Labor Force Participation among Indian Elderly: Does Health Matter?*

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Abstract

The paper analyzes the effect of health status on labour force participation for aged Indians. The potential endogeneity in health and labour force participation has been taken care of by using full information maximum likelihood (FIML) and estimation results are compared with alternative two-stage methods. Results show that health has a significant and positive effect on labour force participation of the aged. In order to keep enough supply of elderly in the labour market, sufficient health care is necessary and hence more investment in this sector is imperative.

Keywords: self-reported health status, labour force participation, elderly, endogeneity, exogeneity, simultaneous equation model

JEL classification: J21, J14, I18, C35

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1. Introduction

Given the importance of labour in endogenous growth theory and the fact that health determines the quality of labour supply, the causal relationship between labour force participation and health have crucial role to play in determining the productivity of labour force for the long term requirements of economic growth. The poor health and low participation rate may have adverse effect on the performance of an economy. The reasons could be in two folds: One, unhealthy potential work force may impose a cost in terms of production loss by restraining its population at large from participating in the labor force or through reduced labor productivity. Second, there could be loss of revenue in terms of cost incurred in providing health care services to maintain good health without any incentive. A better understanding of health, labour force participation relationship is essential to estimate the costs of health limitations to the economy (Chirikos, 1986, 1993; Haveman, Wolfe, Buron and Hill, 1992; and Salkever, 1984) which can further be used to ease burden of demand for public expenditure (in providing pensions, health care, etc.) and maintaining sufficient and productive labour supply.

With increased life expectancy and sustained reduction in death and birth rates, like other Asian countries, India too is on the verge of the ageing process. The continuous decline of the youngest cohorts and faster growth rate of elderly population indicates that in the coming decades, aged[2] will have a significant proportion in country's population. Under the present scenario one of the key questions is that how the older Indians are going to manage their day to day's requirements given their limited and poor financial resources.

Unlike most Asian countries, India also have shown low elderly participation in the labour force possibly because of fewer job opportunities; low physical and mental alertness; lack of modern skills; unfriendly public transport system and of course, low health status and high incidences of disability. Moreover, rapid population ageing with low labour market participation rate and increasing trend towards earlier retirement among men (Kohli et al. 1991; Quinn and Burkhauser, 1995) is expected to result in labour shortages and shortfalls in existing public pension and health care systems[3] due to increased demand for public expenditure on pensions, health care and social services. The paper analyzes the linkage between health and labour force participation by addressing the issue of possible endogeneity.

The paper is outlined as follows: section 2 attributes to the theoretical overview of relationship between participation decision and health status. Section 3 specifies methodological framework whereas measurement and related issues are discussed in section 4. Data and model specifications are described and specified in section 5. Next section outlines the results of tests and estimations. Finally, the paper ends with section 6 where conclusions and implications of the study on health and employment policies for elderly are briefly discussed.

[2] Individuals with age 60 years or above
[3] For industrialized countries, see Gruber and Wise (2004)

2. Health and Labour Force Participation: Theoretical Overview

Quinn (1977) suggests that individual's retirement decisions are very much influenced by economic factors such as the availability of public and private pensions. While some recent empirical studies indicate that a generous pensions influence early retirement decision of elderly (Gruber and Wise, 1999, 2004; Blundell, Meghir, and Smith, 2002); some suggest that explicit financial incentives to delay retirement could also force them to postpone retirement (Lumsdaine and Mitchell, 1999; Gruber and Wise, 1999, 2004) irrespective of the cultural expectations of people to retire earlier (Gruber and Wise, 2004).

Apart from these economic factors, studies have found that health status also influences labour force participation decision of individuals (Ogawa et al., 1994 Boskin, 1977). It is recognized as one of the most important driving forces in the decision (Adams et al., 2003; Smith, 2004) and has potential to determine the optimal retirement age (Lumsdaine and Mitchell, 1999). However, the empirical analysis show that the nature of health impact on labour force participation is somewhat mixed (Dwyer and Mitchell, 1999) and the link is not straightforward (Smith, 1999; Adam et al., 2003). This may be partially due to problems with data, measurement and methodological difficulties including the issue of enodogeneity.

Studies find that work outcomes of elderly are important for health (Kerkhofs and Lindeboom, 1997; Charles, 2002). Further, literature on retirement models[4] indicates that health and work participation may be endogenously related. The endogenous relationship between health status and labor force participation has been widely examined for developed countries (e.g. Currie and Madrian, 1999 for United States, Campolieti, 2002 for Canada, Cai and Kalb, 2006 for Australia and Gameren, 2008 for Mexico). However, results are somewhat mixed. While some studies indicate for endogeneity[5], other finds either absence or only weak evidences of endogeneity[6].

Literature emphasize that the endogenous relationship, if exists, could be direct or indirect: an improved health status could be achieved by investing time and resources as one will be paid by participating in labour market and can spend the money on his/her health to get better nutritional supplements, medicines etc., on the other hand, stressed and bad working conditions could be harmful to health and hence reduces the leisure time. Thus, directly a good health could be achieved through labour force participation and this participation may lead to poor level of health status which forces an individual to get out of the labour force. Indirectly, health may be correlated with some unobserved factors, for example, an individual's time preference, previous investments in human capital and health capital that affects both health and labour force participation decisions (Fuchs, 1982).

[4] These models are followed in Parsons, 1982; Anderson and Burkhauser, 1985; Bazzoli, 1985; Burtler, Burkhauser, Mitchell and Pincus, 1987; Stern, 1989, Bound, 1991; Kerkhofs and Lindeboom, 1995; Dwyer and Mitchell, 1999 and Kreider, 1999

[5] see for example, Kerkhofs, Lindeboom, and Theeuwes, 1999; Disney, Emmerson and Wakefield, 2006; Cai and Kalb, 2006

[6] see for instance, Stern, 1989; Dwyer and Mitchell, 1999; Wolff, 2005

3. Self-reported Health Status: Measurement and Issues

Numerous studies show that self-reported health status (SRHS) is an increasingly common and comprehensive measure of health in empirical research (e.g. Ettner, 1996; Saunders, 1996; Schofield, 1996; Idler and Benyamini, 1997; Deaton and Paxson, 1998; Keneddy et al., 1998; Smith, 1999). Further, studies suggest that it predicts morbidity and subsequent mortality (Okun et al., 1984; Connelly et al., 1989; McCallum et al., 1994; Idler and Kasl, 1995) and allows examination of how health status varies over the life course (Case and Deaton, 2003).

However, some studies have questioned over the reliability of self-reported health status (see for example, Lambrinos, 1981; Parsons, 1980a b; Sen, 2002). Further, several issues exist with self-reported health status in the empirical analysis of effect of health on labour force participation (Bound, 1991; Bound et al., 1999) and one of them is under-reporting of health status or over-reporting of health problems. As self-reported measures are based on individual's own perception about their health, people may justify their exclusion/withdrawal from the labour force by underreporting their actual health status and is referred to as 'justification hypotheses' and SRHS may suffer from measurement error. Thus, both subjective and objective measures of health should be used in the analysis (Gameren, 2008).

4. Methodological Framework

The objective of the paper is to investigate the effect of health on the labor force participation by taking care of possible endogeneity between them. And therefore, we need to estimate two equations simultaneously: one for health and other for labour force participation. Our strategy[7] will be to get a variable that represents each individual's 'health stock', free from subjectivity and endogeneity in the first stage equation and then to use that as a proxy for health in the second and final stage equations for participation decision (Stern, 1989; Bound et al., 1999; Campolieti, 2002; Cai and Kalb, 2006; Disney, Emmerson and Wakefield, 2006; Gameren, 2008).

Here, the first stage equation that describes the true health of an individual is given as follows:

$$H_i^{**} = \alpha_H P_i^{*} + \beta_H x_{i1} + \vartheta_{iH} \qquad (1)$$

where H_i^{**} and P_i^{*} are unobserved variables. H_i^{**} represents latent true health status, which depends on the latent propensity (inclination) to participate in the labour force P_i^{*}. P_i^{*} enters in the health equation due to endogeneity between the two. Further, $x_{i1} = x_i + z_{iH}$ where x_i denotes a set of common individual characteristics such as age, gender, education, household size, location, number of children, marital status, social group they belong to, household facilities etc. and z_{iH} represents a set of personal health characteristics such as disability status, disease profile etc. It can be noted that the variable P_i^{*} is no more endogenous to H_i^{**} as H_i^{**} is the true health status and not the self-assessed. The parameter α_H is therefore, represents the causal effect of labor force participation decision on the true health, β_H represents the coefficients associated

[7] will be similar to Stern (1989), Cai and Kalb (2006) and Gameren (2008)

with exogenous variables and ν_{iH} is the independently identically distributed (i.i.d) disturbance term.

Now, the labour force participation equation is specified as

$$P_i^* = \alpha_P H_i^{**} + \beta_P x_{i2} + \vartheta_{iP} \quad (2)$$

where $x_{i2} = x_i + z_{iP}$ with x_i defined as above and z_{iP} is the type of household based on the principle occupation. Here also, the parameter α_P measures the causal effect of health on the participation decision and expected to be positive (>0), β_P is the parameter associated with x_{i2} and ϑ_{iP} is the i.i.d error term.

After defining health and participation equations, let H_i^* be the continuous latent health that relate to the self-assessed observable health. and assume that $H_i = k(k = 0,1,2)$, where k takes values 0, 1, and 2 corresponding to poor, good/fair and excellent/very good self-reported health status, respectively, for $m_k < H_i^* \le m_{k+1}$ (m_k are unobserved and unknown cut-off points to be estimated along with the other parameters while $m_0 = -\infty$ and $m_3 = +\infty$). Therefore,

$$H_i = \begin{cases} 0 & if \ -\infty < H_i^* \le m_1 \\ 1 & if \ \ m_1 < H_i^* \le m_2 \\ 2 & if \ \ m_2 < H_i^* \le +\infty \end{cases} \quad (3)$$

Now, since true health H_i^{**} is unobserved as the observable health variable H_i is self-reported and subjective, we estimate true health equation counter part of H_i as

$H_i^* = H_i^{**} + \delta_H P_i^* + \xi_{iH,}$ which can be rewritten as

$$H_i^{**} = H_i^* - \delta_H P_i^* - \xi_{iH} \quad (4)$$

Intitutively, the positive sign of δ_H indicates that non-participation of individuals in the labor force is justified by understating the self-assessed health and participation occurs by overstating self-reported health status. Here, ξ_{iH} is the i.i.d. disturbance term.

Further, observed participation variable P_i is the binary choice for whether individual participates in labour force or not and therefore is defined as

$$P_i = \begin{cases} 1 & if \ -\infty < P_i^* \le w_1 \\ 0 & if \ \ w_1 < P_i^* \le +\infty \end{cases} \quad (5)$$

where w_1 is unobserved cut-off point and ϑ_{iH}, ξ_{iH} and ϑ_{iP} are assumed to be jointly normally distributed.

From equation (1) and (4), we get

$$H_i^* = \theta_H P_i^* + \beta_H x_{i1} + \varepsilon_{iH} \quad (6)$$

where $\theta_H = (\alpha_H + \delta_H)$ and $\varepsilon_{iH} = (\vartheta_{iH} + \xi_{iH})$. Here, it is to be noted that only θ_H is identified but α_H and δ_H can not be estimated separately. In other words, true endogeneity[8] and rationalization endogeneity[9] can not be separated and only the total endogeneity can be estimated. However, the sign of θ_H can give useful information about which type of endogeneity dominates.

Further, substituting H_i^* from equation (4) in equation (2) we get,

$$P_i^* = \theta_p H_i^* + \eta_P x_{i2} + \varepsilon_{iP} \quad (7)$$

where $\theta_p = \alpha_P/(1+\delta_H\alpha_P)$, $\eta_P = \beta_P/(1+\delta_H\alpha_P)$, and $\varepsilon_{iP} = (\vartheta_{iP} - \alpha_P\xi_{iH})/(1+\delta_H\alpha_P)$

Thus, ε_{iH} and ε_{iP} are correlated through ξ_{iH}, even if ϑ_{iH} and ϑ_{iP} were assumed to be independent. However, ϑ_{iH} and ϑ_{iP} are expected to be correlated in high probability as some common unobserved factors may affect both health and labour force participation. Now, equation (6) is clearly an ordered probit/logit model and equation (7) is a probit/logit model. There is no compelling reason to choose probit over logit and vice versa as both provide similar results (Long, 1997). However, we restrict to the use of ordered probit and probit models respectively in equation (6) and equation (7). Thus, α_H, β_H, γ_H and m_k can only be identified up to a factor (equals to the inverse of the standard deviation of ε_{iH}) (Maddala, 1983). Similarly, α_P and η_P can only be identified up to a factor (equals to the inverse of the standard deviation of ε_{iP}).

Following the methodology in section 4, our goal is to estimate two simultaneous equations (6) and (7). The inclusion of z_{iH} and z_{iP} in x_{i1} and x_{i2} guarantees the identification of the model, but it cannot be estimated by standard techniques because we observe qualitative dependent variables instead of continuous variables. We estimate these equations using two approaches: the full information maximum likelihood (FIML) (Greene, 2003)[10] and two-stage approach[11] due to

[8] occurs because participation directly affects the true health status

[9] occurs due to justification of the labour force

[10] it takes care of the correlation between the error terms in simultaneous equation system and thus, produces consistent as well as efficient estimators. Another advantage is that the significance of the coefficient on the labour force participation variable and the correlation coefficient between the two error terms can be jointly tested and is therefore, true test of exogeneity hypothesis.

[11] it is an instrumental variable method where all exogenous variables are used as instruments to estimate each equation in the system separately. Produced estimators are consistent but not efficient and only exogeneity can be tested partially. However, Gameren (2008) argues that using detailed information on both labour force participation and on diseases and symptoms, the probability that common omitted unobserved factors affect both labor force participation and health can be reduced to near zero and thus increases the likelihood that our assumption that $\rho_{HP} = 0$, is valid.

Stern (1989). It can be noted that the observed self-assessed health H_i is measured on a three-point scale, and assuming that ε_{iH} and ε_{iP} follow standard bivariate normal distribution with a correlation coefficient ρ_{HP}.

5. Data and Model Specifications

5.1. Data: Source

The paper is based on 60th round (Schedule 25.0) data which was collected by National Sample Survey Organization (NSSO) in the period between January-June 2004. This particular survey has been conducted using a stratified multistage sampling design and covers 73,868 households from all over India, except some inaccessible regions. The data set provides a wealth of information on labour market activities, socio-economic, demographic and health status of individuals along with their household characteristics. Following the nature of study, analysis is carried out by taking a sample of individuals having age 60 years and above from the entire dataset and then for the purpose of gender wise analysis it is further disaggregated to men and women samples separately. The model is estimated separately for men aged, women aged and all aged.

5.2. Model Specifications

All the variables used in the analysis along with their respective forms and definitions are presented in Table 1. As we are dealing with the two equations simultaneously, we have two dependent variables: one corresponding to health status and other to the labour force participation. In health equations, self-assessed ordered health status (poor, good/fair, and excellent/very good) is used in FIML and two-stage approaches while in labour force equations, labour force participation dummy (participated vs. not participated) variable has been used. While estimating the equations using FIML method, as suggested by Maddala (1983) and Greene (1995) and followed by Cai and Kalb (2006), we use estimates of two stage method as initial values for the parameters because though not efficient, the initial estimators are consistent.

Further, as coefficients of male, female and all aged equations are only identified up to a factor (which may not be same for all); we will refrain to compare magnitude of these coefficients directly, however, sign of the coefficients are comparable.

Following Maddala (1983), to avoid identification problem in the simultaneous models, while most of the explanatory variables have entered into both the equations, atleast some of them are kept different. Common sets of independent variables constitute gender, age, number of children, education, household size, physical mobility, marital status, social group, location, household facilities of latrine, drainage, drinking water availability and its quality.

The variables used in both the equations are not random but have some theoretical base. For example, age appears in all the equations as both health and propensity to participate in the labour force are likely to be affected with increase in age of an individual. Literature shows that with age going up health deteriorates (Kenkel, 1995) and due to increased disability and other factors associated with ageing the likelihood of being excluded from the labour market too increase. Age-squared variable is used in all the models to look after the non-linear effect of age.

Table 1 Definition of the Variables Used in the Analysis

Variables	Definitions
Endogenous variables	
Labour force participation: dummy	=1 if participated in labour force; 0 otherwise
Current health status: ordered	assessment of own current health status on a three-point scale (0=poor; 1=good/fair; 2= Excellent/very good)
Common explanatory variables	
Gender: dummy	= 1 if male; 0 if female
Age beyond 60	(actual age in years -60
Age-squared	Square of age beyond 60
Number of children	Number of children
Marital Status	
Married: dummy (reference category)	=1 if married; 0 if single(never married/ widowed/ divorced/separated)
Currently married: dummy	=1 if current married; 0 otherwise
Educational Status	
Up to primary: dummy (reference category)	=1 if up to primary including illiterate; 0 otherwise
Middle or secondary: dummy	=1 if middle or secondary; 0 otherwise
Higher secondary or above: dummy	=1 if higher secondary or above; 0 otherwise
Other Health Characteristics	
Chronic Disease: dummy	=1 if suffers from any chronic disease; 0 otherwise
Disability : dummy	=1 if suffers from disability; 0 otherwise
Ailment_15days: dummy	=1 if reports ailment in last 15 days; 0 otherwise
Physical mobility: dummy	= 1 if physically mobile; 0 if confined to bed or home
Location Characteristics	
Sector: dummy	= 1 if rural; 0 if urban
Other Household Characteristics	
Social group: dummy	= 1 if Scheduled Tribe/Scheduled caste; 0 otherwise
Size of household	size of the household
Latrine facility: dummy	=1 if latrine facility is available, 0 otherwise
Drainage system: dummy	= 1 if drainage system available; 0 otherwise
Quality of drinking water: dummy	=1 if from bottled water/tap, tube-well/ handpump, tankers, pucca well; 0 if from tank/pond reserved for drinking
Treatment of water: dummy	=1 if treated by ultra-violated/resin/reverse osmosis/boiling/filter/cloth screen; 0 if by any disinfectant and other modes
Self-employed hh: dummy	=1 if household is self-employed in non-agriculture in rural areas and self-employed in urban areas; 0 otherwise
Agricultural/regular Labour hh: dummy	=1 if agricultural labour in rural or regular wage in urban areas; 0 otherwise
Other/Casual labour hh: dummy	=1 if other labour in rural or casual labour in urban areas; 0 otherwise
Self-employed in agriculture: dummy	=1 if self-employed in agriculture in rural areas; 0 otherwise
Other hh: Dummy (reference category)	=1 if other household types; 0 otherwise

Similarly, studies have suggested for gender differential in the labour force participation and health, which is, in general, biased towards male[12]. Further, it can be hypothesized that higher education may affect the labour force participation decision[13] by providing less intensive job opportunities and at the same time through awareness and other indirect factors it can also enhance health status. Cai and Kalb (2006) argue that age, age-squared and education can be treated as instruments for wage in the health and labour force equations as to earn wages one needs to participate in the labour force and this earning (wages) have an impact on health.

On association of marital status and health, numerous studies have shown advantages of being married on health of individuals[14]; married have lower rates of mortality, morbidity, and mental disorders in comparison to single[15] and divorced and separated have the highest rate of poor self-reported health status, followed by the widowed (Verbrugge 1979). Further, estimation results of Gameren (2008) shows that being married had negative effect on health and labour force participation. Therefore, marital status can be one of the potential explanatory variables in both the equations[16]. In India as location of residence (rural or urban) and social group are often highly related with poverty and therefore, they may have a negative impact on health and positive on the labour force participation. Household size and number of children variables can be viewed as support system of elderly for their maintenance and therefore, these could have an affect on the health and retirement decision both. Income in terms of per capita monthly expenditure could also affect both health and labour force participation decision but is again an endogenous variable and therefore, we include dummies for various household facilities as a proxy for standard of living of the households. Moreover, these facilities can also directly affect health of an individual. Finally, as physical mobility can be correlated with both health and labour force, we include this variable in both the equations.

Apart from these exogenous variables, some additional variables occur separately in health and labour force equations. For example, disability, chronic diseases, ailments within last 15 days are supplementary health variables that have been accommodated only in health equation while dummies for household types based on main occupation of the household are entered only in labour force equation and we hypothesize that the occupation of the household may have an impact on the participation decision of an individual in the labour market.

5.3. Data Descriptions

Table 2 documents that labour force participation rate among elderly is only about 34 (per 100), of which share of male and female are 53 and 15 percent, respectively. These figure further reduced when health status of participants are taken into account. While about 91 percent female aged with poor health do not participate in the labour market; over 67 percent their male counterpart do so and the combined figure raised to more than four-fifth of the total elderly population in that health category. Similar trend can also be observed in elderly of age sub-

[12] See for example, Artazcoz et al., 2001; Fernandez et. al., 1999; Arber and Ginn, 1993; Svallfors, 2007; Almquist, 1987

[13] See Kennedy and Hedley, 2003; Chiswick and Miller, 1994; Kenyon and Wooden, 1996

[14] Chakraborti, 2004; Rahman 1993; Zick and Smith 1991; Hu and Goldman 1990; Kisker and Goldman 1987; Livi-Bacci 1984

[15] Includes never married, divorced, separated and widowed

[16] We compare married vs. single due to negligible presence of never married and divorced or separated

groups 60-75 and 75+ years. While only 23 percent of the elderly with poor health in the age group 60-75 years participate in the labour force, the share of women elderly of this age group just touches two digit percentage points. Furthermore, for age group 75 years and above the proportion participation in the labour market further decline to 7, 1 and 13 percent for all, female and male elderly, respectively.

Table 2 Participation Rate (per 100) among Elderly by Age Group, Gender and Health Status

	Self-assessed health status			
	Poor	Good/fair	Excellent/very good	All
Aged 60-75				
Men	40.5	61.9	70.3	59.1
Women	10.9	18.0	25.9	16.7
All	23.1	40.5	53.8	37.7
Aged 75 and above				
Men	13.1	29.0	38.1	24.4
Women	1.2	4.3	2.6	3.6
All	7.0	17.7	22.1	14.3
Aged 60 and above				
Men	32.7	57.3	67.7	53.0
Women	8.6	16.3	23.4	14.8
All	19.1	37.2	50.9	33.9

It can also be seen that the percentage share of participation increased with the increase in ordered health status from poor to excellent and even within that health status category from female to male. Thus, from the table 2 it can be inferred that the participation rate is maximum for elderly with excellent/very good health followed by elderly with good/fair and poor health status. This trend continues in within men and women of the same age group and also across age groups and gender. Thus, we observe that participation rate for elderly men are higher than their women counterparts in all age groups; irrespective of the health status.

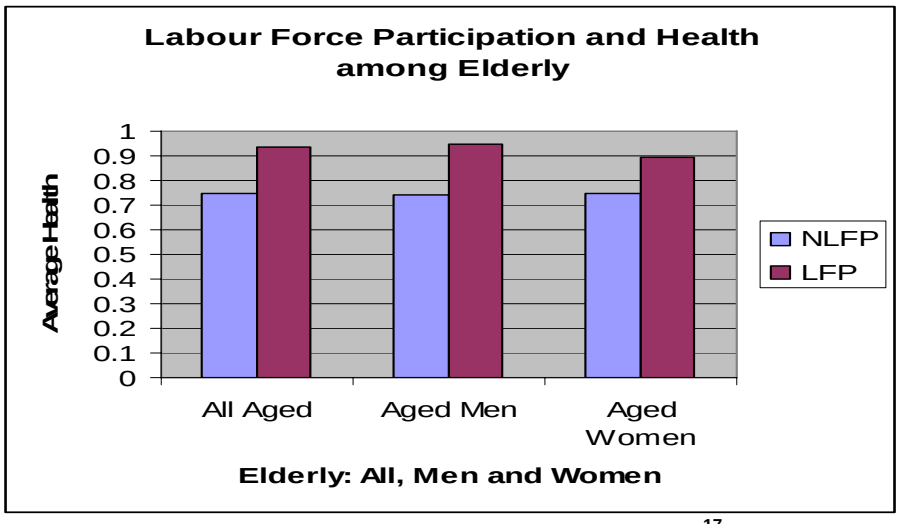

Figure 1 Labour force participation and health of elderly[17]

[17] NLFP and LFP stands for non-participation and participation in the labour force, respectively.

Also, we can easily observe from the figure 1 that irrespective of the gender of aged individual, health status seems to be better for those who participate in the labour market in compared to those who do not. However, slight gender differential can be is observed in favour of male elderly.

Table 3 Descriptive Statistics for the Variables Used

Variables	%	Mean	Std. deviation	Min	Max
Endogenous variables					
Labour force participation: dummy	33.9	-	-	0	1
Current Health Status	-	0.8	0.5	0	2
Poor	23.8	-	-	0	1
Good/Fair	70.9	-	-	0	1
Excellent/Very Good	5.3	-	-	0	1
Explanatory Variables					
Personal Characteristics					
Gender: dummy	50.0	-	-	0	1
Age beyond 60	-	7.5	6.9	0	50
Age-squared	-	103.5	188.1	0	2500
Number of children	-	3.8	2.1	0	15
Marital Status					
Never married: dummy	1.2	-	-	0	1
Currently married: dummy	59.3	-	-	0	1
Widowed: dummy	39.0	-	-	0	1
Divorced/separated: dummy	0.5	-	-	0	1
Educational Status					
Up to primary: dummy	85.4	-	-	0	1
Middle or secondary: dummy	10.3	-	-	0	1
Higher secondary or above: dummy	4.4	-	-	0	1
Other Health Characteristics					
Chronic Disease: Dummy	13.1	-	-	0	1
Disability : Dummy	6.4	-	-	0	1
Ailment_15days: Dummy	31.0	-	-	0	1
Physical Mobility: Dummy	91.9	-	-	0	1
Location Characteristics					
Sector: dummy	75.8	-	-	0	1
Other Household Characteristics					
Social group: dummy	24.1	-	-	0	1
Size of household	-	5.5	3.2	1	40
Latrine facility: dummy	42.0	-	-	0	1
Drainage system: dummy	53.2	-	-	0	1
Quality of drinking water: dummy	97.4	-	-	0	1
Treatment of water: dummy	27.1	-	-	0	1
Self-employed hh: dummy	20.2	-	-	0	1
Agricultural/regular Labour hh: dummy	22.8	-	-	0	1
Other/Casual labour hh: dummy	7.8	-	-	0	1
Self-employed in agriculture: dummy	33.5	-	-	0	1
Other hh: Dummy (reference category)	15.7	-	-	0	1

Now, table 3 suggests that about 71 percent elderly report good or fair health status followed by poor (24%) and excellent/very good (5%). This indicates that majority of elderly report that they have good or fair health. This could be attributed to reporting response errors and part of it can be explained through the perception of elderly to suppose health as a natural gift of ageing. The gender composition is balanced among elderly with average age 67.5 years.

In extended Indian family system, many of the aged, particularly those who lost their spouse, depend on their children and other household members for their maintenance. Descriptive statistics shows that spreading over a range of 2 to 15, average elderly has 4 living children with 5-6 members in the family on an average. In contrast to developed countries, majority of elderly population in India (about 59%) is ever-married; 39 percent are widowed and unmarried or divorced and separated together constitute less than 2 percent share.

The literacy rate among elderly is as expected very low as only 15 percent of them are educated above primary level of education. Table 3 documents that more than three-fourth (about 76%) of elderly population in India lives in rural areas.

Social composition of elderly household shows that one-fourth of them are Scheduled Tribe and Scheduled Castes. Among the elderly households, 42 percent elderly households have latrine facility, 53 percent have drainage system, about 97 percent reports that they have access to safe drinking water whereas 27 percent households use treated water for household purposes.

Turning on to additional health variables, about 6 percent elderly suffers from atleast one kind of disability as against 13 percent from at least one chronic disease. 31 percent elderly reports atleast an ailment within 15 days prior to the survey and only 8 percent say they are confined to bed or home and therefore, physically immobile. As we hypothesized occupation of the household may also influence occupation and retirement decision of the individuals', about 34 percent of households with at least one elderly are self-employed in agriculture (rural areas), 31 percent in any kind of labour work and 20 percent are involved in self-employment including non-form sector in rural India.

6. Results

6.1. Tests for Exogeneity

(a) Under FIML approach

We have Followed Cai and Kalb (2006) to test for the exogeneity of health to labour force participation. For health to be exogenous to labour force participation, the estimated coefficients of labour force participation in the health equation (θ_p) and correlation coefficient between error terms in health and labour force participation (ρ) should jointly be zero. Under the null hypothesis of $H_0 : \theta_p = 0, \rho = 0$ against alternative $H_1 : \theta_p \neq 0, \rho \neq 0$, test for the exogeneity will be based on the Wald-test statistics which asymptotically follow chi-square test with 2 degrees of freedom.

Table 4a Wald Test for Exogeneity Under Full Information Maximum Likelihood approach

Health Status	Men aged	Women aged	All aged
$\chi^2_{(2)}$	59.04***	12.65***	60.24***

***: significant at 1% level of significance

Table 4a suggests that for all aged, men and women aged, the exogeneity hypothesis is rejected at 1% level of significance and therefore, we conclude that the health variable is truly endogenous to labour force participation and therefore, the use of FIML is justified here.

(b) Under Two Stage approach

Three alternative tests have been used to test the null hypothesis $H_o : (\theta_H = 0,\ \rho_{HP} = 0)$ for exogeneity under two stage set up. Following Gameren (2008), under the assumption that $\rho_{HP} = 0$ breaks down to a test of the significance of θ_H in equation (13). Due to the assumed absence of correlation, it remains a partial test for exogeneity.

First test is based on subjective information and labour force participation variable is regressed over all explanatory variables of equation (12) plus health variable to test whether coefficient of health variable is significant. Second test for the exogeneity of health in the participation decision is the Hausman test (Smith and Blundell, 1986). In this test, prediction error on the health equation (13), $\hat{\varepsilon}_{iH} = H_i^* - \hat{H}_i$ is used as an explanatory variable in the participation equation (12) to test its significance. If coefficient of the prediction error appears significant, there is evidence that model suffers from misspecification, which can potentially be due to the endogeneity of health. We will use observable variable H_i instead of unobserved latent health variable H_i^*.

In the third test, we estimate equation (12) by considering all the subjective and objective information on health variable and look for the coefficient of observed health variable to appear significant.

Table 4b Alternative Tests for Exogeneity Under Two Stage approach

Health Status	Men aged	Women aged	All aged
Subjective information	0.357***(0.026)	0.234***(0.031)	0.314***(0.020)
Hausman-test	-0.309***(0.042)	-0.196***(0.057)	-0.263***(0.034)
Subjective and objective information	0.312***(0.026)	0.211***(0.033)	0.278***(.020)

Note: coefficients and standard errors (in parentheses) are reported. ***: significant at 1% level of significance

Table 4b clearly shows that all the alternative tests reject that null hypothesis of exogeneity at 1% level of significance. However, it can be noted that the Hausman test is very general and merely indicates that there could be a problem with model specification (Garemen, 2008).

6.2. Estimation Results

After confirming that health is endogenous to labour force participation, estimation results are documented in this section. All the estimation results for all aged, male aged and female aged are presented in Table 5, 6 and 7, respectively. Each of these tables report estimation results based on FIML and two stage methods.

From labour force equation presented in table 5, 6 and 7 it is evident that impact of health on the propensity to participate in the labour force is significant and positive for all, male and female aged. In other words, being all other factors at equal level, better health status increases the likelihood of an elderly to participate in the labour force. Further, all the additional characteristics describing household occupation (z_{iP}) are significant, which shows that individual's decision to participate in the labour market also depends upon their household occupation.

6.3. Assessing the effect of health on labour force participation

As in the presence of endogeneity marginal effects of health on labour force participation cannot be computed, only coefficients estimates are documented in Table 5, 6 and 7. However, we compute conditional probabilities of labour force participation by observed poor, good/fair and excellent/very good health status as shown in Table 8. This table gives a sense of how change in the probability to participate varies with the health status. Based on average predicted probabilities to participate corresponding to each observed health status, we compute percentage change in the conditional probabilities as compared to higher health status (i.e. for poor as compared to good/fair and for good/fair as compared to excellent/very good health status) and then percentage change in the predicted probability as compared with excellent health status.

Table 5 Estimation Results: All Aged

Estimation Method	Full Information Maximum Likelihood (FIML)		Two-Stage	
Dependent Variables	Labour force	Health	Labour force	Health
Explanatory Variables	Coefficient (Standard errors)	Coefficient (Standard errors)	Coefficient (Standard errors$)	Coefficient (Standard errors$)
Labour force participation: dummy	-	0.073***(0.016)		0.072***(0.016)
Current health status	0.361***(0.030)	-	0.379***(0.032)	
Age beyond 60	-0.056***(0.004)	-0.038***(0.003)	-0.057***(0.004)	-0.038***(0.003)
Age-square	0.000**(0.000)	0.001***(0.000)	0.000***(0.000)	0.001***(0.000)
Gender: dummy	1.218***(0.025)	0.053*(0.027)	1.233***(0.021)	0.051*(0.027)
Number of children	-0.008*(0.005)	-0.006(0.004)	-0.008*(0.004)	-0.006(0.004)
Middle or secondary: dummy	-0.115***(0.030)	0.150***(0.025)	-0.117***(0.029)	0.151***(0.025)
Higher secondary or above: dummy	-0.373***(0.043)	0.274***(0.036)	-0.362***(0.043)	0.273***(0.035)
Size of household	-0.059***(0.003)	0.001(0.002)	-0.059***(0.003)	0.001(0.002)
Physical mobility: dummy	0.366***(0.065)	1.184***(0.030)	0.348***(0.063)	1.175***(0.032)
Ailment_15days: dummy		-0.475***(0.017)	-	-0.464***(0.018)
Married: dummy	0.245***(0.021)	-0.038**(0.018)	0.255***(0.021)	-0.038**(0.018)
Social group: dummy	0.063***(0.022)	0.010(0.018)	0.069***(0.021)	0.008(0.018)
Sector: dummy	0.326***(0.027)	-0.111***(0.020)	0.336***(0.027)	-0.110***(0.019)
Disability : dummy	-	-0.358***(0.030)	-	-0.331***(0.034)
Chronic Disease: dummy	-	-0.276***(0.022)	-	-0.297***(0.022)
Latrine facility: dummy	-0.237***(0.022)	0.111***(0.019)	-0.243***(0.022)	0.112***(0.018)
Drainage system: dummy	-0.117***(0.021)	0.134***(0.017)	-0.121***(0.020)	0.134***(0.017)
Quality of drinking water: dummy	-0.204***(0.046)	-0.160***(0.039)	-0.174***(0.045)	-0.160***(0.039)
Treatment of water: dummy	-0.088***(0.022)	0.123***(0.018)	-0.095***(0.022)	0.123***(0.018)
Self-employed hh: dummy	1.306***(0.038)	-	1.324***(0.037)	-
Agricultural/regular Labour hh: dummy	0.953***(0.037)	-	0.953***(0.037)	-
Other/Casual labour hh: dummy	0.986***(0.044)	-	1.032***(0.046)	-
Self-employed in agriculture: dummy	1.377***(0.037)	-	1.377***(0.039)	-
constant	-2.053***(0.082)	-	-2.155***(0.081)	-
Cut-off Point m0	-	-0.183***(0.060)	-	-0.181(0.061)
Cut-off Point m1	-	2.410***(0.060)	-	2.389(0.062)
Correlation rho	-0.276***(0.036)		-	-
Log likelihood	-32139.098		-13161.31	-19526.763
Model Statistic	4315.99***		12344.83***	6093.58***
Pseudo R^2	-		0.3193***	0.1350***
Number of observations	29813		30819	29813

Note: Model statistics reported here are wald statistics for FIML and likelihood ratio chi-square for two stage method, respectively.

$Standard errors are in parenthesis and are bootstrapped (1500 replications). ***, **, * indicates significance at 1%, 5%, 10% level of significance.

Table 6 Estimation Results: Male Aged

Estimation Method	Full Information Maximum Likelihood (FIML)		Two-Stage	
Dependent Variables	Labour force	Health	Labour force	Health
Explanatory Variables	Coefficient (Standard errors)	Coefficient (Standard errors)	Coefficient (Standard errors)$	Coefficient (Standard errors)$
Labour force participation: dummy	-	0.089***(0.020)	-	0.087***(0.020)
Current health status	0.414***(0.036)		0.434***(0.039)	
Age beyond 60	-0.062***(0.006)	-0.042***(0.004)	-0.064***(0.005)	-0.041***(0.004)
Age-square	0.000**(0.000)	0.001***(0.000)	0.001***(0.000)	0.001***(0.000)
Number of children	0.002(0.006)	-0.007(0.005)	0.002(0.006)	-0.007(0.005)
Middle or secondary: dummy	-0.159***(0.034)	0.174***(0.030)	-0.157***(0.034)	0.174***(0.029)
Higher secondary or above: dummy	-0.425***(0.048)	0.307***(0.042)	-0.409***(0.047)	0.305***(0.040)
Size of household	-0.040***(0.004)	-0.003(0.003)	-0.038***(0.004)	-0.003(0.003)
Physical mobility: dummy	0.370***(0.083)	1.253***(0.046)	0.341***(0.077)	1.242***(0.050)
Ailment_15days: dummy		-0.521***(0.024)	-	-0.51***(0.026)
Married: dummy	0.407***(0.031)	0.046*(0.028)	0.421***(0.031)	0.045(0.028)
Social group: dummy	-0.015(0.029)	0.012(0.025)	-0.012(0.027)	0.01(0.026)
Sector: dummy	0.400***(0.034)	-0.084***(0.028)	0.412***(0.034)	-0.084***(0.028)
Disability : dummy	-	-0.335***(0.044)		-0.29***(0.050)
Chronic Disease: dummy	-	-0.238***(0.031)		-0.263***(0.033)
Latrine facility: dummy	-0.175***(0.029)	0.107***(0.026)	-0.179***(0.028)	0.107***(0.026)
Drainage system: dummy	-0.054*(0.028)	0.121***(0.024)	-0.055**(0.027)	0.121***(0.024)
Quality of drinking water: dummy	-0.167***(0.063)	-0.214***(0.053)	-0.118**(0.061)	-0.214***(0.052)
Treatment of water: dummy	-0.166***(0.029)	0.118***(0.025)	-0.177***(0.029)	0.119***(0.024)
Self-employed hh: dummy	1.483***(0.049)	-	1.502***(0.046)	-
Agricultural/regular Labour hh: dummy	0.919***(0.045)	-	0.941***(0.045)	-
Other/Casual labour hh: dummy	0.971***(0.056)	-	1.065***(0.057)	-
Self-employed in agriculture: dummy	1.574***(0.049)	-	1.599***(0.046)	-
constant	-1.335***(0.101)	-	-1.431***(0.099)	-
Cut-off Point m0	-	-0.198**(0.083)	-	-0.194(0.083)
Cut-off Point m1	-	2.395***(0.084)	-	2.37(0.084)
Correlation rho	-0.326***(0.043)		-	-
Log likelihood	-17572.88		-7981.313	-9951.382
Model Statistic	2256.91***		5882.37***	3263.65***
Pseudo R^2	-		0.269	0.141
Number of observations	15216		15758	15216

Note: Model statistics reported here are wald statistics for FIML and likelihood ratio chi-square for two stage method, respectively.

$Standard errors are in parenthesis and are bootstrapped (1500 replications). ***, **, * indicates significance at 1%, 5%, 10% level of significance.

Table 7 Estimation Results: Female Aged

Estimation Method	Full Information Maximum Likelihood (FIML)		Two-Stage	
Dependent Variables	Labour force	Health	Labour force	Health
Explanatory Variables	Coefficient (Standard errors)	Coefficient (Standard errors)	Coefficient (Standard errors)$	Coefficient (Standard errors)$
Labour force participation: dummy	-	0.071**(0.031)	-	0.07**(0.030)
Current health status	0.272***(0.053)		0.29***(0.056)	-
Age beyond 60	-0.057***(0.007)	-0.034***(0.004)	-0.056***(0.007)	-0.034***(0.004)
Age-square	0.001***(0.000)	0.001***(0.000)	0.001***(0.003)	0.001***(0.000)
Number of children	-0.029***(0.007)	-0.004(0.005)	-0.029***(0.007)	-0.004(0.005)
Middle or secondary: dummy	-0.282***(0.078)	0.129***(0.048)	-0.292***(0.084)	0.13***(0.045)
Higher secondary or above: dummy	-0.238*(0.126)	0.24***(0.078)	-0.262**(0.136)	0.241***(0.082)
Size of household	-0.108***(0.006)	0.008**(0.004)	-0.108***(0.007)	0.008**(0.004)
Physical mobility: dummy	0.278***(0.105)	1.138***(0.041)	0.267***(0.102)	1.132***(0.042)
Ailment_15days: dummy		-0.428***(0.024)		-0.416***(0.025)
Married: dummy	0.184***(0.032)	-0.093***(0.024)	0.187***(0.031)	-0.092***(0.023)
Social group: dummy	0.179***(0.034)	0.004(0.027)	0.186***(0.033)	0.004(0.027)
Sector: dummy	0.165***(0.043)	-0.132***(0.027)	0.168***(0.044)	-0.13***(0.027)
Disability : dummy		-0.381***(0.042)	-	-0.366***(0.044)
Chronic Disease: dummy		-0.31***(0.031)	-	-0.33***(0.033)
Latrine facility: dummy	-0.33***(0.036)	0.114***(0.028)	-0.339***(0.035)	0.115***(0.027)
Drainage system: dummy	-0.189***(0.033)	0.155***(0.025)	-0.194***(0.034)	0.154***(0.025)
Quality of drinking water: dummy	-0.254***(0.07)	-0.088(0.058)	-0.255***(0.065)	-0.088(0.059)
Treatment of water: dummy	0.077**(0.037)	0.117***(0.026)	0.077**(0.037)	0.116***(0.025)
Self-employed hh: dummy	0.92***(0.062)	-	0.95***(0.067)	-
Agricultural/regular Labour hh: dummy	0.913***(0.06)	-	0.907***(0.064)	-
Other/Casual labour hh: dummy	0.859***(0.07)	-	0.885***(0.076)	-
Self-employed in agriculture: dummy	1.036***(0.059)	-	1.032***(0.068)	-
constant	-1.193***(0.125)	-	-1.223***(0.119)	-
Cut-off Point m0	-	-0.104(0.082)	-	-0.101(0.083)
Cut-off Point m1	-	2.507***(0.083)	-	2.495(0.084)
Correlation rho	-0.223***(0.064)		-	-
Pseudo R^2	-		0.1802	0.1254
Number of observations	14597		15061	14597
Log likelihood	-14152.687		-4792.773	-9528.041
Model Statistic	2063.34***		2106.57***	2732.67***

Note: Model statistics reported here are wald statistics for FIML and likelihood ratio chi-square for two stage method, respectively.
$Standard errors are in parenthesis and are bootstrapped (1500 replications). ***, **, * indicates significance at 1%, 5%, 10% level of significance.

Table 8 Conditional Probability of Labour Force Participation

Health Status	Average predicted probability of LFP	% Change compared with higher health status	% Change compared with excellent health status
Men Aged			
Poor	0.4242	-31.6688	-38.8496
Good/Fair	0.6208	-10.5089	-10.5089
Excellent/very good	0.6937	-	-
Women aged			
Poor	0.0973	-21.9727	-34.6541
Good/Fair	0.1247	-16.2525	-16.2525
Excellent/very good	0.1489	-	-
All aged			
Poor	0.2478	-35.3509	-49.9192
Good/Fair	0.3833	-22.5344	-22.5344
Excellent/very good	0.4948	-	-

It can also be seen that the predicted conditional probability increases from lower health status to higher observed health status in all the samples for all aged, men aged and women aged. Also, higher change in percentages can be observed as we move from poor health to upper next health categories. However, while women aged dominates in terms of percentage reduction in probability to participate in labour force when we compare poor health status to good/fair or excellent/very good health (32% and 39% as compared to 22% and 35% change as compared to higher and highest health category); it is men aged who dominate when we look at the change from good/fair to excellent/very good health status (16% as compared to 11% change in probability). Overall, result indicates that those who have better health also have other characteristics that allows for increased probability in favour of participation in the labour force.

Further, it is evident from both FIML and two stage estimates that labour force participation has also significant and positive feedback effect on health. This positive effect suggests that self-assessed health for elderly, whether male or female, rationalization endogeneity may occur and thus, poor health could lead to non-participation of elderly in the work force. However, this may not be the proper explanation. The positive relationship may be due to self-decision of an elderly to enter or to get out of the labour force and freedom to choose the kind of job they do or involve in. This means that those elderly who are currently in the labour force are in upper level of health and their job and working conditions are either helpful in improving their health or at least do not have negative effect on their health. The later explanation follows the findings of Ettner (1997) that self-assessed measures of health may not be affected by employment status, endorsed by Cai and Kalb (2006) for older Australian women. Also, as expected all the additional health variables including physical mobility, disability, ailments within 15 days and chronic diseases are significant and have expected sign in the estimated health equation.

6.4. Explaining the role of other explanatory variables

Now turning to the exogenous variables, though results are presented for labour force and health status for the sake of simplicity, mostly we would report result for labour force equation only. From table 4 (column 1), we find that significant gender differential is present in the health and labour force participation, biased towards male elderly. Similarly, in combined sample and in both health and labour force equations, we find that age has negative and age-square has positive sign, which indicate that with increase in age, both health status and propensity to participate in the labour force reduced significantly and confirm the non-linear effect of age on health and labour force participation. Household size has significant and negative effect on participation decision of elderly household member in the labour force. The effect of education can also be observed to be negative on labour force participation while it is positive for health status. This result is expected as individuals with higher level of education may have sufficient savings and income and therefore they could prefer early retirement from the labour market while capable for maintaining their health status. FIML estimates do suggest that marital status of elderly also has an impact on the labour force participation as well as on their health status. Table 5 indicates that for all elderly, as compared to single, being married increases the probability of participation. However, result is not similar for male and female elderly. As it has been mentioned earlier, the household facilities are used as proxy for household standard of living. Most of the indicators have negative sign in labour force participation indicate that the presence of these facilities discourages their older members to work further. Social status and location also determines the propensity to participate in the labour force. Estimation results of various models consistently shows that for full sample, being scheduled caste and scheduled tribe and located in rural areas have more probability to be in labour market than other castes and those who reside in urban areas. However, this result is not consistent for male and female elderly where these variables act differently (see table 6 and 7).

Moreover, it can be noticed that unlike the findings of Cai and Kalb (2006), both FIML and two stage approaches produce almost similar estimation results in terms of sign, coefficients and significance level[18].

7. Conclusion and Discussions

In the paper, we have examined the linkages between health and labour force participation. Descriptive statistics and graphical presentation suggests that low participation rate of elderly is associated with lower level of health status. Also, both participation rate and health status is lower for women aged in comparison to their men counterpart. Using NSSO 60th round survey, the paper tries to address the issue of potential endogeneity of own perception about health of the elderly on the decision to participate in the labour market. Simultaneous equations estimates have been obtained using full information maximum likelihood method which takes into account the correlation between the disturbance terms. The paper takes care of the issue of measurement biasness in self-assessed health status variable by introducing additional health information on diseases, ailments, physical mobility and disability in the health equations and household

[18] In addition to FIML and two stage method, we also use seemingly unrelated probit model. For this, we converted ordered SRHS into dichotomous variable (poor =0 and other=1) and use it with labour force variable as in other models. We found that its result is also similar to FIML and two stage methods. Estimation results are not presented here, however, can be obtained from the author.

occupation variables in the labour force equations. For comparison purposes, we also applied two stage approach of model estimation. Estimation results indicate strong positive effect of health status on labour force participation for Indian elderly which is in accordance with Stern (1989), Bound (1991), Campolieti (2002), Cai and Kalb (2006) and Gameren (2008). Further, joint test of significance of labour force participation coefficient and the correlation coefficient between error terms of health and labour force equations (Wald test) strongly rejects the null hypothesis of exogeneity and therefore, suggests that health should be treated as endogenous to labour force. Our combined and separate estimates for men and women aged indicate strong positive effect of health on labour force participation and vice-versa implying two-way causation running between health and labour force participation among elderly in India. However, result is in contrast to Gameren (2008) which finds no clear evidence of a causation running from labour force participation to health in case of Maxican elderly.

Moreover, conditional probability of labour force participation reported in Table 8 indicates that with change in the health status from bottom health category to upper and the uppermost, the probability to participate in the labour force increased for both male and female elderly; however, the increase in probability is more for women aged. Like Cai and Kalb (2006) findings on older women, the possibility of rationalization endogeneity can not be ignored as the positive effect of health on labour force is consistently significant for all, male and female aged. Other exogenous variables are having expected sign and most of them are significant.

FIML estimates has also been compared with that of two stage procedures and we find that, in contrast to Cai and Kalb (2006), estimates are similar in their effect, direction and significance status. However, to counter possible endogeneity bias FIML is recommended over the two stage approach.

From policy perspectives, the above findings have implications for the health care and employment policies in the country. The strong indications of gender differential in both health and labour force participation are alarming and this needs to be addressed by the policy makers. Finally, the study suggest that in order to keep more elderly in the labour market, sufficient health care is necessary and accordingly more investment in this sector is imperative.

References:

Adams, *et al* (2003): Healthy, Wealthy, and Wise? Tests for Direct Causal Paths between Health and Socioeconomic Status, *Journal of Econometrics*, **112**: 3-56.

Almquist E M (1987): Labor Market Gender Inequality in Minority Groups, *Gender and Society*, **1**(*4*): 400-414.

Anderson, K H and R V Burkhauser (1985): The Retirement-Health Nexus: A New Measure of an Old Puzzle, *The Journal of Human Resources*, **20**(*3*): 321-330.

Arber, S and J, Ginn (1993): Gender and inequalities in health in later life, *Soc Sci Med*, **36**(*1*):33-46.

Artazcoz, L, C Borrell and J Benach (2001): Gender inequalities in health among workers: the relation with family demands, *J Epidemiol Community Health*, **55**:639-647.

Bazzoli, G (1985): The Early Retirement Decision: New Empirical Evidence on the Influence of Health, *Journal of Human Resources*, **20**: 214-234.

Blundell, R, C Meghir, and S Smith (2002): Pension Incentives and the Pattern of Early Retirement, *Economic Journal*, **112**: C153-C170.

Boskin, M J (1977): Social Security and Retirement Decisions, *Economic Inquiry*, **15**: 1-25.

Bound, J (1991): Self-Reported Versus Objective Measures of Health in Retirement Models, *Journal of Human Resources*, **26**(*1*): 106-138.

Bound, J and RV Burkhauser (1999): Economic Analysis on Transfer Programs Targeted on People with Disabilities, in O Ashenfelter and D Card (eds.), *Handbook of Labor Economics*, **3c**: 3417-528, Amsterdam: North-Holland, Elsevier.

Butler, J S, R V Burkhauser, J M Mitchell and T Pincus (1987): Measurement Error in Self-Reported Health Variables, *Review of Economics and Statistics*, **69**(*4*): 644-650.

Cai, L and G Kalb (2006): Health Status and Labour Force Participation: Evidence From Australia, *Health Economics*, **15**: 241-261.

Campolieti, M (2002): Disability and the Labor Force Participation of Older Men in Canada, *Labour Economics*, **9**: 405-432.

Case, AC and A Deaton (2003): Broken Down by Work and Sex: How Our Health Declines, NBER working paper, 9821. Available from http://www.nber.org/ papers/ w9821. Last accessed on November 3, 2008.

Chakraborti, R D (2004): *The Greying of India: Population Ageing in the Context of Asia*, SAGE Publications.

Charles, K (2002): Is Retirement Depressing?: Labour Force Inactivity and Psychological Well-being in Later Life, NBER working paper, 9033.

Chirikos, T N (1986): Accounting for the Historical Rise in Working Disability Prevalence, *Milbank Q*, **64**(*2*): 271-301.

Chirikos, T N (1993): Relationship between Health and Labour Market Status, *A\nnual Reviews of Public Health*, **14**: 293-312.

Chiswick, B, and P Miller (1994): *Post-Immigration Qualifications in Australia: Determinants and Consequences*, Australian Government Publishing Service, Canberra.

Connelly, JE, JT Philbrick, RG Smith, DL Kaiser and A Wymer (1989): Health Perceptions of Primary Care Patients and the Influence on Health Care Utilization, *Medical Care*, **27**: S99-S109.

Currie, J and B C Madrian (1999): Health, Health Insurance and the Labor Market, *Handbook of Labor Economics*, in O Ashenfelter and D Card (eds.), *Handbook of Labor Economics*, **3c**: 3310-3415, Amsterdam: North-Holland, Elsevier.

Deaton, A S and C H Paxson (1998): Aging and Inequality in Income and Health, *American Economic Review*, **88**: 248–253.

Disney, R, C Emmerson, and M Wakefield (2006): Ill Health and Retirement in Britain: A Panel Data-based Analysis, *Journal of Health Economics*, **25**: 621-649.

Dwyer, D S and O S Mitchell (1999): Health Problems as Determinants of Retirement: Are Self-Rated Measures Endogenous?, *Journal of Health Economics*, **18**: 173-193.

Ettner, S (1997): Is Working Good for You?: Evidence on the Endogeneity of Mental and Physical Health to Female Employment, Unpublished paper (Harvard School of Public Health).

Ettner, SL (1996): New Evidence on the Relationship between Income and Health, *Journal of Health Economics*, **15**: 67–85.

Fernandez E, A Schiaffino, L Rajmil, X Badia and A Segura (1999): Gender Inequalities in Health and Health Care Services Use in Catalonia (Spain), *J Epidemiol Community Health*, **53**:218–222.

Fuchs, V R (1982): Self-employment and labour-force participation of older males, *Journal of Human Resources*, **17**:339–57.

Gameren (2008): Labor Force Participation of Maxican Elderly: The Importance of Health, *Estudios Economicos*, **23**(*1*): 89-127.

Goldman N, S Korenman, and R Weinstein (1995): Marital Status and Health among the Elderly, *Social Science & Medicine*, **40**: 1717-1730.

Gove, W R (1972): Sex, Marital Status and Suicide, *Journal of Health and Social Behavior*, **13**:204-13.

Greene, W H (1995): *LIMDEP Version 7.0*, Bellport, NY: Econometric Software.

Greene, W H (2003): *Econometric Analysis*, 5th Edition, Delhi, Pearson Education, India.

Gruber, J, and DA Wise (1999): Social security programs and retirement around the world, *Research in Labor Economics*, **18**: 1-40.

Gruber, J, and DA Wise (2004): *Social security programs and retirement around the world: Micro-Estimation*, NBER/Chicago University Press.

Haveman RH, B Wolfe, L Buron and S Hill (1992): Productivity Losses from Health Disability in the United States from 1973-1983: an Earnings Capacity Approach, in proceedings of the Annual Meeting of the American Economic Association. New Orleans.

Hu, Y R and N Goldman (1990): Mortality Differentials by Marital Status: An International Comparison, *Demography*, **27**: 233-250.

Idler, EL and SV Kasl (1995): Self-Rating of Health: Do They Also Predict Change in Functional Ability?, *Journal of Gerontology*, **50**(*6*): S344-53.

Idler, EL and Y Benyamini (1997): Self-Rated Health and Mortality: A Review of Twenty Seven Community Studies, *Journal of Health and Social Behavior*, **38**: 21-37.

Kenkel, D S (1995): Should You Eat Breakfast? Estimates from Health Production Functions, *Health Economics*, **4**: 15-29.

Kennedy, BP, I Kawachi, R Glass and D Prothrow-Stith (1998): Income Distribution, Socio-Economic Status, and Self Rated Health in the United States: Multilevel Analysis, *British Medical Journal*, **317**:917–921.

Kennedy, S and D Hedley (2003): *A Note on Educational Attainment and Labour ForceParticipation in Australia*, Treasury Working Paper, 2003/03, November.

Kenyon, P and M Wooden (1996): Labour Supply, in Norris and Wooden (eds), *The Changing Australian Labour Market*, AGPS, Canberra.

Kerkhofs, M and M Lindeboom (1995): Subjective Health Measures and State Dependent Reporting Errors, *Health Economics*, **4:** 221-235.

Kerkhofs, M and M Lindeboom (1997): Age Related Health Dynamics and Changes in Labour Market Status, *Health Economics*, **6**:407-24.

Kerkhofs, M, M Lindeboom, and J Theeuwes (1999): Retirement, Financial Incentives and Health, *Labour Economics*, **6**: 203-227.

Kisker, E E and N Goldman (1987): Perils of Single Life and Benefits of Marriage, *Social Biology*, **34**:135-152.

Kohli, M, M Rein, A M Guillenmard and H van Gunsteren (eds.) (1991): *Time for Retirement : Comparative Studies of Early Exit from the Labour Force*, Cambridge: Cambridge University Press.

Kreider, B (1999): Latent Work Disability and Reporting Bias, *The Journal of Human Resources*, **34**(*4*): 734-769.

Lambrinos, J (1981): Health: A Source of Bias in Labor Supply Models, *Review of Economics and Statistics*, May, 206-212.

Livi-Bacci, M (1984): Selectivity of Marriage and Mortality: Notes for Future Research, in N Keyfitz and Belgium Liege (eds.), *Population and Biology*, International Union for the Scientific Study of Population, 99-108.

Long, J S (1997): *Regression Models for Categorical and Limited Dependent Variables*, Thousand Oaks, CA: Sage Publications.

Lumsdaine, R L, and O S Mitchell (1999): New Developments in the Economic Analysis of Retirement, in O Ashenfelter, and D Card (eds.), *Handbook of Labor Economics*, **3c**: 3261-3307, North-Holland, Amsterdam.

Maddala, G (1983): *Limited Dependent and Qualitative Variables in Econometrics*, New York: Cambridge University Press.

McCallum, J, B Shadbolt and D Wang (1994): Self-Rated Health and Survival: a 7-year Follow-Up Study of Australian Elderly, *American Journal of Public Health*, **847**:1100-1105.

Ogawa, N and RW Hodge (1994). Patrilocality, Childbearing, and the Labour Supply and Earning Power of Married Japanese Women, in JF Ermisch and N Ogawa (eds.), *The Family, the Market, and the State in Ageing Societie*, Clarendon Press: 105-131.

Okun, MA, WA Stock, MJ Haring and RA Witter (1984): Health and Subjective Wellbeing: A Meta-Analysis, *International Journal of Aging and Human Development*, **192**:111-132.

Parsons, D O (1980a): The Decline of Male Labor Force Participation, *Journal of Political Economy*, **88**:117-134.

Parsons, DO (1980b): Racial Trends in Male Labor Forms Participation, *American Economic Review*, **70**: 911-920

Parsons, DO (1982): The Male Labour Force Participation Decision: Health, Reported Health, and Economic Incentives, *Economica*, **49**(*193*): 81-91.

Quinn (1977): Microeconomic Determinants of Early Retirement: a Cross-Sectional View of White Married Men, *Journal of Human resources*, **12:**329-46.

Quinn, J F and & RV Burkhauser (1995): Retirement and Labor Force Behavior of the Elderly, in L G Martin and S H Preston (eds.), *Demography of aging*, 50–101, Washington, DC: National Academy Press.

Rahman, O (1993): Excess Mortality for the Non-Married in Rural Bangladesh, *International Journal of Epidemiology*, **22**: 445-56.

Salkever, D S (1984): Cost Implications of Hospital Unionization: a Behavioral Analysis, *Health Services Research*, **19**(*5*):639-64.

Saunders, P (1996): Income, Health and Happiness, *The Australian Economic Review*, 353-366.

Schofield**,** D (1996): The Impact of Employment and Hours of Work on Health Status and Health Service Usage, NATSEM Discussion Paper, 11, Canberra, March.

Sen, AK (2002): Health: perception versus observation, *British Medical Journal*, **324**:860-861.

Smith, J (2004): Unraveling the SES Health Connection, IFS working paper, WP04/02.

Smith, JP (1999): Health Bodies and Thick Wallets: the Dual Relation between Health and Economic Status, *Journal of Economic Perspectives*, **13**: 145-166.

Smith, R J, and R W Blundell (1986): An Exogeneity Test for a Simultaneous Equation Tobit Model with an Application to Labor Supply, *Econometrica*, **54**: 679-685.

Stern, S (1989): Measuring the Effect of Disability on Labour Force Participation, *The Journal of Human Resources*, **24**(*3*): 361-395.

Svallfors, S (2007): *Analyzing Inequality: Life Chances and Social Mobility in Comparative Perspective*, Stanford University Press.

Verbrugge, L M (1979): Marital Status and Health, *Journal of Marriage and Family*, **41**(*2*): 267–285.

Wolff, F Ch (2005): Disability and Labour Supply during Economic Transition: Evidence from Bulgaria, *Labour*, **19**: 303-341.

Zick, C D and K R Smith (1991): Marital Transitions, Poverty, and Gender Differences in Mortality, *Journal of Marriage and the Family*, **53**: 327-36.