Risk Management in OECD Agriculture: From a holistic approach to the reality of support measures

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Introduction

Managing risk is an important part of farming. Improving risk management strategies is a concern for governments for which managing risk is an agricultural policy objective. This chapter presents the OECD framework for the analysis of risk management in agriculture[2] and an application to measure the magnitude of risk-related measures in the Producer Support Estimate (PSE).

The framework is presented in section 5.1 and could be used for the analysis and efficient design of policies in this area. It has a holistic approach as opposed to a linear approach. A linear analysis which deals with only a specific source of risk, a specific farmer's strategy, or a specific type of policy measure is likely to lead to inefficient policy choices. Risk management should be analysed as a system in which there is interaction between many elements. The framework organises these elements according to three axes: the sources of risk, farmers' strategies and government policies.

Policy and support related to risk management in agriculture, present difficult problems for decision makers. Section 5.2 identifies four important trade-offs that need to be analyzed for good policy design. These are: *ex ante* measures are

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[2] This framework is defined in chapter 1 of OECD (2009). The analysis of PSE risk related measures is presented in chapter 2, while chapter 3 is devoted to existing evidence about risk exposure of agriculture.

sometimes said to substitute for *ex post* disaster assistance; government support measures can potentially crowd out other market or on-farm strategies which would reduce their effectiveness to improve risk management; risk-related measures have the potential to improve farmers' welfare, but other measures can be more efficient for this purpose; and finally, risk related measures also have an impact on production.

Although the reality of agricultural support goes well beyond risk management, recent changes in agricultural policy legislation, such the US 2008 Farm Act, have significant risk related provisions. The last section of this chapter uses the information in OECD's Producer Support Estimate (PSE) database to analyze the extent to which support has moved towards more risk-related measures over the last decade. The results depend strongly on the inclusion of market price support, which is the main risk-related measure in most OECD countries. Market price support has been reduced in many countries, while the share of risk-related measures, other than price support, increased in most OECD countries.

5.1   A holistic approach to risk management in agriculture

### The meaning of a "holistic approach"

Agricultural production is subject to many uncertainties. Any farm production decision is typically associated with multiple potential outcomes with different probabilities. Weather, market developments and other events cannot be controlled by the farmer but have a direct incidence on the returns from farming. In this context, the farmer has to manage risk as part of the general management of his farming business.

In response to the potential impact of uncertain events, farmers implement diverse risk management strategies in the context of their production plans, the available portfolio of financial, physical and human capital, and the degree of aversion to risk. These risk management strategies may include on-farm decisions, changes in portfolio structure, use of market instruments, government programs, and diversification to non-agricultural sources of income. Many general agricultural support policies have risk management implications and influence risk management decisions. Because of the complexity of these interactions, governments need to make significant efforts to achieve coherence, particularly among different policies and between policies and market strategies. Agricultural risk is an interrelated "system" in which markets and government actions interact with risks and farmers' strategies. Government programs may underpin the development of market strategies, but they may also crowd out market developments or on-farm strategies. The result of these interactions is the set of risk management strategies and tools that is available and used by farmers.

There is a growing literature that tackles risk-related issues from a governance angle. It focusses mainly on risks with significant consequences for society or the economy that go well beyond consequences for the individual. These "systemic risks" can also be relevant to agriculture. This literature covers risk management as part of a broader risk governance framework that typically includes at least three stages: risk assessment and evaluation; risk management; and risk communication (e.g. International Risk Governance Council, 2008).

A risk management system is composed of many sources of risk that affect farming, different risk management strategies and tools used and available to farmers, and all government actions that affect risk in farming. The old fashioned approach in analysing risk management policies involved three linear steps: 1. measuring the risk or variability faced by farmers; 2. use this information to analyse the optimal risk management tool for a given farmer, accounting for his endowments and risk preferences; and 3. decide on appropriate government policies to improve risk management strategy (top of Figure 5.1).

FIGURE 5.1
Two approaches for the analysis of agricultural risk management
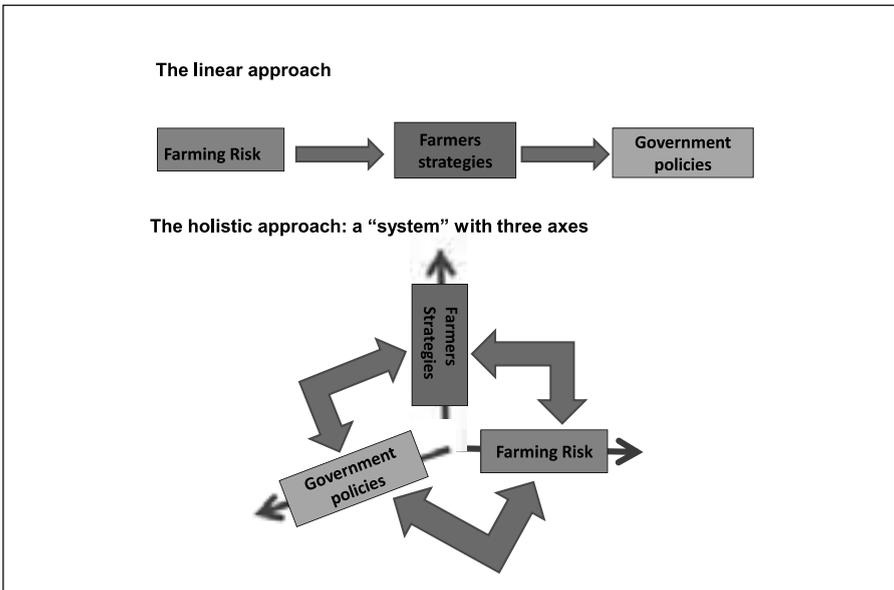
The linkage among these three sets of elements, however, is not linear in nature and the analysis cannot flow unidirectionally from the sources of risks to the available tools to deal with each risk, nor from the availability of tools and markets, to the optimal government policies. There are many examples that illustrate these links. If, for a specific farmer, prices are strongly negatively correlated with production, revenue can be relatively stable and there may be less need to manage price risk; diversifying output production can, in some cases, be a good strategy to reduce risk and it act as a substitute for some of the demand for insurance; measures that stabilize domestic prices are likely to crowd out the development of futures markets.

Links move in all directions therefore, and the system is better represented by the three dimensions or axes of a cube (second part of Figure 5.1). Continuous inter-action amongst the elements in all axes leads to a simultaneous determination of risks, risk management strategies and policies. The availability, development and use of each instrument or strategy is determined to a great extent by the whole system that includes the nature of all farm risks, the extent to which they are correlated, farmers' preferences and endowments (including off-farm), market developments, and all government actions. A holistic approach is needed for policy making in such an integrated system.

Diversity of sources of risk: characteristics and correlations

The risks and sources of risks relevant to agriculture have different characteristics and can be classified in very different ways [Baquet *et al*. (1997), Hardwood *et al.* (1999), OECD (2000), World Bank (2000), Holzmann and Jogensen (2001), Musser and Patrick (2001), Moschini and Henessy (2001), Huirne *et al.* (2004), Hardaker *et al.* (2004)]. It is not necessary to opt for a particular classification of risk, different ones can be used for different purposes. However, some technical characteristics of risks apply across different classes and can be significant in terms of the appropriate and available strategies to deal with each risk. All classification of risks in agriculture underline the fact that an individual farmer may be facing very different risks at the same time. In these conditions, the optimal choice of a strategy requires that correlations among risks must be accounted for. The chapter by Coble in OECD (2009) makes an in depth review of the literature on the sources of risk in agriculture, correlations among them, and their relative importance.

In all possible classifications, the boundary between different types of risk is blurred. Price or production risk is often associated with different singular events (e.g. droughts) that are also denoted as risks. Table 5.1 proposes a presentation of agricultural risks that combines four types of sources of risk identified in Hardwood *et al.* (1999) (Markets / prices, Production, Financial, and Institutional / legal) with the systemic characteristics from Holzmann and Jorgersen, covering most of the categories of risk identified by different authors. This table singles out events

that could occur with some uncertainty and affect a farm household's welfare. Idiosyncratic risk such as personal hazards, e.g. illness of the operator or the employees, are specific to individual farms or farmers and may actually be more important than systemic risks. Some weather-related events, e.g. hail and frost, can be idiosyncratic. Risks of a macroeconomic nature are typically systemic and are often correlated across farms in a country and across sectors in the economy. Droughts and floods tend to be systemic, affecting whole regions or nations. Output price risk is typically systemic with high price correlations among domestic markets due to trade. The price of land, however, is determined more locally.

TABLE 5.1

Some risks in agriculture: types of risk and idiosyncratic / systemic characteristics

Type of risk	Micro (Idiosyncratic) Risk affecting an individual or household	Meso (Covariant) Risk affecting groups of households or communities	Macro (Systemic) Risks affecting Regions or Nations
Market / Prices		Changes in price of land, new requirements from food industry	Changes in Input / output prices due to shocks, trade policy, new markets, endogenous variability…
Production	Hail, frost, non-contagious diseases, personal hazards (illness, death) assets risks	Rainfall, landslides, pollution,	Floods, droughts, pests, contagious diseases, technology
Financial	Changes in income from other sources (non-farm)		Changes in interest rates / value of financial assets / access to credit
Institutional / legal	Liability risk	Changes in local policy or regulations	Changes in regional or national policy and regulations, environmental law, agricultural payments

Source: OECD (2009), adapted from Hardwod *et al.*. (1999) and Holzmann and Jorgersen, 2001.

There are some characteristics of risk that are very important in order to understand the possibilities for developing appropriate market instruments. Four can be singled out:

1. The systemic nature of the risk: risks that are highly (positively) correlated across farmers are difficult to pool, while more independent risks can be pooled more easily.
2. The availability of information on the true distribution of the risk: if the information is not available (because there is little record of past events or because there is reason to believe that information on the past is not

relevant or misleading about the future), it is hard to imagine that a market instrument could be developed with an appropriate price. An extreme situation of information scarcity is denoted as cognitive failure.

3. The degree of asymmetry in the distribution of information: if significant information is not shared between the producer and other agents, or certain risk-relevant producer actions can be hidden, the likelihood of market failure increases.

4. The existence of potential buyers of the farmers' risk who face a risk of the opposite sign (highly negatively correlated with the risk faced by the farmer).

Climate change is a reality that is likely to have an impact on agricultural risk. According to the Inter-governmental Panel for Climate Change (IPCC, 2007a), there is evidence that temperatures at the surface of the earth have risen globally, with important regional variations. This is likely to result in an increase in the frequency of extreme events such as floods and droughts. At the same time, risk awareness amongst farmers and in society as a whole may be increasing. The extent to which farm revenue variability will increase and where and whether this will imply more difficulties to manage risk in agriculture is not yet known.

A wide range of risk management instruments and strategies

The farmer is the agent who is best positioned to know the extent, characteristics and correlations of the risks that affect his farm, and the suitability of different instruments or strategies to deal with them. It is the farmer's responsibility as manager of his own farming business to take the appropriate decisions to manage the risk associated with his economic activity: farming. The basic principles behind the generic strategies to reduce risk (risk sharing, risk pooling and diversification) are simple and well known to economists and have been extensively used by farmers.

Actual risk management strategies can be grouped into three categories (Holzmann and Jogersen, 2001): *prevention* strategies to reduce the probability of an adverse event occurring; *mitigation* strategies to reduce the potential impact of an adverse event; and *coping* strategies to relieve the impact of the risky event once it has occurred. Prevention and mitigation strategies focus on income smoothing, while coping strategies focus on consumption smoothing. Strategies can be based on arrangements made at different institutional levels: farm household or community arrangements, market based mechanisms and government policies. The main groups of tools and strategies available to the farmer are presented in Table 5.2. These vary from country to country and for different farmers; for example, due to their size, location or availability of information, some farmers may have more difficult access to market instruments than other farmers.

TABLE 5.2

A menu of possible farm risk management instruments and strategies

|	Farm / household / community	Market	Government
Risk Reduction	Technological choice	Training on risk management	Macroeconomic policies Disaster prevention (flood control…) Prevention of animal diseases
Risk Mitigation	Diversification in production Crop sharing	Futures and options Insurance Vertical Integration Production / marketing Contracts Spread sales Diversified financial investment Off-farm work	Tax system income smoothing Counter-cyclical programs Border and other measures in the case of contagious disease outbreak
Risk Coping	Borrowing from neighbours / family Intra-community charity	Selling financial assets Saving / borrowing from banks Off-farm income	Disaster relief Social assistance All agricultural support programs

Source: OECD (2009), based on Holzmand and ogersen (2001) and OECD (2001).

Farmers face price risk because there are biological lags that require that decisions about what and how to produce have to be taken far in advance of harvest. The simpler instrument available to deal with price risk is a "forward contract". In such a contract the farmer and a buyer of the agricultural output agree in advance on the terms of delivery, including the price. A *futures* contract is essentially a standardised forward contract traded on an organized exchange such as the Chicago Board of Trade. The contract is standardised in terms of quantity, quality, and time and location for delivery. The possibilities for covering price risk have been expanded with the use of *options* on futures for some commodities.

Economics textbooks typically give a standard solution to manage uncertainty: using and developing markets –namely insurance markets- that facilitate the exchange of risk with other agents, realizing the potential gains from pooling or sharing the risk. However not all risks that affect agriculture have a corresponding insurance market. It may be that not all risks are insurable: insurance contracts for some risks do not exist because the insurance premium covering all the costs would be prohibitive. There are some conditions that are required — at least to a certain extent — for the insurability of a risk. They are not always expressed in the same terms (Skees and Barnett, 1999), but could be grouped as: independence of risk for different agents, availability of information about the distribution of probabilities, symmetric information, and probability of occurrence in a "medium" range (not too rare, not too frequent).

But there are some risks that may be difficult to insure through market mechanisms, which may require segmenting risks into different layers to manage each layer with different tools and strategies. This segmentation is a basic risk management technique that may help to match each set of risks with different "buyers" of risk or available management mechanisms. It is frequently argued that markets are more likely to fail in the case of catastrophic risk (World Bank, 2005). Therefore the layers could be defined in terms of the probability of occurrence and the magnitude of the losses, and therefore, the extent to which risk is catastrophic (Figure 5.2).

FIGURE 5.2
Probability density function and risk layers
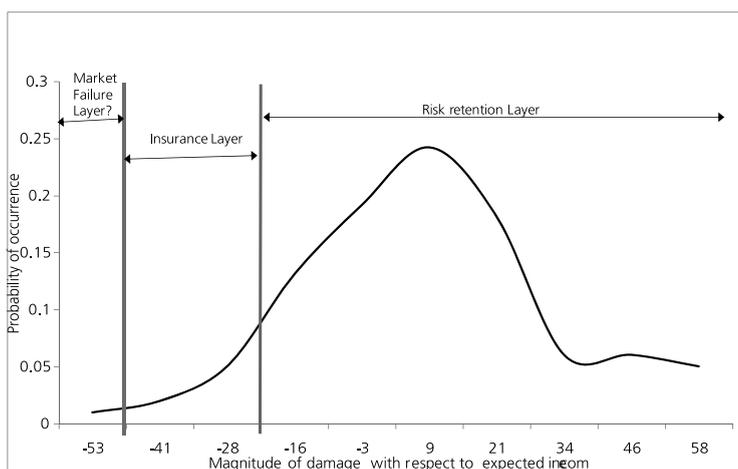
There are losses (or gains) that are part of the normal business environment; they are very frequent but cause relatively limited losses. Farmers should themselves manage this type of "normal risk" that corresponds to the *risk retention layer*[3]. The *market or insurance layer* corresponds to risks that have more significant impacts but are less frequent. Both frequency and magnitude are in the middle of the respective ranges and there is scope for farmers to use specific market instruments such as insurance or options. The third layer includes risks that are catastrophic in nature because they generate very large losses, even if their frequency is low. This type of risk is more difficult to share or pool through the market mechanism, particularly if it is systemic. This is the "catastrophic risk" or the *market failure layer*.

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[3] This terminology is taken from World Bank (2005).

The distinction of risks with respect to two different criteria -their frequency of occurrence and magnitude of losses- could be contradictory if big losses were not associated with low probabilities. But many risks or combination of risks lead to a distribution of impacts where larger losses have lower probabilities, with a shape similar to that of a normal distribution (Figure 5.2). We can then define three different layers that are ordered at the same time from higher to lower probability of occurrence and from smaller to larger magnitude of production loss. Most of the outcomes will be in the first layer where it is deemed that the risk should to be retained by the farmer. Only a minority of outcomes will be in the third, market failure layer. This distinction would be easy to implement to the extent that we had well defined boundaries among layers. This is not usually the case.

What role for government?

Standard results from welfare economics are not very promising nor directly applicable when analysing risk management due to the extent of missing markets. The market outcome may not be Pareto optimal, and we cannot be sure about the direction of the bias. In this context two questions are relevant in terms of the role to be played by the Government. Does the economy provide the "correct" set of markets that allow risk to be traded efficiently? If this is not the case, the government may try to establish or develop the basis for the creation of new risk related markets. And, given the existing markets, are resources efficiently allocated? If not, there may be some role for government improving welfare.

The main potential for market failure in risk related markets is due to the existence of information asymmetries and transaction costs associated with the access to market relevant information. In general, the farmer knows better than any other agents (including insurance companies) the degree of risk exposure associated with his own production decisions (hidden information that may generate adverse selections). Farmers also have less incentive to avoid risk once they are insured (hidden actions that generate moral hazard). Those situations can generate market failure in the related risk markets. Asymmetries of information affect different types of risk in different ways. For instance price related risk does not usually generate information asymmetries since market prices are known by all agents at the same time. On the contrary yield/production related risk may have associated information asymmetries because the farmer has better knowledge about his own production risks than any other agent. The existence of "cognitive failure" can also contribute to generate information asymmetries. In these contexts, there is a potential role for government to help to establish, regulate and supervise risk markets, and to provide risk instruments when markets are constrained or fail. But it is also possible that "asymmetric information applies also to the relation between the citizen and the government leading to government failure and political risk" (Holzmand and Jorgensen, 2001). The capacity of the government to improve resource allocation

depends to a great extent on its access to information and its capacity or efficiency in creating or transferring this information.

Government may have objectives other than increasing efficiency. It is common to have redistribution objectives, especially in the case of events that put particular economic stress on specific agents, inter alia, farmers. In more political economy terms, government's objective may be to react with some relevant action when farmers "suffer" or are seen as "vulnerable". Therefore, both efficiency and equity objectives could potentially drive government action on risk management in agriculture.

The "role of government" can be analysed in a strict normative framework in terms of advising about the economic effects and implications of alternative policy measures. This will imply the selection of policy measures that are best in terms of improving efficiency and redistribution (normative approach). But, particularly in an area with as many uncertainties as "risk management", a positive political economy approach is also needed to understand the policy making process (Innes, 2003) and the risk governance implications (Renn, 2006). The social perception of risk events that require policy responses and the political pressure on governments result from the whole institutional and governance framework. Table 3 presents a set of policy actions on agricultural risk management that are observed in reality. The table does not evaluate whether these measures are appropriate. It distinguishes between measures that are taken and implemented before the risky event takes place *(ex ante)*, and measures that are taken or implemented *ex post* after the event has occurred (Cafiero *et al.*, 2007).

All efforts by government in support of market creation or in modifying market incentives will be, by definition *ex ante* measures. In the areas of risk reduction and mitigation, and coping with risk, both types of measures, *ex ante* and *ex post*, are possible. Most of the government actions described in Table 5.3 relate to efficient risk management in agriculture. Equity considerations are likely to play a more important role as we move towards *ex post* interventions in which individuals have no margin of action, and risk coping strategies for consumption smoothing are needed.

Market creation

If there are missing markets for risk management, the government may have a role in helping the development of new markets. Markets, including risk management markets for agriculture, develop much more easily in the context of a stable macroeconomic and business environment. Providing this environment is an important role for government. It is known that information weaknesses are the main causes of market failure in agricultural risk management. Government could play a role through direct research and production of the missing information or

TABLE 5.3

Potential roles of government in risk management in agriculture, based on observed policy measures

	Market creation	Modifying market incentives	Risk reduction and mitigation (income smoothing)	Coping with risk (consumption smoothing)
Ex ante	• Stable macroeconomic policies and business environment • Risk management training and information to farmers • Facilitating the production and sharing of information on risks • Increase competition in the insurance market • Law and institutions for futures and options markets • Defining the limits of government and farmers responsibility in risk management • Private / public partnerships	• Subsidies to insurance • Subsidies to reinsurance • Subsidies on futures contracts • Participation in mutual funds • Incentives on saving accounts • Facilitate access to credit • Output Market interventions/ Regulations (price stabilization) • Border measures (tariffs…)	• Disaster prevention (flood control…) • Prevention of animal diseases (domestic and border measures) • Legal form of farms • Research and Development of new varieties or breeds • All agricultural support programs	 • All agricultural support programs
Ex post - *triggered ex post* - *decided ex post*			• Countercyclical programs • Tax system for income smoothing • Border and other measures in case of contagious disease outbreak • Ad hoc payments for quick economic recovery	• Social assistance • • Disaster relief (payments, subsidised credit…) • Other Ad hoc ex post payments

Source: OECD (2009)

facilitating arrangements for sharing information. On the demand side, farmers' risk management skills could be improved through training and information about different risk management instruments. On the supply side, enforcement of fair competition among insurance companies should make products more attractive for farmers. In some particular markets (such as futures and options) government may need to provide the appropriate legislation and institutions, to facilitate the development of the market.

Modifying market incentives

In any case government action will not be able to generate a complete set of risk markets. In this imperfect world, government may have a role in trying to alter incentive prices –through taxes and subsidies- in order to bring the economy to a more efficient outcome, or just to achieve some specific risk coverage objective. Several OECD countries subsidize crop insurance (the United States, Canada, Mexico, Spain, France, Japan…) to different extents and with different arrangements. Some

countries provide some re-insurance subsidies, normally through re-insurance arrangements with government participation. It is less frequent to subsidize futures contracts, but there are some countries like Mexico that provide such support. Farmers may create mutual funds to insure some types of risk and these funds receive some government financial participation in some countries.

Risk reduction and mitigation

Governments are sometimes seen as having some responsibility for carrying out the appropriate works and implementing the appropriate legislation to reduce the probability and / or the adverse impact of hazardous events. This is often argued to be the case for catastrophic events. One example is flood control for which public works can help to reduce the probability of a flood but actions on the farm to reduce water run-off can also reduce and/or mitigate flood risks. Some of these actions may generate externalities that could require some appropriate incentives. In the area of prevention of animal diseases possible measures include both domestic and border measures when there is a risk of a disease being imported from abroad. Once the risky event has occurred, the tax and social security system also provides some mitigation of effects.

Coping with risk

Once all available measures or instruments to reduce or mitigate risk have been exhausted, only consumption smoothing strategies are available to cope with any remaining problem. Of course, all agricultural support programs contribute, to some extent, to consumption or income smoothing. Coping with risk refers to ensuring minimum consumption requirements of farmers or their families and they are, by definition, related to equity considerations. Once a risky event has occurred, government may have strong political incentives to provide some assistance. *Ex post* government actions may include social assistance, disaster relief (payments, subsidised credit…) and / or *ad hoc ex post* payments. If the purpose is to help to adjust from a hazard that may reduce household consumption towards poverty (equity concern), the criterion for such aid should be proximity to the poverty line, and equity considerations would suggest that in a first best policy option all farm household income and/or wealth should be included in the assessment.

5.2   Some policy dilemmas

Do ex ante measures substitute for ex post disaster assistance?

There is no single precise way of defining a catastrophic event, in general, and in agriculture in particular: it has to be infrequent and severe for individuals. But to be catastrophic for a government it needs to be also systemic, that is correlated

across farmers and, therefore, severe also for a country or a region as a whole. From a political economy perspective, an event is catastrophic if it triggers some special catastrophic or disaster aid or program. Most governments provide disaster assistance at some moment. The *ex post* reaction of governments to "catastrophes" is, in this sense, part of the risk management system which farmers take into account when planning their own decisions and strategies. The distinction between risk and crisis is sometimes made for policy analysis (Cafiero *et al.,* 2007; European Commission, 2005). It is argued that a crisis is "unforeseen" and it exceeds the individual capacity to cope. This idea of exceeding the capacity to cope is obviously only applicable *ex post*. Once the event has occurred, all *ex ante* decisions, strategies and measures are found to be insufficient to cope with the situation and smooth consumption to acceptable levels. The inability to cope with risk *ex post* calls for an equity or "social solidarity" action. The very existence of this inability, its probability and scope depend, however, crucially on *ex ante* decisions and strategies.

The trade-off between measures *ex ante* and *ex post* is an essential part of the policy discussion on managing catastrophic risk. Innes (2003) underlines the political economy dimension of this debate: "because *ex ante* insurance coverage diminishes the political will for ex post emergency relief, government insurance programs may be designed, in principle, to deter disaster relief". The argument is the following: insurance is not supposed to cover for non-insurable risks like most catastrophic risks, but if government provides insurance subsidies, they could be designed to minimize the need for *ex post* disaster aid. Some anecdotal studies on EU member countries suggest that insurance subsidies may have deterred ad hoc disaster payments (Garrido and Bielza, 2008; JRC 2006), but there is no rigorous empirical evidence. For example, Spain provides strong ex ante insurance subsidies but much smaller ex post disaster aid, while the opposite occurs in the United Kingdom.

The same trade-off between *ex ante* insurance subsidies and *ex post* disaster assistance is discussed for the United States by Glauber (2004). Crop insurance is considered preferable to *ex post* disaster assistance because it provides *ex ante* risk protection. However, it is argued that despite the expansion of insurance subsidies since the Federal Crop Insurance Improvement Act of 1980, they have failed to replace disaster assistance. His explanation is the existence of asymmetric information. A new role is therefore proposed for government in managing catastrophic risk, in the development of area-yield and weather index insurance contracts that minimize both adverse selection and moral hazard. Governments are aware of this trade-off, which is why, in some cases, disaster payments are reduced for insured farmers by the amount of the indemnities, or/and in other cases, eligibility for disaster payments is limited to the insured (Goodwin *et al.*, 2007). The impacts and incentives created by these provisions deserve further investigation.

Do government measures crowd-out market and on-farm strategies?

All agricultural support measures affect risk in some way. OECD (2004) estimates the impacts on variability of aggregate receipts of different categories of PSE support measures. It was found that most PSE categories reduce aggregate revenue variability. In particular, market price support was found to reduce variability in all the cases that were analysed. However, variability reduction is not proportional to the amount of support and therefore there are payments and programs that are more risk related than others. If a measure reduces risk, there will be a risk related response with impacts on production and on the use of other risk management strategies.

Interaction among policy measures has been shown to be very significant (OECD, 2005, Coble *et al.*, 2000). In particular there is scope for crowding out market measures that cover the same type of risk as government programs: deficiency payments or price stabilization schemes tend to crowd out price hedging through futures and options. There is also evidence that insurance subsidies may increase specialization of the farm (O'Donoghue and al, 2009), and therefore crowd-out diversification strategies. This effect of crowding out other strategies diminishes the capacity of such mechanisms to reduce variability and improve welfare.

There are also concerns about the interactions between risk management instruments such as insurance of futures and environmental outcomes (Babcock *et al.,* 2003). Some argue that insurance programs and agrochemicals are substitutes and farmers who purchase insurance are likely to reduce the application rates of fertilizers and pesticides. On the contrary other argue that risk management instruments induce farmers to increase output, including through further use of agrochemicals.

The three layers of risk represented in Figure 5.2 illustrate the interaction between measures and strategies. If government actions cover risk layers 1 (catastrophic) and 3 (normal risk retention layer), the scope for insurance markets to develop and be viable is reduced. If government action takes the form of insurance subsidies and they expand too much, there may be little space for developing instruments for the third layer that, in principle, should be retained by the farmer. Defining and limiting the boundaries of government responsibility leaves room for markets and for on-farm strategies developed and implemented by farmers themselves.

Does risk mitigation imply increased farmers' welfare?

Different policy instruments have different relative efficiency in achieving different policy objectives such as risk reduction and increasing farmers' welfare. Some policy measures contribute to reduce risk and can be effective for this purpose, particularly if they are targeted to farmers' main sources of risk and variability. For instance,

crop insurance subsidies can potentially be effective in inducing farmers to buy insurance and –therefore- reduce the variability of their returns. If farmers are risk averse, as is generally assumed, this mitigation of risk will improve also their welfare. Other policy measures can be highly efficient in transferring income to farmers. This is the case of area payments, particularly if based on historical based area: if the farmer owns the land, compared to other forms of support, area payments reach the farmer's pocket with smaller efficiency losses and leakages to other agents (OECD, 2006). It is most likely that the income improvements derived from these area payments will also contribute to facilitate risk management and mitigate the negative implications of risk exposure.

Figure 5.3 illustrates this situation with an example based on a set of micro model simulations extracted from Antón and Giner (2005). It compares the impacts of a given amount of support provided in the form of insurance subsidies or area payments. The outcomes are compared in terms of risk (measured as variability of profits) and welfare (as measured by expected utility of a risk averse farmer). Both insurance subsidies and area payments contribute to reduce risk and to improve welfare, but to different extent. Minimizing risk exposure would require providing a big share of the support in the form of insurance subsidies. On the contrary, farmers' welfare maximization would be achieved when all support was given in the form of area payments. The choice of the policy mix is likely to face a tradeoff between these two potential objectives related to the farmers: reducing their risk exposure and maximizing their welfare.

Do risk related measures have production effects?

All agricultural support measures have some impact on production; but there can be large differences in the size of these impacts (OECD, 2001). Risk related measures will have a risk-related impact on production if farmers are risk averse. This effect can be large if the policy instrument is well targeted to commodity specific main risks. Table 5.4 illustrates these effects for the same amount of payments. These comparisons need to be taken with caution since typically the total amount of payment on crop insurance is much lower than for area payments, and the results depend on the degree of risk aversion.

All risk related subsidies and payments in Table 5.4 show an impact on production decisions of risk averse farmers. Furthermore, often the production response is larger the larger the reduction of risk. This is particularly true for the most risk averse farmers. On the contrary, a risk neutral farmer would not change its production decisions in response to an insurance subsidy: they would not buy insurance in any case. These impacts on production are relevant for the efficient functioning of commodity markets.

FIGURE 5.3

Crop insurance subsidies and area payments: Minimizing risk exposure or maximizing welfare?

Simulated iso-risk and iso-welfare curves for a hypothetical farmer
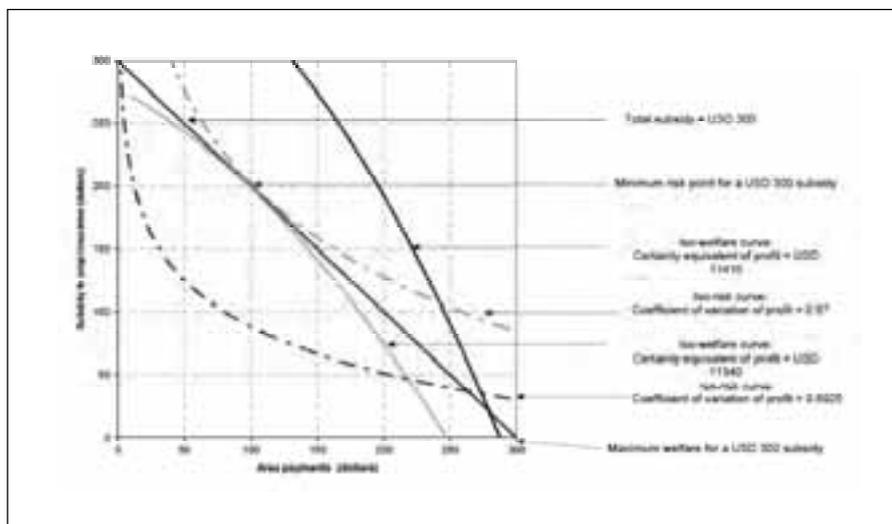
Source: Anton and Giner (2005)

5.3 Are OECD countries moving towards more risk related agricultural support?

Some OECD countries have implemented significant new agricultural policy legislation or frameworks that sought to reinforce measures related with risk management. In the United States, the 2008 Farm Act increases target prices for most commodities and gives farmers the opportunity to change to the revenue-based countercyclical programme ACRE, confirming a commodity-specific risk management approach that now allows price and yield risk to be combined into a revenue programme. Canada's Growing Forward agreed programmes take a whole-farm approach to risk management with measures that cover several risk layers, from small frequent reductions in margins to catastrophic risks. Finally, the Health Check of the European Union expands the possible uses of article 68 "Assistance to sectors with special problems" to include co-financing of subsidies to national crop insurance programmes and mutual funds for animal diseases. Other countries have increase their expenditure in risk related measures; for instance, Mexico has increased eight-fold in three years the outlays on its price hedging programme, which subsidises the price of options. But does this mean that OECD countries are moving toward more risk related agricultural support? This is not so easy to

TABLE 5.4

Comparison of impacts of a payment to risk reducing policies. An example based on micro model simulations for a hypothetical farmer

Impact for the same amount of payment given through different programmes

Strategy	Risk averse farmer		Risk neutral farmer	
	Change in expected production (%)	Change in coefficient of variation of profit (%)	Change in expected production (%)	Change in coefficient of variation of profit (%)
Crop insurance[1]	0.24%	-5.53%	0.00%	0.00%
Price hedging	0.12%	-2.36%	0.00%	0.00%
Deficiency payments	0.12%	-0.88%	0.09%	-1.66%
Area payments counter-cyclical with yields	0.05%	1.66%	0.02%	-2.67%
Area payments counter-cyclical with prices	0.05%	-1.01%	0.02%	-1.80%

[1] Econometric studies such as OECD (2002), estimate small but significant production effects of insurance subsidies, even smaller than for area payments. But further work is required for a definitive conclusion about the relative production effects of insurance subsidies as compared to other forms of support (OECD, 2006).
Source: OECD (2005)

conclude without a systematic estimation of risk related support measures. The Producer Support Estimate (PSE) database from the OECD is used for this purpose (OECD, 2009)

Risk related measures

All agricultural policy measures have an impact on risk[4]. Some measures, however, are specifically designed to reduce price, yield or income variability, or to smooth consumption, and thus help farmers manage risk, either because they prevent or reduce the occurrence of risk (risk reduction), or because they limit the effect of risk on income (risk mitigation) or consumption (risk coping). Risk reduction measures would be, for example, disease control measures such as vaccination, which aims to limit the occurrence and spread of animal diseases and thus prevent/reduce potential losses in livestock receipts. Market price support (MPS) measures, which stabilise domestic prices, also reduce domestic price risk. Risk mitigation and coping can operate through established (*ex ante*) mechanisms such as insurance schemes

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[4] The risk effects of various measures have been estimated in a series of OECD studies on decoupling (notably OECD, 2004), whose main results are summarised in OECD (2006).

or income stabilisation programmes, or through *ex post* interventions such as *ad hoc* assistance to compensate income losses.

Following the framework defined in OECD (2009), the policy measures that are specifically designed to reduce price, yield or income variability, or to smooth consumption are referred to as "risk-related" measures. They are classified as either contributing to risk reduction or risk mitigation/coping. Among risk reduction measures, MPS is identified separately as it dominates any other risk reduction measure in many countries in terms of support level. Other support measures that provide a stable (fixed rate) transfer to income can also have risk impacts and enter into farmers' risk management strategies.

Risk reduction measures reduce the occurrence of risk as they increase domestic price stability, limit production losses, reduce marketing uncertainties, and encourage the adoption of risk management techniques. Government intervention in risk reduction includes price stabilisation; inspection and food safety measures; and support to production and marketing techniques. A number of specific measures to reduce the occurrence of risk are identified in OECD countries and selected emerging economies. These are: market price support measures, through price stabilisation[5]; market interventions such as private storage or non-marketing of agricultural products; support to production techniques such as water management (irrigation, drainage, flood control and other); purchase of certified seeds and animal breeds; pest and disease control; technical assistance and extension; and inspection of agricultural products and food safety measures.

Risk mitigation and coping measures contribute to smoothing income or consumption by helping farmers to get insurance against drops in price or yield and by providing assistance in the event of income losses. We can distinguish between ex ante mechanisms for mitigating the consequences of risk and ex post interventions, such as ad hoc payments. However, the distinction is sometimes difficult to make, for example in the case of disaster payments made after the damage has been registered but using established mutual funds. The main types of ex ante measures for smoothing farm household income are: payments with a variable rate (or countercyclical payments) compensating for all or part of the income losses suffered according to a pre-established formula; subsidies for risk management tools such as insurance systems or futures markets; income tax smoothing systems; and income diversification support. The main types of ex post measures for smoothing income or consumption are: disaster relief payments; ad hoc assistance; and other measures such as debt relief, social assistance or labour replacement services.

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[5] Deficiency payments are considered as a risk mitigation measure, typically as payments based on output with a variable rate. While they stabilise prices faced by producers in much the same way as MPS, this occurs in reaction to a change in market prices.

Risk related measures in the OECD indicators of support (PSE database)

Tables 5.5 and 5.6 identify support associated with measures used respectively for risk reduction, and for risk mitigation and coping, and including both support to producers (PSE) and general services (GSSE). Overall, risk-related measures accounted for two-thirds of support to OECD producers in 2002-07, compared to three-quarters a decade earlier (Table 5). Their share exceeds 50% in all OECD countries (except Norway, where it was slightly below). In emerging economies, the share of risk-related measures in total support has also been above 50% in most recent years. Countries with a share of risk-related measures over 80% include Japan, Korea, Russia and South Africa, where MPS accounts for close or over 90% of the total of those measures, as well as Canada and New Zealand, where over half of risk-related support comes from non-MPS measures.

The importance of MPS in OECD countries is confirmed. While its share in the OECD PSE decreased from 70% in 1992-07 to 56% in 2002-07, its share in risk-related support decreased from 92% to 86%. In 2002-07, MPS accounted for over 40% of the PSE in all OECD countries except Australia, where it was slightly over 10%, and the United States where it was slightly below 30%. *Ex ante* Support for measures helping farmers deal with the consequences of risk is negligible in a majority of OECD countries. It is significant as a share of producer support in Australia, Canada, Mexico, New Zealand and the United States. *Ex post* measures, which include disaster relief, *ad hoc* assistance, social assistance and debt relief, are mainly used in Australia, Canada, New Zealand and emerging economies.

Risk reduction support other than MPS includes mainly government expenditures on pest and disease control, extension and water management. It is significant in Australia, Mexico, the United States, where support to technical assistance dominates, and particularly important in New Zealand, where support for pest and disease control measures is of the same magnitude as MPS. In New Zealand, risk-related measures, which include MPS, pest and disease control and some disaster payments, make up for almost all support to producers, which is 1% of farm receipts. In the emerging economies considered, risk reduction measures other than MPS are particularly significant in Chile, where they consist of technical assistance to farmers. Government support to technical assistance provided to individual farmers is also significant in Brazil and China, but does not exist in Russia, South Africa and Ukraine.

Some risk reduction measures are included in general services to agriculture as they benefit farmers collectively: this is the case of inspection services, some pest and disease control measures and water management infrastructure assistance. The latter account for a notable share of GSSE indicator in Chile, Japan, Korea and Mexico. In other countries, the aggregate for infrastructure assistance may include support for irrigation systems, but it is not possible to identify it separately. Inspection services account for a growing share of GSSE in many countries.

TABLE 5.5

Transfers from risk-related policies in OECD countries, 1992-97 and 2002-07

Million EUR	Australia		Canada		European Union*		Iceland		Japan		Korea	
	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07
Risk reduction measures in PSE	**772**	**298**	**1 876**	**2 513**	**58 005**	**51 308**	**67**	**85**	**44 592**	**32 484**	**16 734**	**16 498**
-- MPS	*633*	*145*	*1 852*	*2 485*	*56 773*	*49 454*	*64*	*81*	*44 228*	*32 224*	*16 681*	*16 405*
-- Other risk reduction measures	*139*	*152*	*25*	*28*	*1 232*	*1 854*	*3*	*4*	*364*	*261*	*53*	*93*
Private storage/non marketing	0	0	0	0	0	0	0	0	0	0	0	0
Water management[1]	0	34	0	0	205	187	0	0	206	118	48	65
Certified seeds/breeds	0	0	0	0	0	77	0	0	0	0	0	0
Technical assistance/extension	81	57	22	3	163	401	1	3	134	104	5	27
Pest and disease control	57	61	3	26	863	1 189	2	1	24	39	0	0.5
Risk reduction measures in GSSE	**33**	**83**	**239**	**483**	**164**	**605**	**1**	**2**	**4 106**	**2 671**	**569**	**1 073**
Water management[2]	0	6	0	0	0	0	0	0	4 033	2 604	504	969
Inspection (GSSE)	33	78	239	483	164	605	1	2	73	66	64	104
Ex ante risk mitigation/coping measures in PSE	**70**	**319**	**930**	**1 191**	**359**	**465**	**0**	**0**	**1 790**	**1 263**	**0**	**39**
Variable rate payments based on output[3,4]	0	0	135	0	210	157	0	0	1 176	751	0	0
Variable rate payments based on current A/An/R/I[3,5]	0	0	587	1 011	0	0	0	0	0	24	0	0
Variable rate payments based on non-current A/An/R/I, production required[3,6]	0	0	0	87	0	0	0	0	0	0	0	0
Variable rate payments based on non-current A/An/R/I, prod. not required[3,7]	0	138	207	94	0	0	0	0	0	0	0	0
Insurance subsidies[8]	0	0	0	0	149	308	0	0	615	488	0	39
Futures markets subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Income tax smoothing schemes	70	181	0	0	0	0	0	0	0	0	0	0
Ex post risk mitigation/coping measures in PSE	**97**	**181**	**11**	**1 012**	**418**	**1 131**	**1**	**1**	**40**	**23**	**35**	**41**
Disaster relief payments	96	177	4	536	337	940	1	1	40	23	35	41
Ad hoc assistance[9]	0	0	7	475	0	0	0	0	0	0	0	0
Social assistance/labour replacement	0	3	0	0	80	191	0	0	0	0	0	0
Debt rescheduling/write-off	0	0	0	1	0	0	0	0	0	0	0	0
Total PSE	**1 246**	**1 256**	**3 337**	**5 255**	**91 397**	**104 094**	**117**	**167**	**48 736**	**36 644**	**17 611**	**17 973**
Total risk-related measures in PSE	**939**	**797**	**2 817**	**4 717**	**58 782**	**52 904**	**68**	**85**	**46 422**	**33 770**	**16 769**	**16 578**
% share of risk-related measures in PSE	*75*	*64*	*84*	*90*	*64*	*51*	*58*	*51*	*95*	*92*	*95*	*92*
% share of risk-related measures other than MPS in PSE	*25*	*52*	*29*	*42*	*2*	*3*	*3*	*3*	*5*	*4*	*0*	*1*
%share of MPS in PSE	*51*	*12*	*55*	*47*	*62*	*48*	*55*	*48*	*91*	*88*	*95*	*91*
%share of MPS in risk-related measures	*67*	*18*	*66*	*53*	*97*	*93*	*95*	*95*	*95*	*95*	*99*	*99*
Total GSSE expenditures	**272**	**561**	**1 271**	**1 775**	**8 484**	**11 348**	**12**	**16**	**14 519**	**8 876**	**2 352**	**2 662**
Risk related measures in GSSE	**33**	**83**	**239**	**483**	**164**	**605**	**1**	**2**	**4 106**	**2 671**	**569**	**1 073**
% share in GSSE	*12*	*15*	*19*	*27*	*2*	*5*	*8*	*13*	*28*	*30*	*24*	*40*

A/An/R/I: Area/Animal number/Receipts/Income
* EU12 for 1992-94; EU15 for 1995-2003, EU25 for 2004-06 and EU27 in 2007.
1. Subsidies to water use and investment assistance in irrigation and drainage systems on the farm.
2. Infrastructure assistance for water management off the farm.
3. Payments of this PSE category that have a variable rate label, except those included in the disaster relief payments or insurance subsidies items in this table.
4. Includes for example the EU production aid for banana; and the Farming Income Stabilization Programme (JRIS) and the Sugar Cane Farm Income Stabilization Programme in Japan.
5. Includes the Canadian Agricultural Income Stabilisation (CAIS) programme, The Ontario Risk Management programme, the Assurance-Stabilization des revenus agricoles (ASRA), NISA and crop insurance payments in Canada; and the Rice Farmers Management Support in Japan.
6. Includes the AgriInvest Kickstart Program and the Canadian Farm Families Options Program in Canada.
7. Includes the Australian Dairy Industry Restructure Package; and the Western Grain Transition Program in Canada.
8. Includes subsidies to national insurance schemes in the EU; and insurance subsidies in Japan. In Canada, payments from insurance programmes are considered under variable rate payments.
9. Includes the Alberta Farm income Assistance Program, the agricultural Policy Framework Transition Funding, the Cost of Production Payment, the Farm Income Payment, the Grains and Oilseeds Payment Program, and Provincial CAIS enhancements.
Source: OECD, PSE database 2008.

TABLE 5.5

Transfers from risk-related policies in OECD countries, 1992-97 and 2002-07 (continued)

	Mexico		New Zealand		Norway		Switzerland		Turkey		United States	
	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07
Risk reduction measures in PSE	**2 861**	**2 862**	**52**	**62**	**1 107**	**1 111**	**3 252**	**2 231**	**3 607**	**6 674**	**14 109**	**13 352**
-- MPS	*2 506*	*2 496*	*27*	*33*	*1 088*	*1 101*	*3 238*	*2 217*	*3 531*	*6 501*	*11 476*	*9 240*
-- Other risk reduction measures	*355*	*366*	*25*	*29*	*18*	*10*	*14*	*14*	*76*	*173*	*2 633*	*4 113*
Private storage/non marketing	0	0	0	0	9	0	0	0	0	0	0	3
Water management[1]	224	62	0	0	0	0	0	0	48	38	334	238
Certified seeds/breeds	5	6	0	0	0	0	0	0	24	128	0	0
Technical assistance/extension	97	97	0	0	0	0	12	6	0	0	1 902	3 005
Pest and disease control	29	201	25	29	9	10	1	9	4	6	397	866
Risk reduction measures in GSSE	**121**	**234**	**14**	**54**	**1**	**0**	**9**	**8**	**121**	**87**	**713**	**928**
Water management[2]	113	93	4	17	0	0	0	0	0	0	267	237
Inspection (GSSE)	8	140	10	38	1	0	9	8	121	87	446	691
Ex ante risk mitigation/coping measures in PSE	**35**	**378**	**0**	**0**	**0**	**0**	**0**	**0**	**40**	**28**	**2 948**	**5 879**
Variable rate payments based on output[3,4]	6	291	0	0	0	0	0	0	0	0	211	2 650
Variable rate payments based on current A/An/R/I[3,5]	0	0	0	0	0	0	0	0	40	26	2 325	0
Variable rate payments based on non-current A/An/R/I, production required[3,6]	0	0	0	0	0	0	0	0	0	0	0	0
Variable rate payments based on non-current A/An/R/I, prod. not required[3,7]	0	0	0	0	0	0	0	0	0	0	0	1 930
Insurance subsidies[8]	29	37	0	0	0	0	0	0	0	3	412	1 298
Futures markets subsidies	0	51	0	0	0	0	0	0	0	0	0	0
Income tax smoothing schemes	0	0	0	0	0	0	0	0	0	0	0	0
Ex post risk mitigation/coping measures in PSE	**9**	**204**	**1**	**5**	**26**	**31**	**0**	**0**	**0**	**10**	**553**	**856**
Disaster relief payments	3	94	1	5	21	12	0	0	0	10	553	856
Ad hoc assistance	0	0	0	0	0	0	0	0	0	0	0	0
Social assistance/labour replacement	6	13	0	0	5	19	0	0	0	0	0	0
Debt rescheduling/write-off	0	97	0	0	0	0	0	0	0	0	0	0
Total PSE	**4 080**	**5 421**	**53**	**67**	**2 476**	**2 487**	**4 594**	**4 336**	**5 145**	**8 932**	**24 089**	**31 860**
Total risk-related measures in PSE	**2 905**	**3 444**	**52**	**67**	**1 132**	**1 142**	**3 252**	**2 231**	**3 647**	**6 712**	**17 610**	**20 087**
% share of risk-related measures in PSE	*71*	*64*	*99*	*100*	*46*	*46*	*71*	*51*	*71*	*75*	*73*	*63*
% share of risk-related measures other than MPS in PSE	*10*	*17*	*48*	*51*	*2*	*2*	*0*	*0*	*2*	*2*	*25*	*34*
%share of MPS in PSE	*61*	*46*	*50*	*49*	*44*	*44*	*70*	*51*	*69*	*73*	*48*	*29*
%share of MPS in risk-related measures	*86*	*72*	*51*	*49*	*96*	*96*	*100*	*99*	*97*	*97*	*65*	*46*
Total GSSE expenditures	**688**	**683**	**75**	**122**	**131**	**194**	**377**	**327**	**1 313**	**1 139**	**24 317**	**31 411**
Risk related measures in GSSE	**121**	**234**	**14**	**54**	**1**	**0**	**9**	**8**	**121**	**87**	**713**	**928**
% share in GSSE	18	34	18	44	1	0	2	2	9	8	3	3

A/An/R/I: Area/Animal number/Receipts/Income
1. Subsidies to water use and investment assistance in irrigation and drainage systems on the farm.
2. Infrastructure assistance for water management off the farm.
3. Payments of this PSE category that have a variable rate label, except those included in the disaster relief payments or insurance subsidies items in this table.
4. Includes for example Ingreso objetivo payments in Mexico and various payments in the United States such as loan deficiency and market loss payments.
5. Includes potato, sugar and tobacco compensation payments in Turkey; and former deficiency payments in the United States.
6. No measures in this category in the countries above.
7. Includes Countercyclical payments introduced in the 2002 Farm Bill in the United States.
8. Includes ANAGSA/AGROASEMEX insurance subsidies in Mexico; and Crop insurance and Adjusted gross revenue insurance payments in the United States.
Source: OECD, PSE database 2008.