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Analysing Catastrophic OOP Health Expenditure in India: Concepts, Determinants and Policy Implications

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Abstract

The present paper attempts to modify definition of catastrophic out-of-pocket health expenditure by characterising it based on consumption of necessities. In literature, catastrophic expenditure is defined as that level of OOP health expenditure which exceeds some fixed proportion of household income or household's capacity to pay. In the present paper, catastrophic health expenditure is defined as one which reduces the non-health expenditure to a level where household is unable to maintain consumption of necessities. Based on this definition of catastrophic health expenditure, the paper examines determinants of catastrophic OOP health expenditure in India. Findings suggest that it is important to carefully revise the concept of catastrophic health care spending and the method developed in this paper can be considered as one of the possible alternatives. We find that education is one of the important policy instruments that can be used to reduce incidence of catastrophic spending in India. The findings also suggest that even after efforts to reduce differences among various social classes in India, socially deprived classes are still vulnerable as they are more likely to experience financial catastrophe due to illness.

Keywords:

Catastrophic health expenditure; Consumption of Necessities; India.

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1. Introduction:

Studies on economic consequences of health shocks provide important insights for policy makers. Health policies are concerned not only with improving health status of population but also with protecting households from financial catastrophe of illness (Peters *et al.*, 2002). Studies examining out-of-pocket (OOP) health expenditure throw light on effect of illness on economic wellbeing of household. The concept of catastrophic OOP health expenditure assumes importance in this context. Catastrophic OOP health expenditure is concerned with high levels of OOP health expenditure which might affect household's standard of living. In literature, catastrophic expenditure is defined as that level of OOP health expenditure which exceeds some fixed proportion of household income or household's capacity to pay. The present paper has two objectives: first is to define catastrophic health expenditure based on household's required consumption of necessities and second is to examine determinants of catastrophic OOP health expenditure in India. We propose to use the Engel curves to measure this required consumption. Based on this definition of catastrophic expenditure, we examine determinants of catastrophic OOP health expenditure in India.

Examining catastrophic OOP health expenditure to evaluate health system dates back to Berki (1986). Since then different definitions of catastrophic OOP health expenditure have been provided in literature. According to Berki (1986), catastrophic OOP expenditure is one which constitutes large part of household budget and thus, affects household's ability to maintain customary standard of living. The idea behind this approach is that if health care spending constitutes large portion in household budget, then it will affect consumption of other items. Thus, as pointed out by Russell (1996), this approach is concerned with opportunity cost of health care spending.

Wagstaff and van Doorslaer (2003) measures incidence and extent of catastrophic OOP health expenditure in Vietnam using share of OOP expenditure in total household budget. Following Berki (1986), Wagstaff and van Doorslaer (2003) defined catastrophic OOP health expenditure as health expenditure that exceeds some fixed proportion of total household expenditure. This threshold level is set arbitrarily. Wagstaff and van Doorslaer (2003) sets this threshold at 10 percent of total household budget. However, as pointed out

by Wagstaff and van Doorslaer (2003), taking same threshold level for poor and rich households leads to some problem. In particular, rich households are more likely to exceed the threshold level than poor as they have more resources to spend on health care. In this context, Russell (1996) notes that in the short run rich households may reduce 'unnecessary' consumption while poor households may have to forgo essential consumption in order to support OOP health expenditure. In the first case it is difficult to judge whether household is facing a catastrophe, even if OOP health care spending is above the threshold level.

Xu *et al.* (2003) argues that share of OOP expenditure should be taken in terms of household's capacity to pay. They define household's capacity to pay as income after accounting for median level of food consumption in society. Households spending more than 40 percent of their capacity to pay on health care are said to experience catastrophic OOP health expenditure. Xu *et al.* (2003) takes actual food consumption for households with income lower than median food consumption. Arbitrariness in defining threshold level remains in this approach as well. Apart from this, as rightly pointed out by Wagstaff (2008), the criterion may actually lead to conclusion that a poor household has higher capacity to pay than a household who is just above the subsistence level. It is important to note that, both of these approaches consider OOP health expenditure as involuntary and thus assume that it does not contribute to household's welfare (Wagstaff, 2008).

Even though there are some weaknesses, above two methods provide important measures of catastrophic OOP health expenditure. Moreover, these measures are very useful in making comparisons across societies or countries. Many studies have used these methods to examine share of OOP expenditure and evaluate financial protection provided by health systems in context of developing countries[1], including India[2]. Some of these studies, for instance O'Donnell *et al.* (2005), note that since catastrophic OOP health expenditure is defined as one that exceeds 10 percent of household budget, rich households are more likely to incur catastrophic OOP health expenditure, which seems counterintuitive. These empirical finding supports Russell (1996) which argues against same threshold level for poor and rich households.

The above two methods of defining catastrophic OOP expenditure do not consider household's external resources. For instance, if household is able to borrow to finance OOP health expenditure then its present consumption will have lower impact than a situation

[1] For instance, see O'Donnell *et al.* (2005), Su *et al.* (2006), Thuan *et al.* (2006), Covangnero *et al.* (2006), and van Doorslaer *et al.* (2007).
[2] Garg and Karan (2005), O'Donnell *et al.* (2005) and Vaishnavi and Dash (2009) have examined catastrophic OOP health expenditure for India.

where household cannot borrow. Flores *et al.* (2008) presented revised definition of catastrophic OOP health expenditure after accounting for sources used to finance health expenditure. They showed that if the method of financing is not considered then catastrophic OOP health expenditure might be under- or over-estimated. This approach is an important improvement over the method described in Wagstaff and van Doorslaer (2003). At the same time, this approach is also subjective in nature, as it imposes arbitrary threshold level after accounting for sources of financing.

In the present paper, we attempt to bring in some objectivity in measurement of catastrophic OOP health expenditure and define it as OOP health expenditure that results in consumption deprivation of necessities. While doing this, we retain the assumption of earlier studies that health expenditure is involuntary. This assumption means that OOP health expenditure has entirely negative effect on household welfare as it deprives household of resources that could have been spent on other goods and services (Wagstaff, 2008). At the same time, our study differs from previous studies on following grounds.

- We take into account community's preferences for defining necessities and estimate income level required to attain saturation level of consumption of necessities. Methodology of estimating required consumption of necessities is based on Sitaramam *et al.* (1996) and Kumar *et al.* (2009)[3]. OOP health expenditure is defined as catastrophic if it reduces non-health expenditure to a level which is lower than the required level.
- Next, we examine the factors that lead to catastrophic OOP health expenditure in India. For this purpose, we use nationwide sample survey on consumption expenditure of households conducted by the National Sample Survey Organisation (NSSO).

The rest of the paper is organised as follows: the next section describes the methodology used to define catastrophic OOP health expenditure. Section 3 illustrates the data source. Section 4 elaborates on econometric techniques used and explanatory variables used in our analysis. Section 5 discusses empirical findings. Finally, section 6 concludes.

2. Defining Catastrophic OOP Health Expenditure:

We have seen that previous studies generally measure catastrophic OOP health expenditure in terms of proportion of OOP expenditure in total household budget or household's capacity to pay. As mentioned in the previous section, there are some

[3] These studies use similar methodology to estimate consumption deprivation index.

weaknesses of this approach. One of the important questions to ask is whether the same level of OOP health expenditure can be considered as catastrophic for rich and poor households. Since resources of poor households are limited, allocating five percent of household budget towards health care might have negative impact on their standard of living. On the other hand, even if rich households allocate 25 percent of household budget to health care, that will not result in lower standard of living for them. Russell (1996) argues that a rich household might just forgo consumption of 'unnecessary' items to spend on health care and thus, even if share of OOP expenditure in total budget exceeds the threshold level it should not be considered as catastrophic. For instance, in case of India, a larger proportion of rich households spend more than 10 percent (conventional threshold level) on health care than poor households (see Table 1). Poor households have lower resources compared to rich households and as a result their capacity to spend on health care is also lower. Consequently, poor households are less likely to be categorised as incurring catastrophic payments than rich households. In this context, Russell (1996) points out that it is important to determine what are necessary consumption and unnecessary consumption to define catastrophic OOP health expenditure. We attempt to proceed in this direction and measure income required to protect consumption of necessities. After calculating this 'required income', we define catastrophic health expenditure. As mentioned in the previous section, while doing our analysis we maintain the assumption that OOP health expenditure is entirely involuntary and does not add to household welfare.

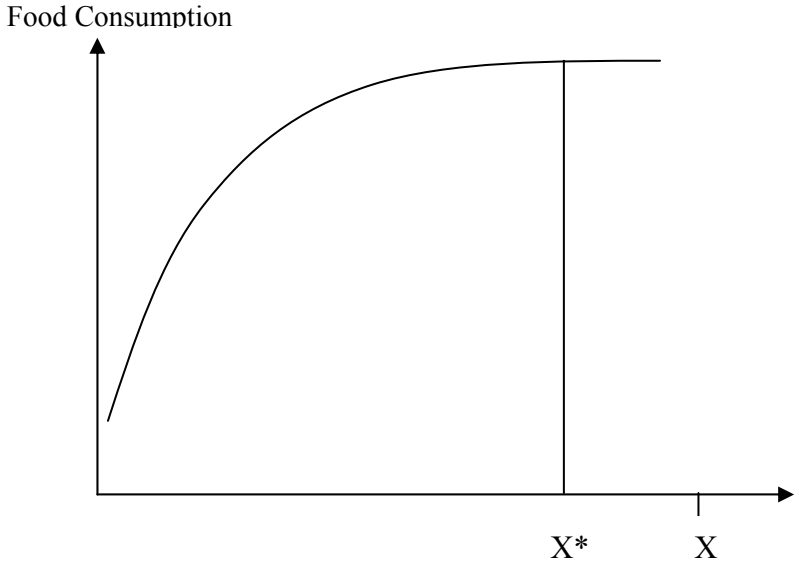
In order to derive required income[4], we borrow from poverty literature. Sitaramam *et al.* (1996), Kumar *et al.* (2008) and Kumar *et al.* (2009) measure poverty using cereal consumption deprivation. The argument behind this approach is that Engel curve for necessities is concave in nature and the point where it saturates can be taken as deprivation point. Thus, the inflexion point gives required consumption on a necessity and the associated minimum total expenditure to attain this consumption. Households consuming below this point are considered as deprived households who are unable to attain saturation level of cereal consumption. We use this concept to derive total household expenditure required to maintain saturation level of consumption of necessities. Here, we consider more than one necessity.

Next, we use this 'required income' as threshold level to define catastrophic OOP health expenditure. For instance, consider a household that is consuming only one necessity,

[4] We use total consumption expenditure as a proxy for household income as information on income is not available.

food. Engel curve for this good is depicted in Figure 2.9. In the figure, X* is minimum total expenditure required to consume saturation level of food. Beyond this point, food consumption does not increase with total household expenditure, but rather remains constant. Now, suppose household's total expenditure is X. In this case, (X-X*) gives the maximum amount that household can spend without affecting the food consumption. Thus, [(X-X*)/X] can be taken as threshold level of proportion that household can allocate for health care. Moreover, for households with total expenditure lower than X* the threshold level is zero, as any expenditure on health will affect their consumption of necessities.

Figure 1: Engel Curve for a Necessity



Now suppose household consumes two necessities, say food and fuel. In this case, we will get two levels of required total expenditure from estimation of Engel curves for each of these two commodities, say, X_1* and X_2*. To calculate required income, we take maximum of X_1* and X_2*, as at the maximum level of total expenditure consumption of both the commodities will be at saturation level[5]. Threshold level can be measured as:

$$h^* = \frac{X - \max(X_1^*, X_2^*)}{X} \qquad \text{if} \quad X \geq \max(X_1^*, X_2^*)$$

$$h^* = 0 \qquad \text{if} \quad X < \max(X_1^*, X_2^*)$$

[5] Alternatively, one can aggregate over commodities first and then estimate the aggregate Engel curve. However, there is a problem with this approach as it would over-or under-estimates total household expenditure required to achieve saturation level of consumption of necessities. In particular, at the point where the aggregate Engel curve saturates, it is not necessary that individual Engel curves will saturate at the same point.

We can easily generalise this approach to more than two necessities. When the household consumes more than two necessities, the threshold level to define catastrophic OOP health expenditure will be given by:

$$h^* = \frac{X - \max(X_1^*, X_2^*, ..., X_n^*)}{X} \qquad \text{if} \quad X \geq \max(X_1^*, X_2^*, ..., X_n^*)$$

$$h^* = 0 \qquad \text{if} \quad X < \max(X_1^*, X_2^*, ..., X_n^*)$$

Note that, this approach does not arbitrarily impose threshold level, rather consider preferences of households to determine required consumption of necessities and thus, threshold level. Moreover, since income of rich households is much higher than required consumption of necessities, the threshold level for them will be higher than poor households. This approach is similar to capacity to pay approach provided by Xu *et al.* (2003). Our methodology differs from that proposed by Xu *et al.* (2003) on grounds that we consider all necessities consumed by households rather than only food consumption. Secondly, if household's total expenditure is below the expenditure required for consumption of necessities, then we say that any expenditure on health is catastrophic as it affects consumption of necessities.

3. Data Source:

We use data collected in the 61st round of socio-economic survey conducted by the NSSO during July, 2004 to June, 2005. This nationwide survey covers 79,298 households from rural areas and 45,346 households from urban. The total survey period was divided into four sub-rounds of three months each. This division of entire survey into four sub-rounds eliminates seasonal biases in household consumption. Moreover, in order to get a good representation of all groups, some groups of population are oversampled. In order to avoid such sampling biases, we use probability weights in our estimation.

For our study, the variables of interest are OOP health expenditure and household's spending on different consumption items. Above mentioned data set provides information on a wide range of consumption items, such as food items, intoxicants, fuel, clothing, education, medical, entertainment, rent, durables and others. Expenditure on these consumption items is given with preference period of 30 days. Apart from these key variables, we require some measure of household's economic wellbeing. Following Filmer and Pritchett (2001), we

construct a wealth index using principal components analysis. The data set provides information on durable goods possessed by the household on the date of survey. Using this data it is possible to construct a wealth index. Wealth index acts as an indicator of permanent income.

One of the limitations of this data set is that medical expenses do not include travelling expenses associated with getting medical treatment. As a result, economic burden of illness is underestimated. Secondly, this data set does not provide information on health status of household members. Health status is an important determinant of catastrophic OOP health expenditure. In order to capture effect of health risks, we consider demographic (for instance, age composition of household) and environmental (for instance, cooking methods used by household[6]) factors.

4. Econometric Methodology:

4.1. Engel Curve Specification:

Following Sitaramam *et al.* (1996) and Kumar *et al.* (2008), we specify a saturating Engel curve as[7]:

$$q_i = \frac{Vy_i}{K + y_i} \qquad (1)$$

where, q_i is i[th] household's per capita consumption of necessity, y_i is i[th] household's per capita consumption expenditure and V and K are parameters. We estimate this equation with non-linear least squares estimation technique. Note that we use household size to normalize consumption expenditure across households. A better method is to normalize with equivalent household size. However, while estimating Engel curves for different commodities, it is appropriate to use different equivalent size for each of these commodities[8]. It is difficult to aggregate over necessities if we use different equivalent household size to normalize. As a result, we estimate the Engel curves using household size. We consider eight categories of

[6] Parikh *et al.* (2003) note that cooking methods used by households are important determinants of health status.
[7] As pointed out by Kumar *et al.* (2008), and Kumar *et al.* (2009), Engel curve for necessities is concave upto a point and afterwards it becomes convex. They truncate the sample to concentrate on concave portion using cubic specification of Engel curve. We follow their methodology to truncate the sample.
[8] The idea behind using equivalent size is that all members of the households do not consume all the commodities in same magnitude. For example, commodities for children, such as baby-food, are not consumed by adults. As a result, weights are given to each member of the household with respect to adult male. Note that weights given to member of the household differ for each commodity. For instance, weights given to adult female will differ for consumption of jewelry and consumption of cigarettes.

consumption items as potential necessities and estimate equation (1) for each of them, viz, cereal, sugar, salt, egg/fish, vegetables, clothing, rent and fuel separately for rural and urban areas of 15 fifteen major states[9]. Note that all these commodities were not necessities in all the cases. We consider these commodities for deriving threshold level for catastrophic OOP health expenditure only in those cases where they were necessities. We follow the procedure explained in the previous sub-section to get threshold level for OOP health expenditure.

4.2. Probit Specification for Catastrophic OOP Health Expenditure:

After determining threshold level for catastrophic OOP health expenditure, we are interested in finding out the determinants of catastrophic OOP health expenditure. The probability of incurring catastrophic health expenditure is modelled using probit model as:

$$\Pr(h_i = 1) = \Phi(x_i \beta)$$

where h_i represents the event of incurring catastrophic health expenditure, x_i is a vector of various explanatory variables, β is a vector of parameters and ε_i is random error term. The variables that are used as explanatory variables in the above regression are explained below[10]. It is important to note that catastrophic OOP health expenditure, as defined in the present paper, depends on level of OOP health expenditure and household's income. The factors that affect these two variables will also affect incidence of catastrophic OOP health expenditure. Various factors are catagorised into three groups, namely, economic variables, demographic variables and regional variables.

Economic Variables:

Among other factors, catastrophic OOP health expenditure is determined by household's income. Higher the income higher is the household's capacity to pay for health care without affecting consumption of necessities. To capture this fact, we include some indicators of household's wealth as explanatory variables[11]. In particular, we include land

[9] Sitaramam *et al.* (1996), based on the NSSO data on household consumption over 40 years, shows that these consumption items are the most frequently selected in the first four priority items in household consumption.
[10] Table 2 provides definitions of explanatory variables.
[11] We do not include household expenditure as an indicator of household income for two reasons. First, total household expenditure is likely to be affected by OOP health expenditure. However, fixed assets are less likely to get influenced by health expenditure. Secondly, since we have used total expenditure to determine threshold

possessed by household. Land possessed is an important indicator of wealth in rural India; however it is expected to have little significance for urban sector. We also consider cooking methods used by the household and whether household has access to electricity. These variables can be considered as indicators of household's economic wellbeing. Cooking methods also influence health risks. For instance Parikh, *et al.* (2003) shows that long-term exposure to solid cooking fuels increases the chances of falling ill. The extent of exposure to health risk in turn determines the level of health expenditure. In addition to these variables, we consider possession of durable goods to calculate wealth index. For this purpose, we use propensity score matching technique suggested by Filmer and Pritchett (2001). For constructing this wealth index, we include possession of nine indicator items, namely, radio, television, electric fan, air conditioner, air cooler, sewing machine, refrigerator, bicycle, motorcycle, and car.

Another important variable that might affect OOP expenditure is education. With education individual are more likely to take care of their health, thus reducing OOP health expenditure and likelihood of incurring catastrophic health expenditure. In literature this effect is termed as efficiency mechanism (Grossman, 1999 and Cowell, 2006). Education also increases the opportunity cost of getting ill (Cowell, 2006). More education is generally associated with more income. As a result, getting ill and forgoing income becomes costly with higher education. This provides incentive for people to take care of health which results in lower health care spending. Additional, if education is an indicator of income, then with increase in education probability of catastrophic OOP health expenditure goes down. To empirically examine effect of education on catastrophic OOP health expenditure we include education level of head of the household as one of the explanatory variables.

Demographic Variables:

Composition of household affects health expenditure. For example, children or elderly persons are more vulnerable to health risks and thus households with more number of children and elderly persons are likely to spend more on health care (Cavagnero *et al.*, 2006). Apart from composition, we also expect the household size to be an important determinant of catastrophic health care spending. As explained in O'Donnell et al. (2005), larger household size means higher probability of someone being ill. Moreover, if the disease is contagious then it is more likely that that more number of persons will be sick in larger household. As a

level, incorporating total household expenditure will provide little information on impact of household's economic status on probability of incurring catastrophic health expenditure.

result, we expect that expenditure on health care to be more for larger households. Since larger health expenditure is morel likely to result in catastrophic OOP expenditure, the above mentioned variables are also expected to increase the probability of catastrophic health expenditure.

In Indian context, it is of interest to examine whether socially backward groups are more likely to spend on health care. In order to analyse this fact, we include social groups, namely, Scheduled Caste (SC), Scheduled Tribes (ST), Other Backward Classes (OBC) as regressors in our estimation model and take 'Others' are base category. Moreover, we check whether richer households belonging to socially backward groups are less likely to incur catastrophic OOP health expenditure. To verify this hypothesis, we consider two different specifications of our econometric model, one with interaction terms between wealth index and social status and second one with interaction between land possession and social status.

Gender and age of the household head also influence the probability of incurring catastrophic OOP health expenditure. It is generally observed (for instance, see Cavagnero *et al.*, 2006) that female-headed households have higher chance of facing catastrophic OOP expenditure. We include dummy variable for male headed household to test this hypothesis in Indian context.

Regional Variables:

One would expect health care spending to differ across rural and urban sectors. We carry out our analysis separately for rural and urban sectors. Furthermore, we have included state dummies to control for health determinants at state level.

2.6. Empirical Findings:

Our analysis shows that clothing and rent are not necessities in Indian states. As a result, we drop them to calculate the threshold level. Moreover, all the remaining commodities are not necessities across all states and sectors. We have considered them only in cases where they were necessities on the basis of Engel curve estimation. Table 3 shows the minimum per capita total expenditure required to consume saturation level of each of the necessities. We take maximum of these expenditure levels and calculate incidence of catastrophic OOP health expenditure as explained in Section 2.

Findings of probit model depict that economic wellbeing and education are among factors which reduce probability of catastrophic spending. On the other hand, (deprived)

social status and household composition are important factors resulting in higher probability of catastrophic OOP health expenditure.

Land possession and wealth index reduce probability of catastrophic spending in rural India. As expected, land does not affect probability of catastrophic OOP expenditure in urban areas. However, wealth index remains to be an important determinant in urban sector[12]. Other wealth indicators, namely, usage of safe cooking method, usage of electricity (only in rural sector) and presence of regular salaried head also reduce the probability. However, it is interesting to note that impact of cooking methods is the highest among all the wealth indicators in both rural and urban sectors (refer Table 4). For instance, in rural and urban sectors, usage of safe cooking methods reduces probability of catastrophe by almost 16 and 21 percent, respectively, as against 10 percent in case where household head is regular salary earner. As explained in literature (for instance, see Parikh *et al.* (2003)), safe cooking methods do not have adverse effect on health as opposed to other methods such as usage of coal. Thus, safe cooking methods not only indicate higher wealth, but also indicate better health condition as opposed to other cooking methods. This two dimensional relation of cooking methods with OOP health expenditure might explain large impact on probability of catastrophe. In order to examine effect of cooking methods on health, we introduce interaction term between wealth index and usage of cooking methods. We find that usage of safe cooking methods reduce the probability of catastrophe even for rich households in urban sector. This result provides important policy implication: reduction of government subsidy on cooking gas (LPG) might force households to switch to other unsafe cooking methods, increasing their health risk and thus chance of catastrophic spending on health care.

Another important determinant of probability of incurring catastrophic OOP expenditure is education. In case of rural India, all the three categories of education level, namely, literate, primary and above primary are having significant negative impact on the probability (Table 4). On the other hand, for urban sector, education seems to reduce probability of catastrophe only when it is above primary level (Table 4). These results correspond with results found by O'Donnell *et al.* (2005). Moreover, interaction terms between education levels and wealth index show that education is more effective at lower levels of income in rural areas (Table 6). This result indicates that spreading education in rural areas especially among poor households will reduce incidence of catastrophic health care spending.

[12] As a result, for estimating coefficients of interaction terms we consider interaction with wealth index alone for urban sector.

Along with economic factors, demographic and social factors play important role in determining whether household will experience financial catastrophe due to illness. As expected, household size, number of children and elderly persons in house increase the probability of catastrophic spending in rural sector. For urban sector, the number of elderly persons present in household is not a significant variable affecting the probability.

Moreover, households from socially deprived classes (SC, ST or OBC) are more likely to spend catastrophically on health care in both rural and urban sectors (Table 4). At the same time, it is interesting to note that in rural India, this effect is lower for households belonging to socially backward classes but with relatively higher wealth (Table 7). Thus, it seems that it is not social background per se that matters but social background along with income status is important factor contributing to catastrophic OOP health expenditure. On the contrary, for urban sector, our results show that probability of catastrophic expenditure does not reduce with higher wealth for households from socially deprived classes. We carry out similar analysis to check whether education reduces probability of incurring catastrophic OOP health expenditure among socially deprived groups.

Another interesting finding of our analysis is that in rural sector, gender of head of household is important factor affecting probability of catastrophic spending. In rural areas, female-headed households have 2 percent lower probability of experiencing financial catastrophe than households with male head (Table 4). It is likely that effect of gender changes with income. To examine this hypothesis, we re-estimate the model with interaction term between wealth index and gender of head. The results show that effect of gender is higher with income in rural areas, i.e., probability that male headed households will incur catastrophic OOP health expenditure increases with wealth (Table 8).

Moreover, it is expected that the female literacy matters more for health outcomes and thus health expenditure. We check this hypothesis by including interaction terms between education level and gender of household head. Our results show that if female head has completed primary education then the probability of catastrophic spending is 5 percent less as compared to household with male head who has completed primary education (Table 9). This clearly points out importance of female education in rural areas. Contrary to this result, in urban sector education of male head is more important for reducing probability of catastrophic expenditure on health care as compared to female education.

2.7. Discussion:

The present paper attempts to provide new approach to catastrophic OOP health expenditure. We define catastrophic OOP health expenditure as that health expenditure which reduces the consumption of necessities below the required level. Next, we examine the determinants of catastrophic health expenditure in India.

Our findings suggest that defining catastrophic OOP health expenditure as some fixed proportion of total household budget might lead to misleading results as our data shows that generally for rich households, share of OOP health expenditure is higher.

Next, we analyse the determinants of probability of incurring catastrophic OOP health expenditure. We find that apart from economic status, education reduces the risk of catastrophic payments. Specifically, in rural sector, female education is more helpful than male education. Thus, spreading education among female in rural areas might help reducing incidence of catastrophic OOP health expenditure. Secondly, our results show that some sections of society are vulnerable. Households from scheduled castes, particularly poor households, are more likely to incur catastrophic health expenditure than others. Moreover, household composition matters in this regard. Presence of children and elderly members increase the probability of catastrophic OOP health expenditure. This finding suggests that there is need to subsidise health care services for these sections of society in order to reduce incidence of catastrophic payments.

Our results need to be interpreted with possible limitations of the study. Firstly, our estimation of threshold level depends on form of Engel curve. There is lot of debate on choosing correct form of Engel curve[13].

Secondly, while defining catastrophic OOP health expenditure we take only short-term approach and ignore the effect of health expenditure on future consumption. It is likely that household protects its present consumption by borrowing (or some other source of finance) and thus, OOP health expenditure does not show impact on present consumption. However, it might have impact on future consumption. Such future impact of OOP health expenditure is beyond the scope of our analysis.

Nonetheless, our analysis provides understanding of catastrophic OOP health expenditure in terms of intra-temporal effects. It points out the importance of carefully defining catastrophic OOP health expenditure for providing any meaningful policy

[13] However, note that Kumar *et al.* (2008) and Kumar *et al.* (2009) demonstrate that the form used in the present paper is the best-fitting among several other alternatives based on three quinquennial survey data of NSSO. several alternatives they considered with respect to three quinquennial survey data of NSSO.

implications. Using the definition based on concepts of the Engel curve and consumption deprivation, our study throws light on factors leading to catastrophic payments in India. These results have useful policy implications, in terms of providing financial subsidy for health care to socially backward households, children and elderly person.

Table 1: Proportion of Households Allocating Different Shares of Household Budget on Health Care (Across Consumption Quintile Groups)

Consumption Quintile Groups	Proportion of Households Spending Positive Amount on Health Care		Proportion of Households Spending More than 10 Per Cent on Health Care	
	Rural	***Urban***	***Rural***	***Urban***
Poorest	50.72	53.77	14.68	14.71
Second Quintile	60.22	63.39	16.14	18.86
Third Quintile	65.38	64.50	21.75	16.99
Forth Quintile	69.60	63.79	26.17	21.28
Richest	73.38	65.59	34.90	23.29

Source: NSSO 60th Round Survey on Socio-Economic Characteristics of Households for year 2004-05, and Author's Calculations

Table 2: Description of Explanatory Variables

Variable Name	Variable Description	Average	
		Rural	Urban
Economic Variables			
Land	Land possessed by household in 0.000 hectors	0.828	0.145
Wealth Index	Index based on nine indicator variables	-.278	0.280
Cooking Method	= 1 if household uses LPG or kerosene for cooking; = 0 otherwise	0.105	0.684
Electricity	= 1 if household has electricity in house; = 0 otherwise	0.552	0.918
Regular Salary	= 1 if household head is regular salary earner; = 0 otherwise	0.109	0.430
Literate (Base category: Illiterate)	= 1 if household head is literate without any formal education; = 0 otherwise	0.110	0.078
Primary	= 1 if the highest education completed by household head is primary education; = 0 otherwise	0.156	0.136
Above Primary	= 1 if household head has completed education higher than primary education; = 0 otherwise	0.300	0.596
Demographic and Social Variables			
Household Size	Total number of household members	5.130	4.694
No. of Children	Number of children in household	0.740	0.534
No. of Elderly Persons	Number of elderly persons in household	0.263	0.237
SC (Base category: Others)	= 1 if household belongs to Scheduled Castes; = 0 otherwise	0.219	0.152
ST	= 1 if household belongs to Scheduled Tribes; = 0 otherwise	0.069	0.023
OBC	= 1 if household belongs to Other Backward Classes; = 0 otherwise	0.439	0.378
Gender_Head	= 1 if household head is male; = 0 otherwise	0.903	0.898
Age_Head	Age of household head (in years)	46.007	46.061

Table 3: Per Capita Total Expenditure Required for Saturation Level of Necessities (in Rupees)

	Cereal	Fuel	Salt	Sugar	Vegetables	Egg/Fish
			Rural			
Andhra Pradesh	463.65	…	297.75	744.33	598	…
Assam	423.93	…	295.33	628.63	…	…
Bihar	305.6	430.5	308.2	…	573	…
Gujarat	327.29	…	315.43	708.65	…	868.16
Haryana	370.77	677.5	283.7	366.15	…	679.67
Karnataka	500.38	666.45	301.13	482.88	630.77	654.32
Kerala	566.95	833.5	289.98	416.92	…	…
Madhya Pradesh	237.08	641	236	567.36	596.5	…
Maharashtra	259.17	735.25	195.88	416.37	462.5	…
Orissa	283.88	582	149.25	388.6	…	…
Punjab	285.29	…	364.33	211.92	874.5	…
Rajasthan	358.15	605	249	547.6	483	…
Tamil Nadu	661.88	485.25	219	542.58	543.65	878.17
Uttar Pradesh	268.14	500.5	258	…	463.4	740.89
West Bengal	464.05	757.8	257.37	562.15	679	…
			Urban			
Andhra Pradesh	501.73	1231	320.25	857	714.25	1062.75
Assam	422.2	1135	374.5	…	1040.13	…
Bihar	270	944	…	…	…	630.63
Gujarat	552	…	386.6	487.24	700.25	846.44
Haryana	667	…	565.5	321.58	…	…
Karnataka	1352.36	…	389	338	…	…
Kerala	634.98	1156.5	549.32	362.68	…	…
Madhya Pradesh	378.75	813.02	339.8	401.6	653.8	…
Maharashtra	395.66	…	222.25	323.2	941.33	927.05
Orissa	260.17	798.63	268.5	663	939.5	918.7
Punjab	457.67	1326	426	505.4	1047.5	831.25
Rajasthan	376.29	1109	332.57	383.75	579	608
Tamil Nadu	576.15	…	293.65	651.75	537.72	608.34
Uttar Pradesh	318.25	…	303	427.5	656.75	538
West Bengal	259.58	…	288.5	561.17	843.64	…

Table 4: Probit Model for Incidence of Catastrophic OOP Health Expenditure (Base Model)

	Rural			Urban		
	Coefficient	***Marginal Effects***	***P-value***	***Coefficient***	***Marginal Effects***	***P-value***
Economic Variables						
Land	-0.198	-0.054	0.000	-0.006	-0.002	0.895
Land Square	0.006	0.002	0.000	-0.002	-0.001	0.660
Wealth Index	-0.333	-0.091	0.000	-0.454	-0.178	0.000
Cooking Method	-0.506	-0.160	0.000	-0.552	-0.209	0.000
Electricity	-0.214	-0.058	0.000	0.073	0.029	0.487
Regular Salary	-0.329	-0.099	0.000	-0.253	-0.099	0.000
Literate	-0.077	-0.021	0.074	-0.013	-0.005	0.891
Primary	-0.130	-0.037	0.001	-0.008	-0.003	0.922
Above Primary	-0.333	-0.096	0.000	-0.392	-0.152	0.000
Demographic and Social Variables						
Household Size	0.203	0.055	0.000	0.309	0.121	0.000
No. of Children	0.179	0.049	0.000	0.075	0.029	0.029
No. of Elderly Persons	0.073	0.020	0.003	0.035	0.014	0.418
SC	0.327	0.082	0.000	0.279	0.107	0.000
ST	0.409	0.094	0.000	0.219	0.084	0.068
OBC	0.125	0.034	0.000	0.306	0.118	0.000
Gender_Head	0.068	0.019	0.066	-0.016	-0.006	0.792
Age_Head	-0.006	-0.002	0.000	-0.003	-0.001	0.111
Number of obs	31259			18523		
Wald chi2	4488.07			2191.31		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-12347.7			-7299.28		
Pseudo R2	0.312			0.429		

Note: Constant and State dummies are included in regression analysis.

Table 5: Probit Model for Incidence of Catastrophic OOP Health Expenditure (Interaction between Wealth Index and Cooking Method)

	Rural			Urban		
	Coefficient	***Marginal Effects***	***P-value***	***Coefficient***	***Marginal Effects***	***P-value***
Economic Variables						
Land	-0.197	-0.054	0.000	-0.008	-0.003	0.858
Land Square	0.006	0.002	0.000	-0.002	-0.001	0.680
Wealth Index	-0.343	-0.093	0.000	-0.390	-0.153	0.000
Cooking Method	-0.543	-0.173	0.000	-0.585	-0.221	0.000
Wealth*Cooking	0.036	0.010	0.078	-0.075	-0.030	0.039
Electricity	-0.204	-0.055	0.000	0.022	0.009	0.836
Regular Salary	-0.328	-0.099	0.000	-0.256	-0.101	0.000
Literate	-0.075	-0.021	0.081	-0.018	-0.007	0.846
Primary	-0.128	-0.036	0.001	-0.015	-0.006	0.862
Above Primary	-0.331	-0.095	0.000	-0.395	-0.153	0.000
Demographic Variables						
Household Size	0.203	0.055	0.000	0.308	0.121	0.000
No. of Children	0.179	0.049	0.000	0.074	0.029	0.031
No. of Elderly Persons	0.074	0.020	0.003	0.036	0.014	0.405
SC	0.326	0.081	0.000	0.281	0.107	0.000
ST	0.405	0.093	0.000	0.229	0.087	0.054
OBC	0.124	0.034	0.000	0.301	0.117	0.000
Gender_Head	0.068	0.018	0.068	-0.018	-0.007	0.767
Age_Head	-0.006	-0.002	0.000	-0.003	-0.001	0.112
Number of obs	31259			18523		
Wald chi2	4529.13			2203.75		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-12345.6			-7293.64		
Pseudo R2	0.312			0.43		

Note: Constant and State dummies are included in regression analysis.

Table 6: Probit Model for Incidence of Catastrophic OOP Health Expenditure (Interaction between Wealth Index and Education)

	Rural			Urban		
	Coefficient	***Marginal Effects***	***P-value***	***Coefficient***	***Marginal Effects***	***P-value***
Economic Variables						
Land	-0.197	-0.053	0.000	-0.004	-0.001	0.934
Land Square	0.006	0.001	0.000	-0.002	-0.001	0.642
Wealth Index	-0.378	-0.102	0.000	-0.425	-0.167	0.000
Wealth*Literate	0.004	0.001	0.888	0.013	0.005	0.834
Wealth*Primary	0.052	0.014	0.032	0.101	0.040	0.083
Wealth*AbovePrimary	0.069	0.019	0.000	-0.052	-0.020	0.184
Cooking Method	-0.519	-0.164	0.000	-0.561	-0.212	0.000
Electricity	-0.201	-0.054	0.000	0.026	0.010	0.808
Regular Salary	-0.334	-0.101	0.000	-0.250	-0.098	0.000
Literate	-0.062	-0.017	0.150	-0.015	-0.006	0.870
Primary	-0.108	-0.030	0.004	0.006	0.002	0.940
Above Primary	-0.318	-0.091	0.000	-0.387	-0.150	0.000
Demographic Variables						
Household Size	0.205	0.056	0.000	0.306	0.120	0.000
No. of Children	0.179	0.049	0.000	0.077	0.030	0.024
No. of Elderly Persons	0.074	0.020	0.003	0.035	0.014	0.421
SC	0.324	0.081	0.000	0.284	0.109	0.000
ST	0.404	0.093	0.000	0.220	0.084	0.064
OBC	0.124	0.033	0.000	0.301	0.117	0.000
Gender_Head	0.070	0.019	0.068	-0.007	-0.003	0.908
Age_Head	-0.006	-0.002	0.000	-0.003	-0.001	0.113
Number of obs	31259			18523		
Wald chi2	4525.7			2208.54		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-12336.9			-7281.12		
Pseudo R2	0.312			0.430		

Note: Constant and State dummies are included in regression analysis.

Table 7: Probit Model for Incidence of Catastrophic OOP Health Expenditure (Interaction between Wealth Index and Social Background)

	Rural			Urban		
	Coefficient	***Marginal Effects***	***P-value***	***Coefficient***	***Marginal Effects***	***P-value***
Economic Variables						
Land	-0.198	-0.054	0.000	-0.004	-0.002	0.933
Land Square	0.006	0.002	0.000	-0.002	-0.001	0.659
Wealth Index	-0.321	-0.087	0.000	-0.475	-0.186	0.000
Wealth*SC	-0.022	-0.006	0.362	0.087	0.034	0.026
Wealth*ST	-0.205	-0.056	0.000	0.135	0.053	0.057
Wealth*OBC	-0.010	-0.003	0.556	0.025	0.010	0.375
Cooking Method	-0.512	-0.162	0.000	-0.559	-0.211	0.000
Electricity	-0.208	-0.056	0.000	0.040	0.016	0.706
Regular Salary	-0.323	-0.097	0.000	-0.259	-0.102	0.000
Literate	-0.075	-0.021	0.079	-0.016	-0.006	0.866
Primary	-0.127	-0.036	0.001	-0.010	-0.004	0.906
Above Primary	-0.331	-0.095	0.000	-0.395	-0.153	0.000
Demographic Variables						
Household Size	0.203	0.055	0.000	0.308	0.121	0.000
No. of Children	0.179	0.049	0.000	0.076	0.030	0.027
No. of Elderly Persons	0.073	0.020	0.004	0.039	0.015	0.366
SC	0.327	0.081	0.000	0.280	0.107	0.000
ST	0.294	0.071	0.000	0.204	0.078	0.071
OBC	0.129	0.035	0.000	0.289	0.112	0.000
Gender_Head	0.067	0.018	0.073	-0.016	-0.006	0.791
Age_Head	-0.006	-0.002	0.000	-0.003	-0.001	0.104
Number of obs	31259			18523		
Wald chi2	4488.09			2198.6		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-12336.5			-7289.98		
Pseudo R2	0.313			0.43		

Note: Constant and State dummies are included in regression analysis.

Table 8: Probit Model for Incidence of Catastrophic OOP Health Expenditure (Interaction between Wealth Index and Gender of Head)

	Rural			Urban		
	Coefficient	***Marginal Effects***	***P-value***	***Coefficient***	***Marginal Effects***	***P-value***
Economic Variables						
Land	-0.198	-0.054	0.000	-0.007	-0.003	0.883
Land Square	0.006	0.002	0.000	-0.002	-0.001	0.656
Wealth Index	-0.386	-0.105	0.000	-0.535	-0.209	0.000
GenderHead*Wealth	0.057	0.016	0.022	0.088	0.035	0.029
Cooking Method	-0.504	-0.159	0.000	-0.549	-0.208	0.000
Electricity	-0.212	-0.057	0.000	0.079	0.031	0.453
Regular Salary	-0.331	-0.100	0.000	-0.254	-0.100	0.000
Literate	-0.074	-0.021	0.076	-0.007	-0.003	0.940
Primary	-0.129	-0.036	0.000	0.000	0.000	0.999
Above Primary	-0.333	-0.096	0.000	-0.391	-0.151	0.000
Demographic Variables						
Household Size	0.203	0.055	0.000	0.311	0.122	0.000
No. of Children	0.179	0.049	0.000	0.074	0.029	0.029
No. of Elderly Persons	0.074	0.020	0.003	0.035	0.014	0.409
SC	0.328	0.082	0.000	0.280	0.107	0.000
ST	0.411	0.094	0.000	0.219	0.084	0.078
OBC	0.125	0.034	0.000	0.305	0.118	0.000
Gender_Head	0.089	0.025	0.020	-0.009	-0.003	0.892
Age_Head	-0.006	-0.002	0.000	-0.003	-0.001	0.092
Number of obs	31259			18523		
Wald chi2	4513.52			2270.11		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-12344.3			-7293.74		
Pseudo R2	0.312			0.4293		

Note: Constant and State dummies are included in regression analysis.

Table 9: Probit Model for Incidence of Catastrophic OOP Health Expenditure (Interaction between Gender and Education Level of Household Head)

	Rural			Urban		
	Coefficient	***Marginal Effects***	***P-value***	***Coefficient***	***Marginal Effects***	***P-value***
Economic Variables						
Land	-0.198	-0.054	0.000	-0.007	-0.003	0.876
Land Square	0.006	0.002	0.000	-0.002	-0.001	0.667
Wealth Index	-0.333	-0.091	0.000	-0.454	-0.178	0.000
Cooking Method	-0.503	-0.159	0.000	-0.556	-0.210	0.000
Electricity	-0.213	-0.057	0.000	0.069	0.027	0.507
Regular Salary	-0.331	-0.100	0.000	-0.258	-0.101	0.000
Literate	-0.130	-0.037	0.305	0.154	0.059	0.577
Primary	-0.414	-0.126	0.000	0.215	0.082	0.390
Above Primary	-0.501	-0.148	0.000	0.077	0.030	0.682
Literate*Gender	0.065	0.017	0.606	-0.120	-0.047	0.574
Primary*Gender	0.315	0.077	0.001	-0.170	-0.067	0.388
AbovePrimary*Gender	0.185	0.049	0.054	-0.401	-0.157	0.004
Demographic Variables						
Household Size	0.203	0.055	0.000	0.310	0.122	0.000
No. of Children	0.178	0.049	0.000	0.074	0.029	0.029
No. of Elderly Persons	0.074	0.020	0.003	0.037	0.015	0.383
SC	0.326	0.082	0.000	0.278	0.106	0.000
ST	0.410	0.094	0.000	0.226	0.086	0.061
OBC	0.124	0.033	0.000	0.307	0.119	0.000
Gender_Head	-0.006	-0.002	0.901	-0.213	-0.082	0.048
Age_Head	-0.006	-0.002	0.000	-0.003	-0.001	0.079
Number of obs	31259			18523		
Wald chi2	4512.05			2256.19		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-12340.6			-7290.17		
Pseudo R2	0.312			0.430		

Note: Constant and State dummies are included in regression analysis.

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