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Thesis on household poverty and wellbeing in China

A thesis submitted for the degree of

Doctor of Philosophy

by

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Declaration

I, SHUO DING, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature: SHUO DING Date: 24/06/2022

Abstract

My research is focused on estimating household vulnerability to poverty in China. Different from the traditional assessment of household economic status, which measures the static status of household poverty, I stress poverty as being a multifaceted and dynamic phenomenon and estimate the ex-ante probability of households being poor in the future.

In the first chapter, I propose a subjective poverty line for each household to quantify the vulnerability to poverty in urban and rural households by considering residents' expectations and their propensity to compare their perceived welfare level with those of other community members. The research question is whether the Chinese rural household are more likely to enter the poverty under the measurement of subjective poverty line. The findings show that the overall vulnerability incidence in urban households is lower than in rural households. The regional differential in terms of vulnerability to poverty continues to exist, but the western province in both urban and rural households has not shown a significantly higher vulnerability rate than in other regions. Educational qualification is a determinant of the vulnerability of rural residents, whereas it does not have remarkable positive effects on urban households. Meanwhile, the impacts of welfare systems upon both urban and rural households are larger than expected, while the coverage of them is incomplete and calls for government to implement more social reforms to mitigate the risk and buffer the vulnerability, and to adopt a more equalising approach (instead of unrestrained growth).

In the second chapter, I apply the FGLS approach in order to explore the incidences and sources of poverty and vulnerability in urban China, the research question is whether the influence of covariate shocks upon household vulnerability to

poverty is more than that of idiosyncratic shocks in urban Chinese household. Our results show that idiosyncratic shocks have a greater influence on household vulnerability, though both idiosyncratic and covariate shocks make contributions to household vulnerability to poverty. All the regions that we have discussed in this study follow this pattern except for Chongqing, a municipality in the western region that shows that idiosyncratic shocks have impacts that are equal to those of covariate shocks, which indicates that the insurance mechanism within the community makes a contribution to household income that is similar to that of the insurance mechanism across spatially separated communities. This implies that, in contrast to all other regions, which show a higher impact of idiosyncratic shocks upon household income than that of covariate shocks, Chongqing finds it easier to implement an ex-ante coping strategy to reduce household vulnerability to poverty, as idiosyncratic shocks are more difficult to anticipate than covariate shocks.

In the third chapter, based on the 2013, 2015 and 2018 Chinese elder household surveys, I observe the changes in vulnerability of elder households to poverty during these years and the first research question is whether the different types of medical insurance are closely link with the incidence of vulnerability. And the second one is whether types of medical insurances have more significant effects on reduce the vulnerability to poverty in rural household than that in urban household. The results show that the vulnerability rate in rural areas is decreasing gradually, while the vulnerability rate in urban areas is increasing. Meanwhile, New Cooperative Rural Medical Insurance and Civil Servant Medical Insurance show a significant impact on reducing household vulnerability, while other medical insurance makes no significant contributions to the incidence of vulnerability, which is contrary to the empirical studies suggested.

Overall, from the first chapter to the last chapter, different types of poverty line are used to test the characteristic Chinese household with vulnerability to poverty. The first chapter emphasizes the significant impact of children and youth on the household and the second one focus on the effect of adult and the last chapter concentrates on the influence of the elder on the household vulnerability to poverty. The whole paper covers all age groups in Chinese household and considers all the possible structures of Chinese household.

Impact Statement

Inside academia

I assess the incidence of Chinese household vulnerability based on cross-sectional and longitudinal data, and observe the changes in household risk of being poor under the effects of different types of individual-level and household-level shocks, which fills the gap that previous relevant research papers have focused only on a fixed year, unable to evaluate the trend of vulnerability rates. Moreover, the methodology that I have applied in this thesis could inspire researchers to explore relevant research studies.

Meanwhile, this thesis applies the new equivalence scale for the different size households. Considering the difference of costs between children aged between 0 and 7, and youth between 7 and 16 and assign them with different adult equivalence. Then explores how welfare schemes contribute to household well-being, providing a clear perception of how welfare policies affect individual decision making after retirement, health, and saving behaviors. Furthermore, it shows a deep understanding of how urban and rural residents respond to different types of pensions and medical insurance, behaviors that are not easy to capture through standard economic models.

Outside of academia

This thesis shows that with the influence of the one-child policy, the traditional Confucian value of taking care of elders as a priority, which is rooted in the hearts of several Chinese generations, has changed. On the contrary, an increasing number of elders must share the dual burden of taking care of themselves and offspring, which is harmful for their well-being after retirement. Throughout the course of my PhD, I have spoken to officials at the Chinese National Social Security Bureau to discuss the results of my research. They agree with my findings, and policymakers are aiming to solve this problem in the next decade. I will endeavor to continue to do so and undertake future research in these areas.

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Introduction

The United Nations set the first goal of the 17 Sustainable Development Goals as alleviating all forms of poverty everywhere by 2030. As a developing country that once had the largest number of poor people in rural areas, eliminating poverty has been a consistent theme for the Chinese government (Liu et al., 2020). Since the reform and opening-up in 1978, China has made great contributions to alleviating absolute poverty by delivering improvements in residents' living standards, public amenities, and infrastructural services, which decreased the absolute poverty rate from 49.8% in 2000 to 0.6% in 2019, as well as lifting more than 700 million rural residents out of poverty (National Bureau of Statistics of China, 2020; Wang and Zhou, 2020).

The success with regard to eliminating poverty in China is highly related to the implementation of a great number of large-scale anti-poverty programmes, which can be divided into the following four stages: first stage (1978–1985) with the aim of reducing the absolute poverty rate; second stage (1986–2000) with the aim of alleviating poverty with an orientation towards development; third stage (2001–2012) with the aim of alleviating poverty with an orientation towards consolidation; and fourth stage (2013–2020) with the aim of alleviating poverty for targeted groups. During the fourth stage, the number of poor residents in rural China decreased from 98.99 million to 0, with 128,000 impoverished villages getting rid of poverty (Guo et al., 2019; Zhang, 2021; Nong et al., 2021).

Compared to eliminating the absolute poverty rate, the assessment of vulnerability in Chinese households has gradually become a particular concern in China and an important topic of analysis for scientific research on sustainability.

As the definitions of vulnerability in research and the target objectives are varied across previous research studies, in this study I define vulnerability as a stochastic poverty prediction, i.e., the risk of a household being poor in the future.

This thesis applies multidimensional methods in order to identify household vulnerability to poverty and explore its determinants among the different characteristics of Chinese households. Specifically, the first chapter applies the subjective poverty line based on households' annual minimum cash requirement and household income to assess how the poverty rates and vulnerability incidences vary across urban and rural Chinese households. In order to explore how household-level (idiosyncratic) and community-level (covariate) shocks contribute to household vulnerability incidences mutually, the second chapter applies a multilevel model in order to take both idiosyncratic and covariate shocks into account, aiming to identify their impacts on urban households' vulnerability to poverty. Based on the first and second chapters, the third chapter further analyses the driving force behind vulnerability to poverty in households with elders from 2013 to 2018, not only estimating the trend of households being poor, but also assessing the impacts of national welfare schemes, such as medical insurance and pension, on reducing the probability of households entering poverty in urban and rural Chinese households separately.

Chapter 1 – A comparative analysis of vulnerability to poverty between urban and rural households in China

1.1. Introduction

During the economic reform that started in 1978, China experienced rapid economic growth and underwent a remarkable transformation. During the process, the disparity (in terms of household poverty) between urban and rural areas and among provinces increased significantly, attracting considerable attention (Park and Wang, 2001; Li et al., 2013; Zhang et al., 2014; Qi and Wu, 2016). Indeed, the Chinese government has taken measures to curtail household poverty. However, as the traditional poverty line mainly measures absolute poverty and assesses the current poverty status, it does not consider the future poverty status. In other words, the existing absolute poverty line[1] considers only the static status of household poverty while ignoring that poverty is a multifaceted and dynamic phenomenon. Under this circumstance, the vulnerability assessment estimates the ex-ante probability of households becoming poor in the future.

Furthermore, unlike previous research that established a standardised poverty line for households, this analysis proposes a subjective poverty line for each household to quantify the vulnerability to poverty in urban and rural households by considering residents' expectations and their propensity to compare their perceived welfare level with that of other community members. Moreover, this study will explore how potential factors affect vulnerability to poverty and how these factors foster social and economic disparities between urban and rural households. Meanwhile, it is worth evaluating how

[1] China set its absolute poverty line in 2011 at 2300 RMB per annum at 2010 constant prices. The amount was equivalent to 340 US dollars.

geographical differences exist in the vulnerability to poverty of urban and rural households in regions with distinct economic growth statuses (Peng et al., 2010; Rizov and Zhang, 2013). Specifically, the economic reform and the open-door policy[2] in 1978 not only brought spectacular economic growth into coastal regions, but also widened the regional disparities between coastal regions and inland regions, especially for western areas with few highways and navigable rivers.

The findings also evaluate the effects of several social welfare systems launched by the Chinese government since 2003 upon poverty reduction and assess whether the gap between urban and rural households in terms of vulnerability to poverty has decreased. Specifically, the Chinese government implemented the New Medical Insurance Scheme to reduce the financial burden on poor patients by gradually covering extended medical treatment and establishing a rural pension scheme to double the pension coverage in rural regions (Zhang et al. 2006; Atella, Brugiavini, and Pace 2013).

The paper is structured as follows. The literature review looks at recent research on vulnerability to poverty and examines various forms of poverty lines to assess household deprivation. After the data sample description, the methodology section explains how the subjective poverty line can measure the impacts of various factors upon the vulnerability level of households in urban and rural areas, respectively. Final results are provided regarding how the vulnerability level varies regionally and across urban and rural households. They can be adopted to illustrate possible factors that affect poor households and conduct a multidimensional assessment of the vulnerability in urban and rural households, respectively.

[2] The open-door policy consists of two major types of policy change: the opening-up of geographical regions to foreign investment (Guangdong, Shenzhen, Fujian, Liaoning and Shandong provinces), and the opening-up of specific institutions nationwide.

1.2. Literature review

Among many studies have discussed the issue of households' vulnerability, some describe vulnerability as the probability of becoming poor in the near future (Suryahadi, Sumarto & Pritchett, 2000; Kurosaki, 2002; Chaudhuri, Jalan & Suryahadi, 2002; Heitzmann, Canagarajah & Siegel, 2002; Chaudhuri, 2003; Christiaensen and Subbarao, 2005). Chaudhuri, Jalan & Suryahadi (2002) claim that vulnerability is concerned with the ex-ante probability of a non-poor household falling below the poverty line or a poor household remaining in poverty. Heitzmann, Canagarajah & Siegel (2002) partially agree with the argument and further point out that vulnerability could be regarded as the probability of welfare loss relative to a predetermined benchmark. Chaudhuri (2003) arrives at the same conclusion and goes further to explain vulnerability as the probability of incurring a significant welfare shock, which results in a household being unable to reach a predefined benchmark. Accordingly, Christiaensen and Subbarao (2005) define vulnerability as the probability of becoming poor in the future.

Meanwhile, some studies have highlighted the relationship between risk and vulnerability. Suryahadi, Sumarto & Pritchett (2000) regard vulnerability as the risk of a household experiencing poverty at least once in the near future. Kurosaki (2002) presents a similar argument and explains vulnerability to consumption risk as the situation in which consumption must be drastically reduced after experiencing negative shocks. Similar to Kurosaki (2002), several studies have linked vulnerability with consumption. According to Christiaensen and Boisvert (2000), food consumption is related to vulnerability and the probability of being undernourished in the future. Thus, it should be considered in the measurement of vulnerability in households. Furthermore, Kamanou and Morduch (2002) raise a concern on vulnerability related to not only food consumption, but also the consumption of necessities in daily life. According to the

authors, “households or groups are judged to be more vulnerable if standard deviations of past consumption changes are higher”.

Günther and Harttgen (2009) disagree with Kamanou and Morduch (2002) concerning vulnerability and regard vulnerability as the probability of suffering negative income shocks. A similar argument also appears in the study conducted by Glade (2003), wherein vulnerability is defined as a stochastic poverty prediction, which is based on past analysis of income and shocks. Both Cunningham and Maloney (2000) and Albert, Elloso and Ramos (2007) point out that vulnerability is a question of both changes in economic status and the initial position in income distribution.

Vulnerability has been conceptualised in various ways in the aforementioned studies. However, all the definitions share a common feature: Vulnerability implies a relation among poverty, risk, and risk management.

With regard to the poverty threshold, absolute poverty and relative poverty lines are widely discussed (Townsend, 1985; Chen and Ravallion, 1996; Khan and Riskin, 2001; Park and Wang, 2001; Sen, 2008; Green and Hulme, 2005). Khan and Riskin (2001) define an absolute poverty line based on a minimum appropriate caloric requirement of between 2000 and 2500 calories per person per day and non-food consumption per person per day. The absolute poverty line considers a minimum living standard. However, several scholars have criticised its feasibility when measuring the living standard in countries with different institutions (Callan and Nolan, 1991; Park and Wang, 2001; Sen, 2008). Sen (2008) argues that the measurement of absolute poverty neglects “welfarism”, and explains the term as encompassing any interpersonal comparisons of utilities. Park and Wang (2001) raise a concern surrounding the errors associated with the sources of measurement in the calculation of an absolute poverty

line, and show that the inter-provincial differences in food prices increase the difficulty of obtaining a united standard.

In Mainland China, there is no mandated and united absolute poverty line for households across urban regions. Instead, the living standard guarantee programme is considered to be the urban absolute poverty line (Wu et al. 2010; Zhang et al. 2014). The urban minimum living standard guarantee programme in China is called *dibao*. It is aimed at providing very low-income households with a transfer payment, which would enable them to maintain their basic livelihood. In accordance with the programme, a direct payment is provided to households. The payment is equal to the difference between the average income per person in a household and the defined minimum income threshold. This threshold needs to be equivalent to the cost of clothing, food, and other necessities. This programme is administered at the municipal level and the payment amount varies among regions and considerably reflects the financing capacity of the local government[3]. In addition, the price differences between the 31 mainland first-level administrative areas (including provinces, provincial-level municipalities, and autonomous regions — all such entities are referred to as "provinces" hereafter) imply that the urban minimum income threshold is different across provinces. It is based on the province-specific consumer price indexes. However, Li et al. (2013) argue that the gap between thresholds in certain provinces is larger than the expected result based on the GDP. Specifically, the urban minimum income poverty line in Shanghai is one third higher than in urban Henan, and nearly two thirds higher than in urban Jilin, where the GDP per capita level is higher than Henan. In addition, the ability of the minimum income thresholds to reflect the actual economic status has been

[3] In developed regions, like Shanghai and Beijing, the payment was higher than 8000 RMB per annum in 2015, while in less developed regions, like Anhui and Henan, the payment was merely 4500–4800 RMB per annum (www.nrra.gov.cn).

questioned. Bhattamishra (2008) stresses that the average threshold in China is much higher than the poverty line defined by the World Bank. Moreover, the *dibao* system excludes certain residents who are eligible for entitlement.

In many developed countries, compared to the absolute poverty line, the relative poverty line is mainly used to measure the degree of poverty. Instead of being based on a fixed minimum living standard, it considers the standards of living to which the majority are subject. Specifically, contrary to the absolute poverty line, this measurement is more concerned with whether a household is stressed when excluded from the standard of living of most households in the society. Both Sen (2004) and Townsend (1985) point out that this measurement is highly correlated with the welfare measure's development within the sample. If the income distribution widens, the poverty headcount rate at the relative poverty line will increase.

The relative poverty line is also used to measure the degree of poverty in China (Wong, 1995; Wong, 1997; Saunders, 2007; Osberg and Xu, 2008; Qi and Wu, 2016). Compared to provinces in developed countries with similar economic development, the heterogeneous economic development of different provinces in China tends to be measured at the regionally differentiated poverty line. Wong (1995, 1997), based on local economic development and the local standard of living, suggests a relative poverty line at 50% of the median income in Guangzhou and Shanghai. It is further illustrated that the regional difference in terms of income inequality widened from 1995 to 1997. Saunders (2007) adopts a similar approach to the one proposed by Wong (1995, 1997). The study focuses on elderly residents in urban China and points out that the relative poverty rates among the elderly in urban China are as high as the relative poverty rates among the elderly in developed countries such as the United Kingdom and the United States. Furthermore, Osberg and Xu (2008) define the relative poverty line at 50% of

the median income in urban and rural China, respectively. They find that in terms of the poverty rate there is a considerable difference between urban and rural areas. A similar approach is adopted by Qi and Wu (2016), wherein the focus is mainly on investigating the relationship between the relative poverty rate and the number of children in urban China. They find that the relative poverty rates for households owning local city *hukou* [4] with more than one child had increased in comparison to those households with one child under the same conditions in the past decade. It is worth noting that some of the aforementioned papers set a relative poverty line based only on per adult consumption and neglect the effects of children upon household consumption, while some of them merely consider the number of children in a household and ignore the difference between children and adults in terms of consumption. Thus, their consideration of the possible influencing factors is not comprehensive. Moreover, instead of reflecting on an individual's actual economic status, the aforementioned studies focus only on measuring the proportion of the population obtaining an income lower than a fixed percentage of the median income.

In addition to the two mainstream measurements of poverty mentioned above, Goedhart et al. (1977), Gustafsson, Shi & Sato (2004) and Gustafsson and Yue (2006) consider household income and expenditure and create a subjective poverty line based on a respondent's minimum cash requirement. They apply it in order to measure the degree of poverty in urban and rural households, respectively. The equivalence scale is an important component in estimating the subjective poverty line. It changes from one country to another. Forster (1994) points out that if the household size is used as the determinant, equivalence scales can be shown through "equivalence elasticity" [5].

[4] Hukou is a system of household registration used in mainland China.
[5] The rate at which economic needs change with household size.

Atkinson, Rainwater & Smeeding (1995) apply the same method to the measurement of household poverty and further explain that equivalence elasticity can range from 0, when unadjusted household disposable income is obtained as the income measure, to 1, when per capita household income is used. In other words, the smaller this equivalence elasticity is, the higher the economies of scale that appear in consumption. Several equivalence scales are used for estimating the subjective poverty line in countries with different institutions. Even in the OECD, it is difficult to find an equivalence scale that can be recommended for general use.

Several studies have provided different equivalence scales in China. The analysis groups are different and intra-differentiation exists across different regions. Huang (2013) assigns the value of 1 to the first member of the household in Hong Kong. The value of 0.33 is applied to other adults in the household, and the value of 0.47 is applied to each child in the family. Although this equivalence scale has been widely criticised, it is difficult to deny that the expenditure on education and healthcare for children in Hong Kong is higher than in most cities in East Asia. In contrast to the criticism of the equivalence scale in Hong Kong, there are few debates surrounding the equivalence scales in Mainland China.

If we consider the number of children in a household, it is difficult to ignore the effects of the one-child policy, which was implemented in the 1980s, on Mainland China's households. The policy mandated that each family could have only one child, which reduced China's fertility rate dramatically. However, in contrast to urban areas with more severe punishment regarding multiple-birth households, rural areas showed laxity in enforcing punishment on those households, which means that the average number of children in rural areas is greater than that in urban areas (Zhang, 2008). It is

worth noting that previous studies have not considered the effects of children upon the level of poverty and that the value is set only for adults in households.

The expenditure on smaller children in a family is higher than expected, especially for children aged below seven in Mainland China. Expenditure on smaller children comes mainly from two aspects. The first aspect is food consumption, with parents more likely to feed babies with more expensive imported food, such as milk, instead of rice and grain (as is customary with adults). A survey indicates that young parents insist that imported children's food has more nutrition and is helpful for children to grow up. However, the average bottle of imported milk costs $40, which is more expensive than other food in China and increases food consumption in households significantly (Sabates, Gould & Villarreal, 2001; Gould and Villarreal, 2006). Simultaneously, the coverage of public kindergarten in the Chinese community is limited and unable to satisfy the needs of most households with small children, forcing parents with a strong desire towards "providing their children with a head start" to turn to private kindergarten with expensive educational expenditure (Pan et al., 2020; Wang and Wu, 2021). Moreover, households with small children are unable to gain more financial support from local municipal authorities. In addition, compared to children between the ages of seven and 16, children below the age of seven require more care from the family, which causes parents to struggle to manage the family budget, and they may be more likely to enter poverty. The percentage of child expenditure in a household in China is higher than that in other Asian countries and it is worth taking the number of children aged between zero and seven into account in this study (Zhang, 2008; Huang, 2013).

This study divided children into two groups, namely children aged between 0 and 7 and children aged between 7 and 16, as China implemented a nine-year compulsory education policy in 1986 and enables all children to have free education in both primary

school (Grades 1–6) and junior secondary school (Grades 7–9). In general, a child starts primary school in year 7 and finishes secondary school in year 16 (Liu and Qi, 2005; Yang, 2018). During this period, teachers in different types of schools assume the responsibility of caregivers, and literally decrease household expenditure in this respect. Furthermore, it is worth observing whether free education could decrease the financial burden on families and whether the number of children (below year 7) and number of youths (years 7–16) show varied impacts on household vulnerability to poverty.

Moreover, considering that the consumptions of children aged between 0 and 7 and children aged between 7n and 16 are varied, this study assigns them different values when measuring the household income scale, which is different from in past papers and ensures that the adjusted per adult household income equivalent and per adult household minimum cash requirement equivalent could reflect the actual economic situation for each household.

1.3. Data description

In general, panel data is suited to estimating household vulnerability to poverty, since it provides essential information on the same households for a period of time. However, detailed panel data, such as the minimal monetary demand of a household, is difficult to find in China. In these scenarios, cross-sectional data will be employed in this study to evaluate vulnerability to poverty.

The cross-sectional data comes from the Chinese household income project 2013-urban (CHIPU) and the Chinese household income project 2013-rural (CHIPR), which contain respondents' personal information such as age, educational qualifications, health conditions, marital status, employment situation, and whether the pension, work injury, and housing fund are available, respectively. In addition to basic personal

information, the Chinese household income project collects financial information on each respondent's family, such as household income, total value of durables, and financial assets, which can be used to assess the relationship between family characteristics and their vulnerability to poverty. Furthermore, this dataset depicts the minimal cash necessary to support the entire family, which may be used to compute each household's subjective poverty line.

Tables 1.2 and 1.3 show the factors that are used in this study. To accurately measure a household's income scale, the head of the household and other adult family members are assigned values of 1 and 0.7, respectively, while those below the age of 18 but above seven and those below the age of seven are assigned values of 0.47 and 0.30, respectively. The new values are created in this paper basing on the average costs for raise children and youths.[6] A household's income and minimum cash requirement are then divided by the household's total equivalent, and the household's income per adult equivalent and the household's cash requirement per adult equivalent can be calculated independently (Huang, 2013; Angelillo, 2014).

In addition, we examine *hukou*, a unique method of household registration utilised in Mainland China. There are several types of *hukou* in urban and rural China, including local city *hukou*, non-local city *hukou*, local city rural *hukou*, and non-local rural *hukou*. Of these, only local city *hukou* is assumed to significantly impact urban and rural residents' income and welfare programmes, as this type of *hukou* entitles holders to purchase a house and car in a local city and provides them with a generous medical aid, housing fund, and pension, as well as enabling their children to access local public elementary and secondary schools. Thus, we control local city *hukou* as an independent

[6] The average costs can be found on the Chinese children nutrition survey for 2013,2015 and 2017.

variable to measure a household's vulnerability to poverty in both urban and rural families.

The following two marital status categories are evaluated as being married, according to the head of a household's marital status: married and remarried. As married persons are more likely to share the burden of caring for the elderly and children, they can be relieved from some mutual job and familial pressures. Previous research has suggested that, compared to a single person, a marital status of married may boost a household's income and reduce the risk of becoming poor, which is worth discussing in this study (Stone and Short, 1990; McDowell, 2005).

It is necessary to mention that this study uses an aggregate index for well-being, rather than individual variables, since the endowment of different social securities by households is strongly connected, and inserting them into the model separately might result in no significant impact. The welfare index is calculated by the following five social security variables of medical insurance, housing fund, work injury, pension, and unemployment insurance proportionally and contrast to put each of them into model, the issue of correlation will be solved.[7].

Table 1.1: Descriptive statistics for urban households.

Description of the variables	Mean	SD	Min	Max
ln (household income per adult equivalent)	10.28	0.63	6.70	13.66
ln (household minimum cash requirement per adult equivalent)	9.64	0.62	6.34	12.25
Adult equivalent	2.25	0.68	1	5.5

[7] The scoring coefficient is presented in Appendix 1.

Head of household: female	.27	.45	0	1
Age of head of household	50.22	13.18	17	97
Married	0.89	0.32	0	1
Household belongs to ethnic minority	0.05	0.21	0	1
Number of the elderly	0.52	0.80	0	4
Number of youths (aged 7-18)	0.25	0.47	0	4
Number of children	0.19	0.42	0	2
Belong to the CPC[8]	0.27	0.45	0	1
Bad health	0.06	0.24	0	1
With local hukou	0.84	0.36	0	1
Coastal regions	0.17	0.38	0	1
With Long-term contract	0.37	0.48	0	1
Illiteracy	0.21	0.41	0	1
Demolition[9]	0.12	0.33	0	1
Employed	0.66	0.48	0	1
Demolition with no compensation	0.23	0.43	0	1
Satisfy with living standard	0.83	0.37	0	1
Satisfy with economic situation	0.21	0.41	0	1
ln (financial assets)	10.47	1.40	4.61	15.20
welfare	0.35	0.17	0	1.25

Source: Own elaboration from Chinese urban household income project 2013

Number of observations = 6674 household

[8] CPC is short for The Communist Party of China.
[9] Assign the demolition as 1 if the household's property is demolished within the past 2 years. Otherwise, assign the demolition as 0.

Table 1.2: Descriptive statistics for rural households.

Description of the variables	Mean	SD	Min	Max
ln (household income per adult equivalent)	9.38	0.97	6.01	13.41
ln (household minimum cash requirement per adult equivalent)	8.81	0.66	5.57	11.80
Adult equivalent	2.91	1.01	1	9.4
Head of household: female	0.09	0.28	0	1
Age of head of household	51.84	11.52	18	97
married	0.71	0.29	0	1
Household belongs to ethnic minority	0.07	0.26	0	1
Number of the elderly	0.57	0.80	0	4
Number of children	0.30	0.57	0	5
Number of youths	0.35	0.60	0	5
Belong to CPC[10]	0.11	0.31	0	1
Bad health	0.10	0.29	0	1
With local hukou	0.02	0.15	0	1
Coastal regions	0.16	0.37	0	1
With Long-term contract	0.05	0.21	0	1
Illiteracy	0.17	0.37	0	1
Demolition	0.04	0.21	0	1
Employed	0.78	0.41	0	1
Demolition with no compensation	0.13	0.19	0	1
Satisfy with living standard	0.80	0.40	0	1

[10] CPC is short for The Communist Party of China.

Satisfy with economic situation	0.17	0.38	0	1
In (financial assets)	9.67	1.48	2.30	15.10
welfare	0.04	0.12	0	1.33
Size of land (acres)	5.57	8.84	0	225.50

Source: Own elaboration from Chinese rural household income project 2013

Number of observations = 10489 household

1.4. Methodology

As highlighted in the literature review, the subjective poverty line is more appropriate than the absolute poverty line for estimating vulnerability to poverty in developing countries, particularly China. It is based on the respondents' answer about the expectation of minimum cash requirement and contrast to other poverty lines, it enables the residents to show a comprehensive picture of expected living standard.

The CHIPU and the CHIPR provide information on actual income and the minimum cash requirement in urban and rural households, respectively.

Instead of focusing on family expenditure, we try to develop a subjective poverty line based on real household income and the minimum cash requirement. Thus, by following the method suggested by Gustafsson and Yue (2006), we divide each household's minimum cash requirement and actual household income by the number of adult equivalents and obtain the minimum cash requirement and actual income per adult equivalent separately. The dependent variable is the minimum cash requirement per adult equivalent, while the independent variables are the actual income per adult equivalent and other affected factors[11]. By means of the OLS regression, a subjective poverty line in each household can be obtained.

[11] The province dummies are employed as an independent variable for urban households. The mean village income

As Verbeek (2008) suggests, wealthier families may exhibit greater volatility of consumption than poorer families, which means that the homoscedasticity assumption of the Gauss–Markov theorem of all the error terms with the same variance will be violated and may lead to the problem of heteroscedasticity. Under this circumstance, this study applies FGLS estimators, enabling us to correct the problem of heteroscedasticity of error terms in the regression model of household income and undertake an efficient estimation[12] (Chaudhuri, 2000; Chaudhuri et al., 2002; Verbeek, 2008).

Firstly, household income is generated as follows:

$$lnI = X_s\theta + e_s \quad (1)$$

Where I represents household income per adult equivalent; X_s is a set of recorded household characteristics including the number of family members in the household, the age of the head of the household, and the head of the household's educational status; θ represents a vector of parameters; and e_s is a mean-zero disturbance term.

It should be mentioned that because this study relies on cross-sectional data from a single year, instead of panel data, it cannot identify parameters that drive the persistence in the income level of each household, which raises the problem of heteroscedasticity. Thus, the variance of $\sigma^2_{e,s}$ of e_s could be written as equation (2):

$$\sigma^2_{e,s}=X_s\beta \quad (2)$$

is utilised as an independent variable for rural households.

[12] The issue of endogeneity may consider in this paper. In the previous studies, several scholars selected a third variable, and tried to prove that it correlates to dependent variables but with no correlation with independent variables. (Chintagunta et al.,2005; Bopape and Myers, 2007; Miller and Albertini, 2016) The disaster and weather-related variables are often used in these tests, but it is unable to find similar variables in this data set. Meanwhile, there is only one year data including the essential question about subjective poverty line could be found in this set of data, instead of panel data, which cannot solve the endogeneity issue completely. If futurethe third variable can be found, the endogeneity issue can be effectively solved.

Thereafter, we use a three-step feasible generalised least squares method to obtain consistent estimators of θ and β, and apply the consistent and asymptotically efficient estimators of $\hat{\theta}$ and $\hat{\beta}$ to estimate the expected log income for each household, equation (3) is formulated as follows:

$$\hat{E}\left[\ln \hat{I}_s \mid X_s\right] = X_s\hat{\theta}_{FGLS} \tag{3}$$

And the variance of the log income for each household is shown as follows:

$$\hat{V}\left[\ln \hat{I}_s \mid X_s\right] = \hat{\sigma}^2_{e,s} = X_s\hat{\beta}_{FGLS} \tag{4}$$

Once these estimates are obtained, it is possible to estimate the probability of households with characteristics X_s being poor in the future. In other words, we can estimate a household's vulnerability level as follows:

$$\hat{v}_s = \Pr(\ln I_s < \ln z | X_s) = \Phi\left(\frac{\ln z - X_s\hat{\theta}}{\sqrt{X_s\hat{\beta}}}\right) \tag{5}$$

From equation (5), the probability of each household facing poverty can be observed. Accordingly, it is necessary to distinguish those who are vulnerable and those who are not by setting different vulnerability thresholds. The more general approach is to set thresholds at 0.29 and 0.50[13].

Following Chaudhuri et al. (2002) and Katsushi (2012), the probability of a household entering poverty V^* can be calculated using the equation below:

$$V^* = 1 - \sqrt[n]{1 - V_n} \tag{6}$$

[13] The value of 0.29 is considered to be the lower threshold for the measurement of a household's vulnerability to poverty, while the value of 0.5 is regarded as the upper threshold for the measurement of a household's vulnerability to poverty (Khan and Riskin, 2001; Chaudhuri et al., 2002; Katsushi, 2012).

Where V_n is the set vulnerability threshold and n is the number of following years. For example, if we apply the vulnerability threshold of 0.5 and calculate the vulnerability rate for a household in the following year, which means that n = 1, then V^* will be 0.29. This means that in the following year, the probability of a household falling into poverty once is 0.29.

1.5. Empirical analysis

1.5.1 Discussions about the source of vulnerability in urban and rural households

Table 1.3 illustrates the impact of a set of variables upon the vulnerability level in urban and rural households. Female heads of households show a lower probability of becoming vulnerable than their male counterparts in both urban and rural households. Several previous studies arrived at a similar conclusion and explained that a certain number of urban female-headed households worked as managers in private companies or cadres in the government (Christiaensen and Boisvert, 2000; Christiaensen and Subbarao, 2004; Nicola, 2014). Our finding further reveals that this trend not only appears in urban areas, but also fits in rural areas in China. A potential reason could be — in the same way as urban female heads of households — that rural female heads of households are also more likely to be employed in higher positions and receive a respectable income. Moreover, the impact of a marital status of being married upon the level of risk is also negative. Specifically, a marital status of being married will benefit a household's income and reduce the household's vulnerability to poverty. This finding contrasts with Brody's (2003) argument that married women will decrease a household's income, and partially agrees with the view of McDowell (2005) that a husband will assist his wife in taking care of the elderly and children in the household, which will not reduce the household's income.

In terms of the influence of the number of different groups upon a household's vulnerability level, the outcomes indicate that as the number of children and youth in both urban and rural households increases, there is a higher probability that they will become poor in the future. This finding stresses the significance of providing financial aid to families with more than one child or youth member. A similar result appears in terms of the number of elderly individuals.

Compared to households with elders, households without elders have less chance of becoming vulnerable. It calls for a discussion surrounding the coverage of medical insurance and pension at the retirement age. As the data description section explained, this study constructs a welfare index based on five characteristics that reflect welfare in a household. Accordingly, it was found that a comprehensive welfare programme could be considered an efficient tool for both urban and rural households to buffer vulnerability.

Compared with heads of households with other types of contractual jobs, those with long-term contractual jobs are less likely to face poverty. This result provides a reasonable explanation as to why Chinese Communist Party members show a lower risk of becoming poor. Specifically, compared with non-Chinese Communist Party members, Chinese Communist Party members are primarily employed in state-owned enterprises, government, and public sectors, which provide long-term contracts with higher job security.

In both urban and rural households, heads of households without educational qualifications are more likely to face poverty than those with educational qualifications. However, the coefficient in rural households is much greater than that in urban households. This result indicates that the impact of educational attainment upon a

household's income in rural families is higher than that in urban households. More specifically, investing in education generates rich returns, particularly in rural areas. A similar differential effect appears in coastal regions, wherein the risk of a rural coastal household becoming poor is more significant than that in urban coastal areas, though both are negatively correlated with the risk level. This finding provides evidence that the regional income difference is greater in rural areas than in urban areas.

As discussed in the literature review section, the critical way in which to distinguish urban and rural residents is to find out whether they own local *hukou*. With regard to urban households, the vulnerability level is low for urban local *hukou*. On the contrary, for rural households, the vulnerability level is high for rural local *hukou*. This result verifies the significance of urban *hukou* for a household's income. However, it considers only local urban *hukou*, instead of all urban *hukou*. In other words, if the efficiency of urban *hukou* for a household's income is considered, the regional difference may also need to be taken into account. What is more, when rural families face demolition, it brings about a lower risk of becoming poor, while urban households may encounter a higher probability of vulnerability. If compensation is removed, both urban and rural families face the risk of vulnerability (as expected). However, the significance of the impacts on rural households is higher than that on urban households. It brings about a further discussion regarding how the different methods of compensation after demolition affect the vulnerability level.

It is worth noting that both variables satisfying the economic situation and the standard of living are significantly negatively correlated with the vulnerability level, which proves that the subjective question of the minimum cash requirement used in this study is effective in testing a household's income and predicting a household's vulnerability in the following few years. Another interesting result is the larger land

size of rural households and the higher risk of facing poverty, which contradicts expectations and requires further analysis.

Table 1.3: The impact of potential variables on the vulnerability level in urban and rural households.

	Urban	Rural
Dependent variable: Φ		
Explanatory variable		
Head of household: female	-0.03*** (-7.03)	-0.06*** (-10.29)
Age of head of household	0.06*** (6.77)	0.04*** (4.25)
Married	-0.04*** (-6.24)	-0.02** (-3.19)
Household belongs to ethnic minority	0.03*** (3.97)	0.03*** (4.99)
No elder	-0.01** (-2.79)	-0.05*** (19.08)
More than 1 children	0.01*** (1.21)	0.01** (1.14)
More than 1 youth	0.03*** (7.46)	0.02*** (8.67)
Belong to CPC[14]	-0.02*** (-4.49)	-0.03*** (-5.71)
Bad health	0.08*** (10.26)	0.09*** (17.85)
With local hukou	-0.03** (-2.06)	0.04*** (4.46)
Coastal regions	-0.06*** (-11.45)	-0.13*** (-28.41)
With Long-term contract	-0.05*** (-10.54)	-0.01* (-1.17)
Illiteracy	0.01* (2.15)	0.03*** (6.83)
Demolition	0.01 ** (1.31)	-0.05*** (-3.80)

[14] CPC is the abbreviation of the Communist Party of China.

Employed	-0.02*** (-3.64)	-0.04*** (-9.40)
Demolition with no compensation	0.01** (1.36)	0.05*** (3.42)
Satisfy with living standard	-0.05*** (-11.68)	-0.07*** (-17.31)
Satisfy with economic situation	-0.02*** (-3.75)	-0.01*** (-3.20)
In (financial assets)	-0.10*** (-71.17)	-0.11*** (-99.61)
welfare	-0.03** (-2.89)	-0.05*** (-3.58)
Size of land		0.001*** (14.30)
_cons	0.93*** (26.82)	1.34*** (43.98)
Number of Observations	6674	10489
Adj R-squared	0.65	0.67
*** p<0.05, ** p<0.01, *** p<0.001**		

1.5.2 Comparisons of vulnerability incidences and poverty rates between urban and rural households

This study calculates the subjective poverty line for each household and set the vulnerability threshold at 0.29 and 0.50, respectively, corresponding to the probability of becoming poor in the following year and in the following two years. The poverty rate concerns the rate of a household whose adult equivalent income is lower than its subjective poverty line, while the vulnerability rate for each household is calculated via equation (5). Graph 1.1[15] illustrates the comparisons of vulnerability and poverty rates between urban and rural households at different vulnerability thresholds. Nearly 5.36% of urban households earn an income below their subjective poverty line, while 12.69% of rural families have an income lower than their subjective poverty line. Both urban and rural households show a similar trend in which the total vulnerability incidence is

[15] Details of the poverty rates and vulnerability incidences in urban and rural China are presented in Appendix 2.

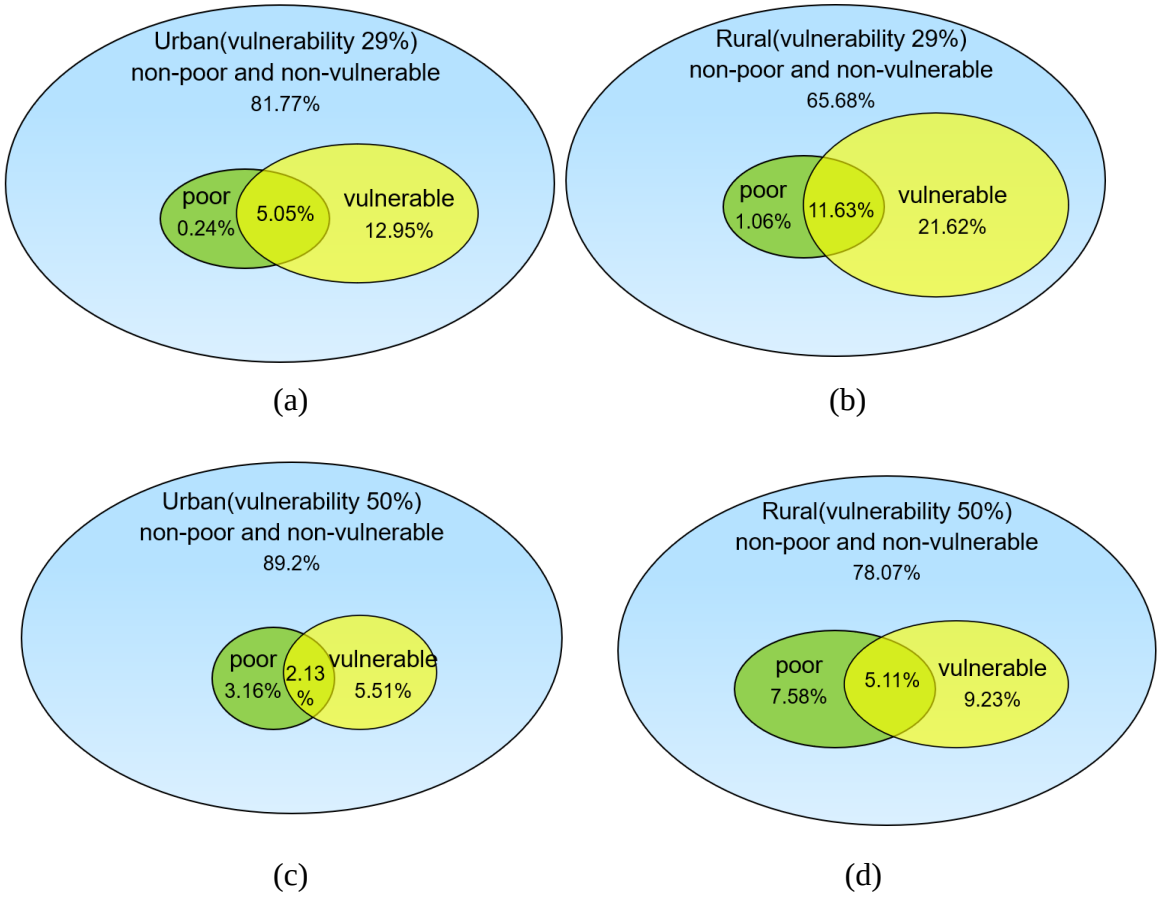
greater than the total poverty rate, not only when the vulnerability threshold is set at 29%, but also when the vulnerability threshold is set at 50%.

With regard to urban households, 0.24% earn lower than the subjective poverty line, while their probability of being poor is lower than 29%. This figure increased to 3.16% if the vulnerability threshold was changed to 50%. Meanwhile, among the non-poor group, 12.95% face the risk of becoming poor in the following year and the percentage is halved if the risk of entering poverty in the following two years is considered. In rural areas, 1.06% of households are poor. However, their probability of becoming poor in the future is lower than 29%, which increased dramatically to 7.58% if the vulnerability threshold was set at 50%. Simultaneously, 21.62% of them face the risk of becoming poor in the following year even though they are not poor currently, and the number of target groups declined to 9.23% when the probability of entering poverty in the following two years was taken into consideration.

As expected, the poverty rates and vulnerability rates in rural households are higher than those in urban households. Meanwhile, the gap between rural and urban households in poor and non-vulnerable groups and in non-poor and vulnerable groups becomes significant, particularly at the vulnerability threshold of 29%. Specifically, the percentage of rural households suffering idiosyncratic shocks and entering poverty in the following year, though not poor, is twice that of the percentage of urban households with similar conditions. The percentage of rural households with the probability of being poor is lower than 29%. Even though their income is currently below the subjective poverty line, it is nearly five times greater than the percentage of urban households with the same conditions. A striking finding can be found in the comparisons between vulnerability at 29% and vulnerability at 50% for the poor and non-vulnerable groups in urban areas. Accordingly, the figure increased by more than

13 times when considering the possibility of becoming poor in the following one to two years, while in rural areas this figure increased only seven times. This result indicates that poor households in urban areas are more likely to get rid of poverty relative to rural households with identical conditions.

Figure 1.1: Classification of non-poor and non-vulnerable groups in urban and rural China.



1.5.3 Discussions about province

This study calculates the percentage of households below their subjective poverty line in provinces for urban and rural households and draws provincial maps that.

In Figures 1.2 and 1.3, the overall trend of the poverty rate in coastal areas, inland areas, and western areas ranges from high to low. There is relatively low poverty in

both urban and rural areas in coastal areas in comparison to all other areas. It verifies that the denser transportation nets of provinces create additional opportunities and higher income for residents. However, Liaoning is an exception, which is close to the sea and shares a higher poverty rate than in several inland and western areas in both urban and rural areas. This is primarily due to outdated mechanism management, under the competition of newly industrialised cities, resulting in fewer opportunities, low income, and brain drain.

As a western city, Chongqing provides an intriguing result: The number of households below the subjective poverty line is not only much lower than in all other western areas, but also smaller than in several coastal areas. More specifically, the poverty rate in urban Chongqing is lower than in coastal areas of Guangdong and in all other western and inland areas, while the poverty incidence in rural Chongqing is smaller than in coastal areas of Shandong and in all other western and inland areas. A potential explanation is that the municipality, which is directly administered under the central government, allows access to more sources under higher decision-making power, which helps to obtain a higher salary level that is the same as that in the provincial capital.

Figure 1.2: Urban Provincial Poverty Rate

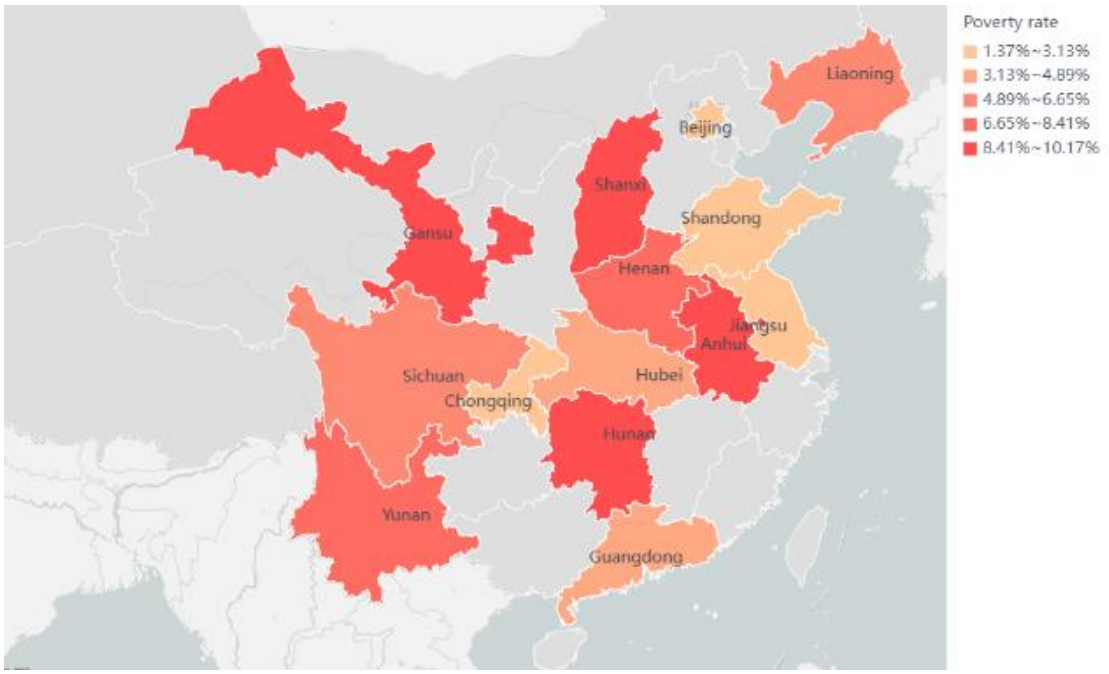
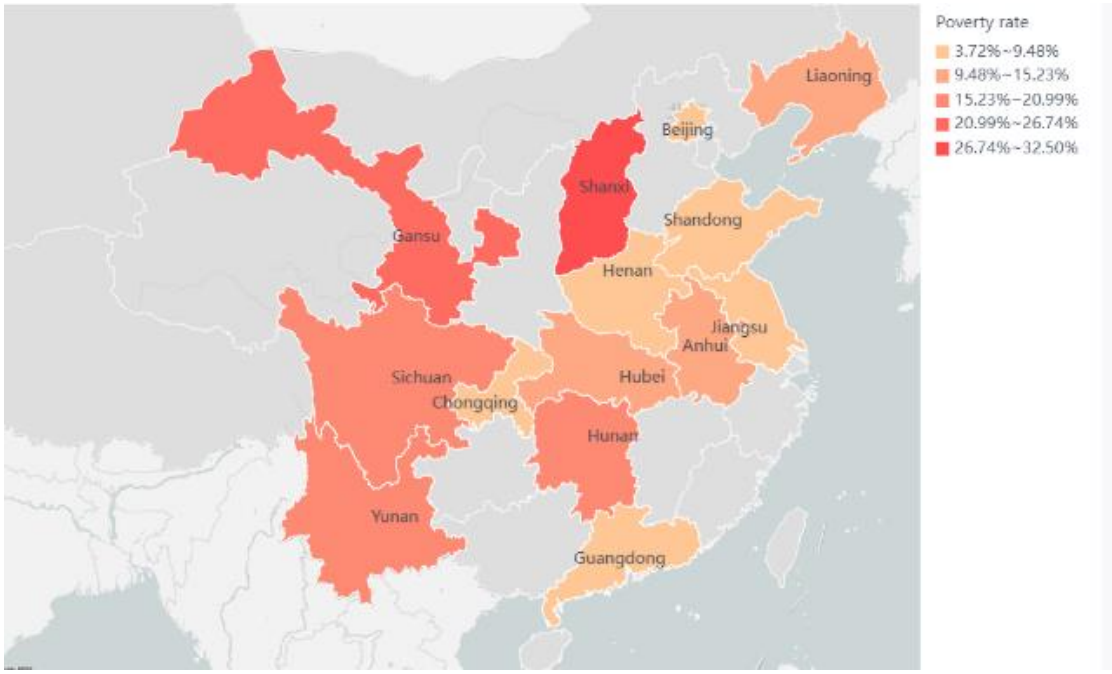


Figure 1.3: Rural Provincial Poverty Rate



Figures 1.4 to 1.7 indicate the percentage of households with a vulnerability level higher than 29% and 50% in urban and rural areas, respectively. As expected, Liaoning exhibits a greater percentage of vulnerable households when compared with all the

coastal areas at different thresholds. Interestingly, as mountainous regions in the west, Chongqing and Sichuan share a much smaller vulnerability rate relative to other similar regions, such as Gansu and Yunnan.

In general, Jiangsu exhibits the lowest vulnerability rate in both urban and rural regions. At the same time, Shanxi represents the highest vulnerability in both urban and rural areas. These findings question whether the gap of resource-based regions, such as Shanxi, is gone. From the perspective of urban households, 6.70% of households in Beijing are vulnerable households when the vulnerability threshold is 29%, whereas this figure is smaller by nearly 1/7 if the vulnerability threshold is changed to 50%, which shares the widest gap. Simultaneously, rural households in Guangdong represent the largest gap between 29% and 50% vulnerability levels.

If the gap between urban and rural households is considered based on the same vulnerability level, Shandong exhibits the largest gap at a vulnerability level of 29%, whereas Beijing shares the widest gap when the vulnerability threshold is set at 50%. Notably, when making a comparison between urban and rural households, Guangdong exhibits an unexpectedly higher level of vulnerability in urban households than in rural households at two vulnerability thresholds. This finding is similar to those of previous studies that suggested that urban families are more likely to establish a subjective poverty line that is much higher than that used in rural households (Haughton and Khandker, 2009).

Figure 1.4: Urban Provincial Vulnerability 29%

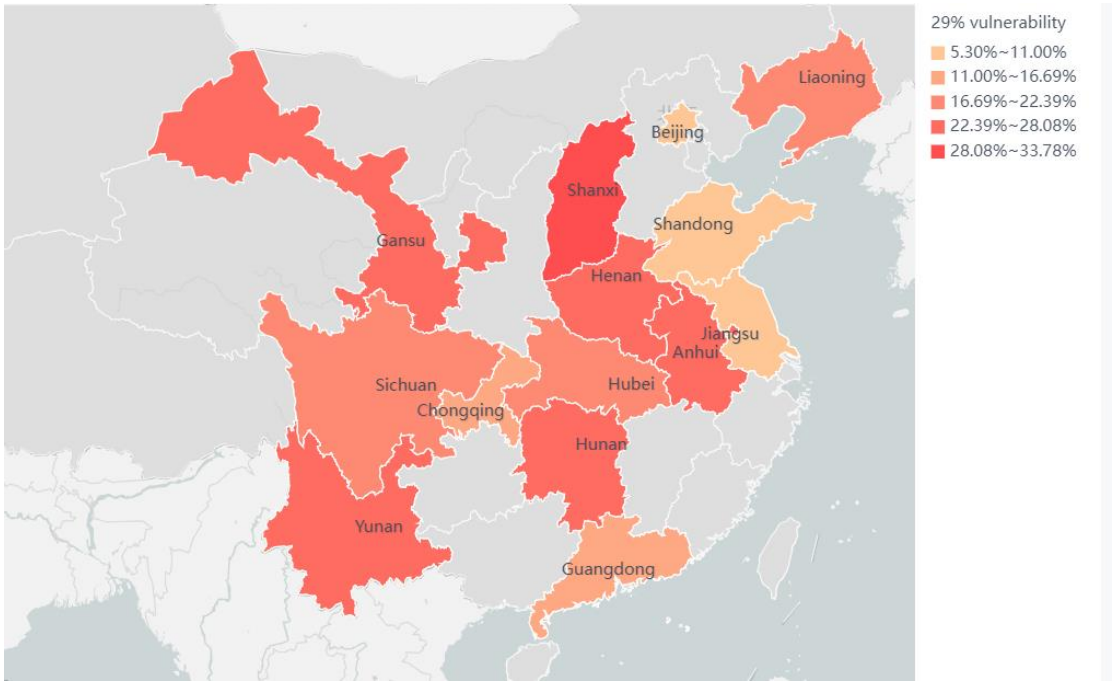


Figure 1.5: Rural Provincial Vulnerability 29%

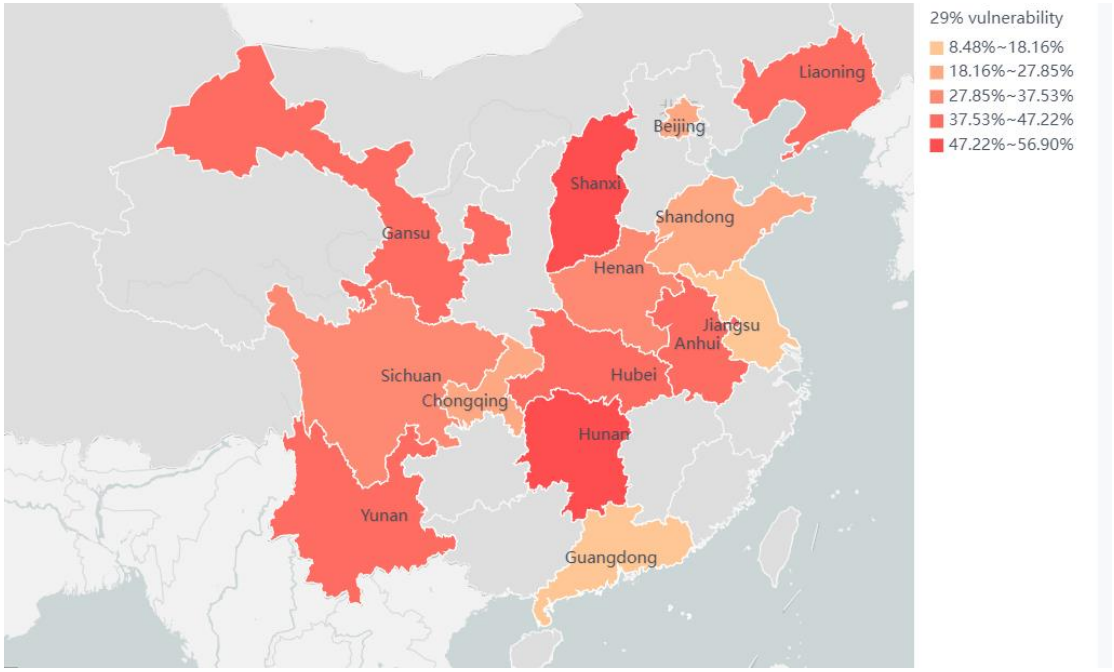


Figure 1.6: Urban Provincial Vulnerability 50%

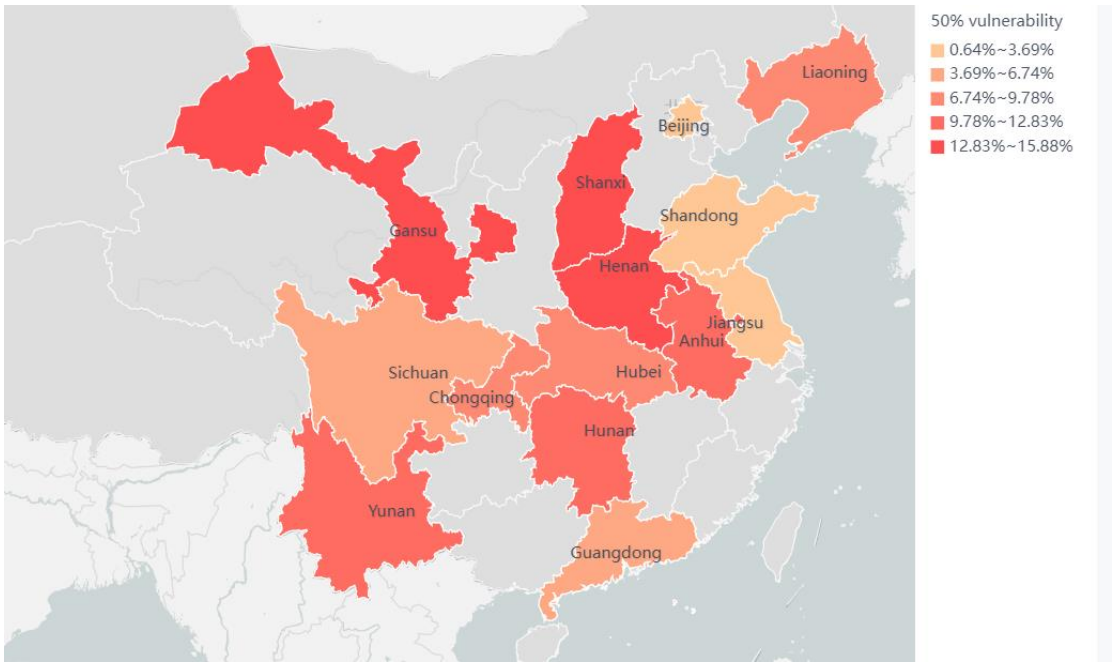
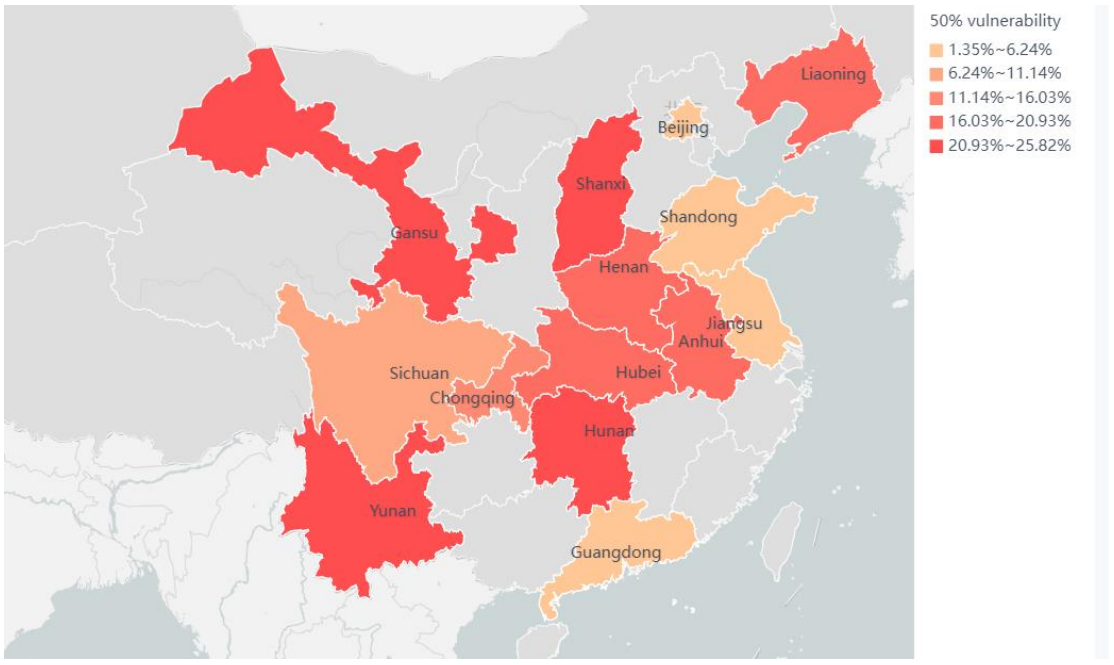


Figure 1.7: Rural Provincial Vulnerability 50%



1.5.4 Discussion about poverty and vulnerability profiles

We calculated the poverty rates and vulnerability incidences for households with different characteristics, respectively. For example, I divided the heads of households into three groups based on age: the first group concerns heads of households aged below 30, the second group concerns those aged between 30 and 60, and the last group concerns those aged above 60. Furthermore, I calculated the percentage of poverty and vulnerability of heads in each age group and made comparisons among them. Figure 1.8 indicates that the percentage of heads aged below 30 in urban households is significantly smaller than those of the other two groups in terms of the poverty rate and vulnerability incidence. In other words, the gap in vulnerability and poverty rates between households headed by individuals aged below 30 and those aged 30 to 60 and between households headed by individuals aged below 30 and those aged above 60 is dramatically wider than that between those aged 30 to 60 and those aged above 60. Although in rural households the total trend increased with age, and the poverty and vulnerability rates become greater in a similar manner to that of urban households, the difference in poverty and vulnerability rates between households headed by those aged below 30 and households headed by those above the age of 60 is much greater than that between those aged below 30 and those aged 30 to 60. More specifically, in urban areas, younger heads of households aged below 30 are less likely to face poverty in the future. Meanwhile, when the age of the household owner is above 60, there is a higher likelihood of becoming poor in the following one and two years when compared to the same group in rural and urban groups.

In urban households, an increase in the number of children brings about a higher probability of entering poverty in the following one and two years. However, the percentage of households with one child that falls below the subjective poverty line is

lower than those with no children, which is unexpected. The same result appears in rural households. In contrast to urban households, households with one child exhibit the lowest probability of being poor when compared with households without children and those with more than one child at different vulnerability thresholds. A potential explanation could be that, different from urban households, the majority of rural family members work on their own lands, which enables them to bring one child to the workplace. In the meantime, the child is taught to perform some auxiliary work. On the one hand, it decreases expenditure on babysitters. On the other hand, it quickens their progress on the land.

There is a remarkable difference between families with no youth and those with more than one youth in urban households with vulnerability at 29% and 50%, although a slight gap between them exists with regard to the aspect of the poverty rate. Unlike urban households, the probability of families without any youth and families with one youth member becoming poor in the following one or two years is almost the same as in rural households.

If there is a concern surrounding the impact of the number of the elderly in a household upon the vulnerability incidence, an interesting result is observed when one elder exists in urban families. The probability of entering poverty becomes the largest, compared to cases without an elderly member and those with more than one elder. However, in rural households, having more than one elder in the household makes the household more vulnerable to poverty. In contrast to having one elder, single elders in households may require more attention and care, which could accompany each other. Extra care incurs additional expenditure on elder sitters in urban areas and they are more likely to push the household into poverty. Meanwhile, the coverage of pension in rural households is incomplete, which was also implied in several previous studies and

could explain why having more than one elder in rural households makes them more vulnerable (Oksanen, 2010; Angelillo, 2014).

Figure 1.8: Poverty and vulnerability categories for urban variables related to age and number of different groups

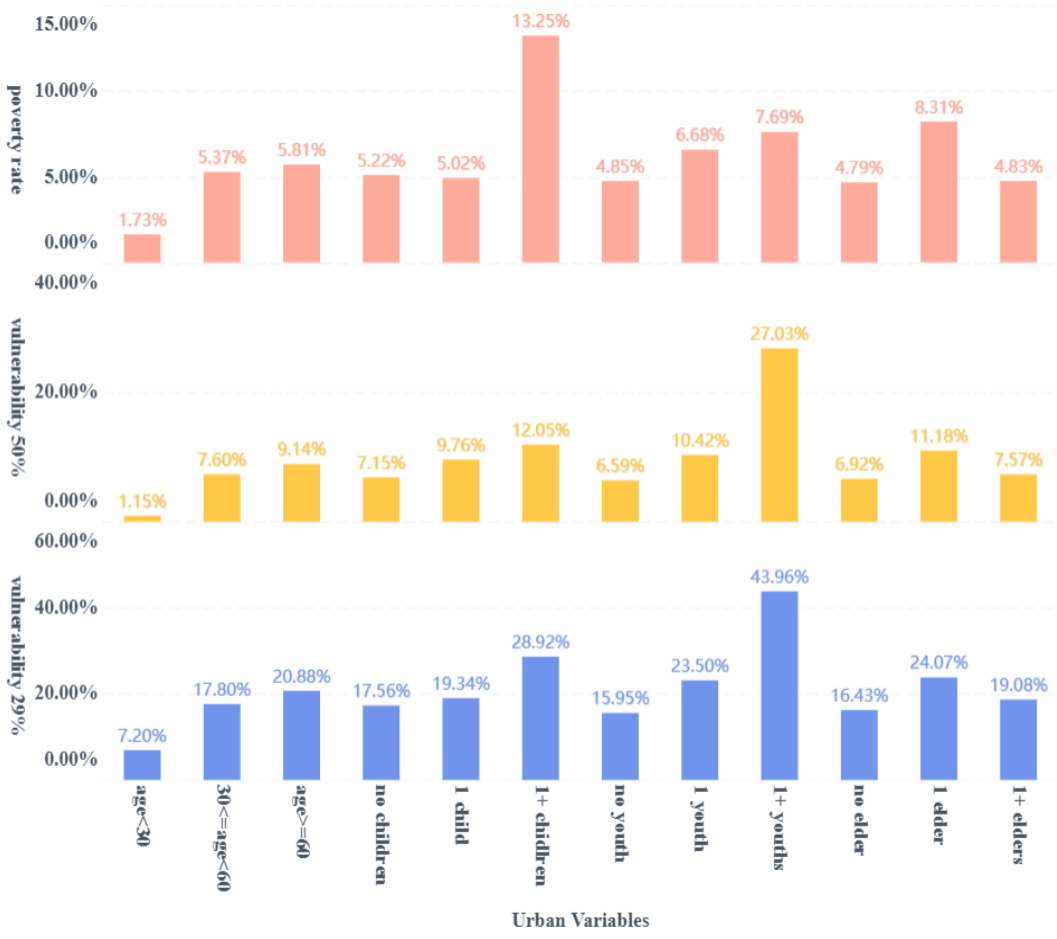
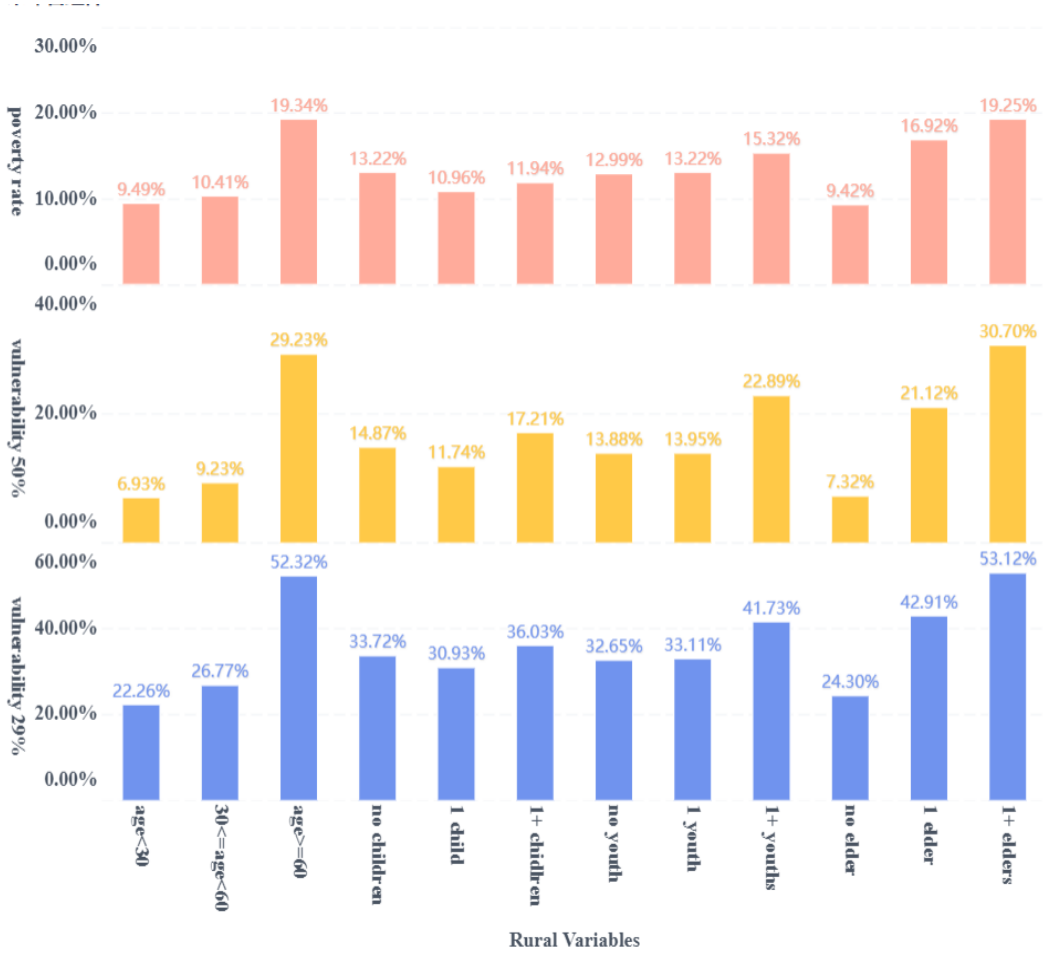


Figure 1.9: Poverty and vulnerability categories for rural variables related to age and number of different groups



Figures 1.10 and 1.11 describe the impacts of variables related to employment upon poverty and vulnerability rates. They deviate slightly from expectation, with heads of households with an educational level lower than a senior school degree exhibiting the highest poverty rate and vulnerability incidence. Meanwhile, the figures are even greater for those without any educational attainment. As free and compulsory primary education[16] has been carried out in China since the 1990s, the number of students completing education has been growing quickly.

[16] Free and compulsory primary education in China refers to nine-year education (including primary and junior school education).

Following this, a certain number of students have chosen to quit and turn to the labour force market due to a series of reasons, such as household poverty and a lack of senior schools in their locality. This provides an excessive labour force with individuals with less than a senior school degree (Cui, Meng & Lu, 2018; Wang and Benjamin, 2019).

However, citizens are not illiterate. Thus, they have to face the dilemma of not obtaining jobs due to the limitation of schooling. Simultaneously, they are not willing to work as manual workers, like most illiterates do. In rural areas, heads of households without educational qualifications exhibit the highest probability of entering poverty in the following one to two years, and have the greatest poverty rate in comparison to literate groups. Meanwhile, households headed by those with more than 12 years' schooling present the lowest probability of being poor. All of this shows that in rural areas, the educational level plays a critical role in getting rid of poverty and vulnerability to poverty, which stresses the importance of universally accessible primary education in rural areas.

In both urban and rural households, having no contract is regarded as the main threat to the heads of households getting rid of poverty and alleviating vulnerability to poverty. Meanwhile, a long-term contract could be an efficient tool with which to buffer poverty and vulnerability.

Importantly, there is no significant difference in poverty and vulnerability rates between an employed and a retired head of a household in urban areas, though households headed by unemployed individuals exhibit the highest probability of poverty and being vulnerable to poverty. However, retired heads of households are more likely to be poor than are those who are employed in rural areas. The results

reiterate that the coverage of pension in urban and rural areas is significantly different, and indicate that the coverage of pension is more complete in urban areas.

Figure 1.10: Poverty and vulnerability categories for urban variables related to employment

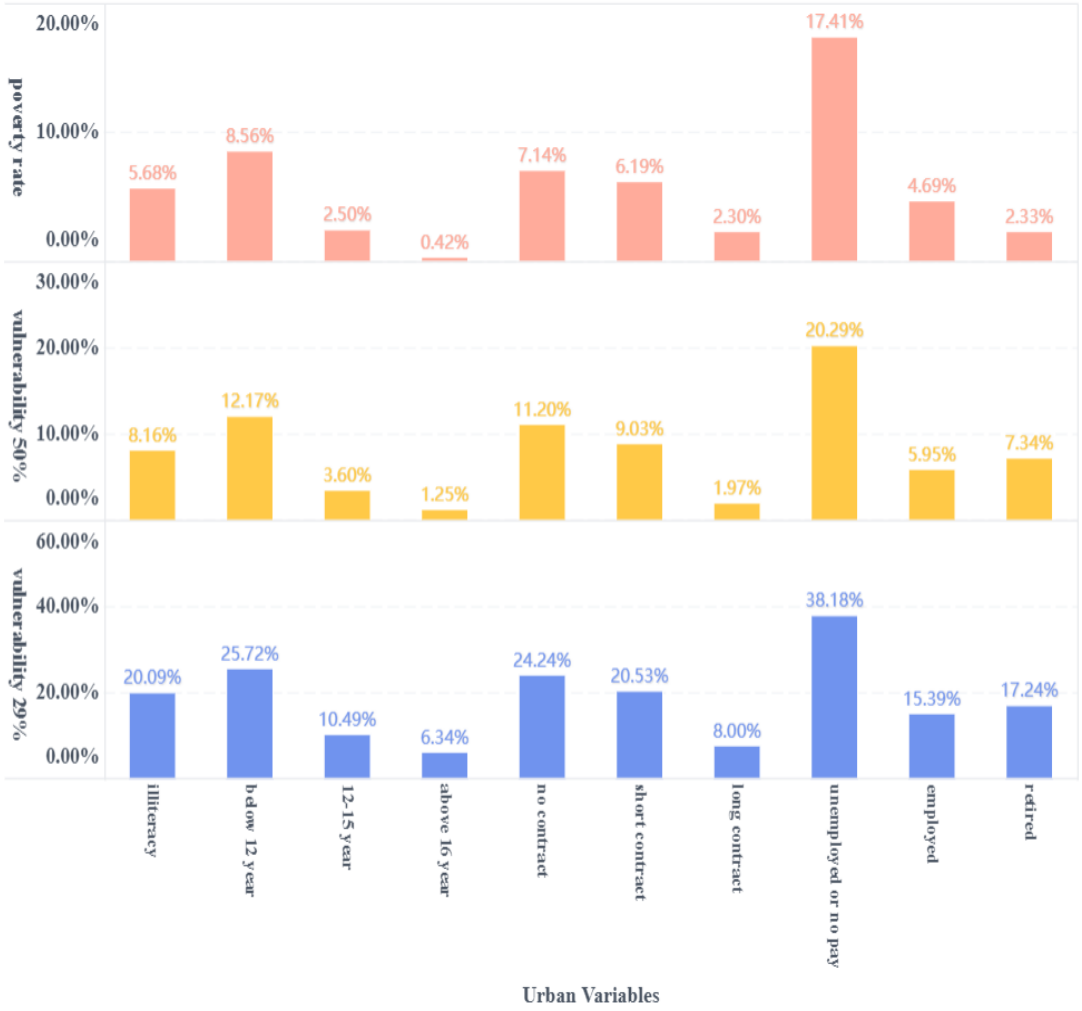
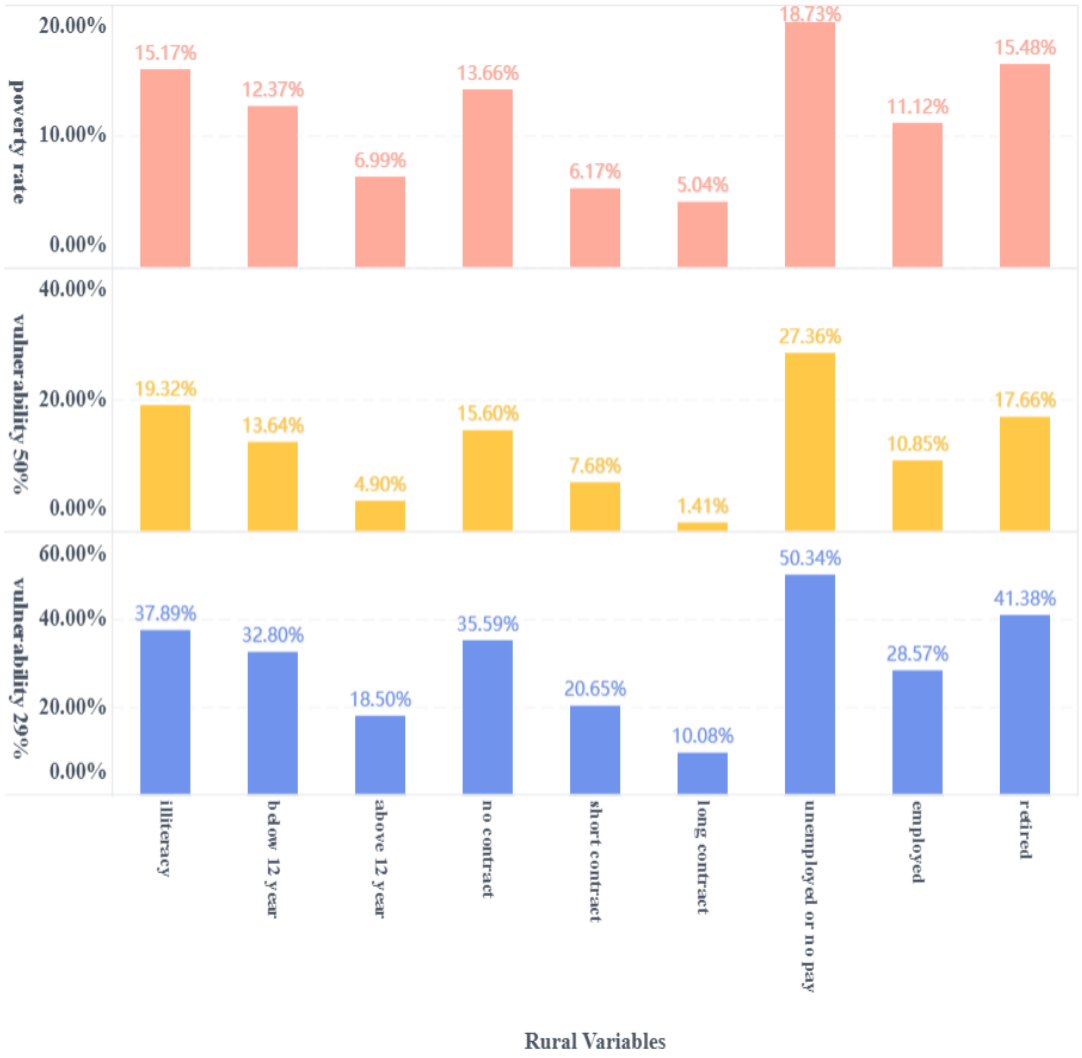


Figure 1.11: Poverty and vulnerability categories for rural variables related to employment



Admittedly, the compensation system for dismantled households is not transparent. However, this study applied a household questionnaire survey to provide useful information on the relocation compensation standard being unfair in urban areas, which is reflected in dismantled households, who are more likely to be vulnerable than households without demolition. Meanwhile, urbanisation has hiked the prices of houses in central areas and the most developed urban regions, making it difficult for dismantled households to buy a house in their original location with the same conditions. As a result, they are forced to move to suburbs with covariate shocks and face the risk of

becoming poor[17]. Interestingly, urban and rural households present opposite results with regard to the impact of demolition upon the incidences of poverty and vulnerability. Compared with urban areas, dismantled households in rural areas find it easier to purchase a new house with the same conditions within proximity of their original home, which is less likely to increase the impact of covariate shocks upon the vulnerability level.

As expected, for both urban and rural areas, no compensation is more likely to push a household towards being poor in the years following demolition. Meanwhile, obtaining dual compensation (including money and housing) benefits them in buffering vulnerability in both urban and rural areas. A striking finding is that the poverty rate for households obtaining dual compensation is higher than for those receiving only money as compensation. Niu (2014) suggests that a potential explanation is perhaps that a compensated house may be difficult to sell, as the location is not always attractive and the financial compensation in dual compensation is not generous, which creates financial burdens on these households.

[17] Li (2011), Liu (2009) and Niu (2014) suggest similar comments in their studies.

Figure 1.12: Poverty and vulnerability categories for urban variables related to demolition

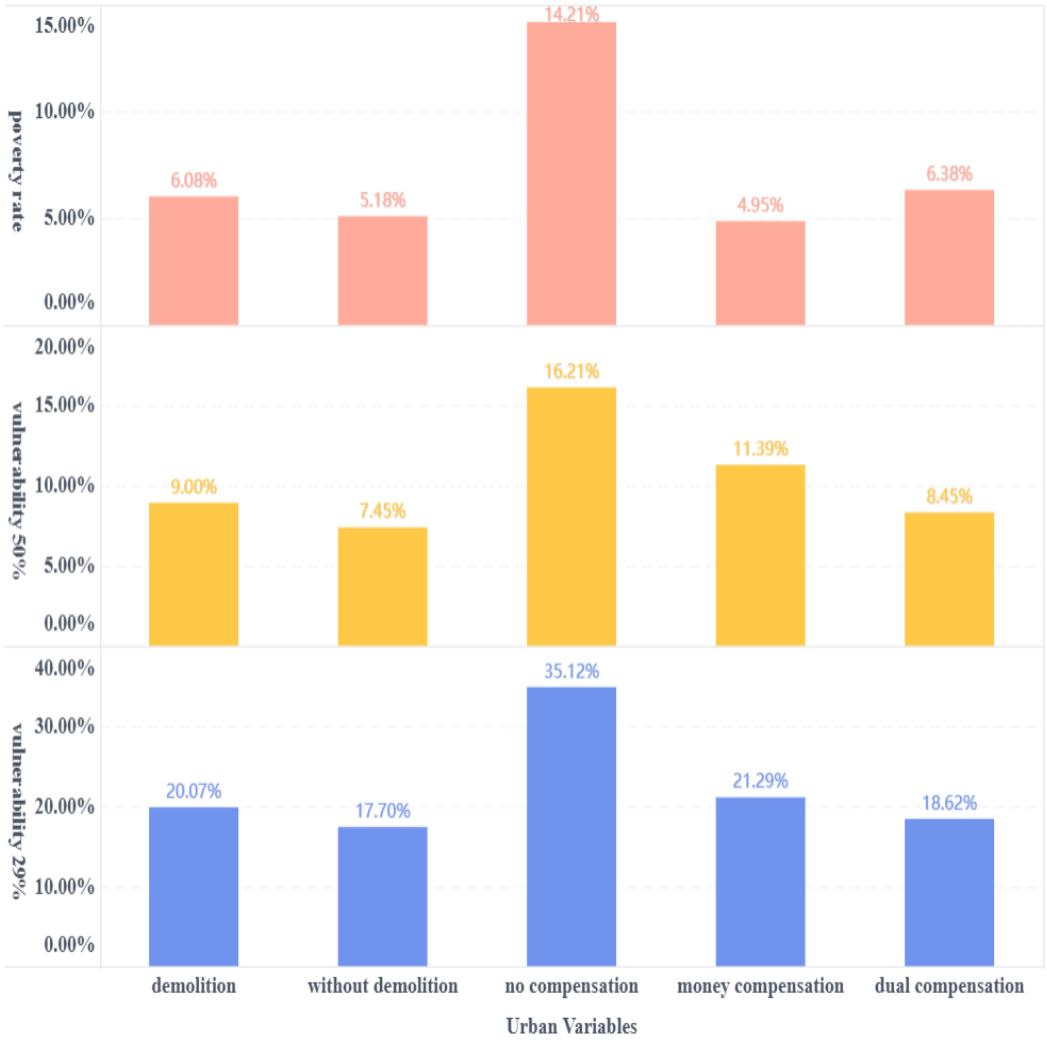
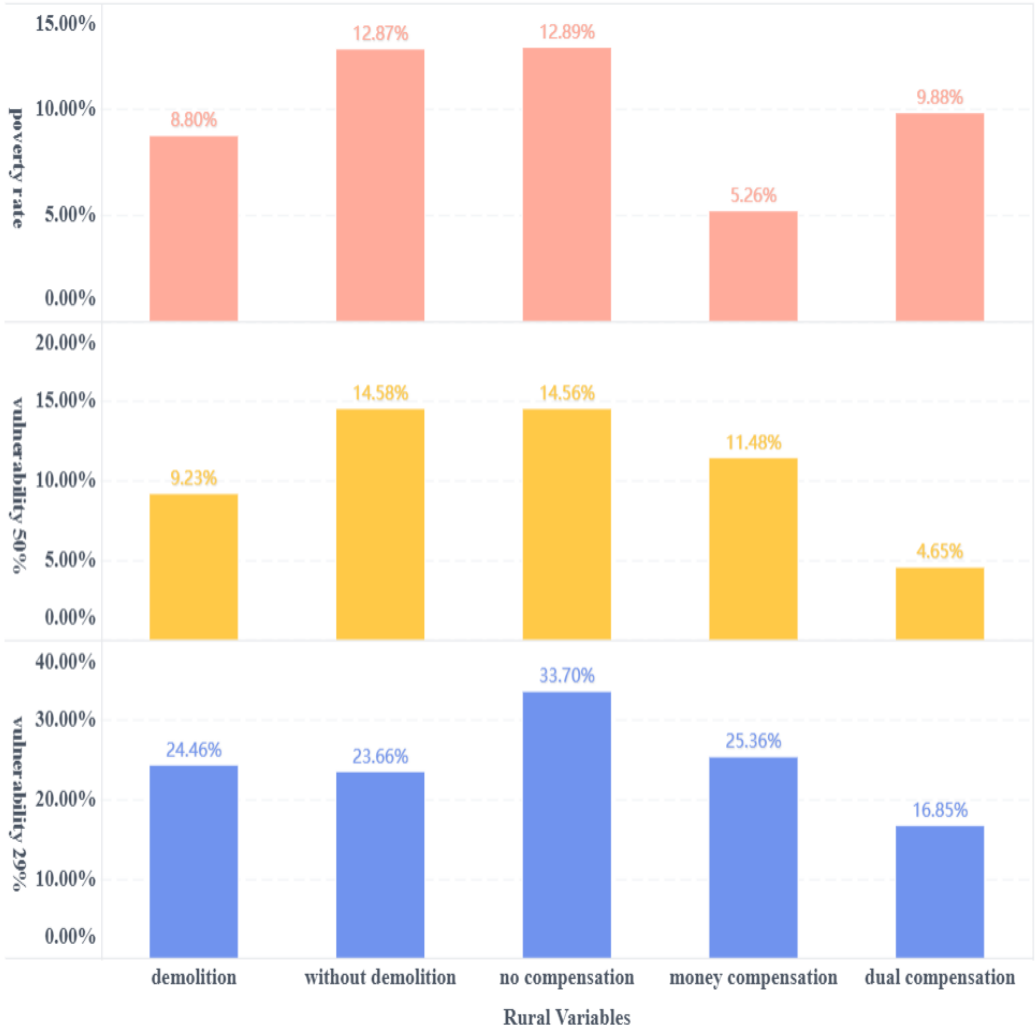


Figure 1.13: Poverty and vulnerability categories for rural variables related to demolition



1.5.5 Discussion about multidimensional study of vulnerability

To distinguish vulnerable households from non-vulnerable households, this study uses the multidimensional method, Multidimensional method covers residents' characteristics from the following four dimensions: economics; educational qualification; health condition and employment, social security situation. Applying this method enables us to see how each dimension affect the household vulnerability to poverty effectively. Table 1.10 to observe which households are deprived in some particular dimensions closely related to being poor in the near future. Following the

method suggested by Alkire and Foster (2011), this study selects a list of indicators and identifies a cut-off point for each indicator. Subsequently, a weight is assigned to the dimensions based on various criteria. Unlike those that stress the significance of specific dimensions and allocate a greater weight to those than to others, this study assigns an equal weight to all dimensions and equally divides into its nested indicators.

As the discussion surrounding the impact of employment and the number of elders upon the vulnerability incidence brings attention to pension and medical insurance, based on the original model, which considers only living standards, educational qualifications, and health, this study also considers employment and social security dimensions in the multidimensional analysis of vulnerability.

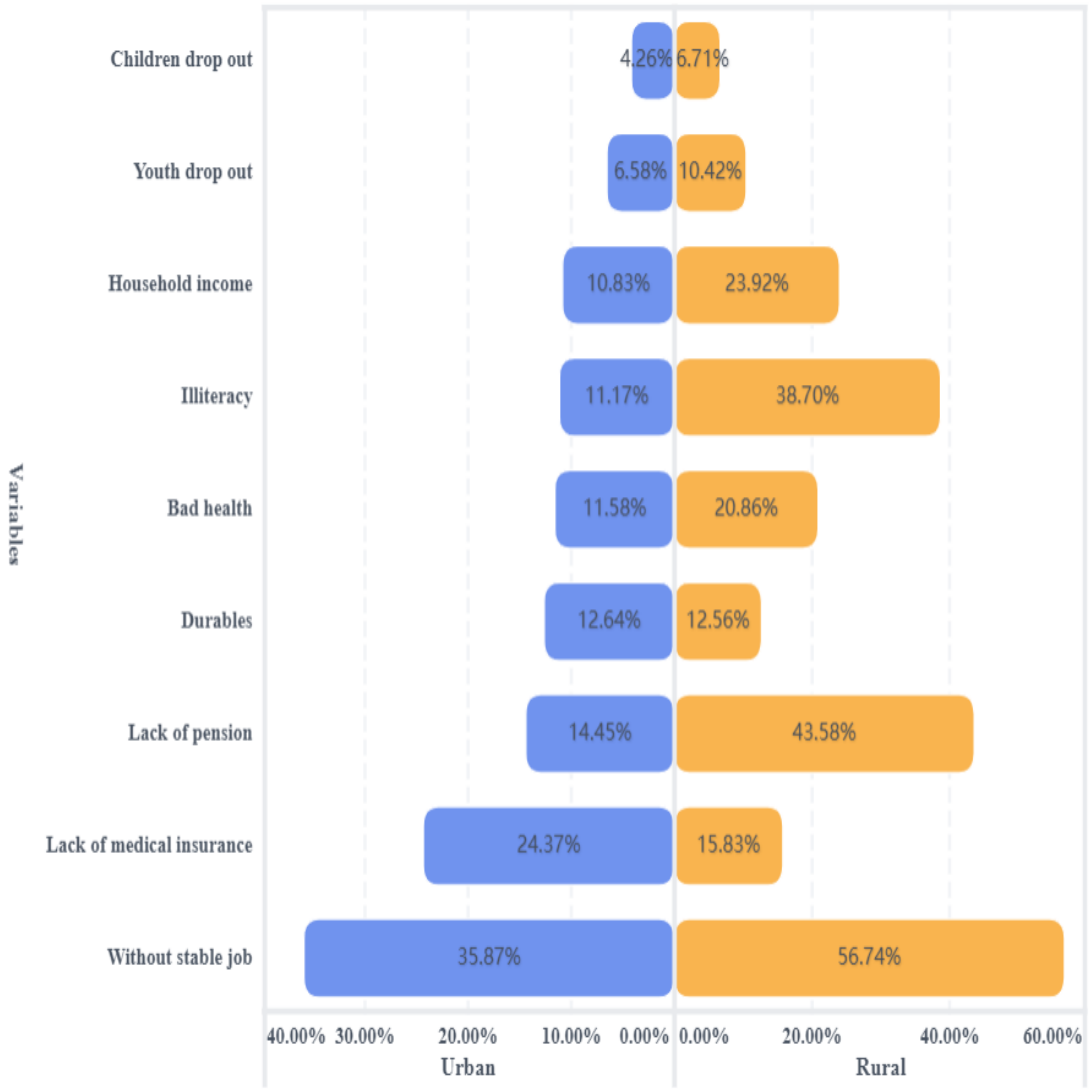
This study combines the results from the discussions above with those from previous studies, defining those households with deprived indicator weights above 0.4 as vulnerable (Alkire and Foster, 2011; Angelillo, 2014; Artha and Dartanto, 2015). Figure 1.14 shows the comparison between urban and rural households in terms of deprived indicators. Regarding urban households, there are 4.2% vulnerable households and the primary determinants of being vulnerable include a lack of job security and a lack of medical insurance. Among rural households, 10.98% of them are vulnerable, which is twice the proportion in urban areas. Thus, a lack of educational attainment, poor pension coverage, and a lack of paid employment are key obstacles in getting rid of a household's vulnerability. It is worth noting that, compared to urban households, a higher number of rural households have received medical insurance, primarily due to the recent efforts of the universal New Rural Cooperative Medical Scheme (NCMS). Meanwhile, the pension coverage in rural households is significantly narrower than that in urban households, which explains why the number of elderly members is positively

related to the risk of being poor. Consequently, it calls for more attention and action from local government.

Table 1.4: Measurement indices of multidimensional vulnerability

Dimension	Indicator	Deprivation cutoff
Economic (1/4)	Household income (1/8)	Household income lower than subjective poverty line is 1; Otherwise, is 0.
	Durables (1/8)	If total value of durables and financial assets minus debts lower than yhat*the number of adults is 1; Otherwise, is 0.
Education (1/4)	Illiteracy (1/12）	At least one adult in household illiteracy is 1; Otherwise, is 0.
	Children (1/12）	At least one child drop out in the household is 1; Otherwise, is 0.
	Youth (1/12）	At least one youth drop out in the household is 1; Otherwise, is 0.
Health (1/4)	Bad health (1/4）	At least one member has bad health condition is 1; Otherwise, is 0.
Employment and Social security (1/4）	Without stable job (1/12）	At least one adult family member is unemployed or no pay is 1; Otherwise, is 0.
	Lack of Medical insurance (1/12）	More than one adult does receive medical insurance 0 is 1; Otherwise, is 0.
	Lack of Pension (1/12）	More than one adult does receive pension when they are in retirement age is 1; Otherwise, is 0.

Figure 1.14: Multidimensional analysis of vulnerability



1.6. Conclusion

This study determines a subjective poverty line for each household based on the minimum cash requirement and actual household income. In doing so, vulnerability is defined as the probability of a household becoming poor in the following years. FGLS estimators are applied in order to adjust the problem of heteroscedasticity in a cross-sectional Chinese household survey. As expected, the results show that the overall vulnerability incidence in urban households is lower than in rural households. Moreover, the results highlight the striking difference among urban households in terms of poverty

and non-vulnerability at different vulnerability thresholds. In other words, as time passes, more urban households are likely to experience poverty, which contrasts with the findings measured from the absolute poverty line. It stresses the significance of measuring vulnerability by means of the subjective poverty line, which calls for additional financial aid from the government while reflecting human suffering. As a western region, Chongqing shows a relatively low incidence of poverty and vulnerability in both urban and rural households, which contradicts the expected results and questions whether welfare levels and urbanisation development in western regions have a higher influence on poverty levels than in inland areas. Besides, this study observes that in Guangdong, the probability of an urban household becoming poor in both the following year and in the following two years is greater than that of rural households, which stresses the effects of infrastructure on buffering such vulnerability, as rural Guangdong owns a greater number of roads and rail networks than any other rural area, thus connecting residents with outsiders.

Educational qualifications are still a determinant of the vulnerability of rural residents. Although the compulsory nine-year primary education scheme was launched decades ago, a considerable number of rural residents are still illiterate. The significant difference between urban and rural residents concerning educational attainment is still prevalent. In other words, rural children should be allowed to access a fair educational environment. Meanwhile, the coverage of pension in rural households is incomplete, which brings about the positive impact of the number of elders upon the rates of poverty and vulnerability. In other words, although the new rural pension scheme was launched in 2008, as of 2014, there is still a long way to go, and the current status is further away from its purpose of guaranteeing easy access to 80% of rural residents to pension benefits.

The New Cooperative Medical Insurance Scheme is the main medical insurance scheme in rural China, and even in 2014, our findings indicate that the coverage of medical insurance in rural households was more complete than in urban households, becoming an efficient tool with which to mitigate the risk of facing poverty.

According to the results, economic growth in China has resulted in disparities in the distribution of wealth between urban and rural regions, particularly in terms of the risk of being poor. It calls for more social reforms to mitigate the risk and buffer the vulnerability. Accordingly, this study recommends the Chinese government to adopt a more equalising approach, instead of unrestrained growth.

Chapter 2 – Estimating the Impacts of Idiosyncratic and Covariate Shocks on the Chinese Urban Household Vulnerability to Poverty

2.1. Introduction

In the past decade, China has made a great advancement in poverty alleviation in the country. Particularly, the observed decrease the absolute poverty rate in rural areas is striking. The household poverty headcount ratio has declined from 66.6% in 1990, to 0.7% in 2015, based on the World Bank of 1.90 dollar per day per capita convention (Fang and Zhang, 2021). However, the rapid urbanization in China brings along a series of problems, such as an increase in labor market competition, underdeveloped social insurance mechanisms, and rising housing prices, all of which increase the vulnerability of urban household to poverty.

The existing studies on urban poverty in China tend to focus on the static measures of poverty in household, with only a few considering the dynamic dimension of poverty. The latter groups effectively involve investigation of household vulnerability to poverty, that is the risk of household being poor in future (Chen and Ravallion, 2020; Duclos et al., 2010; Yu, 2013; Ward, 2016; Wang and Zhao 2020).

Importantly, the impact of the community-level (covariate) shocks on the household vulnerability is widely discussed in the context of developing countries, but scarcely mentioned in the context of China (Pritchett and Sumarto, 2000; Calvo and Dercon, 2005). The community level shocks are typically related to the level of infrastructure in a community, financial and other aids to the low-income individuals, and alike. The covariate shocks tend to be as important as the household-level

(idiosyncratic) shocks, such as educational attainment and health condition. These factors tend to be important in ex-ante estimation of both the expected mean and variance of income of a household (Guntjer and Maier, 2008). Thus, it is critical not only to estimate the dynamics of poverty, but also to assess underlying reason of poverty vulnerability, such as idiosyncratic and covariate shocks, as well as coping strategies adopted to deal with the adverse shocks.

Furthermore, this study attempts to decompose the household vulnerability into the parts which are either poverty or risk induced. Specifically, we check whether the vulnerability is mainly induced by low-income prospects (poverty induced) or is driven by income volatility (risk induced). As there is no panel data of income and expenditure household survey, which would include both the information on idiosyncratic and covariate shocks in urban China, we apply a modelling approach suggested by Chaudhuri (2003) and Tesliuc and Lindert (2004). As a result, we examine the incidence and source of poverty and vulnerability in urban China using a cross-sectional household data. Based on a one-year data, we forecast the risk of being poor in the following three years and analyze the impact of idiosyncratic and covariate shocks on the household vulnerability to poverty. As the minimum living standard line varies across urban regions in China, we can explore the influence of varying minimum living standard line across Chinese regions and the effect of different levels of social assistance provided to the urban household, to check whether the amount of cash subsidy is positively related to the cities' economic performance.

This study is structured as follows. The literature review section evaluates the approaches that empirical literature applies to estimate the household vulnerability and provides a brief overview of the significant shocks at the household and the community levels in China. The data description section describes the source of data and explains

the idiosyncratic and covariate shocks in detail. Then the methodology section proposes a methodology that enables us to decompose the vulnerability into the idiosyncratic and covariates induced. The discussion section provides the estimation results and their analyses. The last section provides conclusions.

2.2. Literature review

2.2.1 The discussion about the four types of measurement of the vulnerability to poverty

There are four main approaches to assess the vulnerability to poverty. The first one defines the vulnerability as an exposure to risk (VER). It is proposed by Christiansen and Subbarao (2005) and identifies the poverty vulnerability as the inability of a household to smooth consumption over time, in the presence of shocks. It effectively distinguishes the group of vulnerable to poverty from the group of persistent poverty[18].The shortcoming of VER approach is that the fluctuations in the lower tail of the income distribution tend to be low, so the household in poverty might not be considered as vulnerable, which may overlook those poor as vulnerable group. Meanwhile, several scholars argue that this approach over-emphases the consumption smoothing and ignores the presence of asymmetry in shocks (Celidoni 2015; Chaudhuri et al. 2002).

The second approach, known as VEU, evaluates the vulnerability via comparing the difference between present utility and expected utility (Ligon and Schechter, 2003). This method bases on the von Neumann–Morgenstern (VNM) utility function and suggests that if an individual's behavior changes from rational to irrational due to either the household-level or community-level shocks, the household is considered as

[18] It is assessing the vulnerability to poverty via comparing the variation of household's welfare in the community.

vulnerable to poverty. This approach is often criticised as inappropriate to assess the vulnerability in the situations when shocks affect individual risk preferences and behaviors. This often leads to incorrect identification of non-vulnerable as vulnerable (Linh and Hang, 2021).

The third approach assesses the vulnerability as expected poverty (VEP) (Chaudhuri et al., 2002). The authors consider the vulnerability as a probability that a household which currently is not in poverty will become poor, or a poor household remains in poverty in the future. Compared to the VER and VEU, VEP is more concerned with the dynamics of poverty over time and measures the vulnerability to poverty by comparing the difference between the expected variance and expected mean of household income. Similar to VEP, VEF assesses the household's vulnerability through contrasting the expected variance and expected mean of household food consumption. In other words, VEF identifies the vulnerability as the probability of a nonfood-poor household falling into food poverty or a food-poor household remaining in the food poverty in future. Both VEP and VEF assess the exposure to poverty, instead of the outcome of poverty itself.

All above four approaches have their advantages and disadvantages. A suitable choice depends on the key objectives and the purpose of research. In this study, the key subjects are the Chinese urban household. Until 2000, only 3.44% households' food consumption remained below the national food consumption poverty line. This came to zero in 2010[19]. That means the food consumption poverty line is no longer useful in the Chinese urban household and vast majority of Chinese household are now not poor in terms of food consumption. This indicates that the international absolute poverty line,

[19] The data resource; National Bureau of Statistics of China (stats.gov.cn)

based on the amount of food intake, is not suitable to measure the household poverty in urban China. Instead, it is more meaningful to access the income of urban household using the relative poverty line, which compares the standards of living with the economic standards of living within the same surroundings. Meanwhile, it is also worth estimating whether the economic status of household will fluctuate between non-poor to poor in future in response to different types of shocks. The VEP approach appears to be more suitable for this study, as this approach enables to analyze the impacts of idiosyncratic and covariate shocks on the ex-ante risk that a non-poor household will become poor in the future.

2.2.2 The Urban Minimum Living Standard Assistance in China

Before the 1990s, Chinese government made significant steps to combat the household poverty in rural areas. By the 2000s, the government realised that it is also essential to implement social policies designed for urban areas with the aim of prompting a more balanced program for the economic development. In this circumstance, the Minimum Likelihood Guarantee Program[20] was established by the Chinese government via Urban Minimum Living Standard Assistance (UMLSA) system (Cheng et al., 2002; Wang, 2007; Riskin and Gao, 2009; Knight and Shi, 2016). It is worth mentioning that there is no fixed absolute poverty line in mainland China. Instead, a minimum living standard varies across cities in urban areas and it is designed by the local UMLSA system based on a chosen level of family income per capita. This income is expected to satisfy the basic needs of local residents and it is provided as a subsidy from local finance office to the qualified households (Tsui, 2005; Zhu and Zhao, 2017). Specifically, if the household per capita income is lower than the local urban

[20] It is also known as the *Dibao* program.

living standard, they are allowed to apply for UMLSA. After getting approval, they are entitled to receive cash transfer from the local government. In addition to cash subsidy, a certain number of provincial governments provide the qualified families with extra social assistance, such as the subsidised medical services for the family with disabled household members and supply of the essential daily necessities for the children with impaired health conditions (China Ministry of Civil Affairs, 2000).

Undoubtedly, the purpose of establishment of UMLSA was to alleviate the urban poverty and maintain social stability. Until the end of 2012, nearly 17 million urban residents received different types of social assistance (Ravallion and Chen, 2015). Nevertheless, several authors argue that the local governments have not supplied the poor households with sufficient amount of cash subsidy to enable them to transit out of the poverty (Leung, 2006; Ngok and Huang, 2014). Some qualitative research reveals that nearly all the regional UMLSA choose to place the recipients' name on public record, resulting in significant stigmatization of social transfers. Specifically, the recipients of transfers are often shamed and marginalised by the local community. The publicity set them apart from peers in a harmful way, and some neighbors regard them as the "marginal group". Under this circumstance, the recipients are ashamed of their poverty and gradually lack the sense of belonging in the community. Some parents, who are eligible for the UMLSA, choose not to apply for the social assistance because of potential stigmatisation of their children at school (Sauders and Sun, 2006; Lombard and Kruger, 2009; Chen et al., 2018). Importantly, maintaining the public record of the transfer recipients is counterproductive to the original central government plan to reduce the household poverty instead of isolating the poor household from the local community indirectly.

In addition, in the absence of central administrative intervention, cities with higher fiscal dependency and larger decision-making power tend to behave differently in the implementation of the social assistance for the poor families. Shi (2012) and Hammond (2013) found that compared to the less-developed areas, well-developed cities such as Shanghai show the amount of cash relief nearly 2 times higher than that in Guizhou and the former also provides the minimum living standard assistance recipients with preferential measures, such as free education and medical services. Moreover, most regions regard the household income as the sole qualified criterion, instead of considering other elements that also have significant impacts on the household expenditure, which potentially result in the household poverty for households with disabled members and households with more children (Knight and Song, 2005; Giles et al., 2008).

These findings indicates that the UMLSA system have not alleviated the poverty effectively and the existing improvement of household income is also far away from its target that balances the economic development. At the same time, the problem of implementation of UMLSA also bring to attention the rise of new forms of urban poverty in China, vulnerability to poverty that are the households which are not poor now but are likely to enter poverty in future.

Although several studies discuss the effects of UMLSA on the alleviation poverty in the Chinese urban regions, few focus on its contribution to the household vulnerability to poverty (Raiser, 1998; Tang et al., 2003; Doje, 2001; Zhu and Zhao, 2017). Meanwhile, the discussion about the variation in social assistance, as opposed to cash relief for the UMLSA recipients in China, is lacking. It is therefore worth exploring the impact of different minimum living standard line and varied types of social assistance on the vulnerability to poverty in the Chinese urban regions and to

find whether the relationship between the economic development of cities and the amount of cash subsidy is positive.

2.2.3 The discussion about the impact of infrastructure on the household income and reduction of poverty

According to the literature, a well-constructed community's infrastructure has a significant effect on prompting urban social development. Initially, the construction of urban infrastructure provides more job opportunities for the residents in the local community and is beneficial for enhancing the urban employment rates. With the development of related industries, the number of new employed workers increased, the income level of residents raises, resulting in the reduction of regional poverty (Thakuria et al., 2013; Johnson et al., 2017; Fageda and Gonzalez-Aregall, 2017; Chakrabarti, 2018). Moreover, the energy environmental infrastructures raise the level of public health and have a positive influence on the reduction of medical expenses (Bennett, 2012; Parikh et al, 2015; Lenz et al., 2017). Also, transportation infrastructure facilitates residents' commute and decrease usage of private transportation also reduces the emission of pollutants, which improves the community's living conditions and residential environment (Singleton and Clifton, 2017; Liu et al., 2018). Importantly, the improvement of schooling infrastructure and quality of schools has significant positive influence on enrollment rates, which is helpful in raising the level of educational qualification in the community (Kenyon, 2011; Siddiquah and Salim, 2017).

Undeniably, the quality of urban infrastructure is positively related to the impact on the social progress and is helpful in raising the residents' income level. However, few studies build a relationship between the urban infrastructure and household

vulnerability level, and it is worth exploring how it affects the community's vulnerable group.

Although communities close to high-ranking primary and secondary schools, hospitals, post offices, and police stations are considered as well-conditioned, the average housing price in these communities is significantly higher than the less-conditioned ones. (Johnson et al., 2017; Lenz et al., 2017). Whether such price is justified by the positive impact of infrastructure on the improvement of resident's living condition and environments also needs to be investigated.

2.2.4 The discussion about the impacts of elder on the household vulnerability

The issue of ageing population in China has become more significant since 2000s, as the first birth peak, which happened in the 1940s, results in a generation experiencing both the rising life expectancy and declining fertility rates when they are older than 60 years. This issue is considered as a potential threat to the sustainable economic development and is closely related to the household poverty (Barrientos, 2011). In 2012, 3.4 million elder adults (above 65 years) received the *Dibao*[21] from the Urban Minimum Living Standard Assistance System (UMLSA). This accounted for nearly 20% of all recipients (China Ministry of Civil Affairs, 2013).

Several papers find that, compared to the younger groups, elder ones are more likely to be in poverty persistently, as they have less chance to change their life circumstances after the retirement. Meanwhile, in contrast to male elders, the female elders show higher propensity to enter the poverty due to a number of reasons specific to them.. Like most countries with "traditional values", females in China are expected

[21] The *Dibao* program allows each locality to set its own *Dibao* standard (essentially the poverty line). Anyone below that standard is formally eligible for *Dibao* assistance. The assistance in theory gives an individual a certain amount of money to reach the *Dibao* standard and the financial support is varied across cities. (China Ministry of Civil Affairs, 2013).

to take more responsibility to look after the children and elders in the household. As the prominent caregivers, they have to spend much time within the household, instead of entering the labor market. Under these circumstances, lots of females have not worked since marriage, and by the retirement age, they are unqualified to receive regular types of pensions. Moreover, in divorce, they are less likely to receive any financial support from the husband (Schroder, 2004; Vera,2012). Secondly, the research found that the females are more likely to be housewives if their children have serious illness or disabled. The households with disabled members are also less likely to pass financial responsibility from one generation to the next, as the disabled tend to be less competitive in the labor market and they are also less capable to support their mother financially. What is worse, the first generation is not only unable to benefit from offspring, but also have to keep proactive parenting continued into old age (Aldwin, 2007; Chen et al., 2018). For the already poor females these often means that the caregivers responsibilities further strain their meagre resources and become a source of stress.

In addition, the elder have shown higher propensity to be struck by the serious illness in China. Because of the limited coverage of medical insurance, many elders struggle to afford medical expenses and unable to follow the medical advice, which impedes their recovery. Meanwhile, the stress arising from poor health further exacerbates by the cost of treatment (Zhang, 2009; Yan, 2014). The poor patients face a dilemma between taking comprehensive treatment and having a good rest beneficial for their health and rehabilitation, while the preconditions of receiving treatment is to work harder to afford the medical expenses.

Although since 2000s, the Chinese central government was devoted to alleviating the urban household poverty via UMLSA, they still do not appear to take the issue the

aging population into account. Until now, there has been no universal welfare provision that designed for the poor elders in China. Thus, several scholars criticized the effectiveness of UMLSA on the reduction of poverty, as "the low-level" and narrow-coverage social welfare system does not match the social need (Black and Rubinstein, 2000; Lloya and Locke, 2008).

While several papers discuss the impact of number of elders on the household poverty in China, few concentrate on the elder groups which currently are not poor and more likely to be poor if exposed to shocks, such as illness, disability and or loss of a partner. In addition, studies in other countries show that, compared with the single elder, two elders are less likely to be vulnerable, as the mutual care and company, not only helpful for relieving the stress, but also beneficial for keeping a good mood, which decreases the probability of being ill (Wheelock and Jones, 2002; Gregg et al., 2003; Brewer, 2005). It is therefore interesting to explore whether this result holds in China, as if it does, it could provide the social policy makers with more inspirations to meet the needs of vulnerable groups that balance growth-led development and changing social needs.

2.3. Date description

This study employs urban data from the 2007-2008 Urban Chinese Household Income Project (UCHIP), which was conducted by the Chinese Institute for Income Distribution Centre (CIFIDC). It not only contains the individual and households' characteristics, such as personal and employment information and details about the family structure, but also provides with the community-level characteristics, such as the location information, *Dibao*-related information, and situation of local community's basic infrastructure facilitates. The period covered is from Jan 2007 to Jan 2008. The

data include 4960 urban household from 8 provinces, 34 municipalities and 777 local communities.

Aiming to estimate the household expected mean and variance in income, we use a broad range of characteristics summarized in Table 2.1. The individual information variables include the age of head of household, health conditions, education attainments, marital status, and the local city *hukou* status. If the head of household has disability or serious illness, it is considered as having bad health condition. As the nine-year compulsory education is well implemented in urban China, we regard the head of household with less than 9 years of education as having no educational attainment, instead of illiteracy (Tsang and Ding, 2005). Employment related information contains the head of household's employment status of, contract length and participation in welfare programs. There are six components in the welfare programs, including the medical expenses subsidies, school fee, bus ticket, cash and non-cash coupon, and other benefits. Household level information includes the number of children, youth and elder in the household. Variables for regional characteristics reflect geographical heterogeneity which were discussed in the previous studies (Justino and Litchfield, 2003; Imai and Gaiha, 2007). This study encodes the western regions of China as 1 and others with 0, with the purpose of exploring whether the regions mainly locate in mountains experience greater household vulnerability when contrast to other regions. The previous studies show that transport access is complementary to availability of other basic "merit" services, such as health care and education. They indicate that the urban household, which often lack access to affordable public transit or come across physical and regulatory barriers to entry by informal transport services, are more likely to be poor in future, as under the shocks, they are less capable to get assistance from outside promptly (Gannon & Liu, 1997; Scheyvens & Momsen ,2008; Lucas et al.,

2016). Moreover, we divide the children, in accordance with the nutrition requirement and other needs, into the following two groups - aged below 7 years and aged 7-16 years.

The previous studies show that urban households can curb their exposure to idiosyncratic risks through community-level insurance arrangements. Specifically, they can build informal networks of mutual assistance around household. Meanwhile, they are assumed to face relatively higher possibilities of information asymmetries and enforcement limitations across communities than within community. In addition, covariate shocks remain uninsured under local risk pooling. They are correlated across families within a community so that the local risk pooling breaks down (Gunther & Harttgen,2008; Azam & Imai, 2012). This study attempts to verify whether this theory fits in urban household in China by controlling the following control variables: Community's geographic charachteristics, such as location, the rate of outsiders and the average monthly rent in local community; the *Dibao* related information, such as *Dibao* line, rate of *Dibao* recipients and *Dibao* benefits across the communities.

We estimate the impact of infrastructure on the household vulnerability to poverty by looking at whether the community is close to convenient facilitates, such as banks, police offices, supermarkets, and transportation stations, and also by considering the community's distance to educational organizations, such as primary secondary and senior high schools. We take several types of welfare in community into account. In other words, the welfare scheme covers different kinds of expenses (concessional or free), such as medical expenses, educational fees, bus ticket fees and cash coupon in supermarket.

It is noteworthy that we apply the welfare index[22] and infrastructure index in this study, which uses several characteristics that reflects the welfare of individuals and the quality of community infrastructure respectively. We can evaluate their impacts on idiosyncratic and covariate shocks on household vulnerability to poverty via principal component analysis. There are three reasons for us to use an aggregate index, instead of individual variables. Firstly, the index used in this study is to provide a proxy of the overall welfare attainment of the individual and infrastructure within the community (Azam and Imai, 2012). Secondly, as Hox (2002) pointed out multilevel regression requires remarkable computational power. Therefore it is wise to be parsimonious with the number of parameters.

Table 2.1：Summary statistics for households and communities

Variable name	Mean	Standard Deviation	Minimum	Maximum
Household-level				
Adult equivalent	2.23	.58	1	5.90
Province	3.20	.40	0	7
Age of head of household	49.78	12.86	18	91
Squared of age of head of household	2637.16	1346.89	324	8281
Welfare	.50	.48	0	1.21
No children[23]	.84	.37	0	1
No youth[24]	.77	.42	0	1
Bad health	.05	.23	0	1
No long-term contract	.49	.50	0	1
Unstable marital status	.07	.25	0	1

[22] The composition of welfare index and infrastructure index is placed in Appendix section.
[23] No children indicate that there are no children aged below 7.
[24] No youth indicate that there are no children aged between 7 and 16.

Educational qualification Below secondary school	.01	.07	0	1
Unemployed	.04	.20	0	1
No local hukou	.02	.15	0	1
Community-level				
Locates in city centre	.58	.49	0	1
Outsider rate[25]	.16	.16	0	.86
Infrastructure index	.77	.15	.22	1.07
Monthly rent[26]	6.52	.71	.69	8.29
The extra benefit of *Dibao*	.40	.49	0	1
***Dibao* line**	8.14	.26	7.73	8.96
The rate of *Dibao* recipents	.043	.07	.01	.92
Province*D*ibao* extra benefits	.05	.22	0	1
Infrastructure*number of youths	.59	.35	0	1.07
Province**Dibao* line**	1.58	3.16	0	8.54
Number of observations	4961			

2.4.1 Methodology – Measurement of vulnerability

This study evaluates the dynamics of poverty over time, rather than the static measures, as a function of both the expected variance and the expected mean of household income.

Formally,

$$V_{it} = \Pr\left(lnhi_{it+1} < lnP | X_{it}\right) \quad (1)$$

[25] The outsider rate indicates the rate of residents not owning the local city hukou.
[26] Monthly rent indicates the average rent for two-bedroom in local community.

where $lnhi_{it+1}$ indicates the per capita (log) household income at time t+1, and lnP is the (log) of the relative poverty line of the household.

Using the cross-sectional data, the equation of household income could be derived:

$$lnhi_{it} = X_i\beta + e_i \quad (2)$$

where X_i is a set of observable household characteristics, β represents a vector of parameters, and e_i indicates the stochastic error term with a mean zero and normal distribution.

To address the concerns surrounding the problem of heteroscedasticity in the cross-sectional data, this study applies the feasible generalised least squares (FGLS) method, which is regarded as an effective method with which to deal with this problem, to estimate the coefficient of equation (2). The vulnerability index could be rewritten as follows:

$$\widehat{V_{it}} = \Pr(lnhi_{it+1} < lnP|X_{it}) = \Phi\left(\frac{lnP - \hat{E}(lnhi_{it}|X_{it})}{\sqrt{\hat{\sigma}_{ei}^2}}\right) \quad (3)$$

where Φ indicates the cumulative density function of the standard normally distribution.$\hat{E}(lnhi_{it}|X_{it})$ is the expected per capita of (log) household income. $\sqrt{\hat{\sigma}_{ei}^2}$ is the estimated value of the standard error of e_i.

Furthermore, due to the problem of heteroscedasticity, the assumption of constant variance may not hold (Chaudhuri et al., 2002); thus, in this study the variance of equation (2) can be written as follows:

$$\sigma_{ei}^2 = X_i\beta + \delta_i \quad (4)$$

2.4.2 Methodology – Feasible Generalised Least Squares

The standard ordinary least squares method assumes homoscedasticity; that is to say, all error terms have the same variance. In contrast, we assume that heterogeneity exists in household income, which brings about the problem of the error term varying across households. This means that the estimation of β via ordinary least squares would lead to unbiased but inefficient coefficients.

Aiming to solve this problem, we follow feasible generalised least squares (FGLS), as suggested by Chaudhuri (2002), which is more efficient in respect of this study. Specifically, the estimation of FGLS allows for heteroscedastic standard errors and enables the correction of error terms in the regression model of household income. We apply FGLS and utilise the estimated residuals obtained from equation (4) via OLS. The estimation could be displayed as follows:

$$\hat{\sigma}^2_{OLS,i} = X_i\beta + \delta_i \tag{5}$$

Then the estimated value of $X_i\hat{\beta}_{OLS}$ obtained from equation (5) enables us to transform the equation into the following:

$$\frac{\hat{\sigma}^2_{OLS,i}}{X_i\widehat{\beta}_{OLS}} = \beta\left(\frac{X_i}{X_i\widehat{\beta}_{OLS}}\right) + \frac{\delta_i}{X_i\widehat{\beta}_{OLS}} \tag{6}$$

We generate $X_i\hat{\beta}_{FGLS}$ via an OLS estimation from equation (6), which is an efficient estimate of σ^2_{ei}. $\hat{\sigma}_{ei}$ could be expressed as follows:

$$\hat{\sigma}_{ei} = \sqrt{X_i\hat{\beta}_{FGLS}} \tag{7}$$

Substituting the estimated value of $\hat{\sigma}_{ei}$ into equation (2), the new transformed equation could be written as follows:

$$\frac{lnhi_{it}}{\hat{\sigma}_{ei}} = \gamma\left(\frac{X_i}{\hat{\sigma}_{ei}}\right) + \frac{e_i}{\hat{\sigma}_{ei}} \tag{8}$$

The estimation from equation (8) provides us with the consistent and asymptotically efficient estimator of $\hat{\gamma}_{FGLS}$. Moreover, utilising $\hat{\gamma}_{FGLS}$ and $\hat{\beta}_{FGLS}$, the expected log income and variance can be estimated for each household as follows:

$$\hat{E}\left[\widehat{lnhi}_{it}|X_{it}\right] = X_i\hat{\gamma}_{FGLS} \tag{9}$$

$$\widehat{Var}\left[\widehat{lnhi}_{it}|X_{it}\right] = \hat{\sigma}_{ei}^2 = X_i\hat{\beta}_{FGLS} \tag{10}$$

With the assumption of the log of household income having a normal distribution, we can use these estimates to measure the household's vulnerability to poverty, and equation (3) could be transformed into the following:

$$\widehat{V_{it}} = \Phi\left(\frac{lnP - \hat{E}(lnhi_{it}|X_{it})}{\sqrt{\hat{\sigma}_{ei}^2}}\right) = \Phi\left(\frac{lnP - X_{it}\hat{\gamma}_{FGLS})}{\sqrt{X_{it}\hat{\beta}_{FGLS}}}\right) \tag{11}$$

2.4.3 Methodology – Two-level linear random intercept model of idiosyncratic and covariate vulnerability

Aiming to measure the relationships between variables at different hierarchical levels, this study applies the two-level linear random intercept model in measuring the impacts of idiosyncratic shocks (household level) and covariate shocks (community level) on vulnerability. This approach has three advantages. Firstly, the multilevel model not only takes into account observations of households and groups simultaneously in the same model, but also does not violate the assumptions of independent observations and provides us with significant tests and the correct standard errors effectively (Goldstein, 1999). This is in contrast to standard regression analysis with hierarchical data, which simply assigns certain community characteristics to

household living within a community and may ignore the assumption individual observations and result in biased standard errors and t-values. Secondly, the multilevel model enables us to explore the relationship among variables within a given level, as well as taking the relationship across different levels into account (Gunther and Harttgen, 2009). Specifically, in this study the multilevel model not only helps us analyse the direct impacts of covariate shocks on each household's vulnerability to poverty, but also allows us to investigate their indirect impacts through the analysis of random components. Lastly, the multilevel model allows us to decompose the unexplained variance of the dependent variable (household income) into the household level and the community level, enabling us to distinguish the source of vulnerability. In particular, this approach benefits us in assessing the impacts of idiosyncratic shocks (household level) and covariate shocks on each household's income through identifying different predictors under the hierarchical nesting structure (Steenbergen and Jones, 2002).

In this study, we suppose that level one (household level) $i = 1,2 \ldots\ldots, n$ units (households) and that level two (community level)$j = 1,2 \ldots\ldots, m$ units (communities). The main hypothesis is that the error term in the income regression captures the impact of both idiosyncratic and covariate shocks on the household's income. Meanwhile, this study also assumes that the variance of household and community characteristics is correlated.

The household income equation is formulated as follows:

$$lnhi_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + e_{ij} \quad (12)$$

where $lnhi_{ij}$ is the per capita household (log) income, X_{ij} denotes a set of household characteristics of household i in community j, and e_{ij} indicates the unexplained variance in each household's income.

Equation (12) assumes that the constant term β_{Oj} and the slope β_{1j} vary across communities. Under this condition, the community characteristics Z_j can be applied in estimating the variance of coefficients across communities:

$$\beta_{Oj} = \epsilon_{00} + \epsilon_{01}Z_j + u_{0j} \tag{13}$$

$$\beta_{1j} = \varepsilon_{10} + \varepsilon_{11}Z_j + u_{1j} \tag{14}$$

where u_{0j} and u_{1j} denote the level two (community-specific) residuals, representing the unexplained heterogeneity of income across communities. Furthermore, if we replace β_{Oj} and β_{1j} in equation (12) from equations (13) and (14) respectively, the new equation is described as follows:

$$lnhi_{ij} = \epsilon_{00} + \epsilon_{01}Z_j + \left(\epsilon_{10} + \epsilon_{11}Z_j\right)X_{ij} + u_{0j} + u_{1j}X_{ij} + e_{ij} \tag{15}$$

where $\epsilon_{00} + \epsilon_{01}Z_j + \left(\epsilon_{10} + \epsilon_{11}Z_j\right)X_{ij}$ represents the deterministic part of equation (15), and the interaction term Z_jX_{ij} reflects the cross-level interactions between variables at level one (household level) and level two (community level). The last three terms capture the stochastic part of the model. It is worth noting that, in contrast to the standard OLS regression, equation (15) not only includes the error term of the household component e_{0j}, but also contains the error terms of the community component $u_{0j} + u_{1j}X_{ij}$. In other words, u_{0j} reflects the unexplained variance across communities of the intercept β_{Oj} (as displayed in equation (13)), while another error term $u_{1j}X_{ij}$ accounts for the unexplained variance across the communities of the slope

β_{1j} (as shown in equation (14)). Besides, the error term of the household component e_{ij} represents the unexplained variance in household income within communities.

It should be noted that in this study we assume that the error term of the household component e_{ij} is independent across households within a community, and that the error terms of community components u_{0j} and u_{1j} are independent across communities but dependent, that is, equal for each household i belonging to community j. This leads to a key assumption of heteroscedasticity within the error terms in this study, and the multilevel model enables us to specify the problem of heteroscedasticity at level one (household-specific) and at level two (community-specific).

In order to assess the impact of idiosyncratic shocks (household level) and covariate shocks on a household's vulnerability, we regress the per capita log of each household income $lnhi_{ij}$on a bundle of household characteristics X_{ij} and community characteristics Z_j, as shown in equation (15). We assume that the error term of the household level e_{ij} reflects the effects of idiosyncratic shocks, and that the error term of the community level $u_{0j} + u_{1j}X_{ij}$ captures the impacts of covariate shocks. Then we follow the method suggested by Chaudhuri (2002) and regress the squared residuals produced by equation (15) on the household characteristics X_{ij} and community characteristics Z_j. Equations (16)– (18) are written as follows:

$$e_{ij}^2 = \mu_0 + \mu_1 X_{ij} + \mu_2 Z_j + \mu_3 X_{ij} Z_j \tag{16}$$

$$u_{0j}^2 = \tau_0 + \tau_1 Z_j \tag{17}$$

$$(e_{ij} + u_{0j})^2 = \mu_0 + \mu_1 X_{ij} + \mu_2 Z_j + \mu_3 X_{ij} Z_j \tag{18}$$

The estimations from equation (16) and equation (17) enable us to obtain the expected idiosyncratic variance $\hat{\sigma}^2_{e_{ij}}$ and the expected covariate variance $\hat{\sigma}^2_{u_{ij}}$ separately. Meanwhile, equation (18) provides us with the total variance $\hat{\sigma}^2_{e_{ij+u_{0j}}}$.

We then use the expected household income obtained from equation (15) and the expected variances provided by equations (16)– (18) to assess the impacts of idiosyncratic and covariate shocks on household vulnerability:

$$\hat{v}_{ij} = prob\left(lnhi_{ij,t+1} < lnP \middle| X_{it}\right) = \varphi\left(\frac{lnP - \hat{E}(lnhi_{it}|X_{it})}{\sqrt{\hat{\sigma}^2_{ij}}}\right) \quad (19)$$

where $\hat{v}_{ij}$ denotes the estimated vulnerability to poverty, φ presents the cumulative density function of standard normal distribution, and $\hat{\sigma}^2_{ij}$ indicates the estimated variance of household income. In this study, we replace $\hat{\sigma}^2_{ij}$ with $\hat{\sigma}^2_{e_{ij}}$ and $\hat{\sigma}^2_{u_{ij}}$ and can obtain the idiosyncratic and covariate vulnerability index in equations (20) and (21), respectively:

$$\hat{v}_{idiosyncratic} = prob\left(lnhi_{ij,t+1} < lnP \middle| X_{it}\right) = \varphi\left(\frac{lnP - \hat{E}(lnhi_{it}|X_{it})}{\sqrt{\hat{\sigma}^2_{e_{ij}}}}\right) \quad (20)$$

$$\hat{v}_{covariate} = prob\left(lnhi_{ij,t+1} < lnP \middle| X_{it}\right) = \varphi\left(\frac{lnP - \hat{E}(lnhi_{it}|X_{it})}{\sqrt{\hat{\sigma}^2_{u_{ij}}}}\right) \quad (21)$$

2.4.4 Critical discussion of cross-sectional data in this study

As there is a lack of long-term information on household income, and we turn to applying cross-sectional household data in order to estimate the expected mean and variance, two strong assumptions need to be made.

The first assumption is that the present variance in our cross-sectional data could be used to estimate the intertemporal variance in household income in the future, which means that the variance in income of a particular household is assumed to be constant over time. In addition, several scholars have argued that the multilevel model based on cross-sectional data will miss the impact of intertemporal shocks at the national level, though the variance in cross-sectional data may explain intertemporal variance via household- or community-level shocks (Luttmer, 2000; Woolard and Klasen, 2005). Harttgen and Gunther (2008) justify that only length panel data could provide us with the intertemporal variance in household income precisely, as it contains information on changes in household income over a long period, but is unable to be found in developing countries.

The second assumption is the appearance of measurement error in the estimation of variance in income, which may result in the overestimation of variance in income and show the overestimation of the impact of household-specific shocks on household income. Thus, we assume that the error term e_i in equation (2) can capture mostly unmeasured variance and less measurement error in household income (Lemieunx, 2006). Although it is difficult to distinguish real income from measurement error, if only used with cross-sectional data, Chaudhuri (2002) proposes an approach that proves its robustness by applying only two-year short panel data from Indonesia and the Philippines. In addition, Ligon and Schechter (2004) demonstrate that the method suggested by Chaudhuri (2002) is the most proper approach to estimating a household's expected mean and variance in consumption via short panel data, as it produces less measurement error. Furthermore, Harttgen and Gunther (2008) and Azam and Imai (2012) apply one-year data on Madagascar and Bangladesh to evaluate the impact of household-specific and covariate-specific shocks on household consumption

respectively. Both studies demonstrate that the approach proposed by Chaudhuri (2002) could also apply to cross-sectional data, as low measurement error has been found in the estimated individual variance in consumption in their studies separately.

Obviously, for the analysis of household vulnerability to poverty, panel data covering a long period is always the best choice. However, it is non-existent in developing countries. Instead, only cross-sectional or short panel data is available to apply in the estimation of household vulnerability to poverty. Thus, we could only use existing data and had to turn to finding the "best" approach for compensating for the deficiencies.

2.5. Decomposition of poverty and vulnerability

Table 2.2 shows the categories of poverty and vulnerability. As a number of groups overlap, we have produced Figure 2.1, aiming to make it clearer. In terms of the choice of a vulnerability threshold — that is, if the household vulnerability is higher than the minimum vulnerability level, then it is termed as a vulnerable family — there are two criteria that have been applied in previous papers: 50% and 29% (Pritchett, Suryahadi and Sumarto, 2000; Chaudhuri, 2003; Suryahadi and Sumarto, 2003; Gunther and Harttgen, 2008; Azeem et al., 2016). The vulnerability threshold of 50% is a more common vulnerability threshold and if the time horizon goes to zero, then currently 'being in poverty' and currently 'being in vulnerable' coincide (Pritchett, Suryahadi and Sumarto, 2000). However, in contrast to rural households, urban households in China tend to have access to relatively more comprehensive welfare schemes and share a higher coverage of pension insurance. Thus, an urban household has a relatively lower vulnerability rate if applying the common vulnerability threshold of 50%, and the actual number of vulnerable groups may be underestimated, and a lower vulnerability

threshold should fit better. Meanwhile, this study also considers the prediction of the time horizon of household vulnerability, that is, the probability of a household being poor in the coming years. Following the approach suggested by Gunther and Harttgen (2008), Azam and Imai (2012) and Azeem et al. (2016), we measure the vulnerability threshold for the next two years as follows:

$$V^* = 1 - \sqrt[n]{1 - V_t}$$

In the equation above, V^* represents the predicted vulnerability threshold, V_t indicates the benchmark threshold (which is 0.29 in this study), and n indicates the following number of years. By means of the calculation, we obtain the value of V^* for the next one, two and three years: 0.290, 0.158 and 0.108, respectively.

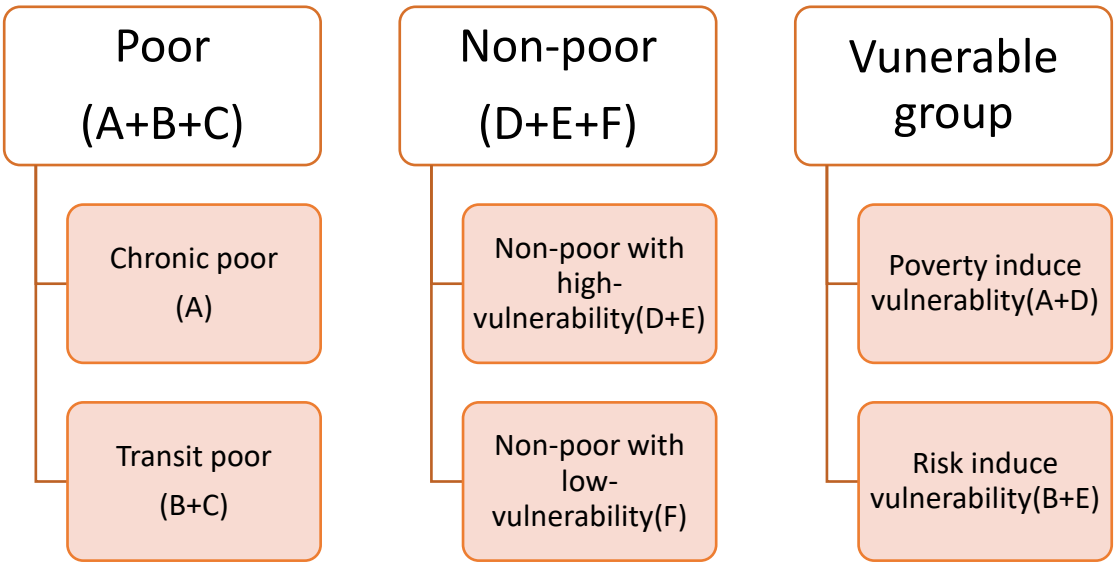
With the purpose of exploring the reason for being vulnerable, we decompose vulnerable groups into poverty-induced vulnerability and risk-induced vulnerability through making comparisons between the poverty line and the expected income. If the vulnerable group has a lower expected income than the poverty line, it is termed as poverty-induced vulnerability, which is the so-called low level of expected income. If a vulnerable household shows an expected income above the poverty line, then it is with risk-induced vulnerability, and also named as a high variability of income (Gunther and Harttgen, 2008; Azam and Imai, 2012).

Table 2.2: Define the vulnerability to poverty

<table>
<tr><th></th><th>Current Income (hi)</th><th>Vulnerability to poverty</th><th>Expected Income</th></tr>
<tr><td>A</td><td rowspan="3">$hi < \bar{hi}$</td><td rowspan="2">$v \geq 0.29$</td><td>$E[hi] < hi$</td></tr>
<tr><td>B</td><td rowspan="2">$E[hi] \geq hi$</td></tr>
<tr><td>C</td><td>$v < 0.29$</td></tr>
<tr><td>D</td><td rowspan="2">$hi \geq \bar{hi}$</td><td rowspan="2">$v \geq 0.29$</td><td>$E[hi] < hi$</td></tr>
<tr><td>E</td><td>$E[hi] \geq hi$</td></tr>
</table>

F		$v < 0.29$	

Figure 2.1: Categorize the poor, non-poor and vulnerable group



2.6.1 Estimation results

Table 2.3 shows the regression results of the two-level multilevel model for the estimated mean of income. R^2_1 and R^2_2 represent the explained variance in income at the household level within communities and at the community level respectively. R^2_1 is 0.23, while R^2_2 is 0.47. When extra household- and community-level variables are added, R^2 does not improve. We utilise the White test to prove that the variance of both error terms of e_{ij} and u_j is heteroscedastic and verify whether they are uncorrelated[27], which enables us to decompose the total error term into idiosyncratic and covariate variance. Thereafter, as equations (16)– (18) show, we regressed the squared error terms

[27] The correlation between e_{ij} and u_j is 0.233.

on household and community variables to estimate the idiosyncratic, covariate and total variance in income for each household in urban China.

Table 2.3: Regression results of REML: dependent variable: Log of income per capita

Independent variables	Coefficients	Z
Adult equivalent	-.14 (***)	-9.39
Province	8.15 (***)	5.33
Age of head of household	-.03 (***)	-6.88
Squared of age of head of household	.01 (***)	6.99
Welfare	.15 (***)	6.82
No Children	-.06 (**)	-2.54
No youth	.18 (**)	2.06
No elder	.14 (*)	1.08
Bad health	-.19 (***)	-5.55
No contract	-.04 (**)	-1.64
Unstable marital status	-.22 (***)	-6.30
Educational qualification below secondary school	-.21 (**)	-2.26
Unemployed	-.32 (***)	-7.06
No local hukou	-.07 (**)	-1.24
Locates in city center	-.07 (***)	-2.69
Outsider rate	.25 (***)	3.11
Infrastructure	.27 (**)	2.28
Monthly rent	.18 (***)	8.01
Infrastructure*number of youths	-.19 (**)	-1.71
***Dibao* extra benefits**	.05	1.91

	(**)	
***Dibao* line**	.50 (***)	6.92
The rate of *Dibao* recipients	-.83 (***)	-4.80
ProvinceDibao* extra benefits**	-.15 (***)	-2.35
ProvinceDibao* line**	-1.02 (***)	-5.30
Random effect parameters	Estimates	Number of observations
Household	0.19	4961
Community	0.08	777
$\mathbf{R_1^2}$	0.23	
$\mathbf{R_2^2}$	0.47	

Note: Z -statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2.6.2 Discussion of results

As mentioned in Figure 2.1, we decompose poverty groups into the chronic poor and the transient poor. We consider the chronic poor to be the poverty group more likely to remain in poverty in the future, and regard the transient poor as households that could leave the poverty group, although currently they are in poverty.

Table 2.4 shows that regarding poor households, the number of households which are always in poverty is larger than those that could leave poverty in the future. Specifically, the ratio of chronic to transient poverty is nearly 2.5 times. In addition, the vulnerability rate in urban China is higher than the poverty rate, and further decomposition finds that 14% of households show a vulnerability rate that is higher than the set threshold of 0.29, though their current household income lies above the urban poverty line. This means that in comparison to the poor, more households face the risk of being poor in the future, although currently they are not considered to be a poor group.

Table 2.4: Estimates for urban poverty and vulnerability to poverty categories.

	Total vulnerability rate	Idiosyncratic vulnerability rate	Covariate vulnerability rate
At 1st year (V^*=0.290)	0.30	0.33	0.18
At 2nd year (V^*=0.158)	0.45	0.55	0.25
At 3rd year (V^*=0.108)	0.52	0.64	0.30
The rate of household with chronic poor	0.17		
The rate of household with transient poor	0.07		
Poverty rate	0.24		
The rate of vulnerable and non-poor household	0.14		
The rate of non-poor and non-vulnerable household	0.63		
The rate of non-poor household	0.76		
Total vulnerable rate	0.30		
The rate of vulnerable household induced by permanent low-income	0.11		
The rate of vulnerable household induced by risk	0.19		

2.6.3 The source of vulnerability

In terms of sources of vulnerability, we consider the impact of household-specific and community-specific shocks on vulnerability. Firstly, we explore the reason for being vulnerable. In other words, we explore whether vulnerability is induced by poverty (structurally induced vulnerability) or driven by risk (transitorily induced vulnerability). Specifically, if the expected mean of income of a household is lower

than the poverty line, then the household is referred to as poverty-induced vulnerability. Meanwhile, if the expected mean of household income is higher than the poverty line, but the vulnerability rate is higher than the threshold of 0.29, then it is termed as risk-induced vulnerability. In contrast to several developing countries in which household vulnerability is mainly caused by poverty, urban household vulnerability in China is mainly driven by high-income fluctuations, referring to risk-induced vulnerability. In other words, transitorily induced vulnerability is nearly 1.73 times higher than structurally induced poverty. This means that the unexpected shocks are more likely to push urban Chinese households towards poverty.

Then we analyse the contributions of idiosyncratic and covariate shocks to household vulnerability to poverty. Table 2.4 shows that according to the following three years, the impact of idiosyncratic shocks is always higher than that of covariate shocks on urban household vulnerability, which implies that household-level shocks have a relatively large influence on urban households' income.

2.6.4 Discussion about poverty and vulnerability categories for regional difference

Table 2.5 shows the estimate of vulnerability in seven urban regions. There is significant variation in poverty rates and vulnerability rates among these regions. Anhui, an inland province, displays the highest vulnerability rate, though its poverty rate is not so considerable when compared to other urban areas. The largest gap between poverty-induced vulnerability and risk-induced vulnerability appears in Anhui. This province also shares the largest number of non-poor but vulnerable households. These findings on Anhui indicate that vulnerable households in this province are mainly driven by risk, which implies that even those that currently are not in poverty are more likely to be poor in the future.

All the regions present a similar pattern, i.e., poverty-induced vulnerability is much less than those caused by risk. It means that urban households have a high propensity to enter poverty due to the high variability of income. In addition, except for a western municipality, namely Chongqing, all other regions share a higher idiosyncratic vulnerability in contrast to covariate vulnerability. One possible reason is that its mountainous terrain and an inconvenient transportation network, which enlarges the negative impact of community characteristics on household vulnerability to poverty.

Table 2.5: Poverty and vulnerability categories for region of residence

	Shanghai	Jiangsu	Zhejiang	Anhui	Henan	Hubei	Chongqing
Total vulnerability rate	0.14	0.06	0.10	0.37	0.12	0.09	0.13
Poverty induced vulnerability	0.02	0.01	0.01	0.01	0.03	0.02	0.05
Risk induced vulnerability	0.12	0.05	0.09	0.36	0.09	0.07	0.09
Idiosyncratic vulnerability rate	0.11	0.06	0.07	0.13	0.09	0.10	0.17
Covariate vulnerability rate	0.06	0.02	0.01	0.04	0.06	0.05	0.17
Poverty rate	0.15	0.10	0.11	0.10	0.12	0.09	0.13
The rate of household with chronic poor	0.01	0.01	0.00	0.01	0.02	0.01	0.03
The rate of household with transient poor	0.14	0.08	0.11	0.08	0.10	0.08	0.10

The rate of non-poor household	0.85	0.91	0.89	0.90	0.88	0.91	0.87
The rate of vulnerable and non-poor household	0.06	0.03	0.06	0.33	0.05	0.04	0.07
The rate of non-vulnerable and non-poor household	0.78	0.88	0.82	0.57	0.83	0.87	0.80

Source: Own calculations.

We define the poverty line as 60% of a city's disposable income per capita, and the poverty line in Shanghai is much higher than in any other regions, as we discussed earlier — nearly 1.5 times higher than in most inland and western regions. It is interesting to observe that Shanghai, a direct-administered municipality with high-speed economic development, presents the highest poverty rate. Meanwhile, this municipality also indicates a relatively higher vulnerability rate when compared to both coastal areas, such as Jiangsu and Zhejiang, and inland and western regions, such as Henan, Hubei and Chongqing.

Moreover, when analysing the reason for poverty in this municipality, we find that transitory accidents push households into poverty, as it shares the highest rate of transient poverty when compared to all other regions discussed in this study. This means that the disparity between the rich and poor in Shanghai is larger than we expected, and the underpinning risk of households being poor needs to be paid more attention.

It is difficult to deny the contribution of the Chinese government to fighting absolute poverty in recent years, and all the regions show a similar pattern that only a tiny proportion of households are chronically poor, which could be considered the best proof.

However, the findings unveil that the prevalence of poverty and vulnerability varied across the urban regions due to different causes, which requires policymakers to have a deeper understanding of poverty dynamics in different regions of urban China.

2.6.5 Discussion about poverty and vulnerability to different profiles

Table 2.6 shows that the incidences of poverty and vulnerability vary by educational qualifications obtained by the head of the household. With the prevalence of nine-year compulsory education in urban China, only a small number of residents are illiterate, and the highest poverty and vulnerability rates appear in households headed by someone with no more than secondary educational attainment. Moreover, with the enhancement of educational qualifications, poverty and vulnerability are gradually diminished. All these three groups present risk as the main cause of being vulnerable, which means that high variability of income results in vulnerability to poverty.

The findings indicate that the fluctuation of income decreases, while educational attainment increases. Only 9% of higher-educated heads of households currently are in poverty, which is no more than one third of those with less education. This further proves that higher-educated people have good coping abilities against future odds, as revealed by the absence of future threats of being poor. Meanwhile, both a meagre 8% of better-educated heads of households experience transient poverty and their vulnerability incidence is smaller than the poverty rate, which indicates that in contrast to other lower-educated people, they find it easier to adapt to changing circumstances and have a greater ex post coping capacity (Christiansen and Subbarao, 2005; Azam and Imai, 2012).

In terms of the impacts of shocks on vulnerability to poverty, idiosyncratic shocks clearly play a significant role for heads of households with lower educational attainment, especially the lowest-educated heads. Specifically, compared to covariate shocks, idiosyncratic shocks are more likely to push heads of households with lower educational qualifications towards poverty in the future. For households with the highest-educated heads, the influence of both idiosyncratic and covariate shocks on vulnerability is almost the same, which means that according to less educated groups, they are less integrated within the urban community, and the insurance mechanism at the community level works worse for them.

Table 2.7 presents the incidence of poverty and vulnerability according to different employment statuses: unemployed, employed and retired. More than half of unemployed heads of households are vulnerable, mainly due to poverty, which means that their low mean of income makes a greater contribution to pushing them into poverty in the future. Although the vulnerability rate of the retired group is higher than that of the employed group, both are mainly caused by risk, i.e., the high variability of income. This implies that employment insurance and pension probably do not work well for them, which decreases their ability to cope with risk in the future. It is worth noting that we also take the vulnerability incidence of two years into account and find that the largest gap between the first year and third year appears in the retired group, with the vulnerability rate having increased nearly two times, which implies that the pension system and healthcare mechanism probably do not provide sufficient support for them.

Table 2.6: Vulnerability and poverty categories by educational qualification of head of household

	Secondary school completed	Senior school completed	Above senior school completed
Total vulnerable rate	0.39	0.24	0.07
Poverty induced vulnerability	0.15	0.08	0.02
Risk induced vulnerability	0.24	0.16	0.05
Idiosyncratic vulnerability rate	0.44	0.26	0.06
Covariate vulnerability rate	0.28	0.21	0.04
Poverty incident	0.30	0.21	0.09
The rate of household with chronic poor	0.09	0.05	0.01
The rate of household with transient poor	0.21	0.15	0.08
The rate of non-poor household	0.70	0.79	0.91
The rate of vulnerable and non-poor household	0.18	0.11	0.03
The rate of non-poor and non-vulnerable household	0.53	0.68	0.87
Vulnerable to poor ratio	1.30	1.14	0.77
Vulnerability rate at 1st year	0.39	0.24	0.07
Vulnerability rate at 2nd year	0.55	0.40	0.18

Vulnerability rate at 3rd year	0.61	0.45	0.24

Source: own calculation.

Table 2.7: Vulnerability and poverty categories by status of employment of head of household

	Unemployed	Employed	Retired
Total vulnerability rate	0.59	0.19	0.24
Poverty induced vulnerability	0.34	0.06	0.05
Risk induced vulnerability	0.25	0.13	0.19
Idiosyncratic vulnerability rate	0.72	0.21	0.24
Covariate vulnerability rate	0.47	0.10	0.13
Poverty incident	0.46	0.18	0.21
The rate of household with chronic poor	0.29	0.04	0.03
The rate of household in transient poor	0.13	0.14	0.18
The rate of non-poor household	0.53	0.82	0.79
The rate of non poor and vulnerable household	0.22	0.09	0.12
The rate of non-poor and non-vulnerable household	0.31	0.73	0.67
Vulnerable to poor ratio	1.28	1.06	1.14
Vulnerability rate at 1st year	0.59	0.19	0.24
Vulnerability rate at 2nd year	0.71	0.33	0.41
Vulnerability rate 3rd year	0.76	0.36	0.49

Source: own calculation.

What is more, the transient poor account for a great proportion of poverty in the employed and retired groups, further verifying that these two groups lack the ability to

cope with unexpected incidents such as serious illness. On the contrary, the number of heads with chronic poverty shares a larger percentage than those with transient poverty in the unemployed group. This indicates that there is no comprehensive insurance system for the unemployed group, and they find it difficult to find a new job and are more likely to remain in poverty in the future.

Table 2.8 shows that the health condition of the heads of households is positively related to the incidences of poverty and vulnerability. Specifically, heads with a bad health condition have the highest poverty and vulnerability rates when compared to those with a relatively better health condition. Chronic poverty in households with heads with bad health shares most of the poverty. At the same time, the non-poor with a highly vulnerable population also share the largest proportion in this group when compared to those in the other two groups.

Table 2.8: Vulnerability and poverty categories by health conditions of head of household

	Bad health	**Average health**	**Very good health**
Total vulnerability rate	0.47	0.28	0.20
Poverty induced vulnerability	0.29	0.11	0.06
Risk induced vulnerability	0.18	0.17	0.14
Idiosyncratic vulnerability rate	0.51	0.32	0.20
Covariate vulnerability rate	0.38	0.12	0.13
Poverty incident	0.39	0.22	0.18
The rate of household with chronic poor	0.23	0.07	0.03
The rate of household with transient poor	0.16	0.15	0.15
The rate of non-poor household	0.61	0.78	0.82

The rate of non-poor and vulnerable household	0.16	0.13	0.09
The rate of non-poor and non-vulnerable household	0.45	0.65	0.72
Vulnerable to poor ratio	1.21	1.27	1.11
Vulnerability rate at 1st year	0.47	0.28	0.20
Vulnerability rate at 2nd year	0.62	0.43	0.35
Vulnerability rate at 3rd year	0.67	0.48	0.41

The main reason for groups with bad health to remain in poverty in the future is the low mean income. It is probable that due to suffering from an illness, they are more likely to have poor performance in their work and be unable to devote themselves to economic activity, resulting in a high probability of losing their job or reducing their income, and increasing the probability of their being poor in the future. Thus, medical insurance and aid for urban residents, especially those with chronic disease, are vital, which enable them to get rid of poverty and decrease the probability of being poor in the future.

In Table 2.9, it is interesting to observe that households with one elder share a larger proportion of the population in poverty and a higher risk of being poor in the future when compared to those with more than one elder, which is quite different from several papers that state that when the number of elders increases, the incidence of poverty and vulnerability increases (Yi et al., 2002; Xie et al., 2015; Yang et al., 2018; Chen and Cao, 2019).

Table 2.9: Vulnerability and poverty categories by number of elder in household

	0 elder	**1 elder**	**More than 1 elder**
Total vulnerability rate	0.23	0.33	0.25

Poverty induced vulnerability	0.09	0.14	0.07
Risk induced vulnerability	0.14	0.19	0.18
Idiosyncratic vulnerability rate	0.25	0.33	0.27
Covariate vulnerability rate	0.13	0.25	0.15
Poverty incident	0.20	0.26	0.22
The rate of household with chronic poor	0.05	0.10	0.06
The rate of household with transient poor	0.15	0.16	0.16
The rate of non-poor household	0.80	0.74	0.78
The rate of non-poor and vulnerable household	0.11	0.14	0.12
The rate of non-poor and non-vulnerable household	0.69	0.61	0.66
Vulnerable to poor ratio	1.15	1.27	1.14
Vulnerability rate at 1st year	0.23	0.33	0.25
Vulnerability rate at 2nd year	0.37	0.48	0.39
Vulnerability rate at 3rd year	0.42	0.54	0.45

A potential reason is that the younger generation in China are more likely to take care of their children (instead of looking after their parents). Thus, the caregiver burden on elders has transferred from elders' adult offspring to elders' partners, which means that more than one elder in a household take care of others without hiring an extra caregiver and incurring additional costs. Moreover, a single elder in a household is more likely to be abused by adult offspring, especially an elder with a serious illness and without a sufficient pension. What is more, lacking sufficient companions, a single elder will find it difficult to adjust themselves after retirement and share a high propensity to be distressed, resulting in illness and producing more medical costs that increase the risk of being poor in the future (Yan et al., 2002).

2.7. Conclusion

This study applies the FGLS approach to explore the incidences and sources of poverty and vulnerability in urban China, and further examines the influence of idiosyncratic and covariate shocks on household vulnerability to poverty.

Our results show that idiosyncratic shocks have a greater influence on household vulnerability, though both idiosyncratic and covariate shocks make contributions to household vulnerability to poverty. All regions that we discussed in this study follow this pattern except for Chongqing, a municipality in the western area that shows that idiosyncratic shocks have equal impacts to those of covariate shocks, which indicates that an insurance mechanism within a community makes a similar contribution to that of an insurance mechanism across spatially separated communities to household income. This implies that in contrast to all other regions, which show a higher impact of idiosyncratic shocks on household income than of covariate shocks, Chongqing finds it easier to implement an ex-ante coping strategy to reduce household vulnerability to poverty, as idiosyncratic shocks are more difficult to anticipate than covariate shocks.

The results also reveal that the incidence of vulnerability amongst heads of households with less human capital, such as a bad health condition, lower educational attainment, and a bad employment situation, is higher than that amongst relatively well-endowed heads. Furthermore, their vulnerability is mainly induced by poverty, instead of risk. This means that according to this group, the most effective way in which to reduce their risk of being poor in the future is to increase their low expected mean income, rather than to take high-income volatility into account. In other words, policymakers should consider lifting this group's educational qualifications and

strengthening their essential skills, for the purpose of enhancing their competition in the labour force market and increasing their income in the future.

One of the important findings is that in contrast to more than one elder in a household, a single elder in urban China is more likely to be poor, with the higher impact of household-level shocks on household income further proving that a single elder will find it difficult to receive care from their children, and the elder being mostly cared for by their spouse, even if they have adult children. This result is in significant contrast to Chinese traditional Confucianism, which emphasises that children should prioritise their parents and take full responsibility regarding caring for them (Fan, 2007; Li et al., 2010; Wang, 2014). It not only calls for Chinese policymakers to implement different policy choices for single elders and double elders respectively, but also needs more attention from children to consider a hierarchy in family care responsibility, where children step in as caregivers only when they lose one of their parents, or when one of their parents no longer fulfils the role of caregiver. Meanwhile, the lack of a Confucian family concept amongst the new generation should be valued by the Chinese educational sector, especially primary and secondary education. In contrast to parents who have a brother and sister, who can share responsibility for taking care of their parents, the majority of the 2010s saw families with only one child. If they are unable to fulfil this responsibility, then the burden will transfer from the individual to the public, resulting in a series of social problems and these should hinder Chinese rapid economic development in the following years.

Another noteworthy result is that Shanghai, well known as the most economically developed city in China, shows the highest vulnerability rate among all the interviewed regions. Moreover, vulnerability to poverty in Shanghai households is mainly induced by income volatility. Simultaneously, Shanghai also appears to have the highest poverty

rate when we apply a relative poverty line. This finding is apparently different from official statistical results which measure the poverty rate based on the absolute poverty line.[28] Our findings expose that Shanghai has witnessed a trend of becoming a highly vulnerable city with its characteristics of income disparities among the different employed groups. It means that the general diminishing of the absolute poverty rate is no longer suitable in this city, and more policies aiming at balancing the income gap should be implemented by the local government in urban China.

[28] The absolute poverty rate in interviewed year in Shanghai is only 2.1%.

Chapter 3 – Vulnerability to Poverty in Chinese Households with Elderly Members: 2013–2018.

3.1. Introduction

The first peak in the birth rate in China appeared in the 1950s. The one-child policy, which aimed to restrict the number of children, was introduced in the 1980s (Zeng and George, 2010). Under these dual effects, China is rapidly transforming into an ageing nation. In 2010, there were 111 million individuals aged above 65, accounting for 8.2% of the total population. The figure is expected to reach 400 million in 2050, which will likely constitute nearly 30% of the total population (Zeng, 2012; Fang et al., 2015).

The traditional Confucianism that is deeply rooted in China calls for younger generations to respect and take care of the elderly in the household (Bai, 2014). However, in recent decades, the rapid development of urbanisation and the implementation of the one-child policy have induced an extreme outflow of labour in rural China (Chow and Bai, 2011). All of this has forced young generations to leave their hometowns and has posed great challenges for adult children about providing their parents and children with adequate care, pushing the elderly towards a dilemma in which they heavily rely themselves on welfare schemes such as pension and medical insurance, as well as suffering the dual burden of taking care of offspring and spouses.

Previous papers analysing the ageing population in Chinese households have mainly focused on elders' physical and mental well-being, instead of considering the risk of their becoming poor after retirement. In addition, previous discussion on household vulnerability to poverty has been limited to several provinces/municipalities, rather than there being multidimensional analysis based on spatial disparity and time

disparity between urban and rural households (Chen, 2009; Dong and Simon, 2010; Feng et al., 2012; Jiang, Zhang and Shen, 2013; Chan et al., 2014).

This paper uses longitudinal data which includes urban and rural households from 27 provinces/municipalities. We assess the vulnerability to poverty in elderly households in 2013, 2015 and 2018. The main objective of this paper is to estimate elderly households' expected consumption and risk-coping strategy between urban and rural China. We first divide all provinces or municipalities into four regions and analyse the spatial disparity between urban and rural households, as well as discussing the annual changes. Thereafter, we make intra-regional comparisons and find the differences in the incidences of vulnerability in different provinces within the same region. Lastly, we explore the underlying factors that affect elders' well-being, such as pension and medical insurance schemes, and provide reasonable explanations for the obtained results by making comparisons at regional and intra-regional levels.

The paper is structured as follows. The second section lists all types of welfare schemes that are closely related to elders' well-being, such as pension and medical insurance, and discusses the advantages and disadvantages among them. The data description section describes the variables employed in this paper as well as details on how to categorise the specific variables. The methodology section explains how the relative poverty line is used to measure the impacts of various factors upon the vulnerability level of elderly households in urban and rural areas, respectively. The results section provides the results on how the vulnerability level varies regionally, intra-regionally, and across urban and rural households in 2013, 2015 and 2018, and explores the potential factors inducing elderly households to be poor in the future with regard to urban and rural households, respectively.

3.2. The Welfare System in China

3.2.1 Pension reform in China

Table 3.1 summarises the main types of pensions applied in Mainland China. The Universal Pension, Rural Residents' Pension, and Urban Residents' Pension are known as having no entry requirements. However, they have been widely criticised for their smaller pension amounts, which are unable to meet residents' minimum living needs (Whiteford, 2003; Zhu and Walker, 2017). The Enterprise Employee Pension (EEP) was founded in 1997 and developed from the traditional pension system under the planned economy into a social insurance system under the market economy (Sun, 2017). In the earlier phases, it only covered employees in state enterprises. until In 2005 its coverage expanded to employees in private enterprises, the self-employed, migrant workers, and other non-standard employees from informal sectors (Ai et al., 2011). Literally, this system is combined with social pooling and individual accounts, and the social pooling aspect is a 'pay as you go' system, which is financed by 20% of contribution wages from employers or 12% of contribution bases from the self-employed, while the individual account is financed by 8% of contribution wages from employees (Social Insurance Management Center, 2016).

However, there are three limitations in the practice of the EEP. The first limitation is the relative restrict requirement for contribution years. In most urban areas in China, employees should contribute to their private account continually for more than 15 years, as the prerequisite for receiving pension after retirement. Secondly, before 2015 there were still a certain number of medium and small-sized enterprises and organisations with low contribution capacity that were not covered by this system, even though the local government had made a great effort to expand the coverage of this system. Thirdly,

the contribution base varies from 60% to 300% of an employee's wage, depending on the type of enterprise. Furthermore, in practice, these contributions are often suspended for some unexpected reason, and have to be paid at the lowest base, which means that the actual contribution rate is quite far below the literal policy rate.

It is noteworthy that from 2015, the Government and Institutions Pension (GIP) gradually merged into the EEP; nevertheless, there is a significant difference between employees in government institutions and employees in other sectors, as the individual account of civil servants is financed by the government, which means that their pension is fully paid by the government, while they receive a relatively high pension after their retirement. Thus, in this study, we will discuss the GIP and the EEP separately, aiming to make comparisons between them regarding the impacts on retired employees' consumption. Moreover, Private Pension (such as Commercial Pension and Life Pension) is bought by individuals, with flexible payments and profit. Compared to other types of pensions in Mainland China, these types of pensions share a relatively small number of participants. Furthermore, local government also provides Old Age Pension Allowance, designed for residents aged above 60 and providing them with different types of exemption, such as free bus and train tickets (Zhang et al., 2012).

Table 3.1: Policy measures against urban elder poverty – Pension Scheme

Name of Pension	Target	Contents
Universal Pensions		
Rural Residents' Pension (RRP) (Zhu and Walker, 2017)	➢ Rural residents who enrol in this programme voluntarily.	➢ Individual and collective subsidies and local fiscal contribute to residents' pension account. ➢ The average pension in this programme is higher than that in the Old Rural Pension programme.

Urban Residents' Pension (URP) (Whiteford, 2003)	➢ Residents who do not have any type of pension in urban areas.	➢ Both residents and local fiscal contribute to this pension account, and residents are able to receive a relatively low pension when they are aged above 60.
Job-Related Pensions		
Government and Institutions Pension (GIP) (Hu, 2012)	➢ People should have a long contract and be employed by government or public institutions.	➢ There are no payments during employment, and they receive a relatively high pension after retirement. ➢ The exact percentage varies among regions.
Enterprise Employee Pension (EEP) (Salditt et al., 2008)	➢ People should work in an enterprise and satisfy the re-equipment of minimum years.	➢ Both employers and employees should contribute a certain percentage of their wages to the Social Pension Funds. ➢ There is more pay during employment, and they receive more after retirement.
Private Pensions		
Commercial Pension (Yu et al., 2020)	➢ Insured people in insurance companies.	➢ Payments and earnings depend on the insurance programme.
Life Pension (Yu et al., 2020)	➢ Insured people in insurance companies.	➢ Payments and earnings depend on the insurance programme.
Other Pensions		
Old Age Pension Allowance (Zhang et al., 2012)	➢ Residents who are aged above 60.	➢ There are free bus/train tickets, free visits, and so on. ➢ Exempted activities are varied across cities.

Table 3.2: Policy measures against urban elder poverty – Medical Insurance Scheme

Name of Medical Insurance	Target	Contents	Additional Notes
Urban Employee Medical Insurance	All urban employees with a long contract.	➢ The insurance is paid by both employers (no	➢ Male employees pay for 25 years and

(Liu, 2004; Lu, 2014)		more than 6% of the total employee wage) and employees (no more than 2% of the total employee wage).	female employees pay for 20 years, which could benefit the medical insurance without any payment after retirement.
Urban Resident Medical Insurance (Li et al., 2017)	Urban residents without Urban Employee Medical Insurance.	➢ It mainly depends on individuals' payments and few local government subsidies.	➢ The insurer should pay year by year, with a minimum years guarantee.
New Cooperative Rural Medical Insurance (Liu and Tsegai, 2011)	All rural residents are eligible for the programme.	➢ In its initial year (2003), the annual premium was $3.62 per person, with $2.42 from central and local governments and $1.21 from households (Ministry of Health et al., 2003). Over time, governments gradually increased the subsidies in the programme.	➢ Nobody will be rejected based on health status or other considerations.
Commercial medical Insurance	Insured people from the insurance company.	➢ The payment and the percentage of reimbursement depend on the insured program.	

3.2.2 Discussion about types of medical insurance in China

Tables 3.1 and 3.2 summarise the types of medical insurance in Mainland China and make comparisons among the main types of medical insurance, respectively. There is no doubt that the coverage of the New Rural Cooperative Medical Scheme (NCMS) is larger than that of other types of medical insurance in Mainland China. It was

established in 2003, and its fund consists of central government subsidies and county government and individual contributions. Specifically, in its initial year, the annual premium was $3.62 per person, with $2.42 from central and local governments and $1.21 from households (Ministry of Health et al., 2012). Both the central and county governments gradually increased the subsidies in the individual account. Between 2003 and2009, the magnitude of subsidies in western China jumped seven-fold, while the subsidies in eastern China roared twelve-fold. With the increasing contributions from governments, the number of participants increased rapidly, and until 2015, more than 1.1 billion rural residents had joined the programme, accounting for the largest population in the world (Qin et al., 2021).

It is noteworthy that the financing of the NCMS varies across regions in China (Lei and Lin, 2009). More specifically, the central government subsidise more in western and central regions, while the local county governments contribute relatively less to the individual account. Meanwhile, in highly affluent eastern regions, such as Jiangsu and Shanghai, there is no contribution from central government; instead, the local county should provide all subsidies, as the local fiscal can do so. In return, the percentages of reimbursement on inpatient and outpatient services in Chinese regions are varied and could be summarised in four models[29] (Du and Zhang, 2007; National Health Commission of the People's Republic of China, 2014). From Appendix 1, we find that the reimbursement of the NCMS is mainly focused on inpatient services, instead of outpatient services.

What is more, the annual free physical check-up is provided in a limited number of counties, and is only offered to participants of the NCMS who do not use any medical

[29] There are four models on the reimbursement of inpatient and outpatient services, which are implemented in different rural counties in China. A summary of them is presented in Appendix 1.

services that require NCMS reimbursement within that year. This implies that the contribution of the NCMS relieves the individual financial burden on healthcare, being especially limited for patients with chronic illness.

Several papers argue the effectiveness of the NCMS in increasing the utilisation of care and improving public health (Wen, 2008; Yip et al., 2008; Wagstaff et al., 2009; Gao and Meng, 2009; Liu and Tsegai, 2011; Zeng et al., 2019). Yip et al. (2008) indicate that the medical saving account, which applies to over 50% of counties, as the alternative government-supported scheme, has a tiny impact on the utilisation of outpatient services and increases the amount of self-medication. Wagstaff et al. (2009) arrive at a similar conclusion to that of Yip et al. (2008) and further figure out that the utilisation of outpatient services, especially for patients with chronic illness, is disproportionately higher in wealthier households in eastern regions, compared to poor households in central and western China. A potential reason could be that of less developed counties offering a lower percentage of real-time reimbursement, with patients in poor households not being able to offer a great amount of out-of-pocket expenses, and turning to self-medication.

However, Qin et al. (2021) hold a different conclusion from those of Yip et al. (2008) and Wagstaff et al. (2009), which illustrates that the NRMS make significant contributions to alleviate poverty in low-income households, while it has not shown remarkable impacts on middle- and high-income families in rural China. Chen and Pan (2019) suggest that from 2014 to 2017, the outstanding improvement of the NCMS mainly focused on the percentage of out-of-pocket medical payments and the utilisation of inpatient services.

3.3. Data Description

The data in this study comes from the China Health and Retirement Longitudinal Study (CHARLS). It contains a high-quality, nationally representative sample of Chinese residents aged above 45 to serve the needs of scientific research on the elderly.

The CHARLS collects data through different methods. Specifically, they apply probability proportion size sampling (PPS) to residents at the county (district) and village level. They utilise electronic mapping software, using a map to make village sampling frames at the household level. Residents are surveyed through a questionnaire, which is designed following several international questionnaires such as the Health, Aging and Retirement Survey in Europe and the England Longitudinal Study of Aging (Ding et al., 2017).

An individual will be followed up every two to three years, and we apply the data from 2013, 2015 and 2018 to analyse the impacts of elders on households in terms of vulnerability to poverty. The individual-level data includes the following information: demographics, such as age, marital status, ethnic group, whether they belong to the Chinese Communist Party (CCP), and educational attainment; work and retirement, such as types of employment, kinds of pension, and the annual pension amount that the respondent received in the previous year; and information related to medical insurance, such as the annual health check-up and the types of medical insurance schemes that the individual has joined.

In line with the Chinese educational system, we categorised educational attainment into five groups and ranked them from low to high with a score of 0 to 5: Never educated (illiteracy); educated for less than five years (lower than primary school educational qualification), educated for6–9 years (lower than junior high school

educational qualification), educated for 10–12 years (lower than higher school educational qualification), and educated for more than 12 years (higher than a bachelor degree). The dataset of the CHARLS provides no details on the heads of households. Accordingly, this study selects the better-educated respondents in households as the objects of analysis.

Even though the Chinese Ministry of Human Resources and Social Security announced that the government is drawing up a plan to delay the retirement age, until 2021, the general retirement age in Mainland China was still 55 for male employees and 50 for female employees[30], which are lower than in other Asian countries, like Japan and Korea (Centre for Public Policy Research, 2021). Furthermore, this study defines the elderly as male and female residents who are aged above 55 and 50, respectively.

From the household perspective, the amount of fixed assets, which may affect elders' quality of living after retirement, is taken into account in this study (Dreger and Zhang, 2009; Eggleston, 2012; Li et al., 2017). Moreover, considering that house prices have soared with the process of urbanisation in China in the last decade, especially in eastern regions, it may have brought a heavy financial burden upon elders who do not own a property and have to rent a house after retirement, and contributed to household vulnerability to poverty to some extent (Ren et al., 2012; Chen and Funke, 2013; Dreger and Zhang, 2013).

Thus, this study considers information on whether the household owns the property and on the value of the property. Furthermore, the results in my previous paper illustrate that caregivers of babies in Mainland China heavily rely on the elderly, with

[30] The retirement age of males in governmental institutions and divisions is 60 and that of females is 55.

their children perhaps even assuming this responsibility. Simultaneously, single elders will find it difficult to receive care from their adult children, and elders are more likely to be cared for by their spouses in urban areas. This means that if the elders lose their spouse, they are unlikely to enjoy their retirement, and often take care of their offsprings. They may face the dilemma that once they become ill and are hospitalised, their children might not assume the responsibility of care and they will have to hire healthcare workers to look after them, incurring additional expenses. Therefore, this study considers the number of elders in a household, whether they are caregivers of offspring, and whether they live with children, aiming to explore the impact of these factors upon ageing household expenditure.

Tables 3.3 and 3.4 present descriptive statistics across urban and rural households for the variables used in the analysis of household consumption in 2013, 2015 and 2018, respectively.

Table 3.3: Summary statistics for urban households

Variable	**n (%)**		
	2013 N=1479	2015 N=921	2018 N=1099
Demographic characteristics			
Female aged higher than 50-year-old Or male aged higher than 55-year-old	88.44%	90.23%	94.27%
The number of elder in household			
0	11.49%	11.07%	3.37%
1	31.17%	36.16%	38.49%
2	57.34%	52.77%	58.14%
Whether belong to Chinese Communist Party			
Yes	11.83%	17.05%	15.01%
No	88.17%	82.95%	84.99%
Whether belong to ethic minority			
Yes	7.44%	6.41%	7.83%
No	92.56%	93.59%	92.17%

Whether married			
Yes	81.34%	78.61%	74.25%
No	18.66%	21.39%	25.75%
Educational attainment			
No educated	9.47%	10.58%	12.28%
Educated 1-5 years	21.43%	23.10%	32.48%
Educated 6-9 years	30.41%	27.99%	28.57%
Educated 10-12 years	30.99%	27.58%	15.38
Educated 12+ years	7.70%	10.74%	11.28%
Types of employment			
Civil Servant	8.49%	8.04%	7.18%
Institutional employee	7.16%	8.58%	7.55%
NGO employee	5.07%	5.50%	5.45%
Enterprises' employee	35.65%	39.12%	35.82%
Self-employed	14.94%	15.97%	23.82%
farmer	27.07%	20.40%	18.63%
Others	1.62%	2.39%	1.55%
Types of pensions			
Without pension	24.07%	28.12%	30.60%
Government and Institutional Pension	8.45%	7.38%	6.55%
Enterprise Employee Pension	19.95%	23.34%	24.27%
Commercial Pension	0.68%	0.76%	0.55%
Life Pension	1.42%	6.62%	3.46%
Rural Resident Pension	35.43%	21.29%	17.65%
Urban Resident Pension	5.54%	6.84%	10.10%
Old Age Pension	4.46%	5.54%	6.82%
ln (annual pension for last year) quartile			
Quintile 1(4.09,2.48,4.61)	1.51%	8.03%	3.64%
Quintile 2(4.61,4.61,9.39)	6.68%	10.00%	28.59%
Quintile 3(9.29,9.92,10.23)	74.24%	65.47%	54.29%
Quintile 4(10.23,10.23,12.26)	18.32%	16.50%	13.48
Regular physical examinations			
Yes	48.48%	54.94%	35.76%
No	51.52%	45.06%	64.24%
Whether belong to western province			
Yes	42.73%	72.96%	68.70%
No	57.27%	27.04%	31.30%
Types of medical insurance			
No medical insurance	14.67%	19.65%	12.65%

Urban employee medical insurance	36.03%	35.50%	36.77%
Urban residents' medical insurance	13.32%	12.81%	18.48%
New Rural cooperative medical insurance	30.44%	28.01%	26.57%
Private medical insurance	5.54%	4.02%	5.55%
Household characteristics			
Whether take responsibility for take care of children			
Yes	60.78%	61.02%	59.87%
No	39.22%	38,98%	40.13%
Whether live with adult children			
Yes	65.99%	72.53%	62.42%
No	34.01%	27.47%	37.58%
Whether own property			
Yes	51.93%	46.04%	38.12%
No	48.07%	53.96%	61.87%
ln (value of owned property) quartile			
Quintile 1(0.26,0.41,0.41)	1.42%	1.63%	2.72%
Quintile 2(0.69,0.69,1.39)	59.91%	63.08%	46.86%
Quintile 3(2.30,3.00,3.40)	9.67%	28.35%	21.02%
Quintile 4(3.00,3.69,6.70)	29.00%	6.94%	29.40%
ln (total value of fixed assets) quartile			
Quintile 1(4.61,3.91,4.61)	2.37%	2.71%	3.18%
Quintile 2(7.60,8.99,9.23)	45.77%	47.77%	46.86%
Quintile 3(9.90,10.86,11.00)	27.05%	24.32%	25.11%
Quintile 4(10.63,11.66,12.18)	24.81%	25.20%	24.85%

Source: Chinese urban elder household surveys for 2013,3015 and 2018.

Table 3.4: Summary statistics for rural households

Variable	**n (%)**		
	2013 N=2700	2015 N=4614	2018 N=4437
Demographic characteristics			
Female aged higher than 50-year-old Or male aged higher than 55-year-old	90.96%	90.98%	92.40%
The number of elder in household			
0	10.63%	10.79%	3.67%
1	30.41%	35.70%	39.10%
2	58.96%	53.51%	57.22%
Whether belong to Chinese Communist Party			

Yes	7.59%	8.11%	7.05%
No	92.41%	91.89%	92.95%
Whether belong to ethic minority			
Yes	8.89%	7.20%	7.23%
No	91.11%	92.80%	92.77%
Whether married			
Yes	79.56%	78.39%	72.26%
No	20.44%	21.61%	27.74%
Educational attainment			
No educated	35.48%	34.00%	31.17%
Educated 1-5 years	39.59%	42.77%	46.36%
Educated 6-9 years	19.67%	17.49%	16.45%
Educated 10-12 years	4.52%	4.89%	4.98%
Educated 12+ years	0.74%	0.85%	1.04%
Types of employment			
Civil Servant	0.26%	0.63%	0.65%
Institutional employee	0.37%	0.72%	0.38%
NGO employee	0.04%	0.04%	0.07%
Enterprises' employee	1.41%	1.89%	1.58%
Self-employed	2.33%	3.21%	3.13%
farmer	63.56%	56.05%	54.97%
Others	1.22%	1.24%	1.33%
Unemployed	30.81%	36.24%	37.89%
Types of pensions			
Without pension	20.22%	23.78%	21.82%
Government and Institutional Pension	1.74%	1.26%	0.43%
Enterprise Employee Pension	1.74%	3.01%	0.02%
Commercial Pension	0.26%	0.13%	0.34%
Life Pension	0.30%	1.41%	0.65%
Rural Resident Pension	67.89%	60.38%	61.48%
Urban Resident pension	2.56%	3.88%	14.24%
Old Age Pension	5.30%	6.16%	1.01%
ln (annual pension for last year) quartile			
Quartile 1(3.18,2.48,3.48)	1.85%	12.07%	6.81%
Quartile 2(4.61,4.61,6.73)	2.96%	6.74%	43.61%
Quartile 3(6.49,6.73,7.09)	73.93%	58.45%	30.16%
Quartile 4(10.23,10.26,10.22)	21.26%	22.74%	19.42%
Regular physical examinations			
Yes	36.56%	38.19%	30.27%

No	63.44%	61.81%	69.73%
Whether belong to western province			
Yes	45.30%	63.52%	64.16%
No	54.70%	36.48%	35.84%
Types of medical insurance			
No medical insurance	4.74%	19.18%	4.06%
Urban employee medical insurance	2.37%	5.05%	3.63%
Urban residents' medical insurance	3.85%	2.45%	13.50%
New Rural cooperative medical insurance	88.74%	71.82%	76.29%
Private medical insurance	0.30%	1.50%	2.52%
Household characteristics			
Whether take responsibility for take care of children			
Yes	60.48%	63.07%	59.34%
No	39.52%	36.93%	40.66%
Whether live with adult children			
Yes	64.48%	67.79%	58.73%
No	35.52%	32.21%	41.27%
Whether own property			
Yes	50.81%	50.63%	36.56%
No	49.19%	49.37%	63.44%
ln (value of owned property) quartile			
Quartile 1(0.26,0.18,0.49)	7.44%	6.57%	6.78%
Quartile 2(0.69,0.69,1.10)	56.59%	64.65%	14.85%
Quartile 3(1.61,1.10,2.20)	12.15%	3.38%	53.50%
Quartile 4(3.00,3.69,7.70)	23.82%	25.40%	24.87%
ln (total value of fixed assets) quartile			
Quartile 1(4.61,3.91,4.61)	5.56%	5.42%	5.63%
Quartile 2(6.91,7.24,7.25)	40.85%	44.78%	44.38%
Quartile 3(8.70,9.26,9.31)	28.93%	24.97%	24.93%
Quartile 4(10.63,11.66,12.18)	24.66%	24.83%	25.06%

Source: Chinese rural elder household surveys for 2013,3015 and 2018.

3.4. Methodology

In this study, we define vulnerability as the probability that a household will enter poverty in the future, and follow the method suggested by Chaudhuri et al. (2002) to estimate the risk of households with elders becoming poor. It is worth noting that this method not only fits cross-sectional data, but also is suitable for short-panel data which this study employs.

Considering the problem of heteroscedasticity, this study applies the feasible generalised least squares (FGLS) method, instead of OLS, whereby avoiding the miscomputation of variance of consumption and standard errors. The stochastic process could then be generated as follows:

$$lnC_h = Y_h\gamma + e_h \quad (1)$$

where $lnC_{h,t}$ represents the consumption per capita (and we assume that it is to be log-normally distributed), $Y_{h,t}\gamma$ indicates the household characteristics that contribute to the consumption, and $e_{h,t}$ refers to idiosyncratic shocks with a zero mean.

Given e_h, the residual in equation (1) may raise the problem of heteroscedasticity across households. Its variance is assumed by equation (2):

$$\sigma_{e,h}^2 = Y_h\alpha \quad (2)$$

Then we apply the three-step feasible generalised least squares suggested by Chaudhuri et al. (2002) to estimate γ and α. The expected log consumption and the variance of log consumption are then estimated with estimators $\hat{\gamma}$ and $\hat{\alpha}$ in equation (3) and equation (4), respectively:

$$\hat{E} = E((lnC_h|Y_h) = Y_h\hat{\gamma} \quad (3)$$

$$\hat{V} = var((lnC_h|Y_h) = \sigma_{e,h}^2 = Y_h\hat{\alpha} \quad (4)$$

The basic vulnerability to poverty model is given as follows:

$$Vulnerability_{h,t} = \Pr\,(C_{h,t+1} \leq pl) \quad (5)$$

In equation (5), $C_{h,t+1}$ is the per capita consumption of household *h* at time *t+1*, *pl* represents the set poverty line, and $Vulnerability_{h,t}$ refers to the vulnerability to

poverty of household h at time t, which is defined as the likelihood that $C_{h,t+1}$ is below the set poverty line at time $t+1$.

Based on the basic model, bringing the estimations from equations (3) and (4), the estimated probability of households with characteristics Y_h becoming poor in the future could be written as equation (6):

$$\widehat{V_h} = \widehat{P_r}(lnC_h \leq lnpl) = \varphi\left(\frac{lnpl - Y_h\hat{\gamma}}{\sqrt{Y_h\hat{\alpha}}}\right) \quad (6)$$

where φ stands for the cumulative density of a standard normal distribution. The poverty lines in this study are based on the mean of 60% of per capita disposable income in the interviewed provinces/municipalities. We calculate them in relation to rural and urban areas respectively and the poverty lines are also varied in respect of the years[31]. With the purpose of the standard of measurement being united in both urban and rural areas, this study applied a mainstream approach that defined the vulnerability threshold at 50% (Mcchulloch and Calandrino, 2003; Li and Bai, 2010; Imai, 2011; Senadjki et al., 2017).

Then we identify the potential factors that induce vulnerability to poverty in elderly households through equation (7):

$$V_i = \partial + \epsilon_{x_{h,t}} + \mu_{h,t} \quad (7)$$

where V_i indicates the household vulnerability rate, ϵ and μ are the coefficients that are normally distributed, $x_{h,t}$ presents the different types of characteristics in individuals and households, and $\mu_{h,t}$ is the error term with a zero mean.

[31] The statistical data comes from the Chinese Statistical Yearbook for 2013, 2015 and 2018.

3.5. Results and Analysis

3.5.1 The regional difference of the vulnerability incidence

We first divide all of the interviewed provinces into the following four districts: central district, which consists of the Yangtze River area and the Yellow River area, including six provinces located in inland China; western district, which consists of the southwest and northwest, including eight provinces/municipalities located in mountainous areas and with less transportation; northeast district, including four provinces far away from the economic and political centre; and eastern district, consisting of the Circum Bohai Sea Zone, the Yangtze River Delta, and other coastal regions, which are considered to be economically developed areas.

We calculate the vulnerability rate for each region and province or municipality in each year separately and, based on their values, draw Sankey diagrams 3.1 to 3.6. We first compare vulnerability incidences between urban and rural households in 2013, 2015 and 2018, respectively, and then describe and analyse the trend of the probability of rural and urban households becoming poor in the future (from 2013 to 2018).

Figure 3.1: The regional difference of vulnerability incidents in rural China in 2013.

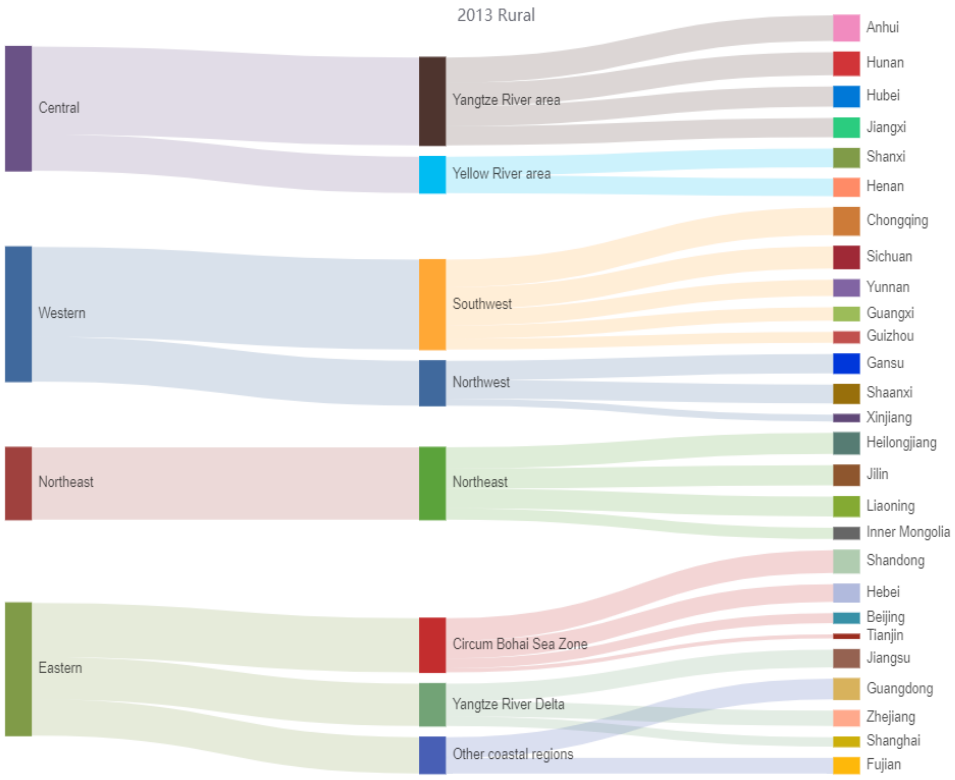
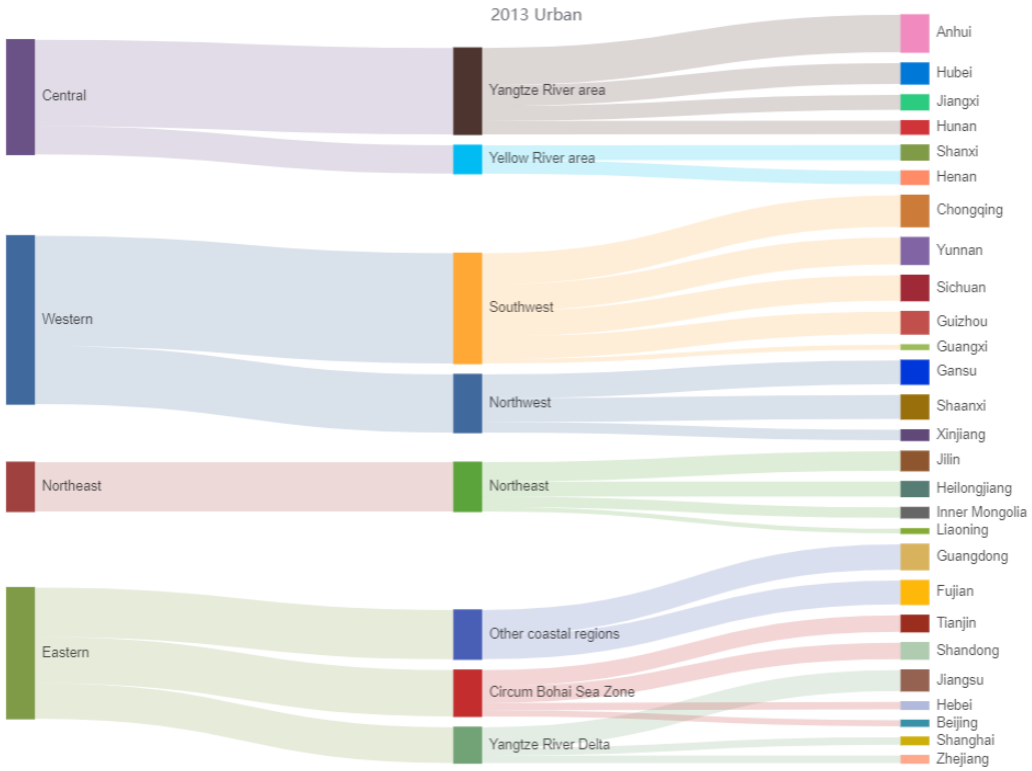


Figure 3.2: The regional different of vulnerability incidents in urban China in 2013.



In 2013, the western district shows the highest vulnerability rate in both urban and rural households, and the percentage of vulnerable households in the rural northeast in China is significantly larger than that in the urban northeast. Meanwhile, the proportions of vulnerable households in the three economic zones in eastern China are different between urban and rural households. Specifically, in rural eastern China, vulnerable households mainly come from the Circum Bohai Sea Zone, and there is a relatively small percentage of vulnerable households living in other coastal regions, while both other coastal regions and the Circum Bohai Sea Zone share a higher vulnerability rate in contrast to the Yangtze River Delta in the urban east.

Figure 3.3: The regional different of vulnerability incidents in rural China in 2015.

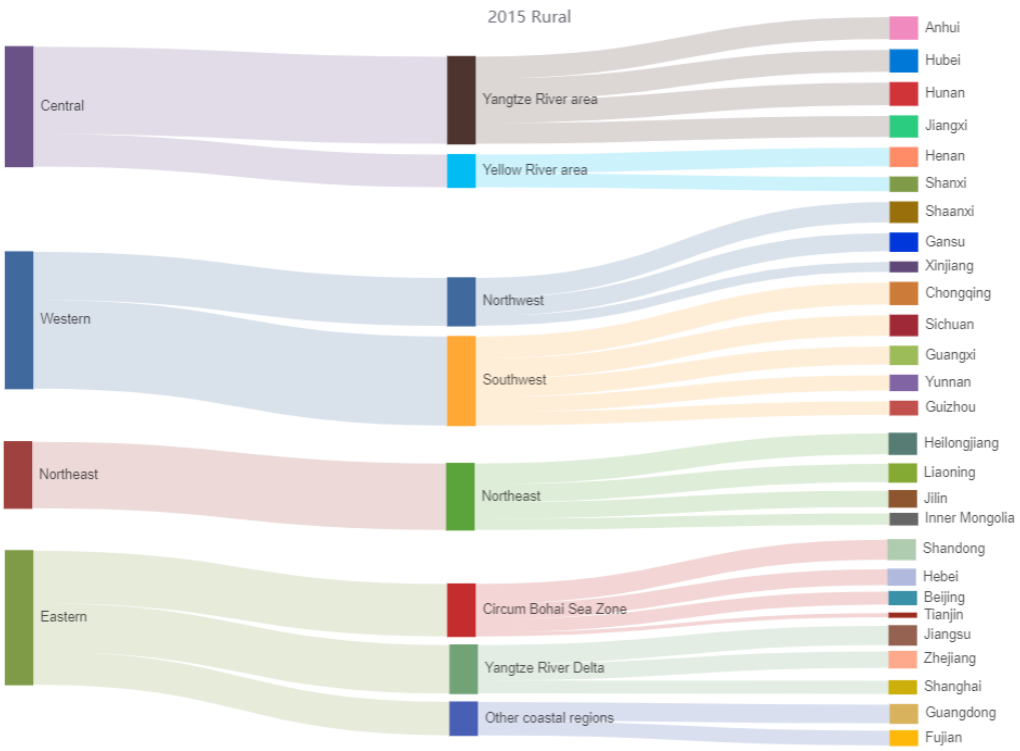
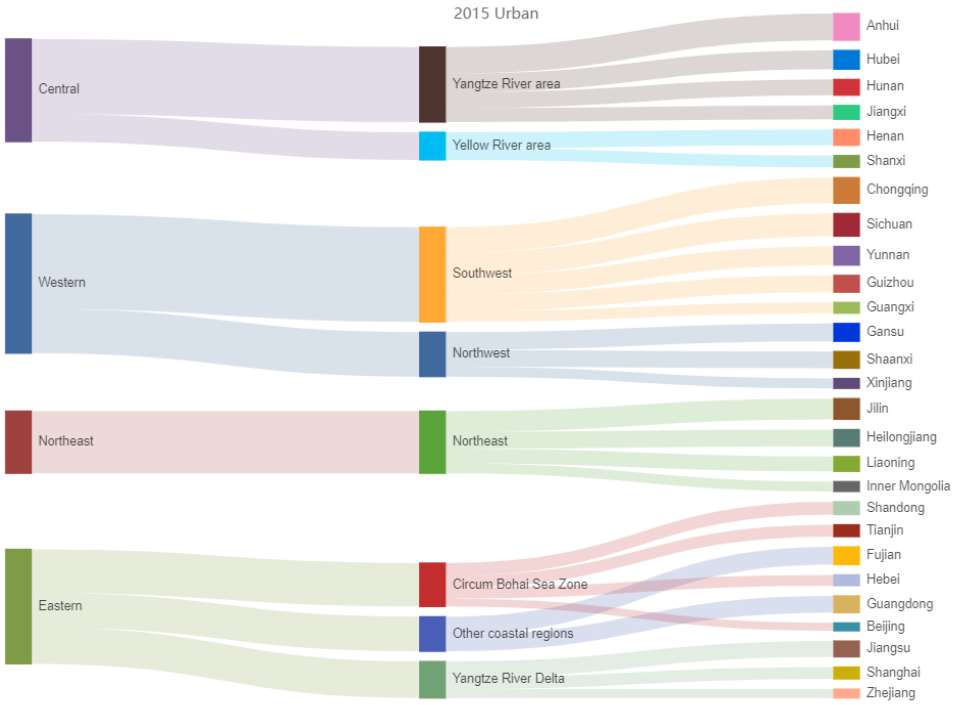


Figure 3.4: The regional different of vulnerability incidents in urban China in 2015.



In 2015, eastern regions account for the largest proportion of vulnerable households in rural areas, while the western district displays the highest percentage of vulnerable households in urban areas. Moreover, in the rural east of China, vulnerable households in western regions are the same as those in central regions.

Both urban and rural households in the northeast of China share the smallest probability of becoming poor in the future. It is interesting to find that in this year, the proportion of the vulnerability incidence among regions within eastern China in rural households is different from that in urban households. In other words, vulnerable households in the Circum Bohai Sea Zone show a similar percentage to those in other coastal regions and both are significantly larger than those in the Yangtze River Delta in eastern rural China. Meanwhile the percentage of vulnerable households in the Circum Bohai Sea Zone is significantly higher than that in the other two economic zones in urban eastern China.

Figure 3.5: The regional different of vulnerability incidents in rural China in 2018.

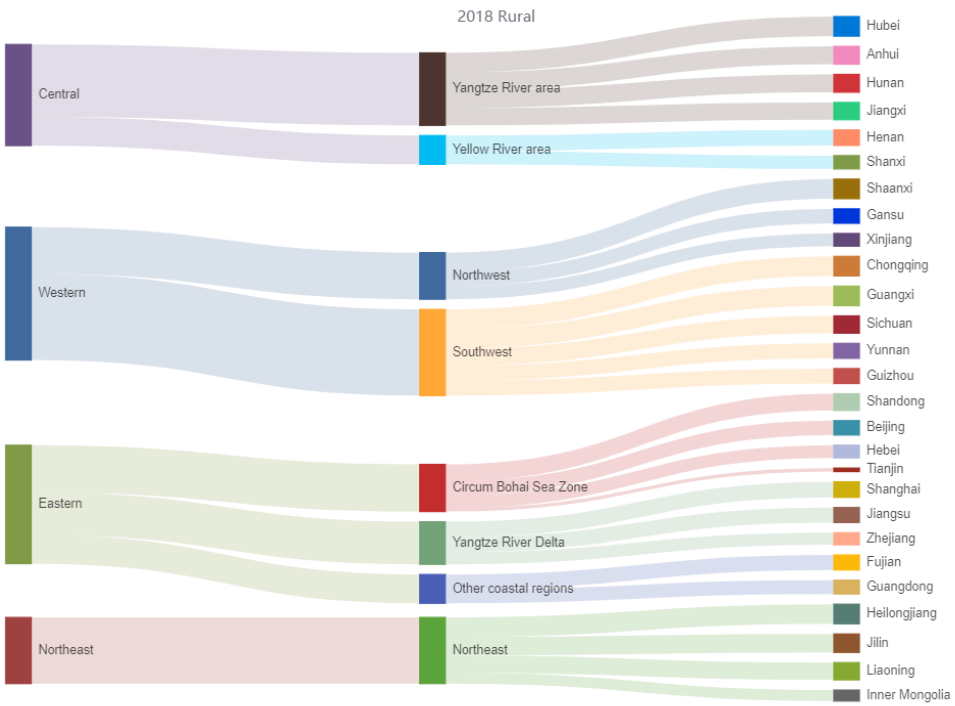
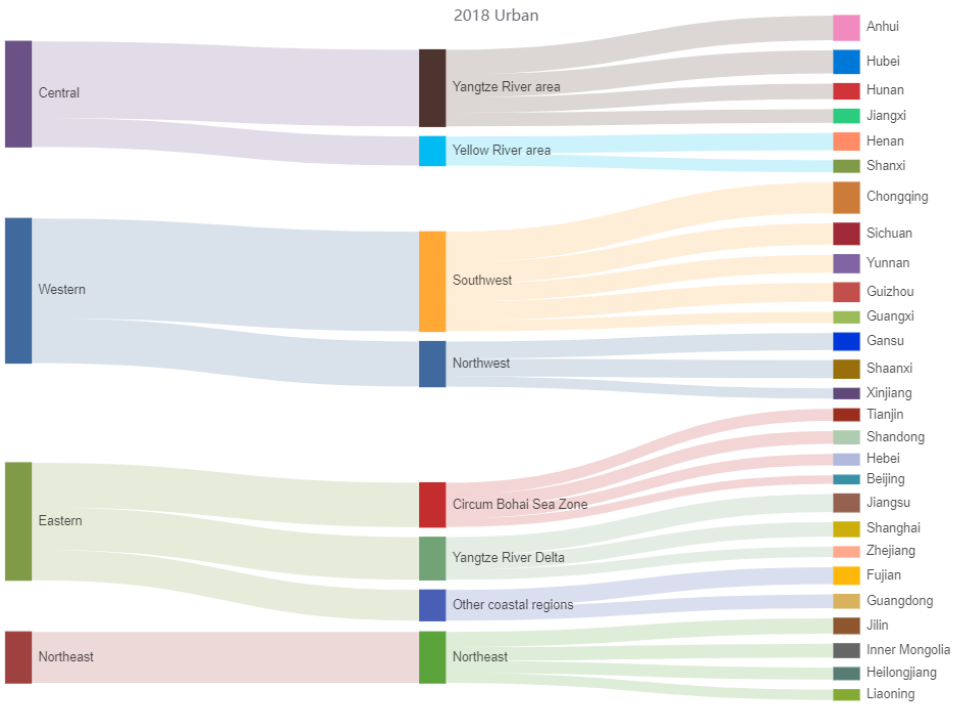


Figure 3.6: The regional different of vulnerability incidents in urban China in 2018.



In 2018, households in both western and eastern regions show the highest probability of becoming poor in the future in rural China, while the proportion of vulnerable households in urban western China is larger than that in eastern China. In addition, the number of households at risk of being poor in rural north-eastern China is larger than that in urban China, though both show the lowest vulnerability possibilities when compared to other regions, respectively.

From 2013 to 2018, there are no changes in the number of vulnerable households in rural north-eastern China, and a slim decrease appears in the rural central China. Households in both rural western and rural eastern China share a vulnerable trend of an increase, decrease and increase, though the fluctuation in western China is more obvious than that in rural eastern China.

It is worth noting that, except for vulnerable households in urban western China gradually increasing from 2013 to 2018, all districts in urban China have not shown obvious changes. Compared with rural regions, the overall trend in urban regions is flatter and there are no significant changes in the number of vulnerable households in the majority of regions in the latter ones.

3.5.2 The intra-regional differences in the vulnerability rate in urban and rural households

The vulnerability rate in all the provinces in urban eastern China increases from 2013 to 2018, while the majority of the provinces in rural China show a decreasing trend.

Only rural Shanghai and rural Beijing, the political centre and economic centre of China respectively, display a growing trend of vulnerable households. This means that both urban and rural households in Shanghai and Beijing present an increasing number of vulnerable households.

The residents interviewed in this study are all aged above 45 and these two municipalities are characteristic of ageing cities, which have the largest number of residents aged above 55. Meanwhile, these two municipalities share higher per capita disposable income when compared to any other cities in China from 2013 to 2018 (National Bureau of Statistics of China, 2013, 2015 and 2018). This implies that in these municipalities, the problem of ageing and the disparity between the rich and poor are more urgent tasks than partially seeking rapid economic growth.

Tianjin, another municipality, shows a higher vulnerability rate in urban households than in rural households, while all other provinces and municipalities present opposite findings. It is located quite close to Beijing, the capital of China, and

the implementation of a great number of farming-friendly policies cultivated the agricultural industry in rural areas. Meanwhile, the soaring urbanisation process from 2013 to 2018 brought about plenty of demolition, and farmers received land and household compensation (Liu et al., 2019; Wang, Zhang and Jin, 2021). Although from the perspective of long-run profit maximisation, it is not a wise choice to sell owned land to government or enterprises, it is difficult to deny the short-run, generous profit.

Shandong, as a province, mainly relies on the agricultural industry and shares the biggest gap in the vulnerability rate between urban and rural households. Although agricultural support expenditure and social security expenditure[32] in rural Shandong increased rapidly during the interviewed period, more financial support from government should be added to rural areas, aiming to narrow the vulnerability gap between urban and rural households in this province.

In addition, except for the municipality of Tianjin, all eastern provinces/municipalities present a gradually smaller vulnerability gap between urban and rural households from 2013 to 2018.

[32] The data on agricultural support expenditure and social security expenditure in Shandong province could be found in Deng (2019) and Zhang (2020).

Figure 3.7: Comparisons of vulnerability rate between urban and rural household in Eastern of China from 2013 to 2018.

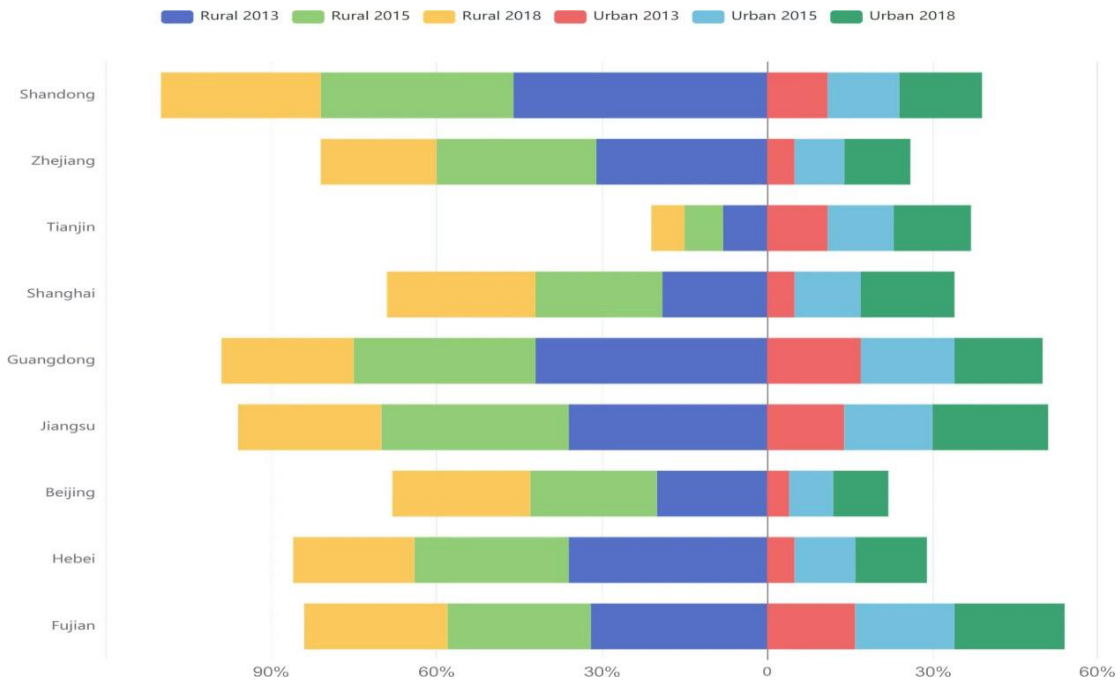
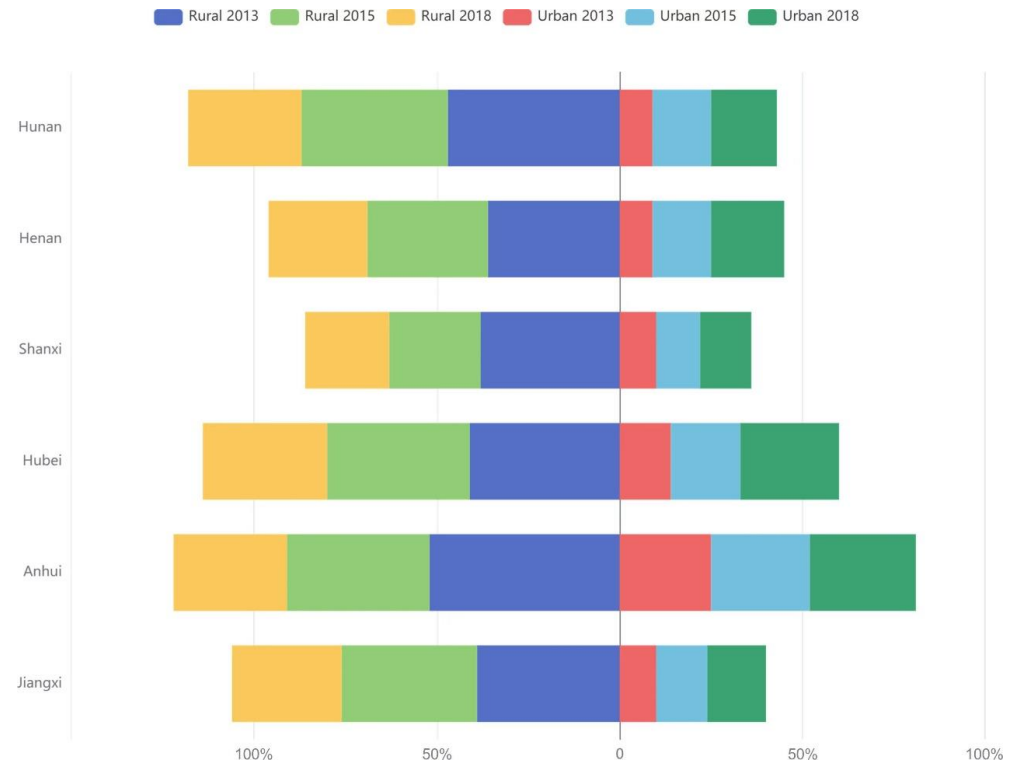


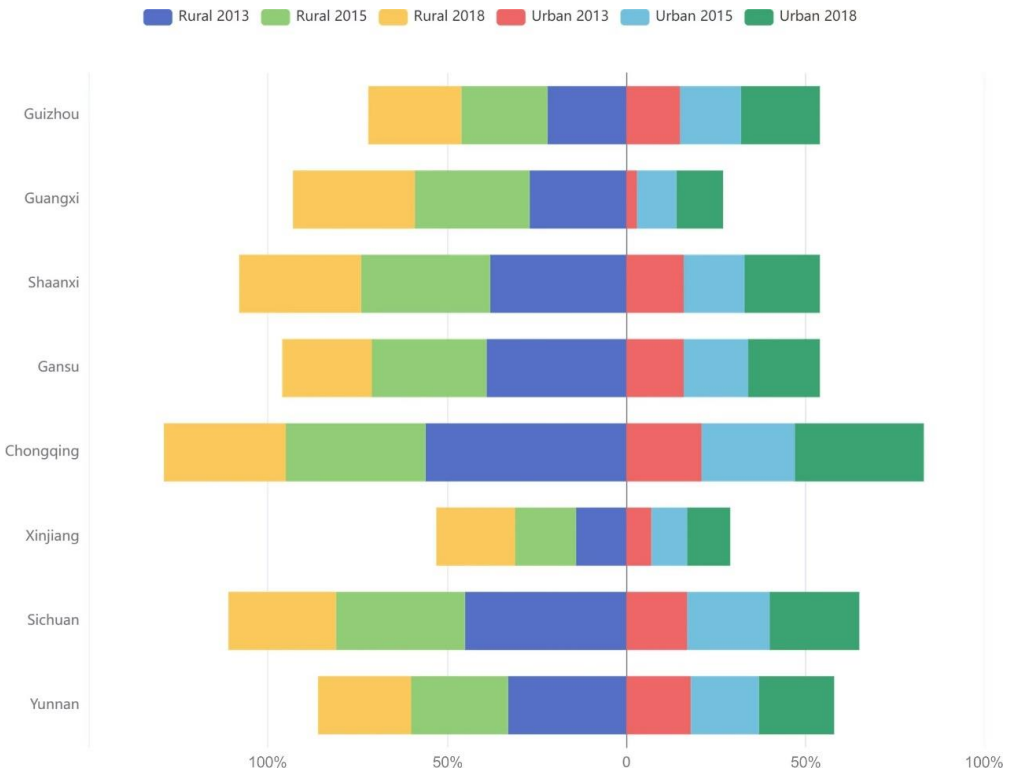
Figure 3.8: Comparisons of vulnerability rate between urban and rural household in Central of China from 2013 to 2018.



In Figure 3.8, except for Hubei province, all rural provinces in central China show a decreasing trend in the number of vulnerable households. A potential reason could be related to the Enshi ethnic-minority autonomous prefecture, which is an area with deep-rooted poverty in Hubei with a great number of poor rural households (Sun et al., 2018; Jing, 2020). Located within the mountains and lacking an essential transportation network, its economic development is restricted. Meanwhile, the relatively isolated community environment hinders the coverage of infrastructural facilities, which further exacerbates the difficulties of poverty alleviation and reducing the vulnerability rate.

What is more, all households in urban central China share the increasing trend of a vulnerability rate, except in Anhui. It is interesting to observe that the gap in the percentage of vulnerable households between urban and rural households in the whole of central China gradually narrowed from 2013 to 2018.

Figure 3.9: Comparisons of vulnerability rate between urban and rural household in Western of China from 2013 to 2018.

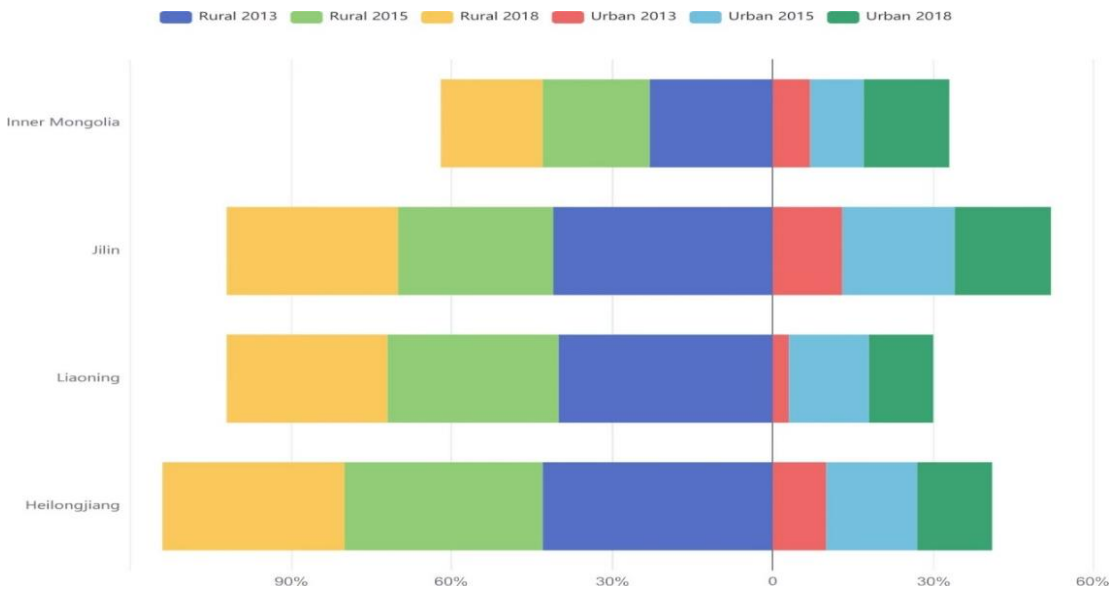


The vulnerability rate in urban households in almost all western provinces is gradually growing, except Yunnan Province. Ethnic minorities probably contribute to household vulnerability to poverty, as Yunnan is the province with the largest number of ethnic minorities in China,

Compared with urban western regions with a relatively similar trend in the percentage of vulnerable households, rural western regions show two opposite trends during the 2013–2018 period. Specifically, rural households in Guizhou, Guangxi, and Xinjiang show an increasing vulnerability rate, while those in Gansu, Chongqing, Sichuan, and Yunnan display a declining vulnerability rate.

The gap between urban and rural households in the vulnerability rate in most western regions is smaller, though Xinjiang and Guangxi present an opposite trend. Xinjiang and Guangxi also have a larger number of ethnic minorities in comparison to any other provinces in China, and it is worth analysing in the next section whether this factor induces the risk of rural households being poor.

Figure 3.10: Comparisons of vulnerability rate between urban and rural household in East-Northern of China from 2013 to 2018.



It is worth noting that in Chongqing, as a municipality, in 2013, the percentage of vulnerable households in rural households was significantly higher than in urban households. However, in 2018, the proportion of vulnerable households in rural households was the same as that in urban households.

From 2013 to 2018, urban and rural households in north-eastern regions show a common trend in terms of the possibility of becoming poor in the future, respectively. Specifically, all rural provinces display a declining number of vulnerable households, while urban regions present a growing number of vulnerable households. Simultaneously, Figure 3.10 shows that the gap in vulnerability rates between urban and rural households is narrowing progressively. These trends are mainly due to the highly similar economic situation, such as per capita disposable income, and resemble economic development patterns in these provinces.

3.5.3 The potential variables that contribute to household vulnerability to poverty

Although the vulnerability rate in both urban and rural households is positively related to the ages of heads of households, with the increasing ages of heads of households, rural households are more likely to be poor than urban households with the same conditions. Meanwhile, with the increasing number of elders, rural households show a higher likelihood of vulnerability to poverty than urban households. It is interesting to observe that heads of households in an ethnic minority in urban households have a lower probability of being poor, while those in an ethnic minority in rural households are more likely to enter poverty. These findings provide potential explanations for urban Yunnan showing a decreasing trend in the vulnerability rate and rural Xinjiang and Guangxi showing an increasing trend in the vulnerability rate in the section above.

In addition, compared with members of other parties, heads of households belonging to the Chinese Communist Party reduce the household risk of becoming poor in the future in both urban and rural regions. We also find that if heads of households have worked as a civil servant or institutional employee, both urban and rural households have a lower probability of being poor when compared to heads who have worked for other industries. These findings are closely connected to each other. Moreover, in both urban and rural households, heads of households with a civil servant pension display the smallest likelihood of being poor when compared to other pensions. If we link these three findings together and illustrate that Chinese Communist Party members mainly work in government and institutional enterprises, and compared to other employees, their pension is more generous and the average salary is higher than the medium salary in each province, which will be more difficult to be influenced by unexpected shocks when compared with other employees.[33]

Table 3.5: Regression results of vulnerability rate in urban household.

Variables	Coefficient	Standard Error
Demographic characteristics		
The head of household's age	0.06 (***)	0.02
The number of elder in household	0.89 (***)	0.45
Whether the head of household belong to Chinese Communist Party	-1.90 (***)	0.35
Whether the head of household belong to ethnic minority	-0.26 (***)	0.30
Educational attainment[34]		
Educated between 1-5 years	0.96 (***)	0.25
Educated between 6-9 years	-1.53 (***)	0.37
Educated between 10-12 years	-1.94	0.54

[33] The following papers support my assumptions: Cai (2016); Chau and Yu (2005); Dickson and Rublee (2000).
[34] Educational attainment refers to the head of household's educational qualification

	(***)	
Educated more than 12 years	-2.12 (***)	0.70
The head of household with Married	0.99 (***)	0.30
Type of the head of household's employment		
Civil Servant	-0.21 (**)	1.09
Institutional employee	-0.37 (*)	1.13
Farmer	10.59 (**)	2.82
NGO employee	1.70 (***)	0.44
Enterprises' employee	3.80 (***)	0.41
Self-employed	3.08 (***)	0.30
Type of pension		
Government and Institutional Pension	-0.57 (**)	0.48
Enterprise Employee pension	-0.51 (**)	0.31
Commercial pension	-1.53	1.19
Life pension	0.54	0.53
Rural residents' pension	-0.06	0.20
Urban residents' pension	-0.11 (*)	0.29
Old age pension	0.035	0.36
ln (annual pension for the head of household the last year)	-0.08 (**)	0.04
Regular physical examinations for the head of household	-2.32 (***)	0.24
Whether belong to western regions	-0.25 (*)	0.15
Type of Medical Insurance the head of household owned		
Urban employee medical insurance	-1.48 (*)	0.98
Urban resident medical insurance	-2.42 (**)	0.97
New cooperative rural medical insurance	-1.25 (*)	0.74
Private medical insurance	-6.67 (**)	0.041

Household characteristics		
Whether the head of household take responsibility for take care of children	0.48 (***)	0.19
Whether the head of household live with adult children	2.40 (***)	0.24
Whether the head of household own property	-1.07 (***)	0.19
ln(value of the head of household owned property)	-1.27 (***)	0.07
ln(total value of fixed assets the head of household owned)	-0.64 (***)	0.06
Integrated variables		
Urban employee medical insurance*age	0.83 (*)	0.56
Urban resident medical insurance*age	1.35 (***)	0.58
New cooperative rural medical insurance*age	0.50	0.44
Private medical insurance*age	4.11 (***)	1.57
Number of observations	3425	
*** p<0.05, ** p<0.01, *** p<0.001**		

The welfare scheme is closely related to elderly household members' well-being. Not all types of pensions contribute to the incidence of vulnerability in households effectively. Due to the limitation of coverage of the welfare scheme, heads of households with a private pension, such as Commercial Pension and Life Pension, are not significantly correlated with household vulnerability to poverty. Moreover, heads of households with a regional universal pension, such as Urban Residents' Pension and Rural Residents' Pension, make less of a contribution to reducing the possibility of entering poverty in both urban and rural households. It is worth noting that the numbers of residents joining these two types of pension schemes are extremely higher than for other pension schemes in China. Furthermore, the coefficient of the variable of the log

of the annual pension amount in both urban and rural households is quite small, further indicating that the actual pension amount is incapable of satisfying the essential living needs of an ageing household.

The influence of Urban Employee Medical Insurance (UEMI), Urban Resident Medical Insurance (URMI), and New Cooperative Rural Medical Insurance (NCRMI) upon decreasing the incidence of rural household vulnerability is greater than that for urban households with the same conditions, respectively. In addition, the impact of Private Medical Insurance (PMI) upon reducing the urban household vulnerability rate is more than three times that for rural households. The limited coverage and the small number of participants of PMI in rural households could be potential reasons. However, in both urban and rural households, with the ages of heads of households increasing, the impact of universal medical insurance such as URMI and NCRMI upon reducing the household vulnerability rate is decreased. A similar trend is also found for UEMI and PMI in both urban and rural households. This implies that with age increasing, the impact of such medical insurance upon reducing out-of-pocket expenses is limited and increases the medical financial burden on households.

In both urban and rural households, heads with regular physical examinations could effectively decrease the risk of households being poor, which stresses the importance of implementing compulsory annual physical examinations for all residents.

Heads of households working as farmers in urban households are more likely to be poor, and households with self-employed heads are more likely to enter poverty in both urban and rural regions. From the perspective of employment, only heads who are civil servants and institutional employers are negatively correlated with the vulnerability rate. This result could explain why the number of Chinese graduates

participating in national civil servant and institutional enterprise examinations has soared in the past decade (Li and Peter, 2019; Liu, 2021).

It is worth noting that households with married heads present a higher likelihood of entering poverty when compared to heads with another marital status. This finding is opposite to that of past empirical analysis (McDowell, 2005). Meanwhile, households with heads taking responsibility for taking care of offspring are positively related to the vulnerability rate. The respondents in the survey that we applied in this study are mainly aged above 45.

The reason for households with married heads having a higher propensity to be poor could be explained as most of them not only being the main caregivers of offspring, but also responsible for taking care of their parents. The dual burden imposed on this age group imbalances their work and lives, and once a family member becomes ill or utilises inpatient services, they will probably have to decrease their work hours and act as caregivers, which will bring down income and increase the household vulnerability to poverty.

However, rural households with married heads are negatively related to the risk of households being poor, and heads as caregivers of offspring are also negatively correlated with the household vulnerability rate. This means that the marital status of married in rural households is more effective than that in urban households in terms of decreasing the risk of becoming poor in the future.

Simultaneously, the results imply that rural household income heavily relies on farming and the majority of heads of households working on their own land, which could allow working flexibly and facilitate taking care of offspring. Meanwhile, urban

household income mainly comes from employers, which means that it is difficult to balance their time between work and family.

The impact of educational attainment upon the incidence of vulnerability in urban households is larger than that in rural households, though the overall trend in urban and rural households is similar. In addition, with the years of heads' education increasing, the probability of urban households becoming poor in the future is reduced. However, this decreasing tendency has not lasted in rural households, which indicates that educational qualifications have a greater impact on the income of urban residents than rural ones.

Compared with rural households, heads of households owning a property in urban regions make a greater contribution in reducing the incidence of household vulnerability. Meanwhile, the influence of the value of fixed assets and property is larger for urban households than rural households in terms of household vulnerability to poverty.

Table 3.6: Regression results of vulnerability rate in rural household.

Variables	Coefficient	Standard Error
Demographic characteristics		
The head of household's age	0.11 (***)	0.01
The number of elder in household	1.58 (***)	0.19
Whether the head of household belong to Chinese Communist Party	-1.51 (***)	0.12
Whether the head of household belong to ethnic minority	1.53 (***)	0.13
The head of household's educational attainment		
Educated between 1-5 years	0.50 (***)	0.09
Educated between 6-9 years	-0.70 (***)	0.14

Educated between 10-12 years	-0.42 (**)	0.23
Educated more than 12 years	-0.26 (*)	0.43
The head of household with Married	1.21 (***)	0.14
Type of the head of household's employment		
Civil Servant	-0.06 (***)	0.48
Institutional employee	-0.41 (*)	0.85
Farmer	2.50 (***)	1.39
NGO employee	0.44	0.36
Enterprises' employee	1.35 (***)	0.20
Self-employed	2.97 (***)	0.008
Type of pension		
Government and Institutional Pension	-0.25 (**)	0.36
Enterprise Employee Pension	-0.22 (*)	0.27
Commercial Pension	0.34	0.69
Life Pension	-0.04	0.42
Rural Residents' Pension	-0.03 (**)	0.02
Urban Residents' Pension	-0.05 (*)	0.14
Old Age Pension	0.82 (**)	0.16
ln (annual pension for the head of household the last year)	-0.07 (***)	0.02
Regular physical examinations for the head of household	-1.27 (***)	0.67
Whether belong to western regions	-0.32 (***)	0.06
Type of Medical Insurance the head of household owned		
Urban employee medical insurance	-1.66 (**)	0.86
Urban resident medical insurance	-5.11 (***)	0.62
New cooperative rural medical insurance	-1.93 (***)	0.31
Private medical insurance	-1.08	0.60

	(*)	
Household characteristics		
Whether the head of household take responsibility for take care of children	-0.42 (***)	0.08
Whether the head of household live with adult children	-2.94 (***)	0.09
Whether the head of household own property	-0.058 (***)	0.07
ln(value of the head of household owned property)	-1.23 (***)	0.05
ln(total value of the head of household's fixed assets)	-0.49 (***)	0.02
Integrated variables		
Urban employee medical insurance*age	0.93 (**)	0.47
Urban resident medical insurance*age	2.92 (***)	0.34
New cooperative rural medical insurance*age	1.11 (***)	0.18
Private medical insurance*age	1.08 (*)	0.60
Number of observations	11751	
*** p<0.05, ** p<0.01, *** p<0.001**		

3.6. Conclusion

This paper investigates the vulnerability to poverty and the welfare schemes of urban and rural households with elders from 2013 to 2018. We apply the FGLS method to estimate the vulnerability rate for each household and make comparisons between urban and rural China as well as the spatial disparity within regions and intra-regions. Moreover, we analyse the trend of the incidence of vulnerability within rural and urban households as time passes, respectively. In addition, we explore the potential factors that induce vulnerability to poverty, and make comparisons between the impacts of

different types of pensions and medical insurance upon vulnerability to poverty in urban and rural households, with the ages of heads of households increasing, separately.

The first interesting finding is that the overall trend regarding the vulnerability rate in urban households from 2013 to 2018 gradually increased, while that in rural targeted households decreased. Several factors make contributions to this result, such as the rapid urbanisation process bringing about increased costs of housing in urban regions, and the multiple-caregiver burden on residents aged above 45. In addition, the vulnerability rate in both rural and urban households in Beijing and Shanghai, municipalities with high economic development, shows an increasing trend, though their relative poverty line is above that of other provinces/municipalities discussed in this study. This calls for policymakers to not only seek soaring economic development, but also consider how to balance the disparity between the rich and poor and benefit the more general elderly residents.

In addition, the coverage of universal pension and medical insurance increased from 2013 to 2018, but the impact of them upon reducing the household risk of being poor remained limited, especially with residents' age increasing, with the positive effects of them decreasing. This indicates that for decreasing the probability of households with elders entering poverty, a more effective way is to increase the amount of pension and the proportion of reimbursement for both inpatient and outpatient services.

Furthermore, according to a great number of elders in both urban and rural households, after retirement, waiting for them is not that of enjoying a remaining comfortable life, but that of a multiple-caregiver burden on them. The expansion of public compulsory kindergartens and nursing homes, which could alleviate elders'

pressure regarding taking responsibility for taking care of offspring and their parents, is essential for local government to establish in the future.

Finally, in the recent five years, several household economics related policies have been implemented, such as abolishment of one child policy, relaxation of the limitation of obtain urban hukou, and significant reform towards rural medical insurance system (Scharping,2019; Ma, 2022). The Chinese universal household census held in 2021 provides us with an opportunity to see how these policies makes any contributions to the household vulnerability to poverty, and how the trend of vulnerability rates between urban and rural Chinese residents changes contrast to the existed results. As household's minimum cash requirements are often contributable to the endogeneity issues (Christiaensen and Boisvert, 2000), we can deal with this issue more efficiently and robustly with available related data.

References

Albert, J. R. G., Elloso, L. V., and Ramos, A. P. (2007). *Toward measuring household vulnerability to income poverty in the Philippines* (No. 2007-16). PIDS Discussion Paper Series.

Aldwin, C. M. (2007). *Stress, coping, and development: An integrative perspective*. New York, NY: Guilford Press.

Alkire, S., and J. Foster. (2011). *Counting and multidimensional poverty measurement.* Journal of Public Economics 95 (7): 476–487.

Angelillo, N. (2014). *Vulnerability to poverty in China: a subjective poverty line approach, Journal of Chinese Economic and Business Studies,* 12:4, 315-331, DOI: 10.1080/14765284.2014.952512.

Artha, D., and T. Dartanto. (2015). *Multidimensional Approach to Poverty Measurement in Indonesia.* LPEM-FEUI Working Paper - 02, https://www.lpem.org/wp-content/uploads/2015/01/WP-LPEM_02_TeguhDes.pdf. Accessed Feb 2021.

Atella, V., A. Brugiavini, and N. Pace. (2013). "The Health Care System Reform in China: Effects on Out-of-pocket Expenses and Saving." *Research Papers Series, CEIS, Tor Vergata* 11 (14):1–30, Article no.: 296.

Atkinson, A.B., L. Rainwater and T. M. Smeeding (1995). Income Distribution in OECD Countries, *OECD Social Policy Studies,* No. 18, Paris.

Azam, M. S., & Imai, K. S. (2012). Measuring households' vulnerability to idiosyncratic and covariate shocks–The case of Bangladesh. *Research Institute for*

Economics and Business Administration, Kobe University, Japan. (Discussion Paper Series).

Azeem, M. M., Mugera, A. W., & Schilizzi, S. (2016). Living on the edge: Household vulnerability to food-insecurity in the Punjab, Pakistan. *Food Policy*, (64), 1-13.

Bai, X. (2014). Images of ageing in society: A literature review. *Journal of Population Ageing, 7(3), 231-253*.

Bennett, D., (2012). Does clean water make you dirty? Water supply and sanitation in the Philippines. J. *Hum. Resour. 47 (1),* 146–173.

Bhattamishra, B. (2008). Community-based Risk Management Arrangements: An Overview and Implications for Social Fund Programs. Social Protection Discussion Paper No. 0830. The World Bank, Washington D.C.

Bishop, J. A., Luo, F., & Pan, X. (2006). Economic transition and subjective poverty in urban China. *Review of Income and Wealth, (52),* 625–641.

Black, H. K., & Rubinstein, R. L. (2000). *Old souls: Aged women, poverty, and the experience of god*. Piscataway, NJ: Transaction Publishers.

Bopape, L. and Myers, R., (2007). *Analysis of household demand for food in South Africa: Model selection, expenditure endogeneity, and the influence of socio-demographic effects.* In Proceedings of the African Econometrics Society Annual Conference . 4-6.

Brewer, M. (2005). Comparing in-work benefits and the reward to work for families with children in the US and the UK. *Fiscal Studies, 22(1),* pp.41-77.

Brody, E. M. (2003). Women in the middle*: Their parent-care years. Springer Publishing Company.*

Cai, M., (2016). Land for welfare in China. *Land Use Policy*, 55.1-12.

Callan, T., and Nolan, B. (1991). Concepts of poverty and the poverty line. *Journal of Economic Surveys, 5(3),* 243–261.

Calvo, C., & Dercon, S. (2005). *Measuring individual vulnerability.*Discussion paper no. 229. Oxford: University of Oxford.

Centre for Public Policy Research (2021) "*Setting an Ideal Retirement Age*!". Archived from the original on 7 April 2021.

Chakrabarti, S., (2018). Can highway development promote employment growth in India?*Transport Policy, (69),* 1-9.

Chan, J. C., Zhang, Y., & Ning, G. (2014). Diabetes in China: a societal solution for a personal challenge. *The lancet Diabetes & endocrinology*, *2(12)*, *969-979*.

Chau, R.C. and Yu, W.K., (2005). *Is welfare unAsian?. In East Asian welfare regimes in transition* (pp. 21-46). Policy Press.

Chaudhuri, S. (2000). *"Empirical Methods for Assessing Household Vulnerability to Poverty", mimeo*, Department of Economics, Columbia University: New York.

Chaudhuri, S. (2002). Empirical methods for assessing household vulnerability to poverty. New York: Mimeo, Department of Economics, Columbia University.

Chaudhuri, S. (2003). *Assessing Vulnerability to Poverty: Concepts, Empirical Methods and Illus- trative Examples*. New York: Columbia University.

Chaudhuri, S., Jalan, J., & Suryahadi, A. (2002). *Assessing household vulnerability to poverty from cross-sectional data: A methodology and estimates from Indonesia.* Discussion paper no. 0102-52. New York: Columbia University.

Chen, S., and Ravallion, M. (1996). Data in transition: Assessing rural living standards in Southern China. *China Economic Review*, 7(1), 23–56.

Chen, Z. (2009). Launch of the health-care reform plan in China. *The Lancet, 373(9672), 1322-1324.*

Chen, X., & Funke, M. (2013). Real-time warning signs of emerging and collapsing Chinese house price bubbles. *National Institute Economic Review, 223*, R39-R48.

Chen, Y. Y., Walker, R., & Hong, L. (2018). Subjective experiences of older adults in poverty in urban China and the role of social policy. *Asia Pacific Journal of Social Work and Development, 28(1)*, 1-14.

Chen, C., & Pan, J. (2019). The effect of the health poverty alleviation project on financial risk protection for rural residents: evidence from Chishui City, China. *International journal for equity in health, 18(1)*, 1-16.

Chen, L., & Cao, Q. (2020). Poverty increases the risk of incident cognitive impairment among older adults: a longitudinal study in China. *Aging & Mental Health, 24(11)*, 1822-1827.

Chen S., & Ravallion, M. (2020). Reconciling the conflicting narratives on poverty in China, NBER Working Paper 28147.

Cheng, F., Zhang, X., Sheng gen, F., (2002). Emergence of urban poverty and inequality in China: evidence from household survey. *China Econ. Rev. 13 (4)*, 430-443. https://doi.org/10.1016/S1043-951X(02)00101-3.

Chow, N., & Bai, X. (2011). Modernization and its impact on Chinese older people's perception of their own image and status. *International Social Work, 54(6)*, 800-815.

Chintagunta, P., Dubé, J.P. and Goh, K.Y., (2005). Beyond the endogeneity bias: The effect of unmeasured brand characteristics on household-level brand choice models. *Management Science, 51(5)*, 832-849.

Christiaensen, L. J., and Boisvert, R. N. (2000). *On measuring household food vulnerability: Case evidence from Northern Mali*. Ithaca, NY: Department of Agricultural, Resource, and Managerial Economics, Cornell University.

Christiaensen, L. J., and Subbarao, K. (2005). Towards an understanding of household vulnerability in rural Kenya. *Journal of African Economies*, *14*(4), 520-558.

Croll, E. J. (1999). Social welfare reform: Trends and tensions. *The China Quarterly, (159)*, 684–699.

Cunningham, W., and W. M. Maloney. (2000). *Measuring Vulnerability: Who Suffered in the 1995 Mexican Crisis?* The World Bank.

Cui, Y., Meng, J., & Lu, C. (2018). Recent developments in China's labor market: Labor shortage, rising wages and their implications. *Review of Development Economics, 22(3)*, 1217-1238.

Deng S., Que X., Li M, S. (2019) Analysis of the impact of urban-rural

income gap. *China Agricultural Accounting (12)*: 16-17.

Ding, X., Billari, F.C., Gietel-Basten, S. (2017): Health of midlife and older adults in China: the role of regional economic development, inequality, and institutional setting. *Int J Public Health. (62)*, 857–867.

Dickson, B.J. and Rublee, M.R., (2000). Membership has its privileges: the socioeconomic characteristics of Communist Party members in urban China. *Comparative Political Studies, 33(1)*.87-112.

Doje, C. (2001). *The research and practice of China's minimum living security system***.** Beijing, China: People's Press. (in Chinese)

Dong, X., & Simon, M. A. (2010). Health and aging in a Chinese population: urban and rural disparities. *Geriatrics & gerontology international, 10(1), 85-93.*

Du L, Zhang W. (2007). *The Development on China' Health*, No. 3. Social Science Academic Press: Beijing, China.

Duclos, J.-Y., Araar, A., & Giles, J. (2010). Chronic and transient poverty: Measurement and estimation, with evidence from China. *Journal of Development Economics, 91(2),* 266–277.

Dreger, C., & Zhang, Y. (2013). Is there a bubble in the Chinese housing market?. *Urban Policy and Research, 31(1),* 27-39.

Eggleston, K. (2012). Health care for 1.3 billion: An overview of China's health system. *Asian Health Policy Program Working Paper 28*. Stanford University.

Fang, E. F., Scheibye-Knudsen, M., Jahn, H. J., Li, J., Ling, L., Guo, H., ... & Ng, T. B. (2015). *A research agenda for aging in China in the 21st century. Ageing research reviews, (24), 197-205.*

Fageda, X., & Gonzalez-Aregall, M. (2017). Do all transport modes impact on industrial employment? Empirical evidence from the Spanish regions. *Transport Policy, (55),* 70-78.

Fan, R. (2007). Which care? Whose responsibility? And why family? A Confucian account of long-term care for the elderly. *The Journal of medicine and philosophy, 32(5),* 495-517.

Fang, Y., & Zhang, F. (2021). The future path to China's poverty reduction—dynamic decomposition analysis with the evolution of China's poverty reduction policies. *Social Indicators Research, 158(2),* 507-538.

Feng, Z., Liu, C., Guan, X., & Mor, V. (2012). China's rapidly aging population creates policy challenges in shaping a viable long-term care system. *Health Affairs, 31(12), 2764-2773.*

Förster, M.F. (1994). "Measurement of Low Incomes and Poverty in a Perspective of International Comparisons", *OECD Labour Market and Social Policy Occasional Paper, No. 14, Paris.*

Gao, S., & Meng, X. (2009, January). Health and rural cooperative medical insurance in China: an empirical analysis. In Conference on Asian Social Protection in Comparative Perspective, *University of Maryland and the Lee Kwan Yu School of Public Policy, Singapore* (pp. 7-9).

Gannon, C. A., & Liu, Z. (1997). *Poverty and transport* (No. TWU-30). Washington, DC: World Bank.

Giles, J., Park, A., & Wang, M. (2019). The great proletarian cultural revolution, disruptions to education, and the returns to schooling in urban China. *Economic Development and Cultural Change, 68(1),* 131-164.

Glade, T. (2003). Vulnerability assessment in landslide risk analysis. *Erde, 134(2),* pp, 123-146.

Goedhart, Th., V. Halberstadt, A. Kapteyn and B.M.S. van Praag (1977), *'The Poverty Line: Concept and Measurement,' The Journal of Human Resources, 12, pp. 503-520.*

Goldstein, H. (1999). Multilevel statistical models. London: Arnold

Gould, B. W., & Villarreal, H. J. (2006). An assessment of the current structure of food demand in urban China. *Agricultural Economics, 34(1), 1-16.*

Green, M., and Hulme, D. (2005). From correlates and characteristics to causes: Thinking about poverty from a chronic poverty perspective. *World Development, 33(6),* 867–879.

Gregg, P., Gutiérrez-Domènech, M. and Waldfogel, J. (2003). The employment of married mothers in Great Britain. [London]: Centre for Economic Performance, London School of Economics and Political Science.

Günther, I., & Maier, J. (2008). *Individual vulnerability and loss aversion.* Zuerich: Swiss Federal Institute of Technology (ETH).

Günther, I., and K. Harttgen. (2009). “Estimating Household Vulnerability to Idiosyncratic and Covariate Shocks: A Novel Method Applied in Madagascar.” *World Development 37 (7)*: 1222–1234. doi:10.1016/

Gustafsson, B., Shi, L. and Sato, H. (2004). Can a subjective poverty line be applied to China? Assessing poverty among urban residents in 1999. *Journal of International Development, 16(8)*: pp,1089-1107.

Gustafsson, B., and X. Yue. (2006). *Rural People’s Perception of Poverty in China*. IZA Discussion Paper No. 2486.

Hammond, D. R. (2013). Policy entrepreneurship in China’s response to urban poverty. *Policy Studies Journal*, 41(1), 119–146.

Haughton, J., and S. Khandker. (2009). *Handbook on Poverty and Inequality*. Washington, DC:The World Bank. doi:10.1596/978-0-8213-7613-3

Heitzmann, K., Canagarajah, R. S., and Siegel, P. B. (2002). Guidelines for assessing the sources of risk and vulnerability. *WB Social Protection Discussion Paper*, (0218).

Hu, A. (2012). The global spread of neoliberalism and China's pension reform since 1978.*Journal of World History,23(3)*,609–638.

Hu, H., Lee, P., Xie, L., Wang, Y., Wan, Y., & Qiu, W. (2020). Practical Experience of the Primary Healthcare System for Chinese Rural Residents: Building the Largest Health Insurance Program to Cover People Living in Poverty.

Huang, H. (2013). *Endless hope: the analysis of poverty in HongKong.* Hong Kong: Chung Hwa Press.

Imai, K. S. (2011). “Poverty, Undernutrition and Vulnerability in Rural India: Role of Rural Public Works and Food for Work Programmes.” *International Review of Applied Economics 25 (6)*: 669–691. doi:10.1080/02692171.2011.557052.

Jiang, F., Zhang, J., & Shen, X. (2013). Towards evidence-based public health policy in China. *The Lancet, 381(9882), 1962-1964.*

Jing, L. (2020, December). Countermeasure analysis of targeted poverty alleviation in Western Hubei from the perspective of culture and ecology Based on strategy theory: Taking Enshi Prefecture as an example. *In Proceedings of the 2020 3rd International Conference on E-Business, Information Management and Computer Science (pp. 681-687).*

Johnson, D., Erolani, M., Mackie,P.,(2017).Econometric analysis of the link between public transport accessibility and employment. *Transport Pol. (60)*,1-9.

Kamanou, G. and J. Morduch. (2002). *Measuring Vulnerability to Poverty.* Discussion Paper No. 2002/58. WIDER.

Kenyon, S., (2011). Transport and social exclusion: access to higher education in the UK policy context. J. *Transp. Geogr. (19)*, 763–771.

Khan, A. R., and Riskin, C. (2001). *Inequality and poverty in China in the age of globalization.* New York: Oxford Univ. Press.

Knight, J., Song, L., (2005). *Towards a Labour Market in China*. Oxford University Press,Oxford.

Kurosaki, T. (2002). Consumption vulnerability and dynamic poverty in the North-West Frontier province, Pakistan. *Institute of Economic Research.*

Lei, X., & Lin, W. (2009). The New Cooperative Medical Scheme in rural China: does more coverage mean more service and better health? *Health economics, 18(S2)*, S25-S46.

Leung, J. C. B. (2006). The emergence of social assistance in China. *International Journal of Social Welfare*, 15(3), 188–198.

Lenz, L., Munyehirwe, A., Peters, J., Sievert, M., (2017). Does large-scale infrastructure investment alleviate poverty? Impacts of Rwanda's electricity access roll-out program. *World Dev. (89)*, 88–110.

Lemieux, T. (2006). Increasing residual wage inequality. Composition effects, noisy data, or rising demand for skill? *American Economic Review, 96(3)*, 461–498

Li, L., and X. Bai. (2010). "Measuring and Decomposing Chinese Households' Vulnerability of Poverty". *Journal of Quantitative & Technical Economics 27 (8)*: 61–73. doi:10.13653/j.cnki.jqte.2010.08.002.

Li, W. W., Hodgetts, D., Ho, E., & Stolte, O. (2010). From early Confucian texts to aged care in China and abroad today: the evolution of filial piety and its implications. *Journal of US-China Public Administration, (7)*, 48-59.

Li X, Shen JJ, Lu J, Wang Y, Sun M, Li C, et al. (2013) Household catastrophic medical expenses in eastern China: Determinants and policy implications. *BMC Health Serv Res. (13):506*. doi:10.1186/1472-6963-13-506.

Li, Y., Wu, Q., Liu, C., Kang, Z., Xie, X., Yin, H., Jiao, M., Liu,G., Hao, Y., Ning, N.: (2014) Catast in rophic health expenditure and rural household impoverishment China:

what role does the new cooperative health insurance scheme play? *Journal of Quantitative & Technical Economics 32(4).33-42.*

Li, X., Lu, J., Hu, S., Cheng, K. K., De Maeseneer, J., Meng, Q., Hu, S. (2017). The primary health-care system in China. *The Lancet, (390),* 2584–2594.

Li, J., & Peters, M. (2019). Chinese model of higher education. Encyclopaedia of educational philosophy and theory, 1-8.

Ligon, E., & Schechter, L. (2004). *Evaluating different approaches to estimating vulnerability*. Social protection discussion paper series no.0410. Washington: World Bank.

Liu, Y. (2004). China's public health-care system: Facing the challenges. *Bulletin of the World Health Organization, (82),* 532–538.

Liu, P. and Qi, C., (2005). Reform in the Curriculum of Basic Education in the People's Republic of China: Pedagogy, Application, and Learners. *International Journal of Educational Reform*, 14(1), pp.35-44.

Liu, D., & Tsegai, D. (2011). The new cooperative medical scheme and its implications for access to health care and medical expenditure: Evidence from rural China. *ZEF Discussion Papers on Development Policy*. Bonn: Center for Development Research.

Liu, X., Zhao, S., Zhang, M., Hu, D., & Meng, Q. (2015). The development of rural primary health care in China's health system reform. *Journal of Asian Public Policy, (8),*88–101.

Liu, Y. S., Liu, C. H., & Li, W. (2019). A Review of the Existing Residential Building Retrofit in Tianjin, China. *In IOP Conference Series: Earth and Environmental Science (Vol. 329, No. 1, p. 012036).*

Liu, D. (2021). Habitus, campus experience, and graduate employment: personal advancement of middle-class students in China. *Journal of Education and Work, 34(3),* 344-355.

Liu, L., Wang, K., Wang, S.S., Zhang, R.Q., Tang, X.Y., (2018). Assessing energy consumption, CO2 and pollutant emissions and health benefits from China's transport sector through 2050. *Energy Policy (116),* 382–396.

Lloyd-Sherlock, P., & Locke, C. (2008). *Vulnerable relations: Lifecourse, wellbeing and social exclusion in Buenos Aires, Argentina. Ageing and Society, (28),* 779–803.

Lombard, A., & Kruger, E. (2009). Older persons: The case of South Africa. *Ageing International, (34),* 119–135.

Lu, F. (2014). Insurance coverage and agency problems in doctor prescriptions: Evidence from a field experiment in China. *Journal of Development Economics, (106),*156–167.

Lucas, K., Mattioli, G., Verlinghieri, E., & Guzman, A. (2016, December). Transport poverty and its adverse social consequences. In *Proceedings of the institution of civil engineers-transport* (Vol. 169, No. 6, pp. 353-365). Thomas Telford Ltd.

Luttmer, E. F. P. (2000). Inequality and poverty dynamics in transition economies: Disentangling real events from noisy data. Washington,DC: Mimeo, World Bank.

Ma, X., (2022). *Public Medical Insurance Reforms in China*. Springer.

McCulloch, N., and M. Calandrino. (2003). “Vulnerability and Chronic Poverty in Rural Sichuan.” *World Development 31 (3)*: 611–628. doi:10.1016/S0305-750X (02)00216-4.

McDowell, L. (2005). Love, money, and gender divisions of labour: some critical reflections on welfare-to-work policies in the UK. *Journal of Economic Geography, 5(3),* 365-379.

Miller, M. and Alberini, A., (2016). Sensitivity of price elasticity of demand to aggregation, unobserved heterogeneity, price trends, and price endogeneity: Evidence from US Data. *Energy Policy, (97),* 235-249.

Ministry of Civil Affairs. (2000). *China civil affairs' statistical yearbook*. Beijing, China: China Statistics Press. (in Chinese)

Ministry Of Health, Ministry of Finance & Affairs, & M. O. C. (2012). *Announcement of the Development of new rural cooperative medical scheme in 2012.* China.

Ministry of Civil Affairs. (2013). *China civil affairs' statistical yearbook*. Beijing, China: China Statistics Press. (in Chinese)

National health commission of the people's republic of China (2014). *The progress of the New Rural Cooperative Medical Scheme (NRCMS) in 2013 and major tasks in 2014.*

Ngok, K., & Huang, G. (2014). Policy paradigm shift and the changing role of the state: The development of social policy in China since 2003. *Social Policy and Society*, 13(2), 251–261.

Niu Q.Y., (2014) The Analysis of House Demolition Compensation System in China from the Perspective of Administration and Ethics. *Higher Education of Social Science*. Vol (7). No.3. pp.171-175.

Oksanen, H. (2010). *The Chinese Pension System: First Results on Assessing the Reform Options.* (No. 412). Directorate General Economic and Monetary Affairs, European Commission.doi:10.2765/42337.

Osberg, L., & Xu, K. (2008). How should we measure poverty in a changing world? Methodological issues and Chinese case study. *Review of Development Economics, 12*, 419–441.

Park, A., and Wang, S. (2001). China's poverty statistics. *China Economic Review, 12(4),* 384–398.

Parikh, P., Fu, K., Parikh, H., McRobie, A., George, G., (2015). Infrastructure provision, gender, and poverty in Indian slums. *World Dev. (66),* 468–486.

Pan, Y. J., Liu, Y., Yang, Q. Q., Zheng, X. L., Wu, X., & Song, L. Q. (2020). Interactive effects of kindergarten organizational resources on classroom quality in an era of universalizing ECE in China. *International Journal of Educational Research, 102, 101587.*

Peng, J., He, J., Li, Z., Yi, Y. and Groenewold, N., (2010）. REGIONAL FINANCE AND REGIONAL DISPARITIES IN CHINA. *Australian Economic Papers*, 49(4), pp.301-322.

Pritchett, L., Suryahadi, A., & Sumarto, S. (2000). *Quantifying vulnerability to poverty: A proposed measure, with application to Indonesia*.SMERU working paper, Social Monitoring and Early Response Unit (SMERU). Washington: World Bank.

Qi, D., & Wu, Y. (2016). Child income poverty levels and trends in urban China from 1989 to 2011. *Child Indicators Research, 9*(4), *1043–1058.*

Qin, L. J., Chen, C. P., LI, Y. H., SUN, Y. M., & Hong, C. H. E. N. (2021). The impact of the New Rural Cooperative Medical Scheme on the "health poverty alleviation" of rural households in China. *Journal of Integrative Agriculture, 20(4)*, 1068-1079.

Ravallion, M., & Chen, S. (2015). Benefit incidence with incentive effects, measurement errors and latent heterogeneity: A case study for China. *Journal of Public Economics, 128*, 124–134.

Raiser, M. (1998). Subsidising inequality: Economic reforms, fiscal transfers and convergence across Chinese provinces. *Journal of Development Studies, 34(3)*, 1–26.

Ren, Y., Xiong, C., & Yuan, Y. (2012). House price bubbles in China. *China Economic Review, 23(4)*, 786-800.

Riskin, C. A., & Gao, Q. (2009). *The changing nature of urban poverty in China*. Oxford University Press, Oxford.

Rizov, M. and Zhang, X., （2013）. Regional disparities and productivity in China: Evidence from manufacturing micro data. *Papers in Regional Science*, 93(2), pp.321-339.

Sabates, R., Gould, B. W., Villarreal, H. J., (2001). Household composition and food expenditures: a cross country comparison. *Food Pol. 26, 571–586.*

Saunders, P. (2007). Comparing poverty among older people in urban China internationally. *China Quarterly, 190,* 451–465.

Saunders, P., & Sun, L. (2006). Poverty and hardship among the aged in urban China. *Social Policy & Administration, (40),* 138–157.

Salditt, F., Whiteford, P., & Adema, W. (2008). Pension reform in China. International Social *Security Review,61(3),* 47–71.

Samson, M. (2007). *The impact of social transfers on growth, development, poverty and inequality in developing countries*. Cape Town: Economic Policy Research Institute.

Schröder B, E. (2004). Inter-generational family support provided by older people in Indonesia. *Ageing and Society, (24),* 497–530.

Scheyvens, R., & Momsen, J. H. (2008). Tourism and poverty reduction: Issues for small island states. *Tourism geographies, 10*(1), 22-41.

Scharping, T., (2019). Abolishing the one-child policy: stages, issues and the political process. *Journal of Contemporary China, 28(117),* 327-347.

Senadjki, A., S. Mohd, Z. Bahari, and A. F. C. Hamat. (2017). "Assets, Risks and Vulnerability to Poverty Traps: A Study of Northern Region of Malaysia." Margin: *The Journal of Asian Finance, Economics and Business 4 (4)*: 5–15.

Sen, A. K. (2008). *The discipline of economics. Economics, 75(300),* 617–628.

Shi, S.-J. (2012). Social policy learning and diffusion in China: The rise of welfare regions? *Policy & Politics, 40(3),* 367–385.

Siddiquah, A., Salim, Z., (2017). The ICT facilities, skills, usage, and the problems faces by the students of higher education. *Eurasia. J. Math. Sci. T. 13 (8)*, 4987–4994.

Singleton, P.A., Clifton, K.J., (2017). Considering health in US metropolitan long-range transportation plans: a review of guidance statements and performance measures. *Transport Pol. (57)*, 79–89.

Suryahadi, A., Sumarto, S., and Pritchett, L. (2000). *Quantifying vulnerability to poverty: A proposed measure, applied to Indonesia*. The World Bank.

Stone, R. I., and Short, P. F. (1990). The competing demands of employment and informal caregiving to disabled elders. *Medical care*, 513-526.

Steenbergen, M. R., & Jones, B. S. (2002). Modeling multilevel data structures. *American Journal of Political Science, (46)*, 218-237. doi:10.2307/3088424.

Sun, Z., Liu, H., Liu, Z., Xiong, W., & Zhong, R. (2018). Research on intellectual precision poverty alleviation and rural revitalization strategy of Enshi prefecture in Wuling Mountain area based on agricultural intellectual property rights protection and intellectual resources exploitation. *Acta Agriculturae Jiangxi*, *30(5)*, 135-141.

Tang, J., Sha, L., & Ren, Z. (2003). *Report on urban poverty and alleviation in China***.** Beijing, China: Huaxia Publishing House. (in Chinese)

Thakuriah, P., Persky, J., Soot, S., Sriraj, P.S., 2013. Costs and benefits of employment

transportation for low-wage workers: an assessment of job access public transportation services. *Eval. Program Plann. (37)*, 31–42.

Townsend, P. (1985). A sociological approach to the measurement of poverty: A rejoinder to Prof. Amartya Sen. *Oxford Economic Papers*, 37(4), 659–668.

Tsang, M. C., & Ding, Y. (2005). Resource utilization and disparities in compulsory education in China. *China Review (1)*, 1-31.

Tsui, K. Y. (2005). Local tax system, intergovernmental transfers and China's local fiscal disparities. *Journal of Comparative Economics, 33(1)*, 173–196.

Van Praag, B. M., Spit, J. S., & Van de Stadt, H. (1982). A comparison between the food ratio poverty line and the Leyden poverty line. *The Review of Economics and Statistics, (64)*, 691–694.

Vera S. P. (2012). Gender, poverty and old-age livelihoods in urban South India in an era of globalisation. *Oxford Development Studies, (40),* 324–340.

Verbeek, M. (2008). *A Guide to Modern Econometrics*. Chichester: Wiley.

Wagstaff A, Lindelow M, Gao J, Xu L, Qian J. (2009). Extending health insurance to the rural population: an impact evaluation of China's new cooperative medical scheme. *Journal of Health Economics 28(1)*: 1–19.

Wang, Y. (2007). Inevitable "three security lines" and "two guaranties". *China Social Security*,*(11)*,22–23.

Wang, M., (2007). Emerging urban poverty and effects of the Dibao program on alleviating poverty in China. *China World Econ. 15 (2),* 74-88. https://doi.org/10.1111/j.1749-124X.2007.00062.

Wang, S. X., & Benjamin, F. Y. (2019). Labor mobility barriers and rural-urban migration in transitional China. *China Economic Review, (53)*, 211-224.

Wang H., Zhao, Q., et al. (2020). Poverty and subjective poverty in rural China. *Social Indicators Research, (150)*, 219–242. https://doi.org/10.1007/s11205-020-02303-0.

Wang, Y. C. (2014). In search of the Confucian family: Interviews with parents and their middle school children in Guangzhou, China. *Journal of Adolescent Research, 29(6),* 765-782.

Wang, H., Zhao, Q., Bai, Y., Zhang, L., & Yu, X. (2020). Poverty and subjective poverty in rural China. *Social Indicators Research, 150(1)*, 219-242.

Wang, Z., Zhang, Z., & Jin, X. (2021). A study on the spatial network characteristics and effects of CDW generation in China. *Waste Management, (128)*, 179-188.

Wang, X., & Wu, B. (2021). China Case Study. *The Role of Intergovernmental Fiscal Transfers in Improving Education Outcomes*, 265.

Ward, P. S. (2016). Transient poverty, poverty dynamics, and vulnerability to poverty: An empirical analysis using a balanced panel from rural China. *World Development, (78)*, 541–553.

Wheelock, J., & Jones, K. (2002). 'Grandparents are the next best thing': informal childcare for working parents in urban Britain. *Journal of Social Policy, 31(3)*, 441-463.

Whiteford, P. (2003). From enterprise protection to social protection: Pension reform in China. *Global Social Policy,3(1),*45–77.

Wu, F., et al. (2010). *Urban poverty in China*. Massachusetts: Edward Elgar.

Wong, C. K. (1995). Measuring third world poverty by the international poverty line: The case of reform China. *Social Policy and Administration (29),*189–203.

Wong, C. K. (1997). How many poor people in Shanghai today? The question of poverty and poverty measures. *Issues and Studies (33),*32–49.

Woolard, I., & Klasen, S. (2005). Income mobility and household poverty dynamics in South Africa. *Journal of Development Studies, (41),* 865–897.

Xie, Y., Zhang, X. B., Xu, Q., & Zhang, C. N. (2015). Short-term trends in China's income inequality and poverty: Evidence from a longitudinal household survey. *China Economic Journal, (8),* 235–251.

Yan, M. (2014). New urban poverty and new welfare provision: China's Dibao system. In E. K.Gubrium, S. Pellissery, & I. Lødemel (Eds.), *The shame of it: Global perspectives on anti-poverty policies* pp. 17–36. Bristol: Policy Press.

Yan, E., So-Kum, C., & Yeung, T. D. (2002). No safe haven: A review on elder abuse in Chinese families. Trauma, *Violence, & Abuse, 3(3),* 167-180.

Yang, L., Konttinen, H., Martikainen, P., & Silventoinen, K. (2018). Socioeconomic status and physical functioning: A longitudinal study of older Chinese people. *The Journals of Gerontology: Series B, (73),* 1315–1329.

Yang, Y., & Yang, D. (2009). Community health service centers in China, not always trusted by the populations they serve? *China Economic Review, (20),* 620–624.

Yang, R., (2018). The Global Significance of China's Development in Education: Retrospect and Prospect in the 40th Anniversary Year of Reform and Opening Up. *Frontiers of Education in China*, 13(4), pp.467-485.

Yi, Z., Vaupel, J. W., Zhenyu, X., Chunyuan, Z., & Yuzhi, L. (2002). Sociodemographic and health profiles of the oldest old in China. *Population and Development Review, (28),* 251–273.

Yip, W., & Hsiao, W. C. (2008). The Chinese health system at a crossroads. *Health Affairs, (27),* 460–468.

Yip W, Wang H, Hsiao W. (2008). The impact of rural mutual health care on access to care: evaluation of a social experiment in rural China. *Harvard Working Paper*.

Yu, J. (2013). Multidimensional poverty in China: Findings based on the CHNS. *Social Indicators Research, 112(2),* 315–336.

Yu, W., Wang, F., Sang, Q., Wang, Q., Gao, Y., Huang, Y., ... & Cui, C. (2020). Construction and Analysis of Actuarial Model of the Influence of Personal Tax Deferred Commercial Pension Insurance on Personal Pension Wealth in China. *Mathematics, 8(12),* 2124.

Zeng, Y., & George, L. K. (2010). Population aging and old-age care in China. *Sage handbook of social gerontology. Thousand Oaks: Sage publications, 420-9.*

Zeng, Y. (2012). Toward deeper research and better policy for healthy aging–using the unique data of Chinese longitudinal healthy longevity survey. *China economic journal, 5(2-3), 131-149.*

Zeng, Y., Luo, J., Ou, L., Yuan, M., Zhou, Z., Han, Y., & Fang, Y. (2019). The impact of medical insurance on medical expenses for older Chinese: evidence from the national baseline survey of CLHLS. *Medicine, 98(39).*

Zhang, L., (2008). Governing China's Population: From Leninist to Neoliberal Biopolitics by Susan Greenhalgh and Edwin A. Winckler. *American Ethnologist*, 35(2), pp.2093-2096.

Zhang, L., H. Wang, S. Rozelle, and Y. Yan. (2006). "Insuring Rural China's Health? An Empirical Analysis of China's New Cooperative Medical System." Poster Paper Prepared for Presentation at the International Association of Agricultural Economists Conference. Gold Coast, Australia, August 12–18.

Zhang, H. (2009). Poverty and politics the evolution of minimum living standard guarantee system in China in the period of transition. *Asia Pacific Journal of Social Work and Development, (19),* 5–20.

Zhang, S., Yang, L., & Zhang, T. (2012). International comparison of the pension replacement rate and the pension reform in China. *Zhejiang Academic Journal, (4)* ,170–199.

Zhang, C., et al. (2014). Are poverty rates underestimated in China? New evidence from four recent surveys. *China Econ. Rev* (31).

Zhang H. (2020) Research on the influencing factors of the urban-rural income gap in my country. *Northern Economy and Trade (02): 28-29.*

Zhu, H., & Walker, A. (2018). Pension system reform in China: Who gets what pensions? *Social Policy & Administration, 52(7),* 1410-1424.

Zhu, X., & Zhao, H. (2018). Recognition of innovation and diffusion of welfare policy: Alleviating urban poverty in Chinese cities during fiscal recentralization. *Governance, 31(4),* 721-739.

Appendices

1.1 Scoring coefficients for the social security index in urban

Variable names	Coefficient
Medical insurance	**0.2502**
Unemployment insurance	**0.4045**
Work injury	**-0.1558**
Housing fund	**0.4736**
Pension	**0.2790**
Mean	**0.00**
Standard Deviation	**1.00**

1.2 Scoring coefficients for the social security index in rural

Variable names	Coefficient
Medical insurance	**0.2072**
Unemployment insurance	**0.2233**
Work injury	**0.1255**
Housing fund	**0.4391**
Pension	**0.3739**
Mean	**0.00**
Standard Deviation	**1.00**

Appendix 2: vulnerability incidence and poverty rate in urban and rural areas

Vulnerability 29%

	Urban	Rural
Poor and vulnerable	5.05%	11.63%
Poor and non-vulnerable	0.24%	1.06%
Non-poor and non-vulnerable	81.77%	65.68%
Non poor and vulnerable	12.95%	21.62%
Total vulnerable	18.00%	33.25%
Total poverty	5.29%	12.69%

Vulnerability 50%

	Urban	Rural
Poor and vulnerable	2.13%	5.11%
Poor and non-vulnerable	3.16%	7.58%
Non-poor and non-vulnerable	89.20%	78.07%
Non poor and vulnerable	5.51%	9.23%
Total vulnerable	7.71%	14.34%
Total poverty	5.29%	12.69%

3.1 The characteristics of four models about reimbursement of NCMS

Characteristics	First model	Second model	Third model	Fourth model
Rate of coverage	65.2%[35]	6.70%	11.17%	16.87%
Whether Medical saving account available	Yes	No	No	No
Inpatient services	Yes	Yes	Only reimburse for catastrophic diseases.	Yes
Outpatient services	Yes	No	Only for catastrophic diseases.	No
Extra benefits	There is a deductible and a reimbursement cap for using a medical savings account.	There is free physical check-up each year for whose has not use any medical services that requires r reimburse in NCMS.	No	No

Source: National health commission of the people's republic of China (2014)

[35] The calculation comes from Du and Zhang (2007).