I4 INDEX INSURANCE INNOVATION INITIATIVE

BASIS

DEMAND FOR AND PRODUCTIVITY IMPACT OF WEATHER INDEX INSURANCE IN ETHIOPIA

by Craig McIntosh (ctmcintosh@ucsd.edu), Alexander Sarris, and Fotis Papadopoulos

I4 BRIEF

IMPROVING PRODUCTIVITY BY INSURING RISK

IN SUB-SAHARAN AFRICA increasing agricultural productivity is key to decreasing rural poverty. Despite demonstrated large increases in yields demand for fertilizer is low. High variability in crop yields, high fertilizer prices and lack of information about and availability of fertilizer all contribute to this problem. The dominant role of risk and the lack of individual strategies to manage it can also limit fertilizer use. Thus a key question for policy makers is, "Are farmers constrained from using fertilizer due to risk and credit limitations or by low returns?"

Index insurance has primarily been promoted as a safety net, but in this context it may also improve productivity. Many regard weather index insurance (WII) as a particularly promising welfare-enhancing intervention. If protection against risk can unlock demand for risky productivity-enhancing inputs, WII can contribute towards increasing input usage thus increasing yields and decreasing rural poverty as well as protecting against risk.

INTRODUCING WEATHER INDEX INSURANCE

Our study reports the initial results from a pilot project using WII as a way to expand credit supply and, consequently, fertilizer demand by smallholders. The Ethiopian Project on Interlinking Insurance with Credit in Agriculture (EPIICA) works with the largest private bank in Ethiopia, Dashen Bank, and the largest private insurance company, Nyala Insurance Company (NISCO), and targets a high potential production region where risk and credit are presumed to be major constraints to expanding production. NISCO is the first private insurance company in Ethiopia to pilot WII products.

In 2011, the project implemented a randomized control trial experiment in the Amhara region to explore whether WII interlinked with credit can expand fertilizer demand thereby increasing agricultural productivity. Previous studies in Ethiopia have shown that fertilizer

KEY POINTS

Significant profitable opportunities for fertilizer use are there for Ethiopian farmers, but farmers are still constrained by risk aversion, low cash availability, and poor access to credit.

Subsidy vouchers, even at very small cash amounts, are an effective way of driving index insurance uptake.

Results suggest that WII may provide protection primarily to those who already use inputs at high levels, rather than enabling a 'transformative' increase in input use among those not previously using them.

use, while profitable, is risky. In addition, the lack of insurance against risk leads to low input use and inefficient production choices. Thus we use the baseline data to examine the constraints to agricultural productivity, present the results of an ex-ante Willingness to Pay (WTP) study, and examine the actual uptake of insurance from the first year of the pilot.

The first year of the experiment had implementation problems; not all villages were successfully offered the insurance, and the credit product was not offered due to the reluctance of intermediary institutions. We therefore examine insurance uptake in the subset of cooperatives in which at least one person chose to purchase insurance.

CONSTRAINTS: RISK, CREDIT AND LOW RETURNS

Using observational data on input use and yields for 2011 we examine what limits fertilizer use and the likely profitability of increased use. Despite an effort to target areas of commercial potential, households in the sample are poor and in most places improved input use is low. Agricultural production generally takes place in high risk conditions as it is rain-fed and subject to considerable weather variation.

Households surveyed by the Ethiopian Economic Association in 2004 report that timely and adequate fertilizer supply is a major problem. More than 70 percent reported that fertilizer is often supplied late and around 40 percent reported that supplies were inadequate. In Ethiopia the government monopolizes both fertilizer supply and guarantees agricultural credit. This creates additional risks and constraints, especially when rainfall is inadequate and farmers must repay loans despite low production and incomes.

The average expenditure on chemical fertilizer per household is equal to 30 percent of total cash income. While this share is large, it does not exhaust total cash expenditures for inputs, which amounts to 62 percent of total cash income. Thus, it may not be easy for households to allocate more cash to any input, including fertilizer. An additional constraint to fertilizer usage is that only 15 percent of households received credit for fertilizer, improved seeds or pesticides.

To explore the efficiency of additional input use we estimate the marginal products of labor, land, capital and purchased inputs and compare them to market values. Land is utilized at optimum levels, as the marginal product and the value added per hectare are largely the same. For purchased inputs, the average marginal product is 4.7, far above the market value of 1, implying that inputs are used far below optimal levels. The same holds for agricultural capital. On the other hand, the average marginal product of family farm labor is about one tenth the market wage, suggesting considerable excess farm labor. All of these observations are consistent with an agricultural structure composed of undercapitalized and labor surplus farms, thus holding considerable promise for the use of additional intermediate inputs.

"All of these observations are consistent with an agricultural structure... holding considerable promise for the use of additional intermediate inputs."

WHAT FARMERS SAY THEY WILL DO

Our baseline data collection included a Contingent Valuation (CV) study of the stated demand for index insurance designed to protect farmers from losing their investment in modern input use. After describing the product, we asked farmers whether they would be interested in such a product, and if not, why not. We then framed the product very specifically around the closest weather station, and instituted a yes/no question that featured prices randomized to 50, 100, 150, 200, and 250 birr. The standalone insurance was framed as covering the cost of modern inputs (fertilizers and improved seeds), and was priced per-one quarter of a hectare (one timad). The hypothetical insurance contract would pay 1000 birr per timad insured (the estimated cost of recommended inputs for such a land amount) in one out of every four years, so the actuarially fair price was 250

birr. For those who did want to purchase insurance, we asked how many timad they would insure. For those who did not want to purchase a standalone insurance contract (premiums paid in cash up front), we asked, "Would you become interested in purchasing insurance now if you were to be able to receive the 1000 birr worth of inputs on credit rather than having to pay for them in cash up front?" (for the basic interlinked product). We also asked "Would you become interested in purchasing insurance if both the inputs and the insurance premium were financed by credit?" (for the full state-contingent interlinked loan).

Comparison of these three questions lets us examine the stated willingness to pay (WTP) for standalone insurance, as well as the additional demand created by interlinking. The results show there is a strong demand for WII and that the estimated WTP value (277 bir) is not statistically different from the fair value of the hypothetical contract (250 bir).

WHAT FARMERS ACTUALLY DO

To determine the actual uptake of WII, we examine the 460 research subjects who were members of treatment cooperatives in which at least one contract was sold. We find insurance uptake is driven very strongly by price discount vouchers, and that households who used the most chemical fertilizer had the highest demand for WII.

If we can illustrate that the stated WTP is a good proxy for actual demand, future research to identify promising locations and markets for index insurance products would be much easier. Unfortunately, stated and actual demand are very poorly correlated, and in fact display a significant and negative correlation with each other.

"We find that insurance uptake is driven very strongly by price discount vouchers."

Among those who self-reported as being willing to buy the actuarially fair insurance product in the CV exercise actual uptake was 37.2 percent, while among those who said they would not buy that product, uptake was 44.3 percent. Using simple probit regressions we determine that the major determinant of ex-post uptake is the voucher offer and amount, while the ex-ante WTP is insignificant or negatively correlated. Different specifications of the regression produced similar results.

So what does explain actual uptake of the WII contract? A series of regressions show that economic and demographic factors, behavioral factors and basis risk factors have very little impact. Only the voucher dummy

"Unfortunately, stated and actual demand are very poorly correlated, and in fact display a significant and negative correlation with each other."

and the voucher amount explain the uptake. Among economic variables per capita income is negatively correlated with uptake, indicating that perhaps wealthier households do not need WII. On the other hand, chemical fertilizer use positively affects uptake, consistent with the hypothesis that fertilizer use and the need for cash could be affected by WII. It is also consistent with the analysis suggesting that those with low marginal products of cash inputs display the highest demand for WII. Behavioral variables and covariates measuring the extent of basis risk appear to have a weak effect on actual demand.

WHY THE DIFFERENCE?

The dissonance between anticipated actual demand raises a set of interesting questions concerning both the determinants of modern input use, as well as the willingness to pay for or demand for insurance. The most direct explanation is the issue of basis risk; while actual farm-level yields may be driven by farm-level rainfall, the nearest rainfall station may not provide an accurate measure of rainfall on the farm. Furthermore, crops are subject to additional perils such as pests, hail, frost and theft. While the starting hypothesis was that the main risk faced by households was rainfall deficit, it turned out only two thirds of the study villages faced a risk from rainfall deficit. Secondly, the availability of rainfall data cannot be taken for granted. Data gaps can negatively affect the estimates for appropriate actuarial tables and, hence, the proper pricing of WII products. A product with high basis risk simply fails to achieve the goal of providing protection and is not demanded for perfectly good reasons.

The lack of correlation between pre and post demand for WII could be due to a host of implementation issues. Information about WII, a new and complicated finan-

cial product, was inadequate. Secondly, the various delays in implementation implied that by the time the product was marketed many farmers had likely already bought fertilizer. Thus they did not need insurance for an amount already spent and decisions already made. Thirdly, the timing of the marketing and insurance sales did not pay attention to the likelihood of cash availability.

POLICY RECOMMENDATIONS

As hypothesized, significant profitable opportunities for increased fertilizer use appear to exist in Ethiopia, but farmers are constrained by cash availability and credit. The marginal products of fertilizer use are significantly above market values, while the marginal products of labor are significantly below. These results, also found in other African countries, underscore the importance of increasing agricultural productivity via expanded modern input use. Risk and credit constraint factors are also significant impediments to fertilizer use, thus supporting the underlying hypotheses to promote WII as a means to expand agricultural credit.

However, ex-ante demand for commercial WII was significant, and, in fact, farmers were on average willing to pay the actuarially fair cost of WII. Yet, when offered the actual product, demand was smaller, and influenced by the availability and amounts of subsidy vouchers. Our results provide no evidence that WTP studies predict actual demand for index insurance products.

Subsidy vouchers, even at very small cash amounts, are an effective way of driving WII uptake. In addition, high fertilizer use is a strong determinant of insurance uptake, the sum insured, and the amount of cash that farmers put into buying insurance. This suggests that the product may provide protection primarily to those who already use inputs at high levels, rather than enabling a 'transformative' increase in input use among those not previously using them.

Designing risk management products such as WII in a developing country context is a challenging proposition. Our results have helped clarify many implementation and institutional issues, and have helped understand some of the problems and difficulties in implementing commercially viable WII products. The second year of the study will feature full implementation of the insurance and credit experiments.

FURTHER READING

Clarke, D. J. 2011. "A Theory of Rational Demand for Index Insurance," Department of Economics Oxford University, Discussion Paper Series, No. 572.

Dercon, S. and Christiaensen, L. 2011. "Consumption risk, technology adoption and poverty traps: evidence from Ethiopia", Journal of Development Economics, 96(2), pp. 159-173.

Duflo, E., Kremer, M., and Robinson, J. 2010. "Nudging Farmers to Use Fertiliz er: Theory and Experimental Evidenc from Kenya", MIT Department of Ecc nomics working paper.

Yu, B., Nin-Pratt, A., Funes, J., and Asrat Gemessa, S. 2011. "Cereal production and technology adoption in Ethiopia", International Food Policy Research Institute (IFPRI), Ethiopia Strategy Support Program II (ESSP II), ESSP working paper No 31.

Zerfu, D., and Larson, D.F. 2010. "Incomplete markets and fertilizer use: Evidence from Ethiopia", World Bank, Development Research Group, Agriculture and Rural Development Team, Policy Research Working Paper No. 5235.

BASIS

The BASIS AMA Innovation Lab is a virtual institute hosted at the University of California Davis comprised of researchers from around the globe that aims to improve the agricultural competitiveness and quality of life of the rural poor in the developing world through policy-relevant research that is dedicated to improving access to resources and enhancing the operation of markets.

I4 INDEX INSURANCE INNOVATION INITIATIVE

Hosted at the BASIS AMA Innovation Lab, the Index Insurance Innovation Initiative (I4) is a response to the overwhelming evidence that uninsured risk can drive people into poverty and destitution, especially thosei n low-wealth agricultural and pastoralist households. To rigorously test the hypothesis that by removing correlated risk from smallholder agricultural and pastoral systems we can reduce poverty and deepen financial markets in agricultural areas, the I4 team will design and implement a new generation of livelihood-optimized index insurance contracts.

USAID FROM THE AMERICAN PEOPLE

Publication made possible by support in part from the US Agency for International Development Cooperative Agreement No. AEG-A-00-08-00008-00 through the Assets and Market Access Collaborative Research Support Program. Funding for this project was provided by the United States Agency for International Development. All views, interpretations, recommendations, and conclusions expressed in this paper are those of the authors and not necessarily those of the supporting or cooperating organizations.

For more information, please contact basis@ucdavis.edu.