Intergenerational Support and Subjective Health of Older People in Urban China: Does Education Level Cause a Difference?

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Abstract

This paper aims to study examine the effect of intergenerational support on subjective health of Chinese urban elderly in different education levels using ordered logit models. The findings are as follows. Overall, financial support can significantly improve self-rated health of the elderly, while emotional support can significantly decrease self-rated health of the elderly. In the subgroup regressions, the SRH of the group with lower education level is more positively affected by financial support, and is also significantly negatively affected by emotional support. Emotional support does not significantly affect the self-reported health of the group with higher education levels.

1 Introduction

By far, China's aging population has been the world's largest.[1] China's aging population expanded in a large scale, at a fast speed and in a regionally unbalanced pattern, which is due to the particular urban-rural dual structure; it also features an inversion in the urban and rural aging population (aging of China's population is more severe in rural areas than in cities). Nevertheless, based on the law of China's population development, it is expected that by 2040, the urban aging level will exceed the rural level (Xiang and Wang, 2021). In the current situation of population aging, it is particularly important to pay attention to the determinants of the health of the elderly.

Meanwhile, according to the fourth Sample Survey on the Living Conditions of the Elderly in Urban and Rural China, there is a new trend in the change of China's elderly population: the education level of the aging population has dramatically improved, and the level of the urban elderly is higher than that of the rural elderly[2], which may lead

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to changes in the needs of the elderly.

For a long time, there has been a tradition of "raising children for old age's welfare" in China, where the notion of family is deeply embedded (Hu, 2018). It's easy to see that in China, the support from children plays a vital role in guaranteeing the elderly the quality of life, in which health is an important part.

Up till now, there have occurred three types of studies on intergenerational support and health of the Chinese elderly: the first type focuses on the whole aging population in China or the immigrant elderly; the second type centers around the rural elderly in the light of the urban-rural inversion characteristic; the third divides the elderly into different groups in terms of gender or age and profoundly explores the difference between each group. However, few studies have taken the urban elderly as the research population and studied the relationship between intergenerational support and the health of the elderly from the perspective of education level. This paper aims to study the difference in the intergenerational support received by old people in different education levels and that in the impacts of the received support on their health.

2 Existing Literature

2.1 The relationship between intergenerational support and the health of old people

The existing literature often studies intergenerational support between children and the elderly from three aspects: financial support, instrumental support, and emotional support (Li and Tong, 2006). But their results and viewpoints vary from one to another. In the aspect of the impacts of financial support, two opposite hypotheses were studied. Some researchers held the point that financial support provided by adult children is key to satisfying the basic living and medical needs of the elderly (Cong and Silserstein, 2008); it can significantly improve their physical and mental health and help slow down the decline of their cognitive function (Wang and Gao, 2011). The opposite point also exists. A possible reason is that children's financial support will damage old people's self-esteem and result in them overly depending on their children, which adversely affects their subjective quality of life (Yu, 2017).

The positive impacts of the instrumental support on elder people's health have been testified by researches, as well as the negative impacts. Some believe instrumental support can increase the quality of older people's life, reduce their depression level and improve their mental health, physical health, and life satisfaction (Peng and Yin, 2010). Some other studies have found that the well-functioning elderly who receive more frequent instrumental support exhibit greater risk to their future health than do similarly healthy elders who receive less frequent instrumental support (Seeman et al., 1996). Possible reasons are that instrumental support may induce excessive dependency in older individuals, or that elderly parents prefer to be independent for as long as possible. And in terms of old people with disability, long term of disability can increase the cost

of the children's tending and reduce their tending willingness and effects, which will lead to the decreasing satisfaction of older people with such deed, negatively affecting the physical and mental health of the disabled elderly (Liu and Zhang, 2018).

The impacts of emotional support on old people's health can differ according to countries. There are studies agreeing with its positive impacts, holding that emotional maintenance behavior and help from offspring can help maintain and restore the physical function of the elderly (Levine et al., 2010), and can reduce their loneliness, psychological stress, and depression (Thoits, 2006). A study in Japan also suggests that emotional support is a promoter of better subjective health in older people (Okamoto et al., 2004); however, in China, a negative association between emotional support and elders' health status was reported (Wang, 1990).

2.2 Education level and old people's health

Recent empirical studies document a strong and positive correlation between education and health, the two vital components of human capital. Even when various measures of socio-economic status and different demographical characteristics are controlled for, the correlation remains significant. In his pioneering work in this field, Grossman (1972) proposed two causal paths to link education with health. First, better educated people are more efficient in the use of health care services and, therefore, can obtain more health capital. Second, education discourages individuals from maintaining unhealthy habits (such as smoking, drinking, etc.), which leads them to invest more in health and thus to attain a better health status.

This positive relationship applies to old people as well. It's been proved that improvements in education lead to improvements in health among the South Korean elderly people (Kye et al., 2014). Along with a more positive leisure attitude, old-aged people with high education have a better psychological adjustment concerning well-being. Also, a higher level of education can lead to a better perception of aging changes (physical, life, profession) (Belo et al., 2020).

These studies indicate old people in different education levels may have different needs and health outcomes when receiving intergenerational support.

2.3 Studies in separate groups

There have been studies in separate groups on the relationship between intergenerational support and old people's health, but mostly focused on age and gender. Although their perspectives are not the same as this paper, their approaches can be learned from.

Bai and Gu (2021) conducted a heterogeneity analysis based on gender and age. Their study divided the sample of rural elderly into male and female groups as well as the younger group aged 60-69 and the older group aged over 70. They applied a bivariate Probit model to analyze the impact of intergenerational support on old people's health

in each group. It turned out that the health level of female rural elderly is more likely to be affected by instrumental support, while that of male rural elderly by emotional support. The results also suggest that the health of the younger group is more susceptible to instrumental support, while there is no significant difference in the impact of emotional support on the elderly at different ages. They also found a certain interaction between different dimensions of intergenerational support.

Song et al. (2006) studied the gender differences in the relationship while taking into consideration that different ages may internally impact health, so they divided the sample into five groups aged 60-64, 65-69, 70-74, 75-79, and 80 and above. After establishing a logistic model and controlling the health risk factors such as marriage, they conducted a multi-level analysis to exam the influence of intergenerational support on the health of elderly men and women in rural areas. The results show that while the increase of supports from children to the elderly worsens the health of elder men, the increase of financial supports from the elderly to children and the increase of emotional supports between the elderly and their children better the health of older men.

Feldman et al. (2009), in their longitudinal study, examined the effect of international exchanges, instead of support, on subjective health of Chinese rural elderly in different gender groups. Their choice of dependent and independent variables is similar to those of the two above. They applied separate random-effect logistic regression models to the male and female samples to analyze the association between SRH (self-rated health) and intergenerational support in terms of gender. Their study suggests that there are gender differences in the relationship between intergenerational support and subjective health of older people.

2. 4 Contributions
The research on the issue of elderly people has guiding significance for modern people to understand the needs of their parents and to support them better.
While using the latest sample from China urban old people, this paper will adopt similar approaches mentioned above to analyze the relationship between intergenerational support and older people's self-rated health and how it varies with education levels, and hence shed more light on the needs of the Chinese elderly as they get more educated.

3 Model

3.1 Economic Theories
Grossman (1972) first proposed the model of health demand based on human capital. Grossman regarded personal health as a capital stock depreciating with age, the quality of which is partly innate and partly acquired. This model points out that, after a certain age, the increase of age means the increase of the depreciation rate of the health capital, which entails the necessary investment of the consumer to supplement the deficiency of the health capital. Such investment can be the cultivation of consumer's own good living habits, or the expenses for food, entertainment, sports and various medical

services. The research object in this paper is the elderly over 60 years old, whose physical function and psychological condition are declining. From the perspective of Grossman's theory, family relationship, lifestyle, and consumption expenditure are all the necessary investment for the health of the elderly. Therefore, Grossman's Health Demand Theory is the important theoretical basis for this study.

Morgan (1983) pointed out that, in a narrow sense, intergenerational support is the two-way flow of intergenerational resources between children and parents within a family, namely, the two-way flow of financial resources (such as money) and non-financial resources (such as labor services). Then, Mu (1998) first subdivided intergenerational support into three categories: financial support, instrumental support and emotional support, which is also the commonly-adopted theory in studies of Chinese intergenerational support. Financial support mainly refers to the material such as money provided by parents and children. Instrumental support refers to the care and assistance provided by both sides, such as laundry, cooking, and other housework. Emotional support refers to the emotional communication between parents and children by way of listening to each other and talking to each other.

Based on the above theories, this study adopts the theoretical model as follows, where health is the explained variable and x1, x2 and x3 are explanatory variables standing for three types of support, while other xs act as control variables.

$$H = f(x_1, x_2, x_3, x_4 \dots x_k)$$

Since intergenerational support is regarded as an investment in health, taking into consideration that the more educated elderly group pays more attention to spiritual life and the less educated elderly has lower average income (Li and Wang, 2018), the study proposes the following three hypotheses:

(1) Both financial and emotional support have a positive impact on the self-rated health of older people.
(2) Emotional support has a greater positive impact on the more educated group (who probably pay more attention to spiritual life).
(3) Financial support has a greater positive impact on the less educated group (who probably are on a tighter budget).

3.2 Data

The data in this study are from the datasets of 2013, 2015, and 2018 surveys in The China Health and Retirement Longitudinal Study (CHARLS) , a biennial survey in China conducted by the National School of Development (China Center for Economic Research) at Peking University. These are the latest three waves of the CHARLS. The employment of the latest national data guarantees the timeliness and universality of the results, which also distinguishes the study.

To ensure the samples are all old people and in the meanwhile to increase the sample size, individual samples born before 1958 are selected (who were 55 in the survey of

2013 and 60 in 2018). Also, because this paper aims to study old people in urban China, only old people with nonagricultural Hukou are selected. After combining all data of three years into a balanced panel dataset, the sample size is 1824 with 608 each year.

3.3 Variables and Measurement

Dependent variable

Self-Rated Health (SRH), the dependent variable in this study, is assessed by a five-point scale response to the question "Would you say your health is very good, good, fair, poor or very poor?": 1. very good; 2. Good; 3. Fair average; 4. Poor; and 5. Very poor. This question occurred as the first question in Health Status section in all three waves of studies, and therefore is a qualified yardstick for measuring Self-Rated Health. In this study, the responses are taken as the score of the respondent's Self-Rated Health score. Note that here a lower score indicates a better health, and vice versa.

Independent variables

The independent variable, intergenerational support is supposed to be subdivided into financial support, instrumental support and emotional support as mentioned above, but due to the limitation of the data, there isn't a suitable survey question for instrumental support. Therefore the variable of instrumental support is omitted in this study. However, considering the strong reciprocal relationship between instrumental support and the health of the old people, leaving out this variable decreases the endogeneity to an extent.

Financial support is measured by the response to the question "During last year, what's the amount of financial support received from [XChildName]?". Since a respondent could have more than one child, the value of this variable is the sum of financial support received from all children. This variable is a numerical variable.

Emotional support is assessed using the question "When [XChildName[i]] is not living with you, how often do you contact with him/her on phone/by message/ on WeChat/ by mail/ by email?" The responses are as follows: 1. Almost every day; 2. 2-3 times a week; 3. Once a week; 4. Every two weeks; 5. Once a month; 6. Once every three months; 7. Once every six months. Also, since a respondent could have more than one child, but meanwhile the sum of all the responses for this question is meaningless, to measure the received emotional support more reasonably, this paper decides to treat emotional support as a binary variable: if no emotional support is received from any children, the value is 0, labeled as "No"; if any, the value is 1 , labeled as "Yes".

Control Variables

Grouping criteria: This study aims to investigate whether the health of the elderly with different education levels is affected differently by intergenerational support, which entails grouping samples by education levels. In China, education levels are divided into primary education (attending primary schools), secondary education (attending secondary schools), and higher education (bachelor's degree and above). Since China's

college entrance examination was resumed only in 1977, the proportion of the elderly born before 1958 with higher education is very small, and finishing secondary education is already considered educated at that time. So the elderly are divided into two groups according to education: "Un/ Low-educated Group" (those who only receive primary education or below), and "Intermediate/Highly educated Group" (those who receive secondary education and above).

Other control variables: Other factors that affect investment in health include: gender, a binary variable; age, a numerical variable, marital status, a binary variable; pension, a binary variable.

3.4 Methods and Econometric Model

Firstly, t-tests are applied to see whether there are differences in the support received and SRH of in different education groups. Then, separate random effect ordered logit regressions are applied on the panel data of two education groups. The equation below is the final econometric model for the ordered logit regressions.

$$Logit(P_j)_{it} = -\kappa_j + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 female_{it} + \beta_4 age_{it} + \beta_5 married_{it} + \beta_6 pension_{it} + u_{it}$$

4 Results

This part will display the results of the statistical approaches, compare them with those of previous studies and put forward possible reasons.

4.1 Descriptive Statistics and Preliminary Analysis

Table 1 Descriptive Statistics of All Data

Variable	Obs	Mean	Std.Dev.	Min	Max
SRH	1,517	2.369	1.442	0	5
x1	1,824	2545	6456	0	141000
x2	1,824	0.538	0.499	0	1
female	1,824	0.462	0.499	0	1
age	1,824	67.72	7.867	55	98
married	1,824	0.620	0.486	0	1
pension	1,824	0.786	0.593	0	2
edugroup	1,824	0.553	0.497	0	1

As shown in Table 1, SRH, short for Self-Rated Health, has a mean of 2.369 (here a 0 of SRH means a missing value). x_1 is Financial Support with a mean of 2545 yuan per year, far below the average of the income of the urban elderly, 46100 yuan per year (Li and Wang, 2018), which further indicates that the main income of the urban elderly is not sourced from their children. x_2, Emotional Support, a binary variable, has the mean of 0.55, meaning that about 53% of old people have received emotional support from their child(ren) in the past year.

In terms of control variables, the female variable indicates 46% of the samples are old women; the age variable indicates that in the base year (year of 2013), the average age of the samples is 68 with the youngest at 55 and oldest at 98; the married variable shows that about 62% of the sampled elderly are married; pension is a binary variable with 1 standing for "having pension" and 0 for the opposite, whose features show that 55% of the sampled urban elderly have access to pension, which conforms to the status that the main income source for the urban Chinese elderly is pension (Li and Wang, 2018). Edugroup, a binary variable with 1 for intermediate/highly-educated group and 0 for un/poorly-educated group, indicates that 55% of the samples falls under the former category.

Then, to conduct preliminary analyses on the differences between the two education groups, two sets of t-tests are applied on the data of the two groups, respectively in the base year (the year of 2013) and the last year (the year of 2018). The results are shown in the Table 2.

Both in 2013 and 2018, the financial support received by the two groups were significantly different, and the more-educated group received more than the less-educated. The reason may be that the children of better-educated older adults also have better resources, which leads to higher wages and more financial support to the parents. In terms of SRH, the former also showed significantly better SRH than the latter, which lends preliminary support to the first hypothesis that increased financial support can promote SRH. But these two had no significant difference in received emotional support, which indicates that compared with less educated parents, more educated parents don't necessarily receive more emotional support from their child(ren) in their golden years.

These preliminary analyses lay foundation for subsequent regression analysis and interpretation of the results.

Table 2 T-tests on the variables of different groups

Variables	Group 1 Un/poorly-educated Mean 1	Group 2 Interm/Hi-educated Mean2	Mean Diff (G1-G2)
2013 (The Base year)			
SRH	3.067	2.808	0.260***
X1	2058.507	3716.190	-1657.683**
x2	0.543	0.492	0.051
2018 (The Last year)			
SRH	3.123	2.898	0.225***
x1	2156.642	3377.294	-1220.652**
x2	0.555	0.537	0.018

4.2 Regression results on all data and interpretation
First, an ordered logistic regression is performed on the whole panel data, whose results are shown in Table 3.

The P value of the regression is 0, so it can be concluded that the regression is meaningful. The P values of variables X1, X2, age, and pension are all smaller than 0.05, indicating that their regression coefficients are significant on a 95% confidence interval. It should be noted that in this study, a smaller SRH value represents a better health. Therefore, if the variable coefficient is negative, the independent variable is positively correlated with the dependent variable; otherwise, it is negatively correlated.

The coefficient for x1 is significantly negative, which proves that financial support is a promoter for the SRH of the elderly. Although the main income of the urban elderly is not from their children, financial support from them can still significantly contribute to the improvement of self-rated health of the elderly. The possible reason is that the urban elderly, who widely rely on pensions as their main source of income, with financial support from their children, can obtain more resources besides meeting basic living needs to improve their quality of life and thus improve their self-rated health. This result supports the first half of hypothesis (1).

Table 3 Random-effects ordered logistic regression (All Data)

Log	likelihood	=-2274				
Wald	chi2(6)	=70.69				
	Prob>chi2	=0				
SRH original	Coef.	Std.Err.	z	P>|z|	95% Conf. Interval	
x1	-1.89e-05	7.56e-06	-2.500	0.0120	-3.37e-05	-4.10e-06
1.x2	0.2590	0.1110	2.3200	0.0200	0.04050	0.4770
1.gender	0.0451	0.1300	0.3500	0.728	-0.2090	0.2990
age	-0.0162	0.0080	-2.020	0.0430	-0.0318	-0.000496
1.married	0.1190	0.1340	0.8900	0.374	-0.1430	0.3810
1.pension	1.257	0.1710	7.3400	0	0.9210	1.5930
/cut1	-2.411	0.596	-3.578	-1.243		
/cut2	-1.958	0.592	-3.119	-0.797		
/cut3	-1.357	0.588	-2.509	-0.205		
/cut4	0.9800	0.577	-0.150	2.110		
/cut5	2.7030	0.583	1.561	3.845		
/sigma2 u	0.584	0.164	0.337	1.012		
LR test	vs.	ologit model	ologit	chibar2(01)	=19.29	
		Prob	>=	chibar2	=0	

The coefficient for x2 is significantly positive, indicating that emotional support has a negative impact on the self-rated health of the elderly. There are two possible reasons.

First, the independence of the elderly in urban areas is relatively high, so the emotional support of the children to their parents may turn out excessive, which could interfere and bound the life of the elderly, thus resulting in a lower self-rated health score of them. Secondly, as the measurement for this variable is simply "Contact Frequency" without screening the purpose or the content of the contact, it is possible that even if children contact the elderly, they don't necessarily give support. Especially in China nowadays, the phenomenon of grandparents taking care of grandchildren is common. In this way, children's contact with their parents may increase the burden on the latter and deteriorate their health. This result rejects the latter part of hypothesis 1 (Emotional support promotes SRH).

The coefficient for the age variable is significantly negative, that is, the elderly self-rate their health as better as they grow older. This may be due to the subjective nature of self-rated health: respondents answer the questionnaire question completely out of their own subjective feeling. In the traditional Chinese Confucian culture, there is an old saying goes as "…At fifty, I knew what were the biddings of Heaven. At sixty, I heard them with docile ear. At seventy, I could follow the dictates of my own heart; for what I desired no longer overstepped the boundaries of right…", which indicates that as they get older, the life satisfaction of the Chinese elderly may gradually increase, leading to the improvement of the SRH.

One surprising finding is the positive coefficient for the pension variable. This means that pensioners reported poorer health, which does not conform to the present policy. A possible cause is the work they did in their prime. According to China's pension system, pension recipients need to pay a certain amount of money on a regular basis when young. Therefore, the elderly with pension may have higher work intensity when young that caused greater physical damage, which results in poorer self-rated health when they're old.

4.3 Regression results on separate groups and interpretation
In order to compare the difference of the relationship between the variables in different education groups, separate ordered logistic regressions are performed on the Un/poorly-educated Group and Intermediate/highly-educated Group. The regression results are shown in Table 4 and Table 5.

For Un/poorly-educated Group, financial support has a significant positive effect on SRH, while emotional support has a significant negative effect on SRH. For Intermediate/highly-educated Group, financial support has a significant positive effect on SRH, while emotional support had no significant effect. By comparing the coefficient of X1 between the two groups, hypothesis (2) can be supported: the lower the education level, the greater the positive impact of financial support on SRH. However, the results do not provide support for hypothesis (3), because emotional support has no significant influence on the SRH of the group with higher education levels. The possible reason is that the more educated elderly are more relaxed about

traditional concept of "raising children for old age's welfare" and tend to turn to other sources and spirit-enriching activities for emotional support.

Table 4 Random-effects ordered logistic regression (Group 1)

Log	likelihood	=	-1026			
Wald	chi2(6)	=	53.56	Prob>chi2	=	0

SRH original	Coef.	Std.Err.	z	P>|z|	95% Conf. Interval	
x1	-2.73e-05	1.46e-05	-1.870	0.0420	-5.58e-05	1.32e-06
1.x2	0.4520	0.1620	2.8000	0.0050	0.1350	0.7700
1.gender	0.3580	0.1910	1.8800	0.0610	-0.0159	0.7320
age	-0.020	0.0121	-1.6500	0.0990	-0.0437	0.0037
1.married	0.5500	0.1950	2.8200	0.0050	0.1680	0.9320
1.pension	1.1790	0.2080	5.6700	0	0.7710	1.5860

Table 5 Random-effects ordered logistic regression (Group 2)

Log	likelihood	=	-1227			
Wald	chi2(6)	=	20.27	Prob>chi2	=	0.00250

SRH original	Coef.	Std.Err.	z	P>|z|	95% Conf. Interval	
x1	-1.84e-05	8.72e-06	-2.120	0.0340	-3.55e-05	-1.36e-06
1.x2	0.0503	0.156	0.320	0.746	-0.255	0.355
1.gender	-0.273	0.185	-1.480	0.139	-0.635	0.0889
age	-0.0149	0.0113	-1.320	0.185	-0.0370	0.00716
1.married	-0.270	0.187	-1.440	0.149	-0.637	0.0965
1.pension	1.110	0.320	3.470	0.00100	0.482	1.737

4. 4 Postestimations, Limitations, and Critique

Parallel Lines Assumption is the premise on which ordered logistic regression results are meaningful. Since there is no command for parallelism test on panel data in Stata yet, this paper carried out parallelism test on the cross-sectional data of three years respectively. The results are not significant, indicating that the parallelism hypothesis is not violated. This is used as a substitute test for Parallel Lines Assumption test for the panel data. At the same time, in order to detect whether there are misspecifications, linktest command is employed, whose results show that there is no misspecifications issue in this model.

5 Conclusions

5.1 Concluding remarks and implications for policy

This study explores the impacts of intergenerational support on self-rated health of the

elderly from the perspective of the education level. Overall, financial support can significantly improve self-rated health of the elderly, while emotional support can significantly decrease self-rated health of the elderly. In the subgroup regressions, the SRH of the group with lower education level is more positively affected by financial support, and is also significantly negatively affected by emotional support. Emotional support does not significantly affect the self-reported health of the group with higher education levels.

These results confirm the effects of children's support on the health of Chinese elderly population. It proves the necessity of children providing financial support to their parents even when they're on pension. The negative effects of emotional support are equally constructive. It suggests that when children contact their parents, they should pay attention to their methods and approaches to avoid negative effects on their parents' health. At the same time, the self-rated health of the elderly group with higher education levels are not significantly affected by their children's emotional support, indicating that this part of the elderly may actively seek spiritual sustenance and spiritual support outside the family, which should be taken into account when equipping the communities for the elderly.

5.2 Limitations and Critique

Endogeneity is an unavoidable problem, and it can be inferred that endogeneity caused by reciprocal causation exists in this study. However, the existing researches in this field almost all ignore or avoid the endogeneity caused by the reciprocal relationship between financial support and health of the elderly (Liu, 2016). For example, although financial support has an impact on health, elderly people with poorer health may also need more financial support. If endogeneity is not taken into account, it may be concluded that the more intergenerational support, the worse the health. For example, Wang and Li (2011) found that financial support for the elderly accelerated the decline rate of activity of daily living(ADL) among the elderly, and the two authors themselves believed that such results run counter to common senses. Panel data compared with OLS can eliminate the error of missing variables that do not change over time, but not the error of missing variables that change over time and the error of reverse causality. Feng et al. (2007) believed that the causal relationship between the independent variable of a lag period and health is more convincing. Endogeneity is a major limitation of this paper. At the same time, due to the limitations of time, capital and other resources, data samples are not taken in consecutive years, which also makes it unpractical to add lag term to alleviate endogeneity.

The second limitation is the forced choice of random-effects regression model. Due to the limited Stata command, only random-effects ordered logit regression can be used, which is under the assumptions that the error term is independent of the regressors. However, these independence assumptions on the individual-specific error term are undesirable. Fixed-effects models should relax them.

5.3 Further Steps

In future work, to alleviate endogeneity instrumental variables will be searched for if possible. And as packages for Stata improves (Baetschmann et al., 2020), fix-effects ordered logit models will also be adopted. Due to the defects of the data themselves, if necessary, different data selection will be needed for more proper variable measurement.

(4915 words)

6 Appendix

Appendix 1: Variable Definition

Variable	Description
SRH	**Categorical variable** **Self-Rated Health of the respondent, scoring from 1-5; 0 represent missing value.**
X1	Numerical variable Financial Support The sum of financial support received from all children of the respondent.
X2	Binary variable Emotional Support =0 if the respondent receives no emotional support at all from his/her child/ all of his/her children =1 if the respondent receives emotional support from his/her child/ any of his/her children
Female	Binary variable =0 if the respondent is male =1 if the respondent is female
Age	Numerical variable
Married	Binary variable =0 if the respondent is unmarried =1 if the respondent is married
Pension	Binary variable =0 if the respondent is not on pension =1 if the respondent is on pension
Edugroup	Binary variable =0 if the respondent receives only primary education or less =1 if the respondent receives secondary education and above

Appendix 2: Ordered Logit Model

In the ordered logit model, there is an observed ordinal variable, Y, believed to be a function of a continuous latent variable Y*. The continuous latent variable Y* has threshold points κ (κ is the Greek small letter Kappa); every time it crossed a particular threshold, the observed variable Y falls under a category of a higher level. And then the sum of $\beta_k x_k$ is used to estimate Y*; when operated with data, there is an error term

u_i, which is assumed to be logistically distributed. In this case, Y* should be a function as follows, where x_1 represents Financial Support, x_2 represents Emotional Support and others describe the control variables respectively: gender, age, marital status, and pension.

$$Y^* = \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 female_i + \beta_4 age_i + \beta_5 married_i + \beta_6 pension_i + u_i \qquad (1)$$

To an inconstant ordinal variable, it's only meaningful to calculate the probability of it being in different value. The ordered logit model estimate the cumulative probability in a logistic function, which can come to a linear function after the Logit Transformation.

$$P_j = \Pr(Y \le j) = \frac{1}{1 + \exp[\kappa_j - (\beta_1 x_1 + \beta_2 x_2 + \beta_3 \text{gender} + \beta_4 age + \beta_5 married + \beta_6 pension)]} \qquad (2)$$

$$Logit(P_j)_{it} = -\kappa_j + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 gender_{it} + \beta_4 age_{it} + \beta_5 married_{it} + \beta_6 pension_{it} + u_{it} \qquad (3)$$

Equation (3) is the final econometric model.

Appendix 3: The Results of Omodel Command

Table 6 Omdel test for 2013

Log	likelihood	=-392.19503				
LR	chi2(5)	=9.030				
	Prob>chi2	=0.108				
SRH original	Coef.	Std.Err.	z	P>|z|	95% Conf. Interval	
x1	-4.19E-05	2.07e-05	-2.030	0.0420	-8.24e-05	-1.42e-06
1.x2	0.354	0.230	1.540	0.124	-0.0965	0.805
1.gender	0.472	0.248	1.900	0.0570	-0.0146	0.959
age	0.00928	0.0141	0.660	0.510	-0.0183	0.0369
1.married	0.0574	0.262	0.220	0.826	-0.456	0.571
1.pension	-4.19E-05	2.07e-05	-2.030	0.0420	-8.24e-05	-1.42e-06
/cut1	-1.400	1.026	(Ancillary	parameters)		
/cut2	-0.211	1.017				
/cut3	2.512	1.031				
/cut4	4.106	1.060				
Approximate likelihood- test of			proportionality of odds ratio			
across	response	categories				
chi2(15)	=	9.750				
Prob>chi2	=	0.835				

Table 7 Omodel test for 2015

Log	likelihood	=-820.2					
LR	chi2(5)	=5.880					
	Prob>chi2	=0.318					

SRH original	Coef.	Std.Err.		z	P>|z|	95% Conf. Interval	
x1	5.86e-07	9.23e-06	0.0600	0.949	-1.75e-05	1.87e-05	5.86e-07
1.x2	0.179	0.157	1.150	0.252	-0.128	0.486	0.179
1.gender	0.272	0.174	1.560	0.118	-0.0692	0.613	0.272
age	0.00806	0.0103	0.780	0.436	-0.0122	0.0283	0.00806
1.married	0.360	0.185	1.950	0.0510	-0.00161	0.722	0.360
1.pension	5.86e-07	9.23e-06	0.0600	0.949	-1.75e-05	1.87e-05	5.86e-07
/cut1	0.959	0.774		(Ancillary	parameters)		
/cut2	1.164	0.774					
/cut3	1.455	0.774					
/cut4	3.060	0.784					

Approximate	likelihood-	test of		proportionality	of odds	ratio	
across	response	categories					
chi2(15)	=	27.22					
Prob>chi2	=	0.129					

Table 8 Omodel test for 2018

Log	likelihood	=-820.2					
LR	chi2(5)	=5.880					
	Prob>chi2	=0.318					

SRH original	Coef.	Std.Err.		z	P>|z|	95% Conf. Interval	
x1	5.86e-07	9.23e-06	0.0600	0.949	-1.75e-05	1.87e-05	5.86e-07
1.x2	0.179	0.157	1.150	0.252	-0.128	0.486	0.179
1.gender	0.272	0.174	1.560	0.118	-0.0692	0.613	0.272
age	0.00806	0.0103	0.780	0.436	-0.0122	0.0283	0.00806
1.married	0.360	0.185	1.950	0.0510	-0.00161	0.722	0.360
1.pension	5.86e-07	9.23e-06	0.0600	0.949	-1.75e-05	1.87e-05	5.86e-07
/cut1	0.959	0.774		(Ancillary	parameters)		
/cut2	1.164	0.774					
/cut3	1.455	0.774					
/cut4	3.060	0.784					

Approximate	likelihood-	test of		proportionality	of odds	ratio	
across	response	categories					
chi2(15)	=	27.22					
Prob>chi2	=	0.129					

Appendix 4: The Results of Linktest Command

Table 9 Results of linktest

Log	likelihood	=-2675.5877				
Wald	chi2(6)	= 73.38				
	Prob>chi2	=0				
SRH original	Coef.	Std.Err.	z	P>|z|	95% Conf. Interval	
_hat	-0.7762	0.1127	6.8900	0	0.5553	0.9970
_hatsq	0.1068	0.0855	1.2500	0.212	-0.0608	0.2745
_cons	2.8856	0.0725	39.8300	0	2.7436	3.0276
var(e.SRH_original)	1.9837	0.0720			1.8475	2.1399

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