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AGRICULTURAL RISKS AND CLIMATIC CHANGE MANAGEMENT

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ABSTRACT

Risk and uncertainty are inherent in agriculture, and they have a direct impact on output and profitability. Risk management is a useful strategy for farmers to reduce uncertainty. Weather risks as droughts, floods, windstorms are frequent and the economy are heavily dependent on them. These variables affect many families and companies in the same area at the same time. However, there is a scarcity of research on combining several risk management methods at once, as well as the possibility for overlap and consequences. Climate change adaptation in agriculture is important for evaluating the impacts and vulnerabilities of climate change as well as creating climate change policy. To insulate farmers against risks in agriculture, the government has implemented various schemes such as the National Agricultural Insurance Scheme and weather index-based crop insurance schemes, and this paper develops a typology of adaptation to systematically identify and define agricultural adaptation options to climate change. After that, the topic of risk management is addressed, followed by a look at hedging models. We wrap up with a thorough examination of agricultural insurance, focusing on the moral hazard and adverse selection issues that crop insurance raises.

KEYWORDS: *Adaptation, Climate Change, Crop Insurance, Policy, Weather.*

1. INTRODUCTION

Agriculture is a risky industry in areas where natural catastrophes such as floods, droughts, and cyclones are common. Agriculture contributes for 24% of India's GDP, and any interruption in output has a multiplier effect overall economy. Given the inextricable link between economic and agricultural development, policymakers and academics confront a significant challenge in controlling agricultural hazards. Risk aversion causes underinvestment in agriculture, which leads to inefficiency. Crop insurance helps farmers maintain a steady level of output and profit. It helps in resource allocation in the production process. The Indian government has voiced worry about increasing agricultural risks, which has resulted in the sad occurrence of farmer suicides, such as the one that happened in Maharashtra. In the face of uncertainty and risk in agriculture, different programs to safeguard farmers have evolved throughout time in various nations, including guaranteed pricing, subsidized loans, and crop insurance, which are of urgent importance in the near term.

Approximately 1 billion people live on less than $1 per day. Three-quarters of those live in rural areas, and over one-half depend on agriculture or agricultural labor as their primary source of livelihood (International Fund for Agricultural Development 2001) [1]. Thus, poor rural households are particularly susceptible to the financial consequences of weather-related natural disasters. Many of the rural poor have income sources that are related to the success of agricultural production or are otherwise highly vulnerable to severe weather events, even though they are not directly involved in agricultural production. Uninsured weather risks contribute both directly and indirectly to the existence of chronic poverty in rural households. While health issues are often cited as the greatest risk facing many rural households, uninsured weather risks often contribute both directly and indirectly to the existence of chronic poverty. Droughts and floods, for example, can directly kill productive assets that have accumulated at a high opportunity cost over years of squandered consumption. Households that are thrown into poverty as a result of such events often struggle to recover and begin the long process of acquiring productive assets[2].

Agriculture adaptation involves a wide range of stakeholders with a wide range of functions that are often interwoven. Individual producers (farmers), governments (and other government organizations), as well as private enterprises and businesses, all have a part in the adaptation process. Governments and companies need to understand how public (like increased investment in income stability or crop insurance) and private (like crop production or crop insurance) policies influence producer choices. Agricultural adaptation decisions are made in real time, in an "incremental" way, in response to a range of (climatic and non-climatic) inputs and circumstances. Many people advocating for adaptations must realize that farmers, in particular, consider climate change to be a component of their continuous management choices. The rural poor in certain areas employ a variety of structural mitigation techniques to protect themselves against weather-related losses. Supplemental irrigation, for example, to compensate for the risk of insufficient rainfall, or flood control dams and levees are examples. On the other hand, these structural mitigation techniques are not always feasible, reliable, or cost-effective. Households may reduce the financial effect of risk via savings, diversification, share tenancy, creating lower risk outputs, or producing outputs that need less investment in variable productive assets.

1.1 Weather Index Insurance:

Researchers and development agencies have been looking into the possibility of using weather index insurance to provide risk management options for the rural poor in recent years. Weather index insurance pays indemnities based on the realizations of a weather index that is highly associated with actual losses, rather than the policyholder's actual losses. A weather index, in its most basic form, calculates a particular weather variable (such as rainfall or temperature) at a specific weather station over a specified time span. When compared to traditional insurance plans, operational expenses are cheap due to the simplicity of sales and loss adjustment, the fact that policyholders do not have to be classified according to their risk exposure, and the absence of asymmetric information. Because no farm-level risk assessment or loss adjustment is required, insurance firms without extensive agricultural expertise may sell and service the products. Disease, pest infestation, or any number of other factors other than the meteorological variable on which the index is based may cause losses. Second, it is possible that the meteorological variable used to calculate the index is not spatially covariate. Therefore, the measurement of the weather variable on the farm or at home may differ considerably from the measurement at the weather station.

1.2 Data Collection and Management:

For weather index insurance to be successful, both the insurer and the policyholder must have confidence that the index is being computed properly and that the data is secure from manipulation. To establish this confidence, a trustworthy government or commercial source of publicly available meteorological data should produce the underlying index. New Product Development Because the underlying index is based on publicly accessible data, competitors may simply duplicate a weather index insurance policy once it is produced and offered for sale by an insurance provider. Due to the "free rider" problem, private-sector insurance companies are unlikely to engage in the necessary research and development to bring a weather index insurance product to market. Governments and donors have continued to finance feasibility studies and pilot tests of new weather index insurance products as a result of this. Governments and donors may also be able to support by providing weather index insurance companies with a source of contingent resources. According to some data, those who are at risk appear to overlook the likelihood of the most serious and infrequent loss events [3], [4].However, weather index insurance insurers and reinsurers cannot continue to disregard the possibility of such incidents.

Premium rates must be added to account for the possibility of very uncommon weather occurrences, such as those that are more severe than those recorded are in historical data. Because there is no data to quantify the frequency and severity of such severe occurrences, insurers and reinsurers seem to be very cautious when calculating the premium burden. As a result, there is a disconnect between what buyers are prepared to pay for severe weather insurance and what sellers are willing to accept. Crop insurance is generally recognized as a critical instrument for maintaining farm income stability by encouraging technology, enabling investment, and increasing credit flow in the agricultural industry. Crop insurance promotes self-sufficiency and self-esteem among farmers by enabling them to seek compensation as a matter of right in the case of crop failure. Therefore, it lessens the impact of crop loss by protecting farmers against natural catastrophes beyond their control. As a safety net, the federal and state governments of India have established a variety of crop insurance programs in recent years. Recognizing the importance of crop insurance in managing risk and uncertainty in agriculture, the present research examined farmers' crop insurance knowledge and perceptions of different agricultural hazards.

1.3 Weather Data:

Comprehensive and reliable weather data for the past and future is a prerequisite for the emergence of a competitive weather risk market. Historical data, usually at least 30 years of regular information on key parameters, must be available and affordable. Operational weather stations must be established, as well as the basis weather variables and cleaning procedures. The World Meteorological Organization collects SYNOP data from all countries' weather stations (WMO)[5].Finally, the lack of widely agreed quality control protocols, as well as different characteristics of non-SYNOP data[5], differing meanings of daily average or maximum temperature data, for example – pose a problem to the weather markets, just as they do in OECD countries. There are a number of options for obtaining safe and accurate rainfall data:

- First and foremost, incentive systems must be oriented toward precise data measurements.
- Second, comparing historical raw data and cleaned data for pricing purposes, as well as matching weather station series with information from third-party sources, will help to provide an understanding of the cleaning methodology used by weather stations.
- Third, meteorological services, like the Moroccan weather service, may have close relations with major existing weather service authorities in OECD countries. These collaborations will help to ensure that international quality requirements are met.
- Fourth, the possibility of data tampering can be effectively mitigated by using the weather risk provider's fallback stations as well as crosschecks with nearby stations. Weather data sensors installed directly on end-user clients' premises, such as multiple moisture or tiny temperature gauges on farmland, can be very effective in preventing data manipulation. The Canadian Earth observation satellite RADARSAT is investigating the possibility of using satellite data for back-up and verification purposes in a collaboration with the World Bank [6].

Data tampering can also be prevented by contract design. Proportional contracts, for example, have less incentives for exploitation than digital contracts, which have payoffs that are fixed on a "all-or-nothing" basis. Furthermore, weather risks are linked within an area. Local insurers with insufficient geographic diversification find it difficult to pool losses and have affordable insurance coverage due to this spatial covariance. Although primary insurers can move risks to a foreign reinsurance market in principle, there is little risk transfer from emerging markets for a variety of reasons. Due to a lack of standardization and asymmetric knowledge between insurer and reinsurer, the size of weather risk readily available for underwriting is small, and transaction costs are high [7].

Finally, government risk management programs can crowd out risk management in the private sector. Many governments have stepped in to support farmers with a number of interventions. Governments minimize risk by, for example, stabilizing costs, subsidizing crop yield insurance, and providing drought relief. While most programs, especially multiple-peril crop insurance, have consumed significant public funds, there is little evidence that they have had a positive impact on agricultural lending or development. Instead, they have contributed to farmers taking undue risks and an increasing reliance on government disaster relief [8].

1.4 Vulnerability to Weather-Shocks:

Most families and businesses in developing countries depend on agriculture and agribusiness for their primary source of income; in 1999, 69 percent of the population in low-income countries lived in rural areas, compared to 50 percent in middle-income countries and 23 percent in high-income countries. In low-income countries, agriculture accounted for 27% of GDP, compared to 10% in middle-income countries and just 2% in high-income countries[6]. These figures understate the importance of agriculture for economic development, which is amplified by multiplier effects, the role of agricultural exports as a source of foreign exchange (over associations with agriculture to additional financial fields), and the overarching importance of subsistence farming for the majority of the population's livelihood.

Agriculture is inherently reliant on the vagaries of nature, such as rainfall variations. This puts farmers' productivity (or yield) at risk, affecting their ability to repay debt, pay land rents, and provide for their families' basic needs. Weather events, on the other hand, are essential for rural lending institutions and agribusinesses because they decide borrowers' and input providers' risk exposure. Since weather conditions influence a large portion of business activity, many developing countries in Sub-Saharan Africa and other areas of the world have high vulnerability to rainfall variability in both agriculture and GDP[9].

Farmers and producers' precarity ultimately transforms into macroeconomic vulnerability. Developing countries are not only more weather-dependent, but they also bear the brunt of natural disasters (due to dangerous environmental conditions), many of which are exacerbated by weather hazards. Natural disasters took an estimated 50,000 lives per year between 1988 and 1997, according to the World Bank (2001), and caused direct damage worth more than US$60 billion per year.The vast majority of these costs were borne by developed countries: Between 1990 and 1998, 94 percent of the world's 568 major disasters occurred in developing countries. The total annual cost of floods in Asia, which experiences 70% of the world's floods, was estimated at US$15 billion in the 1990s. These figures are likely to grow in the future, based on current trends. El Nio occurrences, which are associated with unusual floods, droughts, and storms, have become more common in the last ten years [10].

1.5 Traditional Weather Risk Management is Costly and Ineffective

Farmers in developing countries have always been exposed to weather threats, and have developed strategies for reducing, minimizing, and dealing with these risks for a long time. Traditional risk management encompasses steps taken both before and after a potentially hazardous incident. Ex-ante strategies include building up buffer stocks as a safety net and diversifying income-generating activities by shifting labor allocation (working in farm and non-farm small businesses, and seasonal migration) or changing cropping practices (planting different crops, like planting in different fields and staggered over time, intercropping, and relying on low risk inputs).Companies may also self-insure by diversifying their business operations and growing their capital. To minimize weather hazards, communities employ irrigation systems and conservation tillage, which protects soil and moisture. Ex-post methods include farmers looking for off-farm employment, distressed sales of cattle and other farm assets, removing children from school for agricultural labor, and borrowing money from family, friends, and neighbors.

Risk management has aided poor nations in dealing with weather hazards, but it has significant flaws. These methods are costly because they often decrease short-term vulnerability while raising long-term susceptibility. For example, when a farmer diversifies, he foregoes greater revenue due to specialization in exchange for reduced income volatility. A farmer, on the other hand, who sells productive assets like draught oxen to make ends meet decreases his future revenue stream. Similarly, if a business decides to take up less credit than it needs in order to keep a credit reserve in case of a weather shock, it misses attractive market possibilities.

1.6 Climate Stimuli for Agricultural Adaptation:

The effects of climate change on agriculture have traditionally been debated in terms of present typical (or "natural") growing season conditions and potential future normal conditions. Changes in average (mean) temperature and precipitation are typically the subject of traditional climate effect scenarios. Some have also considered other climate characteristics such as the growing season length and the timing of frosts, and climate-related factors such as pests and diseases, invariably for an average year sometime in the future. Despite the significant impact of climate change, including instability and extremes, agricultural adaptation does not work or develop solely in response to these climatic stimuli. Economic circumstances, policies, the atmosphere, population, and technology, among other non-climatic factors, all have important consequences for agricultural decision-making, including adaptive decision-making.

2. DISCUSSION

Farmers in emerging and transition economies must consider risk when making investment and financing decisions. Figure 1 shows the Challenged Faced by Insurance Companies in Order to provide Services. Agricultural insurance, while being one of the most commonly listed risk management methods, may play a critical role in managing the risks associated with farming. In practice, agricultural insurance is almost always used in conjunction with a broader range of risk management strategies, of which good farm management practices are a key component. Agriculture insurance schemes may help farmers reduce their disaster risks. Adaptation is exacerbated by the consequences of shifting market markets, trade negotiations, resource utilization rights, and government subsidies and support services. Agricultural changes are made on a regular basis in response to non-climatic factors, especially the demand, as well as changing climate conditions. Non-climatic factors can either intensify or worsen climate-related threats, or they can dampen, mitigate, or overwhelm the consequences of climate change. Adaptive decisions in agriculture are taken in terms of the combined impact of climatic and non-climatic conditions, which are ultimately felt economically by commercial producers.

Furthermore, when it comes to coping with weather hazards, certain informal risk management methods are ineffective. Weather-related occurrences are a kind of covariate risk since they affect a significant number of families in a city or region at the same time. Informal agreements, on the other hand, tend to fall apart at times of extreme stress, such as crop loss due to drought, since everyone in the group, or "risk pool," is impacted at the same time. Because the village's total income is low, community-based informal insurance arrangements have broken down.When supply exceeds demand, livestock prices plummet, as they happened in the preceding example of the farmer attempting to sell cattle to make ends meet following a drought. In the same way, when farmers seek off-farm employment in the aftermath of a natural catastrophe, the rapid increase in labor supply lowers market wages.

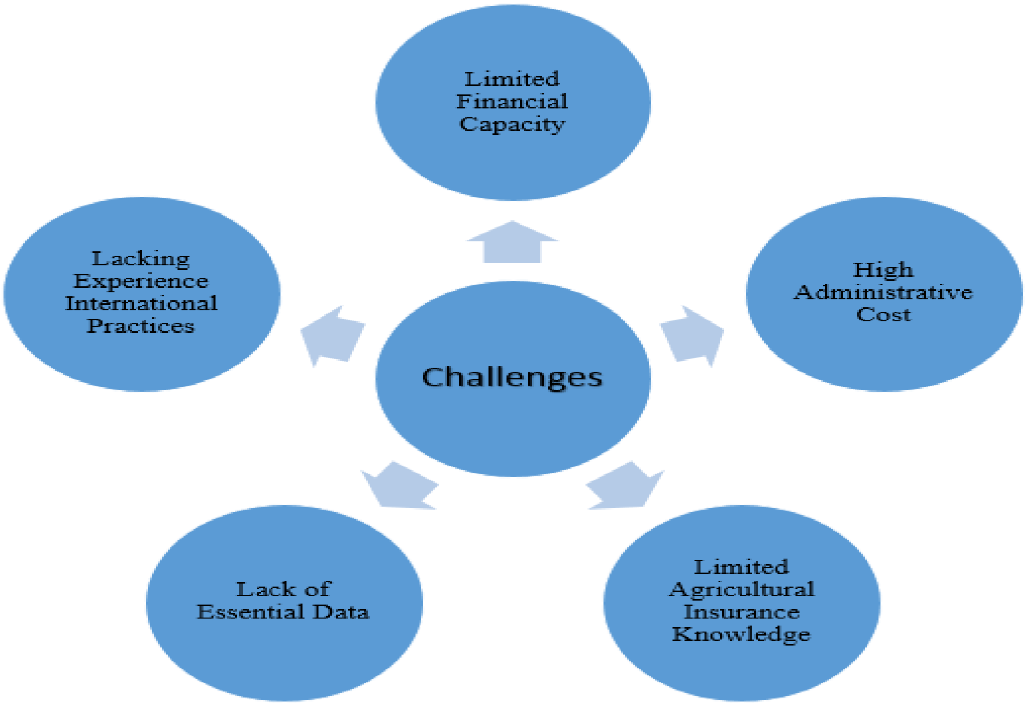

Figure 1: The above figure shows the Challenged Faced by Insurance Companies in Order to provide Services

3. CONCLUSION

Crop production, weather and climate information systems, and water management technologies, such as irrigation, are all examples of technical advances that are being developed by government and industry and will be adopted by farmers in the future. Government agricultural subsidy and support systems (including crop insurance, defined income stabilization, and ad hoc compensation), government resource management schemes, and the financial services sector's production of private insurance are all examples of government programs and insurance.In order for climate change risk assessments and/or risk assessments in agriculture to be realistic, well-founded forecasts of the possible use of response options must be included. This necessitates an understanding of agricultural decision-making mechanisms, as well as how future climate change adaptation blends into current government, business, and producer management decision-making, as well as the pressures and triggers for adaptation. Simultaneously, any attempt to facilitate and support the introduction of agricultural adaptation options should provide an assessment of the options available.

Consequently, this study recommends the strategies toward the risk reduction strategies for disaster risk reduction. This study also offers a basis for identifying the various agricultural choices available, the forms themselves are somewhat generic. Obviously, complex adaptation steps for specific farm systems, territories, and farmers will need to be adapted to local requirements and decision-making processes. The study also exploring the potential effects of agriculture insurance for disaster risk reduction because of unplanned urbanization, persistent poverty, and ecosystem degradation. The disaster risk reduction by financial strategies may play an important role in disaster risk reduction. Secondly, this study discussed the existing lack of experience to have a better financial mechanism, limited scope for product diversification, and high administrative operational costs.

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