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Effects of Health Status on the Labor Supply of Older Adults with Different Socioeconomic Status

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Abstract: Based on the panel data of the China Health and Retirement Longitudinal Study (CHARLS) collected from 2011 to 2018, this paper establishes a model using the instrumental variables method to investigate the effects of poor health on labor participation, labor hours, agricultural labor participation, agricultural labor hours, off-farm labor participation, and off-farm labor hours of older adults with different economic statuses. This paper conducts an empirical analysis to examine how subjective, self-rated poor health and objective poor health measured using the number of chronic diseases can affect the labor supply of older adults. The study of its influence on labor supply from the perspective of health can help to maintain the labor supply of the aged from the perspective of improving the health of the aged, provide a certain reference for the labor shortage caused by China's aging society, and enrich the content of health economics. According to the research findings, subjective, self-rated poor health significantly reduces the labor participation of older adults. Although self-rated poor health does not affect the off-farm labor participation of older adults, it significantly reduces the likelihood of older adults engaging in agricultural labor. In addition, self-rated poor health also reduces the overall labor hours and off-farm labor hours of older adults, although no effects were observed on their agricultural labor hours. On the other hand, chronic diseases also reduce the overall likelihood of labor participation for older adults, resulting in significantly lower off-farm labor participation, although no effects were observed on their agricultural labor participation. The number of chronic diseases found in older adults does not affect their off-farm labor hours, but it does increase the hours they invest in agricultural labor.

Keywords: socioeconomic status; labor supply; labor participation; self-rated poor health



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1. Background

1.1. The Deepening Population Aging

Chinese society has long entered a stage of population aging, with this trend becoming increasingly prominent over recent years [1]. According to statistics from the 7th National Census, there were 264.02 million people aged 60 and above in China, accounting for 18.70% of the total population. Among them, people aged 65 and above amounted to 190.64 million, accounting for 13.50% of the total population (National Bureau of Statistics. The Seventh National Population Census [EB/OL]. (11 May 2021) [12 September 2021]. http://www.gov.cn/xinwen/2021-05/11/content_5605871.htm, accessed on 11 May 2021). The aging problem in China is characterized by its large scale, fast growth, and severe conditions [2].

With the escalating aging population, the overall supply of the labor force in China and the structure of China's labor market will undergo tremendous changes [3]. An increase in the proportion of older adults in Chinese society will inevitably result in an aging working-age population, which will have a great impact on labor participation and bring down the overall labor force participation in China [4]. This, combined with the increasing demand for the labor force in the years to come due to China's strong economic drive, will result in conflicts between the supply and demand of the labor force.

1.2. “Ceaseless Toil” among the Rural Elderly

Older adults in China’s rural areas are mainly engaged in agricultural labor, which consists of farming, forestry, animal husbandry, fishing, and animal breeding. In China, it is quite common for older adults living in rural areas to bear the heavy burden of agricultural labor and perform physical work for long hours [5]. The reason behind this is related to the relatively scarce resources for old-age support in China’s rural areas. Faced with a shortage of basic living guarantees, older adults in rural areas often have no other choice but to continue performing agricultural labor, regardless of whether their physical conditions permit them to perform labor. Therefore, it is not hard to understand why the rural elderly population usually continues to perform agricultural labor at the expense of their health and a supposedly “idle” life in their old age. Some studies have shown that instead of cutting back on their labor hours, older adults in rural areas continue to engage themselves in agricultural production regardless of their deteriorating health conditions [6]. This would inevitably create a severe negative impact on their quality of life, leading to a situation of “ceaseless toil” among the rural elderly. Indeed, for older adults who have managed to maintain good health in their old age, it is perfectly fine that they continue to perform agricultural labor or other kinds of work. After all, this is exactly what we should encourage in today’s times of labor shortage. However, for those who have no choice but to continue with physical labor despite their inadequate health conditions, this already constitutes a situation of “ceaseless toil”, which severely damages the well-being of the elderly. In view of this, it is the root cause that has led to “ceaseless toil” for the rural elderly, and addressing this problem has become a major issue with profound realistic implications that deserve our special attention.

In this context, this paper tries to find a way to strike a good balance between ensuring the health of the elderly and the sufficient labor supply for Chinese society so that some older adults can continue to work under the precondition of good health, while others who are suffering from poor health can be freed from “ceaseless toil” due to the heavy pressure of living.

2. Literature Review

Scholars at home and abroad have conducted extensive research on the effect of personal factors on labor supplies among the elderly, and there is a large body of literature devoted to the health condition effects of older adults with respect to labor supplies. Compared to their Chinese counterparts, foreign researchers have an early start on the relationship between health and labor supply. Grossman [7] argued that older adults in better health would have higher labor productivity and, therefore, more time to engage in labor. As an essential component of human capital, the quantification of health is also an important issue in studying the impact of health on labor supplies among older adults. Most of the early literature used self-rated health status as the independent variable, with findings showing that self-rated health statuses can significantly affect labor force participation [8,9]. However, one of the major drawbacks of self-rated health is justification bias, namely the tendency of subjects to underrate their health status after having retired or stopped working, as a way to justify their act of not working [10]. Another issue with self-rated health is that it may give rise to measurement errors [11], which can result in an endogenous problem. Due to these drawbacks in self-rated health, some scholars have since started to measure health statuses using objective health indicators, which include the ability to take care of oneself in daily life (ADL or IADL) and the number of common chronic diseases suffered by the subject (hypertension, respiratory diseases, gastric diseases, arthritis, etc.). Tian [12] managed to address the endogenous problem by establishing a simultaneous equation between health and labor force participation using the data from two provincial pre-surveys for CHARLS. Her research findings revealed that the health status of older adults had a significant positive effect on their labor participation. Using sodium intake before developing hypertension as an instrumental variable, Li, Lei, and Zhao [13] also managed to overcome the potential endogenous effects of information with

respect to diseases. Their research demonstrated a significant effect of hypertension on labor force participation in urban middle-aged and older adults, without the same effect found in the rural population. Wang and Chen [14] set up a number of health indicators, including self-care ability in daily life, mental health, and self-rated health using CHARLS data to study the effect of health shocks on the labor supply of middle-aged and elderly people in rural areas, which observed that health shocks could significantly reduce the labor supply of the rural elderly. The sudden change in health status played a major role in the decline in work capacity among the rural elderly. In addition, a previous research study has also shown that the endogenous problem could be overcome by using objective health variables as the instrumental variable for subjective health variables [15], but this would also compromise the innate advantage of subjective health evaluations.

Apart from this, researchers have also found that poor health would raise the likelihood of workers aged 50 and above progressing to retirement or economic inactivity [16]. Cai et al. [17] used a traditional Tobit model to estimate the effects of health and health shocks on the working hours of Australian employees. Their research found that health shocks and poor health were associated with reduced job opportunities and fewer working hours for both male and female employees, while men who suffered health shocks but remained in the workforce cut back on their working hours by a much larger proportion than female employees, and women who suffered health shocks were more likely to leave their jobs than men. Trevisan and Zantomio [18] consolidated relevant data from the English Longitudinal Study of Ageing (ELSA) and the Survey of Health, Ageing and Retirement in Europe (SHARE), which covered 16 European countries with diversified institutional representations between 2002 and 2013, and used a combined approach of stratification and propensity score matching to show that older workers who experienced acute health shocks including myocardial infarction, stroke, and cancer show on average a doubled risk of leaving the labor market. This is also accompanied by deterioration in their physical functions, mental health, and reduced life expectancy.

From the gender perspective, Cai and Kalb [15] took advantage of the data from the Household, Income and Labour Dynamics in Australia (HILDA) to address the potential endogenous problem of health, especially self-rated health, in the labor force participation equation by using the simultaneous estimation of both the health equation and labor force participation equation. The findings suggest a greater effect of health on labor force participation for female older adults than for males, while labor force participation has a significantly positive effect on the health status of older females and a significantly negative effect on the health status of younger males. García-Gómez et al. [19] analyzed the data from the British Household Panel Survey from 1991 to 2002. Their findings suggest that health has a greater impact on males' entry into and exit from the job market than females. Similar to poor health, disabilities would also lead to a decline in the labor force participation rates. Oguzoglu [20] introduced a two-equation dynamic panel data model to analyze the effect of work-limiting disability on an individual's working hours and showed that disabilities in the current period would reduce the likelihood of being employed in the current period, while disabilities in the past period would also indirectly impact the current employment status by affecting the likelihood of being unemployed in the past.

Thanks to the progress made in the micro-data collection and improved research methods in China over recent years, there have been more research studies that approach the issue of labor supplies among older adults from the perspective of individual behavior and decision-making. Wang [21] used multidimensional health indicators, that is, a complete set of health indicators including the history of diseases, BMI, and nutrition intake, to eliminate the measurement errors generated by a single indicator. His findings suggested that self-rated health was inadequate in reflecting the effect of Chinese residents' actual health status on labor participation and that each health indicator was able to provide some relatively independent information. Cao and Hao [4] analyzed the effect of health on old-age labor supply and identified a two-way causal relationship between health and labor supply time, namely the better the health status, the longer the labor supply time, and the

longer the labor supply time, the better the health status. This is because individuals who are able to earn an income from their employment would have access to better healthcare resources, which will, in turn, lead to an improvement in their health status.

In addition to the well-studied health factors, education level, age, and gender can also be influencing factors behind the old-age labor supply. Deng et al. [22] conducted an empirical analysis using data collected from the 2011 and 2013 CHARLS, which showed that the “young-old” were more likely to take part in the labor market. In examining the relationship between retirement, labor force participation, and family care, Feng et al. [23] found that the marginal effect of retirement on labor participation diminished with the increased level of education. Wang and Zheng [24] built a multiple logistic regression model using data from the 2016 China Family Panel Studies (CFPS) and identified a negative relationship between the level of education and labor participation in old age. This is because older adults with higher educational levels have generally accumulated certain amounts of material wealth with access to social security benefits to guarantee a more comfortable life in their old age.

3. Data and Methods

3.1. Data Source

The data used in this paper are from the China Health and Retirement Longitudinal Study (CHARLS) between 2011 and 2018.

The CHARLS is led by the National School of Development at Peking University and jointly implemented by the Institute of Social Science Survey (ISSS) of Peking University and the Peking University Communist Youth League Committee. The study was designed to survey middle-aged and older adults aged 45 and above in a wide range of areas, including demographic characteristics, income, health, family status, health care, work and retirement, housing, and many other aspects. The national baseline survey of the CHARLS data began in 2011 and has been updated every two years since then, with the second survey conducted in 2013, the third in 2015, and the fourth in 2018. At its outset, the CHARLS baseline survey was conducted in 450 villages and dwellings in 150 counties and districts in 28 provinces across China. However, by the time of the survey in 2018, the sample size already covered 19,000 respondents in 12,400 households. This paper utilized the CHARLS panel data from 2011 to 2018. Since this paper is focused on the elderly group as the research object, we retained the data of older adults aged 60 and above during the selection of samples.

3.2. Variable Selection

The dependent variable includes the old-age labor supply, which is measured using two dimensions: labor participation and labor hours of older adults. (1) The CHARLS data of each year from 2011 to 2018 involved certain questions on labor participation. In 2018, for example, respondents were asked, “Have you done any farm work for other farmers or employers to earn money for at least 10 days over the past year?” and “Have you been engaged in any farm work or agricultural activity for your own family for at least 10 days over the past year?” If the respondent answered “Yes”, then he/she would be deemed as engaged in agricultural labor; if the respondent answered “No”, then he/she would be deemed as not engaged in agricultural labor. In addition to the above questions, the respondents were also asked the following: “Aside from farm-related work, have you been engaged in other work for at least one hour in the last week? It includes paid work, self-employment and private business, or helping out in the family business without being paid.” They were also asked, “Do you have any off-farm work as presented in the previous question, that you didn’t perform last week (or not for a full hour), but are currently on temporary leave, sick leave, or other leave, or receiving on-the-job training?” and “Will you be able to return to your previous work within 6 months or any determined period?” If the respondent answered “Yes” to any of the above questions, then he/she would be deemed as engaged in off-farm labor; otherwise, he/she would be

deemed as not engaged in off-farm labor. At the end of the survey, the overall situation of labor participation was analyzed based on both the agricultural and off-farm labor participation of the respondents. (2) Old-age labor hours consist of labor hours invested into agricultural self-employment, agricultural employment, off-farm employment, and non-primary occupation. For agricultural labor, respondents were asked about the time they invested in farming, managing fruit trees, and collecting agricultural and forestry products for their own families, as well as the time they invested in farming, raising livestock, or fishing for other farmers in the 2011 and 2013 CHARLS survey. The questions included: “How many months have you worked over the past year?”, “How many days a week did you usually work over the past year?”, and “How many hours a day did you usually work over the past year?” Thus, the total number of hours that each respondent invested in agricultural labor was calculated by multiplying the product of the above three by four. For off-farm employment, respondents were asked, “How many months have you worked over the past year?”, “How many days a week did you usually work over the past year?”, and “How many hours a day did you usually work over the past year?” Thus, the total number of hours each respondent invested in off-farm employment was calculated by multiplying the product of the above three by four. The number of hours that older adults invested into non-primary occupation was derived from the following question: “On average, how many hours per week did you put into other duties aside from the main work you were just asked about (including farm work for your family) over the past year?” Thus, the total number of labor hours for each respondent is the sum of hours he/she invested in agricultural labor, off-farm employment, and non-primary occupation.

The core variable in this paper is health status. Many previous studies used self-rated health as the measurement for the health status of the respondents since self-rated health indicators are quite easy to obtain and have been proven to be fairly reliable. This paper has chosen self-rated health as the subjective indicator when measuring the health status of older adults. However, there were slight differences in the types of answers to questions about self-rated health status in the questionnaires used by the 2011–2018 CHARLS surveys. In the 2018 survey, respondents were asked, “How do you think your health is? Is it very good, good, average, bad, or very bad?”, and the answers were graded into five types including: “Very good”, “Good”, “Average”, “Bad”, and “Very bad”. In the 2011, 2013, and 2015 surveys, however, there were two questions about self-rated health with different answer types: “How do you think your health is? Is it great, very good, good, average, or bad?” and “How do you think your health is? Is it very good, good, average, bad, or very bad?” Due to the presence of different answer types in different years and considering the fact that this paper utilized the panel data of the CHARLS survey, it is necessary to consolidate and unify the variables over the years. In this paper, respondents who answered “Bad” or “Very bad” are regarded as those with self-rated poor health, while those who answered otherwise are regarded as those with self-rated good health. Therefore, for the variable “self-rated poor health”, Yes = 1 and No = 0.

Apart from the subjective self-rated health status, this paper also uses objective health indicators to measure the health status of older adults. The objective health indicator used in this paper is the number of chronic diseases suffered by the respondent. In the CHARLS questionnaire, respondents were asked, “Has a doctor ever told you that you have any of the following chronic diseases?” These chronic diseases cover 14 different types including hypertension; dyslipidemia; diabetes or elevated blood sugar; malignancies such as cancer; chronic lung diseases such as chronic bronchitis or emphysema; pulmonary heart disease; liver disease; heart disease; kidney disease; gastric disease or digestive disorders; emotional and mental problems; memory-related disorders; arthritis or rheumatism; and asthma. The greater the number of chronic diseases suffered by the respondent, the worse the health status. It is worth noting that most previous studies only used one of these diseases, such as the presence or absence of hypertension, to measure the health status of older adults. This paper, however, believes that this falls short of a comprehensive approach and has chosen the total number of chronic diseases suffered by the elderly as an indicator of their

health status. Other control variables include gender, the type of household registration, marital status, education level, and household income, please see Table 1.

Table 1. Variable Definition.

Variables	Variable Definition
Dependent variables	
Labor participation	Yes = 1 No = 0
Off-farm labor participation	Yes = 1 No = 0
Agricultural labor participation	Yes = 1 No = 0
Total labor hours	Continuous variable
Off-farm labor hours	Continuous variable
Agricultural labor hours	Continuous variable
Independent variables	
Male	Yes = 1 No = 0
Age	Continuous variable
Household registration type	
Rural	Yes = 1 No = 0
Unified	Yes = 1 No = 0
Non-rural	Yes = 1 No = 0
Marital Status	
Married	Yes = 1 No = 0
Education level	
Illiterate	Yes = 1 No = 0
Elementary education non-completion	Yes = 1 No = 0
Elementary education	Yes = 1 No = 0
Junior secondary education	Yes = 1 No = 0
Senior secondary education	Yes = 1 No = 0
Above senior secondary education	Yes = 1 No = 0
Total household income	Continuous variable
Family size	Continuous variable
Year	
2018	Yes = 1 No = 0
2015	Yes = 1 No = 0
2013	Yes = 1 No = 0
2011	Yes = 1 No = 0
Core explanatory variables	
Self-rated poor health	Yes = 1 No = 0
Number of chronic diseases	Continuous variable
Limited ADL	Yes = 1 No = 0
Limited IADL	Yes = 1 No = 0
Access to old-age insurance	Yes = 1 No = 0
Financial support from offspring	Continuous variable

3.3. Descriptive Analysis of Variables

For the data analysis in this paper, the invalid values of each variable are removed while the missing values are retained. This is because the missing values of different variables are found to be disparate, especially for the dependent variables. Since not every respondent who completed the questionnaire had been engaged in agricultural labor or off-farm labor, the observed values of labor participation, off-farm labor participation, agricultural labor participation, total labor hours, off-farm labor hours, and agricultural labor hours were drastically different. In addition, there are also some differences between the observed values of other core explanatory and control variables. However, this did not impede the subsequent empirical study. The results of the descriptive analysis of each variable are presented in Table 2.

Table 2. Descriptive statistical analysis of variables.

Variable	Observed Value	Mean Value	Standard Deviation
Dependent variables			
Labor participation	39,422	0.5231	0.4995
Off-farm labor participation	27,495	0.1517	0.3588
Agricultural labor participation	39,428	0.4392	0.4963
Total labor hours	18,952	1372.4530	1223.0480
Off-farm labor hours	5647	1735.8030	1392.0960
Agricultural labor hours	15,524	1030.3440	963.9006
Control variables			
Male	36,617	0.4905	0.4999
Age	35,227	68.6418	7.0390
Household registration type			
Rural	36,548	0.7621	0.4258
Unified	36,548	0.0109	0.1039
Non-rural	36,548	0.2270	0.4189
Marital Status			
Married	36,622	0.7899	0.4074
Education level			
Illiterate	36,069	0.3450	0.4754
Elementary education non-completion	36,069	0.2082	0.4060
Elementary education	36,069	0.2282	0.4197
Junior secondary education	36,069	0.1375	0.3444
Senior secondary education	36,069	0.0637	0.2442
Above senior secondary education	36,069	0.0174	0.1308
Total household income	34,861	21,432.8000	222,069.6000
Family size	18,716	3.5276	2.2964
Year			
2018	39,456	0.2807	0.4493
2015	39,456	0.2929	0.4551
2013	39,456	0.2336	0.4231
2011	39,456	0.1928	0.3945
Core explanatory variables			
Self-rated poor health	37,139	0.2920	0.4547
Number of chronic diseases	19,801	1.1642	1.3525
Limited ADL	30,280	0.3251	0.4684
Limited IADL	37,931	0.3582	0.4795
Access to old-age insurance	38,038	0.7818	0.4130
Financial support from offspring	20,536	8329.1550	488,789.6000

3.4. Research Methodology

This paper uses the household income of respondents to measure the socioeconomic status of the elderly. Based on different household income levels of the respondents, the income status of the elderly is divided into five groups from the highest to the lowest, and they are named “the high-income group”, “the medium-to-high-income group”, “the medium-income group”, “the medium-to-low-income group”, and “the low-income group” [25]. The old-age labor supply status is then analyzed by each income group.

Considering the potential endogeneity between the poor health status of the elderly and the old-age labor supply, the instrumental variable is used to analyze the effect of poor health on the labor supply of the elderly, and the following model is constructed using the panel data from the 2011 to 2018 CHARLS surveys:

$$\text{Labor supply} = \alpha_1 \text{health}_{it} + \alpha_2 X_{it} + \delta + \epsilon$$

On the left side of the equation is the predictor variable, which in this paper is the old-age labor supply. On the right side of the equation, “ health_{it} ” represents the health status of the elderly i at t time, which is the subjective self-rated poor health of the respondents. “ X_{it} ” stands for a series of control variables. δ stands for the intercept. ϵ stands for the

stochastic error term. In predicting labor participation, off-farm labor participation, and the agricultural labor participation of the elderly, “labor supply” is used to represent these three variables.

Due to the dichotomous nature of the dependent variables, a panel logit model is used for the basic regression in this paper. However, given the endogenous problem between the health status and labor participation identified in previous research (that is, the health status of older adults may affect their labor participation, while labor participation can, in turn, affect the health status of older adults), this paper also employs the instrumental variables approach in the analysis as a method for addressing the potential endogeneity issue. Previous studies attempted to address the endogeneity between health and labor participation with the use of instrumental variables, and the variable most often used was the health status of older adults in their childhood. It was assumed that the health status in one’s childhood would affect the health status of the same person in old age, yet it has no direct impact on his/her labor participation. However, this paper believes that although it is true that one’s health status in childhood would have a certain impact on his/her health status in old age, it is quite difficult to determine such impacts due to the long period in between and the many uncertainties that might have occurred. Therefore, this paper proposes and adopts a new approach to address the endogenous problem.

When the predictor variable represents the labor hours per year, which includes total labor hours, off-farm labor hours, and agricultural labor hours, the dependent variables are continuous. Considering the potential endogenous problem between the self-rated health status of older adults and their labor hours, this paper adopts a panel OLS model and the method of instrumental variables for regression analyses.

3.5. Research Hypotheses

It is found that there are health inequalities associated with socioeconomic status in China. This means that older adults with higher socioeconomic statuses tend to have better health, while those with lower socioeconomic statuses tend to have worse health. This paper aims to analyze whether health inequalities among older adults with different socioeconomic statuses have an impact on the old-age labor supply. Therefore, this paper suggests that for older adults with high socioeconomic status, their willingness to work would be reduced when they experience poor health, given their relatively higher income levels. In contrast, for older adults with low socioeconomic status, their willingness to work is less likely to be reduced when they experience poor health, given their relatively lower income levels and the fact that they probably need the work to maintain a basic standard of living. Thus, the following research hypotheses are proposed:

For older adults with higher socioeconomic statuses, poor health has a greater impact on their labor participation, while for older adults with lower socioeconomic statuses, poor health has a smaller or even no impact on their labor participation.

For older adults with higher socioeconomic statuses, poor health has a greater impact on their labor hours, while for older adults with lower socioeconomic statuses, poor health has a smaller or even no impact on their labor hours.

For older adults with higher socioeconomic statuses, poor health has a greater impact on their off-farm labor participation, while for older adults with lower socioeconomic statuses, poor health has a smaller or even no impact on their off-farm labor participation.

For older adults with higher socioeconomic statuses, poor health has a greater impact on their agricultural labor participation, while for older adults with lower socioeconomic status, poor health has a smaller or even no impact on their agricultural labor participation.

For older adults with higher socioeconomic statuses, poor health has a greater impact on their off-farm labor hours, while for older adults with lower socioeconomic statuses, poor health has a smaller or even no impact on their off-farm labor hours.

For older adults with higher socioeconomic statuses, poor health has a greater impact on their agricultural labor hours, while for older adults with lower socioeconomic status, poor health has a smaller or even no impact on their agricultural labor hours.

4. Empirical Results

4.1. *The Effect of Self-Rated Poor Health on Labor Participation for Older Adults in Different Income Groups*

Table 3 shows the effect of self-rated poor health on labor participation for older adults in different income groups. Results (1)–(5) show findings for the low-income group, the medium-to-low-income group, the medium-income group, the medium-to-high-income group, and the high-income group, respectively.

From the empirical findings, it is clear that the coefficients of self-rated poor health are significantly negative in results (1), (3), (4), and (5), while being insignificant in result (2).

This indicates that self-rated poor health significantly reduces the likelihood of labor participation among older adults in the low-income, medium-income, medium-to-high-income, and high-income groups, while it does not affect the likelihood of labor participation among older adults in the medium-to-low-income group. Moreover, the absolute value of the coefficient is the largest in the result (4), indicating that the effect of self-rated poor health is the greatest for older adults in the medium-to-high-income group.

In results (1)–(5), the coefficients of the “male” variable are significantly positive, indicating an increased likelihood of labor participation among male older adults relative to female adults. The coefficients of the “age” variable are significantly negative from the second to fifth columns of the results, indicating a lower likelihood of labor participation among older adults as they age. Among older adults in the low-income group, there is no significant difference in the likelihood of labor participation between those with unified household registration and those with other types of household registration, while in other income groups, older adults with unified household registration are less likely to participate in labor than those with rural household registrations. This indicates a reduced likelihood of labor participation among older adults with non-rural household registration relative to those with rural household registration. The coefficients of the variable “being married” are significantly positive in all five groups, indicating a significantly increased likelihood of labor participation among older adults who are married compared to those who are not married.

Education levels also have effects on the labor participation of older adults, although slight differences were observed in the results across the five groups. According to the results in all five groups, there is no significant difference in the likelihood of labor participation between older adults who have no education at all and those who have not completed elementary education. Moreover, within the low-to-medium-income group, no significant difference is observed in the likelihood of labor participation between older adults who received elementary or above senior secondary education and those who received no education at all. For those in the other groups, however, the likelihood of labor participation is significantly lower for older adults who received elementary or above senior secondary education than for those who received no education at all. In addition, older adults who completed junior secondary or senior secondary education are also significantly less likely to participate in labor than those who have no education at all. The coefficients of total household income are significantly positive in results (1)–(3), significantly negative in result (4), and insignificant in result (5). This indicates that for older adults in the low-income, medium-to-low-income, and medium-income groups, higher household income enhances their labor participation. For older adults in the medium-to-high-income group, however, an increase in total household income reduces their labor participation. In contrast, for older adults in the high-income group, the total household income has little impact on the likelihood of their labor participation. The dummy variable “year” has mixed effects on the results of different groups. In results (1) and (2), the likelihood of the labor participation of older adults increased in 2015 relative to 2011, while it decreased in 2018 relative to 2011. In result (3), the likelihood of the labor participation of older adults decreased in 2013, 2015, and 2018 relative to 2011. In result (4), the likelihood of the labor participation of older adults increased in 2018 relative to 2011. In result (5), the likelihood of labor participation of older adults increased in 2013, 2015, and 2018 relative to 2011.

Table 3. The effect of self-rated poor health on labor participation for older adults in different income groups (IV model).

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Self-rated poor health	−0.272 *** (0.105)	−0.150 (0.153)	−0.271 *** (0.104)	−0.310 *** (0.075)	−0.171 *** (0.055)
Male	0.073 *** (0.016)	0.133 *** (0.013)	0.115 *** (0.013)	0.135 *** (0.013)	0.165 *** (0.012)
Age	−0.014 *** (0.001)	−0.019 *** (0.001)	−0.018 *** (0.001)	−0.019 *** (0.001)	−0.021 *** (0.001)
Unified household registration	0.017 (0.072)	−0.266 *** (0.078)	−0.230 *** (0.064)	−0.303 *** (0.048)	−0.231 *** (0.045)
Non-rural household registration	−0.223 *** (0.021)	−0.258 *** (0.026)	−0.315 *** (0.021)	−0.406 *** (0.015)	−0.376 *** (0.014)
Married	0.048 *** (0.018)	0.086 *** (0.014)	0.080 *** (0.014)	0.106 *** (0.015)	0.096 *** (0.015)
Elementary education non-completion	0.006 (0.022)	0.002 (0.016)	−0.023 (0.015)	−0.007 (0.016)	−0.029 (0.019)
Elementary education	−0.058 *** (0.021)	−0.001 (0.017)	−0.038 ** (0.017)	−0.027 * (0.016)	−0.066 *** (0.018)
Junior secondary education	−0.078 *** (0.027)	−0.051 ** (0.024)	−0.113 *** (0.024)	−0.099 *** (0.019)	−0.103 *** (0.020)
Senior secondary education	−0.130 *** (0.035)	−0.090 ** (0.044)	−0.165 *** (0.035)	−0.074 *** (0.026)	−0.106 *** (0.023)
Above senior secondary education	−0.106 ** (0.046)	0.088 (0.187)	−0.204 ** (0.087)	−0.188 *** (0.058)	−0.147 *** (0.032)
Total household income	0.060 *** (0.006)	0.022 ** (0.010)	0.049 *** (0.014)	−0.066 *** (0.017)	−0.003 (0.009)
2013	0.069 (0.048)	−0.016 (0.020)	−0.066 *** (0.019)	−0.014 (0.017)	0.037 ** (0.018)
2015	0.148 *** (0.031)	0.041 * (0.021)	−0.064 *** (0.020)	0.029 (0.018)	0.050 ** (0.020)
2018	−0.055 ** (0.026)	−0.126 *** (0.018)	−0.082 *** (0.014)	0.058 *** (0.014)	0.043 *** (0.015)
Constant	1.297 *** (0.086)	1.711 *** (0.116)	1.567 *** (0.154)	2.557 *** (0.180)	1.973 *** (0.126)
Observed value	2869	6015	6190	6077	5899

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

4.2. The Effects of Self-Rated Poor Health on Off-Farm Labor Participation for Older Adults in Different Income Groups

Table 4 shows the effects of self-rated poor health on off-farm labor participation for older adults in different income groups. The coefficients of self-rated poor health are insignificant from results (1) to (5), indicating that the self-rated health status of older adults is not a factor affecting their participation in off-farm labor, regardless of which income group they are in.

In results (1)–(5), the coefficients of the “male” variable are significantly positive, indicating an increased likelihood of off-farm labor participation among male older adults relative to females. Compared to older adults with rural household registration, unified household registration has a positive effect on off-farm labor participation for older adults in the low-income group and a negative effect for those in the medium-to-high-income group. In the medium-to-high-income group and high-income group, older adults with non-rural household registration are less likely to participate in off-farm labor compared to those with rural household registrations. Their education levels have disparate effects on off-farm labor force participation for older adults in different income groups. In the medium-

to-high-income group and high-income group, older adults who have not completed their elementary education show an increased likelihood of off-farm labor participation compared to those who are illiterate. The coefficients of “elementary education” and “senior secondary education” are significantly positive in the medium-to-high-income group only. For older adults in medium-to-low-income, medium-income, and medium-to-high-income groups, those who completed junior secondary education show an increased likelihood of off-farm labor participation compared to those who are illiterate. The effect of household income on the off-farm labor participation of older adults is significant in the medium-income group only. Moreover, the likelihood of off-farm labor participation among older adults also varies over the years. With the exception for those in the low-income group, older adults in all other groups showed an increased likelihood of off-farm labor participation in 2015 relative to 2011. In 2018, older adults in the medium-income group and the high-income group showed a decreased and increased likelihood of participating in off-farm labor, respectively, compared to the situation in 2011.

Table 4. The effects of self-rated poor health on off-farm labor participation for older adults in different income groups (IV model).

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Self-rated poor health	−0.004 (0.060)	−0.010 (0.114)	0.011 (0.090)	−0.046 (0.074)	−0.030 (0.053)
Male	0.027 *** (0.009)	0.039 *** (0.010)	0.061 *** (0.011)	0.144 *** (0.013)	0.143 *** (0.012)
Age	−0.005 *** (0.001)	−0.006 *** (0.001)	−0.008 *** (0.001)	−0.014 *** (0.001)	−0.016 *** (0.001)
Unified household registration	0.130 *** (0.042)	0.051 (0.055)	−0.018 (0.050)	−0.128 *** (0.044)	−0.045 (0.041)
Non-rural household registration	−0.008 (0.013)	0.017 (0.020)	0.000 (0.018)	−0.102 *** (0.015)	−0.113 *** (0.013)
Married	−0.013 (0.011)	−0.011 (0.010)	−0.007 (0.012)	−0.017 (0.015)	0.019 (0.015)
Elementary education non-completion	0.018 (0.013)	0.003 (0.012)	−0.001 (0.013)	0.031 * (0.017)	0.037 * (0.019)
Elementary education	−0.012 (0.013)	0.020 (0.014)	−0.008 (0.014)	0.050 *** (0.016)	0.010 (0.019)
Junior secondary education	−0.015 (0.017)	0.036 * (0.019)	0.056 *** (0.022)	0.052 *** (0.019)	0.024 (0.020)
Senior secondary education	−0.022 (0.020)	0.041 (0.034)	−0.010 (0.029)	0.071 *** (0.025)	0.024 (0.022)
Above senior secondary education	−0.024 (0.026)	−0.107 (0.151)	−0.071 (0.069)	−0.056 (0.054)	0.017 (0.030)
Total household income	0.005 (0.004)	0.000 (0.008)	0.065 *** (0.012)	0.009 (0.018)	0.011 (0.009)
2013	−0.035 (0.038)	−0.003 (0.015)	0.008 (0.022)	−0.008 (0.020)	0.014 (0.020)
2015	0.037 (0.023)	0.030 * (0.017)	0.054 ** (0.024)	0.103 *** (0.023)	0.113 *** (0.023)
2018	0.023 (0.015)	−0.025 (0.016)	−0.041 ** (0.019)	−0.006 (0.016)	0.029 * (0.016)
Constant	0.356 *** (0.054)	0.506 *** (0.110)	0.099 (0.139)	0.975 *** (0.188)	1.074 *** (0.123)
Observed value	2200	3579	4016	4448	4751

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

4.3. The Effects of Self-Rated Poor Health on Agricultural Labor Participation for Older Adults in Different Income Groups

Table 5 shows the effects of self-rated poor health on agricultural labor participation for older adults in different income groups. As observed from the results, the coefficients of self-rated poor health among older adults are significantly negative in the low-income group, medium-income group, medium-to-high-income group, and high-income group, while in the medium-to-low-income group, the coefficient of self-rated poor health among older adults is insignificant. This indicates that with the exception of older adults in the medium-to-low-income group, self-rated poor health significantly reduces the likelihood of agricultural labor participation for older adults in all other groups.

Compared to older female adults, the males of all groups show a higher likelihood to engage in agricultural labor. For older adults, their likelihood of participating in agricultural labor diminishes with the increase in their age. Compared to those with rural household registrations, older adults with unified or non-rural household registration show a lower likelihood of engaging in agricultural labor, with the only exception being those in the low-income group, in which the variable “unified household registration” is insignificant. Older adults who are married show a higher likelihood of engaging in agricultural labor. Education levels have disparate effects on agricultural labor participation for older adults in different income groups. For older adults in the medium-income group and high-income group, those who have not completed elementary education are less likely to engage in agricultural labor than those who have no education at all. The variable “elementary education” is insignificant for older adults in the medium-to-low-income group. However, in other groups, older adults with elementary education show a lower likelihood of engaging in agricultural labor than those who are illiterate. The variable “above senior secondary education” is insignificant for older adults in the medium-to-low-income group, while older adults with junior secondary, senior secondary, and above senior secondary education show a significantly lower likelihood of engaging in agricultural labor. An increase in household income increases the likelihood of agricultural labor participation among older adults in the low-income and medium-to-low-income groups, but it reduces the likelihood of agricultural labor participation among older adults in the medium-to-high-income and high-income groups. Compared to 2011, in 2013, older adults in the low-income and high-income groups showed a higher likelihood of agricultural labor participation, while those in the medium-income group showed a lower likelihood of agricultural labor participation. In 2015, older adults in the low-income, medium-to-low-income, and high-income groups showed an increased likelihood of agricultural labor participation, while those in the medium-income group showed a decreased likelihood of agricultural labor participation. Compared to 2011, in 2018, older adults in the low-income, medium-to-low-income, and medium-income groups showed a decreased likelihood of agricultural labor participation, while those in the medium-to-high-income group showed an increased likelihood of agricultural labor participation.

4.4. The Effect of Self-Rated Poor Health on Total Labor Hours for Older Adults in Different Income Groups

Table 6 shows the effects of self-rated poor health on total labor hours for older adults in different income groups. As observed from the table, the coefficients of self-rated poor health are significantly negative for older adults in the medium-to-high-income and high-income groups, and they were insignificant in all other groups. This indicates that self-rated poor health reduces the total labor hours for older adults in the medium-to-high-income and high-income groups.

In the medium-to-low-income, medium-income, medium-to-high-income, and high-income groups, male older adults invest more total labor hours compared to females. Across all five groups, the total labor hours of older adults decline with increases in their age. Older adults with non-rural household registration invest fewer total labor hours than those with rural household registrations. With the exception of those in the low-

income group, older adults who are married invest more labor hours in all other groups. Education levels have insignificant effects on the total labor hours of older adults, although the coefficient of elementary education is significantly negative in the medium-to-low-income and medium-income groups, while the coefficient of senior secondary education is significantly negative in the medium-income and high-income groups. For older adults in the medium-to-low-income group, an increase in household income reduces their total labor hours, while for older adults in the medium-income group, their total labor hours increase with an increase in their household income. Compared to 2011, older adults in the medium-income and high-income groups observed a reduction in their total labor hours in 2013, and older adults in the medium-to-low-income and medium-income groups observed a reduction in their total labor hours in 2015. With the exception of those in the low-income group, older adults in all other groups observed a reduction in their total labor hours in 2018 compared to 2011.

Table 5. The effects of self-rated poor health on agricultural labor participation for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Self-rated poor health	−0.296 *** (0.103)	−0.176 (0.154)	−0.278 *** (0.108)	−0.335 *** (0.081)	−0.177 *** (0.055)
Male	0.059 *** (0.016)	0.132 *** (0.013)	0.103 *** (0.014)	0.081 *** (0.013)	0.096 *** (0.012)
Age	−0.011 *** (0.001)	−0.018 *** (0.001)	−0.016 *** (0.001)	−0.012 *** (0.001)	−0.011 *** (0.001)
Unified household registration	−0.090 (0.070)	−0.346 *** (0.079)	−0.255 *** (0.067)	−0.295 *** (0.051)	−0.263 *** (0.045)
Non-rural household registration	−0.230 *** (0.020)	−0.309 *** (0.027)	−0.368 *** (0.022)	−0.424 *** (0.016)	−0.407 *** (0.014)
Married	0.061 *** (0.018)	0.101 *** (0.014)	0.090 *** (0.015)	0.132 *** (0.016)	0.100 *** (0.015)
Elementary education non-completion	−0.001 (0.021)	−0.009 (0.016)	−0.029 * (0.016)	−0.018 (0.017)	−0.039 ** (0.019)
Elementary education	−0.055 *** (0.021)	−0.013 (0.017)	−0.035 ** (0.017)	−0.053 *** (0.017)	−0.070 *** (0.019)
Junior secondary education	−0.075 *** (0.027)	−0.085 *** (0.025)	−0.146 *** (0.025)	−0.149 *** (0.020)	−0.102 *** (0.020)
Senior secondary education	−0.124 *** (0.034)	−0.140 *** (0.045)	−0.179 *** (0.036)	−0.139 *** (0.028)	−0.097 *** (0.023)
Above senior secondary education	−0.095 ** (0.045)	0.139 (0.189)	−0.168 * (0.091)	−0.175 *** (0.062)	−0.154 *** (0.032)
Total household income	0.059 *** (0.006)	0.017 * (0.010)	0.018 (0.015)	−0.070 *** (0.018)	−0.027 *** (0.010)
2013	0.096 ** (0.048)	−0.009 (0.020)	−0.070 *** (0.020)	−0.017 (0.019)	0.038 ** (0.018)
2015	0.143 *** (0.030)	0.038 * (0.022)	−0.097 *** (0.021)	−0.038 * (0.020)	−0.024 (0.020)
2018	−0.083 *** (0.026)	−0.118 *** (0.018)	−0.086 *** (0.015)	0.040 *** (0.015)	0.003 (0.015)
Constant	1.083 *** (0.085)	1.604 *** (0.117)	1.631 *** (0.160)	2.121 *** (0.193)	1.521 *** (0.126)
Observed value	2869	6015	6190	6078	5899

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

Table 6. The effect of self-rated poor health on total labor hours for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Self-rated poor health	−0.364 (0.409)	0.096 (0.461)	−0.015 (0.370)	−0.251 *** (0.075)	−0.222 *** (0.020)
Male	0.182 (0.120)	0.221 *** (0.053)	0.179 *** (0.048)	0.344 *** (0.048)	0.311 *** (0.061)
Age	−0.035 *** (0.009)	−0.023 *** (0.004)	−0.019 *** (0.004)	−0.040 *** (0.005)	−0.048 *** (0.005)
Unified household registration	0.334 (0.449)	−0.279 (0.410)	0.385 (0.316)	−0.317 (0.219)	0.112 (0.218)
Non-rural household registration	−0.539 *** (0.176)	−0.350 *** (0.132)	−0.190 * (0.098)	−0.241 *** (0.074)	−0.130 * (0.072)
Married	−0.001 (0.144)	0.182 *** (0.063)	0.139 ** (0.057)	0.187 *** (0.067)	0.288 *** (0.085)
Elementary education non-completion	0.082 (0.142)	−0.002 (0.065)	−0.012 (0.056)	−0.057 (0.059)	0.003 (0.082)
Elementary education	−0.123 (0.154)	−0.112 * (0.067)	−0.133 ** (0.060)	−0.029 (0.061)	0.007 (0.083)
Junior secondary education	−0.135 (0.191)	−0.066 (0.099)	−0.060 (0.086)	−0.103 (0.074)	0.009 (0.095)
Senior secondary education	−0.051 (0.292)	0.073 (0.173)	−0.430 *** (0.140)	−0.025 (0.106)	−0.222 ** (0.111)
Above senior secondary education	0.215 (0.584)	−0.603 (0.651)	−0.707 (0.450)	0.017 (0.382)	−0.089 (0.204)
Total household income	−0.017 (0.040)	−0.068 * (0.039)	0.218 *** (0.053)	−0.003 (0.066)	0.033 (0.044)
2013	0.308 (0.246)	0.059 (0.081)	−0.142 ** (0.070)	−0.073 (0.075)	−0.156 * (0.086)
2015	−0.089 (0.153)	−0.173 ** (0.076)	−0.269 *** (0.071)	−0.021 (0.068)	−0.023 (0.088)
2018	−0.000 (0.171)	−0.538 *** (0.077)	−0.669 *** (0.053)	−0.310 *** (0.055)	−0.223 *** (0.071)
Constant	8.938 *** (0.668)	8.325 *** (0.434)	6.140 *** (0.606)	9.311 *** (0.720)	9.278 *** (0.634)
Observed value	711	2964	3744	3444	2691

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

The effects of self-rated poor health on off-farm labor hours for older adults in different income groups are as follows:

Table 7 shows the effect of self-rated poor health on off-farm labor hours for older adults in different income groups. As observed from the results, the coefficients of self-rated poor health are insignificant for older adults in the low-income and medium-to-low-income groups, while the coefficients were significantly negative for older adults in the medium-income, medium-to-high-income, and high-income groups. This indicates that self-rated poor health significantly reduces off-farm labor hours for older adults in the medium-income group and above.

Male older adults in the low-income group invest more off-farm labor hours compared to females. The “age” variable is significant in the medium-to-high-income group only. In the medium-to-high-income group, older adults with unified household registration invest more off-farm labor hours compared to those with rural household registration; in the medium-income and high-income groups, older adults with non-rural household registration also reported more off-farm labor hours. The variable, “junior secondary education”, is significantly positive in the medium-income and medium-to-high-income

groups. In the medium-to-high-income group, older adults who have completed senior secondary education invest more off-farm labor hours compared to those with no education at all. However, older adults with above senior secondary education invest fewer off-farm labor hours compared to those with no education. For older adults in the low-income group, an increase in their household income results in fewer off-farm labor hours, while for those in the medium-income and medium-to-high-income groups, an increase in their household income leads to more off-farm labor hours. Compared to 2011, older adults in the low-income group reported more off-farm labor hours in 2015, while those with medium income and above reported fewer off-farm labor hours in 2018.

Table 7. The effect of self-rated poor health on off-farm labor hours for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Self-rated poor health	0.474 (0.370)	−0.066 (0.174)	−0.291 ** (0.131)	−0.271 * (0.140)	−0.538 ** (0.239)
Male	0.731 ** (0.289)	0.029 (0.158)	−0.115 (0.108)	−0.022 (0.078)	0.108 (0.078)
Age	0.014 (0.023)	0.022 (0.014)	0.015 (0.010)	−0.016 * (0.008)	−0.011 (0.009)
Unified household registration	1.168 (0.742)	0.193 (0.826)	−0.156 (0.468)	0.706 ** (0.356)	−0.018 (0.236)
Non-rural household registration	0.507 (0.320)	0.069 (0.251)	0.367 ** (0.165)	0.030 (0.096)	0.158 ** (0.078)
Married	0.479 (0.302)	0.007 (0.186)	−0.112 (0.134)	0.111 (0.105)	0.148 (0.128)
Elementary education non-completion	0.006 (0.347)	0.097 (0.202)	0.077 (0.133)	0.048 (0.103)	0.059 (0.115)
Elementary education	−0.066 (0.354)	−0.067 (0.211)	0.057 (0.136)	0.106 (0.100)	−0.031 (0.118)
Junior secondary education	−0.279 (0.409)	0.398 (0.243)	0.372 ** (0.159)	0.204 * (0.110)	0.036 (0.122)
Senior secondary education	−0.243 (0.462)	0.274 (0.346)	0.092 (0.272)	0.260 * (0.142)	0.006 (0.133)
Above senior secondary education	−0.340 (0.604)	−0.647 (1.448)	0.830 (0.876)	0.422 (0.466)	−0.350 * (0.202)
Total household income	−0.205 * (0.107)	−0.160 (0.117)	0.382 *** (0.119)	0.344 *** (0.103)	−0.082 (0.053)
2013	0.809 (0.936)	−0.174 (0.233)	0.081 (0.174)	0.032 (0.128)	−0.204 (0.127)
2015	0.827 * (0.447)	−0.224 (0.204)	−0.124 (0.140)	−0.036 (0.104)	−0.125 (0.114)
2018	0.066 (0.344)	−0.135 (0.225)	−0.667 *** (0.132)	−0.530 *** (0.094)	−0.295 *** (0.098)
Constant	5.258 *** (1.638)	6.106 *** (1.227)	2.762 ** (1.284)	4.817 *** (1.152)	8.793 *** (0.844)
Observed value	112	398	698	1176	1159

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

The effects of self-rated poor health on agricultural labor hours for older adults in different income groups are as follows:

Table 8 shows the effect of self-rated poor health on agricultural labor hours for older adults in different income groups. As observed from the results, the coefficients of self-rated poor health are insignificant for older adults in all five groups, indicating that self-rated poor health has little impact on the agricultural labor hours of older adults.

Table 8. The effect of self-rated poor health on agricultural labor hours for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Self-rated poor health	−0.735 (0.544)	−0.257 (0.455)	−0.181 (0.413)	−0.006 (0.121)	−0.010 (0.090)
Male	0.185 (0.130)	0.196 *** (0.056)	0.132 ** (0.051)	0.231 *** (0.056)	0.196 *** (0.075)
Age	−0.031 *** (0.010)	−0.020 *** (0.004)	−0.016 *** (0.004)	−0.016 *** (0.005)	−0.011 * (0.006)
Unified household registration	0.018 (0.539)	−0.561 (0.490)	0.439 (0.357)	−0.351 (0.261)	−0.282 (0.278)
Non-rural household registration	−0.763 *** (0.205)	−0.639 *** (0.159)	−0.482 *** (0.118)	−0.558 *** (0.103)	−0.656 *** (0.105)
Married	0.065 (0.157)	0.226 *** (0.066)	0.175 *** (0.061)	0.314 *** (0.081)	0.370 *** (0.100)
Elementary education non-completion	0.077 (0.151)	−0.031 (0.066)	0.020 (0.060)	−0.137 ** (0.067)	−0.148 (0.092)
Elementary education	−0.154 (0.164)	−0.123 * (0.068)	−0.153 ** (0.064)	−0.189 *** (0.070)	−0.067 (0.095)
Junior secondary education	−0.215 (0.209)	−0.285 *** (0.102)	−0.225 ** (0.096)	−0.451 *** (0.089)	−0.329 *** (0.111)
Senior secondary education	−0.507 (0.335)	−0.153 (0.191)	−0.504 *** (0.155)	−0.363 *** (0.136)	−0.698 *** (0.139)
Above senior secondary education	−2.720 *** (0.828)	−0.499 (0.650)	−1.506 *** (0.490)	−0.328 (0.545)	−1.327 *** (0.350)
Total household income	0.031 (0.042)	−0.068 * (0.041)	0.085 (0.056)	−0.228 *** (0.077)	0.090 * (0.054)
2013	0.320 (0.254)	0.079 (0.084)	−0.160 ** (0.074)	−0.133 (0.087)	−0.054 (0.100)
2015	−0.158 (0.161)	−0.202 ** (0.079)	−0.437 *** (0.078)	−0.407 *** (0.082)	−0.275 ** (0.107)
2018	−0.052 (0.188)	−0.679 *** (0.081)	−0.718 *** (0.056)	−0.548 *** (0.063)	−0.579 *** (0.084)
Constant	8.499 *** (0.745)	8.204 *** (0.442)	7.020 *** (0.643)	9.737 *** (0.839)	6.047 *** (0.748)
Observed value	637	2750	3416	2825	1950

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

In the medium-to-low-income group and above, male older adults invest more agricultural labor hours compared to females. Older adults in all income groups reported fewer agricultural labor hours with the increase in their age. Moreover, in all five groups, older adults with non-rural household registration invest fewer agricultural labor hours compared to those with rural household registrations. The “marriage” variable is insignificant in the low-income group. However, in all other groups, older adults who are married invest more agricultural labor hours compared to those who are not. For older adults in the low-income group, only those with above senior secondary education invest fewer agricultural labor hours compared to those who received no education. For older adults in the medium-to-low-income group, those who have completed elementary education or junior secondary education invest fewer agricultural labor hours compared to those who are illiterate. For older adults in the medium-income group, those who have completed elementary education or junior secondary education invest fewer agricultural labor hours compared to those who received no education. For older adults in the medium-income group, those who completed elementary education or above invest fewer agricultural labor hours compared to those with no education. For older adults in the medium-to-high-

income group, a decrease in agricultural labor hours was observed in those who have not completed elementary education as well as those who have completed elementary education, junior secondary education, or senior secondary education. For older adults in the high-income group, those with junior secondary education or above reported fewer agricultural labor hours. The total household income has a negative effect on agricultural labor hours for older adults in the medium-to-low-income and medium-to-high-income groups, but it has a positive effect on agricultural labor hours for those in the high-income group. On top of this, the total household income also had a negative effect on agricultural labor hours for older adults in the medium-to-low-income and medium-to-high-income groups, yet it had a positive effect on agricultural labor hours for those in the high-income group. In 2013, older adults in the medium-income group reported fewer agricultural labor hours compared to 2011. In 2015, with the exception of those in the low-income group, older adults in all other groups reported fewer agricultural labor hours compared to 2011. The same pattern was also observed in 2018.

5. Robustness Test

In this section, self-rated health variables are replaced with objective health indicators—the number of chronic diseases—for the purpose of a robustness test. Tables 9–14 present the regression results with the dependent variables comprising labor participation, off-farm labor participation, agricultural labor participation, total labor hours, off-farm labor hours, and agricultural labor hours of older adults, respectively. Since the changes in the results of the control variables from the previous ones were not substantial, this section only examines the results of the core explanatory variables.

Table 9 shows the regression results for the effect of chronic diseases on labor participation for older adults in different income groups. As observed from the results, the coefficients of the “number of chronic diseases” are insignificant in the low-income, medium-income, and high-income groups, while they are significantly negative in the medium-to-low-income and medium-to-high-income groups. This indicates that for older adults in the medium-to-low-income and medium-to-high-income groups, an increase in the number of chronic diseases would reduce their likelihood of labor participation.

Table 9. The effect of chronic diseases on labor participation for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Number of chronic diseases	0.009 (0.020)	−0.033 * (0.018)	−0.020 (0.018)	−0.024 * (0.014)	0.008 (0.019)
Male	0.077 *** (0.017)	0.135 *** (0.019)	0.118 *** (0.015)	0.143 *** (0.014)	0.159 *** (0.014)
Age	−0.014 *** (0.001)	−0.018 *** (0.001)	−0.019 *** (0.001)	−0.021 *** (0.001)	−0.020 *** (0.001)
Unified household registration	−0.027 (0.076)	−0.377 *** (0.104)	−0.214 *** (0.076)	−0.236 *** (0.053)	−0.237 *** (0.049)
Non-rural household registration	−0.218 *** (0.020)	−0.247 *** (0.035)	−0.298 *** (0.026)	−0.392 *** (0.017)	−0.375 *** (0.016)
Married	0.032 * (0.018)	0.053 *** (0.019)	0.064 *** (0.017)	0.146 *** (0.017)	0.110 *** (0.018)
Elementary education non-completion	−0.001 (0.023)	0.000 (0.022)	−0.003 (0.018)	−0.004 (0.018)	−0.007 (0.021)
Elementary education	−0.032 (0.023)	−0.010 (0.023)	−0.016 (0.019)	−0.027 (0.018)	−0.026 (0.021)
Junior secondary education	−0.039 (0.028)	−0.032 (0.032)	−0.054 ** (0.025)	−0.089 *** (0.021)	−0.064 *** (0.022)

Table 9. Cont.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Senior secondary education	−0.087 ** (0.034)	−0.082 (0.059)	−0.186 *** (0.042)	−0.038 (0.030)	−0.064 *** (0.025)
Above senior secondary education	−0.060 (0.045)	0.194 (0.267)	−0.191 (0.120)	−0.183 ** (0.081)	−0.103 *** (0.036)
Total household income	0.060 *** (0.006)	0.048 *** (0.014)	0.064 *** (0.016)	−0.038 * (0.019)	0.010 (0.011)
2013	0.269 (0.212)	−0.079 * (0.046)	−0.096 * (0.051)	−0.079 ** (0.037)	0.029 (0.039)
2015	0.173 (0.212)	−0.112 (0.109)	−0.276 (0.181)	0.038 (0.119)	0.181 (0.116)
2018	−0.058 ** (0.029)	−0.177 *** (0.024)	−0.107 *** (0.021)	0.022 (0.017)	0.041 * (0.021)
Constant	1.135 *** (0.089)	1.492 *** (0.134)	1.450 *** (0.170)	2.339 *** (0.206)	1.706 *** (0.142)
Observed value	2367	3104	4481	4351	4403

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

Table 10 shows the regression results for the effect of chronic diseases on off-farm labor participation for older adults in different income groups. As observed from the results, the coefficients of the “number of chronic diseases” are insignificant in the medium-to-low-income, medium-to-high-income, and high-income groups, while being significantly negative in the low-income and medium-income groups. This indicates that for older adults in the low-income and medium-income groups, an increase in the number of chronic diseases would reduce their likelihood of engaging in off-farm labor.

Table 10. The effect of chronic diseases on off-farm labor participation for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Number of chronic diseases	−0.007 ** (0.003)	−0.009 (0.010)	−0.050 *** (0.014)	−0.021 (0.014)	−0.005 (0.018)
Male	0.033 *** (0.009)	0.036 *** (0.011)	0.044 *** (0.011)	0.140 *** (0.013)	0.136 *** (0.013)
Age	−0.004 *** (0.001)	−0.005 *** (0.001)	−0.006 *** (0.001)	−0.012 *** (0.001)	−0.014 *** (0.001)
Unified household registration	0.142 *** (0.040)	−0.088 (0.056)	0.018 (0.054)	−0.108 ** (0.048)	−0.053 (0.044)
Non-rural household registration	−0.008 (0.010)	0.019 (0.019)	0.031 * (0.018)	−0.087 *** (0.016)	−0.120 *** (0.014)
Married	−0.018 * (0.010)	−0.004 (0.011)	0.000 (0.013)	−0.006 (0.017)	0.020 (0.017)
Elementary education non-completion	0.021 (0.013)	0.010 (0.013)	0.006 (0.013)	0.030 * (0.018)	0.038 * (0.020)
Elementary education	−0.002 (0.013)	0.002 (0.014)	0.000 (0.014)	0.043 ** (0.018)	0.022 (0.020)
Junior secondary education	−0.004 (0.015)	0.030 (0.019)	0.079 *** (0.018)	0.046 ** (0.021)	0.045 ** (0.021)
Senior secondary education	−0.016 (0.018)	0.037 (0.031)	−0.019 (0.029)	0.079 *** (0.028)	0.051 ** (0.023)

Table 10. Cont.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Above senior secondary education	−0.015 (0.024)	−0.074 (0.168)	−0.094 (0.080)	−0.082 (0.074)	0.039 (0.033)
Total household income	0.006 (0.004)	0.016 * (0.009)	0.049 *** (0.012)	0.052 *** (0.020)	0.016 (0.010)
2013	-	−0.014 (0.032)	−0.010 (0.046)	−0.046 (0.039)	0.044 (0.040)
2015	−0.023 (0.189)	0.122 * (0.064)	0.029 (0.128)	−0.071 (0.150)	0.270 ** (0.112)
2018	0.015 (0.014)	−0.039 ** (0.016)	−0.092 *** (0.020)	−0.022 (0.020)	0.035 (0.022)
Constant	0.317 *** (0.048)	0.358 *** (0.083)	0.217 * (0.126)	0.466 ** (0.208)	0.908 *** (0.132)
Observed value	2028	2361	3397	3528	3898

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

Table 11 shows the regression results for the effect of chronic diseases on agricultural labor participation for older adults in different income groups. As observed from the results, the coefficients of the “number of chronic diseases” are insignificant in all five groups, indicating that the number of chronic diseases has little impact on agricultural labor participation for older adults at different income levels.

Table 11. The effect of chronic diseases on agricultural labor participation for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Number of chronic diseases	0.016 (0.019)	−0.029 (0.018)	−0.004 (0.019)	−0.011 (0.015)	0.015 (0.019)
Male	0.056 *** (0.016)	0.132 *** (0.019)	0.113 *** (0.015)	0.098 *** (0.014)	0.093 *** (0.014)
Age	−0.011 *** (0.001)	−0.017 *** (0.001)	−0.017 *** (0.001)	−0.016 *** (0.001)	−0.011 *** (0.001)
Unified household registration	−0.176 ** (0.072)	−0.328 *** (0.104)	−0.265 *** (0.078)	−0.225 *** (0.057)	−0.235 *** (0.048)
Non-rural household registration	−0.226 *** (0.019)	−0.286 *** (0.035)	−0.372 *** (0.027)	−0.406 *** (0.018)	−0.388 *** (0.016)
Married	0.049 *** (0.017)	0.054 *** (0.019)	0.066 *** (0.018)	0.170 *** (0.018)	0.112 *** (0.017)
Elementary education non-completion	−0.010 (0.022)	−0.019 (0.022)	−0.009 (0.018)	−0.026 (0.019)	−0.014 (0.021)
Elementary education	−0.030 (0.022)	−0.015 (0.023)	−0.011 (0.019)	−0.050 *** (0.019)	−0.029 (0.020)
Junior secondary education	−0.034 (0.026)	−0.059 * (0.032)	−0.089 *** (0.026)	−0.127 *** (0.022)	−0.068 *** (0.022)
Senior secondary education	−0.077 ** (0.032)	−0.132 ** (0.059)	−0.185 *** (0.043)	−0.107 *** (0.032)	−0.061 ** (0.024)
Above senior secondary education	−0.048 (0.042)	0.243 (0.267)	−0.113 (0.123)	−0.152 * (0.086)	−0.115 *** (0.035)
Total household income	0.058 *** (0.006)	0.036 *** (0.014)	0.040 ** (0.017)	−0.059 *** (0.021)	−0.017 (0.011)

Table 11. Cont.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
2013	0.341 * (0.201)	−0.076 * (0.046)	−0.118 ** (0.053)	−0.070 * (0.040)	−0.023 (0.038)
2015	0.201 (0.201)	−0.239 ** (0.110)	−0.363 * (0.186)	0.061 (0.126)	−0.095 (0.114)
2018	−0.075 *** (0.028)	−0.162 *** (0.024)	−0.095 *** (0.022)	0.016 (0.018)	−0.000 (0.021)
Constant	0.911 *** (0.084)	1.430 *** (0.134)	1.459 *** (0.175)	2.103 *** (0.218)	1.290 *** (0.140)
Observed value	2367	3104	4481	4351	4403

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

Table 12. The effect of chronic diseases on the total labor hours for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-income Group	(5) High-Income Group
Number of chronic diseases	−0.127 (0.117)	−0.087 (0.080)	−0.034 (0.072)	0.013 (0.070)	−0.039 (0.100)
Male	0.104 (0.172)	0.192 ** (0.085)	0.140 ** (0.055)	0.401 *** (0.057)	0.329 *** (0.076)
Age	−0.016 (0.012)	−0.025 *** (0.006)	−0.019 *** (0.005)	−0.036 *** (0.006)	−0.052 *** (0.007)
Unified household registration	0.930 (0.650)	−0.841 (0.967)	0.377 (0.344)	−0.426 * (0.248)	0.141 (0.259)
Non-rural household registration	−0.254 (0.238)	−0.404 ** (0.205)	−0.169 (0.129)	−0.302 *** (0.095)	−0.135 (0.087)
Married	−0.118 (0.198)	0.041 (0.094)	0.167 ** (0.072)	0.256 *** (0.083)	0.315 *** (0.107)
Elementary education non-completion	−0.017 (0.202)	−0.089 (0.101)	0.012 (0.066)	−0.086 (0.069)	0.154 (0.098)
Elementary education	0.006 (0.218)	−0.070 (0.106)	−0.216 *** (0.070)	−0.045 (0.072)	0.109 (0.102)
Junior secondary education	−0.057 (0.271)	−0.054 (0.142)	−0.093 (0.092)	−0.123 (0.087)	0.051 (0.111)
Senior secondary education	−0.027 (0.420)	0.575 ** (0.284)	−0.436 ** (0.173)	−0.123 (0.123)	−0.136 (0.129)
Above senior secondary education	0.007 (0.672)	−0.404 (0.974)	−2.312 *** (0.741)	−0.910 (0.635)	0.160 (0.254)
Total household income	0.002 (0.043)	−0.015 (0.058)	0.294 *** (0.063)	0.037 (0.078)	0.050 (0.052)
2013	0.936 (0.834)	−0.055 (0.211)	−0.311 (0.226)	0.376 * (0.211)	−0.148 (0.211)
2015	0.090 (1.016)	−0.432 (0.556)	−1.044 (0.907)	0.513 (0.629)	0.530 (0.623)
2018	−0.097 (0.193)	−0.663 *** (0.111)	−0.708 *** (0.080)	−0.305 *** (0.073)	−0.236 ** (0.101)
Constant	7.793 *** (0.866)	8.424 *** (0.602)	5.549 *** (0.671)	8.568 *** (0.864)	9.253 *** (0.753)
Observed value	391	1308	2659	2500	1904

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

Table 12 shows the regression results for the effect of chronic diseases on the total labor hours for older adults in different income groups. As observed from the results, the coefficients of the “number of chronic diseases” are insignificant in all five groups, indicating that the number of chronic diseases has little impact on the total labor hours for older adults at different income levels.

Table 13 shows the regression results for the effect of chronic diseases on off-farm labor hours for older adults in different income groups. As observed from the results, the coefficient of the “number of chronic diseases” is significantly negative for older adults in the low-income group, indicating that an increase in the number of chronic diseases would reduce off-farm labor hours for older adults in the low-income group. However, for older adults in the medium-to-low-income group or above, the number of chronic diseases has little impact on their off-farm labor hours.

Table 13. The effect of chronic diseases on off-farm labor hours for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Number of chronic diseases	−0.382 * (0.202)	−0.081 (0.102)	0.039 (0.144)	−0.019 (0.038)	0.084 (0.100)
Male	0.139 (0.322)	−0.368 (0.234)	−0.123 (0.139)	0.016 (0.100)	0.080 (0.097)
Age	−0.002 (0.027)	0.014 (0.020)	0.007 (0.013)	−0.024 ** (0.011)	−0.009 (0.010)
Unified household registration	1.022 (0.713)	0.448 (1.440)	−0.034 (0.524)	0.647 (0.481)	0.059 (0.285)
Non-rural household registration	0.546 (0.338)	0.274 (0.381)	0.388 * (0.216)	−0.012 (0.136)	0.274 *** (0.096)
Married	0.413 (0.378)	−0.181 (0.253)	−0.094 (0.179)	0.090 (0.139)	0.162 (0.160)
Elementary education non-completion	−0.241 (0.377)	0.279 (0.289)	0.170 (0.174)	0.076 (0.129)	0.221 (0.143)
Elementary education	0.591 (0.407)	0.388 (0.321)	0.190 (0.177)	0.182 (0.126)	0.135 (0.147)
Junior secondary education	0.078 (0.417)	0.356 (0.356)	0.547 *** (0.202)	0.261 * (0.139)	0.178 (0.146)
Senior secondary education	−0.109 (0.544)	1.103 ** (0.511)	0.329 (0.347)	0.297 * (0.178)	0.156 (0.159)
Above senior secondary education	0.373 (0.700)	-	-	0.423 (1.185)	−0.306 (0.258)
Total household income	−0.050 (0.113)	−0.169 (0.163)	0.186 (0.156)	0.402 *** (0.129)	−0.035 (0.063)
2013	-	−0.054 (0.565)	0.199 (0.503)	0.606 * (0.351)	−0.592 ** (0.266)
2015	-	0.191 (0.819)	−2.032 ** (0.911)	−0.043 (0.833)	−0.002 (0.531)
2018	−0.128 (0.348)	−0.203 (0.232)	−0.625 *** (0.170)	−0.527 *** (0.102)	−0.239 * (0.129)
Constant	6.712 *** (2.018)	6.974 *** (1.732)	4.736 *** (1.646)	4.687 *** (1.446)	7.814 *** (1.020)
Observed value	81	192	445	803	859

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

Table 14 shows the regression results for the effect of chronic diseases on agricultural labor hours for older adults in different income groups. As observed from the results, the coefficient of the “number of chronic diseases” is significantly positive for older adults in

the low-income and medium-income groups. In the low-income group, the coefficient of the “number of chronic diseases” is significant at the 5% significance level, while in the medium-income group, the coefficient is significant at the 10% significance level. This indicates that for both groups, an increase in the number of chronic diseases suffered by older adults would actually enhance their agricultural labor hours. Moreover, the coefficients of the “number of chronic diseases” are insignificant in models (3), (4), and (5), indicating that the number of chronic diseases has little impact on agricultural labor hours for older adults in the medium-income, medium-and-high-income, and high-income groups.

Table 14. The effect of chronic diseases on agricultural labor hours for older adults in different income groups.

Variables	(1) Low-Income Group	(2) Medium-to- Low-Income Group	(3) Medium- Income Group	(4) Medium-to- High-Income Group	(5) High-Income Group
Number of chronic diseases	0.145 ** (0.073)	0.023 (0.034)	0.025 * (0.014)	0.013 (0.034)	−0.004 (0.036)
Male	0.151 (0.193)	0.184 ** (0.089)	0.114 ** (0.058)	0.261 *** (0.064)	0.203 ** (0.093)
Age	−0.008 (0.013)	−0.017 ** (0.007)	−0.015 *** (0.005)	−0.013 ** (0.006)	−0.014 * (0.008)
Unified household registration	0.318 (1.008)	−2.307 * (1.373)	0.436 (0.390)	−0.347 (0.282)	−0.244 (0.320)
Non-rural household registration	−0.639 ** (0.307)	−0.639 ** (0.250)	−0.493 *** (0.161)	−0.508 *** (0.126)	−0.691 *** (0.128)
Married	−0.102 (0.222)	0.110 (0.100)	0.194 *** (0.075)	0.434 *** (0.098)	0.382 *** (0.126)
Elementary education non-completion	0.024 (0.218)	−0.141 (0.106)	0.041 (0.069)	−0.103 (0.077)	0.008 (0.114)
Elementary education	−0.054 (0.238)	−0.126 (0.110)	−0.264 *** (0.073)	−0.198 ** (0.082)	−0.007 (0.119)
Junior secondary education	−0.223 (0.306)	−0.269 * (0.150)	−0.282 *** (0.098)	−0.399 *** (0.101)	−0.295 ** (0.134)
Senior secondary education	−0.561 (0.546)	−0.114 (0.325)	−0.635 *** (0.188)	−0.422 *** (0.152)	−0.680 *** (0.165)
Above senior secondary education	−2.089 ** (1.037)	−0.277 (0.981)	−2.051 *** (0.748)	−0.800 (0.765)	−0.612 (0.444)
Total household income	0.028 (0.046)	−0.047 (0.061)	0.212 *** (0.067)	−0.264 *** (0.088)	0.120 * (0.065)
2013	0.936 (0.850)	0.002 (0.223)	−0.373 (0.244)	0.330 (0.259)	−0.053 (0.268)
2015	0.359 (1.047)	−0.660 (0.793)	−0.216 (1.292)	−0.494 (0.760)	−1.214 (1.421)
2018	−0.147 (0.212)	−0.730 *** (0.094)	−0.750 *** (0.059)	−0.542 *** (0.067)	−0.592 *** (0.091)
Constant	7.138 *** (0.950)	7.908 *** (0.615)	5.848 *** (0.691)	9.688 *** (0.969)	5.847 *** (0.902)
Observed value	335	1197	2460	2112	1365

Note: Standard deviation is provided in brackets; *, **, and *** indicate the coefficient being significant at the 10%, 5%, and 1% significance levels, respectively.

6. Conclusions and Discussion, Recommendations, Limitations, and Future Studies

6.1. Conclusions and Discussion

The empirical part of Section 4 effectively confirms all the hypotheses of this paper. This paper conducted an empirical study that probes the effects of subjective self-rated poor health and objective poor health measured using the number of chronic diseases on the labor supply of older adults. The study of its influence on labor supply from the perspective of health can help to maintain the labor supply of the aged from the perspective

of improving the health of the aged, provide a certain reference for the labor shortage caused by China's aging society, and enrich the content of health economics. Taken together, this research yielded the following insights:

- (1) When no consideration is given to the endogenous problem between the health status of older adults and their labor supply, poor health statuses would significantly reduce the labor supply of older adults, regardless of whether subjective self-rated health indicators or objective health indicators are used. However, when taking into account the potential endogenous problem between the health of the elderly and their labor supply, the use of subjective/objective health indicators would lead to inconsistent results. As Grossman [7] found, older people with better health have higher labor productivity, so they have more time to participate in labor. At the same time, good health will increase the labor supply time [4].
- (2) The number of chronic diseases has little impact on the labor hours of older adults. This pointed to the fact that instead of cutting back on their labor hours due to poor health, older adults continued to work despite the presence of chronic diseases, and there might even be cases where they continue to work with illness. However, Li et al. [13] obtained different research results. They selected sodium intake before hypertension as an instrumental variable to overcome the possible endogenous influence of disease information, and they found that hypertension had a significant impact on labor participation of urban middle-aged and elderly people, but not on rural people.
- (3) Self-rated poor health has the greatest effect on labor force participation for older adults in the low-income and medium-to-high-income groups. This indicates that for older adults in these two groups, poor health would significantly lower their likelihood of labor participation. This result is the same as that of Lindeboom and Kerkhofs [16], and Huang [26] stated that poor health increases the likelihood that workers aged 50 and over will reach retirement or become economically inactive. Huang [26] found that, compared to the middle-aged and elderly who did not receive a pension, the annual labor supply time was reduced by 89.01 h. On the one hand, a retirement pension will increase the real purchasing power of middle-aged and elderly people, which will increase leisure and reduce labor supply, and it belongs to the income effect. On the other hand, middle-aged and elderly pensioners usually have jobs and may be rehired after retirement, which makes their leisure more expensive, reduces leisure, and increases labor supply, and it belongs to the substitution effect. The total effect is negative, indicating that the income effect is greater than the substitution effect. A pension has a negative impact on the labor supply of the elderly in China.
- (4) With increased chronic diseases suffered by older adults, their agricultural labor hours also increase, especially for those in the low-income and medium-income groups. This might be explained by the fact that older adults with low or medium incomes have to invest additional hours into agricultural labor to earn the income needed for the treatment of their chronic diseases. Wang and Chen [14] found the same problem. They found the weekly working hours of rural middle-aged and elderly people are significantly reduced by 3.16 to 3.70 h due to health shocks. When analyzing the reasons for the reduction in labor supply, it is found that the probability of rural middle-aged and elderly people choosing to continue working after health shocks decreases by 2.9%, but the result is not significant. This shows that the elderly in rural areas do not stop working. He [5] analyzed the reason using the elasticity of labor supply. Although there is a significant positive relationship between labor income and the supply of working time of the elderly in rural areas, the labor supply of the elderly in rural areas is inelastic, and the labor supply elasticity is less than 1. When labor remuneration increases, the labor supply time of the elderly in rural areas will not increase much. For the elderly in rural areas, their participation in labor is mainly for

the maintenance of livelihood and pension, and they do not have high requirements for living standards.

6.2. Recommendations

First, we should strengthen top-level design to turn the aging population into a positive factor for promoting economic and social development and increasing the labor participation rate. We should integrate public service resources and institutions and promote the construction of a health service system with health care prevention, treatment, and nursing as the core, as well as the construction of a comprehensive public service information platform. By carrying out health publicity, we should enhance the self-care awareness of the elderly and guide them to choose scientific fitness activities and develop a healthy lifestyle [27].

Second, by raising the mandatory retirement age, we can provide policy guarantees for the participation of the elderly in the labor market. At present, the legal retirement age of most developed countries is 65 years old, while the current retirement age in our country is 60 years old for men and 55 years old for women. It is suggested to implement a retirement policy as soon as possible, adopting the adjustment mechanism of “taking small steps slowly and gradually getting into place”, and to gradually realize the extension of the legal retirement age with the flexible retirement mechanism, on the basis of respecting worker initiative and market leadership [28]. We will reform the pension replacement rate, create a flexible employment environment, and improve the relaxed employment system.

Third, we should optimize medical and health resources to improve the health of the elderly. The health status of the elderly is an important guarantee for their continued participation in the workforce. To tap the labor potential of the elderly, we should not only consider their own willingness to participate in labor, but also consider their objective physical health conditions. According to the conclusion of this paper, the decline in the health status of the elderly significantly reduces the likelihood of total labor participation, non-agricultural labor participation, and agricultural labor participation of the elderly [29]. Therefore, we must pay more attention to the health of the elderly population, ensure that the elderly can get timely treatment when they fall ill, strengthen the health investment and health security of the elderly, increase the construction of health infrastructure and medical security systems, improve the health of the elderly, and truly provide health security for their return to the market.

6.3. Limitations and Future Studies

This paper has two research limitations. Firstly, this paper establishes a model using the instrumental variables method to investigate the effects of poor health on labor participation, labor hours, agricultural labor participation, agricultural labor hours, off-farm labor participation, and off-farm labor hours of older adults with different economic statuses. However, this paper does not consider relevant factors such as social security and intergenerational family support. What are the reasons for the poor health of the elderly? Are there health inequalities? Secondly, what are the reasons why the health status of the elderly is different? Are there health inequalities in the health status of older people? The above problems are not analyzed in depth in this paper.

In future studies, we will focus on the relationship between the different health statuses of the elderly and health inequality of the elderly, the influence of health inequality of the elderly on the labor supply of the elderly, the influence of health inequality of the elderly on the labor supply of the elderly based on family support intervention, and other aspects.

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