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Catastrophic Health Expenditures in the Dominican Republic: Analysis of Determinants and Linkages to Impoverishment

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Catastrophic Health Expenditures in the Dominican Republic: Analysis of Determinants and Linkages to Impoverishment

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Background

Analyzing the determinants of catastrophic health expenditure (CHE) and its relation to household impoverishment is highly important to determine the optimum design of a country's Health Financing System that seeks to reduce the levels of CHE of its affiliates. Although in recent years the Dominican Republic's Health System has experienced a radical reform, little research has been done on its impact on household health expenditures and none intended to focus on the determinants of CHE as well as its linkage to household impoverishment.

Therefore, this research seeks to answer the latter questions by using regression and descriptive analysis. The research seeks to determine which household characteristics have a higher incidence on catastrophic health expenditure and impoverishment due to health expenditures. The paper is structured as follows: section 1 describes the empirical strategy used for the analysis. The section includes a thorough explanation of the indicators used, the performed regression analysis and the data. Section 2 discusses the descriptive statistics. Section 3 presents the regression results and Section 4 concludes.

Empirical Strategy

The empirical approach of the paper is discussed in two stages, first the methodology used to construct the indicators used for the analysis and second the methodology followed to estimate the determinants of CHE and impoverishment.

Indicators

To assess the determinants of CHE and its linkage to poverty we first construct a series of indicators following the methodology of Wagstaff and van Doerslaer (1999, 2003), Xu et al (2003) and Knaul, Arreola, Mendez et al (2006). The different methodologies were applied to calculate out of pocket health expenditure (OOP), capacity to pay (CP), incidence of catastrophic health expenditure (CHE), CHE gap, CHE concentration index, impoverishing expenditure (IE), IE gap and IE concentration index.

OOP: The health expenditure corresponds to direct payments of health services; therefore it excludes social security and health insurance payments.

CP: Represents the effective income of the household after subsistence expenditure.

$CP = EXP - SE$; where EXP corresponds to Household Total Expenditure and SE represents the household's subsistence expenditure.

We construct four different CP depending on the definition used for SE. SE is defined as the poverty line. For the construction of the indicators we used three different poverty lines: i) a national poverty line constructed using the same survey of the analysis, ii) an international poverty line constructed using the PPP methodology at US$ 1 per day and iii) an endogenous poverty line

following the methodology proposed by Xu et al, 2003. Additionally, we also use the household's food expenditure as a proxy for SE (CP=EXP-FOOD).

Incidence of CHE: Measures the incidence of a household's OOP in the household's total expenditure. A household's OOP is considered catastrophic if the ratio OOP/CP is higher than a predefined threshold level (k).

K has three possible predefined levels:20%, 30% and 40%. More explicitly, if k=20%, a household with an OOP that represents the 20% or more of the household's total expenditure is considered to have a CHE: OOP/CP>=k; then CHE=1.

CHE Gap: Measures the intensity of the CHE.

$$CHEgap = \frac{OOP}{CP} - k \quad \text{if} \quad \frac{OOP}{CP} > k$$

When CP<0, we follow the Wagstaff method where we use substitute the household's OOP/CP ratio with the average OOP/CP of household's with CHE and CP>0.

CHE Concentration Index: Indicates the fluctuations of the CHE along the income distribution. A positive value represents a higher tendency of wealthier households to go over the threshold levels of CHE (k). A negative value indicates a higher tendency of poor households of going over k. The indicator is measured as two times the area between the concentration curve and the equality curve.

Impoverishing expenditure (IE): An out of pocket health expenditure is considered impoverishing if a household goes below the poverty line after experiencing an OOP. This indicator is constructed with the three different poverty lines.

IE Gap (IEG): Measures the intensity of the OOP for households with impoverishing expenditure.

$IEG=IEG_{post} - IEG_{pre}$

Where IEG_{pre} represent the amount of resources necessary for all households to be out of poverty. IEG_{pre}=EXP-PL if EXP<PL.

And IEG_{post} represents the amount of resources necessary for all households that had experienced an OOP to be out of poverty. IEG_{post}=EXP-OOP-PL if (EXP-OOP)<PL.

The IEG is constructed using the three different poverty lines.

IE concentration Index (IEI): Measures the fluctuations of the IE along the income distribution. A positive value indicates a higher tendency of wealthier households to go below the poverty line. A negative value indicates a higher tendency of poorer households to go below the poverty line. The IEI is measured as two times the area between the concentration curve and the equality curve.

Additionally, all the aforementioned indicators were disaggregated by type of residence of the household, expenditure quintiles, household size and ownership of health insurance.

Regressions

The analysis of the determinants of CHE and impoverishing expenditure are divided in three different set of regressions:

1. **Determinants of the household's health expenditure.** The regression model is:

$$Y_i = \beta_1 + \beta_2 X_i + \mu_i$$

We run an OLS model taking as the dependent variable the proportion of out-of-pocket health expenditure of the household's total expenditure and the capacity to pay. The regression for the household's capacity to pay is performed with the three different poverty lines and with the simple method for calculating capacity to pay (OOP/EXP-FOOD). The vector X is a set of independent variables, particularly, type of residence, expenditure quintile, household composition (number of members and indicator of children and elders in the household) and ownership of health insurance.

Dependent variables:

a. OOP/EXP
b. Out-of-pocket health expenditure as a ratio of the capacity to pay (simple method). OOP/EXP-FOOD.
c. Capacity to pay (CP), using the national poverty line. (OOP/EXP-PL national).
d. Capacity to pay (CP), using the international poverty line. (OOP/EXP-PL international).
e. Capacity to pay (CP), using the endogenous poverty line. (OOP/EXP-PL endogenous).

For the cases when EXP<PL (and therefore the ratio takes a negative value) we take as capacity to pay (EXP-PL) the average capacity to pay of households with CHE (at the 30% level)[1] and with CP>0.

2. **Determinants of catastrophic health expenditure.** The estimated model is:

$$E[Y_i \mid X] = \Phi(\beta_1 + \beta_2 X_i)$$

Where Φ is the cumulative standard distribution function. The reported coefficients are the marginal effects, explicitly the change in the conditional mean of Y when the explanatory variables changes by one unit. The dependent variable is the CHE calculated with the simple capacity to pay and the three poverty lines. To estimate this regression we use a probit model. X is a vector of explanatory variables (refer to section 1).

[1] Several thresholds have been defined to account for a CHE, particularly 20%, 30% and 40%. If the ratio of OOP/EXP-PL is higher than the aforementioned cut-off points, the household is considered to have a CHE.

Dependent variables:

a. CHE using the simple capacity to pay (OOP/EXP-FOOD) at a threshold level of 30%. This variable takes a value of 1 if the household's OOP was higher than 30% of its total capacity to pay; otherwise it takes a value of 0.
b. CHE using the national poverty line (OOP/EXP-PL national) at a threshold level of 30%. This variable takes a value of 1 if the household's OOP was higher than 30% its capacity to pay; otherwise it takes a value of 0.
c. CHE using the international poverty line (OOP/EXP-PL international) at a threshold level of 30%. This variable takes a value of 1 if the household's OOP was higher than 30% its capacity to pay; otherwise it takes a value of 0.
d. CHE using the endogenous poverty line (OOP/EXP-PL endogenous) at a threshold level of 30%. This variable takes a value of 1 if the household's OOP was higher than 30% its capacity to pay; otherwise it takes a value of 0.

3. **Determinants of the impoverishing expenditure**. This third regression follows the same model as the one in section 2. We use a probit model to assess the probability that a household experience an impoverishing expenditure. The dependent variable in this model is the impoverishing expenditure constructed with the international poverty line.

Data

To analyze the determinants of CHE and the linkages to poverty we use ENCOVI, a Living Standard Measurement Survey (SLMS). ENCOVI is a 2004 survey of 9,825 households that measures the socio-economic aspects that characterize Dominican households. The survey provides information regarding access and usage of public services such as education, health, electricity, water and sewers.

The survey has detailed data on overall household expenses and particularly health expenses and usage of that specific public service.

Descriptive Statistics

This section explores the indicators of out of pocket health expenditure, catastrophic health expenditure and impoverishing health expenditure from a perspective of the household's characteristics: composition, size, type of residence, expenditure quintile, ownership of insurance in order to identify risk factors in the household's environment that might help identify the determinants of CHE and impoverishing health expenditure.

Table 1 and 2 show the descriptive statistics. The statistics for the entire sample show that 64% of the population lives in urban households, 36% of the population earn an income among the two first quintiles, 53% of the population live without children or elders, 38% have from 3 to 4 members in the household, and 36% has at least one person in the household with insurance.

Table 1. Descriptive Statistics.

Variable	Complete Sample	Households With Catastrophic Health Expenditure																	Household with Impoverishing Health Expenditure		
		OOP/Exp-Food			OOP/Exp-PL1 (PL1a) [2/]			OOP/Exp-PL1 (PL1b)[3/]			OOP/Exp-PL2 (PL2a)[2/]			OOP/Exp-PL2 (PL2b)[3/]			OOP/Exp-PL3			(PL1) (IE1)	(PL2) (IE2)	(PL3) (IE3)
	(0)	(1)			(2)			(3)			(4)			(5)			(6)			(7)	(8)	(8)
	NA	k=20%	k=30%	k=40%	k=20%	k=30%	k=40%	k=20%	k=30%	k=40%	k=20%	k=30%	k=40%	k=20%	k=30%	k=40%	k=20%	k=30%	k=40%	NA	NA	NA
Type of Residence																						
Urban	63.9%	15.4%	8.7%	5.7%	13.1%	8.1%	5.4%	12.4%	7.3%	4.5%	9.2%	5.0%	3.0%	9.2%	4.9%	2.8%	17.5%	11.1%	7.7%	0.4%	0.2%	1.4%
Rural	36.1%	18.8%	11.8%	7.9%	19.1%	14.1%	10.9%	16.9%	11.2%	7.7%	11.7%	6.9%	4.8%	11.4%	6.6%	4.4%	22.7%	15.8%	12.0%	1.8%	0.6%	3.3%
Income Quintile																						
Quintile I (+ poor)	17.5%	19.7%	13.4%	9.9%	25.7%	22.7%	20.1%	20.2%	15.5%	12.1%	5.9%	3.1%	1.7%	14.0%	9.3%	7.1%	21.6%	15.6%	12.3%	3.5%	1.9%	4.1%
Quintile II	18.5%	14.9%	7.7%	4.7%	14.7%	9.2%	6.6%	13.3%	7.7%	4.9%	6.4%	3.4%	1.9%	6.4%	3.4%	1.9%	19.6%	12.5%	9.1%	1.3%	0.0%	3.0%
Quintile III	19.3%	15.2%	8.2%	4.9%	11.3%	6.1%	3.4%	11.2%	6.1%	3.4%	7.6%	3.1%	1.4%	7.6%	3.1%	1.4%	21.0%	14.4%	10.2%	0.0%	0.0%	2.5%
Quintile IV	20.5%	17.3%	9.9%	5.7%	12.6%	6.7%	3.2%	12.6%	6.7%	3.2%	9.7%	4.2%	2.0%	9.7%	4.2%	2.0%	19.7%	12.0%	8.1%	0.1%	0.0%	1.3%
Quintile V (- poor)	24.2%	16.2%	10.1%	7.4%	13.7%	8.4%	5.6%	13.7%	8.4%	5.6%	11.9%	7.5%	4.7%	11.9%	7.5%	4.7%	16.0%	10.4%	7.5%	0.0%	0.0%	0.4%
Household Composition																						
With Children	28.0%	11.8%	5.9%	3.2%	12.7%	8.4%	5.9%	11.2%	6.6%	4.0%	5.9%	3.1%	1.7%	5.8%	3.0%	1.6%	17.5%	11.1%	7.6%	0.8%	0.0%	2.1%
With Elders	15.7%	32.5%	22.0%	17.1%	31.2%	22.4%	17.8%	29.1%	19.6%	14.5%	23.7%	16.0%	11.0%	23.3%	15.6%	10.4%	34.5%	24.0%	18.7%	2.0%	1.4%	4.0%
With Children and Elders	2.8%	23.9%	12.6%	8.6%	24.9%	16.9%	11.6%	22.1%	13.7%	8.3%	17.6%	6.7%	5.7%	16.9%	6.0%	5.1%	26.8%	20.2%	16.2%	1.9%	0.0%	3.0%
Without Children and Elders	53.5%	14.2%	8.2%	5.0%	11.4%	7.3%	4.9%	10.8%	6.4%	3.9%	8.0%	4.0%	2.4%	7.9%	3.9%	2.3%	15.5%	10.0%	7.0%	0.6%	0.2%	1.5%
Household Size																						
2 or less members	27.7%	21.5%	14.6%	10.7%	16.7%	12.4%	10.0%	15.7%	11.0%	8.3%	13.4%	9.0%	7.0%	13.2%	8.7%	6.6%	19.1%	12.9%	9.8%	1.4%	1.1%	2.2%
3 - 4 members	38.1%	16.3%	9.3%	6.1%	13.9%	8.8%	5.7%	13.3%	8.0%	4.7%	9.7%	5.1%	2.6%	9.5%	4.9%	2.5%	19.4%	12.7%	8.8%	0.6%	0.1%	1.8%
5 or more members	34.3%	13.0%	6.6%	3.5%	15.6%	10.1%	7.2%	13.6%	7.7%	4.6%	8.0%	3.7%	2.0%	7.9%	3.6%	1.9%	19.5%	12.8%	9.3%	0.8%	0.0%	2.2%
Insurance																						
Insured	36.1%	13.6%	7.4%	4.6%	11.3%	6.8%	4.0%	11.0%	6.5%	3.6%	8.2%	4.1%	2.5%	8.2%	4.1%	2.5%	15.9%	9.9%	6.8%	0.3%	0.0%	1.1%
Not Insured	63.9%	18.3%	11.2%	7.6%	17.5%	12.2%	9.4%	15.8%	10.0%	6.9%	11.3%	6.6%	4.2%	11.0%	6.3%	3.9%	21.3%	14.4%	10.7%	1.3%	0.5%	2.7%

Source: Based on author's calculations using ENCOVI 2004

Notes:

[1/] Calculations were done including sample design and ajustments by expansion factor

[2/] OOP/Exp-PL (a): if EXP<PL, then any OOP>0 is an impoverishing expenditure

[3/] OOP/Exp-PL (b): if EXP<PL, then the PL is substituted by Food (Food expenditure)

[4/] Variables 2 and 4 are calculated with Wagstaff methodology; variables 3, 5 and 6 are calculated with Xu methodology.

Table 2. Catastrophic Health Expenditure

CHE	K		
	20%	30%	40%
OOP/Exp-Food	16.6%	9.8%	6.5%
OOP/Exp-PL1 (PL1a)	15.3%	10.3%	7.4%
OOP/Exp-PL1 (PL1b)	14.1%	8.7%	5.7%
OOP/Exp-PL2 (PL2a)	10.1%	5.7%	3.6%
OOP/Exp-PL2 (PL2b)	10.0%	5.5%	3.4%
OOP/Exp-PL3	14.9%	8.8%	5.6%

Table 2 shows that 16.6% of households pay 20% or more of their income after food expenditure in health expenditures, 9.8% of the households pay 30% or more and 5.5% pay 40% or more.

When we calculate the CHE with the national poverty line, around 15.3% of households experience CHE of 20% or more of their income, 10.3% a CHE of 30% or more and 7.4% a CHE of 40% or more.

Using the international poverty line provides the lowest results with 10% households incurring in health expenditures of 20% or more of their disposable income, 5.7% of households expend 30% or more and 3.6% expend 40%.

Columns 1 to 6 of table 1 present the statistics for households with catastrophic health expenditure and columns 7 to 9 have data on households with impoverishing health expenditure.

In all the different methods, the rural type of residence has a higher incidence in households with CHE. The percentages of households with CHE that live in rural areas oscillate from 22% with a threshold level (k) of 20% for the endogenous poverty line to 11.4% (for the same k) for the international poverty line.

The income quintile, presents an interesting composition. When the quintile distribution is analyzed for the entire sample, the quintile with the highest weight is the 5th quintile representing 24.2% of the households, and the ratio goes down as the quintile approximates the 1st quintile corresponding to the poorest households. However, the composition for households with CHE changes in an opposite direction. For the simple method (column 1), it can be shown that households within the 1st quintile represent the 19.7% and the ratio goes down as the quintile increases. A similar behavior is presented in the others methods as well. This implies that poorer household's in the bottom quintile have a higher propensity to experience CHE.

Household composition for the entire sample is distributed with 28% of households with children, 15.7% with elders, 2.8% with children and elders and 53.5% without children or elders. For households with CHE the distribution changes gaining importance households with elders which represent 32% for the simple method for a threshold level (k) of 20% (and similar for calculations with the national and endogenous poverty line) and household with children and elders which represent 23% of households for the simple method and a threshold level (k) of 20%. It is interesting to notice that households with elders and children only represent 2.8% of the entire sample; however it has a considerable participation in households with CHE, the same for households with children but to a lesser extent. This indicates that household with elders (people older than 65 years old) are more prone to have a CHE.

The latter results could be also explained by the household structure, which could not be analyzed within the scope of the present study. It is possible that households with elders have fewer members with income and households with elders and children receive income from various members as well as external remittances. A study on these aspects is recommended in the next steps.

When looking at household insurance, as it is to be expected, it is shown that uninsured households are more inclined to have a CHE.

Few households go below the poverty line after having an out of pocket health expenditure. When the impoverishing expenditure is calculated with the national poverty line only 0.9% of the households' experiment impoverishing expenditure, the same indicator is 0.34% when the IE is calculated with the international poverty line and it rises to 2.09% when the IE is calculated with the endogenous poverty line. The distribution of characteristics for households with impoverishing health expenditure is similar to the distribution of characteristics for households with CHE.

The distribution of weight among household characteristics and percentage of households that incurred in CHE remain very similar when the CHE is estimated using the simple method (OOP/Exp-Food-column 1), the national poverty line (column 2 and 3) and the endogenous poverty line. The distribution for households with CHE when the international poverty line is different in magnitude, but the same weight is maintained within the indicators.

Although the indicators vary among the different methods, the variables that have a higher incidence in the CHE and the impoverishing expenditure are rural type of residence, households that belong to the 1st quintile of income (poorest households), households with elders and children and elders, and uninsured households.

Regression Results

Determinants of the household's health expenditure

Tables 3 and 4 present the regression analysis for the determinants of OOP/EXP and OOP/EXP-FOOD, respectively. All variables are significant at the 1% confidence level except for children in household which is significant at the 10% confidence level and urban type of residence which is not statistically significant. The results suggest that as the quintile increases the ratio of out of pocket to total expenditure increases. The ratio might increase due to an increase of out of pocket health expenditure or due to a reduction of the household's total expenditure. Given that as the quintile approaches the fifth quintile household expenditure rises, it is unlikely that the increase is related to a reduction in total expenditure. Therefore the result suggests that as the quintile increases so does the proportion of total expenditure that is assigned to health expenditures.

Table 3. Determinants of OOP/EXP

Variables	Coef.	Std. Err.	P>t	[95% Conf.	Interval]
Urban	-0.01029	.0023631	0.000	-0.0149254	-0.0056611
Quintile 2	0.000479	.0036759	0.896	-0.0067262	0.0076847
Quintile 3	0.013864	.0038291	0.000	0.0063577	0.0213695
Quintile 4	0.030867	.0039773	0.000	0.0230702	0.0386629
Quintile 5	0.048604	.0042233	0.000	0.0403259	0.056883
Children in HH	0.004625	.0027671	0.095	-0.0007989	0.0100491
Elders in HH	0.05901	.0032094	0.000	0.0527186	0.0653009
Children and Elder in HH	0.03524	.0066882	0.000	0.0221302	0.0483507
3-4 members in HH	-0.01837	.0031448	0.000	-0.0245319	-0.012203
5 members or more in HH	-0.03408	.0035116	0.000	-0.0409625	-0.0271955
Insured	0.012724	.0025058	0.000	0.007812	0.0176359
Constant	0.046251	.0037707	0.000	0.0388592	0.0536419
Number of obs	9823				
F(11, 9811)	57.62				
Prob > F	0				
R-squared	0.0607				
Adj R-squared	0.0596				

Household composition also has a positive relation with the OOP/EXP and OOP/EXP-FOOD ratios. Having children, elders or children and elders in the household increases the OOP/EXP ratio. The strongest impact is due to having elders in the household, which increases the OOP/EXP ratio by 5 percentage points and the OOP/EXP-FOOD ratio by 8 percentage points; followed by having children and elders in the household which increases the OOP/EXP ratio by 3 percentage points and the OOP/EXP-FOOD ratio by 5 percentage points. The effect of having children in the household is positive but small, increasing both ratios in barely 0.4 percentage points. The impact of household composition is consistent with the descriptive statistics analyzed in the previous section. The results are consistent with the idea that elder people (65 years or more) are more inclined to have health problems and therefore household with elder people have higher health expenditure.

The household size has a negative impact on both the OOP/EXP and OOP/EXP-FOOD ratios. Having 3 to 4 members in the household reduces both ratios by approximately two percentage point and having larger households of 5 members of more reduces the OOP/EXP ratio by three percentage points and the OOP/EXP-FOOD by approximately 5 percentage points. Initially, we would suggest that the coefficient is not what would be expected, as it would be likely that a smaller household spends less on health than a larger one. However, this result also suggests that households might be preventing themselves of assigning higher amounts of the household's income to health, not because is not necessary but because the household has other primary needs to cover such as food. Other possible explanation could be higher income in this type of households, but this would require a more detailed analysis of the household structure, which is out of the scope of the present study.

Table 4. Determinants of Out-of-pocket health expenditure as a ratio of the capacity to pay (simple method). OOP/EXP-FOOD.

Variables	Coef.	Std. Err.	P>t	[95% Conf.	Interval]
Urban	-0.0195	.0034259	0.0000	-0.0262122	-0.0127812
Quintile 2	0.007948	.0053293	0.1360	-0.0024986	0.0183946
Quintile 3	0.024252	.0055515	0.0000	0.0133701	0.0351342
Quintile 4	0.042615	.0057662	0.0000	0.0313117	0.0539178
Quintile 5	0.050961	.0061228	0.0000	0.0389593	0.0629633
Children in HH	0.007717	.0040113	0.0540	-0.0001465	0.0155795
Elders in HH	0.088263	.0046528	0.0000	0.0791421	0.0973829
Children and Elder in HH	0.054538	.0096956	0.0000	0.0355323	0.0735432
3-4 members in HH	-0.02473	.004559	0.0000	-0.0336683	-0.0157952
5 members or more in HH	-0.04904	.0050907	0.0000	-0.0590225	-0.0390647
Insured	0.022087	.0036327	0.0000	0.0149663	0.0292079
Constant	0.083826	.0054667	0.0000	0.0731096	0.0945414
Number of obs	9822				
F(11, 9810)	54.29				
Prob > F	0				
R-squared	0.0574				
Adj R-squared	0.0563				

The coefficient for the insured variable might suggest that the sign is not consistent with what would be expected. However, this is not necessarily true, given that the household might be induced to have health expenses that otherwise would not incurred in if it did not had insurance.

Tables 5, 6 and 7 present the regressions results for the capacity to pay using the three different poverty lines as a function of household characteristics. The results for the capacity to pay using the national poverty line in table 5 are statistically insignificant; however the results for the three poverty lines vary with respect to the results for the simple method CP shown in table 4.

Table 5. Determinants of Capacity to pay (CP), using the national poverty line. (OOP/EXP-PL national)[2].

[2] For the cases when EXP<PL (and therefore the ratio takes a negative value) we take as capacity to pay (EXP-PL) the average capacity to pay of households with CHE (at the 30% level)[2] and with CP>0.

Variables	Coef.	Std. Err.	P>t	[95% Conf.	Interval]
Urban	-0.6515	.6515806	0.3170	-1.92873	0.625735
Quintile 2	-1.60375	1.013518	0.1140	-3.59045	0.382952
Quintile 3	-1.62239	1.055792	0.1240	-3.69196	0.447177
Quintile 4	-1.57584	1.096659	0.1510	-3.72551	0.573841
Quintile 5	-1.5241	1.164495	0.1910	-3.80675	0.758549
Children in HH	0.349399	.7630246	0.6470	-1.14629	1.845084
Elders in HH	1.971412	.8849763	0.0260	0.236676	3.706148
Children and Elder in HH	0.516387	1.844298	0.7790	-3.09882	4.131591
3-4 members in HH	-0.49864	.8671634	0.5650	-2.19846	1.201176
5 members or more in HH	-0.33402	.9683316	0.7300	-2.23215	1.564112
Insured	0.157847	.6909889	0.8190	-1.19663	1.512328
Constant	1.988907	1.039687	0.0560	-0.04909	4.026908
Number of obs	9824				
F(11, 9812)	1.35				
Prob > F	0.1904				
R-squared	0.0015				
Adj R-squared	0.0004				

Particularly, the sign for the quintiles variable change to negative in the set of regressions with the poverty lines where in the regression with the simple CP the sign for the quintiles variable is positive. It is useful to analyze how the indicators are constructed to understand the reason of the change in the sign of the regressions. The Simple method capacity to pay is the ratio of OOP/EXP-Food. We could be looking at an adjustment of the variables to meet the subsistence expenditure or the health expenditure. For example, if a family has a health shock in a given month it is likely that they reduce their food expenditure in order to pay the health expenditure originated by the health shock. This is why we are looking at a positive effect of the quintile variable on capacity to pay. It should be noticed that people with positive out of pocket health expenditure have experienced a certain type of health shock, that originated an expenditure and therefore a redistribution of the resources from food expenditure to health expenditure, and as the quintiles rises, it implies that wealthier households are able to reassign a higher share of their total expenditure to health. However, when the capacity to pay indicator is measured with the poverty lines, households have a minimum amount of money destined to subsistence expenditures, and compared with the simple CP households now have to meet fixed subsistence expenditure.

The effects of the quintile on OOP/CP shown in the regressions of tables 5, 6 and 7 are negative and descending, implying that as the quintile rises the OOP/CP ratio decreases at a lower rate as it goes from a poorer quintile to a wealthier one. The reduction of the OOP/CP ratio can be due to a reduction of the OOP or due to an increase in the capacity to pay, which given that the poverty line is fixed can be assumed, is due to an increase in total expenditure. The reduction in the ratio might be due to an increase in total expenditures as households go from a poorer quintile to a richer one.

Table 6. Determinants Capacity to pay (CP), using the international poverty line. (OOP/EXP-PL international)[3].

Variables	Coef.	Std. Err.	P>t	[95% Conf.	Interval]
Urban	-0.0007665	.0076331	0.9200	-0.01573	0.014196
Quintile 2	-0.0658066	.0118731	0.0000	-0.08908	-0.04253
Quintile 3	-0.0550419	.0123683	0.0000	-0.07929	-0.0308
Quintile 4	-0.0397234	.0128471	0.0020	-0.06491	-0.01454
Quintile 5	-0.0265779	.0136417	0.0510	-0.05332	0.000163
Children in HH	0.00837	.0089386	0.3490	-0.00915	0.025892
Elders in HH	0.110617	.0103673	0.0000	0.090295	0.130939
Children and Elder in HH	0.0509852	.0216054	0.0180	0.008634	0.093336
3-4 members in HH	-0.0164023	.0101586	0.1060	-0.03632	0.003511
5 members or more in HH	-0.0286604	.0113437	0.0120	-0.0509	-0.00642
Insured	0.0208801	.0080947	0.0100	0.005013	0.036748
Constant	0.1020516	.0121796	0.0000	0.078177	0.125926

Number of obs	9824
F(11, 9812)	20.09
Prob > F	0.000
R-squared	0.022
Adj R-squared	0.0209

Household composition has a similar effect in the regressions for capacity to pay with poverty lines than in the regression with the simple method. The effect of the household composition is statistically insignificant when the national poverty line is used, statistically significant for the elders in household and children and elder in household when the international poverty line is used and significant for only elders in household when the endogenous poverty line is used. Table 6 shows that similar to the simple method the method with international poverty line also presents a positive effect of elders in the household and children and elder in household with the OOP/CP ratio. It is assumed that the positive effect, as well as for the simple method, is due to a higher propensity of elder persons to experience health shocks, therefore households with elder members are more prone to have out of pocket health expenditures. The results show that having an elder in the household increases the OOP/CP ratio by 11 percentage points and having children and elders increase the ratio in 5 percentage points when CP is measured with the international poverty line. For the CP measured with the endogenous poverty line only elders in household is significant and having and elder member as part of the household increases the OOP/CP ratio by 17.8 percentage points.

Table 7. Capacity to pay (CP), using the endogenous poverty line. (OOP/EXP-PL endogenous)[4].

[3] IDEM.
[4] IDEM.

Variables	Coef.	Std. Err.	P>t	[95% Conf.	Interval]
Urban	-0.00101	.0341932	0.9760	-0.06803	0.066017
Quintile 2	-0.28672	.0531866	0.0000	-0.39098	-0.18246
Quintile 3	-0.63431	.0554051	0.0000	-0.74291	-0.5257
Quintile 4	-0.68527	.0575496	0.0000	-0.79807	-0.57246
Quintile 5	-0.71947	.0611095	0.0000	-0.83926	-0.59968
Children in HH	-0.01702	.0400414	0.6710	-0.09551	0.061468
Elders in HH	0.178372	.0464411	0.0000	0.087338	0.269406
Children and Elder in HH	0.038857	.0967837	0.6880	-0.15086	0.228573
3-4 members in HH	0.238991	.0455063	0.0000	0.149789	0.328192
5 members or more in HH	0.287141	.0508154	0.0000	0.187532	0.38675
Insured	0.014141	.0362612	0.6970	-0.05694	0.08522
Constant	0.540448	.0545599	0.0000	0.433499	0.647397
Number of obs	9824				
F(11, 9812)	24.38				
Prob > F	0.000				
R-squared	0.0266				
Adj R-squared	0.0255				

The size of the household for the regression of capacity to pay with the international poverty line has a negative relation with the OOP/CP ratio, similar to the OOP/CP simple method. Having 3 to 4 members in the household reduces the OOP/CP ratio in 1.6 percentage points (the coefficient is almost significant at the 10% confidence level) and having 5 members or more in the household reduces the OOP/CP ratio in 2 percentage points.

In the case of the regression for capacity to pay with endogenous poverty line the size of household has a positive impact on the OOP/CP ratio and both variables are highly significant. Results suggest that having 3 to 4 members in the household increases the OOP/CP ratio by approximately 24 percentage points and having 5 members or more increases the OOP/CP by 28.7 percentage points.

Determinants of catastrophic health expenditure.

Tables 8 to 11 present the results for the regressions of households with catastrophic health expenditures at a threshold level (k) of 30%. The results are shown with the simple method, and the three poverty lines. The dependent variables is a dummy variable that takes the value of 1 if the household experienced a catastrophic health expenditure of 30% or more of their capacity to pay (measured with the 4 different methods) or 0 otherwise.

Table 8. CHE using the simple method of capacity to pay (OOP/EXP-FOOD).

Variables	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Urban	-0.1943861	0.0370179	-5.25	0.0000	-0.26694	-0.12183
Quintile 2	-0.0500924	0.0578043	-0.87	0.3860	-0.1633867	0.063202
Quintile 3	0.0693022	0.0598268	1.16	0.2470	-0.0479563	0.186561
Quintile 4	0.2797592	0.0608452	4.6	0.0000	0.1605048	0.399014
Quintile 5	0.3168788	0.0653044	4.85	0.0000	0.1888844	0.444873
Children in HH	-0.0934546	0.0479903	-1.95	0.0510	-0.1875139	0.000605
Elders in HH	0.5058663	0.044329	11.41	0.0000	0.418983	0.59275
Children and Elder in HH	0.3844791	0.0979535	3.93	0.0000	0.1924938	0.576464
3-4 members in HH	-0.2360225	0.0475297	-4.97	0.0000	-0.3291791	-0.14287
5 members or more in HH	-0.4476593	0.0554734	-8.07	0.0000	-0.5563852	-0.33893
Insured	0.243144	0.0417917	5.82	0.0000	0.1612337	0.325054
Constant	-1.317518	0.0590738	-22.3	0.0000	-1.433301	-1.20174
Number of obs	9824					
LR chi2(11)	361.8					
Prob > chi2	0.0000					
Pseudo R2	0.0553					

The regressions coefficients presented in tables 8 to 11 are the marginal effects of a change in the explanatory variable in the dependent variable, more specifically, the coefficients represent how the probability of having a catastrophic health expenditure change when the explanatory variables increases in one unit.

The results for the regression on the determinants of CHE when the simple method is used to measure capacity to pay are presented in table 8. The results show that only the variables for the 3rd and 4th quintile are not statistically significant, all other variables are significant at the 1% confidence level except for the children in household variable which is significant at the 5% level.

Results suggest that households that reside in an urban area reduce the probability of having catastrophic health expenditure in 19 percentage points. This is consistent with the results for the determinants of the OOP/CP ratio and with the descriptive statistics. These results are also consistent with the results for the regressions when the capacity to pay is measured with the three different poverty lines, shown in tables 9 to 11. When the national poverty line (table 9) is used residing in an urban area reduces the probability of having a CHE in 17%, when the international poverty line (table 10) is used the probability is reduced in 18% and when the endogenous poverty line (table 11) is used the probability is reduced in 21 percentage points.

The results for the insurance variable are also consistent with previous results on the determinants of the OOP/CP ratio and descriptive statistics and statistically significant at the 1% confidence level in the four different regressions. Table 8 shows that having insurance increases the probability of a household of having catastrophic health expenditure in 24 percentage points. The results are also consistent when the capacity to pay is measured using the poverty lines. Table 9 present the results when the national poverty line is used and the probability of a CHE increases

in 16 percentage points, similarly when the international poverty line is used the probability of a CHE increases in 26% as shown in table 10 and when the endogenous poverty line is used the probability increases in 23%.

Table 9. CHE using the national poverty line (OOP/EXP-PL national).

Variables	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Urban	-0.17002	0.037674	-4.51	0.0000	-0.24386	-0.09619
Quintile 2	-0.27614	0.056401	-4.9	0.0000	-0.38668	-0.16559
Quintile 3	-0.36913	0.060326	-6.12	0.0000	-0.48736	-0.25089
Quintile 4	-0.31578	0.062	-5.09	0.0000	-0.4373	-0.19427
Quintile 5	-0.26399	0.065292	-4.04	0.0000	-0.39195	-0.13602
Children in HH	0.020552	0.047358	0.43	0.6640	-0.07227	0.113372
Elders in HH	0.512674	0.045778	11.2	0.0000	0.42295	0.602398
Children and Elder in HH	0.447038	0.095209	4.7	0.0000	0.260431	0.633645
3-4 members in HH	0.038103	0.050243	0.76	0.4480	-0.06037	0.136578
5 members or more in HH	0.062993	0.056611	1.11	0.2660	-0.04796	0.173948
Insured	0.164098	0.042942	3.82	0.0000	0.079933	0.248263
Constant	-1.26958	0.059616	-21.3	0.0000	-1.38643	-1.15274
Number of obs =	9824					
LR chi2(11) =	300.46					
Prob > chi2 =	0.0000					
Pseudo R2 =	0.0488					

The effect of the household size on the probability of having catastrophic health expenditure is statistically significant and similar in the regressions for the capacity to pay with the simple method, with the international poverty line and the endogenous poverty line. It was not statistically significant for the CHE measured with the national poverty line. Table 8 reports that households with 3 to 4 members reduce the probability of CHE in 23.6 percentage points and households with 5 members or more reduce the probability of CHE in 44.7%.Similarly, when the international poverty line households with 3 to 4 members reduces the probability in 19% and households with 5 members or more in 38.9% and when the endogenous poverty line is used the probability of CHE is reduced in 18.8% for households with 3 to 4 members and 37% for households with 5 members or more. Results suggest that as the households grow in size; less money is destined to attend health expenses. As previously mentioned this might suggest that the family reassigns health expenditure to other subsistence expenditure required in the household.

Table 10. CHE using the international poverty line (OOP/EXP-PL international).

Variables	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Urban	-0.18021	0.045131	-3.99	0.0000	-0.26867	-0.09176
Quintile 2	-0.24908	0.070215	-3.55	0.0000	-0.38669	-0.11146
Quintile 3	-0.22181	0.074419	-2.98	0.0030	-0.36767	-0.07595
Quintile 4	0.023066	0.073072	0.32	0.7520	-0.12015	0.166285
Quintile 5	0.300986	0.074865	4.02	0.0000	0.154253	0.44772
Children in HH	-0.03249	0.060237	-0.54	0.5900	-0.15055	0.085569
Elders in HH	0.59246	0.051148	11.58	0.0000	0.492212	0.692707
Children and Elder in HH	0.307921	0.121825	2.53	0.0110	0.069148	0.546694
3-4 members in HH	-0.19388	0.057656	-3.36	0.0010	-0.30688	-0.08087
5 members or more in HH	-0.38973	0.067742	-5.75	0.0000	-0.5225	-0.25696
Insured	0.261858	0.052298	5.01	0.0000	0.159357	0.36436
Constant	-1.61267	0.07096	-22.73	0.0000	-1.75175	-1.47359
Number of obs =	9824					
LR chi2(11) =	342.08					
Prob > chi2 =	0					
Pseudo R2 =	0.0794					

The effect of the household composition on the probability of experiencing catastrophic health expenditure is similar and statistically significant in all the regression except the regression showed in table 9 with capacity to pay measured with the national poverty line. In tables 8, 10 and 11 having children in the household reduces the probability of catastrophic health expenditure by 9 percentage points when the simple method is used, 3 percentage points when the international poverty line is used and 8.8% when the endogenous poverty line is used. The coefficient for the international poverty line regression is not statistically significant. The results for the effect of children when the national poverty line are positive and statistically insignificant, therefore is assumed that having a children in the household has no effect on CHE when the national poverty line is used to measure capacity to pay.

The highest reported effect is for households with elder members. Having an elder member increases the probability of CHE by 50 percentage points when the simple method is used, by 51% when the national poverty line is used, 59% with the international poverty line and 52% for the endogenous poverty line. All the effects are found to be statistically significant at the 1% confidence level. The results suggest that having a person of 65 years old or more increases the probability of having catastrophic health expenditure. This is consistent with the theory that elder members are more prone to have health deficiencies or chronic illnesses.

Having children and elders in a household also increases in a considerable degree the probability of catastrophic health expenditure. The results are statistically significant for all four regressions. When the simple method is used, the probability of CHE increases by 38% when households have elders and children, when the national poverty line is used to measure the capacity to pay the probability of CHE increases by 44%, when the international poverty line is used the probability

increases by 30.7% and when the endogenous poverty line is used the probability increases by 41%. These results are consistent with previous results of the determinants of OOP/CP and the descriptive statistics. It suggests that having elders and children in the household increases the propensity of CHE given that elders and children are more prone to having health deficiencies or chronic illnesses.

Table 11. CHE using the endogenous poverty line (OOP/EXP-PL endogenous).

Variables	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Urban	-0.21548	0.037982	-5.67	0.0000	-0.28992	-0.14104
Quintile 2	-0.08723	0.058457	-1.49	0.1360	-0.20181	0.02734
Quintile 3	0.003238	0.060877	0.05	0.9580	-0.11608	0.122554
Quintile 4	0.148043	0.06247	2.37	0.0180	0.025604	0.270482
Quintile 5	0.182452	0.067024	2.72	0.0060	0.051087	0.313817
Children in HH	-0.08874	0.049588	-1.79	0.0740	-0.18593	0.008452
Elders in HH	0.524228	0.045183	11.6	0.0000	0.435672	0.612785
Children and Elder in HH	0.412083	0.099404	4.15	0.0000	0.217256	0.60691
3-4 members in HH	-0.18868	0.048887	-3.86	0.0000	-0.2845	-0.09286
5 members or more in HH	-0.37109	0.057043	-6.51	0.0000	-0.48289	-0.25928
Insured	0.234657	0.043371	5.41	0.0000	0.149651	0.319662
Constant	-1.33256	0.060406	-22.06	0.0000	-1.45096	-1.21417
Number of obs	9824					
LR chi2(11)	346.57					
Prob > chi2	0					
Pseudo R2	0.0566					

The quintiles variable has different results along the four regressions. In the regression shown in table 8 where the simple method is used to measure capacity to pay the probability of increasing CHE raises as the quintiles increases. However, the coefficients for the 2nd and 3rd quintiles are not statistically significant suggesting that these variables have no effect on the probability of CHE. The coefficients for the 4th and 5th quintiles are statistically significant at the 1% confidence level and the results shown suggest that as the household has a higher purchase power the probability of CHE increases, going from 27.9% for households in the 4th quintile to 31.6% for households in the 5th quintile.

Table 9 present results for the determinants of catastrophic health expenditure when the national poverty line is used to measure the capacity to pay. The coefficients for the four quintiles are statistically significant at the 1% confidence level. The effects are negative but they do not present a clear trend. Households that have an income that falls into the 2nd quintile have the probability of experiencing CHE reduced by 27%, households in the 3rd quintile by 36.9%, households in the 4th quintile by 31.5% and households in the 5th quintile by 26.3%. Results do not suggest a clear trend whether the probability raises or decreases as the quintiles increases. Results suggest that the effect is higher for the lower and higher quintiles than for the quintiles in the middle of the distribution.

Table 10 present the results for the determinants of CHE when the international poverty line is used to measure capacity to pay. Results are statistically significant for the 2nd, 3rd and 5th quintile. The probability of CHE rises as the quintile increases. For households with an income that falls in the 2nd quintile, the probability of CHE decreases in 24.9% for households with an income in the 3rd quintile category the probability of CHE decreases in 22% and for households in the 5th quintile the probability increases by 30%.

Table 11 present the results for the determinants of CHE when the endogenous poverty line is used to measure capacity to pay. The results of the quintile variables are similar to the results for the simple method shown in table 8. The probability of CHE rises as the quintile increases and is negative for the 2nd quintile and positive for the 3rd, 4th and 5th quintile. The coefficients for the 2nd and 3rd quintiles are not statistically significant. The results show that households with incomes in the 4th quintile have an increase of 14.8% in the probability of CHE and households with incomes in the 5th quintile have an increase of 18.8% in the probability of CHE.

Determinants of the impoverishing health expenditure

Table 12 present the results of the determinants of impoverishing expenditure. The regression model is a probit model, similar to the model used to analyze the determinants of catastrophic health expenditure. The reported coefficients are the marginal effect of the explanatory variable, which is how the probability of having an impoverishing expenditure changes when the explanatory variable changes by 1 unit. The dependent variable is a dummy variable that takes the value of 1 if the household's income level has gone below the international poverty line after an out–of-pocket health expenditure and 0 otherwise.

The results shown in table 12 suggest that residing in an urban area has no relation with the probability of having and impoverishing health expenditure (IE). Likewise, households with children do not have effect on the probability of IE and neither do households with 3 to 4 members in the household.

Consistent with the results presented in the paper, households with elder members have an increase in the probability of experiencing an impoverishing health expenditure of 56.7%. The coefficient is statistically significant at the 1% confidence level.

Likewise, the insurance indicator is also consistent with previous results. A household with at least one member insured has an increase in the probability of experiencing an IE of 43.6%. The coefficient is at the margin of the 10% confidence level.

Table 12. Determinants of the impoverishing health expenditure using the international poverty line.

Variables	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Urban	-0.07023	0.140169	-0.5	0.6160	-0.3449515	0.204499
Quintile 2	-1.07342	0.327178	-3.28	0.0010	-1.714674	-0.43216
With Children	-0.23874	0.377611	-0.63	0.5270	-0.9788465	0.501361
With Elders	0.567775	0.140098	4.05	0.0000	0.293188	0.842361
3-4 HH members	-0.21554	0.184239	-1.17	0.2420	-0.5766419	0.145562
Insured	0.436464	0.273372	1.6	0.1100	-0.0993356	0.972264
Constant	-2.56895	0.285033	-9.01	0.0000	-3.127608	-2.0103
Number of obs	3212					
LR chi2(6)	67.71					
Prob > chi2	0					
Pseudo R2	0.1573					

Conclusions

The aim of this paper was to analyze which household characteristics have higher incidence on catastrophic health expenditure and consequently impoverishment due to health expenditures. The presented result show that household composition, household size, ownership of insurance, type of residence and quintile of expenditure can shape the probability of a household of incurring in catastrophic health expenditure.

Household composition has a positive impact on catastrophic health expenditure, increasing its probability of occurrence. Particularly, having an elder member in the family (a person of 65 years or older) highly increases the probability of CHE followed by when a household has both elders and children (members between the ages of 1 and 5 years).

The results for the household size variable are found to be interesting. It will be expected that as the number of members increase in the household, families employ higher amounts of resources to health expenditures; however results show exactly the opposite. As the number of members increases in the household, families tend to reduce the amount of resources used for health expenditures suggesting that families have to allocate resources to other primary needs such as food.

The insurance variable also presents interesting results. Having insurance increases the probability of incurring in catastrophic health expenditure suggesting that households are incurring in health expenditures due to the fact that they have insurance. These results are worrisome as they indicate that households that do not have insurance might be preventing themselves of incurring in health expenses because it is not affordable.

In all the different forms of estimation the type of residence presented a similar tendency. Households that reside in urban areas have a smaller propensity of incurring in CHE. In the case of quintile of expenditure, results vary from method to method.

Next Steps

As future steps it would be interesting to analyze in more detail the resources allocation among households as their size increase in order to assert the theory that households are employing resources in other primary needs different that health as the size of the household increases. Additionally, the consumption structure of a household with insurance and without is another appealing matter to further investigate as well as the household composition given that it seems that its influencing the members' decision to attend health centers. If these ideas are found to be certain, policymakers should put additional attention to this matter by creating conditions in which insurance ownership and household composition do not limit health expenditure among households. It would also be interesting to perform the analysis with data more recently collected given that the data used for this analysis was collected in a time where the health reform was starting its implementation process, a possible database to be use for am more recent analysis is the Income and Expenditure Survey of 2007 of the National Statistics Office.

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