

---

# A comparative study of risk management in agriculture under climate change

*Jesús Antón, Shingo Kimura, Jussi Lankoski and Andrea Cattaneo  
Trade and Agriculture Directorate, Organisation for Economic  
Co-operation and Development, Paris*

## **SUMMARY OF THE PRESENTATION**

This paper examines agricultural risk management policies and how these respond under conditions of climate change. It investigates the demand and effectiveness of different risk management policy tools using a microeconomic simulation model that is calibrated on different types of individual crop farms in three samples from Australia, Canada and Spain, which are affected in different ways by climate change. Four types of policies are analysed: individual yield insurance triggered by observed yield shocks on the farm; area yield insurance triggered by a reduction in the average yield in a given location; weather index insurance triggered by a rainfall index built from the nearest meteorological station; and *ex post* payments triggered by a large systemic shock.

Few insights into the impact of climate change on the variability of crop yields are provided in the available literature, although there is relatively more empirical information of its impacts on the level of yields. The impact of climate change differs depending on the location. For example, the most reliable sources to date reveal that climate change will increase production risk as measured by yield variability of the main crops in continental Spain, but that yield variability on the Canadian Prairies will likely be reduced for crops such as wheat and barley. In Australia, the evidence varies with some commodities showing increased production risk and others showing reduced risk.

As with any modelling work this analysis has its limitations: the samples of farms are not representative of their respective country or province, the climate change and behavioural scenarios are subject to strong uncertainties, the model only measures welfare gains for individual farmers, the number and representation of farmers' strategies and policy instruments are not exhaustive, and the value of the parameters could always be improved. The objective of this paper is not to deliver specific policy advice to the countries participating in the analysis. On the other hand this research does provide valuable insights about how policies interact with risk management and adaptation strategies, and how to tackle policy-making under strong uncertainties.

There are strong links between adaptation and risk management policies, and government responses to protect farmers from climate change risks will affect their strategies. For example, public support for insurance schemes and for *ex post* payments may reduce the

incentive to diversify farm production away from more climate sensitive crops and farm practices. In this sense these government supported instruments can potentially crowd out appropriate adaptation strategies by farmers.

Previous OECD work has shown that in general, insurance subsidies do not correct potential insurance market failures. This paper confirms that the gain for the farmer from lower risk is generally smaller than the budgetary cost of the measure. In this sense, these risk management policies are a second best response to reduce farm risk. This paper shows that, given an objective of reducing the variability of farm income, it is possible to investigate which is the most cost effective instrument under different scenarios, and then identify a policy that is robust across scenarios. In the absence of perfect and symmetric information, and thus the inability to implement first best policies, the analysis of these second best solutions can provide good guidance for policy-making.

The most reliable scenario of climate impacts only marginally changes the risk environment and, therefore, only marginally increases the demand for insurance (except in Spain). Individual yield insurance tends to be very costly for governments, while weather index insurance and *ex post* payments are cheaper on average. *Ex post* payments are highly variable and can be extremely high in some years. On the whole, however, climate change is likely to only slightly modify the yield variability in some locations and new risks associated with climate change do not seem to be an appropriate justification or basis on which to develop new risk management policies.

The analysis in this paper goes beyond a standard climate change scenario and investigates policy making under strong uncertainty. First, two different climate change scenarios are examined: standard climate change versus a situation with numerous extreme events. Second, three different behavioural responses by farmers are examined: no response due to ignoring climate change (misalignment); adaptation by diversification; and structural adaptation. The strong uncertainties about the climate change scenarios and behavioural responses (referred to as “ambiguities”) are organized in seven scenarios. Additionally, two different policy objectives related to reducing farm income risk are investigated. Estimating the cost-effectiveness of each measure in each scenario is a complex quantitative exercise and the results are not always intuitive and differ across countries and farm types.

The possibility of extreme events and misalignment scenarios significantly changes the policy decision environment. The analysis of government’s best response to this ambiguity is very challenging and requires a significant change in the approach. Rather than identifying optimal policies, the definition and understanding of the plausible scenarios is a core part of the analysis. Governments may seek the implementation of “robust” policies that are not optimal under any scenario but that may be able to respond well to different environments and avoid very bad outcomes, particularly under extreme events and misalignment. The misalignment scenarios are characterized by high budgetary expenditure and low adaptation practices. Other policy initiatives that focus on information and training can help prevent the misalignment of risk perceptions. This paper shows that it is technically feasible to define plausible scenarios and implement robust criteria in response to strong climate change uncertainties.

The first policy objective considered in this paper is the reduction of the overall risk of farm income. It is focused on normal, or marketable, risk and, therefore, there is not a strong case for public support unless it is temporary or oriented to developing insurance markets. It is known that reducing farmer's exposure to normal and marketable risks has crowding out effects on farmer's risk management and adaptation strategies. If a government retains the objective to reduce the overall risk, then area yield and weather index insurance are, in general, robust policy options: cheaper than individual yield insurance and covering a significant part of the farm specific risk.

The second possible objective considered in this paper is to provide an indemnity only when the lowest farm income outcomes occur. This objective is related more to catastrophic risk and the case for market failure and government support is stronger. *Ex post* payments can be effective in dealing with extreme systemic risk situation and are robust across scenarios. Individual yield insurance with the appropriate deductibles can also be better targeted to individual low returns than to overall risk, but it is commodity specific and more costly than other types of insurance.

*Ex post* payments have disadvantages that are not fully reflected in this analysis. The costs of assessing systemic losses may be significant; many countries also experience governance difficulties (such as those derived from moral hazard) in disciplining these *ex post* payments. Other existing social safety nets need to be considered as alternatives.

Insurance schemes offer a continuum from programmes that are individually triggered to those that are triggered based on specific indices. Area-based insurance is similar to individual yield insurance when fewer farmers are included in the area, and similar to an index insurance the larger the size of the area. The associated costs also run along a continuum and this is why there is no obvious best choice among these different instruments. A good alternative is to develop a range of instruments with limited government financial support so that individual farmers can self-select their insurance. Providing free *ex post* assistance in addition to subsidized insurance can hinder the effectiveness of these programmes.

### **The citation for the original paper is:**

Jesús Antón, Shingo Kimura, Jussi Lankoski and Andrea Cattaneo (2012), "A Comparative Study of Risk Management in Agriculture under Climate Change", *OECD Food, Agriculture and Fisheries Working Papers*, No. 58, OECD Publishing. <http://dx.doi.org/10.1787/5k94d6fx5bd8-en>

