Aging, Health and Labour Market Activity: The Case of India

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Abstract
This paper explores the intricate relationship between the health status of the elderly and their labour market participation in rural and urban India. Data for the study are drawn from a nationally representative survey – the 1995/96 National Sample Survey. Using probit regression and propensity-score matching techniques, we found that chronic illnesses and disabilities negatively impact labour market participation across all model specifications and estimation techniques. The effect is stronger in rural than in urban areas.

1. Introduction

One important public policy aspect of population change in the world is population aging, something that has drawn a lot of attention from researchers in the West. The most important strategic concerns due to aging of the population are as follows. First, it will lead to increased demand for health, medical and personal/nursing-home care. Second, the demand for old-age income security will be higher. Third, given the extent of aging in the population, older people may be able to exert political influence on the nature and composition of publicly provided services. Fourth, it will affect the productive capacity of the economy due to an increase in the old-age dependency ratio (the ratio of the elderly to the working-age population) on one hand and an increase in the economic burden

of the aging generation on the other. Fifth, it may alter the pattern of consumption and investment activities of the economy. Understanding each of these concerns and formulating underlying public policy is crucial for the future economic well-being of any society, developed and developing countries alike. In this paper, we focus our attention on one of the key concerns – the labour market participation of elderly Indians.

In India, the elderly (aged 60 and above) comprised approximately 8% of the total population in 2001 (Shah 2004), but this percentage is expected to increase to 13% by 2025 (Rajan et al. 2003). Given falling fertility rates and increased life expectancy, the old-age dependency ratio will eventually be high. The birth rate is expected to decrease to 15 by 2021; for comparison, it was 45 in 1951 (Rajan et al. 2003). Life expectancy at age 60 has been improving and is projected to rise from its current level of 17 to 20 over the next three decades (World Bank 2001).

Mason, Lee and Russo (2000) provided estimates of both the total dependency and old-age dependency ratios for India under alternative fertility scenarios prepared by the United Nations Population Division and alternative mortality scenarios that the authors constructed themselves. Based on their projections for 2025, the total dependency ratio can fall between 0.381 (a low-fertility and high-mortality scenario) and 0.540 (a high-fertility and low-mortality scenario). The old-age dependency ratio can fall between 0.112 (a high-fertility and high-mortality scenario) and 0.133 (a low-fertility and low-mortality scenario). High fertility and low mortality produce the most rapid increase in total dependency, whereas low fertility and low mortality produce the most rapid increase in old-age dependency.

Experience from other Asian countries suggests increasing pressure on pension and healthcare systems due to increases in the dependency ratios. Since the 1950s, men's life expectancy has increased by 15 years in Japan, by 19 years in Taiwan and by 20 years or more in Indonesia, South Korea and Thailand (Westley 1998). For women, the gains have been even greater. At the same time, fertility rates in East Asia have fallen dramatically, from an average of 5.4 to about 2.3 per woman in 25 years (Westley 1998). This has led to an increase in the proportion of the elderly. In Japan, for example, individuals aged 65 and over are projected to make up 27% of the total population by 2025 (Westley 1998). This increase in dependency ratios has put the pension and healthcare systems under serious pressure in Japan, leading recently to major reforms. For instance, the minimum pensionable age in Japan will soon increase from 60 to 65 years (Westley 1998). In addition, the government has begun encouraging private enterprises to keep their workers on in some capacity after retirement, at a reduced wage. More than two thirds of employers with more than 30 employees had done so by the end of the last decade (Westley 1998). The pension system has also been reformed, with an increase in the contribution rate to 17% in 1995 and 30% by 2025 (Westley 1998). Similarly, pension systems have been reformed in Taiwan (Neumeyer 2005). A detailed discussion on the problems that these Asian countries face due to aging is beyond the scope of this paper. However, a good source of discussion on the impact of aging on fiscal policy and healthcare systems in China, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, Taiwan, Vietnam and Hong Kong can be found in Heller (1997). In addition, one can refer to Asher (2002) for a discussion on Singapore, and to Jitapunkul and Bunnag (1999) on Thailand.

Based on the experiences of other developing countries, India is likely to face similar problems in the foreseeable future. In the developed world, consumption by the elderly is financed primarily from their own savings or through social security programs. In India, less than 10% of the population is covered under a pension plan, largely because pensions are limited to the organized sector and a very small section of the population is employed by this sector (World Bank 2001).[1] Also, lifetime earnings are not high enough to facilitate significant savings for retirement. As a result, the elderly rely primarily on transfers, mostly from their children. In all likelihood, family support systems will come under increasing strain as fewer children support parents for a longer time. Hence, the elderly are likely to be more vulnerable to falling into the trap of a low level of economic well-being.

Over the years India has undergone a dramatic change with regard to urbanization, industrialization, migration and a growing sense of materialism, and this change has threatened the hallmarks of

the traditional family (Bhat and Dhruvarajan 2001; Jamuna 1998; Ramamurti and Jamuna 2004). A study of attitudes toward elder care showed that in 1984, 91% of adult children surveyed believed it their duty to care for their elderly parents (Jamuna 2003; Ramamurti and Jamuna, 2005). Repeat studies showed that in 1994 that number had declined sharply to 67% and in 2001 it had further declined to 51% (Jamuna 2003; Ramamurti and Jamuna 2005).Thus, the proportion of the elderly supported by their children is expected to continue its fall in the foreseeable future and beyond. Unless an appropriate social security system is developed, this would mean that the elderly will have to keep on working past what would have been their retirement age. In 1995, approximately 22% of the elderly living in urban areas and 39% of those living in rural areas were either working for an employer or were self-employed.[2] But in all likelihood, their ability to work will ultimately be hampered by adverse health shocks. It is in this context that we present the following paper. We look at how disabilities and chronic illnesses affect labour market participation of the elderly. Different types of disabilities and the number of chronic illnesses are included in a series of probit models to achieve this objective. To account for possible selection bias and to analyze the causal effect, we also adopt a propensity-score matching methodology. It is found that chronic illnesses and disabilities negatively impact labour market participation across all model specifications and estimation techniques.

The rest of the paper is organized as follows: Section 2 reviews some of the existing literature. Econometric techniques are discussed in Section 3. Section 4 includes a description of the data. Empirical results are contained in Section 5 and the conclusion in Section 6.

2. A Brief Review of the Existing Literature

A wide variety of literature deals with the early retirement decisions of individuals aged 55 and over in developed countries.[3] However, there is a paucity of research on the labour market behaviour of individuals past retirement age in developing countries. Friedman et al. (2001) examined the patterns of work and retirement in Vietnam. They found age to be negatively related to the probability of working. Also, those who reported poor health were half as likely to work as those who did not. The respondent's gender did not affect participation. Friedman and colleagues attributed this result to the "legacy of state socialism on female labor force participation." (Friedman et al. 2001: p. 220) Married individuals were more likely to work. Education, wealth and receipt of pension produced statistically insignificant results, which the authors found a bit surprising.

Another study that looked at the elderly labour supply in developing countries was by Cameron and Cobb-Clark (2002). They jointly estimated the determinants of financial transfers from children and the elderly labour supply in Indonesia using 1993 data. Their results showed that labour supply was largely unaffected by financial transfers from children. They found labour supply negatively related with age and education. Also, they concluded individuals with disabilities were likely to work less.[4]

Loew (1995) focused on hours worked by divorced women aged 55 and older in the U.S. She found wage negatively related to hours worked. Education also had a negative effect. A measure of health status was not included in the model for the reason that the survey asked a question on whether a health problem or disability prevented one from working or limited one's ability to work. The author points out that for a cohort of older women, especially those without any, or without recent, work experience, such a question would have led to an incorrect measure of health or disability.[5]

Mete and Schultz (2002) studied the impact of health on labour force participation in Taiwan, using panel data and an instrumental variable approach. The instruments were parent longevity, birthplace and childhood conditions. Results showed that better health led to an increase in labour force participation. Also, the authors found that the effect was about twice as much in the instrumental variables model as in models treating health as exogenous.

Benjamin, Brandt and Fan (2003) discussed methodological issues associated with health and labour supply and empirically estimated the effect using panel data for China. They concluded that

"ceaseless toil," meaning that the elderly have to work their entire lives due to insufficient means of support, described the work patterns. Failing health played only a small role (Benjamin et al. 2003: p. 35).

In their study, Kalwij and Vermeulen (2008 in press) used the Survey of Health, Ageing and Retirement in Europe to analyze the impact of health on labour force participation of individuals 55 to 64 years of age in 11 European countries. Both self-reported health status and objective measures were used. The authors concluded that whereas in some countries self-reported health performed well, in others it could have been endogenous and hence objective measures of health gained importance.

From this section, it is clear that though some work has been done in certain developing countries, there is no study to document the labour supply of the elderly in India. In our study, we attempt to fill this gap.

3. Model

The model used in this paper derives from the standard labour supply model. It can be written as

$$L = \alpha + \beta D + \gamma C + \delta X + \mu$$

where:

L is a measure of labour market response; it is equal to 1 if the individual is working for an employer or is self-employed, and to 0 otherwise;

D is a vector of the various types of disabilities;

C is the number of chronic illnesses;

X is a vector of various socioeconomic characteristics of the individual; and

μ is the error term.

The five types of disabilities considered are visual, speaking, hearing, locomotor and amnesia.[6] Also, individuals with more than one type of disability are considered as a separate category. Disabilities, unless accommodated in some way by an employer, for example, by the provision of assistive technology/employer accommodations, affect an individual's ability to perform tasks. In developing countries it is likely that a majority of disabled individuals have no access to assistive technology and hence are less "equipped" to work than the able bodied. Also, it is possible that individuals with disabilities face labour market discrimination. Based on these two factors, it is expected that the coefficients of various types of disabilities will be negative. Similarly, the number of chronic illnesses is expected to have a negative effect on labour market participation. However, as pointed out by Benjamin, Brandt and Fan (2003), who focus on the elderly in rural China, the relationship between health and labour supply is not that simple. They show that adverse health shocks have an ambiguous impact on labour supply. In their framework, wealth and income are important variables. The elderly in rural China are not well off and hence cannot afford to retire. This is also likely to be true for rural India. If so, we would expect the elderly to keep working until forced to retire due to bad health – disabilities or chronic illnesses. Thus for the relatively wealthy (whether from savings, assets or ample pension), financial security would be a factor in the retirement decision, whereas for the relatively poor, bad health would affect the retirement decision. Hence in countries like India, we would expect a significant negative effect of bad health on labour market participation. In addition, we would expect a stronger negative effect of disabilities and chronic illnesses on labour market participation in rural areas where people are relatively less well off.

Another issue that cannot be ignored is the time of onset of a disability or a chronic illness. If it happened during old age, it would reduce productivity and wages and hence provide a disincentive to work. On the other hand, if the disability had happened at a younger age, it would have reduced productivity and income in that period and would thus have led to lower levels of wealth accumulation, forcing the individual to work during old age. Unfortunately, our data set does not include

information on the onset of disability or chronic illness. Not being able to disentangle these effects has a consequence. If a lot of individuals experienced the onset at a younger age, then the effect of disabilities and chronic illnesses starting during old age is likely underestimated in our model. The focus of this paper, however, is to study the impact of disabilities/chronic illnesses regardless of time of onset.

In addition, our model includes a number of control variables representing the various socio-economic characteristics of an individual. The first set is predetermined controls and includes age, gender, education, marital status, caste and region.

Empirical labour supply literature dealing with the working-age population has found labour supply to have an inverted U-shaped relationship with age. Labour supply is the highest in the middle ages, after which there is a decline. In our paper we look at individuals aged 60 and above, hence we expect age to have a negative effect. In empirical literature dealing with elderly labour supply, two views are expressed about the role of education (Loew 1995). The first states that the more educated people would have accumulated more savings during their working lives due to higher incomes and hence would not feel the need to work during old age. The second states that it would be relatively easier for the more educated to obtain employment and so this category would be more likely to be working. Hence, the sign of the coefficient depends on the relative magnitude of these effects.

In addition, there are other controls which, while being important, can be endogenous. They include wealth, household expenditure (a proxy for household income), pension indicator, living arrangements and household size.

An individual's labour supply is a function of his or her own income and the income of other household members. Ideally, one would want information on an individual's wage rate but, unfortunately, as also pointed out by Benjamin, Brandt and Fan (2003), measurement of economic variables is problematic in developing countries. Wages are frequently not even observed in developed countries. Moreover, wages from self-employment are not reported, and the majority of the working elderly in India are self-employed (see Table 1). Our data set includes information on household expenditures. Such expenditures have routinely been used as a proxy for household income in many studies dealing with developing countries, where information is more readily available for expenditures than for income. As regards household income, Benjamin and colleagues (2003) point out that results need to be interpreted with caution, stating,

> … if health is endogenous to labor supply, it is even more so in an income regression. Most obviously, higher income households may be healthier, so the positive association between health and income may have nothing to do with the causality running from health to income (Benjamin et al. 2003: p. 32-33)

As regards wealth, our data set includes information on whether or not the individual owns property assets. Costa (1998) points out that *a priori* the effect of wealth or income on the response of labour supply to health is ambiguous. On one hand, at the onset of disability or chronic illness, wealth can facilitate withdrawal from work. On the other, the income effect of higher wealth is dominant and the retirement decision is less dependent on the health status.

We also have a dummy variable indicating whether an individual is drawing a pension. One was also included by Friedman et al. (2001). It is expected that receiving a pension is likely to decrease the probability of working.

In developing countries, children are an important source of support during old age. In our model we include a living-arrangement variable. It is expected that the elderly who live with their children are less likely to be working. However, as pointed out by Edmonds, Mammen and Miller (2005) and Hamoudi and Thomas (2005), living arrangements can be endogenous to a labour force participation decision.

From this section, it is clear that the relationship between health and labour supply is not simple.

There are potential concerns of unobserved heterogeneity, and there are endogeneity concerns for some of the regressors discussed above. To address some of these, we produced a series of estimates by gradually increasing the number of controls. We also used more robust methods to control for potential self-selection, using propensity-score methods.[7] It should be noted, however, the endogeneity of health in our models should not be cause for concern because the measures of health that we use are "relatively more" objective, more so in the case of chronic illnesses. As pointed out by Bound (1991) and Kalwij and Vermeulen (2007), self-reported health can be endogenous in a labour supply model due to the justification hypothesis, which states that individuals justify their non-participation by claiming they are in ill health.

4. Data Source and Characteristics

Data for this empirical exercise are drawn from the 52nd round of the National Sample Survey (NSS), a nationally representative survey conducted by the National Sample Survey Organization (NSSO), Ministry of Statistics, Government of India, July 1995 – June 1996 (NSSO 1998). The NSSO adopted a two-stage stratified-sampling design. First-stage units were census villages in rural areas and NSSO urban blocks in urban areas; second-stage units were households in both rural and urban areas. Sample villages and urban blocks were selected with a probability proportional to population size in the form of two independent interpenetrating subsamples. For the selection of households, the frame consisted of three second-stage strata in which a total sample of 10 households was selected. The composition of second-stage stratum was two households reporting at least one child aged 0 years, two households reporting any case of hospitalization and six remaining households. The survey covered the whole of India except for the interior areas of Nagaland, Andaman and Nicobar Islands, and the Ladakh, Kargil and Dodha districts of Jammu and Kashmir. Data were collected separately for urban and rural areas.

The survey covered the problems of aged persons, utilization of maternity and child healthcare services, and morbidity and utilization of medical services. In this paper, we analyze household responses relating to the problems of aged persons. Numbers of persons aged 60 years and above interviewed in the survey in rural and urban areas were 20,949 and 13,032, respectively. NSS data are available in the form of responses pertaining to different segments of the questionnaire. Fortunately, it is possible to link different segments of individual and household responses (using information on state/region code, village/block serial number and second-stage stratum number) and an individual identifier (using household identity and the serial number of members of a household).

Characteristics of individuals included in the sample are shown in Table 1. The dependent variable in our model is labour market participation. All individuals working for an employer or self-employed were considered labour market participants. In urban areas 5.2% of the elderly were working for an employer and 15.7% were self-employed. In rural areas, 8.2% and 30.5% were working or self-employed, respectively.[8]

The majority of the rural elderly, 77.1%, were illiterate, and only 0.6% had higher secondary (high school) education or above. The urban elderly were relatively more educated, and approximately 58.5% were literate. Of these, 9.2% had completed higher secondary or had graduated from university.

Disabilities were more prevalent in rural than in urban areas. Of the urban elderly, 36.4% reported some type of disability, compared with 40.5% of the rural elderly . The most common type was visual. Twenty-five percent of urban and 27% of rural individuals were visually impaired. Hearing was the second most common disability, with 12% of urban and 16% of rural elderly hearing impaired. Seventeen percent of those in rural parts and 13.5% of those in urban parts had more than one type of disability (not shown). Chronic illnesses (not shown) were slightly more prevalent in urban than in rural India, with 55% of urban and 54% of rural residents reporting at least one chronic illness. Among those with at least one chronic illness, the mean number of illnesses was 1.6 in urban areas and 1.5 in rural areas. A chronic problem with joints was the most prevalent ailment, both in the urban (35%) and rural (40%) parts of the country.

Table 1. Characteristics of the sample (percentages in parentheses)

Variable	Urban n (%)	Rural n (%)
Total	12,432	19,906
Activity		
Working	643 (5.2)	1631 (8.2)
Self-employed	1957 (15.7)	6082 (30.5)
Disability type		
Visual	3096 (24.9)	5457 (27.4)
Locomotor	1159 (9.3)	2333 (11.7)
Amnesia	930 (7.5)	2184 (11.0)
Hearing	1548 (12.5)	3350 (16.8)
Speaking	391 (3.2)	847 (4.3)
Mean number of chronic illnesses	0.88	0.80
Age group		
60 to 69	7659 (61.6)	12397 (62.2)
70 to 79	3582 (28.8)	5635 (28.3)
80 and over	1191 (9.6)	1874 (9.4)
Gender		
Male	6147 (49.4)	10204 (51.2)
F emale	6285 (50.6)	9702 (48.7)
Marital status		
Widowed/divorced/separated/ single	5026 (40.4)	8193 (41.1)
Married	7406 (59.6)	11713 (58.8)
Education level		
Illiterate	5161 (41.5)	15350 (77.1)
Primary	3600 (29.0)	3507 (17.6)
Secondary	2527 (20.3)	931 (4.7)
Higher secondary and above	1154 (9.2)	118 (0.6)
Property assets	7547 (60.7)	13197 (66.3)
Pension	1801 (14.5)	1027 (5.2)
Living with child	4301 (34.6)	6808 (34.2)
Caste		
Scheduled caste/tribe	1675 (13.5)	5794 (29.1)
Per capita monthly expenditure(Rs)	564	359

Almost three times as many elderly in urban areas drew a pension or had made provisions for a regular income after retirement, as compared with those in rural areas (14.5% versus 5.2%). The mean per-capita household monthly expenditure in urban India, 564 rupees, was somewhat higher than that in rural parts of the country, 359 rupees. More than half of individuals stated that they owned property assets.

A large percentage of the elderly in both rural and urban parts were either themselves the household head (49%) or were the head's parent (30%) (not shown). Rural India had a higher percentage of elderly males, 51.2%, than urban India at 49.4 %. Approximately 59% of the elderly were married; close to 40% of the individuals in the sample were widowed.

In the following discussion we explore some relationships among the variables, a more formal analysis being presented in the next section. A much larger percentage of males reported participating in the labour market than females, 37% versus 7% in urban areas and 60% versus 16% in rural areas (not shown). Married individuals were more likely to be working. In urban areas, 29% of married and 11% of non-married individuals (i.e.. widowed, single, divorced or separated) participated in the labour market. Comparable numbers for rural areas were 50% and 23%, respectively.

Disability and chronic illnesses seem to decrease labour market participation. In urban areas, 14% of the disabled reported working,

compared with 26% of the able bodied. Corresponding numbers for rural areas were 25% and 48%. The difference in labour market participation between those with and without chronic illnesses was equally pronounced. Among urban (rural) elderly, 18% (32%) of the chronically ill and 26% (46%) of the healthy stated that they were working.

Labour market participation appears to decrease with age. Among those between 60 and 69 years, 27% in urban and 47% in rural areas reported working. Corresponding numbers for those aged 70 and above were 13% and 25%, respectively, in urban and rural parts of the country.

We see that the elderly who received no pension or those who had not made provisions for a regular income after retirement were more likely to be working (25% in urban and 41% in rural parts). Among those who received no pension or who had saved enough, 3% and 6% participated in the labour market in urban and rural areas, respectively. Individuals with property assets were almost three times as likely to be working as those without such assets. Lastly, the elderly belonging to scheduled castes/tribes (termed as "lower" castes) were slightly more likely to be labour market participants (25% versus 21% in urban areas and 43% versus 37% in rural areas).

5. Empirical Results

Since our dependent variable is binary, probit or logit models are appropriate. As is customary in labour supply models, a probit model is estimated. Separate models are estimated for urban and rural areas, given the differences in culture, lifestyles, economic activity and availability of goods and services. The probit model is estimated by maximum likelihood with a robust standard errors option, so the results are heteroscedastic-

Table 2a. Labour market participation probit results – coefficients for urban areas

	Model 1	Model 2	Model 3
Health			
Disability (base: non-disabled)			
Visual only	-0.249*** (0.039)	-0.240*** (0.044)	-0.216*** (0.048)
Locomotor only	-0.418*** (0.086)	-0.402*** (0.101)	-0.393*** (0.108)
Amnesia only	-0.189* (0.097)	-0.085 (0.109)	-0.066 (0.116)
Hearing/speaking only	-0.304*** (0.068)	-0.214*** (0.076)	-0.197** (0.084)
Multiple	-0.608*** (0.046)	-0.537*** (0.055)	-0.507*** (0.060)
Number of chronic illnesses	-0.118*** (0.014)	-0.128*** (0.016)	-0.104*** (0.017)
Age (base: 60–69)			
70–79		-0.451*** (0.034)	-0.439*** (0.037)
80 and over		-0.911*** (0.070)	-0.917*** (0.074)
Education (base: illiterate)			
Primary		-0.200*** (0.036)	-0.169*** (0.039)
Secondary		-0.457*** (0.041)	-0.248*** (0.045)
Higher secondary and above		-0.696*** (0.054)	-0.378*** (0.064)
Region (base: north)			
Central		-0.016 (0.064)	0.030 (0.070)
West		-0.072* (0.042)	0.052 (0.044)
Northeast		0.143** (0.066)	0.030 (0.073)
East		-0.019 (0.047)	0.019 (0.050)
South		0.021 (0.040)	0.106** (0.043)

Table 2a. Continued.

	Model 1	Model 2	Model 3
Other			
Male		1.399*** (0.036)	1.466*** (0.038)
Married		0.070** (0.034)	-0.152*** (0.052)
Scheduled caste/tribe		-0.001 (0.043)	0.035 (0.046)
Have property assets			0.563*** (0.036)
Retired with pension			-1.811*** (0.072)
Monthly expenditures			-0.00003*** (0.000)
Household size			-0.001 (0.006)
Living with child			-0.308*** (0.053)
Constant	-0.566*** (0.018)	-1.068*** (0.043)	-1.137*** (0.070)
Observations	12,432	12,432	12,432

Note. Robust standard errors in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1%.

Table 2b. Labour market participation probit results – marginal effects for urban areas

	Model 1	Model 2	Model 3
Health			
Disability (base: non-disabled)			
Visual only	-0.066*** (0.009)	-0.052*** (0.009)	-0.041*** (0.008)
Locomotor only	-0.100*** (0.016)	-0.078*** (0.015)	-0.065*** (0.014)
Amnesia only	-0.050** (0.024)	-0.020 (0.024)	-0.013 (0.022)
Hearing/speaking only	-0.077*** (0.015)	-0.046*** (0.015)	-0.037*** (0.014)
Multiple	-0.142*** (0.008)	-0.104*** (0.008)	-0.084*** (0.008)
Number of chronic illnesses	-0.034*** (0.004)	-0.031*** (0.004)	-0.021*** (0.004)

consistent estimates. Estimated results are presented in Tables 2 and 3 for urban and rural areas, respectively.[9]

Given the potential concerns of unobserved heterogeneity and endogeneity, we present a series of estimates. The first three sets are presented in Tables 2 and 3. Here we start from a specification with only specific disabilities and chronic illnesses as the regressors. It can be seen that bad health, measured either as the presence of a disability or as the number of chronic illnesses, has a negative influence on labour market participation in both rural and urban areas. The only exception is presence of amnesia among the urban elderly, the results for which are statistically insignificant. Apart from multiple disabilities, the disability with the strongest negative effect on labour market participation is locomotor for both rural and urban parts. Based on the marginal effects contained in Tables 2b and 3b, it can be said that compared to those without a disability, the probability of working for those with a locomotor disability is lower by 0.10 in urban areas and by 0.25 in rural areas. For those with multiple disabilities, the probabilities are lower by 0.14 and 0.24, respectively, in urban and rural areas. Also, as the number of chronic illnesses increases by one, the probability of being employed decreases by 0.03 and 0.05 in urban and rural areas, respectively. Overall, a comparison of results for the two areas reveals that the effect of bad health is much stronger in rural areas. A reason, mentioned in an earlier section, could be that people in rural India are relatively less well off and unlikely to be covered by a pension plan; hence they would likely keep working until an adverse health shock prevented them from

doing so. Another possible explanation could be that work in rural areas is physically much more demanding. Almost all the rural population is engaged in agriculture which, in India, is not as mechanized as in many other countries and hence is very labour intensive. Thus, physical disabilities and chronic illnesses are likely to have a stronger negative effect.

Next, the predetermined controls of age, gender, marital status, education, caste and region are introduced. Conclusions remain unchanged: Once again we see that bad health is a deterrent to work.

Regarding education, results show that in urban areas, the more educated elderly are less likely to work. As explained in an earlier section, education could have either a positive or negative effect. The positive effect could result from the ease of obtaining employment. On the other hand, the negative effect could result from higher incomes and hence higher savings during the working age. Thus, in urban areas it appears that the latter effect is stronger. Another reason for the negative effect could be that educated individuals are more likely to take wise financial decisions during the course of their lives or are better able to organize their available resources during retirement. Hence, they do not need to work after retirement. The result related to education for urban areas, however, is not the same as for the rural areas. Only one coefficient is statistically significant and reveals that compared to the illiterate, those with a primary level of education are more likely to be working.

Age appears to have a strong negative effect on labour market participation. The result holds both for urban and rural areas. Males and those who are married are more likely to be working. Caste has no effect in urban areas; however, in rural areas

Table 2b. Continued.

	Model 1	Model 2	Model 3
Age (base: 60 to 69)			
70–79		-0.097*** (0.007)	-0.081*** (0.006)
80 and over		-0.144*** (0.006)	-0.120*** (0.006)
Education (base: illiterate)			
Primary		-0.046*** (0.008)	-0.033*** (0.007)
Secondary		-0.094*** (0.007)	-0.047*** (0.008)
Higher secondary and above		-0.121*** (0.007)	-0.065*** (0.009)
Region (base: north)			
Central		-0.004 (0.015)	0.006 (0.015)
West		-0.017* (0.010)	0.011 (0.009)
Northeast		0.036** (0.018)	0.006 (0.015)
East		-0.004 (0.011)	0.004 (0.011)
South		0.005 (0.010)	0.022** (0.009)
Other			
Male		0.336*** (0.008)	0.311*** (0.008)
Married		0.017** (0.008)	-0.032*** (0.011)
Scheduled caste/tribe		-0.000 (0.010)	0.007 (0.010)
Have property assets			0.109*** (0.006)
Retired with pension			-0.184*** (0.005)
Monthly expenditures			-0.00001*** (0.000)
Household size			-0.0003 (0.001)
Living with child			-0.060*** (0.010)
Observations	12,432	12,432	12,432

Note. Robust standard errors in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1%.

Table 3a. Labour market participation probit results – coefficients for rural areas

	Model 1	Model 2	Model 3
Health			
Disability (base: non-disabled)			
Visual only	-0.402*** (0.028)	-0.347*** (0.033)	-0.335*** (0.035)
Locomotor only	-0.827*** (0.063)	-0.813*** (0.074)	-0.815*** (0.080)
Amnesia only	-0.451*** (0.059)	-0.317*** (0.066)	-0.314*** (0.069)
Hearing/speaking only	-0.326*** (0.042)	-0.258*** (0.049)	-0.259*** (0.051)
Multiple	-0.715*** (0.028)	-0.584*** (0.033)	-0.590*** (0.035)
Number of chronic illnesses	-0.132*** (0.011)	-0.177*** (0.013)	-0.181*** (0.013)
Age (base: 60–69)			
70–79		-0.484*** (0.024)	-0.462*** (0.025)
80 and over		-1.127*** (0.048)	-1.075*** (0.051)
Education (base: illiterate)			
Primary		0.099*** (0.028)	0.118*** (0.030)
Secondary and above		-0.075 (0.049)	0.174*** (0.053)
Region (base: north)			
Central		0.034 (0.045)	0.067 (0.048)
West		0.079** (0.032)	0.110*** (0.034)
Northeast		-0.006 (0.046)	-0.064 (0.048)
East		-0.024 (0.029)	-0.090*** (0.030)
South		-0.053* (0.031)	-0.032 (0.034)
Other			
Male		1.351*** (0.024)	1.291*** (0.025)
Married		0.233*** (0.023)	-0.001 (0.036)

those belonging to the "lower" castes are more likely to be working.

In the next specification, additional regressors such as wealth, pension indicator, household expenditure, living arrangements and household size are included. Once again, conclusions regarding health remain unchanged. Disabilities and chronic illnesses have a negative effect on the probability of working.

Three variables related to income and wealth are introduced in the model. Results show that the elderly who draw a pension are less likely to be working. We also find that the higher the household expenditure, which is a proxy for household income, the lower the probability of working, though the coefficient is extremely small. Individuals who have property assets are more likely to participate in the labour market. This last finding could be a result of the property not having been paid off by retirement age. Household size has no effect on the probability of working in rural areas; however, the elderly living with children are less likely to be working.

The results based on the probit models discussed above, however, have some obvious limitations. First, as in any cross-sectional study, causal relations may not be so straightforward. Second, there could be potential self-selection problems causing bias in the results. Third, disabilities and chronic illnesses may have short- and long-term effects on labour market outcomes. This is difficult to investigate, since

we have no data on the time of onset of disabilities and chronic illnesses. However, we adopted a more robust approach to control for potential self-selection using the propensity-score matching methodology to arrive at greater insights into causal effects. Measures of whether a person had "any disability" or "any chronic illness" are constructed and the propensity-score matching technique is used to estimate the relationship between "any disability" and labour market participation and "any chronic illness" and labour market participation.

Extensive discussion on propensity-score matching methods can be found in Rosenbaum and Rubin (1983, 1985), Heckman et al. (1997, 1998), Dehejia and Wabha (1999, 2002) and Smith and Todd (2005). The basic idea behind the methodology is to use a statistical matching technique to mimic randomization in control and treatment groups in experimental studies. In the present case, the control group is the one with no disability and the treatment group is the one with at least one disability. Groups are similarly defined for chronic illnesses. If all observations in the control and treatment groups are similar with respect to all observable characteristics, then having any disability or chronic illness may explain the labour market participation decision accurately. A number of authors emphasize that the validity of matching depends on the absence of unobserved effects. In order to satisfy this assump-

Table 3a. Continued.

	Model 1	Model 2	Model 3
Scheduled caste/tribe		0.193*** (0.023)	0.200*** (0.025)
Have property assets			0.662*** (0.026)
Retired with pension			-1.910*** (0.078)
Monthly expenditures			-0.0001*** (0.000)
Household size			-0.015*** (0.004)
Living with child			-0.320*** (0.038)
Constant	0.016 (0.013)	-0.747*** (0.028)	-0.663*** (0.047)
Observations	19,906	19,906	19,906

Note. Robust standard errors in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1%.

Table 3b. Labour market participation probit results - marginal effects for rural areas

	Model 1	Model 2	Model 3
Health			
Disability (base: non-disabled)			
Visual only	-0.143*** (0.009)	-0.118*** (0.010)	-0.110*** (0.010)
Locomotor only	-0.252*** (0.014)	-0.230*** (0.014)	-0.218*** (0.014)
Amnesia only	-0.155*** (0.018)	-0.106*** (0.020)	-0.101*** (0.020)
Hearing/speaking only	-0.116*** (0.014)	-0.088*** (0.016)	-0.085*** (0.015)
Multiple	-0.241*** (0.008)	-0.190*** (0.009)	-0.184*** (0.009)
Number of chronic illnesses	-0.050*** (0.004)	-0.064*** (0.005)	-0.064*** (0.005)
Age (base: 60–69)			
70–79		-0.166*** (0.008)	-0.153*** (0.008)
80 and over		-0.299*** (0.008)	-0.275*** (0.008)

Table 3b. Continued.

	Model 1	Model 2	Model 3
Education (base: illiterate)			
Primary		0.036*** (0.011)	0.042*** (0.011)
Secondary and above		-0.027 (0.017)	0.064*** (0.020)
Region (base: north)			
Central		0.013 (0.016)	0.024 (0.017)
West		0.029** (0.012)	0.039*** (0.012)
Northeast		-0.002 (0.017)	-0.022 (0.017)
East		-0.009 (0.010)	-0.031*** (0.010)
South		-0.019* (0.011)	-0.011 (0.012)
Other			
Male		0.459*** (0.007)	0.429*** (0.007)
Married		0.084*** (0.008)	-0.0001 (0.013)
Scheduled caste/tribe		0.071*** (0.009)	0.072*** (0.009)
Have property assets			0.217*** (0.008)
Retired with pension			-0.335*** (0.005)
Monthly expenditures			-0.00002*** (0.000)
Household size			-0.005*** (0.001)
Living with child			-0.109*** (0.012)
Observations	19,906	19,906	19,906

Note. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

tion, we carefully selected the following variables to estimate the propensity score: age, gender, education, marital status and caste.

We followed the algorithm proposed by Dehejia and Wabha (2002) to estimate propensity scores.

1. Start with a probit model to estimate the propensity score.
2. Rank all observations by the estimated propensity score in ascending order.
3. Impose the Common Support Restriction (i.e., discard observations that are outside the intersection of the supports of the propensity score of treated and controls).
4. Split the sample into five blocks of equal score interval and test whether the average propensity scores of treated and control groups are the same in each block.
5. If the test fails in at least one interval, split the interval in halves and test again. Continue this step until the average propensity scores of treated and control groups do not differ.
6. Test that means of each covariate do not differ between the treated and controls in each block. This is a necessary requirement for Balancing Hypothesis (i.e., observations with the same propensity score have the same distribution independent of treatment).
7. If the means of one or more observable characteristics differ, use a less parsimonious specification.

Following this algorithm, we estimate a probit model to predict the probability of having "any disability" or "any chronic illness" and test for balancing hypothesis.[10] In all cases, the covariate means were equal at the 5% level of significance. Figures 1 and 2 present the final distribution of treated and control observations in rural areas. Starting with five blocks and then eight, we finally find that with nine blocks the average propensity scores of the treated and control groups do not differ. The corresponding results for urban areas are presented in Figures 3 and 4.

In order to compute the average treatment effect on the treated, it is necessary to match the treated and control groups on the basis of propensity score. In practice, it is almost impossible to match the scores precisely, however. Four alternative matching methods are commonly used: stratification, nearest neighbourhood, radius and kernel matching.[11] The radius method of matching was applied with two different specifications of radius.

Results of the estimation are presented in Tables 4 and 5 for rural and urban areas, respectively. They show that having "any disability" and "any chronic illness" affects labour market participation negatively in all specifications, and the effect is stronger in rural than in urban areas. This finding corroborates our earlier results that used a simple probit model.

Table 4. Labour market participation based on propensity score matching method: The effects of disability and chronic illness (urban areas)

Matching Method	Effect of Disability	Number of Observations		Effect of Chronic Illness	Number of Observations	
		Treatment	Control		Treatment	Control
Stratification	-0.086 (-11.5)	4522	7910	-0.066 (-9.5)	6905	5527
Nearest neighbourhood	-0.085 (-12.4)	4522	7902	-0.062 (-8.8)	6905	5526
Radius (r = 0.0001)	-0.116 (-17.5)	4518	7904	-0.102 (-9.9)	6896	5526
Radius (r = 0.0005)	-0.112 (-14.2)	4518	7904	-0.099 (-8.0)	6898	5527
Kernel	-0.095 (-14.4)	4522	7910	-0.078 (-11.0)	6905	5527

Notes.
Standard errors were calculated by bootstrap method (100 replications). t-statistics in parentheses. The control variables on which the propensity score is computed are age, gender, education, marital status and caste. N for any disability = 4522 and N for no disability = 7910. N for any chronic illness = 6905 and N for no chronic illness = 5527.

Table 5. Labour market participation based on propensity-score matching method: The effects of disability and chronic illness (rural areas)

Matching Method	Effect of Disability	Number of Observations		Effect of Chronic Illness	Number of Observations	
		Treatment	Control		Treatment	Control
Stratification	-0.145 (-22.2)	8311	11,595	-0.101 (-14.7)	10,792	9113
Nearest neighbourhood	-0.144 (-24.0)	8311	11,576	-0.101 (-16.8)	10,792	9110
Radius (r = 0.0001)	-0.179 (-25.0)	8302	11,576	-0.124 (-15.8)	10,771	9110
Radius (r = 0.0005)	-0.180 (-14.3)	8308	11,584	-0.119 (-13.0)	10,772	9110
Kernel	-0.158 (-24.3)	8311	11,595	-0.120 (-19.3)	10,792	9113

Notes.
Standard errors were calculated by bootstrap method (100 replications). t-statistics in parentheses. The control variables on which the propensity score is computed are age, gender, education, marital status and caste. N for any disability = 8311 and N for no disability = 11,595. N for any chronic illness = 10,792 and N for no chronic illness = 9114.

Figure 1. Distribution of propensity score (rural areas)

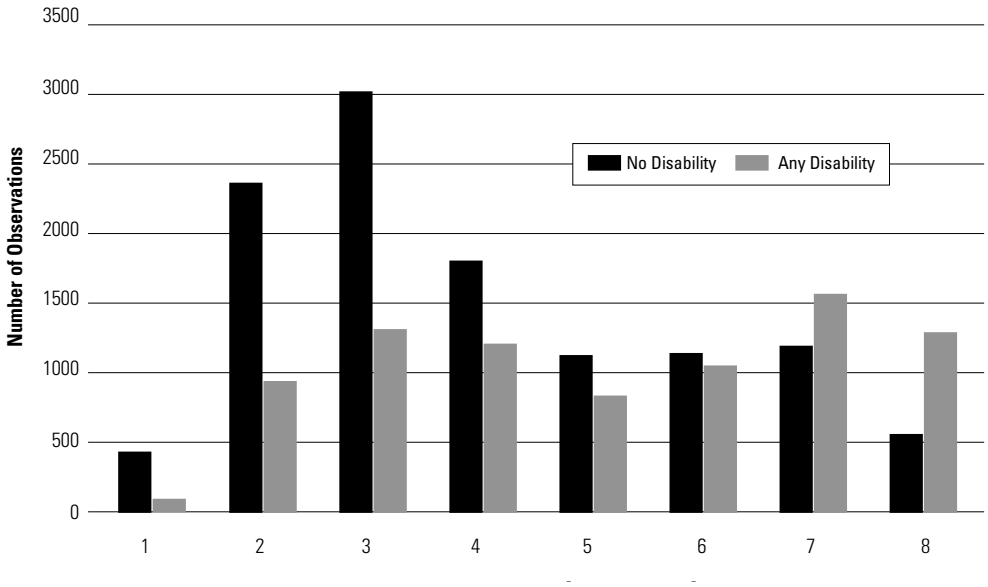


Figure 2. Distribution of propensity score (rural areas)

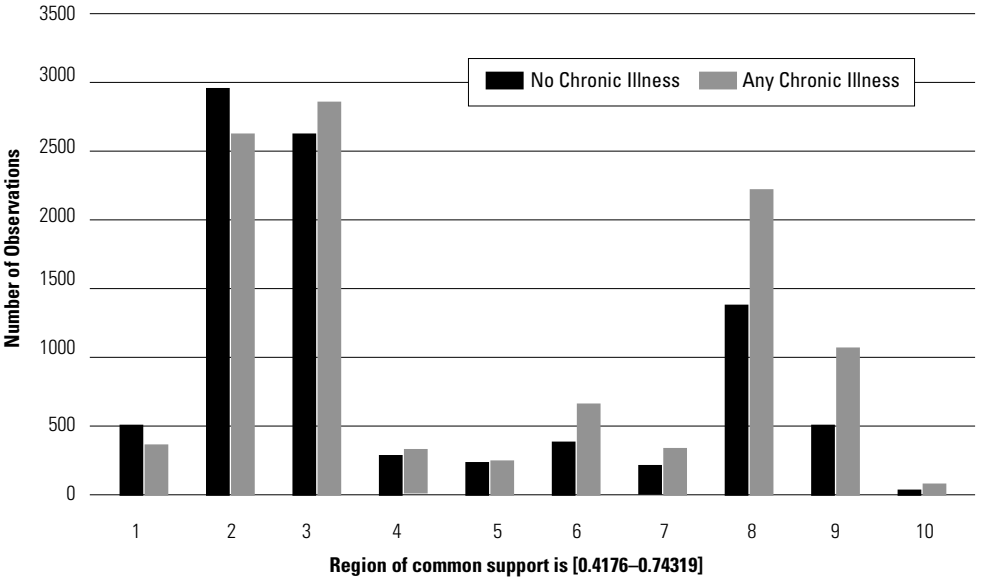


Figure 3. Distribution of estimated propensity score (urban areas)

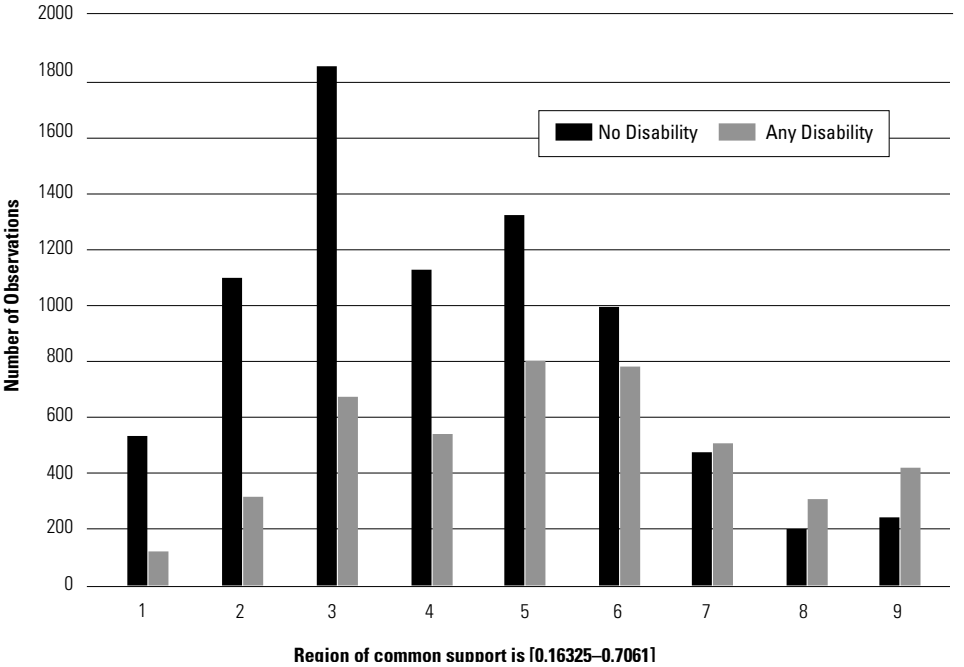
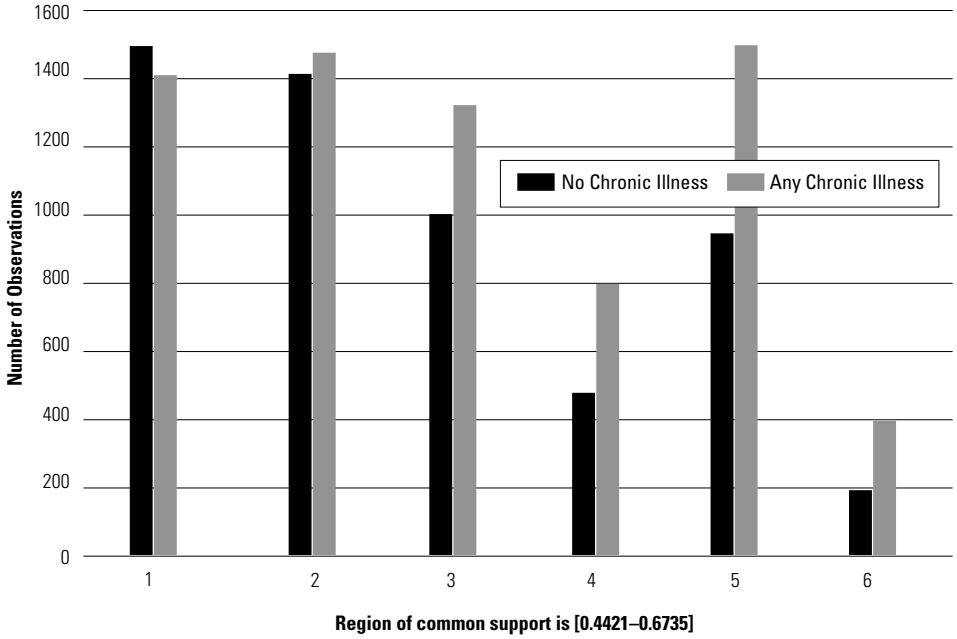


Figure 4. Distribution of propensity score (urban areas)



6. Conclusion

Research on the elderly has gained importance during recent years due to population aging. Most of the research is devoted to developed countries because old-age dependency ratios are higher relative to those of developing countries. However, in countries like India, this ratio will rise in the coming decades. Moreover, developing countries do not have a well-developed and comprehensive pension system. In addition, the joint family system is coming under strain. In light of these factors, a study of the labour market behaviour of the elderly gains importance.

In this paper, we studied the labour market participation decision of individuals aged 60 and above in India. In particular, we estimated the effect of disabilities and chronic illnesses on the probability of working. Our results show that disabilities and chronic illnesses have a negative effect on the probability of working, the effect being stronger in rural areas. This result holds across all model specifications and estimation techniques.

Data show that approximately 21% of the elderly in urban areas and 39% in rural areas were working. Most likely this is because they do not have sufficient means of support. Results from the models show that adverse health shocks – disabilities and chronic illnesses – have a negative impact on being employed. Not having adequate means of support or a job and having bad health would lead to much lower levels of well-being for the elderly. In the absence of a broad-based pension system, with only 10% being covered, this situation might be mitigated by providing assistive technology/employer accommodations to those with disabilities, this provision being likely to increase employment. Also, programs dealing with services such as old-age housing, healthcare and provision of subsidized food through a public distribution system may be a more effective way of serving the elderly.

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Notes

1. Broadly speaking, the organized sector refers to the public sector and that part of the private sector whose activities are regulated under some legal provision.
2. Based on data from the 52nd round of the National Sample Survey.
3. See, for example, Fehr, Sterkeby and Thogersen (2003); Blundell, Meghir and Smith (2002) and Johnson, Davidoff and Perese (2003).
4. The authors note that data on financial transfers were available only for individuals who were able to respond for themselves, hence leaving frail or disabled individuals to be under-represented. Also note that individuals were classified as disabled if they reported having difficulty standing from sitting, dressing or going to the bathroom by themselves. Thus, a majority of disabilities such as speech, hearing and visual were ignored.
5. Other studies have been done for the U.S., but as the focus of our study is developing countries, we do not discuss the other U.S. studies here. Some are Hayward and Grady (1990), Holden (1988) and Purcell (2000).
6. "Locomotor" means (a) an individual's loss or lack of ability to execute distinctive activities associated with the movement of "himself" and objects from place to place and (b) physical deformities other than those involving the hand or leg or both, regardless of whether the same caused loss or lack of normal movement of the body. NSSO(1998)
7. We thank an anonymous referee for advising us to adopt this approach.
8. Hereafter, the classification "working" will be used for labour market participants, i.e., those who were working for an employer or those who were self-employed.
9. The marginal effect for dummy variables is calculated as the discrete change in the probability of working as the dummy variable changes from 0 to 1 by holding all other variables at their means.
10. We use the STATA program developed by Becker and Ichino (2002) to estimate the propensity score and computation of the average treatment effect on treated.
11. See Becker and Ichino (2002) and Caliendo and Kopeinig (2005) about the strengths and weaknesses of each of the matching method.