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# **Poverty and Disability among Elderly in India: Evidences from Household Survey**

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## **Abstract**

The paper examines the causal relationship between disability and poverty among Indian elderly. Using different poverty measures and statistical tests, the paper also attempts to analyze the depth of poverty among disabled elderly. A special round of National Sample Survey data on disability is used for this purpose. The results confirm the hypothesis of causal relationship between poverty and disability. Further, our analysis suggests for higher level of poverty and income inequality among disabled elderly and differences in the income levels vary significantly across different age groups, gender, social group and educational status.

Keywords: Poverty, Disability, Inequality, Poverty measures, Elderly, Estimation

JEL Classification: I32, J14, D63, C13

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# Poverty and Disability among Elderly in India: Evidences from Household Survey

## I. Introduction

The linkage between ageing and disability is a biological fact where the risk of being disabled increases with increase in age, however, with proper policy intervention, can be delayed. Like many other developing countries while age-structure of the total population in India is predominantly young or middle aged, the age structure of disabled persons is predominantly elderly. According to NSS 58<sup>th</sup> round survey, more than one-fourth of the Indian aged population are disabled. Moreover, age-specific disability rates and the severity of disablement increase with age within old age bracket. In the age-groups young-old (60-64), middle-old (65-69), older-old (70-74) and oldest old age-groups (75 and above), the percentages of disabled persons are 36, 42, 51 and 61, respectively. In India, the absence of a safety net for the aged has exacerbated the problem. Traditionally, the joint family took care of the aged but rapid urbanisation and the exodus of persons from rural to urban areas have created a vicious situation. In the absence of the ability to earn, and without community support, in the form of kinsmen or the extended family, the aged are rendered destitute.

Further, though numerous literatures are available on the relationship between disability and poverty<sup>2</sup>, very few are focused on elderly in India (Sengupta and Agree, 2003; Prakash, 2003). Audinarayana and Sheela (2002) reveal that elderly people who belong to the higher socio-economic class were found to have lesser disabilities. Sengupta and Agree (2003) studies covariates of mobility difficulty among older adults in India and find that there is a substantial association between mobility and chronic diseases in the elderly. Kerketta et al. (2009) reveal that there is a high prevalence of physical disabilities with both non-communicable as well as communicable diseases among the elderly primitive tribal members and recommend for the implementation of a special health care strategy to reduce suffering at this crucial age and improve quality of life. In India most

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<sup>2</sup> See World Bank (2007)

of the studies are either just informative or descriptive without much statistical work and therefore, of limited scope. The relationship between disability and poverty in developing countries has not been well-established in the quantitative literature (Braithwaite and Mont, 2008). Further, studies like Sengupta and Agree (2003) and Prakash (2003) are based on old data sources<sup>3</sup> and given the fact that in recent period a lot of changes have been seen on the fronts of age structure, industrialization, urbanization, family disintegration and weakening of social safety nets for elderly in India and therefore, at least for the policy point of view, these studies may not be of much use.

The paper attempts to re-look the relationship between disability and poverty among Indian elderly. Further, paper aims to compare the poverty scenario between individuals with disability and without disability using different measures of poverty and inequality. The estimation results confirm the causal relationship between poverty and disability and reveal that while disability increases the risk of poverty, poverty increases the likelihood of being disabled.

The outline of the paper is as follows: section II briefly describes what literature speaks on the causal relationship between poverty and disability followed by description of data and variables in section III. Unadjusted poverty estimates and Gini Index have been computed in section IV and mean per capita expenditure are compared across various groups in section V. Discussion on econometric models and results are done in section VI and VII respectively. Finally, Concluding observations are presented in section VIII.

## **II. Poverty and Disability: A Causal Relationship**

The association between poverty and disability has been well documented (U.S. Census Bureau, 2004; Wittenburg & Favreault, 2003, Hoogeveen, 2005; Elwan, 1999). The relationship is, in general, found to be a causal (Braithwaite and Mont, 2008, Lustig et al., 2007; DFID, 2000; Moore and Yeo, 2003; Yeo, 2001). Though not all disability is caused by poverty, but poor people who suffer from malnutrition and in lack of adequate access

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<sup>3</sup> Sengupta and Agree, 2003 use 42<sup>nd</sup> round (1986-87) data for the purpose of analysis

to health services including maternal care and trauma services, are more likely to suffer from disability which further ensure their exclusion and marginalization of by reducing their opportunities to contribute productively to the household and to the community, which in turn increases the risk of poverty. DFID (2000) describes a vicious circle and the causal link between disability and poverty suggest that in one hand the poverty increases the likelihood of injury and impairment; on the other hand the exclusion of disability leads to greater rates of poverty. Poverty increases the risk of disability through social role devaluation (Wolfensberger, 2000), environmental risk factors (Evans, 2004; Link & Phelan, 1995), negative group influences (Durlauf, 2001), and weakened sense of coherence<sup>4</sup> (Antonovsky, 1987, 1991). Further, Lustig et al. (2007) emphasise that poverty limits access to resources that finally leads to a chronic health problem or disability. DFID (2002) and Moore and Yeo (2003) provide specific mechanism how the vicious circle between poverty and disability exists and work<sup>5</sup>. Research shows that this vicious circle varies as well within and between cultures and contexts, but is generally acknowledged to be strong. Thus, the link between poverty and disability may be attributed to the discrimination, social exclusion and denial of rights together with lack of access to basic services.

### **III. Data and Variables**

The paper is based on micro-level 58<sup>th</sup> round of National Sample Survey Organization (NSSO) data collected during July 2002 to December 2002. The survey period was divided into two sub-rounds of three months duration each. Equal number of sample first stage units was allocated to each of these sub-rounds with a view to ensuring uniform spread of the interviews over the entire survey period. A stratified multi-stage sample design was adopted for the 58th round. The number of sample villages and urban blocks surveyed in central sample was 4637 and 3354, respectively. A total of 45571 and 24731 households were surveyed in rural and urban areas, respectively.

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<sup>4</sup> defined as a global orientation that the world is incomprehensible, unmanageable, and unmeaningful, see Lustig et al. (2007) for useful discussions

<sup>5</sup> For detailed discussions see Yeo (2005)

**Table 1: Definition and Descriptive Statistics of the Variables used in the Analysis**

Variables	Definition	%	Mean	SD	Min	Max
Dependent Variables						
Disability: dummy	1 if suffers from any disability; 0 otherwise	45.86	-	-	0	1
Log of per capita monthly expenditure	Logarithm of per capita monthly expenditure	-	6.13	0.52	-1.95	9.43
Explanatory Variables						
Gender: dummy	1 if male; 0 if female	48.60				
Age beyond 60	Actual age-60	-	8.35	7.70	0.00	39.00
Age-square	Square of age beyond 60 years	-	129.11	213.20	0.00	1521.00
ST: dummy	1 if social group is Scheduled Tribes, 0 otherwise	25.02	-	-	0	1
SC: dummy	1 if social group is Scheduled Castes, 0 otherwise	42.00	-	-	0	1
Others: dummy (Reference category)	1 if social group is other backwards and other castes, 0 otherwise	32.98	-	-	0	1
Below primary education: dummy (Reference category)	1 if education below primary including illiterate; 0 otherwise	52.22	-	-	0	1
Primary Education: dummy	1 if primary education; 0 otherwise	14.15	-	-	0	1
Middle Education: Dummy	1 if middle education; 0 otherwise	15.07	-	-	0	1
Secondary Education: dummy	1 if secondary education; 0 otherwise	8.65	-	-	0	1
Higher Education: dummy	1 if higher education; 0 otherwise	9.91	-	-	0	1
Rural: dummy	1 if belongs to rural areas, 0 if urban areas	78.15	-	-	0	1
Currently Married: dummy (Reference category)	1 if currently married; 0 otherwise	60.31	-	-	0	1
Unmarried: dummy	1 if unmarried; 0 otherwise	1.46	-	-	0	1
Widow: dummy	1 if widow; 0 otherwise	37.58	-	-	0	1
Divorced/Separated: dummy	1 if divorced or separated; 0 otherwise	0.65	-	-	0	1
Land possessed by household	Land possessed by household in hectare	-	1.00	2.36	0.00	91.06
Estimated log of per capita expenditure	Predicted log of per capita expenditure	-	6.13	0.33	4.89	10.19
Size of household	Size of the household	-	6.27	3.64	1.00	38.00

The survey collects information relating to the magnitude and type of disability, age at onset of disability, possible cause of disability housing condition, village facilities, particulars of slum and consumer expenditure, employment and unemployment.

The analysis is done on the truncated sample for individuals with age more than 60 years. The definition and descriptive statistics of the variables used in the analysis are presented in Table 1. Percentage distribution of disabled elderly according to their age group, sex, social status and education are shown in Table 2. It can be observed that about 46% of the elderly suffer from at least one kind of disability.

**Table 2: % Distribution of Disabled Elderly**

	<b>All</b>	<b>Rural</b>	<b>Urban</b>
<b>All</b>	45.86	45.76	46.21
<b>Age-Group (year)</b>			
60-64	36.07	36.23	35.49
65-69	41.74	41.57	42.36
70-74	51.05	51.45	49.55
75 plus	60.75	60.45	61.74
<b>Gender</b>			
Male	46.83	46.28	48.83
Female	44.94	45.25	43.86
<b>Social Group</b>			
ST	51.70	51.45	54.39
SC	48.91	48.81	49.39
OBC	45.90	45.87	46.06
Other	43.03	42.19	44.94
<b>Educational Status</b>			
Below Primary	47.52	47.27	49.27
Primary	46.56	46.56	46.57
Middle	43.25	42.60	44.99
Secondary	42.59	41.31	44.98
Higher	42.88	41.89	43.79

However, the share of disabled elderly is little higher in urban India and this may be attributed to the fact that the likelihood of disability detection is higher in urban areas due to better health care facilities. Also, it is evident that with increase in age, the share of disabled elderly increases in both rural and urban areas. While only 36% of elderly are suffering from disability in the age-group 60-64, it becomes 42% in age bracket 65-69; 51% in 70-74 and about 61% in the age group 75+ years. The same trend exists in both rural and urban areas. Further, in the same line with individuals of all ages, the share of male elderly is higher than that of female elderly in the old age population. However, while more elderly reports for disability in urban India as compared to rural India (49% and 46%, respectively); the reverse is true in case of female elderly (44% and 45%, respectively for urban and rural areas).

Now, turning to social group wise distribution of disabled elderly in India, we find that the percentages of Scheduled Tribes elderly are the most disabled among all social classes in India. Scheduled caste elderly comes next followed by other backward castes and other castes. While nearly 52% of ST elderly have at least one disability, the percentage goes down to 49% in case of SC elderly. The proportion of OBC and other castes are 46% and 43%, respectively. Here also, Table 2 suggests that more disability live in urban areas as compared to rural part of the country.

Furthermore, as expected most of disabled elderly are illiterate too. Table 2 indicates that among illiterate elderly, 48% suffer from disability. This figure reduced with 47% among elderly with primary education and about 43% who are educated with middle and higher level.

#### **IV. Unadjusted Poverty Estimates and Gini Index**

After brief discussion about sample characteristics, in this section we will try to estimate unadjusted poverty for elderly with and without disability using standard poverty measures. For this purpose, we classify sample households with elderly by disability

status-households with disabled elderly and households without any disabled family members. Further, we use average per capita monthly expenditure (PMCE) as an indicator of standard of living (see Deaton and Paxson, 1995; Pal and Palacios, 2008). Three measures of poverty are used: Head Count Ratio (HCR hereafter), Poverty Gap (PG hereafter) and Squared Poverty Gap (SPG hereafter)<sup>6</sup>. The headcount is calculated by comparing the income  $y_i (i = 1, 2, \dots, n)$ , where  $n$  is the total number of households in the sample, of each household to the state-level poverty lines poverty line  $z_s$ . Let us suppose that  $q$  households have incomes below  $z_s$ , the  $HCR = q/n$ . This does not take account of the depth of poverty and also does not satisfy the principle of transfers. The

poverty gap measure sums of all the proportionate shortfalls below  $z_s$ :  $\frac{1}{n} \sum_{i=1}^q \left( \frac{z_s - y_i}{z_s} \right)$ .

This measure takes account of poverty depth but does not satisfy the principle of transfers. To incorporate the principle of transfers, SPG is used which measures the income gap by the gaps themselves awarding a higher weight to poorer households and

given as  $SPG = \frac{1}{n} \sum_{y_i < z_s} \left( \frac{z_s - y_i}{z_s} \right)^2$ . These poverty indices for elderly with and without

disability are shown in Table 3.

Also, this is further classified according to gender, rural/urban, social group, education and age group. HCR for elderly with disability is little lower with higher standard error than those without disability. Poverty gap index is almost similar for both the elderly groups. However, SPG index suggests that in general households with disabled elderly are having little higher value suggesting for higher level of poverty among households with disabled elderly. For simplicity, we would focus only on SPG index for interpretation purpose.

Table 3 also suggests that in each age group within elderly, as compared to persons without disability the value of SPG index is little higher for persons with disability. This infers that in each phase of old age disabled individuals are in a bad economic condition.

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<sup>6</sup> See Foster et al., 1984

**Table 3: Unadjusted Poverty Measures**

	Headcount Index			Poverty Gap Index			Squared Poverty Gap Index		
	Without Disability	With Disability	All	Without Disability	With Disability	All	Without Disability	With Disability	All
<b>Age-Group (Years)</b>									
60-64	0.296 (0.006)	0.282 (0.010)	0.291 (0.005)	0.065 (0.002)	0.065 (0.003)	0.065 (0.002)	0.021 (0.001)	0.023 (0.002)	0.022 (0.001)
65-69	0.293 (0.007)	0.300 (0.009)	0.296 (0.006)	0.067 (0.002)	0.068 (0.003)	0.068 (0.002)	0.022 (0.001)	0.023 (0.001)	0.023 (0.001)
70-74	0.281 (0.009)	0.288 (0.010)	0.285 (0.007)	0.064 (0.003)	0.069 (0.003)	0.066 (0.002)	0.021 (0.001)	0.024 (0.001)	0.022 (0.001)
75 plus	0.244 (0.009)	0.242 (0.008)	0.243 (0.006)	0.053 (0.003)	0.054 (0.002)	0.054 (0.002)	0.018 (0.001)	0.018 (0.001)	0.018 (0.001)
<b>Gender</b>									
Male	0.274 (0.006)	0.274 (0.006)	0.274 (0.004)	0.061 (0.002)	0.063 (0.002)	0.062 (0.001)	0.020 (0.001)	0.021 (0.001)	0.021 (0.001)
Female	0.294 (0.005)	0.278 (0.007)	0.287 (0.004)	0.066 (0.002)	0.065 (0.002)	0.066 (0.001)	0.022 (0.001)	0.022 (0.001)	0.022 (0.001)
All	0.284 (0.004)	0.276 (0.005)	0.281 (0.003)	0.064 (0.001)	0.064 (0.001)	0.064 (0.001)	0.021 (0.001)	0.022 (0.001)	0.021(0.000)
<b>Sector</b>									
Rural	0.287 (0.005)	0.279 (0.006)	0.284 (0.004)	0.063 (0.001)	0.063 (0.002)	0.063 (0.001)	0.021 (0.001)	0.021 (0.001)	0.021 (0.000)
Urban	0.275 (0.007)	0.264 (0.008)	0.27 (0.005)	0.066 (0.002)	0.068 (0.002)	0.067 (0.002)	0.022 (0.001)	0.023 (0.001)	0.023 (0.001)
<b>Social Group</b>									
ST	0.473 (0.019)	0.469 (0.025)	0.471 (0.016)	0.122 (0.007)	0.124 (0.010)	0.123 (0.006)	0.047 (0.004)	0.045 (0.004)	0.046 (0.003)
SC	0.389 (0.010)	0.375 (0.011)	0.382 (0.007)	0.093 (0.003)	0.092 (0.003)	0.093 (0.002)	0.031 (0.001)	0.032 (0.002)	0.032 (0.001)
OBC	0.307 (0.006)	0.281 (0.007)	0.295 (0.005)	0.066 (0.002)	0.061 (0.002)	0.064 (0.001)	0.021 (0.001)	0.020 (0.001)	0.021 (0.001)
Others	0.175 (0.005)	0.165 (0.006)	0.171 (0.004)	0.037 (0.001)	0.036 (0.002)	0.037 (0.001)	0.012 (0.001)	0.012 (0.001)	0.012 (0.000)

Note: 1. Figures in parenthesis are the standard errors of indices.

2. Poverty cut-off line is derived from Himanshu (2007) by adjusting for CPIIW in urban India and CPIAL in rural India for the year 2001-02. These estimates comes to 481.1638 and 325.3861, respectively.

It also shows that 21% disabled elderly male are living below poverty line as compared with 20% elderly male without disability. The percentage female elderly with and without disability are same (22% each). Again while 22% disabled elderly live in poverty as compared to 21% with no disability.

**Table 4: Inequality measures**

	<b>Gini Index</b>		
	<b>Without Disability</b>	<b>With Disability</b>	<b>All</b>
<b>Age-Group (Years)</b>			
60-64	0.287	0.295	0.290
65-69	0.291	0.300	0.295
70-74	0.294	0.298	0.296
75 plus	0.306	0.327	0.319
<b>Gender</b>			
Male	0.292	0.310	0.301
Female	0.294	0.305	0.299
All	0.293	0.308	0.300
<b>Sector</b>			
Rural	0.247	0.261	0.254
Urban	0.319	0.337	0.328
<b>Social Group</b>			
ST	0.263	0.264	0.264
SC	0.240	0.249	0.244
OBC	0.256	0.265	0.261
Others	0.315	0.340	0.327

Furthermore, the proportion of female disabled elderly is little higher than their male counterpart. This clearly indicates that disabled elderly, in particular female are little disadvantaged in terms of their living standard. Now, the value of SPG index suggests that the while in rural India, the economic condition of elderly with and without disability are almost similar, in urban India elderly without disability are little well-off in comparison to elderly with disability. As far as social group is considered, SPG index value declines from SC to others and here also, higher level of poverty can be found for disabled elderly.

To increase our understanding about the income inequality, we calculate gini-index for elderly with and without disability. Gini-index for elderly according to their age- group, gender, location of residence (rural/urban) and social group are shown in Table 4. It suggests that across each age-group, gender, sector and social groups' inequality among elderly without any disability is lower than that of persons with disability. This means that the distribution of income among disabled elderly is more unequal than that of non-disabled elderly. Interestingly, gini value for disabled male elderly is slightly higher than that of their female counter part. Also, Income inequality is more pronounced among disabled elderly living in urban areas (0.337) as compared to those who reside in rural part of the country (0.261). As for as income inequality within social group is concerned, SC disabled elderly (SCs) have least inequality, followed by disabled elderly from OBC, ST and other castes.

**Table 5: Gender and Sector wise comparison of Mean and Variance of PMCE between elderly individuals with and without disability**

	Mean PMCE for			Standard Deviation for		
	With Disability	Without disability	All	With Disability	Without disability	All
<b>Gender</b>						
Male	601.28	571.01	584.91	431.87	392.03	411.06
Female	591.84	570.62	579.56	428.85	395.41	409.96
Difference/Ratio\$	9.44*	0.39	5.34*	1.01	0.99	1.00
<b>Sector</b>						
Rural	484.53	467.21	474.70	272.39	238.69	253.94
Urban	792.88	768.52	779.56	564.95	531.81	547.20
Difference/Ratio#	-308.35***	-301.30***	-304.87***	0.48***	0.45***	0.46***

Note: T-test is used to compare differences of means of PMCE across groups and F-test is used to test the equality of variances. Also, in general t-test with equal variance is applied, except in those cases where variances are found significantly unequal.

\$ For mean columns, values in this rows are difference of male and female PMCE and for standard deviation columns; values are ratio of standard deviations of PMCE.

#For mean columns, values in this rows are difference of rural and urban PMCE and for standard deviation columns values are ratio of standard deviations of PMCE.

\*\*\*, \*\*, \* indicates significance at 1%, 5%, 10% level of significance.

## **V. Does differences of average Income/Expenditure significant across demographic composition of elderly?**

In order to answer this question, we use t-test of comparison of means followed by F-test for equality of variance for demographic indicators with dichotomous categories. For multiple category demographic variables, we apply Analysis of Variance (ANOVA hereafter). Table 5 documents results of t-test followed by F-test. It can be seen from the table that while there is no statistical difference in the mean PMCE between male and female elderly without any disability; elderly male with disability have significantly higher PMCE as compared with female disabled elderly. However, variation in the PMCE distribution is not significantly different between male and female elderly. Further, as expected average PMCE for urban elderly with and without disability are significantly higher in comparison to rural elderly. Also, variances of rural and urban PMCE are not statistically equal for all elderly, elderly with and without disability. Mean and standard deviations of PMCE for elderly with and without disability according to their age group, social group and educational status are presented in Table 6 followed by Analysis of variance and comparison of multiple means results in Table 7, 8 and 9, respectively.

ANOVA results for comparison of mean MPCE across age groups, social groups and educational level suggests for significance mean difference for all elderly persons with and without disability. Further, based on Chi-square statistics, Bartlett's test rejects the null hypothesis of equal variances between groups. However, the results of difference of means between pair wise combination of age, social and educational groups is mixed.

Table 7 suggests for among elderly people with disability while there is no significant difference of mean PMCE between age groups 60-64 and 65-69; 60-64 and 70-74; 65-69 and 70-74 years, there are evidences of significant differences of mean PMCE between age groups 60-64 and 75+; 65-69 and 75+ and 70-74 and 75+ years.

**Table 6: Mean and Standard Deviations of PMCE for elderly with and without disability according to their Age group, Social Group and Educational Status**

	Without Disability		With Disability		All	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
<b>Age Group (Years)</b>						
60-64	512	333	518	368	514	346
65-69	520	332	525	348	522	339
70-74	528	353	527	351	528	352
75+	564	424	595	461	583	447
<b>Social Group</b>						
ST	392	213	395	215	394	214
SC	421	205	433	230	427	218
OBC	480	261	501	282	490	271
Others	655	468	705	547	676	504
<b>Educational Status</b>						
Below Primary	432	203	441	218	436	210
Primary	501	293	519	315	510	304
Middle	535	288	580	354	554	319
Secondary and higher	775	559	856	644	810	598

**Table 7 ANOVA and Comparison of Mean Per Capita Monthly Expenditure by Age Groups**

Age groups	Analysis of Variance											
	Without Disability				With Disability				All			
Source	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.
Between groups	7174734	3	2391578	19.33***	19264940	3	6421647	42.4***	28294717	3	9431572	69.11***
Within groups	2.88E+09	23249	123711.5		2.76E+09	18241	151437		5.66E+09	41494	136466	
Total	2.88E+09	23252	124004		2.78E+09	18244	152468		5.69E+09	41497	137138	
Comparison of Mean Per Capita Monthly Expenditure by Age groups												
Age Groups	60-64	65-69	70-74	Bartlett's test for equal variances  chi <sup>2</sup> (3) = 358.9538***	60-64	65-69	70-74	Bartlett's test for equal variances  chi <sup>2</sup> (3) = 509.4147***	60-64	65-69	70-74	Bartlett's test for equal variances  chi <sup>2</sup> (3) = 1.0e+03***
65-69	7.571				6.831	-	2.530		7.59582		5.90586	
70-74	16.018*	8.448			9.361	2.530	-		13.5017*	5.90586	-	
75 plus	1.77***	44.202	35.75***		76.8022***	69.97***	67.44***		68.4325***	60.8367***	54.9308***	

\*\*\*, \*\*, \* indicates significance at 1%, 5%, 10% level of significance.

**Table 8. ANOVA and Comparison of Mean Per Capita Monthly Expenditure by Social Groups**

Analysis of Variance												
Social groups	Without Disability				With Disability				All			
Source	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.
Between groups	222134072	3	74044691	646.71***	232153907	3	77384636	553.64***	449354353	3	1.5E+08	1185.58***
Within groups	2.66E+09	23243	114494.2		2.55E+09	18237	139774.7		5.24E+09	41484	126338.7	
Total	2.88E+09	23246	124035.3		2.78E+09	18240	152479.4		5.69E+09	41487	137160.7	
Comparison of Mean Per Capita Monthly Expenditure by Social groups												
Social groups	ST	SC	OBC	Bartlett's test for equal variances	ST	SC	OBC	Bartlett's test for equal variances	ST	SC	OBC	Bartlett's test for equal variances
SC	29.2022**			chi <sup>2</sup> (3) = 4.6e+03***	37.9774***			chi <sup>2</sup> (3) = 4.3e+03***	33.3917***			chi <sup>2</sup> (3) = 8.9e+03***
OBC	88.0921***	58.8899***			105.914***	67.9367***			96.0603***	62.6686***		
Others	262.953***	233.751***	174.861***		309.909***	271.931***	203.995***		282.84***	249.449***	186.78***	

\*\*\*, \*\*, \* indicates significance at 1%, 5%, 10% level of significance.

**Table 9. ANOVA and Comparison of Mean Per Capita Monthly Expenditure by Educational Status**

Analysis of Variance												
Educational Status	Without Disability				With Disability				All			
Source	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Stats.
Between groups	389532462	3	1.3E+08	1210.56***	417107639	3	1.39E+08	1072.58***	798614326	3	2.66E+08	2257.93***
Within groups	2.49E+09	23250	107259.7		2.36E+09	18241	129627		4.89E+09	41495	117897.7	
Total	2.88E+09	23253	123997.8		2.78E+09	18244	152468.4		5.69E+09	41498	137133.8	
Comparison of Mean Per Capita Monthly Expenditure by Educational Level												
Educational Status	Below Primary	Primary	Middle	Bartlett's test for equal variances	Below Primary	Primary	Middle	Bartlett's test for equal variances	Below Primary	Primary	Middle	Bartlett's test for equal variances
Primary	69.0665***			chi <sup>2</sup> (3) = 6.5e+03***	78.8099***			chi <sup>2</sup> (3) = 5.4e+03***	73.5208***			chi <sup>2</sup> (3) = 1.2e+04***
Middle	102.58***	33.5136***			139.534***	60.7241***			118.197***	44.6761***		
Secondary and higher	343.146***	274.079***	240.566***		415.069***	336.259***	275.535***		373.478***	299.958***	255.282***	

\*\*\*, \*\*, \* indicates significance at 1%, 5%, 10% level of significance.

This suggests that though the per capita monthly expenditure for younger old, middle old and older old are not statistically differ, it is significantly different for the oldest old elderly with disability in comparison to elderly below 75 years of age.

Multiple comparison of MPCE according to ST, SC, OBC and others are shown in Table 8 which suggests for significant difference in mean MPCE across each paired combination of social groups for elderly with and without disability. Similar results are documented in Table 9 for educational status.

## VI. The Econometric Model

After exploring the economic condition and inequality among elderly with and without disability, in this section we would do some econometric exercise to explain the possible relationship between poverty and disability. Following the hypothesis that there is causal association between poverty and disability, our model is based on two-stage approach of estimation (Stern, 1989) where first stage equation is

$$PMCE_i = \alpha + \sum_k^m \beta_k X_{i_{jk}} + \gamma Disability_{ijs} + \varepsilon \quad (1)$$

where  $PMCE_i$  is the per capita monthly expenditure (PMCE) of  $i^{th}$  household;  $X_{i_{jk}}$  is the  $k^{th}$  ( $k=1, 2, \dots, m$ ) exogenous control and  $Disability_{ijs}$  is dummy for presence of disability for  $j^{th}$  member of  $i^{th}$  household.  $\alpha$  is intercept,  $\beta$  and  $\gamma$  are coefficients corresponding to  $X_{i_{jk}}$  and  $Disability_{ijs}$ , respectively.  $\varepsilon$  is independently and identically distributed (i.i.d) error term. Here  $X_{i_{jk}}$  are age beyond 60 and its square; dummies for gender, social groups, education level, location of residence, marital status; land possessed by household and size of the households.

We estimate equation (1) using robust regression and then use the estimated PMCE in the second stage equation

$$Disability_{ijs} = \delta + \sum_{e=1}^v \omega_e Z_{i_{je}} + \lambda \overline{PMCE_i} + \xi \quad (2)$$

where  $Disability_{ij}$  is the disability indicator (dummy for presence of any disability),  $Z_{i,je}$  is the  $e^{th}$  exogenous variable corresponding to the  $j^{th}$  member of  $i^{th}$  household.  $Z_{i,je} = X_{i,jk}$  minus land possessed by household.  $\overline{PMCE}_i$  is the predicted per capita monthly expenditure for the  $i^{th}$  household from equation (1) and  $\xi$  is again an i.i.d disturbance term. In the second stage equation (2), as dependent variable is the presence or absence of any disability among elderly i.e. a dichotomous variable, we apply logit regression model to estimate the effect of poverty and other socio-economic variables on the likelihood of disability.

## VII. Estimation Results

### Disability and other correlates of Poverty among Elderly

First step robust regression result of Table 10 suggests that being a disabled elderly is negatively associated with the log of per capita monthly expenditure. This means that in comparison to non-disabled elderly, disabled elderly live in poorer economic conditions. In other words, disability may be a cause of poverty among elderly.

Looking at the other explanatory variables, we observe that being male is significantly associated with higher level of income, which indicates gender inequality in the income distribution within family. Further, though age beyond 60 years is not significant, the positive and significant coefficient of age square indicates for non-linear relationship between log of per capita monthly expenditure and age above 60 years. As far as association of log PMCE with social class of elderly is concerned, both ST and SC shows lower income level as compared with OBC and other castes. Also, significant and increased positive coefficients of education with higher level suggests that in comparison to illiterate and below primary educated elderly, elderly with higher education are more well-off. Again, elderly residing in rural areas shows lower living standard in comparison to their urban counterparts. If we look at the relationship between marital status and poverty, we find that while unmarried elderly are well-off as compared with married elderly, the widows, divorced and separated elderly are poor than the reference category (married elderly).

**Table 10 : Two Stage Estimation Results**

Estimation Method	Step 2. Logit Model		Step 1. Robust Regression
Dependent Variables	Disability: dummy		Log of per capita monthly expenditure
Explanatory Variables	Coefficient (Standard errors)	Marginal Effect	Coefficient (Standard errors)
Disability : dummy	-	-	-0.0117 (0.0040)***
Estimated log of per capita expenditure	-2.9624 (0.4682) ***	-0.7324 (0.1154)***	-
Gender: dummy	0.4729 (0.0347)***	0.1165 (0.0085)***	0.0100 (0.0041)**
Age beyond 60	0.0607 (0.0050)***	0.0150 (0.0012)***	0.0009 (0.0006)
Age-square	-0.0004 (0.0002)**	-0.0001 (0.0001)**	0.0000 (0.0000)*
ST: dummy	-0.1499 (0.0865)*	-0.0367 (0.0210)*	-0.1050(0.0094)***
SC: dummy	-0.3721 (0.0827)***	-0.0904 (0.0196)***	-0.1385(0.0050)***
Primary Education: dummy	0.3269 (0.0552)***	0.0814 (0.0138)***	0.0777(0.0057)***
Middle Education: dummy	0.4148 (0.0843)***	0.1032 (0.0209)***	0.1431(0.0057)***
Secondary Education: dummy	0.7947 (0.1442)***	0.1955 (0.0339)***	0.2773(0.0067)***
Higher Education: dummy	1.4525 (0.2462)***	0.3377 (0.0477)***	0.5082(0.0064)***
Rural: dummy	-0.7452 (0.1245)***	-0.1842 (0.0301)***	-0.2872 (0.0044)***
Unmarried: dummy	1.5305 (0.1270)***	0.3435 (0.0216)***	0.0256 (0.0153)*
Widow: dummy	0.7241 (0.0394)***	0.1784 (0.0095)***	-0.0387 (0.0045)***
Divorced/Separated: dummy	0.9384 (0.1890)***	0.2270 (0.0416)***	-0.080 (0.0225)***
Land possessed by household	-	-	0.04 (0.001)***
Size of household	-0.2336 (0.0177)***	-0.0577 (0.0044)***	-0.0376(0.0006)***
Constant	19.3451 (3.2063)***	-	7.0330(0.0586)***
Number of observations	41475	-	41475
Wald chi <sup>2</sup> (92)	2601.06***	-	-
Pseudo R <sup>2</sup>	0.1118	-	-
Log pseudo likelihood	-25408.694	-	-
F( 93, 41381)	-	-	397.53***

Note: estimates are adjusted for sampling weight and controlled for 78 NSS region dummies. \*\*\*, \*\*, \* indicates significance at 1%, 5%, 10% level of significance.

As expected, per capita monthly expenditure increases with increase in the land owned by elderly while size of the household is significantly associated with low level of PMCE.

### **Poverty and other correlates of Disability among Elderly**

Now, to answer the question whether poverty is a cause for disability among elderly we need to see the marginal effect of logit model given in Table 10. The negative and significant coefficient of estimated log of per capita expenditure suggests that with each unit increase in it, the likelihood of being disabled will get reduced by 73% point. This means as the standard of living will go up; the likelihood of being disabled will get reduced. In other words, by reducing poverty among elderly Indians, the probability of being suffered from disability can be significantly reduced.

Now, turning to other correlates of disability, we find that in comparison to female elderly, male elderly has higher likelihood of being disabled. Again, the probability of presence of disability among elderly increased with increase in age and the relationship between age and disability is non-linear. Further, we have some surprising findings too. Also, as compared to OBCs and other social groups, ST and SC are negatively associated with the presence of disability. Again, in comparison to illiterate and below primary educated elderly, the probability of being disabled is higher for those who have acquired educated primary and higher educational level. Results further show that the elderly who live in rural India are less likely to suffer from any disability. However, being unmarried or widowed or separated or divorced are having more risk to be disabled in comparison to married elderly and this risk get reduced with increase in the number of family members.

### **VIII. Concluding Observations**

The relation between poverty and disability is commonly accepted as a vicious circle and it is widely hypothesised that it is a two way relationship i.e. disability increases the risk of poverty and conditions of poverty increase the risk of disability. The objective of this

analysis was mainly to understand the relationship between poverty and disability in the elderly population of India.

Based on different indices of poverty and inequality, our analysis suggests that as compared to non-disabled elderly, the poverty and income inequality level is higher for disabled elderly. Further, t-test and ANOVA results show that there are significant differences in the income levels of different age groups within elderly population, their gender, residence location, social groups and educational status. It was found that in general, being male, age beyond 60 years and its square, higher level of education, being unmarried, widowed, separated or divorced in comparison to being currently married are positively and significantly associated with disability of elderly whereas living in rural areas; being ST or SC as compared with OBC and others and household size are negatively associated with the likelihood of being disabled. Though the paper is not able to answer why it is the case, we suspect that apart from other reasons, reporting biasness and being not aware about the disability due to lack of health care facilities in rural areas and for the economically backward social classes could be possible explanations for this.

Further investigation focused on the relationship between disability and poverty using two stage estimation methods confirms the causal relationship between poverty and disability in case of Indian elderly. Results suggest that disability is positively associated with the poor standard of living. At the same, poverty is positively associated with likelihood of being disabled.

In conclusion, if our analysis has any validity, it has far many policy implications. There is immediate need to strengthen social security safety nets to uplift poor elderly's economic conditions in one hand and on the other hand, it is also essential to provide sufficient health care facilities to reduce the risk of disability among elderly.

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