TITLE

Does community-based health insurance protect household assets? Evidence from rural Africa

ABSTRACT

Objective: To evaluate whether community-based health insurance (CBHI) protects household assets in rural Burkina Faso, Africa

Data sources: Data was used from a household survey that collected primary data from randomly selected households, covering 42 villages and 1 town, during 2004-07(n=890).

Study design: The study area was divided into 33 clusters and CBHI was randomly offered to these clusters during 2004-06. We applied different strategies to control for selection bias – ordinary least squares with covariates, two-stage least squares with instrumental variable and fixed effects models.

Data collection: Household members were interviewed in their local language every year and information was collected on demographic and socioeconomic indicators including ownership of assets, and on self-reported morbidity.

Principal findings: Fixed effects and ordinary least squares models showed that CBHI protected household assets during 2004-07. The two-stage least squares with instrumental variable model showed that CBHI increased household assets during 2004-05.

Conclusions: CBHI protects household assets. For a subsidized scheme, CBHI also has the potential to increase household assets. Similar studies from developing countries that evaluate the impact of health insurance on household economic indicators are needed to benchmark these results with other settings.

Key words: health insurance; Burkina Faso; instrumental variable; fixed effects; assets

INTRODUCTION

In this paper we studied the effects of a community-based health insurance (CBHI) scheme on household assets in rural Burkina Faso, Africa. Burkina Faso, is one of the poorest countries in the world with 43% of its population living below the poverty line.

In a low-income country like Burkina, where 90% of the population is engaged in subsistence agriculture, cash flows of the households are unreliable and subject to seasonal fluctuations. Households often find it impossible to pay for health services, especially before the rainy season. Households who can pay and decide to visit a doctor incur out-of-pocket (OOP) expenditures that can sometimes be catastrophic for them. This does not necessarily mean that the OOP expenditures are large, but since the income of the households is low, OOP expenditures can constitute a large proportion of their income thereby reducing funds available for basic needs like food, clothes etc (Leive, and Xu 2008; McIntyre et al. 2006; van Doorslaer et al. 2007). A study conducted in 2000-01 in this area found that 6-15% of the households incurred health expenditures that can be regarded as catastrophic (Su, Kouyaté, and Flessa 2006). In the absence of adequate cash savings, households often resort to selling assets, especially livestock to pay for health costs (Sauerborn, Adams, and Hien 1996). This can have an added disadvantage as assets or livestock, like plough or donkeys, could also assist the household in agricultural production. Moreover, loss of livestock leads to loss of their produce e.g. milk that could have been used for self-consumption or sold in the market.

Expectation of large health costs can induce households to delay treatment or opt for self-treatment or traditional medicine, which are perceived as cheaper options (Dong et al. 2008; Mugisha et al. 2002; Uzochukwu et al. 2008). Traditional medicine and self-treatment lead to delay in accessing care from trained professionals. Makinen (2000) estimated that in Burkina Faso only 13% of those reporting ill, visited a doctor. Delay in appropriate treatment is likely to worsen illnesses. This can cause productivity and income losses for the sick and the caregiver. It can also warrant urgent and more costly treatment at the health facilities.

Hence health costs, if paid by selling assets, not only have the potential to reduce current assets, but also reduce farm productivity, nutrition intake, and future stream of income. To avoid these costs, households tend to delay appropriate treatment, exposing them to greater health risks. Reduction in current assets and productivity losses also affect future accumulation of assets.

Against this backdrop, in Burkina Faso and in other countries in Africa, where national health insurance programs were lacking, CBHI became popular in the 1990s. The aim of such schemes was to facilitate access to healthcare and increase financial protection against the cost of illness. Recently, many of these countries have shown an interest to achieve universal coverage in the future. Some are contemplating linking and expanding the coverage of the already existing CBHI schemes as a step towards achieving this goal (Coheur et al. 2007; Tabor 2005). However, in spite of the increasing interest in CBHI, evidence on the impacts of such schemes still remains mixed (Carrin 2003; Ekman 2004; Palmer et al. 2004; Preker et al. 2002).

Two of the main reasons for this gap in evidence are methodological challenges and lack of adequate data. For most of the schemes, enrolment is voluntary. Simply comparing the level of outcomes between insured and uninsured will generate biased results. This is because the insured and the uninsured are different in terms of observed aspects, which can be measured, but also in terms of unobserved aspects. Studies, that fail to control for these differences, can give misleading program effects. There are methods available to correct for this selection bias, but they require appropriate data. For many of these schemes that function in a resource poor setting, collecting data that can be used to measure program impacts is not a priority. Hence, either the data is not available or even if it is available, self-selection problem is not properly addressed (Savedoff, Levine, and Birdsall 2006).

As far as the authors know this is the first article that has studied the impact of health insurance on household economic health in developing countries. This is an important issue as the key reason for health insurance is to provide financial protection. Studies have concentrated mainly on health costs that capture the immediate effects of health insurance incurred by those who access healthcare. These costs if financed by selling assets like farm implements or livestock, a common practice in developing countries, can have a negative impact on the future health and income generating capacity of the household. Therefore, it is essential to investigate not only the impact of health insurance on health utilization and costs but also to investigate the long term effects of health insurance on the overall economic health of the households. The latter is rarely studied and this article aims to fill this gap in evidence. Currently, many developing countries are making plans to move towards achieving universal health insurance. One option before them is linking and integrating the current CBHI schemes in their countries. In this context, documenting the effects of such schemes is even more critical.

The purpose of this paper is to measure the impact of a CBHI on household assets in rural Burkina Faso. CBHI was randomly offered to the villages in the study area in a step-wedge cluster randomized community-based trial (CRCT). In the context of CBHI, CRCT is rarely conducted in low-income countries. In the past, similar CRCTs have been conducted in India and Mexico (King et al. 2007; Morris et al. 2007; Ranson et al. 2007; Ranson et al. 2006). Availability of this rare experiment coupled with panel data, which is also not commonly available from low-income countries, made it possible for us to provide unbiased estimates of the impact of CBHI on household assets.

The CBHI Scheme

A CBHI scheme, "*Assurance Maladie à Base Communautaire*", was introduced in the Nouna Health District, Burkina Faso in 2004 in a CRCT. The area, with approximately 70,000 individuals spread over

41 villages and Nouna town, was divided into 33 clusters: 24 rural (villages) and 9 urban (town of Nouna). Small neighboring villages that shared common ethnic and kin ties were grouped together to form a single cluster. One sector of Nouna town and another village were divided into two clusters each. Each year, 11 randomly selected clusters were to be progressively offered the opportunity to enroll into CBHI. The trial is described in more details elsewhere (De Allegri et al. 2008). Due to practical and ethical considerations, the two larger regions that were divided into smaller clusters were offered CBHI at the same time. Therefore, for this study, we regarded them as two clusters instead of four. Consequently, we counted 31 clusters instead of 33.

Enrolment into CBHI was voluntary. The unit of enrolment was a household, but the premium was set on an individual basis: 1500 CFA (2.29€) for an adult and 500 CFA (0.76€) for a child (less than 15 years old). The premium was set based on feasibility and willingness-to-pay (WTP) studies which had been previously conducted in this region (Dong et al. 2003; Dong et al. 2004). The premium was fixed at the median WTP amount for enrolling a household. The premiums were not enough to cover all the costs associated with providing CBHI. The gap in costs was filled by funds from the Burkinabe Ministry of Health and an international donor. The premium for the entire household was paid in one single installment, at the beginning of the year, after the harvest. Membership had to be renewed yearly. To limit adverse selection, insured were asked to maintain a three month waiting period during which they were not entitled to receive CBHI benefits. Due to low enrolment among poorer households, from 2007 onwards, the premium was subsidized for the poor: 750 CFA (1.14€) for an adult and 250 CFA (0.38€) for a child. The poorest 20% households in every village were identified by a wealth-ranking method described by Souares et al. (2010) and were offered the opportunity to enroll at a reduced premium.

The benefit package included a wide range of medical services available in the Nouna Health District comprising of 6 first-line health facilities (by 2007, there were 7) and the District Hospital in Nouna. The insured were asked to seek care at a pre-assigned health facility. There was no copayment, deductibles or ceiling on the benefits.

METHODS

Data source

This study used data from the Nouna Health District Household Survey (NHDHS), a household panel survey introduced in 2003, in the 33 clusters that were identified in the CRCT. All households registered in these clusters were used in the sampling frame. A complete list of households was provided by the Demographic Surveillance System. 990 households were selected, approximately 10% of the population. This sample size was estimated in advance to have a 90% power of detecting an increase in health service utilization of one visit per year between the insured and the uninsured. It was based on the assumption that the enrolment rate will be at least 50%[1]. Sampling design is described in detail elsewhere (De Allegri et al. 2008). We used data pertaining to years 2004-07. We did not include households for whom data on household assets was missing.

Every year the NHDHS team interviews household members to collect data on demographic and socio-economic indicators, self-reported morbidity, healthcare seeking behavior and insurance membership. Information on agricultural production, livestock and durable goods ownership of the household is also collected.

Variables

In this study, we modeled the effect of CBHI on household assets. We estimated household assets by taking the monetary value of durable goods and livestock owned by the household. Prices were available for year 2004 and we used these prices to calculate the value of household assets for all years[2].

Even though in principle, the unit of enrolment for CBHI was the household, this was not strictly followed. Hence, there were instances when some members in the household enroll while others do not. We therefore, used the number of insured members in the household as our insurance variable. Consequently, we used per capita household assets as the dependent variable. Hence, we studied the effect of insuring an additional member in the household on per capita household assets.

Other household and village level variables that were considered in the analysis are described in Table 1.

Descriptive statistics

Data is described in Table 2. Our sample decreased over the years. In 2003, 990 households were randomly selected, but our analysis is based on 890 households, 90% of the original sample. This is not surprising as out-migration in this area ranged between 7-9% per year during this time period (Sie et al. 2010). In this region seasonal emigration is also common. Therefore, there were instances when an entire household had emigrated one year, but re-appeared in our sample the next year.

Number of households offered insurance increased during 2004-06 as CBHI was progressively offered to more villages. From 2006, CBHI was offered to the entire sample.

During the study period, enrolment was between 5-9%. There was a steep increase in enrolment in 2007. Premium subsidies offered to the poorest households this year could have attributed to this increase. Enrolment had been low although it increased over the years. Dong (2009) and De Allegri (2006a; 2006b) highlight possible reasons for low enrolment in this region which include unit of enrolment being a household which made it difficult for larger households to enroll, premium collected at one point in year, poor perception of quality of care at the health facilities and pre-assigned health facility. Enrolment rates have been substantially lower than that predicted by the WTP study. Dong (2003) mentioned that the WTP technique itself could have overestimated consumers' preferences due to starting point bias. The WTP scenario was slightly different from reality. It did not mention the premium collection process and that the health facility will be pre-assigned.

Figure 1 shows the mean household assets per capita. Overall, the per capita household assets dropped by 0.1% during 2004-07. From 2004-05, there was a severe drop of 19%. The next two years, the households assets recovered: 7% increase in 2006 and 16% increase in 2007.

The fluctuations in household assets can be explained by the yearly fluctuations in the economy of this region. In 2004, Burkina Faso faced a drought and locust invasion (United Nations 2006a). In 2005, the prices increased due to the low food production in 2004[3]. In 2005-06 the harvest improved while in 2007 the harvest was modest (United Nations 2006). In a subsistence agrarian region, households' economic indicators including asset ownership are closely linked to agriculture production, so these fluctuations in household assets are not surprising.

Econometric approach

To capture the causal effect of CBHI, it is important to adjust for self-selection. Previous studies[3] have used different methods depending on the availability of data. When cross-sectional data was available, propensity score matching (PSM), has been used. PSM balances the observed characteristics between the insured and uninsured at the pre-implementation level. The extent to which this method can control for self-selection depends on the number of observable variables balanced. It does not correct for bias due to unobservable variables. Gnawali et al (2009) used PSM to study the impact of CBHI on healthcare utilization in Burkina Faso. They found that out-patient visits were 40% higher in the insured group compared to the uninsured. An alternative to PSM is the instrumental variable (IV) technique. In the absence of an experiment it is not always easy to identify an appropriate IV – a variable that determines insurance status but is not correlated with any other determinant of the dependent variable. Jowett et al. (1999) used an IV technique to study the effect of health insurance on treatment seeking behavior in Vietnam. Trujillio et al. (2005) applied both PSM and IV and found that the Columbian subsidized health insurance program increased healthcare utilization for the poor.

In few cases, when panel data were available, fixed-effects (FE), differences-in-differences (DD) or IV have been applied. FE and DD models correct for selection bias by cancelling out the effect of any time-invariant variables, but do not correct for selection bias due to time-varying variables. Sepehri et al. (2006) used FE to analyze Vietnam's health insurance scheme and concluded that it reduced OOP expenditures between 16-18%. If the schemes are introduced such that there are some areas where insurance is introduced but data is also available from comparable controls, then DD can be applied. If comparable controls are not available, studies have used PSM to control for observable pre-implementation differences, and have then applied DD (Newman et al. 2002; Wagstaff et al. 2009; Wagstaff, and Pradhan 2005; Wagstaff, and Yu 2007). The IV method can also be applied to panel data if an appropriate IV is available. Wagstaff and Lindelow (2008) studied the impact of health insurance on OOP payments in China. They used IV and FE with IV models to control for self-selection.

In rare cases when an experiment is available, the two-stage least squares (2SLS) model with IV can be applied, where the IV comes from the randomization. Randomization insures that the IV is not correlated with any other determinant of the dependent variable.

We estimated three models:

i. Ordinary Least Squares (OLS) for 2004-07

ii. 2SLS for 2004-05 (Simple OLS for comparison)

iii. FE for 2004-07

Our panel model can be described as:

$$HA_{it+1} = f\,(Z_i.\beta_{1i} + X_{it}.\beta_{2i} + I_{it}.\beta_3 + Y_t.\beta_4) \tag{1}$$

where $i = 1,\ldots,n$ represents households and $t = 4,5,6,7$ represents years. HA_{it+1} is a measure of household assets at the end of the insurance period (lead variable), I_{it} denotes the insurance status. Z_i is a vector of time-invariant household characteristics (like ethnicity and gender of the household head) and X_{it} is a vector of time-varying observed characteristics (like household size); Y_t denotes year dummies that capture time shocks.

First, we estimated a simple OLS regression with no covariates. Conceptually, insurance status of the household may be correlated with important omitted variables like household size and health status that may predict ownership of household assets. If these variables are not controlled as in the case of simple OLS, β_3 will be biased because it represents not only the effect of insurance on household assets, but also the effects of some of the omitted variables. We, therefore, re-ran the OLS with various household and village level covariates that proxy for the omitted variables and observed the change in β_3.

Second, since unmeasured or unobservable omitted variables (e.g. risk aversion) are not controlled in the OLS model, we applied 2SLS with IV. As described before, CBHI was randomly and progressively offered to the 33 clusters in the study area. This implies that the ‘offer of insurance’ or *eligibility* was randomized to the study population. Hence, *eligibility* was correlated to the household’s insurance status (relevance) but not to any other determinant of household assets (validity). Since, *eligibility* differed among the households during 2004-05 (in 2003 there was no CBHI and from 2006 CBHI was offered to the entire region), this approach could be applied to only these two years.

The IV, *eligibility*, was tested for relevance by the first-stage F statistic which tests whether the endogenous regressor is weakly identified. F statistic should be above 10 for the IV to be relevant (Stock, Wright and Yogo 2002). We included covariates in this model to reduce some of the variability in HA_{it+1}, to get more precise 2SLS estimates.

Standard errors in panel data models need to be adjusted for autocorrelation in the error term. This is generally done by adjusting for clustering at the household level. In this model since the IV is dependent on village-clusters; we adjusted for clustering at the village-cluster level.

Third, to model the effect of CBHI on household assets for the entire period 2004-07 for which we had data, an experiment was not available. We therefore applied the FE model. A FE model takes advantage of the panel nature of the sample i.e. repeated observations on households. Observed Z_i is not explicitly included because in a FE model household specific dummy variables are created that capture all time-constant variation – observed and unobserved. Hence, FE assumes that the self-selection is due to characteristics that are constant over time. This is a limitation of this model. There could be time-varying omitted variables correlated to I_{it}. Health status is one such variable that can influence the insurance status of the household. We included variable *chronic* to capture this.

RESULTS AND DISCUSSION

OLS (2004-07)

Table 3 columns (1) and (2) shows the results for the OLS models – without covariates and with covariates. When covariates were included, the coefficient for insurance decreased from 0.058 to 0.045 i.e. insurance increased per capita household assets by 5.9% (=$e^{0.058}$) according to the first model and by 4.5% (=$e^{0.044}$) according to the second model. The first model suffers from omitted variable bias, while the second model corrects for some of this bias.

2SLS (2004-05)

Table 3 columns (3) and (4) present the OLS and 2SLS results for years 2004-05. All variables mentioned in Table 2 except *subsidy* that came into effect only in 2007, were included in both models. *Eligibility* was included in only 2SLS as an IV. The IV passed the tests for relevance. The F statistics was 16.47, implying that the IV (*eligibility*) is strongly correlated with the endogenous regressor (*insurance*).

According to the OLS results, *insurance* had no significant impact on per capita household assets. In the 2SLS model, *insurance* had a positive effect on per capita household assets at 10 % significant level i.e. *insurance* increased per capita household assets by 24.6% (=$e^{0.22}$) on an average.

At first glance an increase of 24.6% may look like a fairly large impact. However, in this region with per capita household asset averaging at 67,650 CFA (103€) for 2004-05, this increase would amount to adding assets worth 16,642 CFA (25€) - that's the value of approximately two goats. Further, unlike the health insurance schemes in developed countries, where the premium is set such that insurance protects household wealth, but does not necessarily increase wealth, the CBHI benefits in this context far out-weights the premium[4]. One reason for this is that the CBHI scheme is highly subsidized. The premium was set not to cover the cost of providing CBHI but was fixed at what was thought affordable in the community. In 2004, premiums covered only 53% of the consultation and drugs costs of the insured (For 2005, the corresponding figure was 61%). Hence, in 2004, 47% of the facility costs and the entire cost of running the CBHI scheme were externally funded. This is true for many other CBHI schemes in Africa (Tabor 2005).

With regard to other key covariates household head employed in agriculture or livestock rearing and bigger households were found to have a significant association with per capita assets as per the OLS model, these variables were found to be insignificant in 2SLS. Year 2005 was associated with a drop in household assets that affected all households in the region. As expected, education level of household head was positively associated with household assets. In 2SLS, villages where wells were the main source of water, as compared to running water, were associated with lower per capita household assets. This is because wealthier villages have access to running water in this region.

FE (2004-07)

Table 3 column (5), shows the FE results for the entire period 2004-07. According to this model, *insurance* increased per capita household assets by 1% at 10% significant level. Household size and yearly fluctuations were associated with significant changes in per capita household assets. Compared to year 2004, household assets dropped significantly in 2005-06 and improved by year 2007.

Households who were offered the premium subsidy and households with at least one member with a chronic illness were found to have a positive association with per capita assets, although insignificant. These positive associations are unusual. It was expected that households who received the subsidy were considered the poorest in the villages. It was also expected that households with ill members would have less per capita assets compared to households with healthy members. Perhaps this is because wealthier households, having more assets, access healthcare more and therefore have a greater probability of detecting illnesses.

Comparing OLS, 2SLS and FE results

The impact of insurance estimated by the OLS and FE models is much smaller than that projected by the 2SLS model. Main reason for this is because they analyze different time periods. The period 2004-05 that was captured by the 2SLS model was financially hard for this region because of low agricultural production and rising prices. Drought and financial hardships could have also led to an increase in illness episodes. Insured households, however, were protected from financial shocks related to medical costs. Clustering of financial shocks (loss in agriculture production and medical costs) for the uninsured during this period could explain why the per capita household assets improved for the insured as compared to the uninsured during this period. For the FE model, even though the yearly fluctuations in per capita household assets were large, the change in mean per capita household assets during 2004-07 was very small (See Figure 1) which matches the estimated average increase of 1% per year for the insured. The OLS with covariates model predicted an increase of 4.5%, which is much more than that predicted by the FE model. The OLS model controlled for selection bias only due to the observable variables that were included in the model. However, the FE model controlled for the observable variables included in the model as well as all unobserved or unmeasured time-invariant variables.

CONCLUSION

The objective of this paper was to measure the impact of CBHI on household assets in Burkina Faso. We used three models –OLS with covariates, 2SLS, and FE. All models provided evidence that the CBHI scheme in the Nouna Health District protected household assets. Specifically, the models predicted that CBHI significantly increased household assets. This is not surprising, given that the scheme is highly subsidized - benefits of being insured far out-weigh the cost of purchasing insurance. Unfortunately, there is no other study that has analyzed the impact of CBHI on household economic indicators from a developing country. This makes it difficult for us to benchmark these effects with other schemes.

There are some limitations of this study. First, since CBHI enrolment is low, averaging 5-9%, our analysis might suffer from small sample bias. This can bias the estimates of the 2SLS that uses an IV. But our IV passed the test for relevant. Also, since the IV was randomly assigned, it should not be correlated to any determinants of household assets and therefore should be valid. Second, the FE estimates do not correct for self-selection due to time varying variables. Critical variables like household size and a proxy for health status were included in the model to reduce this bias. Third, attrition in the sample. Originally, 990 households were selected but our analysis is based on 890 households, 90% of the original sample. Most of this attrition can be attributed to emigration that ranged between 7-9% during this period (Sie et al. 2010).

Finally, main reason for health insurance is to provide financial protection. OOP expenditures and health costs capture the immediate effects of health insurance incurred by those who access healthcare. These costs if financed by selling assets like farm implements and livestock, can negatively impact the future income generating capacity of the household. Therefore, it is essential to investigate not only the impact of health insurance on health utilization and costs but also to investigate the long term effects of health insurance on the overall economic health of the households. Currently many developing countries are drafting plans for achieving universal health insurance in the future. One option before them is linking and integrating the current CBHI schemes in their countries. In this context, documenting the effects of such schemes is even more important.

Notes

1. 50% enrolment assumption was based on a prior WTP study (Dong et al. 2003).

2. We did not explicitly adjust for inflation. We created year dummies that captured all yearly external shocks including inflation.

3. In the following paragraphs we discuss some of the methods that have been used to control for selection bias when studying the impacts of CBHI or subsidized health insurance in developing countries. There is no study that has looked at the impact on household assets; therefore, the studies mentioned here analysed the impacts on OOP expenditures, health expenditures or utilization.

4. As a comparison, cost of: malaria test and treatment was 1000 CFA, X-ray was 3000 CFA, ultrasound was 3000 CFA, and basic surgery was 12000 CFA (2007 prices at health facilities).

REFERENCES

Carrin, G. 2003. Community based health insurance schemes in developing countries : facts, problems and perspectives. Geneva: World Health Organization.

Coheur, A., C. Jacquier, V. Schmitt-Diabaté, and J. Schremmer. 2007. “Linkages between statutory social security schemes and community-based social protection mechanisms: A promising new approach.” *World Social Security Forum, Moscow, 10-15 September;*.

De Allegri, M., S. Pokhrel, H. Becher, H. Dong, U. Mansmann, B. Kouyate, G. Kynast-Wolf, A. Gbangou, M. Sanon, J. Bridges, and R. Sauerborn. 2008. “Step-wedge cluster-randomised community-based trials: An application to the study of the impact of community health insurance.” *Health Research Policy and Systems* 6(1): 10.

De Allegri, M., M. Sanon, J. Bridges, and R. Sauerborn. 2006a. “Understanding consumers' preferences and decision to enrol in community-based health insurance in rural West Africa.” *Health Policy* 76(1): 58-71.

De Allegri, M., M. Sanon, and R. Sauerborn. 2006b. “"To enrol or not to enrol?": A qualitative investigation of demand for health insurance in rural West Africa.” *Social Science & Medicine* 62(6): 1520-7.

Dong, H., M. De Allegri, D. Gnawali, A. Souares, and R. Sauerborn. 2009. “Drop-out analysis of community-based health insurance membership at Nouna, Burkina Faso.” *Health Policy* 92(2-3): 174-9.

Dong, H., A. Gbangou, M. De Allegri, S. Pokhrel, and R. Sauerborn. 2008. “The differences in characteristics between health-care users and non-users: implication for introducing community-based health insurance in Burkina Faso.” *European Journal of Health Economics* 9(1): 41-50.

Dong, H., B. Kouyate, J. Cairns, F. Mugisha, and R. Sauerborn. 2003. “Willingness-to-pay for community-based insurance in Burkina Faso.” *Health Economics* 12(10): 849-62.

Dong, H., F. Mugisha, A. Gbangou, B. Kouyate, and R. Sauerborn. 2004. “The feasibility of community-based health insurance in Burkina Faso.” *Health Policy* 69(1): 45-53.

Ekman, B. 2004. “Community-based health insurance in low-income countries: a systematic review of the evidence.” *Health Policy and Planning* 19(5): 249-70.

Gnawali, D. P., S. Pokhrel, A. Sie, M. Sanon, M. De Allegri, A. Souares, H. Dong, and R. Sauerborn. 2009. “The effect of community-based health insurance on the utilization of modern healthcare services: evidence from Burkina Faso.” *Health Policy* 90(2-3): 214-22.

Jowett, M. and R. Thompson. 1999. Paying for healthcare in Vietnam : extending voluntary health insurance coverage. York [England]: University of York, Centre for Health Economics.

King, G., E. Gakidou, N. Ravishankar, R. T. Moore, J. Lakin, M. Vargas, M. M. Tellez-Rojo, J. E. Hernandez Avila, M. Hernandez Avila, and H. Hernandez Llamas. 2007. “A "politically robust" experimental design for public policy evaluation, with application to the Mexican universal health insurance program.” *Journal of Policy Analysis and Management* 26(3): 479-506.

Leive, A. and K. Xu. 2008. “Coping with out-of-pocket health payments: empirical evidence from 15 African countries.” *Bulletin of the World Health Organization* 86(11): 849-56.

Makinen, M., H. Waters, M. Rauch, N. Almagambetova, R. Bitran, L. Gilson, D. McIntyre, S. Pannarunothai, A. L. Prieto, G. Ubilla, and S. Ram. 2000. “Inequalities in health care use and expenditures: empirical data from eight developing countries and countries in transition.” *Bulletin of the World Health Organization* 78(1): 55-65.

McIntyre, D., M. Thiede, G. Dahlgren, and M. Whitehead. 2006. “What are the economic consequences for households of illness and of paying for health care in low- and middle-income country contexts?” *Social Science & Medicine* 62(4): 858-65.

Morris, S. S., M. K. Ranson, T. Sinha, and A. J. Mills. 2007. “Measuring improved targeting of health interventions to the poor in the context of a community-randomised trial in rural India.” *Contemporary Clinical Trials* 28(4): 382-90.

Mugisha, F., B. Kouyate, A. Gbangou, and R. Sauerborn. 2002. “Examining out-of-pocket expenditure on health care in Nouna, Burkina Faso: implications for health policy.” *Tropical Medicine & International Health* 7(2): 187-96.

Newman, J., M. Pradhan, L. B. Rawlings, G. Ridder, R. Coa, and J. L. Evia. 2002. “An Impact Evaluation of Education, Health, and Water Supply Investments by the Bolivian Social Investment Fund.” *World Bank Economic Review* 16(2): 241-74.

Palmer, N., D. H. Mueller, L. Gilson, A. Mills, and A. Haines. 2004. “Health financing to promote access in low income settings-how much do we know?” *Lancet* 364(9442): 1365-70.

Preker, A. S., G. Carrin, D. Dror, M. Jakab, W. Hsiao, and D. Arhin-Tenkorang. 2002. “Effectiveness of community health financing in meeting the cost of illness.” *Bulletin of World Health Organisation* 80(2): 143-50.

Ranson, M. K., T. Sinha, M. Chatterjee, F. Gandhi, R. Jayswal, F. Patel, S. S. Morris, and A. J. Mills. 2007. “Equitable utilisation of Indian community based health insurance scheme among its rural membership: cluster randomised controlled trial.” *BMJ (Clinical research ed.)* 334(7607): 1309.

Ranson, M. K., T. Sinha, S. S. Morris, and A. J. Mills. 2006. “CRTs--cluster randomized trials or "courting real troubles": challenges of running a CRT in rural Gujarat, India.” *Canadian Journal of Public Health* 97(1): 72-5.

Sauerborn, R., A. Adams, and M. Hien. 1996. “Household strategies to cope with the economic costs of illness.” *Social Science & Medicine* 43(3): 291-301.

Savedoff, W. D., R. Levine, and N. Birdsall. 2006. “When will we ever learn? Improving lives through impact evaluation.” *Center for Global Development*.

Sepehri, A., S. Sarma, and W. Simpson. 2006. “Does non-profit health insurance reduce financial burden? Evidence from the Vietnam living standards survey panel.” *Health Economics* 15(6): 603-16.

Sie, A., V. R. Louis, A. Gbangou, O. Muller, L. Niamba, G. Stieglbauer, M. Ye, B. Kouyate, R. Sauerborn, and H. Becher. 2010. “The Health and Demographic Surveillance System (HDSS) in Nouna, Burkina Faso, 1993-2007.” *Global Health Action* 3.

Souares, A., G. Savadogo, H. Dong, D. Parmar, A. Sie, and R. Sauerborn. 2010. “Using community wealth ranking to identify the poor for subsidies: a case study of community-based health insurance in Nouna, Burkina Faso.” *Health & Social Care in the Community*.

Su, T. T., B. Kouyaté, and S. Flessa. 2006. “Catastrophic household expenditure for health care in a low-income society: a study from Nouna District, Burkina Faso.” *Bulletin of the World Health Organization* 84: 21-27.

Tabor, S. R. 2005. Community-Based Health Insurance and Social Protection Policy. Washington, D.C.: The World Bank.

Trujillo, A. J., J. E. Portillo, and J. A. Vernon. 2005. “The impact of subsidized health insurance for the poor: evaluating the Colombian experience using propensity score matching.” *International Journal of Health Care Finance and Economics* 5(3): 211-39.

United Nations Central Emergency Response Fund. 2006a. "Burkina Faso 2006" [accessed on October 5, 2010]. Available at: http://ochaonline.un.org/CERFaroundtheWorld/BurkinaFaso2009/BurkinaFaso2008/BurkinaFaso2007/BurkinaFaso2006/tabid/1862/language/en-US/Default.aspx.

United Nations Food and Agriculture Organization. 2006b. “Sahel Weather and Crop Situation Report.” [accessed on October 5, 2010]. Available at: http://www.fao.org/docrep/009/J7948e/J7948e00.htm

Uzochukwu, B. S., E. O. Onwujekwe, C. A. Onoka, and M. D. Ughasoro. 2008. “Rural-urban differences in maternal responses to childhood fever in South East Nigeria.” *PLoS One* 3(3): e1788.

van Doorslaer, E., O. O'Donnell, R. P. Rannan-Eliya, A. Somanathan, S. R. Adhikari, C. C. Garg, D. Harbianto, A. N. Herrin, M. N. Huq, S. Ibragimova, A. Karan, T. J. Lee, G. M. Leung, J. F. Lu, C. W. Ng, B. R. Pande, R. Racelis, S. Tao, K. Tin, K. Tisayaticom, L. Trisnantoro, C. Vasavid, and Y. Zhao. 2007. “Catastrophic payments for health care in Asia.” *Health Economics* 16(11): 1159-84.

Wagstaff, A. and M. Lindelow. 2008. “Can insurance increase financial risk? The curious case of health insurance in China.” *Journal of Health Economics* 27(4): 990-1005.

Wagstaff, A., M. Lindelow, G. Jun, X. Ling, and Q. Juncheng. 2009. “Extending health insurance to the rural population: an impact evaluation of China's new cooperative medical scheme.” *Journal of Health Economics* 28(1): 1-19.

Wagstaff, A. and M. Pradhan. 2005. “Health insurance impacts on health and nonmedical consumption in a developing country.” *Policy Research Working Paper Series. The World Bank*.

Wagstaff, A. and S. Yu. 2007. “Do health sector reforms have their intended impacts? The World Bank's Health VIII project in Gansu province, China.” *Journal of Health Economics* 26(3): 505-35.

Table 1. Variable definitions

Variable	Definition
	Dependent variable
Household assets per capita †	ln (monetary value of goods and livestock owned by the household in CFA/ Size) Goods: plough, bicycle, radio, television and telephone Livestock: poultry, sheep, goat, cattle, donkey, pig and horse
	Household characteristics
Insurance	Number of individuals insured in the household
Chronic ‡	Any member in the household having a chronic illness. 1=yes; 0 otherwise*
Size	Number of individuals in the household
Age	Square root (age of household head in years)
Ethnicity	Ethnicity of the household head. 1=Bwaba*; 2=Dafing; 3=Mossi; 4=Peulh; 5=Samo
Gender	Gender of the household head. 1 if male; 0 otherwise*
Occupation	Occupation of the household head. 1=Agriculture/livestock; 0 otherwise*
Education	Education level of the household head. 1=can read/write; 0 otherwise*
Eligibility	Household eligible for insurance. 1=yes; 0 otherwise*
Subsidy	Household eligible for premium subsidy. 1=yes; 0 otherwise*
	Village characteristic
VillageCluster	1=villages offered insurance since 2004; 2=villages offered insurance since 2005; 3=villages offered insurance since 2006
Literacy	Proportion of individuals who can read/write in the village
Distance	Square root(Average distance to the nearest health facility in km)
Healthfacility	Nearest health facility from the village. 1=Bourasso*; 2=Dara; 3=Goni; 4= Koro; 5= Lekuy; 6=Nouna; 7= Toni

Water	Main source of water in the village. 1= running water*; 2=well; 3=river/lake/pond
Town	Location of households. 1=Nouna town; 0 otherwise*
	Time shock
Year	4=2004*, 5=2005, 6=2006 and 7=2007

† corresponds to the value of assets at the end of the insurance period (lead variable)

‡ Chronic illness is defined as any illness lasting for at least 3 months at the time of the survey

* Reference category

Table 2. Description of the sample

Year	No. of insured households	No. of uninsured households	Total households	No. of households offered insurance (cumulative)	Insured households	
					Sample †	Study population
2004	21	814	835	354	5.9%	5.2%
2005	35	747	782	628	5.6%	6.3%
2006	38	738	776	776	4.9%	5.2%
2007	65	686	751	751	8.7%	9.1%
2004-07 ‡	95	874	890	890	6.3%	

† Number of insured households / Number of households offered insurance

‡ For 2004-07, the numbers are for the overall sample. Therefore column 2 represents number of ever insured households; column 3 represents number of ever uninsured households, and column 4 represents number of households ever included in this sample

Table 3. Regression results

Variables	**(1) OLS without covariates†**	**(2) OLS with covariates†**	**(3) OLS - comparison for (4)†**	**(4) 2SLS‡**	**(5) FE†**
Time period	**2004-07**	**2004-07**	**2004-06**	**2004-06**	**2004-07**
Insurance	0.058	0.045	0.024	0.220	0.009
	(0.011)***	(0.010)***	(0.020)	(0.121)*	(0.005)*
Chronic_1		0.033	0.065	0.050	0.022
		(0.047)	(0.060)	(0.048)	(0.032)
Size		0.072	0.114	0.115	-0.125
		(0.031)***	(0.065)*	(0.091)	(0.049)***
Age		0.073	-0.052	-0.020	-0.031
		(0.028)**	(0.053)	(0.066)	(0.040)
Gender_1		-0.106	-0.375	-0.374	-
		(0.115)	(0.120)***	(0.106)***	
Occupation_1		-0.104	-1.186	-0.842	-
		(0.069)	(0.453)***	(0.537)	
Education_1		0.318	0.314	0.273	-
		(0.058)***	(0.066)***	(0.082)***	
Subsidy_1		-0.496	-	-	0.029
		(0.090)***			(0.061)
Literacy		0.008	0.571	0.736	-
		(0.505)	(0.515)	(0.527)	
Distance		0.027	0.017	0.014	0.048

		(0.028)	(0.029)	(0.021)	(0.033)
Water_2		-0.150	-0.424	-0.480	0.051
		(0.176)	(0.274)	(0.190)***	(0.098)
Water_3		0.047	0.005	-0.044	-0.012
		(0.133)	(0.146)	(0.182)	(0.067)
Year_5		-0.132	-0.161	-0.192	-0.157
		(0.038)***	(0.041)***	(0.035)***	(0.027)***
Year_6		-0.149 (0.057)***	-	-	-0.085 (0.031)***
Year_7	-	0.141 (0.072)*	-	-	0.124 (0.034)***
F-statistic	30 (p=0.00)	8.97 (p=0.00)	4.86 (p=0.00)	-	10.68 (p=0.000)
R^2	0.013	0.074	0.128	-	0.0007
No. of clusters	890	890	846	31	890
No. of observations	3,144	3,144	1,588	1,588	3,144
First stage F-statistic	-	-	-	16.47 (p=0.0003)	-

Note.

Refer to Table 1 for variable definitions. *Subsidy* that came into effect in 2007 was included in only models (1) and (2). *Eligibility* was included in only model (4) as an instrumental variable. For model (5) only time varying variables were included.

Standard errors in parentheses

† Standard errors were adjusted for clustering at the household level.

‡ Standard errors were adjusted for clustering at the *VillageCluster* level as the instrumental variable is dependent on village clusters.

***1%, **5% and *10% significance levels

Figure 1. Mean household assets per capita in CFA (2004-07)

(1€=656 CFA)