
Creating Safety Nets Through Semi-parametric Index-Based Insurance: A Simulation for Northern Ghana: *Abstract*

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Our paper considers past and present social safety net arrangements in Northern Ghana, where village communities are poor and tend to face risks that affect virtually all members, and consequently call for safety net arrangements beyond individual and mutual insurance. Following a brief historical review, we assess the possible contribution of index-based crop insurance to such arrangements. This recently developed type of insurance bases its indemnification on objectively and easily measurable variables, such as rainfall data and prices at major markets, unlike standard insurance contracts which are individualized and have much higher transaction costs.

After noting that safety net arrangements should be effective, timely, and well-coordinated in securing (a) entitlements (in kind, cash, or as indemnification payments from insurance) for the poor, (b) funding (through taxes or private contributions, possibly insurance premiums), and (c) delivery of necessities such as staples to all households, we observe that index-based insurance could play a useful role in entitlement, and to a lesser extent in funding. However, index-based insurance does not in itself provide for adequate delivery, meaning that under

supply shocks such as droughts the indemnity payments could cause prices to rise and channel away scarce food from the uninsured to the insured. This is particularly relevant in Northern Ghana, where rainfall varies strongly, subsistence farming is dominant, and few remittances flow in.

Turning to the modalities of index-based insurance, we seek to improve on existing indemnification schedules that are commonly specified synthetically or estimated in a simple parametric form. Via an adaptation of available kernel learning techniques, we can estimate a schedule that minimizes farmers' risk of falling below the poverty line. This schedule depends on selected index variables through a perfectly flexible functional form that maintains self-financing up to a prespecified subsidy. We test the scheme's performance as a safety net for Northern Ghana based on the size of its basis risk and its capacity to reduce poverty through full sample estimation as well as bagging. Although our schedule reduces by 20 percentage points the poverty incidence from an initial level of 63%, and proves to be quite robust under bagging, basis risk and associated poverty remain considerable, reflecting the limited capacity of the variables selected to eliminate it.

In the empirical section of the paper we compute the self-financing premium and the indemnification needed to avoid all income shortfalls below the poverty line over a historical record of 26 years, for hypothetical contributor pools consisting of all farmers in Northern Ghana. Under this scheme, we calculated different premiums for different poverty lines. The more the poverty line increases, the more additional

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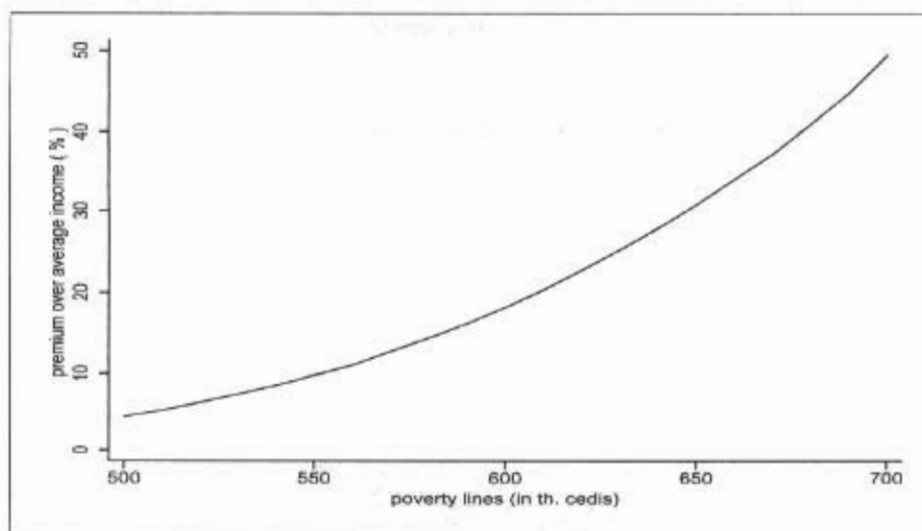
resources are needed to bring all farmers above it. Actually, as shown by Figure 1, the per hectare premium as a percentage of average income ranges from about 5% with a poverty line of 500,000 cedi to approximately 17% with a poverty line of 600,000 cedi, and finally to 50% for the official poverty line of 700,000 cedi (about US\$1 per capita per day).

Figure 2 shows the simulation results from comparison of the case without safety net to the (kernel-smoothed) income distribution under two index-based safety nets targeted at a poverty line of 700,000 cedi (the dotted line) and 600,000 cedi (the continuous line), respectively. Some interesting results emerge. Comparing the uninsured case with the two index-based insurances, we observe a tendency for shortfalls to diminish significantly. The poverty prevalence decreases and the depth of poverty is reduced as well, as can be seen from the narrowing of the right-hand-side tails. Indeed, the safety net targeted at the

600,000 cedi line is much less capable of redistributing income since, by construction, it pays out less frequently, but has a less prohibitive premium (17% of the average income).

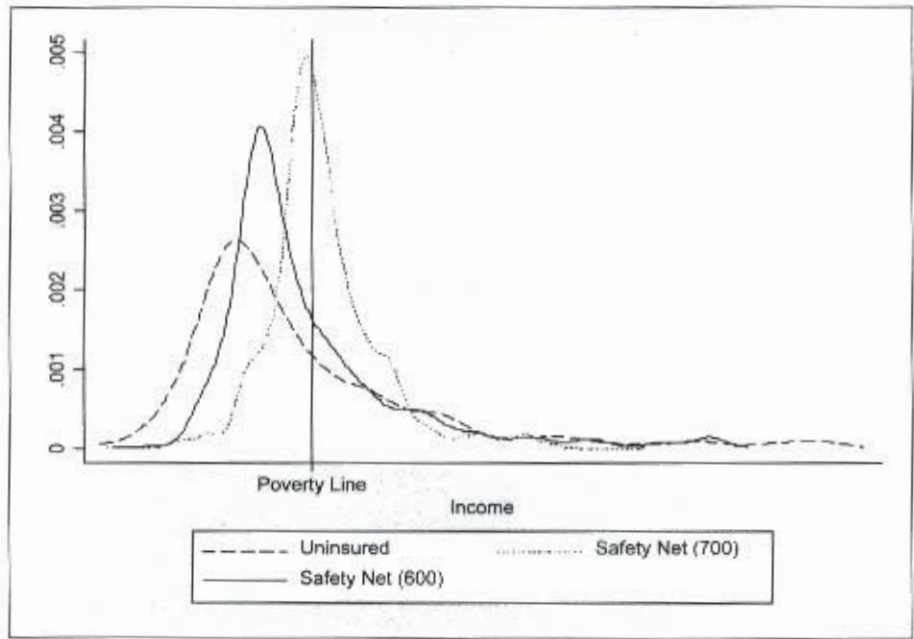
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Source: Keyzer, Molini, and van den Boom (2007).

Figure 1. Premium Variation as a Function of Insurable Poverty Lines



Source: Molini et al. (2007).

Figure 2. Income Distribution Before and After the Index-Based Indemnification: Safety Nets with Poverty Lines at 700,000 and 600,000 Cedis