“To Farm or Not to Farm: An Introduction to Index Insurance” Outline

Overview

The Financial Instruments Sector Team (FIST) at the International Research Institute (IRI) at Columbia University helps people overcome climate risks and improve food security through financial tools such as weather index insurance. This lesson focuses on drought insurance and follows the approach through which FIST engages with farmers to understand their risks, the risk management strategies that are available to them, their preferences, and whether insurance could be a viable and valuable option or not.

Subject

Science

Suggested Level

Middle School

Learning Objectives

- Students will learn about the impacts of drought on certain parts of the world.
- Students will be able to understand how index insurance can help address climate risk.

NGSS

- MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics
- MS-ESS3-2 Earth and Human Activity
- MS-ETS1-1 Engineering Design

Materials Needed

- Hat
- Different colored markers
- Dice
- Playing cards

Background Information

Climate change impacts agriculture all over the world. Certain places experience increased periods of drought while others experience extreme precipitation that causes flooding and some places will experience both. Index insurance aims to help minimize the risk while maximizing the opportunities of the farmers to do well that year. Index insurance uses rainfall data to assess the loss for farmers around the world and now satellite data is used as a better measure. With a changing climate, over time the insurance will likely get more expensive and then it will need to be reevaluated whether insurance is still the best measure for these farmers to minimize their risk. However, there needs to be insurance now that helps protect the farmers as they adapt their farming approaches to adjust to the future climate.

Additional Reading/Resources

- Recording of Lesson
- Earth Institute Lesson with Background Information

Activity 1 - To Farm or Not to Farm

Time Required: 30 minutes

The goal of the FIST team is to develop insurance projects to help farmers make enough money to be able to cover insurance so that any danger is minimized to take out a loan and maximize their opportunities. This activity will model index insurance and drought insurance is the specific climate event being discussed.

Farmers have many decisions to make when planting their crops. The goal is to take advantage of the remaining good years as climate change begins to change the landscape of where they plant. This is called climate adaptation. So the goal is for the FIST team to help the farmers make the most of opportunities that may leave them vulnerable in drought years by reducing risk. There are several ways to reduce risk like changing crop patterns, having savings, working with communities, or drought insurance. The FIST team works to see which would be the most successful for the farmers in their communities.

The reason there is risk with planting crops for farmers especially when climate change is intensifying is because precipitation patterns are changing and becoming less predictable. This means that there will be years when the weather will be fine, which we will call “ok years” in this activity, and years when there will be drought, or bad years.

In this activity, each student will have a hat or some sort of object they can place things in and five items. One of the five of the items should be different from the rest or be marked to differentiate it from the other four. For example, four blue markers and one red. The four similar items will represent the ok years while the different item is a drought year. This represents a probability distribution with 4:1 odds of having an ok year or a 20 percent chance of their being a drought year. The instructor will now have each student pick their own “years” out of their object, but as a class they will collectively vote on the following questions:

1. Without looking at your object, randomly pick one of your items out of your object. What did everyone get?

The students will answer with either drought or ok year. There should be a mix of students that had drought or non-drought years and this is a great example to illustrate that there may be a higher probability of having a non-drought year, but there is still a risk that you will have a drought year. There is the possibility that you go multiple years without a drought because you are replacing the items every time you pick one out of the object, or you can get a drought year every time so the question becomes how do you manage the risk as a farmer. The instructor will have all the students place their items back in their object to pick again with the next question.

2. The situation is that you have a chance to take out a loan and instead of using old seeds, you could take out a loan to buy high quality, locally bred seeds. These seeds are more expensive which is why you need the loan. If you have an ok year, then you get twice as big yields then if you used your old seeds. However, if there is a drought, you cannot pay off the loan because you have produced no seeds. Would you like to take the chance with high quality seeds or not take a chance?

The students will vote on whether or not they would like to take the risk. Once they have decided, the students will shake their object and then randomly select an item from their object. If they elect to take the risk and get a good year, they will earn twice as much money and food, but if it is a drought year, they lose their farm. This is the situation many farmers are in and these are the kind of odds of many business decisions.

3. You could pay a fee to protect yourself from the risk where you get a payout to cover our losses so you do not lose the farm. This is the drought insurance. Do you want to pay the fee?

The students will decide on whether they would like to buy insurance or not. The instructor should explain that the students will break even if there's a drought year and they do not get any more money than that.

4. Now we have the same question, would you like to use a high productivity seed?

If the students chose insurance, they will see they are more protected if they have a bad year with their high productivity seeds because they will not lose their farm rather they just break even that year. The instructor should emphasize that there are many uncertainties in probabilities which is why these decisions are so difficult and important for farmers to make. These questions can be repeated multiple times in a variety of orders so if the students are enjoying them or the instructor wants to focus on the probability aspect of the lesson more, there is freedom and flexibility to do so.

Discussion/Wrap Up

This is used by the FIST team to see if farmers would be interested in index insurance. These games help inform research questions, teach insurance concepts to the farmers, and help design insurance concepts to fit an individual region. It allows the FIST team to measure the demand of the farmers without creating the product first and it can be refined based on local contexts like whether farmers would buy insurance as individuals or as groups or if informal lending mechanisms are more effective than the formal insurance. It has been found that these simulations do increase the demand for insurance if it is offered in the area.

1. If you were a farmer, would you want to buy insurance? Why or why not?
2. Why may some farmers still be hesitant to buy insurance, even after this lesson?

Connections with Other Subjects

Statistics/Math→ Probabilities are a big part of this lesson and the lesson does not delve into the statistics or math behind them, but there is an opportunity for the instructor to integrate coursework for middle school math or statistics by further emphasizing the statistics behind this game.