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Executive Summary

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Risk Management
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Executive Summary

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1. Motivation for the study [1]

The economic stability of an entire rural area can be jeopardised by crises caused by different types of natural disasters, from traditional hazards like weather events to livestock or plant diseases. Moreover, volatility of temperature and precipitation, and the occurrence of extreme weather events have increased – and are likely to continue increasing – due to global climate change. Farm income is not only affected by production risks but also by price risks, market risks (for example an unbalanced relationship with retailers) and policy risks. In the European Union (EU), price volatility might increase due to recent policy reforms.

Governments are aware of the importance of these risks and many countries have decided to help the stabilisation of their agriculture by supporting different agricultural risk management schemes. In the EU, there is an ongoing discussion on the role European policy should have regarding agricultural risk management. The aim of this report is to improve knowledge about risk management in EU agriculture, more specifically to examine the role and the function of agricultural insurance as a risk management tool, and to evaluate the potential of index insurance schemes for crop risk management. This study constitutes a basis with which to analyse strategies to integrate risk management tools within the Common Agricultural Policy (CAP). It provides a collection of mostly unpublished information on risk management tools and experiences at Member State (MS) level that should be useful for the future political debate.

1 This report is a summary of the JRC Scientific and Technical Reports *Agricultural Insurances Schemes* produced by the Institute for the Protection and Security of the Citizen (IPSC) – MARS Unit (before the Agriculture Unit) – of the Joint Research Centre (JRC) of the European Commission in the framework of the administrative arrangements No AGRI-2005-0321 and No AGRI-2007-0343 with the Directorate-General for Agriculture and Rural Development (DG AGRI).

2. Crop risk management systems

2.1 Risk management systems in the US and Canada

Examples of well-developed crop risk management systems can be found in the US and Canada. In both countries, in which there is a full (Canada) or partial (US) involvement of the public sector in the insurance system, yield or multi-peril insurance is widely available for most crops. In the US, different types of revenue insurance have significant demand and income insurance is being developed. In Canada, there are different programmes available for income and disaster protection. Index insurance is present in both countries, specially developed in Canada, with area insurance, weather index insurance and insurance based on satellite imagery.

2.2 Risk management systems in the EU

The information on EU national systems reported in this document comes from national experts from all EU-27 countries, except Malta. Additional information was obtained for Croatia and Turkey. These data are unique but extremely complex to evaluate, because of the diversity of cover of the insurance products and because of the differences in their insertion in the political schemes. In the absence of a legal mandate to collect the data, the information received is very heterogeneous. In some cases, the data provided were clearly incomplete, in particular in countries with little or no public support.

2.2.1 Public aid

The regulation of public aid to agriculture differed between MS up to 2006, although most MS followed the Commission Guidelines. Since December 2006, when a regulation (EC, 2006a) on the application of Articles 87 and 88 of the Treaty was adopted together with new Commission guidelines (EC, 2006b), MS have a common legal framework for bestowing disaster assistance.

Public aid or compensation for agricultural losses is actually given on an ad hoc basis in most countries, regardless of the policy on insurances. When insurance is not subsidised, it is common practice to provide aid through compensation schemes, or through calamity funds, often partially financed by the agricultural stakeholders (on a voluntary or compulsory basis). There is public compensation in the form of ad hoc aid, calamity funds, or both in most MS (in Ireland, Luxembourg and the UK for livestock

only). In the EU-27, the yearly average of public aid through these forms is more than EUR 1 billion. Given that some data on ad hoc aid for livestock are missing, the figure is most probably underestimated.

An inverse relationship appears between the quantities spent in insurance subsidies and the quantities spent in public *ex post* compensation. This means that it is possible to reduce ad hoc aid through fostering insurance. However, this does not necessarily mean that in this way public expenditure becomes more or less efficient.

2.2.2 Insurances

The development of agricultural insurance schemes in each country appears to be linked to two main factors.

- **Risk level** and typology (hail, drought, excessive rainfall at harvest or flowering time, frost kill, etc.). Countries with low crop risks (for example Denmark, Ireland and the UK) show low development of insurance, while countries and sectors with high risks (fruits and vegetables, Mediterranean countries) show a high development and support of insurance.

- **The Member State's policy** to support the system. For non-systemic risks (hail), the private sector offers suitable insurances. For insurance products offering comprehensive cover (including systemic risks) there is a direct relationship between insurance development and public support.

The total amount of agricultural insurance premiums in the EU is around EUR 1.5 billion per year, with a public subsidy of approximately EUR 500 million. The average amount of insurance indemnities or loss compensations received by farmers is close to EUR 1.1 billion, close to the amount of public compensation in the form of ad hoc aid and calamity funds.

In the EU-27, insurance systems are either entirely private, private but publicly fostered, or entirely public (Greece and Cyprus). Technical aspects of insurance are important for a sound insurance system. The development of agricultural insurance schemes is hindered by the high cost of re-insuring systemic risks such as drought. Some countries offer some kind of public re-insurance. This is the case in Spain, Italy and Portugal.

In some countries, insurance is not only fostered through subsidies and re-insurance, but also through regulations. In these countries, the law forbids that ad hoc measures or disaster funds compensate for damages that could have been insured. The 2006 regulation has made a step forward in this direction. From 2010 on, it has imposed a 50% reduction of public compensation for those farmers who did not take up certain insurance cover. This measure is expected to partially avoid the potentially negative effect of public compensation on the insurance demand and the insurance market, and will also encourage farmers to further improve their risk management.

The development of insurance schemes in the livestock sector is generally lower than in the crop sector, focusing mainly on accidents and non-epidemic diseases. Livestock risk management relies on sanitary assistance programmes; major crises (diseases with high externalities) are covered by public aid.

The insurance market in the EU-27 is also very different from one country to another. Nevertheless, in most countries there are few market players, with one or two dominant companies. This suggests that there is a need to promote competitiveness in the sector.

2.3 Implementation of a European risk management system

Given the high diversity of risks and of socio-economic backgrounds in the EU-27 MS, it does not seem advisable to settle on a homogeneous common insurance system. Some alternatives can be a set of actions to encourage national systems:

- facilitating/subsidising the composition of databases, preferably at farm level;

- providing public re-insurance;

- partially subsidising national systems;

- establishing a common regulatory framework for these actions and adequate control tools.

Nevertheless, considering the advantages of index insurance products over other type of schemes, it could be worth further exploring the potential of index based schemes, either to be used directly in risk management, or as control tools for estimating the public compensation for catastrophic losses.

3. Technical feasibility of a European index for risk management

Index insurances, in contrast to traditional agricultural insurances, do not refer to the actual farm losses but to the losses evaluated from an index. They are best suited for homogeneous areas and systemic risks, but can also be useful for catastrophic risks and for re-insurance. Premiums have been estimated for a Regional Yield Insurance (RYI) for Farm Accountancy Data Network (FADN) regions and a number of arable crops. In addition, some meteorological, agrometeorological and satellite imagery indicators were tested. Lastly, a cross-validation is made in order to quantify the farm loss risk reduction due to insurance.

3.1 Regional yield index (RYI)

As in the US, area yield index insurance has been successful. We have designed a hypothetical RYI similar to the US Group Risk Plan (GRP). However, it is non-proportional insurance in the sense that the deductibles due do not decrease as the loss increases. This represents the first attempt to design an area index insurance scheme at European level. It was designed for FADN regions by using Eurostat-REGIO yield data.

We have estimated the premiums rates and the maximum total premium amounts. The commercial premium is estimated by adding the management and administrative costs and the profit of the insurance company, re-insurance, etc. to the 'actuarially fair premium'. The actuarially fair premium rates, expressed as a percentage of the total insured amounts, show a large diversity of yield risk between different regions. These premium rates are extremely sensitive to the deductibles and trigger levels. The commercial premiums of RYI with a 30% trigger and a 50% market penetration (assuming there is no adverse selection) and assuming a load on the fair premium of 42%, could be around EUR 77.6 million for potato, EUR 79.5 million for barley and EUR 69.8 million for wheat. The country average fair premiums per hectare oscillate between EUR 4.17 and EUR 9.17 for most arable crops, but reach EUR 30.70/ha for potato.

3.2 Other indices

Several meteorological indicators from the literature (such as dry soil days, desertification or Embergercontinentality) have been tested. Panel models have been adjusted to Eurostat time series of yield at NUTS-2 level. Tests have been concentrated on wheat, in order to identify a suitable approach to apply to a wider range of crops. Regions with roughly similar climatic conditions have been grouped in clusters. As a result, these indicators do not explain yields optimally, as the Multiple R-Square is only 30%.

The agrometeorological parameters analysed come from the Crop Growth Monitoring System (CGMS). The three parameters selected are Relative Soil Moisture (RSM), Total Water Consumption (TWC) and the Water Limited Storage Organ Weight (WLSOW). Only in some cases, the correlations of these parameters with several crops' Eurostat-REGIO yields are very high.

The satellite imagery parameter analysed is the Normalised difference vegetation Index (NDVI), which is the same one used for the Canadian and Spanish insurance products for pastures. The calculation of the correlation of maximum NDVI and wheat yields has shown that, while a good *spatial* correlation can be observed, the *time* correlations in each FADN region are low. Results improved when taking into account only those maximum NDVI which fall in the period when the crop is more sensitive to nutrients and water stress. This means that the capacity of NDVI for explaining yields could be improved by using the maximum NDVI of these sensitivity periods.

3.3 Cross-validation of indirect index insurance with FADN data

Index insurance was validated with individual farm data from the FADN. With this objective, we first analysed the individual farm risk (crop revenue risk) without insurance and in a second step, with insurance. The decrease of the farm risk gives an indication of the efficiency of the index insurance.

The methodology used to calculate the risk from FADN data was developed by the research project team (JRC-IPSC) and it consists of the 'two-year constant sample' method, and a 'moving-average' method that tries to reproduce the WTO criteria for agricultural risks compensations (developed by Bielza et al. 2008b). It was applied to the area yield insurance RYI. The risk reduction capacity of other indices would be expected to be lower, given that theoretically regional yield should describe the behaviour of farm yield better that other indices at a regional scale.

The observed risk reduction capacity of RYI is in general not very high for the example analysed. This is not surprising given that area yield indices are more adequate for homogeneous regions. However, there are some regions where the risk can be reduced up to 68%. The validity of these results has as a limiting factor the data quality (the correlations between Eurostat yields and FADN yield averages are often weak).

4. Conclusions

The 'Agricultural Insurances Schemes' project has provided a comprehensive view of the state of the art of agricultural insurance and public intervention in risk management in the EU. The development of agricultural insurances in each country appears linked to the needs (risk level), but the MS policy to support the system is also a decisive factor. The private sector offers suitable insurances for non-systemic risks (hail), but public support is associated to wider coverage. The development of insurances in the livestock sector is generally lower than in the crop sector. Livestock risk management relies on sanitary assistance programmes; major crises (diseases with high externalities) are covered by public aid.

The level of risk is very heterogeneous in the EU, from country to country, depending also from the farm type and size. As shown by the amount of *ex post* aid still given in MS, the existing risk management tools are generally insufficient to smooth significant income reduction in bad years. Some actions could be taken to encourage national systems, such as facilitating or subsidising the composition of databases at the farm level, providing public re-insurance, partially subsidising national systems, establishing a common regulatory framework for these actions, and adequate control tools.

The study reviews the relative advantages and disadvantages of implementing traditional insurance versus index insurance depending on the particular cases. While for heterogeneous areas and non-correlated risks, traditional insurance is preferable, for the opposite cases and for re-insurance, index products are advisable.

Some meteorological, agrometeorological and NDVI indicators were analysed. From the statistical analysis, the indicators do not explain yields optimally. But in some agricultural regions with strong vulnerability to specific weather risks, some indices (such as Relative Soil Moisture and meteorological indices relative to water conditions) showed a good response to yield variability. In general, due to the strong heterogeneity within the EU regions, a meteorological index could have a better explanation capacity at a more disaggregated level.

The cross-validation of area yield insurance (RYI) consisted in the calculation of the risk with FADN data with and without insurance. Results show that the risk reduction capacity of yield area index for the case analysed is not very high, but that in some regions the risk can be reduced up to 68%. The risk reduction capacity of other indices is expected to be lower than the yield area index. The study shows that index products' efficiency is relatively low at farm level due to the European heterogeneity of climates and geography and to the large geographical scale of the study. So, index products' efficiency is expected to be higher for re-insurance.

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Abstract
This report summarizes the results of two studies requested by the European Parliament through DG Agriculture. The current tools of EU Member States for agricultural risk management are presented, highlighting the main types of approaches. The financial volumes of insurances and ad-hoc state aids are compared. For meteorological events that are typically local, such as hail, the available insurance products are generally sufficient, but coverage of systemic events, such as drought, needs to be boosted in most countries. The level of some major risks is quantified and mapped with the help of the meteorological database of MARS unit of JRC. The suitability of index insurances is analysed; the principle is that compensation to farmers is trigged by yield statistics, agro-meteorological indexes or satellite images; the results suggest that such insurances are appropriate only when individual damage assessment is too difficult to carry out.

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