Is health a necessity in sub-Saharan Africa? An investigation of income-elasticity of health expenditures in rural Senegal

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Abstract

Investigating income-elasticity of health expenditures can provide insights into the extent of public involvement in the health sector and the need for co-financing schemes. While this is particularly relevant in vulnerable countries, evidence from sub-Saharan Africa is lacking. The paper explores the relationship between permanent and current income and health expenditures. First, at the patient level, income-elasticity of health expenditures during the last medical contact with a qualified health provider is investigated. Second, household-level estimation of last-month household health expenditures is conducted to account for the health care use rate. The results suggest that health is a necessity good which has methodological and policy implications.

1. Introduction

The analysis of income-elasticity of health spending has been extensively researched and debated over the last decades in high-income countries (Manning et al., 1987, Freeman, 2003, Gerdtham and Jönsson, 2000, Di Matteo, 2003, Blomqvist and Carter, 1997, Getzen, 2000, Newhouse, 1977, Hansen and King, 1996, Hitiris and Posnett, 1992, Leu, 1986, Sen, 2005, Herwartz and Theilen, 2003). There has been some evidence that income-elasticity of health spending is the lowest for African countries and hence African countries would benefit the most from donor assistance (Farag et al., 2012). Knowing how a change in income affects the demand for health at the microeconomic level also has strong policy implications since it provides information regarding the allocation and financing of health services. In low-income countries, while households contribute a high proportion toward health financing, the evidence regarding income elasticity of health care expenditures still remains weak. This question is particularly of interest in sub-Saharan African countries since a common feature in those countries is that health is mainly financed by households through out-of-pocket (OOP) medical expenses. In Senegal for instance, households contribute directly up to 38 per cent of total health financing and 89 per cent of these contributions are OOP medical expenses (Government of Senegal, 2009). Whereas the absence of financial protection mechanisms may prevent the poorest from spending on health or may lead to impoverishment, the relationship between income and OOP medical expenses has not been investigated in Sub-Saharan Africa. The importance of investigating such relationship in low and middle income settings has been reinforced by mixed evidence. Indeed, recent evidence from Iran suggests that health care is a necessity good for all income brackets (Zare et al., 2013), which contradicts what has been previously found in Mexico (Parker and Wong, 1997) and Nepal (Rous and Hotchkiss, 2003).

Estimating the income-elasticity of health expenditures is hampered by several methodological issues. First, health expenditure data are only positive for those who experienced an illness during the recall period, so the distribution of health expenditure is right skewed, which implies that the Tobit estimator may produce biased coefficients. Second, the use of household total expenditure as a proxy for income might not be appropriate in settings where a large share of income is spent on health. Given that total expenditures and health expenditures are simultaneously determined, using total expenditure as a proxy for income would result in an over-estimation of the income-elasticity of health expenditures. Third, income may also influence several factors such as the health status and the severity of the disease (Rous and Hotchkiss, 2003), the intensity of health care utilisation (Sepehri et al., 2008), the choice of the health provider visited (Ha et al., 2002, Rous and Hotchkiss, 2003, Akin and Hutchinson, 1999), the method to finance health care (OOP, co-payment or free care) and the quantity of medical inputs in the presence of supplier induced demand (McGuire, 2000), which would in turn affect health expenditures level. If those factors are omitted in the analysis or if there are unobserved factors that are simultaneously correlated with those factors and OOP medical expenses, the effect of income on OOP medical expenses will be biased.

The aim of the paper is to estimate the income-elasticity of health care expenditures in the context of high economic vulnerability. The data set includes information on the clinical pathway and expenses of 2,521 patients whose household is living on agriculture. First, income-elasticity of health expenditures is estimated at the patient level in reference to the last medical visit and conditional on the provider choice. Then it is estimated at the household level by using a one-month recall period in order to further incorporate the frequency of health care utilisation in health expenditures computation.

To avoid several potential biases described previously, information on OOP medical expenses was collected for patients in reference to their last medical visit with a qualified health worker. Thus the information on OOP medical expenses is non-missing for all the individuals in the data set and not only for those who were sick during the recall period and decided to seek care from a qualified health worker. One may want to note that memory lapse bias is unlikely given the high frequency of illness episodes and the high likelihood of using care when sick in the data set (Lépine and Le Nestour, 2013). Conversely, health expenditure at the household level is collected in reference to a one-month recall period and may then capture the frequency of health care utilisation of household members.

Another contribution of the paper is that it investigates if the income-elasticity of health expenditures in low-income countries could be influenced by the measure of income. To do that, the two most common available measures of income in low-income countries are used. The first one, defined as permanent income, is based on asset ownership. One may want to note that permanent income is not likely to be correlated with health expenditure since a very small proportion of individuals (2.6 per cent) have financed health expenditure through the sale of assets. The second income proxy used is current expenditure and is measured by household monthly expenditure. Since the proportion of health expenditure accounts only for 3.9 per cent of total expenditure, the use of the expenditure index is not very likely to result in an over-estimation of the income-elasticity of health expenditures.

In order to take into account that unobserved factors may simultaneously influence health provider choice (low-level versus high-level) and health expenditure level, an endogenous switching regression that uses the relative distance to each type of health providers as an exclusion restriction is used. This allows investigating patient's income-elasticity of health expenses depending on the health provider visited while controlling for endogenous provider choice. At the household level,

a Heckman two-step estimator is used to account for the fact that 7.5% of households did not have any health expenditure during the recall period i.e. during the 30 days prior to the survey.

The findings suggest that the use of the expenditure index and the asset-based indicator do lead to different estimations of the income-elasticity of health expenditures. At the individual level, using the asset index gives a zero income-elasticity, which would entail that health is a sticky good. Conversely, when using total expenditure the income-elasticity is superior to 0 and inferior to 1 implying that health is a necessity good. At the household level, both living standard measures are consistent with health being a necessity good. This finding may suggest that, in settings where there are large transitory shocks to expenditure, the permanent income may successfully predict health expenditures when the measure includes the frequency of health care utilisation but is inadequate to predict the level of OOP medical expenses once patients decide to use care. A main explanation for such finding could be that since farming households perceive seasonal revenues, some of the households that are classified as rich by asset may lack of liquidity at the time of the illness.

The finding that income-elasticity of OOP medical expenses is always inferior to 1 supports the idea that health is a necessity good, which implies that OOP medical expenses have to be treated as involuntary and non-discretionary. This result involves methodological and policy implications. One of them is that health expenditures should not be included in household consumption aggregate in order to estimate poverty figures. Another one is that some individuals may experience catastrophic health expenditure or become impoverished after paying for health, justifying the need to improve financial protection.

2. From income to health expenditure: An analysis of the transmission channels

Figure 1 shows evidence that the main determinants of health expenditures are correlated with income.

Health status and severity of illness

Health status and the severity of illness can positively affect OOP medical expenses of the poorest individuals as they have a worse subjective health status, more chronic illnesses and live in a worse environment (Hwang et al., 2001). As the sickest patients need a higher level of medical services, it can be assumed that they will probably need more medical inputs in order to recover a certain health status.

The behaviour of health providers (induced-demand phenomenon)

While in the Grossman model the individual is seen as the sole decision maker regarding if and how much health care to use, the partisans of the Agency Theory suggest that health providers can also influence the quantity of consumed health inputs because of the presence of asymmetric information (McGuire, 2000). It is not clear if asymmetric information will result in an increase in medical inputs consumption of the richest or poorest patients but it is expected that insured patients would be more susceptible to doctor's manipulation since they do not support the full cost of health care.

Co-financing schemes

If health demand is not induced by health providers and that patients benefit from full or partial co-financing, they will have lower OOP medical expenses (Ekman, 2007, Parker and Wong, 1997).

The choice of the health provider visited

The effect of income on OOP medical spending will differ depending on the health provider visited. In Senegal, patients can choose to seek care at a primary health care (PHC) facility level and then be referred to a high-level provider but they can also choose to seek care directly from a high-level provider since there is no regulation to observe the referral system. Prices of medical services are cheaper at PHC facility level as shown in Table 1, which encourages patients to respect the referral system and explains, that in the sample, only 16.5 per cent of the patients who sought a treatment bypassed the PHC facility level. Because patients know that medical services offered by high-level providers are more expensive and of a higher quality, we would expect that people who have a lower financial constraint and consequently who are less sensitive to price would be more likely to bypass PHC facility level. However, Akin and Hutchinson (1999) found that in Sri Lanka the poorest patients were more likely to bypass first line facilities (Minor Public Western facility). They found that "when people are very ill, they tend to go directly to the high level facility", which explains that individuals with severe illness spend more travel time on average than mildly ill individuals. However, it is expected that since high-level providers offer numerous and more expensive medical services, the effect of income on OOP medical expenses should be higher for the patients who bypassed the PHC facility level.

Insert Table 1

Intensity of medical services utilisation

Finally, when the impact of income on OOP medical expenses is analysed over a period of time (e.g. monthly or yearly OOP health expenditures), income will positively affect OOP medical expenses through the frequency of health care utilisation. In fact, in a previous paper that uses the same data set, it was found that the richest were more likely to seek care when ill than the poorest individuals (Lépine & Le Nestour, 2013).

Insert Figure 1

3. Data

Senegal is a West African country with a population of approximately 12 million of whom 7 million live in rural areas. The study area focuses on Ross Béthio, Gaë and Guédé, three rural communities of the Saint-Louis region. Most of the 110,000 inhabitants of these rural communities derive their livelihoods from subsistence farming, with an annual adult equivalent[i] median household consumption of US$848 of which on average 3.9 per cent is spent on health. A household survey was carried out in 2009 and targeted 504 farmer households. We conducted a census of all the farmer organisations in the rural communities surveyed since most of the farmers in the Saint Louis region are affiliated to a farmer organisation; a local grassroots organisation managed by an elected farmer. In the rural communities surveyed, on average each farmer organisation has 75 members. Farmer organisations are a very important social structure in Senegal (DeJanvry & Sadoulet 2004). They aim to furnish technical assistance to farmers, help in the management of collective goods (rough grazing, water), help with training, are involved in external representation and in the defence of the interests of their members, in this sense they act as labour unions. But most importantly, farmer organisations provide insurance and social cohesion to their members since the Senegalese Agricultural Development Bank (CNCAS) only allocates collective loans to finance agricultural inputs to farmer organisations' members. To sample the 504 households, a two-stage sampling procedure was used, where first 93 farmer organisations using the Probability-Proportional-to-Size (PPS) method were randomly selected and second households were randomly selected from the farmer organisation, which ensures that each household has the same probability of inclusion in the sample.

OOP medical expenses

OOP medical expenses include all categories of health-related expenses paid directly by the patient at the time he/she received curative health services. OOP medical expenses are only computed for the 94% who demanded curative care. Expenditure on health-related transportation is excluded (Xu K et al., 2003). However, reimbursements received from social or private health insurance schemes are included to allow a measure of "net" OOP medical expenses.[ii] OOP medical expenses include how much was spent on consultations, X-rays, lab tests, inpatient care and drugs during the last medical visit. Thus, there is no selectivity issue for those who were not sick or among the sick individuals who did not seek care as it is the case when using a recall period.[iii] The sum of the health-related expenses was created for the observations with no missing responses for all health-related expense categories, which ensures that OOP medical expenses are not underestimated.

The variable oop_i has a mean of CFAF 7,428 (US$16[iv]), a median of CFAF 2,200 (US$5) and varies from CFAF 0 to CFAF 630,200 (US$1,327). Less than 2% of the sample spent nothing during their last medical contact and 95% of the patients have OOP medical expenses below CFAF 25,000 (US$53). Thus, the natural log of OOP medical expenses was used to reduce the effects of the skewed nature of the OOP medical expenses variable.[v]

Monthly health expenditures

The head of the household was asked to state the amount of money that was spent on health by his family members the month prior to the survey. The variable is censored because 7.5% of the households have nil health expenditure over the recall period.

Asset-based index

The asset-based index is used as a proxy for permanent income. The asset index used reflects ownership of 7 private household consumer durables (land area, fridge, fan, air conditioner, radio, TV, vehicle) and 2 indicators measuring dwelling quality (source of lighting and cooking). Weights were derived by using a multiple correspondence analysis.

Monthly total expenditures

Total expenditure –*totexpm*- was obtained by adding food expenditure and non-food expenditure expenses (clothing, transport, communication and energy), as well as remittances received. Since health expenditure is not included, one could argue that if there is a trade-off between investing in health and in something else, households with high health expenditures will have a lower income. In other words, sickness simultaneously depresses economic status and increases medical spending. The impact of total expenditure on OOP medical expenditures would then be underestimated. For this reason, another indicator that includes the previous expenditures plus health expenditures -*totexpm2*- is computed although since health expenditure represents only 6% of total monthly expenditure, results obtained with the two expenditure aggregates are expected to be very close. It is assumed that the true effect of total expenditure on OOP medical expenses lies between the coefficients obtained with –*totexpm*- and -*totexpm2*-.

Other explanatory variables

For the analysis of OOP expenses of patients, control variables include subjective health status (estimated using a visual analogue scale), chronic illness, age, gender, education, reason for consultation and insurance status of the patient as well as household size and education of the head. The severity of illness perceived by patients is assumed to be a main determinant of the likelihood of seeking care from a qualified health provider and also a determinant of health expenditures. Since we do not have any objective evaluation of the severity of the health condition

in the data, it was proxied by the subjective health status and the presence of chronic illness, assuming that people declaring a worse health status would be more likely to suffer from a severe disease. The inclusion of the severity of illness is a useful control if one considers that poor patients will be on average more ill when they go to the facility than rich patients since the estimated effect of income of OOP medical spending would then be biased downwards if this variable was omitted. The size of the household is also added as a control variable since this information is not captured by the two income measures and one would expect larger households will be more likely to own more assets and have greater expenditures.

For the analysis of household's OOP health expenditures, the household size, the proportion of dependents, the proportion of members with a chronic illness, the number of years of education of the most educated member in the household, the proportion of members receiving free care and the proportion of household members insured are included.

All estimates include disaggregated location dummies that approximately cover a radius of 10 kilometres in order to capture the unobserved characteristics of the area that may affect health expenditures, such as for instance the characteristics of the health providers in the area.

Since there are several members in a household, the error term might not be independently and identically distributed. Thus, standard errors that are clustered by household are calculated in order to obtain a cluster-robust covariance matrix estimator for the estimate conducted at the patient level. Descriptive statistics are presented in Table 2 for each type of health provider visited. One can note that those who sought care from a high-level provider have higher OOP medical expenses, own fewer goods, have higher expenditures and belong to smaller households. They are more likely to suffer from a chronic condition and thus have on average a lower subjective health status. They are also more educated, older and are more likely to have compulsory private health insurance coverage.

Insert Table 2

4. Descriptive statistics

Table 3 presents the level of OOP medical expenses by type of health provider visited. Patients who went to a public hospital have the highest OOP medical expenses, followed by private hospitals, health centres and PHC facilities. The high OOP medical expenses incurred at public hospitals compared to private clinics is explained by a large proportion of patients having a third-party reimbursement among those who visited a private clinic. Indeed, patients insured by a compulsory private insurance scheme receive a more generous third-party reimbursement if they go to the private clinic of the insurer, explaining why among the patients who visited a private facility, 19 per cent have health insurance coverage in comparison to the 6 per cent of insured among those who visited a public hospital.

On average the amount of OOP medical expenses paid was CFAF 7,193 (US$15) for the first visit and CFAF 19,616 (US$41) during the second visit. People have higher OOP medical expenses during the second visit as patients who were still sick after their first visit were likely to be referred to a high-level provider (31 per cent against 14 per cent for the first visit). Nevertheless, one can note that even those who visited a PHC facility during the second visit have higher OOP medical expenses. This is explained by the fact that their health condition might be more difficult to cure and may require more medical inputs.

Insert table 3

It is found that OOP drug expenses represent 85% of total OOP medical expenses in the sample. Similar proportion was obtained in Burkina Faso by Mugisha et al. (2002). On average individuals spent CFAF 5,457 (US$11.5) on drugs the last time they visited a health provider and at a high-

level provider the average of OOP drug expenses rose to CFAF 14,790 (US$31). When the patient cannot pay the full prescription, he/she will only buy what can be afforded and thus will not complete the course of treatment or will not buy all the prescribed medicines. Drug sellers in public facilities do not have any medical knowledge, and as a result the practise of self-treatment can have worrying implications for drug use and resistance (Shretta et al., 2000) and can contribute to an increase in the level of OOP drug expenses if the patient is not cured after the first medical visit.

Table 4 shows that when income is measured with the asset-based indicator, there is no difference in OOP medical expenses between the poorest and richest patients. However, when measured with the expenditure index, the richest patients are found to have higher OOP medical expenses. On average, the richest patients spent US$19 during their last medical contact, while the poorest ones spent US$15. This difference is explained by higher OOP medical expenses for the richest patients who visited a low-level provider.

Insert Table 4

By looking at household monthly OOP medical expenses, Table 5 shows that the two income indicators suggest that the richest households have higher health expenditure. The richest households spent on average between US$75 and US$83 on health during the month prior to the survey, while the poorest spent only between US$39 and US$44. The average monthly OOP medical expenses is CFAF 27,677 (US$58) in the sample, which represents CFAF 3,178 (US$7) per person.

Insert table 5

Bivariate analysis does not give much information on the relationship between income and OOP medical expenses because it does not include the severity of illness, the choice of health provider

visited, the presence of co-payment and behaviour of the health provider. As discussed previously, these variables might be influenced by income and might also be important determinants of OOP medical expenses. This is thus an issue that need to be resolved empirically.

5. Econometric Method

5.1. Patient level analysis

Suppose that a patient *i* chooses the type of health provider h_i^* that maximises his/her utility. It is assumed that the choice of the health provided visited is determined by observable and unobservable characteristics. During the last medical visit, *i* chose between two health providers: the patient went to a PHC facility $h = 1$ or he/she bypassed the first level of the sanitary system to visit a high-level provider $h = 2$. Health centres and public and private hospitals are included in the latter regime. Health centre and hospitals could have been split into two different categories but there are many villages that do not have any access to a hospital in the study area. Private and public facilities could also be two different categories but the per centage of patients who visited a private facility is too small in the sample (1.52%) to run regressions on this sub-sample of patients.

Following Maddala (1980), let oop_i^1 and oop_i^2 denote the dependent variable to be explained in each of two regimes $h_i \in \{1,2\}$, and φ^1 and φ^2 the effect of income on OOP medical expenses in regime 1 and 2. Let also h_i^* be a latent variable determining which regime applies and z_i a variable explaining the type of health provider visited. Note that $oop_i^1$and oop_i^2 are here also partially observed since oop_i^1 is only observed for the people who went to a PHC facility and

oop_i^2 is only observed for people who bypassed PHC facility to seek care from a high-level provider. Finally, let v_i^1, v_i^2 and u_i be error terms.

(1a) $$oop_i^1 = \varphi^1 y_i + \omega^1 X'_i + v_i^1 \text{ if } h_i=1$$

(1b) $$oop_i^2 = \varphi^2 y_i + \omega^2 X'_i + v_i^2 \text{ if } h_i=2$$

(1c) $$h_i^* = \delta(oop_i^1 - oop_i^2) + \gamma z_i + u_i$$

(1d) $$h_i = \begin{cases} 1 \; if \; h_i^* = 1 \\ 2 \; if \; h_i^* = 2 \end{cases}$$

The efficiency of the switching-regression models comes from the fact that equations (1a)-(1c) are estimated at once. The switching regression estimated is assumed to be endogenous since there might be some unobservable characteristics affecting the level of OOP medical expenses in both regimes that are correlated with those affecting the type of health provider visited.

The exclusion restriction z_i used is a measure of the relative distance to the closest two types of health providers. In order to choose the most suitable functional form for the variable measuring the relative distance, the likelihood of going to a high-level health provider was regressed over the relative distance using several functional forms. The functional form of *log(a)-log(b),* where *a* is the distance in kilometres to the closest PHC facility and *b* the distance in kilometres to the closest high-level provider was found to have the strongest effect on h_i^*. The relative distance measure varies from -4.6 to 0, which suggests that all the individuals in the sample live closer to a PHC facility than to a high-level provider (or to an equal distance if z_i =0).

The relative distance is very likely to influence the choice of the health provider visited, as shown in Figure 2. Several studies have found that a greater distance implies more travel time to facilities and hence a lower likelihood of choosing a facility (Akin et al., 1995, Bucklin, 1971, Collier et al., 2002, Mwabu, 1989). Thus, a relative distance indicator that combines information on the closest PHC and the competing alternative (high-level facility) is assumed to explain the probability that a patient will visit a given facility. The relative distance to health providers is not expected to affect OOP medical expenses directly. Firstly, by definition, OOP medical expenses exclude transport costs (Xu et al., 2003). Secondly, unlike the distance in kilometres, the relative distance does not influence the utilisation of medical services that could affect OOP medical expenses through the severity of disease or health status. Finally, the question regarding the exogeneity of the location of health facilities is not longer an issue when using relative distances.[vi]

Insert Figure 2

5.2. Household level analysis

Consider a household *j* with monthly OOP medical expenses oop_j. In the sample of households, 7.64% have $oop_j=0$. It is assumed that households with positive health expenditure are not randomly selected from the population. To correct for potential selectivity issue, a sample selection model is estimated (Heckman, 1974).

The selection model introduces a latent variable oop_{1j}^* and the outcome oop_{2j}^* is observed only if $oop_{1j}^*>0$. The two-equation model comprises selection equation for oop_{1j}:

(*2a*) $$oop_{1j} = \begin{cases} 1 \; if \; oop_{1j}^* > 0 \\ 0 \; if \; oop\,^*_{1j} \leq 0 \end{cases}$$

(2b)

$$oop_{2j} = \begin{cases} oop^{*}_{2j}\ if\ oop^{*}_{1j} > 0 \\ -\ if\ oop^{*}_{1j} \leq 0 \end{cases}$$

(2c) $$oop^{*}_{1j} = \theta_1 + \varphi_1 y_{1j} + \omega_1 X'_{1j} + \gamma z_i + v_{1j}$$

(2d) $$oop^{*}_{2j} = \theta_2 + \varphi_2 y_{2j} + \omega_2 X'_{2j} + v_{2j}$$

where φ_2 is the impact of income y_{2j} on monthly OOP medical expenses for household *j* and X'_{2j} is a set of explanatory variables at the household level influencing monthly health expenditure. The exclusion restriction z_j used is a binary variable indicating if a household member was sick during the month prior to the survey. It is expected that this variable determines the likelihood of having positive health expenditure, but does not directly affect the total amount of health expenditure spent by the household.

Assuming that two error terms are jointly normally distributed and homoscedastic:

$$\begin{bmatrix} v_{1j} \\ v_{2j} \end{bmatrix} \sim N\left[\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{bmatrix}\right]$$

where $\sigma_1^2 = 1$ because only the sign of oop^{*}_{1j} is observed. The two-step method is based on the conditional expectation:

$$E\left(\, oop_{2j} \middle| y_j, oop^{*}_{1j} > 0\right) = y'_{2j}\varphi_2 + \sigma_{12}\, \lambda(y'_{1j}\varphi_1)$$

where $\lambda(.) = \emptyset\,(.)/\Phi(.)$ and $E\left(v_{2j} \middle| oop^{*}_{1j} > 0\right) = \sigma_{12}\, \lambda(y'_{1j}\varphi_1)$. The expectation of oop_{2j} is not equal to $\varphi_2 y_{2j}$ as supposed in OLS estimation and thus regressing oop_{2j} by OLS would lead to biased estimates. In contrast, Heckman selection model estimates the second term by $\lambda(y'_{1j}\widehat{\varphi_1})$,

where $\widehat{\varphi_1}$ is obtained by a Probit regression of oop_{1j} on y_{1j} and by using these results, the inverse mills ratio (IMR) is estimated. The OLS regression of oop_{2j} on y_{2j} and the generated regression $\lambda(y'_{1j}\varphi_1)$, called the Inverse Mills Ratio yields a semi parametric estimate of (φ_2, σ_{12}). OLS is run on the sub-sample of non-zero expenditure with the estimated IMR to correct for selection bias in order to estimate oop^*_j. Because of the presence in the regression of the generated regressor $\lambda(y'_{1j}\varphi_1)$ bootstrapping is used to obtain correct standard errors.

(2e) $$oop^*_{2j} = \theta_2 + \varphi_2 y_{2j} + \omega_2 X'_{2j} + \delta \frac{\emptyset(\hat{z}_j\gamma)}{\Phi(\hat{z}_j\gamma)} + v_{2j}$$

6. Results

6.1. Impact of income on OOP medical expenses incurred during the last medical contact

6.1.1. The determinants of health provider visited

The determinants of the choice of the health provider visited are presented in Table 6 (columns 1.1c and 1.2.c). An increase in the distance to the closest PHC facility or a decrease in the distance to the closest hospital increases the likelihood of visiting a high-level provider. The coefficient indicates that when the relative distance increases by 1 point,[vii] the likelihood of visiting a high-level provider increases by about 7 per centage points if other controls are held at mean.

Results suggest that the richest are more likely to bypass the inferior level of the referral system. An increase in income of one standard deviation increases the likelihood of visiting a high-level

provider by 3.7 per centage points. It is interesting to note that the asset-based index and the standardised variable of the expenditure indicator yield a similar prediction. The increase in utility generated by bypassing PHC facility is then not offset by the decrease in utility induced by the loss of time and money in visiting a high-level provider for the richest patients.

Other results suggest that patients with a chronic condition are more likely to seek care from a high-level provider. This is not surprising if one considers that individuals with a chronic condition are more likely to suffer from more severe conditions. Older patients are also slightly more likely to visit a high-level provider. Women have a lower likelihood of visiting a high-level provider than men by 2 per centage points. Patients who have compulsory private health insurance have a greater likelihood of visiting a high-level provider by at least 14 per centage points as explained previously by the fact that private insurers have their own health facilities and that the benefit package offered is more generous when insured patients use care from these facilities.

6.1.2. The determinants of OOP medical expenses incurred during the last medical contact

Results presented in Table 6 suggest that the asset-based indicator is not a determinant of OOP spending incurred during the last medical contact (columns 1.1a and 1.1b). However, an increase in 1% in the expenditure indicator increases OOP medical expenses by 0.48% in the sub-sample who went to a low-level provider and by 0.57% in the sub-sample who went to a high-level provider.[viii] This finding shows that the two measures of income have different effects on OOP medical expenses.

The method suggested by Filmer and Pritchett (2001) was used to confirm that this difference in results was not attributable to measurement errors in the income variables.[ix] A more plausible explanation for this finding is that the patients who have a high permanent income may lack

liquidity once in the health system, since assets included in the computation of the index are not liquid. Results indicate that the measure of income matters when health expenditure is analysed and may explain why, when it is proxied by an asset-based indicator, health expenditure is found to be income-inelastic in Mugisha et al. (2002) and Hotchkiss et al. (2005) studies.

Other results indicate that women who went to a low-level provider have greater OOP medical expenses by 8%. Age also increases OOP medical expenses; an increase in 1 year increases OOP medical expenses by 4% for those who went to a low-level and high-level provider. OOP medical expenses decrease for individuals over 57 years of age that went to a low-level and for those over 38 years of age that went to a high-level health provider. Chronic disease and the reason for consultation strongly affect the level of OOP medical expenses in the sub-sample of patients who went to a high-level provider. Patients who have a chronic illness have higher OOP medical expenses, between 46% and 47%[x] higher for those attending high-level provider and 19% and 21% higher for those who went to a PHC facility, depending on the income measure. The results also suggest that people who visited a health provider for an injury or for maternal care have at least 3.3 and 1.6 times higher OOP medical expenses than those who went for an injection or medications. It was not possible to control for the possibility of induced-demand; however an analysis of the determinants of receiving a drug prescription, presented in Appendix 1, indicates that the richest are not more likely to have been prescribed medicines.

Results suggest that free care policy is effective to reduce OOP medical expenses in the two sub-samples, as people who are covered by free care policy see their OOP medical expenses reduced by 100%. This result can reflect the effectiveness of this health policy but it could also reflect a lack of trust of the health provider towards health insurance schemes. Indeed, people who benefit from free care could be less likely to receive a drug prescription if the health provider fears that

the insurance scheme will not support the costs. Appendix 1 shows that people who benefit from the free care policy had a lower likelihood of receiving a drug prescription during last medical visit by 32 per centage points, after controlling for other factors, which may suggest that the free care policy rations care of the beneficiaries.

Also there is a very low proportion of individuals who have health insurance in the sample, the different insurance schemes have different effects on OOP medical expenses. Those insured by Community-Based Insurance (CBI), also called mutuelle de santé in Senegal, who went to a PHC facility have lower OOP medical expenses by 78%. It is hard to conclude if the scheme is really effective in reducing OOP medical expenses or if health providers are reluctant to prescribe medical services to insured by CBI since those patients have a 17% lower likelihood of receiving a drug prescription. CBI has however no impact on OOP medical expenses for those who went to a high-level provider. This result suggests that CBI in this area may not cover care at high-level provider. However given the fact that less than 2 per cent of people are insured, results have to be interpreted with caution. Moreover since this insurance is voluntary, there could be a selection bias. Insured patients by private compulsory health insurance, called Institution de Prévoyance Maladie (IPM) in Senegal, who went to a high-level provider, have lower OOP medical expenses since this scheme reduces OOP medical expenses by about 97%. In contrast to those insured by CBI, those insured by an IPM do not have a lower likelihood of receiving a drug prescription. Although, it is hard to draw any causal effect given that individuals working in the private sector may have specific characteristics, the result suggests a strong negative correlation between compulsory health insurance and OOP medical expenses. Finally, public compulsory health insurance has no impact on OOP medical expenses. However, given the low number of insured in the sample, it is hard to draw any conclusion on the effect of this insurance scheme.

The correlation coefficient ρ_1 is negative and statistically significant, which suggests that patients who choose to go to high-level providers have greater OOP medical expenses than a random patient from the sample. However, those who choose to go to PHC facilities do not have greater or lower OOP medical expenses than a random individual. This result suggests the endogenous self-selection into the provider choice did not prove to be such an important point to consider in the empirical estimation.

Other regressions were run in order to analyse the effect of income on specific OOP medical expenses (consultation, X-rays, lab tests, inpatient care and drug expenses). The asset-based indicator was never found to be statistically significant in explaining these expenditures. However, an increase by 1% in total expenditure was found to increase OOP drug expenses by 44% for the sub-sample who went to a PHC facility and 42% for those who went to a high-level provider.[xi] Yearly total expenditure was used instead of monthly total expenditure as a proxy for household income. An increase by 1% in income is found to increase OOP by 0.45% and 0.66% among the sub-sample who went to a low-level and high-level health provider respectively.

Insert Table 6

6.2. Impact of income on monthly OOP medical expenses

The analysis of the impact of the economic status on monthly OOP medical expenses takes into account the intensity of service use and includes the demand for preventive care. Results are presented in Table 7. Results indicate that when there is at least one member sick in the household during the month prior to the survey, the likelihood of having positive household monthly health

expenditure increases. The significance of the Inverse Mills ratio suggests that there is a selection bias.

When the intensity of use of medical services is taken into account, the asset-based indicator is significant in explaining health expenditure as presented in Lépine & Le Nestour (2013). An asset-based index increase by one standard deviation, increase OOP medical expenses by 18% This higher semi-elasticity gives evidence of a financial barrier to health care for the poorest households and indicates that some households are not able to react to health shocks for financial reasons. Results obtained with the expenditure index confirm the finding that income-elasticity of monthly health expenditure is stronger than income-elasticity of OOP medical expenses incurred during last medical contact. An increase by 1% in the expenditure index increases household health expenditure by 0.77%.

Even though the Grossman model (1972) predicts a positive relationship between health condition and the demand for health care, Table 7 shows that households whose members have a chronic illness have higher monthly OOP medical expenses. This finding may confirm that individuals are reacting to a health shock rather than choosing the level of medical care in order to increase their health capital.

Insert Table 7

7. Conclusion and discussion

This paper has estimated the income-elasticity of health expenditures among a sample of Senegalese subsistence farmers. The main finding indicates that the income-elasticity of health

expenditures is inferior to the unity, suggesting that health is a necessity good. The results are consistent with the assumption that OOP medical expenses are not voluntary. Since the main causes of consultation in the area relate to infectious diseases, this finding is not much a surprise. It suggests that OOP medical expenses cannot be seen as a result of a deliberate choice of the individual but more as a necessity to cope with a health shock. In this respect, health expenditure could be catastrophic and could lead to impoverishment (Wagstaff and Doorslaer, 2003).

This result has several implications. First, it means that health policies should prevent poor people from having high OOP medical expenses. It has been shown that the extension of health insurance and exemption schemes could reduce the burden of disease by reducing OOP medical expenses. However, those policies have to be implemented correctly when health insurance is assorted to third-party reimbursement. If health providers do not trust those health insurance schemes, insured patients could be rationed and will not be able to obtain the medical services they need. Second, Deaton and Zaidi Deaton and Zaidi (1999) considered that "regrettable necessities" do not contribute to the household's welfare and should not be included in the calculation of consumption aggregates to measure welfare. To determine if health spending is involuntary, one solution is to look at the income-elasticity of health expenditure. When this was done in seven countries (Vietnam, Nepal, Kyrgyz Republic, Ecuador, South Africa, Panama, Brazil), it was found that elasticity of health expenditures is relatively low (0.74-0.86) in contrast to the estimated elasticity for educational expenditures. The results presented in this paper (with an income-elasticity of 0.77) corroborate the idea that health is a regrettable necessity and in this respect should not be included in total depends. Finally, the low income-elasticity of health spending also has implications for poverty measurement. The computation of absolute poverty based on the prevalence of household living with less than one dollar a day includes OOP medical expenses in individual consumption. Including health expenditure as part of household consumption results

in an underestimation of poverty rates since sick individuals would be considered richer than they are. The finding that health expenditures are involuntary gives evidence for the exclusion of health expenditure in household consumption in the computation of poverty figures.

The study also highlighted several transmission channels through which income may affect OOP medical expenses in Senegal. Several assumptions that could explain why income could affect the level of OOP medical expenses were tested. The results suggest that income affects OOP medical expenses through firstly the frequency of use of medical services as it was found that income-elasticity of health expenditure was much larger when the level of health expenditure included the frequency of utilisation. This is in line with the finding that the richest households will be more likely to use care when sick highlighted in Lépine & Le Nestour (2013). This finding confirms that the poorest face a financial barrier to health care access due to their limited revenue and have to forgo health care. The second channel is the choice of the health provider since it is found that the richest are more likely to seek care from a high-level provider. Given the higher prices in high-level providers, richest have on average higher OOP medical expenses. However, since income does not affect the likelihood of receiving a drug prescription, the assumption that the demand is induced by the health provider is not likely to be valid in the context of the study.

An interesting finding of the study is that the choice of the income measures matters since a different effect of income was found depending on the income indicator chosen. The use of the expenditure index leads to an income-elasticity superior to 0 and inferior to 1. However, when income is measured by the asset-based index, the income-elasticity of health expenditures was close to 0. Most of the studies that have analysed the impact of income on OOP medical expenses have used total expenditure as a measure of income and found that OOP medical expenses were strongly income-sensitive (Musgrove, 1983, Parker and Wong, 1997, Rous and Hotchkiss, 2003, Zare et al., 2013). However, because OOP medical expenses are included in total expenditure,

there is a simultaneous relationship between the variables that might bias upward the coefficient associated with the income variable. This is likely to be a greater issue when a larger share of income is spent on health. Although such bias is unlikely to be of importance in our data given the low proportion of health expenditures in total expenditures, it is important to note that a positive relationship between health expenditures and income guards against wrongly concluding that health is a necessity good. It may however cast doubt on the validity of the findings of studies concluding that health is a luxury good.

The analysis has allowed providing information regarding the main drivers of the level of OOP medical expenses. Having a co-financing policy is found to be negatively correlated with the level of OOP medical expenses. Thus, it seems that health care access and the burden of OOP medical expenses could be improved by better targeting the beneficiaries of free care policies and by developing effective health insurance schemes. Governments could also choose to implement crossed-subsidies, in order to increase health care access for particular services such as primary health care services or for particular sub-groups such as children, elderly, the chronically ill and the poor.

The paper highlighted that the determinants of OOP medical expenses are different depending on the type of health provider visited. The results indicate that the presence of chronic illness, the age of the patient and the free care policy were strong determinants of OOP medical expenses in the two sub-samples of patients (those who visited a low and a high-level provider). Subjective health status, gender and coverage by a voluntary health insurance system were found to have an impact on OOP medical expenses only for those who visited a PHC facility. Private compulsory health insurance is found to decrease OOP medical expenses only for those who went to a high-level provider. Patients who demanded maternal care had higher OOP medical expenses when they

visited a PHC facility. Similarly, patients who had an injury and who went to a high-level provider had higher OOP medical.

Regarding the limitations of the findings, our results rely on the models and exclusion restrictions used. Although one could not have known so a priori, the use of the switching model with endogenous switch did not lead to very different results than a model that would not correct for the endogeneity of the provider choice. Also, one may want to note that other models could have been considered for the analysis at the household level, where the health expenditure measure has a mass of zero values. Given the recent use of the generalised gamma model in order to analyse health expenditure determinants (Manning et al., 2005, Basu and Manning, 2009), a regression model based on the generalised gamma distribution was estimated to test the robustness of the findings and this did not alter the findings. This may also suggest that the issue of the selection bias at the household level may also not be of a strong importance.

The study also falls short of highlighting the effect of insurance on health expenditures. The low proportion of insured and the endogeneity of health insurance prevent from knowing if health insurance is effective to reduce OOP medical expenditures. However, the findings highlight two things that would deserve further consideration. First, there is a negative correlation between health insurance and OOP medical expenses. Second, there is a negative correlation between the likelihood of receiving a drug prescription and health insurance. This fact was noticed during the data collection. The elderly patients, who receive free care in Senegal though the "Plan Sésame", complained about it: "*Plan Sésame should be called plan paracetamol because since the implementation of this policy, if I go to the health facility for any kind of health problems, they only give me a tablet of paracetamol.*" Future studies should not only investigate the effect of financing policies on health care utilisation and OOP medical expenses but should also investigate the effect on health provider behaviours.

Table 1: Average prices of medical services at high and low-level health providers

Price of medical services	Low-level (n=16)		High-level (n=5)	
	Mean CFAF	SD	Mean CFAF	SD
Consultation for children	112.5	34	870	1032
Consultation for adults	206	25	740	779
Inpatient care	750	876	2000	935
Prenatal care	253	62	1960	2916
Delivery	2400	949	4500	1732

Table 2: Descriptive statistics of the variables

Individual Level

Variables	Visited a low-level provider			Visited a high-level provider			Mean test
	Obs.	Mean	SD	Obs.	Mean	SD	
Ln(OOP)	2593	7.58	1.39	492	8.85	2.25	<0.01
Asset-based index	2593	0.14	1.03	492	-0.06	1.03	<0.01
Ln(Totexpm) (excludes health expenditure)	2593	5.79	0.44	492	5.92	0.48	<0.01
Ln(Totexpm2) (includes health expenditure)	2593	5.93	0.50	492	6.06	0.50	<0.01
Relative distance of health providers	2593	-2.93	1.08	492	-1.92	1.50	<0.01
Size of the household	2593	10.63	3.81	492	9.98	3.88	<0.01
Chronic disease	2370	0.17	0.37	457	0.26	0.44	<0.01
Health status	2369	7.25	1.61	458	7.17	1.65	<0.01
Gender (coded 1 if female and 0 otherwise)	2593	0.52	0.50	492	0.51	0.50	0.405
Education	2589	2.28	3.42	491	2.09	3.48	0.017
Education of the head	2593	2.32	3.72	492	1.63	3.30	0.143
Age	2593	20.69	18.07	492	30.32	20.65	<0.01
Age squared	2593	754	1171	492	1344	1520	<0.01
Free care	2496	0.01	0.12	483	0.00	0.05	0.523
Voluntary health insurance	2541	0.01	0.08	486	0.00	0.06	0.891
Private compulsory health insurance	2541	0.03	0.17	486	0.06	0.23	<0.01
Public compulsory health insurance	2543	0.01	0.12	486	0.00	0.05	0.029
Reason of visit: Medication/Injection	2435	0.01	0.08	465	0.01	0.09	0.026
Reason of visit: Injury	2435	0.04	0.19	465	0.04	0.20	0.561
Reason of visit: Disease	2435	0.88	0.33	465	0.88	0.32	0.506
Reason of visit: Maternal/infant care	2435	0.07	0.26	465	0.07	0.25	0.759
District 1	2571	0.05	0.21	478	0.02	0.15	0.19
District 2	2571	0.03	0.18	478	0.01	0.11	0.05
District 3	2571	0.04	0.18	478	0.09	0.28	<0.01
District 4	2571	0.08	0.28	478	0.10	0.30	0.23
District 5	2571	0.45	0.50	478	0.18	0.39	<0.01
District 6	2571	0.08	0.27	478	0.08	0.27	0.04
District 7	2571	0.04	0.19	478	0.03	0.18	0.113
District 8	2571	0.01	0.11	478	0.12	0.33	<0.01
District 9	2571	0.06	0.24	478	0.08	0.28	0.23
District 10	2571	0.09	0.28	478	0.11	0.31	0.21
District 11	2571	0.08	0.27	478	0.18	0.38	<0.01

Household level

Variables	Obs.	Mean	SD
Monthly household health expenditure in CFAF	496	8.71	2.76
Asset-based index	504	0.00	1.00
Ln(Totexpm)	504	5.74	0.48
Household size	504	8.95	3.83
Proportion of dependent members in the household	504	0.5	0.18
Proportion of members with chronic disease	504	0.12	0.14
Maximum number of years of education in the household	504	6.89	3.43
Proportion of members with free care	504	0.02	0.09
Proportion of members with community-based health insurance	504	0.01	0.09
Proportion of members with compulsory private health insurance	504	0.03	0.17
Proportion of members with compulsory public health insurance	504	0.01	0.11
One member sick during the last month	504	0.74	0.44
District 1	499	0.05	0.21
District 2	499	0.03	0.17
District 3	499	0.05	0.21
District 4	499	0.09	0.28
District 5	499	0.39	0.49
District 6	499	0.09	0.28
District 7	499	0.04	0.19
District 8	499	0.03	0.17
District 9	499	0.08	0.27
District 10	499	0.08	0.27
District 11	499	0.09	0.28

Table 3: Average OOP medical expenses in health facilities per type of provider and per visit

	First visit			Second visit		
Type of provider visited	Obs.	Mean OOP medical expenses (CFAF)	Std. Dev.	Obs.	Mean OOP medical expenses (CFAF)	Std. Dev.
Private hospital	45	14,813	24,146	3	2,183	2,891
Public hospital	189	45,456	81,954	20	58,125	143,334
Health centre	279	10,680	19,241	19	23,611	34,759
PHC facility	2368	4,324	10,325	80	9,501	22,852
Total	3643	7,193	431	134	19,616	5,015
Total high-level provider	492 (14%)	24,472	55,579	42 (31%)	35,047	101,754

Table 4: OOP for the richest and the poorest using the asset-based indicator and expenditure indicator

a. Asset-based indicator

OOP for total sample and sub-samples depending on the choice of provider visited	50% Richest			50% Poorest			
	Mean OOP during last medical contact (CFAF)	SD	n	Mean OOP during last medical contact (CFAF)	SD	n	Mean-comparison test
Total OOP	7,737	31,511	1,532	8,408	28,990	1,614	t =-0.62 Pr = 0.53
OOP at PHC facility	4,757	12,978	1,307	4,322	11,187	1,286	t=0.91 Pr=0.36
OOP at high-level provider	26,775	77,302	204	27,142	61,064	288	t=-0.05 Pr=0.95

b. Expenditure indicator

OOP for total sample and sub-samples depending on the choice of provider visited	50% Richest			50% Poorest			
	Mean OOP during last medical contact (CFAF)	SD	n	Mean OOP during last medical contact (CFAF)	SD	n	Mean-comparison test
Total OOP	9,148	29,403	1,523	7,065	30,994	1,623	t =1.71 Pr = 0.09
OOP at PHC facility	5,065	14,160	1,205	4,079	9,966	1,388	t=2.34 Pr=0.02
OOP at high-level provider	26,572	58,106	288	27,585	80,553	204	t=-0.84 Pr=0.4

Table 5: Household monthly OOP per income and expenditure quintile

a. Asset-based index

Wealth quintile	Household monthly OOP		Obs.
	Mean (CFAF)	Std deviation	
Poorest	21,092	50,394	221
Richest	35,871	78,400	275
T-test on the mean (Ho: diff = 0)	t =-2.54, p= 0.0114		496

b. Expenditure index

Expenditure quintile	Household monthly OOP		Obs.
	Mean (CFAF)	Std deviation	
Poorest	20,842	63,548	214
Richest	36,684	65,346	282
T-test on the mean (Ho: diff = 0)	t =3.54, p= 0.0004		496

Table 6: Endogenous switching model (n=2,521)

	(1.1a) $lnOOP_{1i}$	(1.1b) $lnOOP_{2i}$	(1.1c) Determinants of visiting a high-level provider	(1.2a) $lnOOP_{1i}$	(1.2b) $lnOOP_{2i}$	(1.2c) Determinants of visiting a high-level provider
Relative distance			0.0762***			0.0708***
			(0.0129)			(0.0117)
Asset-based index	0.0333	0.0802	0.0364***			
	(0.0455)	(0.147)	(0.0116)			
Std(lntotexpm)				0.217***	0.259**	0.0412***
				(0.0407)	(0.116)	(0.00995)
Household size	-0.000329	-0.0221	-0.00277	-0.0162**	-0.0509	-0.00449
	(0.00866)	(0.0344)	(0.00289)	(0.00773)	(0.0360)	(0.00275)
Chronic disease	0.194**	0.392*	0.0718***	0.171**	0.383*	0.0648***
	(0.0777)	(0.202)	(0.0240)	(0.0748)	(0.201)	(0.0229)
Health status	-0.0126	0.0441	0.0110*	-0.0312*	0.0496	0.00902
	(0.0182)	(0.0607)	(0.00607)	(0.0175)	(0.0628)	(0.00597)
Gender	0.0885*	0.137	-0.0244**	0.0797*	0.105	-0.0225*
	(0.0475)	(0.162)	(0.0124)	(0.0464)	(0.161)	(0.0123)
Education *i*	0.00533	0.00163	0.00416*	0.00231	0.00975	0.00506**
	(0.00813)	(0.0265)	(0.00230)	(0.00790)	(0.0259)	(0.00236)
Education *hh*	0.000663	-0.0182	-0.00418	-0.00246	-0.0348	-0.00391
	(0.00993)	(0.0514)	(0.00293)	(0.00893)	(0.0516)	(0.00285)
Age	0.0366***	0.0394**	0.00492***	0.0379***	0.0416**	0.00489***
	(0.00436)	(0.0176)	(0.00114)	(0.00431)	(0.0174)	(0.00115)
Age^2	-0.000317***	-0.000519**	-2.43e-05	-0.000338***	-0.000517**	-2.41e-05
	(6.98e-05)	(0.000234)	(1.63e-05)	(6.87e-05)	(0.000233)	(1.63e-05)
Free care	-5.064***	-8.822***	-0.108***	-4.971***	-9.485***	-0.107***
	(0.759)	(0.600)	(0.0120)	(0.729)	(0.603)	(0.0116)
CBI	-1.528**	1.946	-0.00177	-1.486**	1.814	0.0221
	(0.750)	(1.566)	(0.0690)	(0.750)	(1.670)	(0.0569)
IPM	-0.293	-3.760**	0.200**	-0.291	-3.628**	0.216**
	(0.328)	(1.672)	(0.0992)	(0.323)	(1.614)	(0.103)
Public health insurance	-0.0179	-0.239	-0.0648	-0.00465	-0.0631	-0.0479
	(0.160)	(0.553)	(0.0435)	(0.163)	(0.613)	(0.0571)
Reasons for consultation (ref: injection/medication)	-0.0415	1.349**	0.301	-0.0158	1.206*	0.274
Injury	(0.322)	(0.654)	(0.204)	(0.306)	(0.649)	(0.200)
Reasons for consultation:	0.261	0.427	0.0858*	0.241	0.275	0.0777
Disease	(0.257)	(0.467)	(0.0517)	(0.240)	(0.467)	(0.0550)
Reasons for consultation:	0.465*	0.816	0.220	0.503**	0.729	0.206
Maternal care						
	(0.257)	(0.548)	(0.179)	(0.243)	(0.546)	(0.176)
District dummies	YES	YES	YES	YES	YES	YES
ρ_1	-0.206			-0.168		
	(0.081)			(0.07)		
ρ_2	-0.050			0.084		
	(0.23)			(0.198)		

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, (1) Wald test: chi^2(2) =6.51 Prob >chi^2 = 0.03 , (2) Wald test: chi^2(2) =5.89 Prob >chi^2 = 0.0526.

Table 7: Determinants of household monthly expenditure with Heckman two-step[1] (n=491)

	(1)		(2)	
VARIABLES	$lnOOP_{2j}$	$oop^{*}_{1j} > 0$	$lnOOP_{2j}$	$oop^{*}_{1j} > 0$
Asset-based index	0.174**	0.150		
	(0.0832)	(0.120)		
Std(lntotexpm)			0.350***	0.341***
			(0.0707)	(0.121)
Household size	0.0629***	-0.0485*	0.0337*	-0.0803***
	(0.0192)	(0.0278)	(0.0178)	(0.0309)
Proportion of dependent members	0.140	0.794	0.357	0.977*
	(0.415)	(0.565)	(0.354)	(0.565)
Proportion of members with chronic illness	1.116**	-0.846	0.968**	-0.957
	(0.477)	(0.659)	(0.411)	(0.673)
Max year of education	0.0112	-0.0315	0.00634	-0.0311
	(0.0218)	(0.0324)	(0.0181)	(0.0321)
Proportion of members with free care	-1.700**	-0.695	-1.764***	-0.663
	(0.735)	(0.873)	(0.632)	(0.885)
Proportion of members with community-based health insurance	-1.400*	76.39	-1.225*	68.42
	(0.834)	(0)	(0.700)	(0)
Proportion of members with private compulsory insurance	-0.190	-0.126	-0.277	-0.207
	(0.441)	(0.534)	(0.379)	(0.547)
Proportion of members with public compulsory insurance	0.160	-0.644	0.201	-0.735
	(0.635)	(0.744)	(0.548)	(0.742)
One member sick during the last month		0.861***		0.799***
		(0.211)		(0.215)
District dummies	YES		YES	
IMR	-1.411**		-0.744	
	(0.702)		(0.610)	
Observations	491			
Uncensored observations	455			

Robust standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1

[1] All models include village dummies. Similar results are found by using the type of source of water for drinking as an exclusion restriction (φ=0.2*** and φ=0.38*** for the asset and expenditure indexes respectively). It is found that people who have access to non-drinkable water will be more likely to be sick and to have positive medical expenditure, which is confirmed by the results as people who drink water from unprotected well and drilling are more likely to have positive expenditure than those who have access to water from the public service.

Figure 1: Transmission channels through which income affects OOP medical expenses

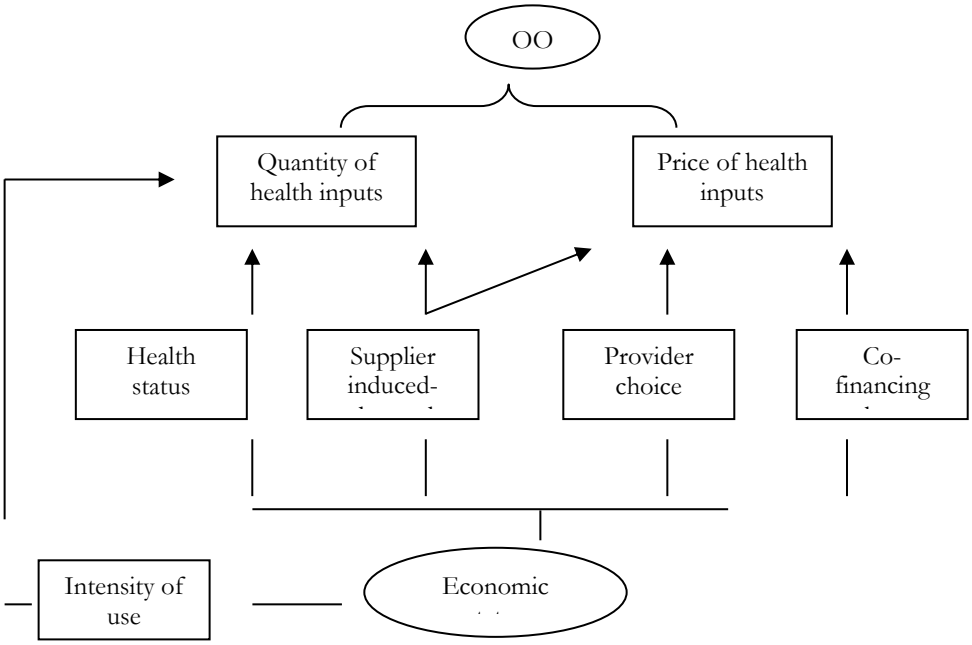
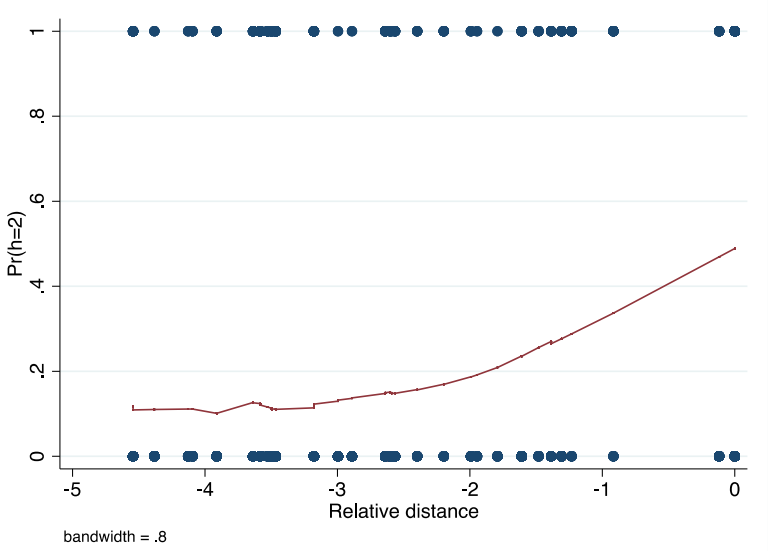


Figure 2: Average probability of visiting a high-level provider depending on the relative distance



Appendix 1: Determinants of drug prescription (ME)

VARIABLES	Received a drug prescription last medical visit	
Asset-based index	-0.00155	
	(0.00218)	
Std(lntotexpm)		0.00180
		(0.00170)
Household size	-1.39e-05	-0.000312
	(0.000480)	(0.000472)
Chronic disease	0.00262	0.00244
	(0.00392)	(0.00398)
Health status	-0.00148	-0.00161*
	(0.000980)	(0.000961)
Gender	0.00617**	0.00622**
	(0.00312)	(0.00315)
Education *i*	0.000533	0.000453
	(0.000461)	(0.000463)
Education *hh*	0.000982	0.000850
	(0.000606)	(0.000587)
Age	-5.64e-05	-6.42e-05
	(0.000263)	(0.000265)
Age squared	1.81e-06	1.84e-06
	(4.16e-06)	(4.21e-06)
Free care	-0.325***	-0.315***
	(0.128)	(0.126)
Community-based health insurance	-0.165***	-0.179***
	(0.127)	(0.137)
Private health insurance	0.00664	0.00652
	(0.00384)	(0.00408)
_Ireason_2: Injury	-0.00235	-0.00181
Reference: injection/medication	(0.0121)	(0.0119)
_Ireason_3: Disease	0.0432**	0.0436**
Reference: injection/medication	(0.0353)	(0.0365)
_Ireason_4: Maternal care	0.00729	0.00747
Reference: injection/medication	(0.00397)	(0.00386)
Observations	3,043	

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

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ENDNOTES

[i] As households differ in size and demographic composition, equivalence scales are used to make comparable consumption indicators. The cost of a child relative to that of an adult was fixed at 0.3 while the economies of scale was set at 0.8 following recommendations from Deaton and Zaidi (1999).

[ii] In Senegal, insured will receive co-payment at the time of the payment, which guarantees that the amount of OOPs is not over-estimated for insured patients.

[iii] One could argue that information on OOP medical expenses was collected from individuals who self-reported a health shock and whose response to this shock was subjective. In fact, individuals sought medical treatment from a qualified health worker when they considered that benefits outweighed the costs. One may want to note that although information on expenses is available for all individuals, there could be unobserved characteristics associated with these subjective considerations and the level OOP medical expenses. It is however unclear how these unobserved characteristics may affect the results.

[iv] At the time of the survey, US$1 =CFAF 475

[v] Note that a transformation was used in order to include the patients with nil expenditure.

[vi] Note that even the location of health facility is not likely to be very endogenous. First, it is not likely that sick individuals will migrate where there is a high-level provider available since farming households own agricultural lands. Moreover, the Government is not likely to build a hospital in an area where the population has specific characteristics. The health map of the area indicates that high-level providers are located cities but the low correlation between the relative distance and the asset-based indicator (coefficient correlation=-0.25) and the relative distance and the expenditure indicator (coefficient correlation=-0.06) does not really support the idea that richest households live in cities in those rural communities.

[vii] This corresponds to an increase in the relative distance (distance to hospital/distance to PHC facility) by three.

[viii] $\varphi^1(lnexpenditure) = 0.48$ and $\varphi^2(lnexpenditure) = 0.57$

[ix] This approach is based on the assumption that the measurement errors of the asset and expenditure indexes are not perfectly correlated. IV regressions were conducted with each income measure using the other measure as an instrument. The ratio of OLS to IV estimates can be considered an estimate of the ratio of signal to signal plus noise for the two indexes. This is a valid indicator of the relative degree of measurement error. The lower the ratio, the worse the index is as a proxy for predicting OOP medical expenses. When OOP medical expenses are regressed on the asset index using monthly expenditure as an instrument, the ratio of the OLS to IV estimates is 0.7. When OOP medical expenses are regressed on the expenditure index using asset index as an instrument, the ratio of the OLS to IV estimates is 1.9, yielding a ratio of the two of 0.36. A ratio of 1.9 (>1) is impossible to interpret in terms of attenuation bias since IV results suggest that the OLS results are biased upwards. However, the ratio of 0.7 indicates that there is a relatively low measurement error in the assets index. The low ratio is consistent with the finding that the two income measures are poorly correlated, since the R-squared of regressing expenditure on the asset index is only 0.09. These results suggest that measurement error is not the source of the differences in effect of income measures on OOP medical expenses.

[x] $e^{0.392}$=1.48 and $e^{0.383}$=1.47

[xi] These results are available from the authors upon request.