# Health and Labor Supply in Rural China

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**Abstract**

Aging in developing countries, especially rural areas, is much more difficult compared to developed countries. In rural regions where the formal pension is almost absent, old-age support heavily relies on elderly's labor income. Therefore, it is essential to understand the factors that affect the elderly's labor supply decisions. For the old-aged adults who are mostly involved in physically demanding jobs, it is particularly important to examine the role of health. Using the CHARLS National Baseline, we examine the link between health and the rural elderly's labor supply behaviors. The findings suggest a strong association between them. Specifically speaking, individuals who reported poor SRH or disability are more likely to leave the labor force at old ages. Moreover, men with poor SRH work fewer hours; however, no significant negative correlation has been found for women. These associations persist after controlling for all the covariates. In addition, differentiated health effects have been detected for old-aged adults with different levels of wealth.

**Keywords**: Health, Labor Supply, Rural China

## 1 Introduction

Aging in developing countries, especially rural areas, is much more difficult compared to developed countries. In rural regions where the formal pension is almost absent, old age support mainly comes from two sources: elderly's labor income and support from their families. Unfortunately, the latter seems to erode over time. Historically, adult children, especially adult sons, share the responsibility

to take care of their elderly parents. However, with the one-child policy established since 1970s, individuals have fewer sons to rely on for old-age support. In addition, as the society becomes more commercial and individual-oriented, it is hard to say that the traditional Confucian filial piety[1] will continue to be strong in the rural areas (Benjamin et al., 2000). This leaves the former source-labor income-extremely important when the elderly think about "retirement" and old-age support.

In one of her books, David-Friedmann once described the situation of the Chinese farmers in the pre-reform era as "ceaseless toil" (Benjamin et al., 2003). And it still seems to be a normal life pattern for most of the rural elderly nowadays: they keep working until they are not physically capable of. Using a nationally representative survey[2] in China, we try to depict this situation. Figure 1 shows the labor force participation rate for rural residents aged 50 and above. For the age 50 cohorts, it is normal to expect that the participation rate for males is higher than 90%; while for females, it is as high as 80%. This rate only slightly goes down for the age 60 cohorts. For the age 70 cohorts, more than 60% of men are working and around half of the women are in the labor force. Even in their eighties, more than 20% of men and women are still involved in productive activities. Figure 2 and Figure 3 further show the total annual hours and hours in agriculture-related acitivities rural elderly worked in the past year. The patterns are similar to that found in Figure 1: both male and female elderly keep working into very old ages. This life path of the rural residents makes it essential to understand the factors that affect their labor supply behaviors. Since they are not only financially vulnerable but also physically vulnerable at old ages, it is particularly important to examine the role health played in the old-aged adults' working lives.

The main objective of this paper is to examine the link between health and labor supply behaviors of rural elderly in China. There are several reasons that this study focuses on this group of individuals. First of all, a majority of the population in China are rural residents. It is important to understand their labor supply behaviors and how they respond to influencing factors like health.

Second, huge differences exist between urban and rural areas in all aspects, and retirement system is one of the most important dimensions among them. For the urban residents, especially

[1] In Confucian philosophy, the meaning of the filial piety includes taking care of one's parents.

[2] The China Health and Retirement Longitudinal Study (CHARLS) National Baseline. There will be detailed discussion about the dataset later.

those who work in the formal sector[3], they face mandatory retirement when they reach certain ages. Specifically, men have to retire at age 60, female civil servants have to retirement at age 55 and female workers at age 50[4] (State Council, 1978). This makes most of the urban residents' retirement decisions depend solely on the mandatory retirement system. On the contrary, in the rural areas, there is no such system. Rural residents can choose when to stop working by themselves. Therefore, this allows us to examine different factors such as health that affect rural residents' labor participation decisions as well as other labor market outcomes.

Third, there is in fact one advantage of studying this relationship in rural China. As have been discussed in a large amount of literature, pension is always a non-negligible factor in people's retirement decisions and it affect individuals' labor supply behaviors in various ways (See Gustman and Steinmeier, 2005; Coile and Gruber, 2007). However, in rural China, this is a problem to be less worried about. For a long time, old-age support in rural China relies on all means but formal pensions. Though New Pension System Program (NPRR) has been established since 2009 in the rural areas, the amount[5] of the pension is extremely small that it can barely cover the expenses of a typical elderly. Therefore, it is natural to expect that at least so far, the role of pension is negligible when rural elderly make their labor supply decisions. This helps to better reveal the relationship between health and labor supply for the old-aged adults without worrying about the complications of pensions.

Despite the numerous things that may affect rural elderly's labor supply behaviors, we mainly focus on health. Because for the old-aged adults who are mostly involved in strenuous and physically demanding works such as farming, health is an extremely important limiting factor when they decide how much effort they should make at work or whether to leave the labor force.

Using the China Health and Retirement Longitudinal Study (CHARLS) National Baseline, this study is able to quantify the relationship between health and labor supply of the rural elderly. Unlike most of the previous literature, health measure in this study is multi-dimensional. We measure health

[3]The formal sector usually refers to government, institutions, state-owned enterprises, firms and etc..

[4]There are some exceptions. For example, people who work in highly dangerous industries can retire earlier. And if an individual becomes disabled and loses his/her ability to work because of job-related accidents, they can retire at any time. Additionally, individuals can retire earkuer if they are deemed to have completely lost the ability to work.

[5]The basic pension benefit per month per person is 55 *yuan*, approximately 9 dollars.

in five different dimensions–self-rated health, stature, physical functioning, mental health and the longevity of parents–in order to examine their differentiated effects. Labor supply in this study is measured by labor force participation and hours of work. Since the majority of the sample is to some degree involved in agriculture-related activities, we also consider participation and hours of work in farming.

One thing to be mentioned is that we are not trying to establish a causal link between health and labor supply behaviors. It is known that health is endogenous and it is hard to find a valid instrument variable from a cross-sectional dataset. Therefore, the analysis in this paper will only focus on the associations instead of a causal relationship.

We estimate the participation decision and hours of work decision simultaneously. Our findings suggest that health is no doubt one of the most important concerns when the rural elderly make their labor supply decisions. Specifically speaking, there is a strong negative association between poor SRH and the elderly's labor force participation. Both men and women who reported poor SRH are more likely to leave the labor force at old ages. Similar correlation has been found between disability and labor force participation. Individuals with ADL/IADL-related limitations are less likely to stay in the labor force. We also find stature to be an important for men when they choose whether to stay in the labor force or leave the jobs. Regarding the hours of work, our results suggest a negative effect from poor SRH. Men with poor SRH work fewer hours; however, no significant negative correlation has been found for women. All these effects from different dimensions of health persist after we controlled for all the other covariates such as demographic characteristics, household economic conditions and family/household structures. However, these links are to some extent mitigated by wealth. We found that health has differentiated effects on participation in agriculture-related activities for individuals with different levels of wealth. It seems that adverse health is less of a constraint for old-aged adults with above average household wealth.

We also examine the impact from household and family, since they are indispensable parts of the old-age support in rural China. Our results show that both men and women are significantly more likely to stay in the labor force at old ages once they have non-adult sons in their families. In

addition men with non-adult sons work longer hours. No significant association has been detected between the number of grandchild and men's labor supply behavior; however, we do find that women with grandkids are significantly more likely to leave the labor force.

The rest of the paper is organized as follows. Section 2 is a brief review of the literature on the link between health and labor market outcomes. Section 3 presents a labor supply model. Data and descriptions of the variables are presented in Section 4. Section 5 is the empirical approach and Section 6 provides detailed results. Section 7 concludes.

## 2 Literature Review

There have been numerous studies documenting the link between health and the labor market behaviors in developed countries[6]. Earlier in the 70s, researchers already started to examine the effect of health on the labor market behaviors. For example, Luft (1975) tried to examine the effect of activity limits on LFP and unemployment. Parsons (1977) studied how self-reported health status affected individuals' annual hours of work. Bartel and Taubman (1979) investigated the impact of several specific chronic conditions on earnings.

In the past few decades, more and more articles started to focus on this issue and some of them, in particular, concentrated on the elderly group, whom are more vulnerable compared to the young and middle-aged ones. Findings from these studies are quite consistent. For instance, Chirikos and Nestel (1981) examined a group of older men between age 55 to age 69 and found a negative association between health and annual hours of work. Bound et al. (1991) focused on the respondents from the Health and Retirement Survey (HRS)[7]. They accounted the dynamic effects of health on the transitions of older workers and indicated that health is an important determinant of labor force participation decisions of the elderly. Several evidence from other OECD countries also support the significant role health played in the elderly's labor supply decisions (Cai and Kalb, 2006; Cai and Cong, 2009; Schirle, 2010).

Health could be a more concerning factor for older people in developing countries, especially

[6] See Currie and Madrian (1999) for review.
[7] Respondents are men and women born between 1931 and 1941 when the first survey was conducted in 1992.

those in the rural areas. For these individuals, work relies heavily on strength. In another word, labor supply behaviors count on health.

In contrast to the literature from developed countries, a large amount of the evidence in developing literature is from experiment or quasi-experiment (See Strauss and Thomas, 1998 for review). However, more studies utilizing household surveys are emerging. For instance, using a nationally representative data of 50-64 years old (Korean Longitudinal Study of Aging), Lee and Smith (2010) found strong evidence that depression leaded to reduced labor force participation. Benjamin et al. (2003) explored the effects of health on labor supply of the elderly in rural China and their results indicated that health only played a small observable role in explaining the declining pattern; however, it is quite significant. The role of health was further confirmed in Pang et al. (2004). By illustrating the factors that might facilitate a rural elderly's work decision, they found that individuals with moderate or severe illness were more likely to exit from the labor force. This link was also observed in Giles et al. (2011), where they showed a very pronounced effect of health status (measured by ADL) on work activities of China's rural residents.

The studies mentioned above all have different ways of measuring health. Most of the studies focused on one specific dimension of health. For instance, Luft (1975) used activity limits; Bartel and Taubman (1979) used specific diseases such as heart disease, arthritis and so on; Bound et al. (1999) used self-reported health status (SRH); Pang et al. (2004) used self-reported illness; and Giles et al. (2011) used ADL-related limits. However, health is multidimensional; focusing only on one aspect would neglect the impacts from other sides. As stated in Blau and Gilleskie (2001), no single measure of health is adequate to explain the labor supply behaviors. To address this issue, some researchers have tried to combine different indicators of health in their study, to examine the effects of health in a broader dimension. Cases are Blau and Gilleskie (2001), which included SRH, difficulties with ADLs and specific conditions; Mete and Schultz (2002), which also used SRH and ADLs; Benjamin et al. (2003), which examined SRH and BMI, though separately.

Another issue that has been addressed by many studies is the endogeneity of health. Most of the earlier literature treated health as exogenous or just estimated the association between health

and labor supply. Later studies experimented various ways to deal with the endogeneity problem. Several researchers adopted an IV approach and used exogenous/objective health variables to instrument for endogenous/subjective ones. For example, Bound et al. (1999) adopted a latent variable approach and used functional limitation variables to instrument for the SRH. They argued that the functional limitation variables are exogenous and therefore the estimates produced by this approach are consistent. In Mete and Schultz (2002), SRH and ADL limitations were instrumented by parent longevity, birthplace and childhood conditions. However, no consensus has been arrived about a valid instrument for health. Objective health measures, to a large extent, are less likely to be subject to issues such as rationalization; however, it is hard to argue that they are not correlated with individuals' labor supply behaviors. So are the instruments used in Mete and Schultz (2002). There are also several studies trying to solve the endogeneity issue by simultaneous modelling approach. For instance, Blau and Gilleskie (2001) jointly estimate a model of health with the employment transition models, allowing correlation btw the LF and health disturbances. Cai and Kalb (2006) also estimated the health equation and the labor force participation equation simultaneously.

Since it is too difficult to find a valid instrument from a cross-sectional dataset that is correlated with health, but uncorrelated with labor outcomes; we will focus on investigating the associations between health and labor supply behaviors for now. Later when the second wave of the CHARLS comes out, we will extend this study to establish a causal link between health and labor supply of the rural elderly.

# 3 Framework

To examine the role of health played in elderly's labor supply decisions, we incorporate it into the frame of the labor supply model. For simplicity, we assume the decision is made at the individual level over one period. An individual's objective therefore is to maximize his/her utility:

$$\underset{c,L,H}{Max}\ U(c, L, H; X, F, E, e_1) \tag{1}$$

subject to

$$pc = w \times L + y \tag{2}$$

where utility depends on consumption $c$, labor supply $L$, health $H$ and other covariates such as demographic and socioeconomic characteristics $X$, family and household structure $F$, community environment (infrastructure, public health environment and etc.) E and unobserved preferences $e_1$. Equation (2) is the budget constraint, where $p$ is the price of consumption, $w$ is the wage and $y$ is the non-labor income.

Following Grossman (1972), a health production function is specified as follows:

$$H = H(I, L; X, F, E, e_2) \tag{3}$$

where health depends on health inputs $I$, labor supply $L$, individual's demographic and socioeconomic characteristics $X$, family and household structure $F$, community environment $E$ and an unobserved part $e_2$.

Wage equation can also be specified as depending on health, individual characteristics, community environment and also an unobserved part $e_3$:

$$w = w(H; X, E, e_3) \tag{4}$$

Solving for the optimal labor supply choice, we can get:

$$L^s = L(H, w(H; X, E, e_3), X, F, E, p, y, e_1) \tag{5}$$

It specifies that the rural elderly residents' labor supply decisions is a function of health $H$, wage $w$, individual characteristics $X$, family background $F$, community environment $E$, real price of consumption goods $p$, non-labor income or assets $y$, as well as the individual's unobserved preferences $e_1$.

# 4 Data

## 4.1 China Health and Retirement Longitudinal Study (CHARLS) National Baseline[8]

The data used for analysis is the Chinese Health and Retirement Longitudinal Survey (CHARLS) National Baseline, which was fielded between June 2011 and March 2012. The CHARLS is a study modeled after the Health and Retirement Survey (HRS) and focuses on the elderly aged 45 and above in China. The sample in the dataset is nationally representative[9]. It covers 28 provinces, 150 counties/districts, 450 villages/urban communities, across the country. The sample was chosen through multi-stage probability sampling. First, counties/districts were grouped into eight geographic regions, and stratified by rural/urban status and by per capita county GDP. 150 counties/districts were then randomly chosen using the probability-proportional-to-size (PPS) sampling technique. The final sample of 150 counties fell within 28 provinces. Second, within each county/district, 3 primary sampling units (PSU)[10] were selected using PPS sampling. Third, after excluding collective dwellings[11], 24 households with an age eligible member were randomly chosen and assigned to interviewers. In sum, the response rate among eligible households was 80.5%[12], which is comparable with that of other HRS baseline surveys[13]. The final sample contains 17,708 individuals in around 10,029 households, among which more than 70% of the respondents are rural residents (rural hukou)[14]. Respondents are followed every two years, using a face-to-face computer-assisted personal interview (CAPI)[15].

The survey consists of an individual session, a household session and a community session. The household and individual surveys include nine modules: Demographic information; Household

[8] See Zhao et al. (2012) for details.

[9] Tibet is excluded.

[10] The lowest level of government organization is used here. For urban areas, a PSU is a neighborhood (shequ) and for rural areas, a PSU is an administrative village (cun).

[11] For example, military base, schools, nursing homes and etc..

[12] Of the 19.5% nonresponse rate, 8.8% is due to refusal to respond, 8.2% is due to the inability of interviewers to contact sample residents, and 2.0% to other reasons.

[13] For example, response rate for the HRS baseline in 1992 is 81.6%.

[14] Hukou status is classified according to individual's registration status. If his/her registration status is non-agriculture, then he/she is classified as urban residents; if his/her registration status is agriculture, then hs/she is classified as rural residents.

[15] The second wave of the CHARLS was fielded in 2013.

roster; Family; Health Status and Functioning; Health Care and Insurance; Work, Retirement and Pension; Income, Expenditures and Assets; Housing Characteristics and Interviewer Observation. In addition, there is a biomarker part. The richness of the dataset, especially the detailed information about work and retirement allows for an in-depth analysis of the labor supply of elderly in China.

Since we focus on the elderly in rural China, the sample is restricted to respondents aged 50 and above and with a rural hukou (registration). This results in 10,640 observations in which women represent about 51%.

## 4.2 Measurement of Labor Supply

**Participation**: Labor force participation measures the elderly's decisions to work. Individuals who were still working[16] at the time of the survey are considered as in the labor force. This group also includes respondents who were not working when the survey took place but was searching for new jobs during the past month[17]. Respondents who reported not working and planned to stay out of the labor force are considered as the counterpart. From the summary statistics (Table 1), it can be seen that in the sample, among rural residents who aged 50 and above, 71% are still in the labor force. Participation rate is higher for men than for women.

**Annual Hours of Work**: To measure the intensity of the elderly's labor supply, annual work hour are constructed for respondents who were in the labor force. Basically there were in total five categories of jobs: farming, employed farming, self-employed (non-farming), employed (non-farming) and family business helpers. Most of the individuals held one job; however, a very small portion of the respondents held a side job besides the main one. They can mostly often be characterized as taking farming as a main job, while doing some small business or employment work as a side job. The annual work hours[18] are calculated as the summation of all the work hours, including in

[16] Here, according to the questionnaire, work includes: 1. Engage in agricultural work (including farming, forestry, fishing, and husbandry for your own family or others) for more than 10 days in the past year; 2. Work (earn a wage, run your own business and unpaid family business work, et. al. Does not include doing own housework or doing voluntary work.) for at least one hour last week; 3. Have a job but are temporarily laid-off, or on sick or other leave, or in-job training, but expect to go back to this job at a definite time in the future or within 6 months or still receive any salary from this job.

[17] The numbers of the respondents falling into this particular group is small. In the rural sample used in the analysis, only 24 individuals reported searching for news jobs during the last month.

[18] In the questionnaire, respondents were asked "How many months did you work on [...] in the past year?", "How many days did you work in [...] per week on average during a normal work month in the past year?", and "How

main job and side jobs. The average annual work hour is around 1,162, among which exists a large gender difference. On average, men work more than 1,400 hours per year, while women work less than 1,000 hours annually.

**Annual Hours of Work in Agriculture-related Activities**: We include another variable measuring the annual work hours in agriculture-related jobs. 80% of the individuals are to some extent engaged in farming. Hours spent in the agriculture jobs are more flexible especially compared to the employed ones. Therefore, this variable may better reflect the respondents' own labor supply decisions. In addition, agriculture jobs mostly involve strenuous laboring, which makes health a more important concerning factor. Thus it may unveil the relationship between health status and respondents' labor supply decisions in a better and cleaner way. The average annual hour spent in agriculture is 830 and the pattern across age groups is similar to the previous work hour measure.

### 4.3 Measurement of Health

The concept of health is multidimensional, which makes it remarkably hard to measure. When evaluating its impact on labor supply decisions, health is more likely to be interpreted as "work capacity". Currie and Madrian (1999)[19] summarized eight categories of the types of measures in this literature: (1) self-reported health status; (2) whether there are health limitations on the ability to work; (3) whether there are other functional limitations such as ADLs problems; (4) the presence of chronic and acute conditions; (5) the utilization of medical care; (6) clinical assessments of such things as mental health or alcoholism; (7) nutritional status; and (8) expected or future mortality. Each indicator has its own advantage as well as limitations. For example, several studies suggested that SRH is the best single measure of health since it is correlated with medically determined health status; however, SRH may suffer from reporting bias[20]. Height, as an aspect of health, is easy to measure. But it may not be closely related to elderly labor supply. In addition, different dimensions

many hours did you usually work in [...] per day during a normal work day in the past year?". We constructed the annual work hours for each job and then add them together if he/she has more than one job.

[19] They also mentioned in this review that, studies of developing countries usually focus on more subjective measures such as nutritional status, ADLs and so on. On the contrary, studies of developed countries are more likely focusing on self-rated health status.

[20] However, as mentioned in Bound (1991), measurement error in SRH biases the coefficient on health downwards, but the endogeneity of SRH may bias the estimated effect upwards. Therefore, these two biases may cancel out, resulting SRH a good measure than more objective ones.

of health reflect different kinds of information, which may have different impacts on an individual's labor supply decisions. For instance, SRH might be an overall assessment of the individual's work capacity, while ADLs is a reflection of a respondent's physical functioning ability. Stature may mirror an individual's childhood nutritional status that affects subsequent labor market outcomes, while depressive symptoms reflect one's psychological welfare which may affect work absence and productivity. Because of this multidimensionality, Strauss and Thomas (1998) argued that it is useful to examine several indicators simultaneously. Therefore, in the following analysis, we include five dimensions of health (eight different measures) investigate how these different aspects affect elderly's labor supply behaviors.

**SRH**: In the dataset, the general self-reported health status is rated on a scale of 5: 1=very good, 2=good, 3=fair, 4= poor, 5=very poor. A binary self-reported health measure is condensed as =1 if reported poor or very poor health; =0 if reported fair, good or very good health. Since health may change dynamically and health status in the past may also affect respondents' current labor supply behaviors (Bound et al. 1999), an indicator of childhood health is also included. In the questionnaire, there is a retrospective question asking the respondents to evaluate their health during childhood up to and including age 15 on a scale of 5. Similar to current SRH, we condensed it to a binary measure which =1 if reported fair or poor, =0 if reported excellent, very good or good. In our sample, 33% of the respondents reported poor health. This percentage is higher for women of whom 37% rated their health as poor or very poor. Self-evaluated childhood health is similar across gender. Around 26% of the respondents reported having poor health when they were young.

**Stature**: In the previous literature which used anthropometric measurements as health indicators, height was always the first choice. However, height of the older individuals is contaminated by height shrinkage from ageing[21]. To tackle this problem, researchers have been using limb length to predict pre-shrinkage height (Chumlea et al., 1985; Myers et al., 1994; Zhang et al., 1998; Huang et al. 2013). Since limb length is positively correlated with attained adult height and it does not shrink as people age, in our study, we use the lower leg length instead of the measured height for

[21] For instance, osteoporosis is a health condition that influence shrinkage directly and through many of these other proximate causes (Huang et al. 2013).

the analysis. From the summary, the average leg length is about 48 centimeters, with men's longer than women's.

**Physical Functioning**: We have two physical functioning-related measures: disability and pain. The disability measure is constructed according to individual's ability to perform ADLs/IADLs-related tasks[22]. Respondents are defined as disabled if they cannot do at least one of those tasks. Also respondents who have great difficulty and need help from others in performing the tasks are also considered as disabled. According to this definition, 33% of the individuals are disabled. Another physical functioning measure, pain, is defined as =1 if the subject suffers from moderate or severe body pains, =0 if he/she is not troubled by body pains or only felt a mild pain. For both measures, the percentage of incidence for women is around 10 percentage points higher than for men.

**Mental Health**: We use CESD (0-30) as an indicator of individual's mental health. In the questionnaire, there is a ten question version of the Center for Epidemiologic Studies Depression Scale (CES-D)[23] which is used to evaluate respondents' depressive symptoms. Respondents were asked to rate how they have felt and behaved during the past week on a scale of 4: rarely or none of the time (<1 day), some or little of the time (1-2 days), occasionally or a moderate amount of the time (3-4 days) or most or all of the time (5-7 days). Following Radloff (1977), CES-D scores (0-30) are constructed as follows: for each negative symptom, if the respondent chooses rarely, then value 0 is assigned; if she/he chooses most or all of the time, then value 3 is assigned. For positive symptoms, the pattern is reversed. The CESD scores range from 0-30 with higher scores representing severer depressive symptoms. Summary statistics suggest that on average, women are more depressed than men.

**Longevity of Parents**: two variables are constructed here: whether the respondent has a living biological father and whether the respondent has a living biological mother. Since the respondents

[22]Difficulties which are expected to last less than three months are excluded. In the health status module, respondents were asked the following questions: DB010-DB015. Because of health and memory problems, do you have any difficulty with dressing, bathing or showering, eating, getting into or out of bed, using the toilet, and controlling urination and defecation? DB016-DB020. Do you have any difficulty with doing household chores, preparing hot meals, shopping for groceries, managing your money and taking medications?

[23]CES-D questions in the questionnaire are as follows: DC009 I was bothered by things that don't usually bother me; DC010 I had trouble keeping my mind on what I was doing; DC011 I felt depressed. DC012 I felt everything I did was an effort; DC013 I felt hopeful about the future; DC014 I felt fearful; DC015 My sleep was restless; DC016 I was happy; DC017 I felt lonely. DC018 I could not get going.

in our sample are all aged 50 and above, the age range of their parents should be around 70 and higher. Needless to say, it is a positive indicator of health if individuals have lived to these ages. If there is intergenerational transmission between parental health and their older adult children's health, then this healthiness of the parents might have been passed on to the next generation. In another word, the parents' living status might to some extent help to control for the genetics-related health aspects that cannot be observed. The sample shows that among the parents of the elderly respondents, mothers are much more likely to outlive fathers. And the possibility of having a living father or mother is almost the same for both men and women.

### 4.4 Covariates

We also include a set of individual characteristics. 1-year interval age dummies are used to better capture the age gradient. Since rural elderly on average have low educational attainments, three educational groups are constructed: illiterate (reference group), have some primary education have some secondary education. Summary statistics show that 38% of the respondents are illiterate, and only 19% have attended secondary schools. One thing to notice is that, there exists a large difference between men and women. Among men, 19% are illiterate. However, for women it is 55%. A binary marital status variable is included in which =1 if married or currently live together, =0 otherwise[24]. It is obvious to note the percentage of married men is higher than married women. One possibility might be that women outlive men.

It is natural to expect that the family and household structure may affect elderly's labor supply decisions directly. For instance, if an old farmer has several adult sons, then he/she may not need to stay in the labor force since the sons might help take care of the agriculture work. Therefore, a set of variables are included to account for the potential impacts. *# of HH Adult Males* is number of men over 25 years old that are counted as household members[25]. Similarly *# of HH Adult Females*

[24]The counterpart includes never married, separated, divorced and widowed.

[25]Household member in the CHARLS is defined as: people who lived with this household for more than six months in the past year (including those who attend school or work away from home but return to this home almost every week, not including non-family members who live here for school or work reasons but generally return to their own home every week. Nannies are included. People who recently left this home because they got married to a member outside the household and moved out, or people who recently divorced a member and then moved out are not included.).

is number of household women over 25 years old. *# of Adult Sons*[26] and *# of Adult Daughters* characterize the number of sons and daughters over 25 years old respectively in this family, while *# of Young Sons* and *# of Young Daughters* indicate the number of sons and daughters between age 15-25 accordingly. Grandchildren might also be a concern for some of the elderly in our sample when they decide whether or not to spend more time taking care of the grandkids. It would be ideal if we can differentiate grandkids that are of the age that must be taken care of (for example, under 6 years old) and grandkids that are older. However, due to the limited information on the ages of the grandkids in the dataset, we only include a variable accounting for the number of grandkids in the family. In addition, *# of Male Siblings* and *# of Female Siblings* are controlled for to examine the sharing of responsibilities among family members and whether it has any effects on the elderly's labor supply.

In addition to the demographic variables and family/household characteristics, economic variables may have important effects on labor supply decisions. Individuals with high incomes may not need to be working when they become old; while individuals with low incomes may have to work as long as they can to support themselves. Since in developing countries, expenditure can be measured with less noise and provides a better measure of welfare than income, log per capital household expenditure (log PCE) is used in the analysis (Strauss and Thomas, 1995).

# 5 Empirical Strategy

As specified earlier, the rural elderly residents' labor supply decisions is a function of health $H$, wage $w$, individual characteristics $X$, family background $F$, community environment $E$, real price of consumption goods $p$, non-labor income or assets $y$, as well as the individual's unobserved preferences $e_1$. However, one limitation here, as well as in most of the developing countries is that, wages may not be observable, especially in rural areas where a majority of the individuals work on their own farms and do not earn "wage". Therefore, we substitute the wage equation (4) into (5), and the labor supply equation becomes:

[26] For this set of measures, we only account for individuals that are alive at the time of the survey.

$$L^s = L(H, X, F, E, p, y, e_1, e_3) \tag{6}$$

The empirical equation of this labor supply function could be written as follows:

$$L^s_{ij} = \beta_0 + \beta_1 * H_{ij} + \beta_2 * X_{ij} + \beta_3 * F_{ij} + \beta_4 * y_{ij} + E_j + \varepsilon_{ij} \tag{7}$$

where$i$ stands for individual and $j$ stands for community.

As mentioned above, two sets of variables are used to characterize elderly's labor supply behaviors: labor force participation and hours of work. In the previous literature, the labor force participation decision and the work hour decision are usually considered separately. Standard univariate Tobit model has traditionally been applied to account for the censoring at zero of work hours. However, one limitation of the application of the Tobit model is that it assumes the same stochastic process for the continuous work hours and the discrete switch at zero. Since zero work hour of an individual might result from unemployment as well as voluntary retirement from the labor force, Blundell and Meghir (1987) proposed to relax this assumption and allow for distinct processes determining the 0-1 choice and the continuous work hours. In the model they depicted, the same factors could have dissimilar effects on the two different decisions. Following their work, we apply a bivariate alternative to the Tobit model distinguishing the two processes. Let $L^*_2$ denote the hours of work and $L^*_1$ be a latent variable determining the participation process.

Participation equation:

$$L_1 = \begin{cases} 1 \quad if \;\; L^*_1 > 0 \\ \\ 0 \quad if \;\; L^*_1 \leq 0 \end{cases} \tag{8}$$

The individual chooses to be in the labor force if the latent variable $L^*_1$ is greater than zero. If $L^*_1$ is lower or equal to zero, then this individual is supposed to be out of the labor force.

Outcome equation:

$$L_2 = \begin{cases} L_2^* & if \;\; L_1^* > 0 \\ \\ 0 & if \;\; L_1^* \leq 0 \end{cases} \tag{9}$$

If the individual is in the labor force, then hours of work is observed. Otherwise, it is assumed to be missing and no one can observe that.

The empirical specification thus can be written as follows:

$$L_{1ij}^* = \alpha_0 + \alpha_1 * H_{ij} + \alpha_2 * X_{ij} + \alpha_3 * F_{ij} + \alpha_4 * y_{ij} + E_j + v_{ij}^1 \tag{10}$$

$$L_{2ij}^* = \beta_0 + \beta_1 * H_{ij} + \beta_2 * X_{ij} + \beta_3 * F_{ij} + \beta_4 * y_{ij} + E_j + v_{ij}^2 \tag{11}$$

We assume that the error terms are joint normally distributed and homoskedastic,

$$\begin{pmatrix} v_{ij}^1 \\ \\ v_{ij}^2 \end{pmatrix} \sim N \begin{pmatrix} 0 & 1 & \sigma_{12} \\ , & & \\ 0 & \sigma_{21} & \sigma_2^2 \end{pmatrix} \tag{12}$$

The likelihood function of the model is given by:

$$\mathcal{L} = \prod_{i=1}^{n} \prod_{j=1}^{m} \left\{ \Pr \left[ L_{1ij}^* \leq 0 \right] \right\}^{1 - L_{1ij}} \left\{ f \left( L_{2ij} \mid L_{1ij}^* > 0 \right) * \Pr \left[ L_{1ij}^* > 0 \right] \right\}^{L_{1ij}} \tag{13}$$

**Endogeneity Issue**: so far we have assumed that health can be truly measured. However, this is not the case in reality. All the health indicators used in the analysis are, to some degree, suffer from random or/and systematic measurement error (See Strauss and Thomas, 1998). For instance, there might be reporting bias in the SRH measure, since no metric has been established for individuals to compare their health to. In addition, the way individuals evaluated their health might be systematically correlated with their educational levels, family backgrounds, incomes and perhaps labor supply behaviors. Similarly, it is normal to assume that an individual's depressive symptoms are affected by his/her socioeconomic characteristics. More objective measures such as disability and lower leg length are less likely to suffer from systematic measurement errors; however,

they may still be contaminated by the random ones.

Many studies have attempted to deal with this endogeneity and measurement error problem by instrumenting health measures (Bound et al., 1999; Blau and Gilleskie, 2001; Mete and Schultz, 2002; Lee and Smith, 2010). However, it is difficult to find convincing instruments that are correlated with health but uncorrelated with labor supply behaviors. Some researchers use objective health indicators to instrument for the subjective health measures; however, if the measurement errors are systematically correlated with other variables, their coefficients will be biased as well.

One thing mentioned by Bound (1991) is that, on the one hand measurement errors in health measures are likely to bias the health effects towards zero, on another hand endogeneity of health indicators might exaggerate the impact of health, therefore these two effects may cancel out.

Thus, in the following analysis, we include eight different health measures trying to capture the differentiate impact of different dimensions of health without particularly dealing with the potential endogeneity issue. When the second wave of the survey comes out, we will come back and deal with this issue then. In this paper, we will only consider about the pattern of association between health and individual's labor supply decisions.

# 6 Results

## 6.1 Simultaneous Decision of LFP and Hours of Work

Table 2 presents the results estimating participation decision and work hour decisions for men simultaneously. We have six sets of regressions. Within each set, first column presents the workhour results and the second column presents the labor force participation results. Only health indicators and demographic characteristics are included. Different dimensions of health are added sequentially in order to investigate their variant effects. All the specification contains a fixed community effects and all the standard errors are clustered at the community level. As is consistent with Blau et al. (1997), the largest effects come from the SRH and physical functioning. The association between poor SRH and LFP is negative and significant. So is the link between poor SRH and hours of work.

Disability, however, only reduces individual's labor force participation. Once they decide to stay in the labor force, it does not have much effect on how many hours they work. One possibility might be that for these individuals, their disability are not severe enough to stop them from working at this age. It is also possible that people select into certain jobs that do not require these abilities. We also find a small positive effect from leg length. It seems that men with longer legs are more likely to keep working at old ages. There are some evidence that men who reported moderate or severe pains and those with depressive symptoms work fewer hours and are more likely to leave the labor force. However, these correlations are not statistically significant. There are some interesting correlations between living parents and men's labor supply behaviors. Men are more likely to work if their parents are still alive. However, they would spend less time working. It is possible that men have to stay working in order to support the family, especially their old parents. Meanwhile, they may have to sacrifice some of their work time to take care of their old parents as well. For the other covariates, marriage consistently has a positive and significant effect on participation and hours of work, while education does not seem to play an important role in both decisions. It is not difficult to note that the same health factors have differential effects on participation and hours of work when these two decisions are considered simultaneously. Health plays an important role when individuals choose whether to stay or leave the labor force, with coefficients before the health measures are individually and jointly significant. However, health does not seem quite essential when evaluating its impact on hours of work. Only people with poor SRH tend to work fewer hours and the joint test of all the health indicators shows non-significance.

Results for female are presented in Table 3. Similarly, poor SRH and disability are strongly negatively correlated with women's labor force participation; though the associations are slightly weaker compared to men. Negative correlation has also been found between poor SRH and annual hours of work. In addition, it is shown that a positive association exists between depressive symptoms and work hours; however, this could result from a reserve relationship in which respondents who work longer hours tend to be more depressed. Moreover, a positive correlation is shown between the retrospective childhood SRH (poor) and work hours. It is widely acknowledged that poor childhood

health is likely to result in adverse adult outcomes. However, the coefficients show that women who reported poor childhood health work longer hours. One possible explanation is that female respondents did suffer from poor childhood health; therefore they have to work longer hours at old ages in order to compensate the loss.

Since the majority of people in the sample are to some degree involved in farming, We also examine the effects of health on agriculture-related activities by estimating the farming participation and hours of farm work simultaneously. Table 4 and Table 5 show regression results for men and women respectively. Aligned with the results in Table 2 and Table 3, poor SRH and disability indicator reduce individual's participations in farming. However, it seems that SRH no longer has any impact on hours of farm work. One possibility might be that farming is strenuous and individuals select into farming based on their health status. People with poor health or disability may stay out of farming. It might also be that individuals who stick with farming are those with the lowest educational attainments or skills. They have no choice but to work on the farm and cannot take the risk of resting even if their health status deteriorates. The depression indicators; however, is positively correlated with hours of work in farming. Nevertheless, this might be due to the fact that individuals who work longer hours on the farm are more depressed than others. Unlike in annual hour results where education does not seem to play a role, it consistently has a strong effect on the labor supply decisions of agriculture-related activities, especially for men. One thing to notice is that, some primary education does not make a big difference; the effect mainly comes from individuals with at least some secondary education.

## 6.2 Family and Household Structures

So far, we have only controlled for individual characteristics and community fixed effects. However, as discussed in some of the literature, household and family characteristics might also affect the older adults' labor supply decisions. Therefore, in this part, we will include family/household composition and household expenditure to investigate their effects and whether including them will change the impact from health. Table 6 shows the regression results from three set of specifications for men

(column 1-6) and women (column 7-12). Similarly, within each set, first column presents the work hour results and the second column presents the participation results. In the first specification, we include log per capita household expenditure, number of adult males in the household, number of adult females in the household, number of adult sons, number of young sons, number of adult daughters and number of young daughters. For the second the third specifications, we gradually add number of grandkids and number of male/female siblings. For both men and women, it can be seen that effects from poor SRH and disability on participation decision remain strong and consistent.

Regarding the family composition, one traditional thought in the context of developing countries is that individuals with more adult sons can retire earlier since they can rely on their sons for the old-age support. However, this situation seems to have changed according to our results. We do not see much effect of having adult sons in the family; on the contrary, the largest impact of the family structure comes from the young sons. Both men and women are more likely to stay in the labor force if they have non-adult sons. Men would work longer hours if they have more non-adult sons in their families. One possible explanation is that parents have to keep working to invest in their non-adult sons' high school/vocational school/college education. And this could be one kind of survival strategy to ensure their retirement in the near future once their non-adult sons start to work and support them (Pang et al., 20004). It is also found that men in a household with more adult females have longer hours of work, which could be the case that the elderly household male head have undertaken the main responsibility to provide for the whole family.

The presence of a grand child might also be a concern when the elderly make his labor supply decisions. If the respondent has a very young grand kid, for instance, less than 6 years old; he may need to help take care of the grand kid when the kid's parents are out working. In this case, we may expect the respondent to spend more time at home, either by reducing their hours of work or leave the labor force if necessary. However, due to the limitation of the data, we can only observe the number of grand children in this family, but cannot differentiate whether they are young enough to be needed taken care of. Results in column 4 and column 6 show a small negative association between the number of grand kids and grandfathers' labor supply (both participation and hours of

work); however, it is not statistically significant. The association between the grandchildren and the grandmothers' labor force participation from column 10 and column 12; on the contrary, is negative and significant. It seems that individuals, especially rural females are more likely to exit the labor force once they have grandkids, perhaps to help take care of the grandkids when their parents are out working, which is common in rural China nowadays.

Another important factor in the family structure is the siblings. If an elderly's parents are still alive, having a sibling, especially a male sibling, may help alleviate his burden of work, since the sibling could share the responsibility to support their parents. However, on the other hand, siblings might also be the ones that needed support. Evidence from the analysis is mixed and it is difficult to distinguish the various channels.

Results (Table 7) examining hours of work in farming are similar when further controlling for household and family compositions. Impacts from health on participation continue to be the strongest, so as marital status and education. Regarding the household/family composition, the number of adult females and young sons is associated with more hours of work on the farm for men. As for women, they are more likely to stay working if they have non-adult sons in the family. In addition, the number of grandchildren significantly reduces women's participation in agriculture works.

### 6.3 Household Economic Resources

At the beginning of the analysis, it is shown that Chinese rural elderly usually keep working until they are too old to work. One possible reason is that they cannot afford to retire at an earlier age. If this is true, then it is normal to expect that individuals with high incomes may tend to work less or leave the labor force early when they grow old. We try to examine this by including a household economic measure into the analysis. The most direct way would be measurement of household income; however, due to the noise in the income measure in developing countries, an indicator of expenditure has been used instead.

Results (Table 6) from all the three specifications show consistent negative effects of log PCE

on labor force participation, though these effects are quite small compared to the coefficients before poor SRH and disability indicator. No significant effect has been found on hours of work for men; however, it is positive and significant for women. This might be due to the reverse relationship. For those who keep working at old ages, working longer hours may lead to higher income and expenditure.

Participation in farming-related jobs seems to be quite responsive to PCE. And the higher PCE they have, the fewer hours men would spend on farming; though this effect is not statistically significant.

### 6.4 Interactions between Health and Wealth

In addition to the household per capita expenditure mentioned above, household wealth may also play a role in rural elderly's labor supply decisions and may further interact with health. On the one hand, having more household wealth may facilitate retirement when their health deteriorates. On the other hand, more household wealth may work in a way just like household expenditure and mitigate the links between health and labor supply. For instance, if a rural elderly has enough wealth, then having a disability might not be such a constraint to him/her. Perhaps he/she could operate a small business which involves very little manual laboring. However, for a rural elderly with little wealth, he/she may not have other choices but to work on the farm, where having a disability will significantly affect their ability to work.

To examine whether there exist differentiated effects of health on labor supply for individuals with different levels of per capita wealth (PCW), several interactions between health indicators and demeaned PCW have been constructed. Results including these interactions for men and women are presented in Table 8 and Table 9 respectively.

It can been seen that the associations between health indicators and participation decision do not change much. When it comes to the interactions, the coefficients are neither individually nor jointly significant if we focus on general participation for men. However, when examining their' decisions of whether involved in farming, it is found that in general wealth mitigates the links between health

and participation decision. For example, originally men with poor SRH are more likely to exit from farming-related jobs; however, with an above average PCW, poor SRH is less of a constraint to them. Similarly, disability becomes a less restrictive issue for people with more wealth. Joint test of the interactions between health and PCW are significant for men regarding their agriculture-related activities, which indicate that the associations between health and hours of work in agriculture-related jobs are also, to some extent, weakened by wealth. Similar differentiated health effects have also been detected on both participation and annual work hours for women.

# 7 Conclusions and Discussions

The main purpose of the paper is to evaluate the role of health in rural elderly's labor supply decisions, which has not been explored much in the context of developing countries, especially China. Thanks to the richness of the CHARLS, this study is able to utilize a broad dimensions of health measures and examine their differentiated associations with labor force participation and hours of work.

Unlike the previous studies that either focus on participation or labor market outcomes, we fit a model to estimate the participation decision and hours of work simultaneously. The findings suggest that health, in particular SRH and disability, are negatively associated with elderly's general participation as well as participation in agriculture-related activities. Stature (measured as leg length in the analysis) is also an influencing factor for male respondents in general labor force participation decisions. We also find a negative and significant association between SRH and annual work hours for both men and women. These correlations persist when all the covariates such as individual's socioeconomic status, household/family compositions and household economic resources are controlled for. These links, however, are to some degree, mitigated by household wealth. It seems that for individuals with more PCW, health is less of a constraint.

In addition to the effects from health, the results indicate that education and marital status are both important in individuals' labor supply decisions. Specifically, individuals with some primary level education do not seem to gain an advantage over those who are illiterate. However, respondents

with at least some secondary education significantly work less on the farm or are more likely to stay out of farming than those with lower educational attainments. A positive and significant association between being married and labor supply can be found throughout the various specifications.

Another impact that should not be neglected is from family/household. With more non-adult sons in the family, men are not only more likely to stay in the labor force, but also work longer hours. For women, effects from family are much more pronounced. Results suggest that women are significantly more likely to stay working once they have young sons in their families. Furthermore, they tend to leave the labor force if they have grandchild.

One thing need to be noticed is that all the associations that have been examined so far are not causal. The endogeneity of health must be accounted for before any causal relationship can be established. However, no consensus has been arrived about a valid instrument for health. Hopefully when the second wave of the CHARLS comes out, we will be able to account for this endogeneity problem then.

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# Appendix

**Figure 1**

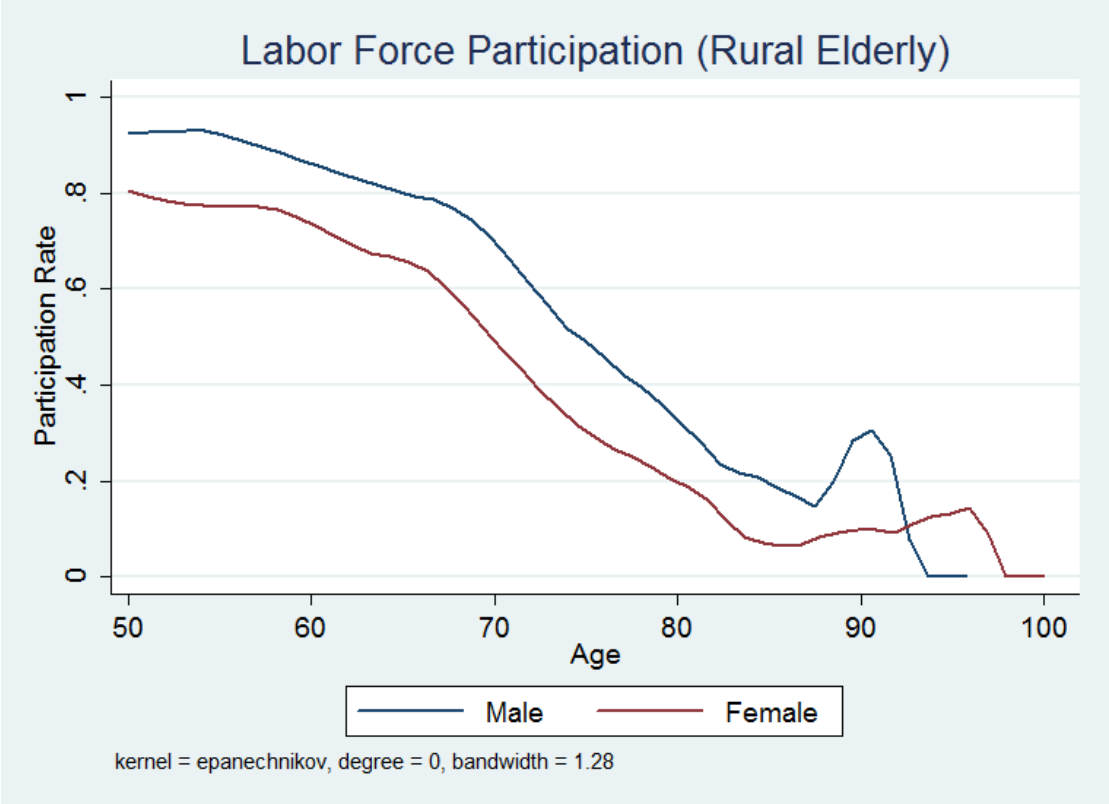


**Figure 2**

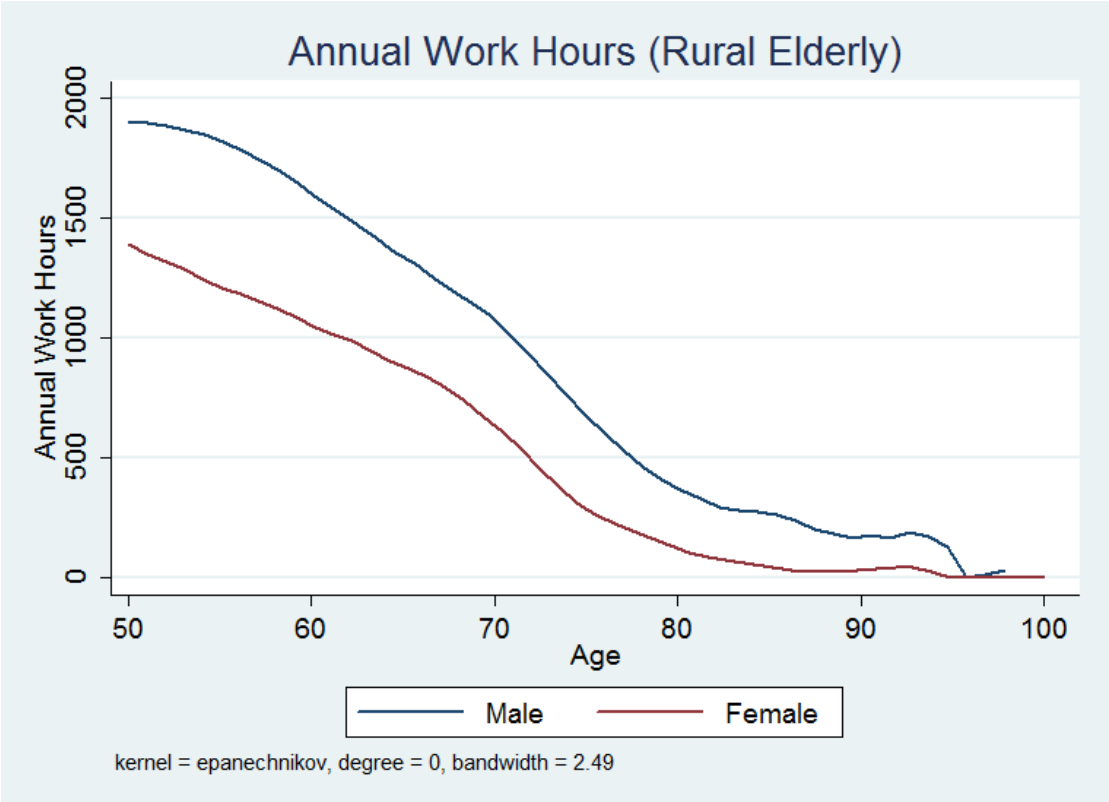

**Figure 3**

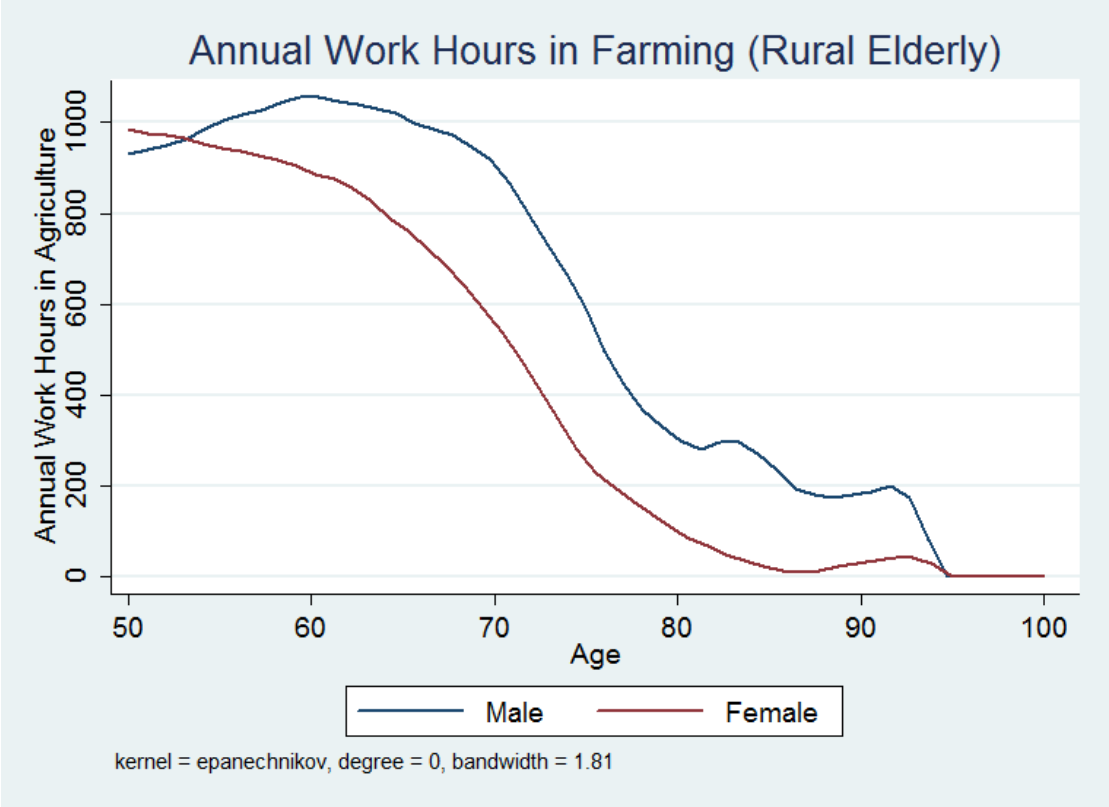
Annual Work Hours in Farming (Rural Elderly)
Annual Work Hours in Agriculture
0
200
400
600
800
1000
50
60
70
80
90
100
Age
Male
Female
kernel = epanechnikov, degree = 0, bandwidth = 1.81

**Table 1. Summary Statistics**

| **Panel A** | | **Total** | | **Male** | | **Female** | |
|---|---|---|---|---|---|---|---|
| | | **Obs** | **Mean** | **Obs** | **Mean** | **Obs** | **Mean** |
| ***Labor Supply*** | | | | | | | |
| | **Labor Force Participation** | 10551 | 0.71 | 5114 | 0.79 | 5428 | 0.64 |
| | **Annual Work Hours** | 9304 | 1162.57 | 4460 | 1422.59 | 4836 | 922.72 |
| | **Conditional Annual Work Hours** | 6228 | 1736.76 | 3374 | 1880.49 | 2847 | 1567.36 |
| | **Annual Work Hours (Agriculture)** | 9517 | 830.42 | 4610 | 918.25 | 4899 | 747.76 |
| | **Conditional Annual Work Hours (Agriculture)** | 5579 | 1416.58 | 2940 | 1439.85 | 2633 | 1391.30 |
| **Panel B** | | **Total** | | **Male** | | **Female** | |
| | | **Obs** | **Mean** | **Obs** | **Mean** | **Obs** | **Mean** |
| ***Health Measures*** | | | | | | | |
| | **Leg Length** | 8731 | 47.73 | 4167 | 49.60 | 4558 | 46.03 |
| | **Childhood Health: Poor** | 10379 | 0.26 | 5030 | 0.25 | 5340 | 0.27 |
| | **Self-reported Health: Poor** | 10579 | 0.33 | 5129 | 0.28 | 5441 | 0.37 |
| | **Disability** | 10447 | 0.33 | 5078 | 0.27 | 5360 | 0.39 |
| | **Pain** | 10543 | 0.28 | 5115 | 0.23 | 5419 | 0.33 |
| | **Depressive Symptoms** | 9722 | 8.46 | 4625 | 7.46 | 5090 | 9.37 |
| | **Father Alive** | 10538 | 0.09 | 5103 | 0.09 | 5427 | 0.09 |
| | **Mother Alive** | 10548 | 0.19 | 5111 | 0.18 | 5429 | 0.19 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Demographic & Socioeconomic Characteristics*** | | | | | | | |
| | **Age** | 10638 | 62.28 | 5156 | 62.16 | 5473 | 62.40 |
| | **Educ_Illiterate** | 10640 | 0.38 | 5157 | 0.19 | 5474 | 0.55 |
| | **Educ_Primary** | 10640 | 0.43 | 5157 | 0.53 | 5474 | 0.34 |
| | **Educ_Secondary** | 10640 | 0.19 | 5157 | 0.29 | 5474 | 0.10 |
| | **Married** | 10518 | 0.85 | 5044 | 0.90 | 5465 | 0.81 |
| | **log PCE** | 10515 | 8.30 | 5105 | 8.32 | 5401 | 8.29 |
| ***HH Structure*** | | | | | | | |
| | **# of HH Adult Males (>25 yrs)** | 10634 | 0.53 | 5153 | 0.50 | 5472 | 0.55 |
| | **# of HH Adult Females (>25 yrs)** | 10634 | 0.44 | 5153 | 0.42 | 5472 | 0.46 |
| | **# of Adult Sons (>25 yrs)** | 10627 | 1.47 | 5147 | 1.37 | 5471 | 1.57 |
| | **# of Young Sons (15-25 yrs)** | 10627 | 0.11 | 5147 | 0.14 | 5471 | 0.09 |
| | **# of Adult Daughters (>25 yrs)** | 10627 | 1.27 | 5147 | 1.19 | 5471 | 1.35 |
| | **# of Young Daughters (15-25 yrs)** | 10627 | 0.12 | 5147 | 0.14 | 5471 | 0.10 |
| | **# of Grandchildren** | 10634 | 4.20 | 5153 | 3.82 | 5472 | 4.57 |
| | **# of Male Siblings** | 10541 | 1.55 | 5116 | 1.49 | 5416 | 1.60 |
| | **# of Female Siblings** | 10541 | 1.48 | 5116 | 1.47 | 5416 | 1.49 |

**Note:** The age range here is above 50.

**Table 2. Health and Simultaneous Labor Supply Decisions (Male)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** |
| **Leg Length** | | | 4.923 | 0.020* | | | 3.559 | 0.024* | 5.255 | 0.022* | 5.913 | 0.022* |
| | | | [8.8255] | [0.0113] | | | [8.8216] | [0.0123] | [8.7974] | [0.0124] | [8.9529] | [0.0125] |
| **Childhood Health: Poor** | | | 18.935 | 0.002 | 9.288 | 0.013 | 8.623 | 0.032 | 16.944 | 0.034 | 8.399 | 0.053 |
| | | | [53.9565] | [0.0834] | [49.7032] | [0.0786] | [54.2243] | [0.0911] | [53.9779] | [0.0914] | [53.9928] | [0.0922] |
| **SRH: Poor** | | | | | -118.929** | -0.831*** | -98.594* | -0.653*** | -92.996 | -0.625*** | -101.527* | -0.645*** |
| | | | | | [53.7704] | [0.0705] | [58.2183] | [0.0849] | [59.8441] | [0.0877] | [60.5256] | [0.0883] |
| **Disability** | | | | | | | -16.112 | -0.621*** | -23.860 | -0.579*** | -23.407 | -0.573*** |
| | | | | | | | [68.3111] | [0.0896] | [68.9785] | [0.0907] | [68.7306] | [0.0918] |
| **Pain** | | | | | | | -51.484 | -0.016 | -58.279 | -0.028 | -61.938 | -0.012 |
| | | | | | | | [59.6763] | [0.0976] | [60.6620] | [0.0988] | [60.7286] | [0.0999] |
| **Depressive Symptoms** | | | | | | | | | -2.842 | -0.003 | -2.759 | -0.002 |
| | | | | | | | | | [5.0139] | [0.0077] | [5.0242] | [0.0078] |
| **Father Alive** | | | | | | | | | | | -59.978 | 0.215 |
| | | | | | | | | | | | [87.1646] | [0.1598] |
| **Mother Alive** | | | | | | | | | | | -55.658 | 0.015 |
| | | | | | | | | | | | [67.4134] | [0.1136] |
| **Educ_primary** | -107.781 | 0.119 | -100.800 | 0.117 | -102.355 | 0.068 | -110.153 | 0.032 | -109.788 | 0.033 | -105.287 | 0.019 |
| | [68.0992] | [0.0843] | [71.9080] | [0.0933] | [68.9268] | [0.0912] | [71.8612] | [0.0988] | [72.0888] | [0.1003] | [72.3679] | [0.0994] |
| **Educ_secondary** | -66.329 | 0.017 | -79.640 | -0.022 | -81.398 | -0.086 | -102.341 | -0.140 | -105.147 | -0.135 | -97.333 | -0.158 |
| | [82.3664] | [0.1033] | [87.6421] | [0.1209] | [82.7779] | [0.1105] | [88.7070] | [0.1287] | [88.7578] | [0.1317] | [88.5444] | [0.1307] |
| **Married** | 302.834*** | 0.523*** | 276.623*** | 0.506*** | 269.546*** | 0.553*** | 260.699*** | 0.475*** | 273.302*** | 0.472*** | 279.427*** | 0.479*** |
| | [84.7949] | [0.0979] | [87.4657] | [0.1067] | [86.1579] | [0.1008] | [87.5614] | [0.1121] | [89.6370] | [0.1165] | [90.0137] | [0.1181] |
| **Age Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Community Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Observations** | 4,356 | 4,356 | 3,575 | 3,575 | 4,279 | 4,279 | 3,547 | 3,547 | 3,499 | 3,499 | 3,466 | 3,466 |
| **rho** | -0.280 | -0.280 | -0.320 | -0.320 | -0.270 | -0.270 | -0.410 | -0.410 | -0.400 | -0.400 | -0.390 | -0.390 |
| **F_stat (health)** | | | 1.730 | 0.170 | 1.050 | 67.430 | 1.700 | 83.830 | 7.250 | 76.350 | 9.060 | 79.110 |
| **P_value (health)** | | | 0.420 | 0.920 | 0.592 | 0.000 | 0.889 | 0.000 | 0.298 | 0.000 | 0.337 | 0.000 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Rho represents the correlation between participation equation and work hour equation.

**Table 3. Health and Simultaneous Labor Supply Decisions (Female)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** |
| **Leg Length** | | | 5.499 | -0.006 | | | 6.000 | -0.001 | 6.325 | -0.002 | 6.504 | -0.001 |
| | | | [7.6137] | [0.0093] | | | [7.5620] | [0.0097] | [7.6101] | [0.0098] | [7.6231] | [0.0098] |
| **Childhood Health: Poor** | | | 96.745* | 0.027 | 70.002 | 0.052 | 94.618* | 0.058 | 86.342* | 0.066 | 91.795* | 0.072 |
| | | | [50.3803] | [0.0675] | [49.2446] | [0.0593] | [50.4044] | [0.0692] | [50.7245] | [0.0711] | [51.7541] | [0.0711] |
| **SRH: Poor** | | | | | -73.978 | -0.590*** | -70.356 | -0.488*** | -90.190* | -0.478*** | -84.542 | -0.472*** |
| | | | | | [51.4108] | [0.0518] | [54.0139] | [0.0634] | [53.4960] | [0.0652] | [53.4887] | [0.0653] |
| **Disability** | | | | | | | 18.308 | -0.285*** | -0.160 | -0.287*** | -6.002 | -0.296*** |
| | | | | | | | [55.3222] | [0.0659] | [56.3154] | [0.0682] | [57.1269] | [0.0687] |
| **Pain** | | | | | | | 14.766 | -0.042 | -16.374 | -0.031 | -10.858 | -0.027 |
| | | | | | | | [47.8710] | [0.0718] | [50.5521] | [0.0759] | [50.6931] | [0.0755] |
| **Depressive Symptoms** | | | | | | | | | 8.392* | -0.002 | 7.799* | -0.003 |
| | | | | | | | | | [4.3578] | [0.0060] | [4.4012] | [0.0060] |
| **Father Alive** | | | | | | | | | | | 20.043 | -0.094 |
| | | | | | | | | | | | [71.5019] | [0.1024] |
| **Mother Alive** | | | | | | | | | | | 77.486 | 0.052 |
| | | | | | | | | | | | [56.4188] | [0.0945] |
| **Educ_primary** | 4.069 | 0.029 | 14.893 | -0.031 | 17.692 | 0.015 | 21.394 | -0.053 | 24.511 | -0.066 | 23.275 | -0.074 |
| | [44.9963] | [0.0598] | [46.0207] | [0.0656] | [44.3954] | [0.0615] | [46.1734] | [0.0666] | [46.0573] | [0.0664] | [46.1177] | [0.0662] |
| **Educ_secondary** | 35.657 | -0.073 | -35.391 | -0.145 | 33.461 | -0.110 | -37.465 | -0.176 | -29.984 | -0.186 | -31.586 | -0.198 |
| | [84.3526] | [0.1041] | [93.0144] | [0.1187] | [84.4863] | [0.1089] | [93.0224] | [0.1225] | [92.7253] | [0.1224] | [92.7962] | [0.1232] |
| **Married** | 25.422 | 0.298*** | 47.925 | 0.235*** | 33.777 | 0.302*** | 50.420 | 0.237*** | 65.558 | 0.216** | 65.736 | 0.201** |
| | [73.8183] | [0.0716] | [74.0758] | [0.0811] | [75.9758] | [0.0739] | [74.0888] | [0.0843] | [73.7755] | [0.0859] | [73.7065] | [0.0858] |
| **Age Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Community Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Observations** | 4,826 | 4,826 | 4,016 | 4,016 | 4,729 | 4,729 | 3,962 | 3,962 | 3,898 | 3,898 | 3,871 | 3,871 |
| **rho** | -0.170 | -0.170 | -0.180 | -0.180 | -0.110 | -0.110 | -0.200 | -0.200 | -0.180 | -0.180 | -0.170 | -0.170 |
| **F_stat (health)** | | | 3.960 | 0.500 | 3.510 | 130.200 | 4.920 | 126.840 | 9.540 | 123.010 | 10.270 | 123.750 |
| **P_value (health)** | | | 0.138 | 0.780 | 0.173 | 0.000 | 0.425 | 0.000 | 0.145 | 0.000 | 0.246 | 0.000 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Rho represents the correlation between participation equation and work hour equation.

**Table 4. Health and Simultaneous Labor Supply Decisions in Agriculture (Male)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** |
| **Leg Length** | | | 6.214 | 0.004 | | | 6.076 | 0.005 | 8.369 | 0.003 | 8.784 | 0.002 |
| | | | [8.1035] | [0.0103] | | | [8.0701] | [0.0107] | [8.0512] | [0.0108] | [8.1598] | [0.0108] |
| **Childhood Health: Poor** | | | 50.572 | 0.009 | 46.246 | 0.013 | 43.919 | 0.027 | 47.672 | 0.011 | 38.344 | 0.021 |
| | | | [49.4363] | [0.0748] | [45.1374] | [0.0659] | [49.2443] | [0.0794] | [48.7450] | [0.0781] | [48.8793] | [0.0788] |
| **SRH: Poor** | | | | | 3.515 | -0.501*** | -4.900 | -0.390*** | -34.492 | -0.357*** | -45.127 | -0.372*** |
| | | | | | [48.5894] | [0.0612] | [53.7151] | [0.0747] | [53.5919] | [0.0793] | [54.5115] | [0.0797] |
| **Disability** | | | | | | | -9.653 | -0.508*** | -37.718 | -0.476*** | -35.306 | -0.473*** |
| | | | | | | | [64.1970] | [0.0808] | [65.2636] | [0.0818] | [64.7311] | [0.0827] |
| **Pain** | | | | | | | 31.563 | -0.003 | -3.495 | -0.014 | -4.731 | 0.006 |
| | | | | | | | [54.5727] | [0.0789] | [54.9380] | [0.0819] | [55.0118] | [0.0826] |
| **Depressive Symptoms** | | | | | | | | | 9.194** | -0.003 | 9.520** | -0.002 |
| | | | | | | | | | [4.6309] | [0.0073] | [4.6414] | [0.0074] |
| **Father Alive** | | | | | | | | | | | -67.713 | 0.210* |
| | | | | | | | | | | | [73.3479] | [0.1168] |
| **Mother Alive** | | | | | | | | | | | -38.084 | 0.010 |
| | | | | | | | | | | | [62.3559] | [0.0919] |
| **Educ_primary** | -86.100 | 0.102 | -56.169 | 0.070 | -74.258 | 0.059 | -61.519 | 0.013 | -54.576 | 0.003 | -49.595 | -0.002 |
| | [60.0486] | [0.0721] | [65.0559] | [0.0851] | [61.4949] | [0.0772] | [64.8035] | [0.0869] | [64.5510] | [0.0893] | [65.0233] | [0.0893] |
| **Educ_secondary** | -244.930*** | -0.193** | -213.892*** | -0.213** | -232.361*** | -0.250*** | -219.012*** | -0.306*** | -216.078*** | -0.320*** | -210.481*** | -0.334*** |
| | [71.6532] | [0.0875] | [77.1312] | [0.1058] | [72.3594] | [0.0912] | [77.3206] | [0.1075] | [77.2996] | [0.1111] | [77.4003] | [0.1107] |
| **Married** | 196.865*** | 0.462*** | 159.963** | 0.479*** | 189.735** | 0.451*** | 149.082** | 0.442*** | 194.537** | 0.441*** | 200.125*** | 0.443*** |
| | [76.0581] | [0.0941] | [74.5487] | [0.1014] | [75.4215] | [0.0943] | [74.7855] | [0.1017] | [76.3323] | [0.1053] | [76.2904] | [0.1062] |
| **Age Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Community Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Observations** | 4,469 | 4,469 | 3,627 | 3,627 | 4,378 | 4,378 | 3,598 | 3,598 | 3,549 | 3,549 | 3,516 | 3,516 |
| **rho** | -0.150 | -0.150 | -0.340 | -0.340 | -0.170 | -0.170 | -0.370 | -0.370 | -0.350 | -0.350 | -0.330 | -0.330 |
| **F_stat (health)** | | | 1.730 | 0.170 | 1.050 | 67.430 | 1.700 | 83.830 | 7.250 | 76.350 | 9.060 | 79.110 |
| **P_value (health)** | | | 0.420 | 0.920 | 0.592 | 0.000 | 0.889 | 0.000 | 0.298 | 0.000 | 0.337 | 0.000 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Rho represents the correlation between participation equation and work hour equation.

**Table 5. Health and Simultaneous Labor Supply Decisions in Agriculture (Female)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** | **Hours** | **LFP** |
| **Leg Length** | | | -3.252 | -0.009 | | | -4.020 | -0.004 | -3.798 | -0.004 | -3.778 | -0.005 |
| | | | [7.4849] | [0.0090] | | | [7.5401] | [0.0093] | [7.5643] | [0.0094] | [7.5782] | [0.0095] |
| **Childhood Health: Poor** | | | 84.965* | 0.014 | 79.684* | 0.030 | 83.801* | 0.047 | 71.911 | 0.056 | 75.009 | 0.058 |
| | | | [45.8422] | [0.0658] | [45.2075] | [0.0582] | [46.9964] | [0.0667] | [46.9962] | [0.0687] | [47.7390] | [0.0684] |
| **SRH: Poor** | | | | | 35.681 | -0.534*** | 33.626 | -0.446*** | 6.107 | -0.436*** | 14.348 | -0.433*** |
| | | | | | [46.9076] | [0.0495] | [50.6033] | [0.0614] | [50.8067] | [0.0634] | [50.7604] | [0.0636] |
| **Disability** | | | | | | | 24.274 | -0.315*** | 1.396 | -0.315*** | -1.201 | -0.318*** |
| | | | | | | | [53.3784] | [0.0650] | [54.6102] | [0.0672] | [55.3210] | [0.0679] |
| **Pain** | | | | | | | 37.804 | -0.047 | -0.568 | -0.028 | 6.465 | -0.024 |
| | | | | | | | [46.8588] | [0.0711] | [48.4896] | [0.0750] | [48.4691] | [0.0752] |
| **Depressive Symptoms** | | | | | | | | | 10.862** | -0.003 | 10.220** | -0.005 |
| | | | | | | | | | [4.2431] | [0.0058] | [4.2731] | [0.0058] |
| **Father Alive** | | | | | | | | | | | 58.005 | 0.031 |
| | | | | | | | | | | | [67.6745] | [0.0988] |
| **Mother Alive** | | | | | | | | | | | 68.548 | -0.058 |
| | | | | | | | | | | | [55.4303] | [0.0837] |
| **Educ_primary** | -10.241 | -0.018 | -2.512 | -0.079 | -3.580 | -0.035 | -5.299 | -0.097 | -2.147 | -0.110* | -2.740 | -0.119* |
| | [40.4746] | [0.0556] | [41.8563] | [0.0590] | [39.9153] | [0.0572] | [41.7309] | [0.0613] | [41.6018] | [0.0609] | [42.0550] | [0.0609] |
| **Educ_secondary** | -101.993 | -0.149 | -126.441* | -0.191 | -100.138 | -0.175 | -131.575* | -0.217* | -122.112 | -0.224* | -123.132 | -0.230* |
| | [69.7979] | [0.1015] | [76.1574] | [0.1163] | [68.9508] | [0.1066] | [76.9816] | [0.1189] | [76.0912] | [0.1185] | [76.1435] | [0.1192] |
| **Married** | 70.548 | 0.312*** | 86.426 | 0.263*** | 79.758 | 0.322*** | 83.971 | 0.270*** | 106.401 | 0.244*** | 108.967 | 0.230*** |
| | [70.5733] | [0.0690] | [74.2941] | [0.0790] | [71.6397] | [0.0715] | [74.6960] | [0.0845] | [74.0218] | [0.0859] | [73.4957] | [0.0856] |
| **Age Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Community Dummies** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Observations** | 4,869 | 4,869 | 4,051 | 4,051 | 4,770 | 4,770 | 3,996 | 3,996 | 3,932 | 3,932 | 3,905 | 3,905 |
| **rho** | -0.320 | -0.320 | -0.370 | -0.370 | -0.270 | -0.270 | -0.360 | -0.360 | -0.330 | -0.330 | -0.330 | -0.330 |
| **F_stat (health)** | | | 3.970 | 1.150 | 4.150 | 116.400 | 6.350 | 120.410 | 10.820 | 117.150 | 12.050 | 119.220 |
| **P_value (health)** | | | 0.138 | 0.564 | 0.125 | 0.000 | 0.274 | 0.000 | 0.094 | 0.000 | 0.149 | 0.000 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Rho represents the correlation between participation equation and work hour equation.

**Table 6. Effects from Family and Household Structure**

| | Male | | | | | | Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | Hours | LFP | Hours | LFP | Hours | LFP | Hours | LFP | Hours | LFP | Hours | LFP |
| **Leg Length** | 5.819 | 0.021* | 5.759 | 0.021* | 5.723 | 0.020 | 5.418 | 0.002 | 5.314 | 0.003 | 5.254 | 0.002 |
| | [8.9674] | [0.0127] | [8.9637] | [0.0127] | [8.9535] | [0.0128] | [7.6991] | [0.0097] | [7.6931] | [0.0097] | [7.6761] | [0.0098] |
| **Childhood Health: Poo** | 16.485 | 0.025 | 16.270 | 0.034 | 19.253 | 0.024 | 96.057* | 0.052 | 94.463* | 0.055 | 94.371* | 0.060 |
| | [53.9921] | [0.0929] | [54.0494] | [0.0928] | [54.4739] | [0.0939] | [52.1441] | [0.0718] | [52.1611] | [0.0719] | [52.3167] | [0.0723] |
| **SRH: Poor** | -110.961* | -0.648*** | -111.152* | -0.654*** | -109.133* | -0.657*** | -90.262* | -0.471*** | -92.337* | -0.473*** | -87.542 | -0.479*** |
| | [59.3006] | [0.0899] | [59.3849] | [0.0900] | [59.6107] | [0.0898] | [53.9879] | [0.0662] | [54.0603] | [0.0662] | [54.5270] | [0.0663] |
| **Disability** | -26.166 | -0.572*** | -26.678 | -0.567*** | -21.344 | -0.586*** | -9.267 | -0.297*** | -12.038 | -0.295*** | -11.576 | -0.287*** |
| | [69.5630] | [0.0919] | [69.6519] | [0.0912] | [69.8311] | [0.0924] | [57.7004] | [0.0699] | [57.6343] | [0.0700] | [57.6527] | [0.0700] |
| **Pain** | -57.989 | -0.022 | -57.767 | -0.025 | -57.505 | -0.036 | -9.109 | 0.004 | -10.920 | 0.012 | -7.035 | 0.016 |
| | [60.7347] | [0.1012] | [60.7522] | [0.1012] | [60.8922] | [0.1005] | [50.8980] | [0.0784] | [51.0118] | [0.0786] | [51.3226] | [0.0787] |
| **Depressive Symptoms** | -1.482 | -0.003 | -1.476 | -0.003 | -1.728 | -0.002 | 8.114* | -0.004 | 8.276* | -0.004 | 8.124* | -0.005 |
| | [5.0235] | [0.0078] | [5.0164] | [0.0078] | [5.0397] | [0.0078] | [4.4075] | [0.0062] | [4.4225] | [0.0062] | [4.4263] | [0.0062] |
| **Father Alive** | -58.090 | 0.221 | -57.918 | 0.231 | -60.498 | 0.207 | 21.576 | -0.099 | 22.055 | -0.103 | 22.122 | -0.113 |
| | [85.8505] | [0.1587] | [85.8084] | [0.1584] | [85.4484] | [0.1562] | [71.2129] | [0.1046] | [71.0998] | [0.1049] | [71.4439] | [0.1054] |
| **Mother Alive** | -90.088 | 0.022 | -89.918 | 0.017 | -93.347 | 0.025 | 70.790 | 0.047 | 71.329 | 0.050 | 62.972 | 0.051 |
| | [67.3961] | [0.1169] | [67.2325] | [0.1162] | [68.1134] | [0.1171] | [57.0164] | [0.0955] | [57.0657] | [0.0951] | [59.0267] | [0.0972] |
| **log PCE** | 29.999 | -0.090* | 29.649 | -0.092* | 29.315 | -0.097* | 85.545*** | -0.169*** | 87.022*** | -0.173*** | 84.742*** | -0.173*** |
| | [32.6395] | [0.0528] | [32.8877] | [0.0526] | [32.9889] | [0.0524] | [31.7874] | [0.0398] | [31.8448] | [0.0404] | [31.7546] | [0.0406] |

**Table 6. Effects from Family and Household Structure (cont.)**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# HH Adult Males** | -25.753 | -0.070 | -25.808 | -0.088 | -25.441 | -0.089 | -6.266 | 0.051 | 1.990 | 0.029 | 9.609 | 0.024 |
| | [50.9613] | [0.0749] | [51.2247] | [0.0749] | [51.1671] | [0.0757] | [45.4032] | [0.0620] | [45.5753] | [0.0634] | [45.4392] | [0.0636] |
| **# HH Adult Females** | 162.443*** | -0.063 | 162.382*** | -0.054 | 161.820*** | -0.054 | -1.524 | -0.095 | -3.911 | -0.086 | -9.864 | -0.085 |
| | [51.8568] | [0.0733] | [51.5976] | [0.0737] | [51.6933] | [0.0742] | [46.8770] | [0.0623] | [46.6622] | [0.0626] | [46.6439] | [0.0627] |
| **# of Adult Sons** | 51.825 | -0.019 | 51.605 | 0.021 | 51.193 | 0.020 | 5.986 | -0.075** | -16.616 | -0.017 | -22.063 | -0.013 |
| | [32.6162] | [0.0449] | [37.5096] | [0.0529] | [37.5046] | [0.0528] | [26.9477] | [0.0342] | [31.2288] | [0.0409] | [31.4934] | [0.0410] |
| **# of Young Sons** | 113.418* | 0.225* | 113.133* | 0.220* | 112.269* | 0.217* | 24.802 | 0.377*** | 25.643 | 0.370*** | 26.389 | 0.373*** |
| | [67.6108] | [0.1167] | [67.6039] | [0.1159] | [67.5935] | [0.1175] | [60.6772] | [0.1159] | [61.3575] | [0.1166] | [61.4088] | [0.1164] |
| **# of Adult Daughters** | -1.976 | -0.015 | -1.705 | 0.031 | -2.330 | 0.033 | -17.591 | -0.036 | -43.263 | 0.029 | -45.700 | 0.029 |
| | [24.7375] | [0.0395] | [33.9115] | [0.0547] | [33.9383] | [0.0547] | [24.8665] | [0.0291] | [32.2894] | [0.0404] | [32.4969] | [0.0405] |
| **# of Young Daughters** | 96.694 | -0.114 | 96.811 | -0.107 | 97.515 | -0.093 | -13.067 | 0.060 | -17.164 | 0.071 | -15.593 | 0.072 |
| | [58.8590] | [0.1160] | [59.4928] | [0.1176] | [59.5254] | [0.1177] | [58.4185] | [0.1027] | [58.6717] | [0.1019] | [58.8968] | [0.1025] |
| **# of Grandkids** | | | -0.286 | -0.028 | -0.090 | -0.028 | | | 16.236 | -0.040** | 17.802 | -0.040** |
| | | | [14.9597] | [0.0216] | [14.9858] | [0.0216] | | | [13.3974] | [0.0178] | [13.4190] | [0.0179] |
| **# of Male Siblings** | | | | | -4.512 | 0.024 | | | | | -7.336 | 0.017 |
| | | | | | [17.6167] | [0.0279] | | | | | [19.3520] | [0.0239] |
| **# of Female Siblings** | | | | | 16.771 | -0.057* | | | | | 28.403* | -0.020 |
| | | | | | [18.2465] | [0.0330] | | | | | [16.6785] | [0.0234] |
| **Observations** | 3,458 | 3,458 | 3,458 | 3,458 | 3,455 | 3,455 | 3,849 | 3,849 | 3,849 | 3,849 | 3,842 | 3,842 |
| **rho** | -0.390 | -0.390 | -0.390 | -0.390 | -0.400 | -0.400 | -0.140 | -0.140 | -0.130 | -0.130 | -0.140 | -0.140 |
| **F_stat (health)** | 11.130 | 79.460 | 11.020 | 79.500 | 10.580 | 80.020 | 10.660 | 114.870 | 10.820 | 114.890 | 10.030 | 114.920 |
| **P_value (health)** | 0.194 | 0.000 | 0.200 | 0.000 | 0.227 | 0.000 | 0.222 | 0.000 | 0.212 | 0.000 | 0.263 | 0.000 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Adult household members are defined as household members aged 25 and above. Adult sons are defined as sons aged 25 and above. Adult daugthers are defined as daugthers aged 25 and above. Young sons are defined as sons between age 15-25. Young daughters are defined as daughters between age 15-25. Demographic characteristics such as education levels and marital status are included in all the specifications, so as age dummies and community dummies. Rho represents the correlation between participation equation and work hour equation.

**Table 7. Effects from Family and Household Structure-Agriculture**

| | Male | | | | | | Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | Hours | LFP | Hours | LFP | Hours | LFP | Hours | LFP | Hours | LFP | Hours | LFP |
| **Leg Length** | 9.467 | 0.003 | 9.443 | 0.003 | 9.163 | 0.003 | -4.928 | -0.001 | -4.914 | -0.001 | -4.906 | -0.001 |
| | [8.2466] | [0.0114] | [8.2494] | [0.0113] | [8.2628] | [0.0113] | [7.6441] | [0.0095] | [7.6345] | [0.0095] | [7.6419] | [0.0094] |
| **Childhood Health: Poo** | 37.654 | -0.004 | 36.589 | 0.003 | 37.558 | -0.005 | 78.390 | 0.042 | 77.161 | 0.044 | 74.515 | 0.042 |
| | [48.2871] | [0.0804] | [48.2245] | [0.0803] | [48.3985] | [0.0810] | [48.1457] | [0.0682] | [48.0551] | [0.0683] | [48.2775] | [0.0689] |
| **SRH: Poor** | -49.085 | -0.368*** | -47.702 | -0.370*** | -44.234 | -0.364*** | 11.485 | -0.425*** | 11.650 | -0.428*** | 13.700 | -0.431*** |
| | [53.1368] | [0.0809] | [53.1407] | [0.0810] | [53.1819] | [0.0816] | [50.9584] | [0.0645] | [50.8638] | [0.0643] | [51.1497] | [0.0646] |
| **Disability** | -42.846 | -0.472*** | -42.723 | -0.470*** | -38.558 | -0.478*** | -4.703 | -0.317*** | -5.875 | -0.315*** | -6.069 | -0.310*** |
| | [65.3359] | [0.0831] | [65.1694] | [0.0829] | [65.4887] | [0.0837] | [55.3797] | [0.0688] | [55.2508] | [0.0690] | [55.3672] | [0.0687] |
| **Pain** | 0.359 | 0.010 | -0.413 | 0.008 | -0.354 | 0.010 | 4.291 | 0.007 | 2.166 | 0.016 | 5.792 | 0.012 |
| | [54.5049] | [0.0851] | [54.5366] | [0.0849] | [54.5869] | [0.0848] | [48.8226] | [0.0777] | [48.9132] | [0.0780] | [49.4196] | [0.0782] |
| **Depressive Symptoms** | 10.242** | -0.004 | 10.199** | -0.004 | 10.170** | -0.004 | 10.517** | -0.006 | 10.660** | -0.006 | 10.606** | -0.006 |
| | [4.6578] | [0.0074] | [4.6636] | [0.0074] | [4.6948] | [0.0074] | [4.2586] | [0.0060] | [4.2771] | [0.0060] | [4.2581] | [0.0060] |
| **Father Alive** | -71.400 | 0.215* | -71.921 | 0.220* | -73.829 | 0.231** | 59.899 | 0.032 | 59.873 | 0.029 | 64.543 | 0.019 |
| | [72.1897] | [0.1155] | [72.1999] | [0.1155] | [72.1389] | [0.1161] | [67.1448] | [0.1011] | [67.0053] | [0.1014] | [67.6331] | [0.1022] |
| **Mother Alive** | -62.998 | 0.033 | -61.852 | 0.028 | -59.698 | 0.053 | 63.163 | -0.063 | 63.616 | -0.061 | 65.413 | -0.058 |
| | [61.6637] | [0.0923] | [61.4459] | [0.0918] | [61.9142] | [0.0924] | [56.0294] | [0.0842] | [56.1129] | [0.0837] | [58.4757] | [0.0855] |
| **log PCE** | -21.387 | -0.194*** | -19.228 | -0.197*** | -17.550 | -0.195*** | 74.178** | -0.197*** | 75.794** | -0.200*** | 73.630** | -0.199*** |
| | [31.8977] | [0.0460] | [32.3389] | [0.0460] | [32.3775] | [0.0461] | [30.0907] | [0.0405] | [30.2899] | [0.0409] | [30.0551] | [0.0410] |

**Table 7. Effects from Family and Household Structure-Agriculture (cont.)**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# HH Adult Males** | -22.921 | -0.045 | -16.798 | -0.058 | -16.883 | -0.057 | 13.392 | 0.057 | 20.564 | 0.040 | 27.782 | 0.037 |
| | [41.4020] | [0.0651] | [41.5717] | [0.0654] | [41.3683] | [0.0657] | [43.9482] | [0.0592] | [43.8679] | [0.0602] | [43.3975] | [0.0603] |
| **# HH Adult Females** | 89.455** | -0.084 | 86.768* | -0.077 | 85.977* | -0.079 | -17.232 | -0.065 | -19.414 | -0.057 | -25.149 | -0.055 |
| | [45.5803] | [0.0643] | [45.2487] | [0.0641] | [45.8911] | [0.0645] | [45.6540] | [0.0583] | [45.3610] | [0.0584] | [44.9543] | [0.0584] |
| **# of Adult Sons** | 11.497 | -0.052 | -5.585 | -0.011 | -5.927 | -0.009 | 20.016 | -0.057* | 0.402 | -0.009 | -4.208 | -0.005 |
| | [29.4901] | [0.0409] | [33.7675] | [0.0479] | [33.7517] | [0.0480] | [26.1577] | [0.0326] | [32.6201] | [0.0396] | [32.7463] | [0.0396] |
| **# of Young Sons** | 191.643*** | 0.031 | 191.691*** | 0.030 | 189.687*** | 0.019 | 30.220 | 0.252** | 30.682 | 0.249** | 36.365 | 0.250** |
| | [64.0216] | [0.0894] | [64.1155] | [0.0894] | [63.9109] | [0.0894] | [64.0768] | [0.1084] | [64.3363] | [0.1093] | [64.7334] | [0.1095] |
| **# of Adult Daughters** | -10.127 | -0.048 | -30.014 | -0.001 | -30.237 | 0.000 | -7.684 | -0.018 | -29.885 | 0.035 | -33.885 | 0.038 |
| | [23.6508] | [0.0370] | [33.3528] | [0.0498] | [33.4581] | [0.0498] | [23.4509] | [0.0288] | [33.3097] | [0.0402] | [33.4624] | [0.0403] |
| **# of Young Daughters** | 33.200 | 0.011 | 28.885 | 0.019 | 29.024 | 0.011 | -8.423 | 0.038 | -12.801 | 0.048 | -11.741 | 0.047 |
| | [50.8082] | [0.0892] | [51.2456] | [0.0900] | [51.2133] | [0.0891] | [59.6873] | [0.0964] | [60.2478] | [0.0960] | [60.3129] | [0.0962] |
| **# of Grandkids** | | | 12.739 | -0.029 | 12.787 | -0.031 | | | 13.975 | -0.033* | 15.483 | -0.033* |
| | | | [14.3375] | [0.0196] | [14.3210] | [0.0197] | | | [13.9938] | [0.0173] | [13.9942] | [0.0175] |
| **# of Male Siblings** | | | | | -10.175 | -0.023 | | | | | -25.400 | 0.010 |
| | | | | | [15.5955] | [0.0238] | | | | | [16.6731] | [0.0229] |
| **# of Female Siblings** | | | | | 5.003 | -0.053* | | | | | 13.182 | -0.017 |
| | | | | | [16.7004] | [0.0282] | | | | | [15.4099] | [0.0236] |
| **Observations** | 3,508 | 3,508 | 3,508 | 3,508 | 3,505 | 3,505 | 3,883 | 3,883 | 3,883 | 3,883 | 3,876 | 3,876 |
| **rho** | -0.350 | -0.350 | -0.350 | -0.350 | -0.380 | -0.380 | -0.310 | -0.310 | -0.320 | -0.320 | -0.320 | -0.320 |
| **F_stat (health)** | 11.130 | 79.460 | 11.020 | 79.500 | 10.580 | 80.020 | 12.420 | 106.920 | 12.460 | 107.130 | 12.320 | 107.460 |
| **P_value (health)** | 0.194 | 0.000 | 0.200 | 0.000 | 0.227 | 0.000 | 0.133 | 0.000 | 0.132 | 0.000 | 0.138 | 0.000 |

~~Note: Standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and~~ indicates significant at 1% level. Adult household members are defined as household members aged 25 and above. Adult sons are defined as sons aged 25 and above. Adult daugthers are defined as daugthers aged 25 and above. Young sons are defined as sons between age 15-25. Young daughters are defined as daughters between age 15-25. Demographic characteristics such as education levels and marital status are included in all the specifications, so as age dummies and community dummies. Rho represents the correlation between participation equation and work hour equation.

**Table 8. Interactions btw Health and Wealth (Male)**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | **Hours** | **LFP** | **Hours in Agriculture** | **LFP in Agriculture** |
| **Leg Length** | 3.779 | 0.024* | 3.065 | 0.002 |
| | [9.1246] | [0.0128] | [8.6388] | [0.0112] |
| **Childhood Health: Poor** | 3.342 | 0.031 | 15.337 | 0.004 |
| | [55.3058] | [0.0940] | [50.6308] | [0.0809] |
| **SRH: Poor** | -99.200 | -0.622*** | -36.187 | -0.350*** |
| | [64.2951] | [0.0909] | [57.1531] | [0.0829] |
| **Disability** | -4.865 | -0.584*** | 2.164 | -0.472*** |
| | [82.3563] | [0.0968] | [76.2859] | [0.0887] |
| **Pain** | -68.424 | -0.036 | 5.704 | 0.004 |
| | [70.7406] | [0.1030] | [59.3471] | [0.0863] |
| **Depressive Symptoms** | -2.602 | -0.003 | 6.447 | -0.006 |
| | [5.2534] | [0.0077] | [4.8937] | [0.0072] |
| **Father Alive** | -65.386 | 0.179 | -89.006 | 0.226* |
| | [85.2356] | [0.1567] | [74.6839] | [0.1226] |
| **Mother Alive** | -59.865 | 0.003 | -44.395 | 0.010 |
| | [68.1288] | [0.1182] | [64.4261] | [0.0933] |
| **Leg Length X PCW** | -1.967 | 0.002 | -3.407** | 0.000 |
| | [1.4565] | [0.0017] | [1.3969] | [0.0018] |
| **SRH X PCW** | 8.383 | 0.013 | 7.107 | 0.009 |
| | [10.1845] | [0.0133] | [9.9460] | [0.0110] |
| **Childhood SRH X PCW** | -16.507 | -0.015 | -16.175 | -0.005 |
| | [10.0828] | [0.0133] | [10.3219] | [0.0104] |
| **Disability X PCW** | 11.118 | 0.009 | 24.072 | 0.008 |
| | [19.5040] | [0.0156] | [16.1216] | [0.0141] |
| **Pain X PCW** | -10.284 | 0.003 | 1.380 | 0.006 |
| | [19.0655] | [0.0167] | [12.3142] | [0.0153] |
| **Depressive Symptoms X PCW** | -1.326 | -0.001 | -2.245** | -0.001 |
| | [1.0320] | [0.0008] | [0.9092] | [0.0008] |
| **Father Alive X PCW** | 17.934 | 0.016 | 0.953 | -0.004 |
| | [18.4769] | [0.0232] | [16.0443] | [0.0222] |
| **Mother Alive X PCW** | 5.399 | -0.013 | -1.238 | -0.061*** |
| | [10.4250] | [0.0143] | [14.9333] | [0.0176] |
| **demeaned PCW** | 111.153 | -0.103 | 186.379*** | -0.009 |
| | [74.3508] | [0.0855] | [71.8030] | [0.0927] |
| **Observations** | 3,411 | 3,411 | 3,461 | 3,461 |
| **rho** | -0.380 | -0.380 | -0.390 | -0.390 |
| **F_stat (health)** | 7.340 | 103.360 | 4.940 | 73.620 |
| **P_value(health)** | 0.500 | 0.000 | 0.764 | 0.000 |
| **F_stat2 (healthXPCW)** | 10.420 | 5.300 | 21.830 | 15.180 |
| **P_value2 (healthXPCW)** | 0.237 | 0.725 | 0.005 | 0.056 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Adult household members are defined as household members aged 25 and above. Adult sons are defined as sons aged 25 and above. Adult daugthers are defined as daugthers aged 25 and above. Young sons are defined as sons between age 15-25. Young daughters are defined as daughters between age 15-25. Demographic characteristics and HH/family compositions are included in all the specifications, so as age dummies and community dummies. Rho represents the correlation between participation equation and work hour equation.

**Table 9. Interactions btw Health and Wealth (Female)**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | **Hours** | **LFP** | **Hours in Agriculture** | **LFP in Agriculture** |
| **Leg Length** | 3.065 | 0.002 | -7.610 | -0.001 |
| | [8.6388] | [0.0112] | [7.9535] | [0.0107] |
| **Childhood Health: Poor** | 15.337 | 0.004 | 52.790 | 0.062 |
| | [50.6308] | [0.0809] | [49.4449] | [0.0704] |
| **SRH: Poor** | -36.187 | -0.350*** | 13.836 | -0.460*** |
| | [57.1531] | [0.0829] | [53.6942] | [0.0692] |
| **Disability** | 2.164 | -0.472*** | 8.422 | -0.305*** |
| | [76.2859] | [0.0887] | [58.4602] | [0.0711] |
| **Pain** | 5.704 | 0.004 | 2.539 | 0.015 |
| | [59.3471] | [0.0863] | [50.1992] | [0.0788] |
| **Depressive Symptoms** | 6.447 | -0.006 | 12.641*** | -0.005 |
| | [4.8937] | [0.0072] | [4.3409] | [0.0063] |
| **Father Alive** | -89.006 | 0.226* | 88.595 | 0.056 |
| | [74.6839] | [0.1226] | [68.5240] | [0.1063] |
| **Mother Alive** | -44.395 | 0.010 | 57.060 | -0.054 |
| | [64.4261] | [0.0933] | [60.1773] | [0.0867] |
| **Leg Length X PCW** | -3.407** | 0.000 | -2.366* | -0.001 |
| | [1.3969] | [0.0018] | [1.3325] | [0.0019] |
| **SRH X PCW** | 7.107 | 0.009 | -3.945 | -0.005 |
| | [9.9460] | [0.0110] | [10.2354] | [0.0155] |
| **Childhood SRH X PCW** | -16.175 | -0.005 | -18.084* | -0.001 |
| | [10.3219] | [0.0104] | [10.3474] | [0.0112] |
| **Disability X PCW** | 24.072 | 0.008 | 9.864 | 0.021* |
| | [16.1216] | [0.0141] | [8.9064] | [0.0119] |
| **Pain X PCW** | 1.380 | 0.006 | -4.220 | 0.016 |
| | [12.3142] | [0.0153] | [4.0093] | [0.0099] |
| **Depressive Symptoms X PCW** | -2.245** | -0.001 | 0.258 | -0.001 |
| | [0.9092] | [0.0008] | [0.6651] | [0.0011] |
| **Father Alive X PCW** | 0.953 | -0.004 | 21.921 | 0.037** |
| | [16.0443] | [0.0222] | [13.4855] | [0.0168] |
| **Mother Alive X PCW** | -1.238 | -0.061*** | 1.282 | -0.020* |
| | [14.9333] | [0.0176] | [9.4658] | [0.0118] |
| **demeaned PCW** | 186.379*** | -0.009 | 113.367* | 0.031 |
| | [71.8030] | [0.0927] | [59.1703] | [0.0879] |
| **Observations** | 3,461 | 3,461 | 3,822 | 3,822 |
| **rho** | -0.390 | -0.390 | -0.280 | -0.280 |
| **F_stat (health)** | 4.940 | 73.620 | 15.510 | 100.840 |
| **P_value(health)** | 0.764 | 0.000 | 0.050 | 0.000 |
| **F_stat2 (healthXPCW)** | 21.830 | 15.180 | 27.930 | 14.390 |
| **P_value2 (healthXPCW)** | 0.005 | 0.056 | 0.000 | 0.072 |

**Note:** standard errors are in the parenthesis. All standard errors clustered in the community level. * indicates significant at 10% level, ** indicates significant at 5% level and *** indicates significant at 1% level. Adult household members are defined as household members aged 25 and above. Adult sons are defined as sons aged 25 and above. Adult daugthers are defined as daugthers aged 25 and above. Young sons are defined as sons between age 15-25. Young daughters are defined as daughters between age 15-25. Demographic characteristics and HH/family compositions are included in all the specifications, so as age dummies and community dummies. Rho represents the correlation between participation equation and work hour equation.