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Abstract

Purpose: The study assessed the challenges facing the adoption and implementation of weather indexed insurance by insurance firms

Methodology: This was accomplished through the use of a desktop literature review. The use of Google Scholar was utilized in order to locate seminal references and journal articles that were pertinent to the study. In order to meet the inclusion criteria, the papers had to be no more than ten years old.

Findings: Using a certain weather parameter, a specific weather station, and a predetermined length of time, Weather Index Insurance is calculated. To avoid crop losses, the insurance might be constructed to cover against index realizations that are predicted to be too high or low. Pilots and feasibility studies have indicated that while the weather index product appears to be a boon, there are numerous hurdles or downsides to weather index products. Because of this, we set out to find out what obstacles insurance companies may face in implementing weather-indexed insurance. Index insurance's biggest flaw is its exposure to basis risk. In addition, weather-related risks exhibit characteristics that frequently contravene classical insurance rules. Drought and other slow-developing meteorological hazards, such as floods, can have a systemic effect since they are regionally connected. As a result, actuarial ratemaking becomes more challenging because of the increased volatility of meteorological variables and non-stationary loss distributions. Third, a lack of yield and weather data makes it difficult to estimate loss distributions accurately. Some farmers may not comprehend weather index insurance and hence not buy it, and a significant number of farmers may also require a subsidy if they want to get weather insurance.

Unique contribution of theory, practice and policy: Crop insurance companies can benefit from approaches like time diversification, local test procedures, and the addition of expert knowledge to observational data, as well as mechanisms like supporting insurance market development as a means of facilitating adaptation. In addition, better training on weather index insurance and regular communication are required.

Keywords: *weather indexed insurance, insurance firms*

INTRODUCTION

Agricultural risks can range from being completely unrelated to one another (such limited hail damage or a single farmer's illness), to being significantly associated with one another (for example, market price risk or widespread drought). Agriculture presents a unique set of challenges when it comes to risk management because many of the hazards involved are strongly interrelated, which can result in entire communities being impacted all at once. It is abundantly clear that regaining lost financial ground is a particularly difficult and challenging task due to the widespread extent of the resulting loss. There may be significant monetary repercussions for governments as a result of the expenditures made for social safety nets or the reconstruction of destroyed infrastructure. For insurance companies, having a large number of policyholders all of a sudden experience losses puts a strain on their reserves and threatens their financial viability. In rural areas, there is frequently no choice except to liquidate assets, which typically takes place at prices below market value (Adeyinka et.al, 2016). This article focuses solely on a particular category of risk (weather), a particular approach to attempting to mitigate that risk (insurance), and a particular kind of insurance product (weather).

The effects that a certain weather event has on an agricultural system, its changeable water balances, the type of soil and crop that is being grown, and the availability of other risk management techniques all play a role in how those impacts play out (such as irrigation). In addition, the negative effects of weather events can be made worse by insufficient infrastructure (such as inadequate drainage), as well as by poor management. When it comes to the management of weather risks, there are two primary categories of risk to take into consideration. These refer to unexpected occurrences that nobody could have predicted, like windstorms or downpours, as well as cumulative occurrences that take place over an extended period of time (for example, drought) (Weber, 2019). The effects that either of these categories of risk have can differ greatly depending on the type of crop, the variety, and the time of year in which they occur. The three most important components of agricultural risk management are known as risk mitigation, coping, and transfer.

Farmers and other stakeholders can manage risks that are too large for them to manage on their own by using insurance as one of the tools that are available to them (risk layering). The assumption of some of that danger is contracted out to a third party, who does so in exchange for payment (or premium). Agricultural insurance, whether it be for crops or livestock, may be of considerable assistance to farming households when it is both available and reasonable. It is possible and even encouraged to use insurance as a supplement to other risk management strategies. Farmers can manage minor to moderate risks by relying on informal techniques that can be implemented at the household and community level, such as diversifying their crops and their sources of labor. In the event of a significant weather shock, insurance policies can be constructed to safeguard against losses in revenue or consumption. Because of this, households are able to avoid selling assets vital to their means of subsistence or using savings. Farmers that have insurance will have a better chance of gaining access to new prospects, which they can do by increasing their capacity to borrow either money or in-kind credits. As a result of this action, farm households stand a better chance of experiencing safer and probably even larger returns.

Products of insurance that are based on weather indices make use of an underlying index in order to calculate damages caused by a particular incident. The index is used as a stand-in for losses, as contrast to traditional insurance, which bases compensation on the amount of actual damage sustained by the insured. The index is nearly always based on meteorological data, and the amount of damage that can be attributed to weather is calculated based on how much the index deviates from typical weather trends in the past. This emphasis on objective data rather than on-ground observation as the major indicator of a payout enables for a cost-efficient and objective assessment of loss. On-ground observation was previously used as the key indicator. In addition to that, it enables a speedy payout to the policyholders and provides transparency in the application process.

The use of insurance as a potential option to offset the negative effects of weather risk has been proposed as a potential answer for many years. In particular, over the course of the previous ten years, study, discussion, and experiments have been carried out about the possibility of utilizing weather indexes to insure agricultural investments or to support catastrophe risk finance for African governments. A broad number of uses have been found for these index-based insurance instruments, and in some cases, they have been put into effect. This is in contrast to traditional agricultural insurance products, which do not have the same degree of adaptability. These diverse approaches have generated a substantial amount of business opportunities for weather index instruments, but they have also generated a substantial amount of controversy and, at times, uncertainty regarding the most appropriate applications for these products.

Pilots and feasibility studies have indicated that while the weather index product appears to be a boon, there are numerous hurdles or downsides to weather index products. Index insurance's biggest flaw is its exposure to basis risk. The gap between the index's payment and the farmer's actual loss is what we're talking about here. A field loss assessment is not required when insuring with index insurance, which means that the actual loss is not taken into account. Several factors play a role in determining the degree of basis risk. To begin with, the base risk is lower when the insured risk is correlated, meaning that it affects a big geographic area to a same extent and at the same time. Hail and localized frost are two dangers that are not well-correlated. Drought, temperature, and wind are better indicators of risk. A higher level of basis risk is present in areas with a diverse range of microclimates, management approaches, and crop varieties; in other words, while the impact of weather risk may be highly heterogeneous, correlations between them do exist (Isaboke et.al, 2016).

Weather index insurance is additionally hampered by a lack of current product options for various types of weather risks. The bulk of Weather index insurance policies have been intended to cover rainfall risk, which is not necessarily the most serious or noticeable weather risk in many locations of the United States. It is necessary to have prior experience insuring various weather-related risks using new indices. A combination of factors, such as rising temperatures and pest infestations, can contribute to farm losses in many parts of the world. If a "basic" Weather index insurance product were to be used for this, it would have to include more than one index or require the farmer to take out a separate insurance product to cover the additional risks.

In order to address these challenges and to promote effective and sustainable markets for weather index insurance and catastrophic insurance in developing countries, the World Bank Group (WBG) launched in 2009 the Global Index Insurance Facility (GIIF), administered by the International Financial Corporation (IFC). The GIIF is meant to be a comprehensive insurance-based program to address the scarcity of affordable insurance protection against weather and natural disasters in developing countries (Jin et.al, 2016). Our study therefore aims at evaluating the challenges facing the adoption and implementation of weather indexed insurance by insurance firms.

LITERATURE REVIEW

In Bangladesh, Al-Maruf et.al (2021) conducted a pilot study on a weather index-based crop insurance system. The study was carried out in Bangladesh. Interviews were conducted in order to gather the necessary data for the study. According to the data, the vast majority of small farmers have a limited formal education and are ignorant of how insurance works or how it applies to their crops. The majority of them do not understand the concept of crop insurance, and they do not have bank accounts, which means that they have very little interaction with the conventional financial system. Many people are concerned that insurance is a Ponzi scheme; in fact, the literature and the discussions that took place in our focus groups were full with remarks from farmers who had experienced theft at the hands of insurance companies or other financial companies in the past. The most difficult obstacle to overcome when developing a viable plan is undeniably convincing farmers of the value of purchasing crop insurance. According to the findings of the study, inter-agency cooperation with the Ministry of Agriculture and its local agricultural extension agents should be considered. These agents are highly knowledgeable about local crop, seed, and fertilizer decisions, which are frequently intertwined with decisions about how best to protect against crop losses. Farmers place a significant amount of trust in these agents, and they enjoy significant levels of farmer confidence.

A study was conducted by McIntosh et.al (2013) to investigate the connection between the use of fertilizer and the demand for weather index insurance (WII) among smallholder farmers in Ethiopia. The research was conducted in Ethiopia. They investigated whether or not the use of fertilizer is profitable under the current conditions of smallholder production, whether or not risk-related factors influence the use of fertilizer, and estimated the returns to inputs in the agricultural production function when insurance was unavailable. After that, they investigate the relationship between insurance demand and the fundamentals of agricultural production functions. In the study, a survey-based estimate of willingness to pay was compared to actual uptake for the weather insurance. The researchers discovered that the reported demand and the actual demand were almost completely uncorrelated. Only those with low marginal returns to inputs really buy insurance, which is consistent with the product's stated function as input insurance. Those with high marginal returns to inputs claim they would buy insurance, but only those with low marginal returns actually do. It turns out that the availability and quantity of insurance vouchers that are distributed at random have a significant impact on the demand for insurance.

When it comes to climate change and the possibilities of weather index insurance, researchers Isaboke et.al (2016) highlight the risks and rewards that climate change presents. Because it protects against weather risks, weather index insurance is especially important to climate change, according to the authors. Although climate change impacts can complicate the pricing of weather index insurance, there are a number of possible benefits that help households adapt to climate change. As climate change increases the probability of extreme weather, insurance premiums must rise as well. In some situations, this may be unaffordable to families. This is followed by a list of advice for individuals who want to assist insurance market growth in an effort to help people adjust. Risk assessments and market development start-up costs are most effectively funded by government and donor financing. By encouraging people to maintain or increase investments in unsustainable livelihoods, government support in the form of premium subsidies may actually hinder adaptation. If the danger is broken down into two levels, the government's support is less likely to be misconstrued. Consider whatever investment governments and donors make to help the insurance markets in light of their potential opportunity costs because adaptation demands are significantly greater than currently available funds.

Researchers from China's Province of Hainan, Lin et.al (2015) did a study to better understand the factors that influence farmers' desire to purchase weather index insurance for crops, as well as to give additional background information on weather index insurance, Farmers in Hainan, China, were asked if they'd be ready to buy weather index insurance. Farmers' desire to purchase weather index insurance is explained by a total of 11 of the 15 variables in the model. First and foremost, farmers may not be interested in weather index insurance because of the danger of the basis. Second, some farmers may not comprehend weather index insurance well enough to buy it, and a large percentage of farmers may also require financial assistance to buy weather insurance, preventing them from doing so. A lower-cost alternative to traditional crop insurance may be weather index insurance, however basis risk remains a major concern.

In the study conducted by Sibiko et.al (2018), survey and choice-experimental data from Kenya were combined in order to investigate the history of an existing weather index insurance program in Kenya and the ways in which alterations to the contractual design could encourage participation in the program. They discover that a significant number of the program's smallholder participants have difficulty completely comprehending its operation, which shakes their trust in the initiative. Farmers' willingness to pay for weather index insurance would grow dramatically if appropriate rainfall readings and thresholds were provided on a regular basis. Farmers place a positive value on mechanisms that minimize basis risk as well, albeit not to the same extent as they place a positive value on increased levels of openness. According to the findings of the study, a potential way to boost participation in insurance programs would be to award contracts to smaller groups rather than to individual farmers. According to the findings of the study, improved training on weather index insurance and more consistent communication are both required. It's possible that group contracts can assist cut down on transaction expenses. Farmer groups have the potential to be useful educational forums, particularly for the dissemination of information regarding novel risk transfer instruments. These concrete results are unique to Kenya; nonetheless, they offer some broader policy-relevant insights into usual concerns pertaining to weather index insurance in the context of small farms.

In their study, Ali et.al (2020) evaluate farmers' readiness to pay for weather index-based insurance (WII) as a market option for sharing climatic risks. This was done so that they could better understand the market. The data were acquired from 704 households in northern Togo, West Africa, using a random sampling method. The data were then employed in a choice modeling methodology. According to the findings of a statistical analysis of the data, farmers' primary concern is dry spells, and maize is regarded as the food crop that is most affected by this issue. The findings also show that respondents are eager to take part in a WII market and would choose to insure maize crops against drought rather than sorghum or rice for an average premium of roughly $14.5 per hectare. The findings indicate that WII should not be provided on its own, but rather in conjunction with other elements, such as the distribution of drought-resistant and highyielding varieties, the provision of loans to organized farmer's groups, the dissemination of weather information via television, radio, and mobile phones in regional languages, and the promotion of education in order to facilitate the proliferation of more advisory services. Because of these characteristics, there is a good chance that farmers' preferences regarding their participation in a WII market will improve.

Singh et.al (2021) use interpretive structural modeling (ISM) in conjunction with fuzzy-MICMAC to investigate and prioritize the constraints that clients face when adopting weather index insurance (WII). Using the Fuzzy-MICMAC approach, the reliance and driver power of barriers have been examined in indirect interactions. An ISM structural model based on binary direct relationships was constructed based on the findings of this study, which revealed 15 major hurdles to client adoption of WII. Fuzzy-MICMAC was then used to examine the relationship between each weather index insurance adoption barrier and its dependence and driving power using the ISM model results. When using the ISM model, the top level of the adoption barrier is related to customer knowledge of weather index insurance. The middle level is tied to weather index insurance demand, while the bottom level is related to weather index insurance supply. An understanding of the mutual relationships between WII adoption barriers can help WII insurers devise a strategy to reduce the dominating key hurdles so that their client base grows.

Agricultural weather risk insurance challenges were examined by Odening et.al (2014), as well as possible solutions to these issues. A narrative on weather insurance was developed in their study, largely based on previously published work. Insurability criteria are regularly violated by weather concerns, according to a study. It is important to note that some weather risks are spatially connected and produce systemic problems, such as drought. As a result, actuarial ratemaking becomes more challenging because of the increased volatility of meteorological variables and non-stationary loss distributions. Third, a lack of yield and weather data makes it difficult to estimate loss distributions accurately. Crop insurance businesses can improve their risk management and product design by implementing some of the recommendations made in the assessment, including time diversification, local test processes, and expert knowledge augmentation of observational data.

In their review, Norton et.al (2013) attempted to build an empirical technique for managing geographical basis risk in weather index insurance by doing research into the underlying causes for variances in weather risk between distributed sites. This was done in order to achieve their goal. In this research, a systematic comparison is made between the amounts paid out by insurance companies in neighboring regions that are based on variances in geographical features. The differences in altitude, latitude, and longitude between the stations, as well as the distance between them, are included in the geographic attributes. According to the data, differences in geographical location are not good predictors of rewards. Payout in nearby locations is the best indicator of the amount that will be distributed at a particular site. The payment differences for the risk of precipitation are also increased when there is a greater distance between stations. However, altitude continues to have an effect on the heat risk. Given that payouts in any particular area are highly connected, the article suggests that it may be viable to insure several weather stations under a single contract as a "risk portfolio" for any one place. This is because payouts in any given area are highly correlated.

The problem of basis risk, which occurs when insurance payouts are dependent on an index that is imperfectly related with actual losses experienced by the insurance policyholder, was analyzed by Clement et.al (2018) in their review. This risk occurs when an insurance policyholder suffers actual losses. The construction of the index, the quality and sampling of data, the estimate of basis risk and its influence on insurance demand and index-insurance supply were all given a great deal of focus and consideration. In its conclusion, the paper makes a number of recommendations for public policy, some of which are as follows: there should be a methodical approach to quantify the magnitude of basis risk; index design should be informed by participatory approaches; index insurance should be made available through existing risk sharing networks. In addition, they suggest improving policyholders' access to information about their risk and the measures they can take to limit risk; creating an enabling environment for a well-functioning insurance market; and having an integrated approach that incorporates insurance with other mechanisms that reduce basis risk. All of these recommendations can be found in the article linked above.

Wairimu et.al (2016) conducted a study on the factors that effect weather index-based crop insurance in Laikipia County, Kenya. A weather-based crop insurance known in Kenya as Kilimo Salama, or "safe farming" in English, is the focus of their research paper, which used a twofold hurdle model to examine factors influencing adoption and the eventual level of uptake. Access to extension, perception and group membership had significant positive effects on adoption (at 1% level), while distance to agrovet and distance to the extension agent office, farming experience, the age of the household head, and the size of cultivated land all negatively influenced adoption (at 1% level) (at 10 percent level). At the 1% level, distance to agrovet negatively influenced adoption, while distance to an extension agent and farm size favorably influenced adoption at the 5% and 10% levels. It is important to promote initiatives that give farmers easier access to agricultural information, group membership, lower transaction costs, and education on the advantages of an insurance plan in order to increase their participation in the Kilimo Salama insurance program and, as a result, lower production risk for their farms.

Mußhoff et.al (2017) checked which role-bounded rationality might play as an explanation for farmers' lacking readiness to take weather index insurance in their article. Their objective was to determine which role-bounded rationality might play (WII). WII is a cutting-edge tool for risk management that has a modest impact on expenditures associated with administration and regulation. In addition, index insurance is not affected by either the problem of moral hazard or the issue of adverse selection. Farmers are used as experimental subjects in an extra-laboratory experiment that takes the shape of a multi-period, single-person business simulation game. The goal of this experiment is to study the factors that may contribute to the low level of readiness to adopt WII. According to the data, first, there is a declining demand for WII when there is an increasing premium loading. Second, there is a correlation between open communication about the loading and a decrease in demand. This correlation suggests that farmers would not engage in a transaction if they believe that the other side will earn an excessive amount of money. Third, informing farmers that the index insurance has been subsidized results in an increase in demand for the product, despite the fact that the cost of the insurance in terms of loading remains the same. This might be interpreted as a sign that farmers view subsidies as a signal for actions that would result in profitable outcomes.

METHODOLOGY

Incorporating a literature search into the job process was a need. Prior theoretical material, both published and unpublished, was taken into account during the study process. A literature review is the primary subject of this study, with a particular focus on the adoption and implementation of weather indexed insurance. Beginning in 2013 and finishing in 2022, a search of the literature was conducted. This finding was made possible by conducting a comprehensive search across multiple databases using a variety of keywords. Google and other search engines were used for both basic and complex searches by the authors. When searching through the data, the phrase "adoption and implementation of weather indexed insurance by insurance firms" was used as the search term. The phrase "Challenges facing the adoption and implementation of weather indexed insurance by insurance firms" was the focus of the initial search and the subsequent Google search. This analysis relied entirely on the information found in these sources. If the article or report was to be included, it had to be peer-reviewed, be written in English, describe the method employed, and reflect the study's findings. The articles were read numerous times to have a sense of the content in order to learn about the challenges facing the adoption and implementation of weather indexed insurance by insurance firms.

FINDINGS

It was discovered that the inverse relationship that exists between price and yield limits the effectiveness of weather insurance while offsetting some of the risks that are there. It was found that the effectiveness of hedging varied from location to location, and it was also shown that the effectiveness was depending on the methodology that was used. The findings of the loss ratio study demonstrated that grouping together insurance policies lowered the level of risk faced by the insurer. Some individuals may not adequately understand weather index insurance, and as a result, they may choose not to purchase it. In addition, a sizeable portion of farmers may require a subsidy in order to purchase weather insurance, which creates a challenge for the successful implementation of the program. Interest in weather index insurance may also be limited due to basis risk. Additionally, some individuals may not sufficiently understand weather index insurance, and as a result, they may choose not to purchase it (Norton et.al, 2013).

As the premium loading rises, there is a corresponding decline in the demand for weather index insurance. Demand can also be reduced by communicating the loading in an open and honest manner. This is an indication that consumers will not engage in transactions if they believe that the other party would earn an excessive amount of money. The increase in demand occurs despite the fact that the costs of insurance in terms of loading have remained unchanged. This is because people are informed that the index insurance has also been subsidized. Because of this, the manner in which people embrace weather index insurance is impacted, and its overall application is restricted (Singh et.al, 2021).

According to the findings, weather index insurance is particularly pertinent to the topic of climate change because it protects against the risks associated with adverse weather. There are a number of possible benefits that can be gained from purchasing weather index insurance, which can boost a household's ability to adapt to the effects of climate change. However, the implications of climate change can also make it difficult to price weather index insurance. In areas where climate change is increasing the likelihood of extreme weather events, insurance premiums will need to rise as well, and in certain situations they may need to rise to a level that is likely unaffordable for households. The emergence of weather index insurance presents an opportunity for those who choose to use it to get a promising new risk management tool (Lin et.al, 2015). The funding of risk assessments and market development start-up costs is expected to be the most productive use of investments from the government and donors. It is possible that financial assistance from the government in the form of premium subsidies, in which the government pays a predetermined percentage of the total insurance premiums, could actually make adaptation more difficult by encouraging households to continue or increase their investments in livelihoods that are not sustainable. A structure of ongoing government support that is less likely to distort reality would be one that divides the risk into a commercial layer that is moderately severe and a social layer that is highly severe. Because the costs of adaptation are so much higher than the levels of funding that are now available, whatever contributions governments and donors make to assist insurance markets should be carefully examined in light of their opportunity costs.

CONCLUSIONS

It has been established through pilots and feasibility studies that despite the apparent benefits of the weather index product, practical implementation presents a variety of difficulties or disadvantages. Index insurance's biggest flaw is its exposure to basis risk. It's also common for weather-related hazards to exhibit features that don't meet traditional insurance standards. It is important to note that some weather risks are spatially connected and produce systemic problems, such as drought. As a result, actuarial ratemaking becomes more challenging because of the increased volatility of meteorological variables and non-stationary loss distributions. Third, a lack of yield and weather data makes it difficult to estimate loss distributions accurately. In addition, some farmers may not comprehend weather index insurance well enough to buy it, and a significant number of farmers may need financial assistance to get weather insurance.

Insurance market development is recommended as a way to promote adaption, according to the report. Risk assessments and market development start-up costs are most effectively funded by government and donor financing. By encouraging people to maintain or increase investments in unsustainable livelihoods, government support in the form of premium subsidies may actually hinder adaptation.

Weather index insurance and regular communication are also recommended by the study. Contracts among a group of people can help keep transaction costs down. Innovative risk transfer products, for example, can be discovered through groups. In addition, the study suggests various techniques for crop insurance companies to improve their risk management and product design, such as time diversification, local test processes and the inclusion of expert knowledge to observational data.

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