asset-based and means-tested.

This recommended national health insurance programme would provide a generous reimbursement plan, like the benefit package currently available under the UEBMI programme, to people with low household wealth. Additionally, it would provide a smaller reimbursement rate to wealthy people, like the one which the RHI scheme presently employs. This type of health insurance would efficiently allocate resources to the people who need them most and reduce the waste of resources. Moreover, our results also suggest that the government should enhance supervision on healthcare service providers and restrict them from giving excess treatment to patients for profit-making.

5.3 Limitations and Future Research

In Chapter Two, we analyse household savings and the old-age dependency ratio with aggregate data. Future work could look at the savings behaviour of elderly Chinese people with individual-level or household-level data, focusing on the role of out-of-pocket medical expenditure. In Chapter Three, we analyse household composition and household consumption with a 2-year panel data. Therefore, we cannot apply a dynamic model to test the changes in household consumption over time. In addition, our study does not consider the potential endogeneity between household consumption and the departure of household members. Our results are therefore not able to reflect the causality effects that may exist between these two variables, and this is an area worth further investigation. Furthermore, it would be interesting to apply our model to other countries in a comparative context in order to establish whether similar results could be obtained.

In Chapter Four, we use the CHARLS data, which focus on residents aged 45 and over, and is thus not a representation of the whole Chinese population. Using a dataset which also considers residents aged under 45 may probably lead to different conclusions. This is the limitation in Chapter Three as well. Also, we do not consider the possible endogeneity between participation in public health insurance and our key variables. Furthermore, the medical expenditure data are only available for people who have received medical treatment. This means that the medical expenditure data can only be partially observed. We use random-effects Tobit model to estimate the equation of medical expenditure. Future work could apply more advanced methodologies to eliminate section bias. In addition, it would be interesting to study this topic in other countries where there is more than one public health insurance scheme, like India. Finally, further research

could investigate the effects of health insurance, considering the health status of other household members.

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