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**Research Report**

## Willingness to pay for weather index insurance linked to production cost: An application to Ethiopia

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## Willingness to pay for weather index insurance linked to production cost: An application to Ethiopia

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### Abstract

Weather index insurance (WII) has been introduced in pilot form in several developing countries as a tool to help poor farmers deal with rainfall risk. However, uptake has typically been quite low. This policy brief, deals with willingness to pay (WTP) for weather insurance as it pertains to productive decisions of low-income farm households in developing countries. The product examined is designed to cover the risk faced by farmers who incur a cost for modern inputs to apply to their farms, but face the risk of not being able to recoup that outlay if rainfall on their farms is low.

LA FERDI EST UNE FONDATION RECONNUE D'UTILITÉ PUBLIQUE. ELLE MET EN ŒUVRE AVEC L'IDDRI L'INITIATIVE POUR LE DÉVELOPPEMENT ET LA GOUVERNANCE MONDIALE (IDGM). ELLE COORDONNE LE LABEX IDGM+ QUI L'ASSOCIE AU CERDI ET À L'IDDRI. CETTE PUBLICATION A BÉNÉFICIÉ D'UNE AIDE DE L'ÉTAT FRANÇAIS GÉRÉE PAR L'ANR AU TITRE DU PROGRAMME « INVESTISSEMENTS D'AVENIR » PORTANT LA RÉFÉRENCE « ANR-10-LABX-14-01 »

.../... Ex-ante WTP turns out to be healthy, and on average equal to actuarial cost. Ex-post uptake also turned out to be reasonable, but heavily influenced by an encouragement design in the form of insurance premium subsidies. Hence commercial adoption and viability of WII products seems to be an area where considerable education and market penetration costs must be incurred.

## ► Policy Brief

Rainfall variation is a major source of income and subsequently consumption risk among smallholder farm households. It is well known that weather shocks, and the subsequent inability of small farmers to service debts they have incurred or to maintain consumption, are major factors in keeping poor rural households in a poverty trap. In this context, a financial innovation that has been proposed and piloted in several countries, in order to alleviate the consequences of risk exposure of smallholder farmers is weather index insurance (WII). The idea with this product is that it pays an indemnity when it is triggered by low rainfall observed at publicly observable weather stations, or by another measure such as area yield impartially measured. The objectivity of the index makes it appropriate to deal with the well-known insurance problems of adverse selection and moral hazard, and it is fast in paying out an indemnity as there is no need for individual loss assessment. This lowers the cost of providing the insurance. However, it introduces other issues, the major one being basis risk. This is because payment of the index based insurance product is based on a measure, which may not be related to individual farmer's income, as the rainfall in a rainfall station, which maybe located far from the farmer's fields may not be correlated with the individual farmer's rainfall experience. The same applies for farmer yield and its imperfect correlation with district area yield (Carter, 2008).

Beginning in the early 2000s, WII was introduced in pilot form in several developing countries as a potentially important tool to help poor farmers deal with rainfall risk. However, when WII

products have been directly marketed to farming households in developing countries, in pilot applications, uptake has typically been quite low (Cole et al. 2012), and adoption of modern technology, one of the purported aims of such products, has been found to be negatively correlated with the provision of index insurance (Gine and Yang 2009). The early assessment of the results of these pilots was that the impact is rather meager for a variety of institutional and behavioral reasons, and the fact that farmers have other informal risk sharing arrangements that reduce their demand for formal insurance and prevent formal markets from being established.

The divergence between anticipated and actual demand raised a set of interesting questions concerning both the determinants of modern input use, as well as the demand or willingness to pay (WTP) for WII. Several candidate explanations have emerged. First and most direct is the issue of basis risk; while actual farm-level yields may be driven by farm-level rainfall, the nearest rainfall station may measure a very imperfect correlate of this quantity. An insurance product with high basis risk simply fails to achieve the desired goal of providing protection against correlated risks to consumption, and hence is not demanded for perfectly good reasons. More subtle explanations explored in recent years include the idea of 'ambiguity aversion' (Bryan 2012), under which households do not perfectly understand the distribution from which the relevant probabilities are drawn, and because they have a dislike of taking on contracts with uncertain properties, their demand is limited. Another preference-related explanation is due to Clarke (2011), who suggests that in the presence of basis risk it is possible that households end up without payouts in the worst state of the world and yet still must pay premiums; hence highly risk-averse agents may dislike the product.

Another reason for which most of the standalone rainfall index insurance pilots have failed to generate demand among those targeted, is that most of WII pilot products have been aimed mostly at general income and consumption smoothing, rather than to deal with spe-

cific risks involving cash flow for the household. Most smallholder households smooth their consumption when hit by idiosyncratic risks, but are much less able to deal with covariate risks, such as those caused by adverse weather, and this is what has given rise to the experimentation with index insurance products. In fact several authors have shown that in the face of such covariate risks low income farming households in developing countries tend to adopt low risk but low return production structures and technologies, which prevent them from growing out of persistent poverty (e.g. Dercon and Christiaensen, 2011, Fafchamps and Pender, 1997).

The paper by McIntosh Sarris and Papadopoulos (2013), underlying this policy brief, deals with weather insurance as it pertains mostly to productive decisions of low-income farm households in developing countries. One major drawback of ex-ante willingness to pay studies that are not backed with an actual insurance product is that they do not necessarily represent actual behavior. In fact, households seem to behave very differently when faced with an actual insurance product. The paper makes an attempt to compare the ex-ante willingness to pay (WTP) for WII with ex-post demand based on an actual offer of the relevant product. The results they report concern a two year experiment in rural Ethiopia, where in the first year, the potential clients of WII products were surveyed and asked about their WTP for WII, while in the second year, they were offered a WII product, and their actual uptake was recorded.

The product offered in that paper is designed to cover the risk faced by farmers who incur a cost (either through own cash or a loan) for modern inputs to apply to their farms, but face the risk of not being able to recoup that outlay if rainfall on their farms is low. In fact the idea of the project is to examine whether the provision of WII could increase the uptake of modern inputs, and hence increase agricultural productivity. The initial analysis of McIntosh et. al. pertains to the productivity and profitability of inorganic fertilizer, and they show that not only fertilizer use is low in most of the project areas, thus affecting negatively observed yields,

but also that fertilizer use, though profitable at observed market prices, is negatively affected by risk related constraints. In such a setting WII seems like a product that could benefit farmers, and allow fertilizer use expansion.

In their baseline analysis they showed that the average as well as the median price households stated they were willing to pay for WII was close to the actuarially fair value of the relevant hypothetical product. The major reason for lack of ex-ante interest was the lack of adequate cash to pay for the WII product. Subsequent to this baseline exercise, actual WII was marketed through a local well-known insurance company. Incentives were provided in the form of randomized allocations of vouchers which were designed to cover a fraction of the cost of the WII premium for insuring the value of inputs of a unit of land, of a size close to the average land cultivated by the project farmers. The range of subsidy amounts ranged from zero subsidy all the way up to 70% of the intended premium price.

The uptake of WII turned out to be reasonable among the study sample, close to 25 percent. However, it was much lower in the overall population, which was exposed and eligible to purchase the WII product. An interesting observation when the uptake figures were analyzed was that in general rather than using the voucher amount to cover a fraction of the cost of insuring all of their land, the farmers instead used the voucher to cover all of the cost of covering part of their land. Furthermore, among those who purchased WII only 21 percent paid an amount over and above the amount covered by the voucher. In other words it appears that it was the subsidies in the form of premium vouchers that induced farmers to take up the insurance. Furthermore, even among those who were given non-zero vouchers, the uptake rate was around 50 percent, implying that even if farmers were offered a "free good", many chose not to take it. A rather disturbing finding of the analysis is that ex-ante stated and actual demand for WII are very poorly correlated. While the ex-ante and ex-post demands were for slightly different WII products, and there was considerable time lag between the ex-ante and ex-post assessments,

their findings suggest that there are limits to the ex-ante studies of WTP for WII.

McIntosh et. al. tried to explore whether the actual demand for WII is affected by a variety of behavioral and other factors, among which several related to basis risk. They found very little correlation between uptake and basis risk related factors or behavioral parameters, while the overwhelming influence was by the subsidies. However, they had rather imperfect measures of basis risk, and also it was not clear whether the farmers themselves had a good notion of basis risk, as most of them, while aware of the rainfall conditions on their farms, were not informed about the weather conditions of the rainfall station used for the index.

As noted in the beginning, earlier pilot projects making available WII have experienced low demand. However, this can be due to the neglect of fundamental issues of design of the indices so as to reduce basis risk, as well as neglect of the context and the real needs for risk management or avoidance of farmers. Careful design as well as implementation can result in healthy uptake, and hence open up a new insurance related commercial market as well as the possibility of behavioral changes and productivity enhancements in the rural areas of developing countries. While the results reported in the paper are preliminary, they are encouraging and suggestive of ways to proceed.

A notable finding of the paper by McIntosh et. al. is the fact that the encouragement design with insurance premium subsidies, was crucial in getting farmers to accept and utilize the WII products. This is reasonable for new, complex, and untested products, such as those of WII, but it remains to be seen whether these products will prove cost effective, scalable, and sustainable without premium subsidies. Nevertheless, the results of the paper are encouraging, given the potential benefits. They demonstrate that understanding the dynamics of insurance demand and the interventions needed to encourage sustained demand remain a challenging but very interesting and promising area of research and development policy.

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