Using Respondents' Uncertainty Scores to Mitigate Hypothetical Bias in Community-Based Health Insurance Studies

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Abstract

Community-based health insurance has been implemented in several developing countries to help the poor to gain access to adequate health care services. Assessing what the poor are willing to pay is of paramount importance for policy-making. The contingent valuation method, which relies on a hypothetical market, is commonly used for this purpose. But the presence of the hypothetical bias which is most often inherent in this method tends to bias the estimates upward, and compromises policy-making. This paper uses respondents' uncertainty scores in an attempt to mitigate hypothetical bias in community-based health insurance in one rural setting in Cameroon. Uncertainty scores are often employed in single dichotomous choice surveys. An originality of the paper is to use such an approach in a double-bounded dichotomous choice survey. The results suggest that this instrument is effective at decreasing the mean WTP.

Keywords: *Community-based health insurance, contingent valuation method, hypothetical bias.*

JEL Classification: C35, D80, I38.

1. Introduction

Access to adequate health care services is a fundamental right for every human being. In the Declaration of Alma Ata in 1978 [1], health is considered as a good that must be available to all the strata of the population. Since then, "Health for All" has become a major goal for any health program in Africa, and there has also been active research to develop effective health policies to improve the well-being of the poor in rural areas. Community-Based Health Insurance (CBHI)[1] has been proposed in an attempt to provide health care service to low-income households. The main characteristics of CBHI are the followings: voluntary membership, non-profit objective, link to a health care provider (often a hospital in the area), and risk pooling relying on mutual aid/solidarity [2, p.5]. CBHI is relevant to a large number of people who would otherwise not have health protection as argued by Jakab and Krishnan [3]. Most CBHI schemes have evolved in the context of severe economic constraints, and lack of market-based health insurance to provide adequate health care to low-income households. The high transaction cost in market-based health insurance partly contributes to exclude low-income households from the reach of formal insurance.

Though CBHI may help the poor to improve their health, it has some limitations. Firstly, some households are reluctant to conventional medicine because of their culture and/or their religion according to Wiesmann and Jütting [4]. For instance, in some societies, households interpret sickness as the wish of gods and hence refuse conventional medicine. Secondly, the poorest of the poor cannot afford CBHI according to Desmet et *al.* [5] who showed that the poorest people in Bangladesh refused to participate to CBHI, unlike middle and low income people. In another study taking place in Senegal, Jütting [6] also found that the lowest income households rejected this health insurance scheme (other examples can be found in Ahuja and Jütting [2] and in Jakab and Krishnan [3]). Thirdly, a high social capital in the community contributes to the success of CBHI [7]. CBHI requires people to have a network and trust each other. Fourthly, adverse selection [8, 9] and moral hazard problems [10-12] could pose a threat to the development of CBHI. Finally, the effectiveness of CBHI depends on the available resources. The government may not have enough resources to set up such scheme and run it. The government may need external funding from international organizations [13].

[1] CBHI is also sometimes called community health funds, mutual health organizations or rural health insurance.

Over the last decades, there has been an increase of CBHI in the African continent, especially in rural areas. In eleven Western French African countries, CBHI has increased from 366 to 626 from 2003 to 2006 [14]. Before expanding such risk-sharing mechanism in rural areas, policymakers need to know what households living in this area are willing to pay. The estimation of such demand is of paramount importance since it gives information for conceiving strategies to increase allocative efficiency of resources, and to improve the quality of life in the rural areas. A way to estimate the demand for CBHI is to use the Contingent Valuation (CV) method which consists of presenting a hypothetical change to the respondents and asking them how much they are willing to pay for it. Nevertheless, the main difficulty that many researchers encounter in this method is the hypothetical bias. In CV survey, some respondents are not truthful when revealing their Willingness-To-Pay (WTP) because they do not fully consider their budget constraint. The discrepancy between WTP and ability to pay, or hypothetical bias, may be high in Africa due to low income, especially in rural areas. For instance, results may suggest that people are very interested in CBHI, and that policy-makers ought to implement it, although it might not be the case. This stresses the need to implement tools that mitigate hypothetical bias in CV surveys conducted in rural Africa.

Up-to-date hypothetical bias has not been addressed in CV studies focusing on CBHI. Hence, the overall objective of this paper is to deal with hypothetical bias in a CV survey conducted in rural Cameroon. The approach proposed by Champ et *al.* [15] is followed for this purpose. Follow-up Certainty Questions (FCQ) are used to reduce the mean WTP. To the best of our knowledge, this approach has never been used in Double-Bounded Dichotomous Choice (DBDC) studies although it has been used in Single-Bounded Dichotomous Choice (SBDC) surveys, as it will be explained in the next section. The rest of the paper is organized as follows: Section 2 proposes an overview of the treatment of hypothetical bias in CV survey. Section 3 presents the methodology used, while section 4 focuses on the survey design and administration of the questionnaire. Section 5 considers the empirical results of the study, section 6 discusses the findings and section 7 concludes with some policy implications.

2. Previous studies

A significant number of studies have used CV to estimate the WTP for CBHI in some rural areas of developing countries, including Namibia [16], India [17, 18], Burkina Faso [19-21], Ghana [22] and Nigeria [23]. It comes out from these studies that most rural household heads

are willing to pay for CBHI. Nevertheless, these studies do not address the hypothetical bias that most often leads to an overestimatimation of WTP. The results may thus not be fully reliable for policy purposes.

There exist two main approaches to mitigate hypothetical bias in CV survey: ex-ante approach and ex-post approach. Ex-ante approach is used before the valuation question. It consists of: (a) reminding the respondents to take into consideration their budget before stating their WTP [this is called budget reminder, see for instance: 24, 25], (b) warning the respondents about the existence of the hypothetical bias in CV studies, and explicitly asking them to respond to the valuation question as if the payment was real[2] [this is called cheap talk, see for instance: 26, 27-29], (c) giving respondents time to think to respond to the valuation question [see for instance: 30], (d) explicitly informing the respondents that they should consider that the results of the study will be consequential, [31] or (e) asking respondents to sign an oath of honesty or to swear (or promise) to answer truthfully as if they were in a courtroom [this is known as explicit contract between the interviewer and the interviewee, see for instance: 32, 33, 34]. The ex-post approach addresses hypothetical bias with FCQ after the valuation question. Respondents are asked to state how certain they are regarding their answer to the WTP question. The certainty responses can be either quantitative [35, 15] or qualitative [36, 37]. In the former, the respondent is asked how sure he feels about his answer on a scale ranging from 1 to 10 for instance. "Yes" respondents who are unsure about their answers, as suggested by responses to the FCQ, are treated as "no" respondents. This recoding approach has proven to be effective at mitigating hypothetical bias and has produced promising results over the past years [36, 38, 39].

So far, this recoding approach has only been applied in studies using the SBDC format, which provides limited information on WTP. A single bid amount is assigned to the participant who is asked to state whether he would accept to pay for the good at the given amount. In the DBDC format, two subsequent bids are offered to the respondent, if the respondent accepts the first bid or states "yes" to the initial single bounded question, a higher bid is offered in the

[2] The use of the cheap talk in CV survey has produced controversial results. In some studies, the cheap talk has been effective to reduce the hypothetical bias. In other studies, the use of cheap talk has exacerbated the hypothetical bias. Furthermore, the use of budget reminder and substitutes were also ineffective in many studies.

second bounded question, and vice versa. The recoding approach can also be applied to the second bid responses, as will be explained in the next section.

3. Methods

Though the issue of WTP uncertainty is commonly addressed in the field of environmental economics, it is seldom addressed in the field of health economics. This gives room for more investigation especially for health care services. Hypothetical bias might be explained by the uncertainty in responses to CV survey. Li and Mattson [40] assumed that respondents had incomplete knowledge about their true valuation of a commodity and might give wrong answers to the valuation question, i.e. their answers do not match their true WTP. In the context of CV surveys, respondents may be uncertain about their WTP because they are uncertain about the provision of a public good or because they are uncertain about their future income [41].

In the SBDC, there are two options that are available to respondents: the status quo $\left(q^{o}\right)$ and the proposed change $\left(q^{1}\right)$. As the proposed change (CBHI) corresponds to an improvement, $q^{1} \succ q^{0}$ and $v\left(p,q^{1},y,s,\varepsilon\right) > v\left(p,q^{0},y,s,\varepsilon\right)$ where $v(\bullet)$ is the indirect utility function which depends on p the price of the market goods, q the non-market item to be valued, y the level of income, s the individual's characteristics and ε a stochastic component allowing for Random Utility Maximization (RUM).

In the survey, the respondent is informed that the change will cost him a certain amount A and he is then asked whether he would be in favor of it at that price. The respondent will answer "yes" if only $v\left(p,q^{1},y-A,s,\varepsilon\right) \geq v\left(p,q^{0},y,s,\varepsilon\right)$ and "no" otherwise. Hence,

$$\Pr\left\{response\ is\ "yes"\right\} = \Pr\left\{v\left(p,q^{1},y-A,s,\varepsilon\right) \geq v\left(p,q^{0},y,s,\varepsilon\right)\right\} \quad (1)$$

By using the compensating variation measure, the quantity C satisfies:

$$v\left(p,q^{1},y-C,s,\varepsilon\right) = v\left(p,q^{0},y,s,\varepsilon\right)$$

Thus, $C = C\left(p,q^{0},q^{1},y,s,\varepsilon\right)$ represents his maximum WTP for the change from q^{0} *to* q^{1}. It follows that he answers "yes" if the stated price is less than his WTP and "no" otherwise. Hence, an equivalent condition to (1) is:

$$\Pr\{response\ is\ "yes"\} = \Pr\left\{C\left(p, q^0, q^1, y, s, \varepsilon\right) \geq A\right\} \quad (2)$$

Furthermore, it is assumed that $C\left(p, q^0, q^1, y, s, \varepsilon\right)$ is a random variable, while the respondent's WTP for the change in q is something that he himself knows, it is something that the researcher does not know but treats as a random variable. Let $G_c(\bullet)$ be what the investigator assumes is the cumulative distribution function of *C*, and $g_c(\bullet)$ the corresponding density function. Then (2) becomes:

$$\Pr\{response\ is\ "yes"\} = 1 - G_c(A) \quad (3)$$

The form of the function $G_c(A)$ determines the econometric model to be used. If the $G_c(A)$ follows a normal standard distribution and the model to estimate is linear, then the expected mean WTP is:

$$Mean\,WTP_{SBDC} = -\frac{\alpha}{\beta}, \quad (4)$$

where α is the intercept and β the estimated marginal utility of income.

In the DBDC, two subsequent bids are offered to the respondent, if the respondent accepts the first bid or states "yes" to initial single bounded question (hereafter denoted A), a higher bid is offered to him in the second bounded question (hereafter denoted B), and vice versa (the lower bid is denoted C). The WTP is unobserved by the researcher and there are three cases depending on the respondent's answer: WTP lies somewhere (1) between the two bids ("yes" –"no", "no" – "yes"), (2) below the second bid ("no" – "no") or (3) above it ("yes" – "yes").

The interval data model [42] can be used to estimate the mean WTP and to explore the determinants of WTP. This model corresponds to a reparametrization of RUM model proposed by Hanemann *et al.* [43]. The WTP, which is unobserved, is treated as a latent variable. The function to be estimated is:

$$WTP_i = x_i'\beta + \varepsilon_i, \quad (5)$$

where WTP_i is the unobserved willingness-to-pay, x_i a vector of explanatory variables including individual's characteristics, and ε_i a random component following a normal

distribution with mean zero and standard deviation σ. The linear form is chosen over the log-linear form because the latter generally leads to a higher mean WTP [44, 45].

The probabilities associated to each case are:

$$\mathrm{P}(t_{li} < WTP_i < t_{ui}) = \mathrm{P}\left(\frac{t_{li} - x_i'\beta}{\sigma} < z_i < \frac{t_{ui} - x_i'\beta}{\sigma} \right) = \Phi(z_{ui}) - \Phi(z_{li}), \quad (6)$$

$$\mathrm{P}(WTP_i < t_{ui}) = \mathrm{P}\left(z_i < \frac{t_{ui} - x_i'\beta}{\sigma} \right) = \Phi(z_{ui}), \quad (7)$$

$$\mathrm{P}(t_{li} < WTP_i) = \mathrm{P}\left(\frac{t_{li} - x_i'\beta}{\sigma} < z_i \right) = 1 - \Phi(z_{li}), \quad (8)$$

where t_{li} denotes the lower bound, t_{ui} the upper bound, z is the standard normal variable and Φ is the cumulative distribution function of the standard normal distribution.

The following log-likelihood function can then be maximized for N independent observations to estimate both β and σ:

$$\mathrm{LnL} = \sum_{i=1}^{N} \left[I_i^1 . \ln(\Phi(z_{ui}) - \Phi(z_{li})) + I_i^2 . \ln(\Phi(z_{ui})) + I_i^3 . \ln(1 - \Phi(z_{li})) \right], \quad (9)$$

where the indicator variables I^1, I^2 and I^3 take the value one when the argument is true and zero otherwise. The mean WTP is estimated by removing the explanatory variables from the WTP function. The model applies to both calibrated and non-calibrated mean WTP.

To address hypothetical bias, the FCQ calibration is used, based on the Champ et *al.* [15]'s approach. A scale ranging from 1 (very uncertain) to 10 (very certain) is displayed to the respondents. "Yes" responses are then recoded as a "no" responses if the participant states a score that is below a given threshold that is set by the researcher. In the current study, a threshold of 7 out of 10 is set like in Ethier et *al.* [38], Poe et *al.* [46][3]. All "yes" answers are

[3] These authors found that a certainty level of "7 or higher" best corresponded with actual participation rates. They also recommend that lower levels of FCQ in hypothetical payment should be used to calibrate hypothetical values to actual contributions. The use of a certainty level of "7 or higher" in this paper reflects this more conservative approach to calibration.

recoded into “no” if the answer to the FCQ is below 7. This rule can also be applied to the second bid. If the individual responds “yes” to the second bid amount and is uncertain about his WTP, the “yes” answers can be treated as a “no” answer. Table 1 illustrates the different cases.

[Insert Table 1 here]

A one-tailed paired t-test is used to compare the calibrated and non-calibrated mean WTP:

$$\begin{aligned} H_o &: WTP_{NC} - WTP_C \leq 0 \\ H_1 &: WTP_{NC} - WTP_C > 0 \end{aligned} \tag{10}$$

where WTP_C and WTP_{NC} correspond to the calibrated and non-calibrated mean WTP respectively. Both mean are calculated using the interval data model [42].

The rejection of the null hypothesis at the conventional level of significance would suggest that the calibration approach is effective at reducing the mean WTP.

4. Survey design and administration

The policy being valued in the study is the provision of CBHI to the rural households in Bandjoun (West province of Cameroon, Central Africa). A strategic plan for the promotion and development of CBHI in Cameroon by policymakers is adopted. It aims at: (a) putting in place CBHI per health district by 2015, (b) covering at least 40% of the population by the CBHI by 2015. A representative sample of 369 rural households was used. The heads of households were interviewed using a face-to-face interview by a two-stage cluster sampling technique. First, six villages were selected based on population size and availability of public health care facilities. The names of the six villages were: Tsela, Mbiem, Mbouo, Pète, Dja and Toba. Second, household heads in these villages were randomly selected. The CV questionnaire was conceived and administered by following guidelines prescribed by Arrow et *al.* [47], Carson [48], Whitehead [49] and Whittington [50]. Focus groups and pretest were performed before the final questionnaire. They showed that some participants refused to pay for CBHI because they did not believe that the conventional medicine was effective. Thus, the final questionnaire highlighted the advantages of the conventional medicine over the

traditional medicine. For instance, it was explained to the participants that they could die if they did not go to hospital when getting sick. Furthermore, the focus group and pretest stages showed that some people did not trust the government. It was further explained that a NGO would establish CBHI.

The scenario was worded as follows: *A trustworthy NGO would establish a health insurance scheme in your community so that you and your whole family (ten members at most) can use health care services at any nearest public health care facility. The following health services would be offered to you: diagnosis, laboratory tests, surgeries, drugs, childbirth etc. If you decided to join such a system and be covered when you and your family get sick, you would pay a monthly amount as premium. Furthermore, this community insurance would be managed by a committee that you and other households in your community would elect. The committee would use the premiums to pay for drugs, laboratory tests and so on. The premiums paid would be kept in the bank and be managed by the committee. The committee would give an up-to-date financial report to you and the other members involved in this community-based health insurance on a regular basis.*

Following Arrow et *al.* [47], visual aids were used to better transmit the core message of the scenario[4]. To mitigate hypothetical bias, both ex-ante approach and ex-post approach were used like in Whitehead and Cherry [29]. In the ex-ante approach, people were asked to consider their income and were explained that the survey will be made available to policy makers: *Before answering the questions below, consider the advantages associated with the proposed scheme, your monthly income, and also that, there are other things your money could be spent on. Note also that the results of this study will be made available to policymakers, and could serve as a guide for future decisions.* The 10-point likert scale of Champ et *al.* [15] was used for the ex-post approach. "Yes" respondents were asked to assess how certain they were regarding their answer to the WTP question: *So you think that you would pay the amount X CFA francs to have the above benefit. We would like to know how sure you are of your response. On a scale ranging from 1 to 10, where 1 means "Very Uncertain" and 10 means "Very Certain", how certain are you that you would pay the amount X CFA francs monthly if the program were actually implemented in your village?*

[4] In addition to the use of visual aids, we chose enumerators that were from the local areas and sometimes, the administration of the questionnaire was done in the local language.

Focus groups and pretests were conducted to set the bid amounts that were used in the final survey and to ensure that the questionnaire was properly honed. Each respondent of the final survey was assigned one of the following bids: 250, 350, 450, 550, 650 and 800 CFA francs, the bid being randomly assigned to the respondents as recommended by Mitchell and Carson [51]. The follow-up bids were the double of the initial bids if the respondent answered "yes" to the valuation question and half of the initial bids if he answered "no".

5. Results

Table 2 provides the different variables used in the study and some descriptive statistics.

[Insert Table 2 here]

Regarding the SBDC, we investigate whether the probability of "yes" responses monotonically decreases as the bids increase. Figure 1 clearly indicates that the percentage of "yes" responses based on the first bids is downward sloping. This suggests a downward sloping Hicksian demand function. This figure demonstrates that the responses of households are in conformity with expectations. In fact, as the premiums increase, WTP for CBHI decreases.

[Insert Figure 1 and Table 3 here]

Following Loomis and Ekstrand [52], we compare the efficiency gain of the DBDC over the SBDC. The ratio of the confidence interval to the mean WTP is used as a relative measure of efficiency of WTP estimates (CI/mean = (Upper bound – lower bound)/meanWTP). The lower the ratio, the higher the efficiency. A close look at the estimates in table 4 confirms that the ratio of the confidence interval to the mean WTP of DBDC is lower than that of the SBDC ($0.15<0.68$)[5]. Accordingly, DBDC yields WTP estimates that are more efficient than the ones obtained in the SBDC. This is a justification of using the DBDC in the current study.

[Insert Table 4 here]

[5] The DBDC yields four times efficiency gains as compared to the SDBC.

The regression results for the interval regression of the DBDC are shown in table 5. As shown by the coefficients of age in the regression results, when the respondent is young, a one unit increase of age has a large negative effect on the WTP for CBHI. But when he is older, a one unit increase of age has a lower effect on the WTP. Furthermore, the household heads who have been more involved in associations are more willing to pay for CBHI. This is consistent with other studies that showed that social cohesion and solidarity influence WTP for CBHI [53, 7]. The coefficient related to religion is positive and statistically significant implying that household from catholic religion has a higher WTP than those practicing other religions, or not practicing any religion.

The positive and significant coefficient of the usual means of seeking treatment implies that the household heads who regularly use the conventional means of seeking treatment (clinics/hospitals) when sick are more willing to pay than those who use other means (traditional healers, herbalists). This variable is an important factor for establishing CBHI since the establishment of the CBHI requires the regular use of conventional means of treatment. Policymakers may decide to launch mass media communications to educate households. The positive sign of the coefficient of the income is in conformity with microeconomics theory and intuition. Out of the six villages that were surveyed, the WTP was positive and significant in three villages (Mbouo, Dja and Toba). Thus, policymakers may decide to set up CBHI in these villages in priority.

[Insert Table 5 here]

The mean WTP for CBHI was computed by following Cameron [42] and removing the explanatory variables in equation 5. The mean WTP without calibration $\left(WTP_{NC}\right)$ is 973.63 CFA francs/person/month ($2.07) as shown in table 6. The calibrated mean WTP $\left(WTP_{C}\right)$ is 804.82 CFA francs/person/month ($ 1.71) (see table 6). When comparing the two means, it comes out that the difference between the two means $\left(\Delta = WTP_{NC} - WTP_{C}\right)$ is positive (168.81 CFA francs) and statistically significant at 5% (p-value = 0.00).

[Insert Table 6 here]

6. Discussion

Several factors may explain why WTP for CBHI can be overestimated. First and foremost, income is very low in Africa, especially in rural areas, so it is very easy to violate the budget constraint when stating WTP. Furthermore, most rural household heads are not familiar with CBHI. In the current study, only 27.07% of households reported to know what CBHI is all about. As outlined by Mitchell and Carson [51], the degree of hypothetical bias increases with the level of unfamiliarity with the good. Another explanation is the social desirability. In fact, CBHI aims at providing health care services to the poor, respondents may consider it as a good cause for the poor and will eventually make themselves look good when answering CV questions. Giving the importance of the estimates of the WTP for CBHI to policymakers, researchers conducting CV survey must thoroughly address the hypothetical bias, and the use of the FCQ may be effective for this purpose.

Addressing the hypothetical bias in an African rural setting is a big challenge for researchers. The illiteracy of households in rural areas may affect their understanding of the CV scenario and the FCQ. One way of tackling this issue is the use of visual aids [47]. Another challenge is the cost of setting-up a CV study. In some cases, this cost may be higher than the budget of the entire insurance. Researchers may try to limit the sample size by using an elicitation question that provides a high level of information such as the DBDC. Other researchers may decide not to conduct surveys and use the benefit transfer method[6]. These researchers may transfer available information from WTP studies already completed in another location and/or context which are similar.

7. Conclusions

The poor in rural communities of developing countries lack adequate resources to cope with the burden of diseases. CBHI is now used in different parts of Sub-Saharan African countries and policymakers are keen to know what the poor are willing to pay for CBHI. A way to value this demand is to undertake a CV survey. Nevertheless, the WTP estimates can be biased since the hypothetical bias is inherent to the CV survey. Up-to-date, no studies have been conducted to address the hypothetical bias in CBHI. Furthermore, the issue of

[6] Benefit transfer can sometimes be used when one does not have the budget or the time to carry out a survey

hypothetical bias is seldom treated in health economics. Thus, the overall objective of the paper was to deal with the hypothetical bias in CBHI in one rural setting in Cameroon. To achieve this, the FCQ was used to calibrate the respondents' answers to the valuation question. The FCQ for each of the two yes/no responses was used, which has never been done in CV studies, to the best of our knowledge. The results of the study show that the mean WTP decreases when applying the calibration approach, which suggests the presence of hypothetical bias. The use of the FCQ reduces the mean WTP estimates by about 17%, which ranges from 973.63 CFA francs/person/month ($2.07) to 804.82 CFA francs/person/month ($ 1.71).

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Table 1: Willingness-to-pay bounds in DBDC with calibration

Response to the first bid A	Response to the second bid B,C (B>A>C)	Certainty level to the first bid	Certainty level to the second bid	Outcomes	WTP bounds
Yes	Yes	≥ 7	≥ 7	Yes-Yes	$WTP \in [B, +\infty[$
Yes	Yes	≥ 7	< 7	Yes-No	$WTP \in [A, B[$
Yes	Yes	< 7	≥ 7	No-No	$WTP \in]-\infty, A[$
Yes	Yes	< 7	< 7	No-No	$WTP \in]-\infty, A[$
Yes	No	≥ 7		Yes-No	$WTP \in [A, B[$
Yes	No	< 7		No-No	$WTP \in]-\infty, A[$
No	Yes		≥ 7	No-Yes	$WTP \in [\mathrm{C,A}[$
No	Yes		< 7	No-No	$WTP \in]-\infty, C[$
No	No			No-No	$WTP \in]-\infty, C[$

Notes: when the first "yes" response is recodes as "no", the second answer is automatically recodes as "no". This ensures the two responses to be consistent.

Table 2: Description of the variables and summary statistics

Variable	Description	Mean	Standard deviation	Min	Max
Male	Gender of the respondent (1 if the respondent is a male, 0 otherwise)	0.61	0.49	0	1
Healthstate	Health status of the respondent (1 if the respondent has a poor or very poor health state, 0 otherwise)	0.73	0.44	0	1
Knowledge	Knowledge regarding the concept of community health insurance (1 if respondent knows the concept, 0 otherwise)	0.25	0.43	0	1
Hhnumber	Number of people in the household (continuous)	6.22	3.91	1	30

Age	Age (number of years)	42.25	12.44	22	82
Farmer	Profession (1 if the respondent is a farmer/seller, 0 otherwise)	0.53	0.49	0	1
Meanstreatment	The means of seeking treatment when any member of the household falls sick (1 if conventional, 0 otherwise)	0.84	0.38	0	1
Education	Level of education of the respondent (1 if the respondent has been to school at least 7 years, 0 otherwise)	0.95	0.22	0	1
Involvement	Participation of the respondent in an association (1 if yes, 0 otherwise)	0.52	0.50	0	1
Income	Income of the respondent (continuous, expressed in thousands of CFA francs)	37.134	44.85	7.5	202.5
Catholic	Religion (1 if Catholic, 0 otherwise)	0.58	0.49	0	1
Qualityhealth	Quality of health care services in the public health care facility (1 if the health care services are of good quality, 0 otherwise)	0.32	0.47	0	1
Distance	Distance between the house of the household and health public facility in kilometers (continuous)	1.60	1.26	0.01	8

Village Mbiem	Village of the respondent (1 if the respondent lives in Mbiem, 0 if he lives in Tsela)	0.17	0.37	0	1
Village Mbouo	Village of the respondent (1 if the respondent lives in Mbouo, 0 if he lives in Tsela)	0.15	0.37	0	1
Village Pète	Village of the respondent (1 if the respondent lives in Pète, 0 if he lives in Tsela)	0.15	0.36	0	1
Village Dja	Village of the respondent (1 if the respondent lives in Dja, 0 if he lives in Tsela)	0.16	0.37	0	1
Village Toba	Village of the respondent (1 if the respondent lives in Toba, 0 if he lives in Tsela)	0.18	0.39	0	1

Figure 1: The aggregate demand curve for CBHI based on the first answer

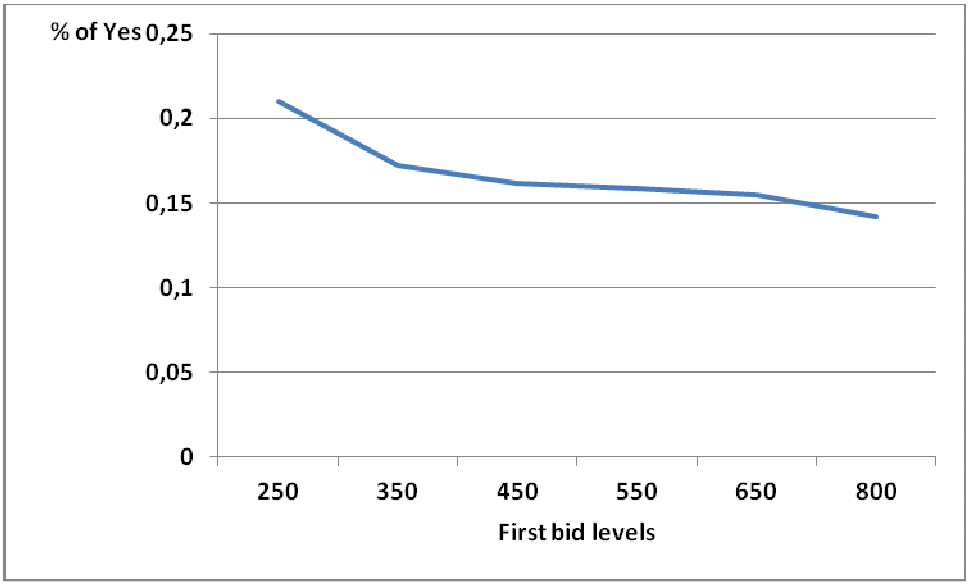

Table 3: Regression results for SBDC

Variable	Probit model
Bid	-0.001* (0.0003)
Intercept	1.73* (0.23)
LogL	-176.91
Pseudo R^2	0.04

Table 4: Comparison of the mean WTP between SBDC and DBDC

Statistic	*Value*
Mean WTP_{SBDC}	1064.95 (140.74)
$CI/Mean_{SBDC}$	0.68
Mean WTP_{DBDC}	973.63 (38.03)
$CI/Mean_{DBDC}$	0.15

Notes: $MeanWTP_{SBDC}$, $MeanWTP_{DBDC}$ are the mean WTP of the SBDC and DBDC respectively. $CI/Mean_{SBDC}$ and $CI/Mean_{DBDC}$ are the relative measure of efficiency of WTP estimates of the SBDC and DBDC respectively.

Table 5: Results of the interval data regression model without the certainty calibration

Variables	Coefficients
age	-33.14** (14.92)
Age²	0.29** (0.15)
Male	27.34 (67.65)
Income	2.2*** (0.85)
Distance	-27.84 (24.08)
Meanstreatment	218.8** (87.93)

Knowledge	58.94
	(75.10)
Involvement	207.4***
	(75.31)
Farmer	-77.55
	(64.45)
Village Mbiem	-173.0*
	(104.1)
Village Mbouo	200*
	(103.2)
Village Pète	92.32
	(107.3)
Village Dja	364.1***
	(107.5)
Village Toba	324.9***
	(126)
Education	113.3
	(97.97)
Catholic	129.1*
	(66.08)
Qualityhealth	10.08
	(67.01)
Healthstate	37.72
	(70.82)
Hhnumber	10.59
	(8.47)
Intercept	1043.7***
	(372.1)

Notes: ***, **, and *significant at 1, 5 and 10% respectively. Standard errors are in brackets.

Table 6: Mean comparison

Mean WTP	**Value without calibration**	**Value with calibration**	**P-value**
$MeanWTP_{SBDC}$	1064.95	975.49	0.00
	(140.74)[1]	(179.41)	
$MeanWTP_{DBDC}$	973.63	804.82	0.00
	(38.03)	(33.03)	

Notes: the delta method is used to calculate the standard errors.