Risk management instruments in agriculture

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The Dutch Ministry of Agriculture asked LEI, IRMA and Berenschot to evaluate different risk management instruments in terms of its initial goal(s), efficacy and distortions. At EU-level, the government involvement in agriculture insurance is discussed as part of the so called 'Health Check'.

In total, 13 risk management instruments in different European countries, USA and Canada have been evaluated as well as the role of the governments with respect to risk management instruments.

Based on the theoretical framework and the evaluation of the cases, recommendations for prospective risk management instruments are made.

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Contents

Preface

This report evaluates a number of risk management instruments (RMI), including agricultural insurance, available to farmers to protect them against adverse events. A theoretical framework is described in order to evaluate any RMI in terms of its (initial) goal(s), efficacy and distortions. Subsequently, cases of operational RMIs in different countries (i.e., yield insurance, livestock insurance and revenue insurance) are selected for an in-depth analysis. Data on the selected RMIs and other relevant (country) data were collected through questionnaires administered to country experts. Finally, based on the theoretical framework and the evaluations of the cases, recommendations for prospective RMIs are made.

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Abbreviations

AIDA   = Agricultural Income Disaster Assistance
CAP   = Common Agricultural Policy
CAIS   = Canadian Agricultural Income Stabilization
CFIP   = Canadian Farm Income Program
EU   = European Union
ESU   = European Size Units
GDP   = Gross Domestic Product
GRIP   = Group Risk Income Protection (in the USA)
GRIP   = Gross Revenue Insurance Plan (in Canada)
GRP   = Group Risk Plan
HRO   = Harvest Revenue Option
MPCI   = Multiple Peril Crop Insurance (in the USA)
NASS   = National Agricultural Statistics Service (in the USA)
NISA   = National Income Stabilization Account
RMI   = Risk Management Instrument
WTO   = World Trade Organisation

Summary

Introduction

The Dutch Ministry of Agriculture raised a research question regarding the efficacy and distortions of different risk management instruments in agriculture in Europe, the USA and Canada and the government involvement. The reason for this research are discussions at EU level to offer national governments the opportunity to support weather insurances. These discussions are part of the 'Health check' of the common agriculture policy of the European Union.

Research goal

The main goal of this research project is to provide an overview of the risk management instruments, as well as the role of governments in risk management in agriculture.
The main research questions are:
- Summarise different relevant risk management instruments as applied in the agricultural sector. This is relevant in terms of real cases and/or proven concepts. What is the role of government in these operational risk management instruments? Who (government or market) takes the initiatives for constructing insurance systems or crisis funds?
- How do the different systems for risk insurance work from the perspective of farmers and government? Is income insurance an effective system to replace different yield or revenue insurance systems? Identification of the key success (and failure) factors to the efficacy and distortions of these instruments.
- What role does political and socio-economic context play in the choices governments make for different risk management instruments and financial support? What are the objectives and perceptions concerning risk management instruments of different national governments that are part of this research?
- What is the influence of resilience of the sector on governments'choices for different risk management instruments and financial support?

Research method

Seven countries and 13 risk management instruments were selected to answer the above-mentioned questions.

Based on a theoretical framework a questionnaire was developed by the Dutch team of researchers. This questionnaire was answered by experts on risk management in five European countries (Estonia, Poland, Germany, The Netherlands and Spain) and the USA (which answered the questions for both the United States and Canada).

Project meetings with these experts were used to discuss the findings of these questionnaires and to make comparisons between countries.

Main results

No clear evidence was found that the political and socio-economic context in terms of government attitude, additional ad hoc support by the government, continuity of governmental involvement, economic importance of agriculture sector in total economy, agricultural employment and relative capital intensiveness, strongly influences the current government attitude towards the agriculture sector, nor the government involvement in risk management instruments. Also, no clear evidence was found on the relation between the resilience of the agriculture sector and the current government involvement in risk management instruments. There is a strong indication that the involvement depends strongly on the circumstances at the time of the introduction of measures. This implies that there is no adaptation of the involvement of governments to changing circumstances.

The selected cases differ greatly with respect to the covered perils, the policy approach, the coverage basis, the public private partnership, the governmental support and the voluntary or compulsory participation of farmers. For crop insurances, a wide spectrum of risk management instruments was considered in the research. For livestock only two risk management instruments were selected which don't differ much.

The Spanish crop insurance for winter cereals is effective from both farmers and government perspective. Also the American Group Risk Income Protection and Group Risk Plan are both effective from the perspective of these stakeholders. The Canadian National Income Stabilization Account and Canadian Agricultural Income Stabilization are both effective from a farmer's perspective but not from a government perspective. The Estonia Crop Insurance, which has been phased out, was not effective from both perspectives.

Both the compulsory Animal disease funds in Germany and the Netherlands are effective from farmers'perspective and government perspective.

Almost all risk management instruments studied in this research showed one or more distortions. The Dutch Rainfall mutual is prone to *adverse selection* because of the small pool and no premium differentiation.

Compensations based on loss appraisal may lead to *moral hazard behaviour* if indemnified losses are within control of the farmer. In four cases this could play a role however it is difficult to prove the occurrence of moral hazard.

Rent seeking and capitalisation of subsidised insurances play a role in most of the cases because, in reality, many of the existing risk management instruments are financially supported by the government.

Misreporting may be encountered in indemnity-based insurance. For example, some farmers may declare larger losses than they really incurred.

Governmental support to farmers may create perverse incentives such as *excessive risk exposure*, for example production in marginal, high-risk areas.

A final distortion is that government involvement *crowds out* private initiatives.

There are ways of minimising all distortions. For example, adverse selection can be countered by implementing a mandatory system and rent seeking can be minimised by lowering the public subsidies.

Conclusions

- From an economic point of view subsidising insurance is not effective as it disturbs markets.
- In the real world, a long history exists of subsiding agriculture in different ways.
- Within the EU there are different RMI in use for production or yield risks.
- Within the EU there are no successful RMI to cope with price risks.
- The existence of instruments today cannot be explained by the current political context, or by the current resilience of the sector.
- Instruments that are adopted do not adapt to changes in the context.
- Within the EU, the direct costs of notifiable diseases are indemnified by EU, national governments and in some countries (The Netherlands, Germany) also partly by farmers.
- Participation of farmers to insure the indirect costs of notifiable diseases, such as production interruption, is low.
- The role and involvement of national governments differs between adverse weather events and notifiable diseases.

- For adverse weather events, government participation varies from ad-hoc relief in the case of crises to public-private insurance arrangements.
- For notifiable animal diseases, national governments have a role in prevention and eradication. In addition, part or all of farmers'direct losses are indemnified by EU and national governments.

- Most countries express a desire to move away from a system of ad-hoc support due to its unpredictability and cost.
- The overriding trend is that support in the form of agricultural subsidies is still considered to be desirable.
- The efficacy of non-subsidised private insurance instruments is generally low for farmers and government mainly because of the low participation of farmers (hail and thunderstorms being an exception).
- Despite other instruments, in periods of crisis, governments often support the agricultural sector.
- Public-private systems of multi-peril insurance are effective for farmers and national government but is potentially distorting, and crowds out other privately developed schemes.
- In Spain, most deficiencies encountered in publicly provided crop insurance have been successfully fought since the mid-1990s at the expense of high premium subsidisation.
- From the point of view of social welfare, none of the schemes reviewed can be said to be 'optimal'. The analysis of distortions show that some arrangements are more societal efficient than others.
- Existing income systems (like NISA and CAIS in Canada) are not effective.

Recommendations

1. The choice for any new system (or the revision of an existing one) is a political decision where efficacy, efficiency and distortions (see also table 5.1) must be weighed. If subsidies are involved, special attention should be given to limiting the potential efficiency losses due to negative distortions.
2. The government involvement should be focused on the correlated risks problems and should offer opportunities for private sector insurers to introduce products that pay indemnities on individual farm losses (almost uncorrelated losses).
3. An interesting addition to this study would be to evaluate the third major stakeholder in risk management: the insurance companies. This was not part of the scope of this study, yet getting them involved in this may offer

new opportunities and insights. Questions such as: 'What would move the insurance companies to offer certain types of insurance?' could be very helpful in determining the most appropriate policy whereby the need for RMIs by the sector is also taken into account. Actuaries at the major insurers have a keen eye for the existing markets, and are able to help determine where the largest opportunities are.

4. The need for RMI as stated by the sector does not necessarily lead to more government involvement. Each government can make its own decision about the role it will take. A trend can be seen in the support of subsidies. Subsidising insurance systems does not cover all risks. The risks of large, extensive crises are not insured. It is even the question whether insurance companies can insure them. From this, it can be concluded that the agricultural sector needs a last resort. The government should acknowledge and anticipate that fact.

5. The case studies suggest that ad hoc support of national governments will continue to be important in times of crises. To the Dutch government the recommendation can be made to incorporate ad hoc relief in its policies. Furthermore, if the Dutch government wishes to support farmers suffering from a crisis by means of an institutional ad hoc relief instrument, this could be conditional upon the farmer's participation in private or public-private insurance scheme. This reduces the risk of adverse selection.

1   Introduction

1.1   Research problem

In agriculture, most available risk management instruments (RMIs) are not en-
tirely market-based; various forms of private-public RMIs such as subsidised in-
surance schemes or income stabilisation schemes are in place to safeguard
farmers against adverse events. The health check of the Common Agricultural
Policy (CAP) provides opportunities for governments to support risk manage-
ment instruments. Providing safety nets for farmers is one of the underlying ob-
jectives of the health check. The choice which RMIs are best able to achieve this
objective is a complicated one. Evaluating the efficacy and distortions of RMIs is
a complex and challenging task. There is a plethora of international studies
evaluating performance of insurance schemes in agriculture through reporting
the more or less standard fact sheets. Problems often observed in these stud-
ies relate to the schemes'sustainability and efficiency. In fact, most subsidised
crop insurance schemes have failed to sustain a positive rate or return (Wright,
2006). However, many of the published evaluations present only a partial reality
since they generally ignore some key factors (e.g. distortions) that affect
RMIs'performance.

1.2   Research goal

The goal of this research project is to give an overview of the risk management
instruments, as well as the role of governments in respect to risk management
in agriculture. We do this by means of a seven-country case study approach, in
which we examine a total of 13 RMIs including the case of the direct payments
under Common Agricultural Policy (CAP) of the European Union (EU)[1]. For this
study, the emphasis will be on market-oriented and various designs of pub-
lic/private instruments, based on risk pooling.

   Not only does the success or failure of the various RMIs depend to some
degree on the context in which these must live, but it may reasonably be as-
sumed that their existence does as well. Whether or not an instrument covers a

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1 Cases are divided as follows: Canada (2), Estonia (1), EU (1), Germany (1), Netherlands (2), Poland
(2), Spain (2) and the United States (2).

single peril or multiple perils, the degree to which an instrument is subsidised, or whether an insurance or a fund is used as an instrument, are all outcomes from a process that takes place in each country individually. This process also takes place on a larger stage, and several trends may be observed at a global level.

Main research questions are:
- Summarise different relevant operational RMIs as applied in the agricultural sector. This is relevant in terms of real cases and/or proven concepts. What is the role of government in these operational RMIs? Who (government or market) takes the initiatives for constructing insurance systems or crisis funds?
- How do the different systems work for risk insurance from the perspective of farmers and government? Is income insurance an effective system to re-place different yield or revenue insurance systems? Identification of the key success (and failure) factors to the efficacy and distortions of these instruments.
- What role does context (political and socio-economic) play in the choices governments make for different RMIs and financial support? What are the objectives and perceptions concerning RMIs of different national governments that are part of this research?
- What is the influence of resilience of the sector on governments'choices for different RMIs and financial support?

Risk management instruments studied are diverse but commonly aim at helping farmers to cope with adverse events. Similarly, efficacy is evaluated from the perspective of an instrument being effective in reducing farmers'income fluctuations and shortfall risks. Possible risk management instruments include on-farm instruments, such as diversification, production flexibility and information gathering, as well as risk-sharing instruments, such as insurance schemes and futures markets (Hardaker et al., 2004). For this research there is a strong focus on private, public and private-public insurance schemes.

From the last two research questions it can be deducted that the goal is to determine how the two main indicators (context and resilience) influence the existence of the different RMIs. To examine the context, one must juxtapose the arguments and convictions regarding the role of the government against the behaviour of agricultural entrepreneurs. On the other hand one must evaluate the extent to which government actions and attitudes are influenced by the

resilience of the sector, in other words, its capacity for risk absorption. Both spheres of influence are examined on a per-country basis in this case study. A part of this study is aimed at identifying the factors that drive government's choices for RMIs and their involvement.

1.3 Research Method

For this research experts from six countries were selected to do the research. The selection of the experts, countries and RMIs was determined by the following considerations:

(a) the need to include different EU member states, both the old and new member states, as well as the USA and Canada.
(b) the need to include countries with different climatic conditions and institutional environments.
(c) the need to cover RMIs used in different agricultural sectors (i.e. crop and livestock).
(d) the need to consider diverse designs of RMIs, with special focus on different forms of public-private partnership.

Per expert, two cases were selected. The USA team also analysed two cases from Canada. In total, 13 cases formed part of this research. The cases were selected in such a way that 'comparable' RMIs from different countries could be compared. Also RMIs which have been phased out and newly established are part of the research. The selection of the cases was carried out during the first meeting with all experts.

The cases are described by a format developed by the Dutch team.

The format (see separate appendix) has the following global content:
- Environmental scan
  - General description of agriculture, risk attitude and solidarity of farmers
  - Institutional characteristics
  - Farm structure
  - Risk environment
  - Overall needs and wishes with respect to agriculture

- Description of RMI
  - Situation prior to RMI evaluated
  - General description of RMI evaluated
  - Efficacy
  - Efficiency
  - Current involvement of the government

During the second meeting with all the experts, the described RMIs were discussed and compared between countries. All the described cases will be published in a separate appendix which is available on request.

The methods for analysing the cases are described in chapter 2.

1.4 Outline report

The report begins by describing the theoretical framework in order to evaluate any RMI in terms of its (initial) goal(s), efficacy and distortions. Also the framework analysing the impact of political and socio-economic context and resilience of agriculture farms on RMI and government involvement is described in this chapter.

In chapter 3 the results of the analysis of the impact of political and socio-economic context and resilience of agriculture farms on RMI and government involvement are presented.

Subsequently in chapter 4, cases of operational RMIs in different countries (i.e., yield insurance, livestock insurance and revenue insurance) are selected for an in-depth analysis. Data on the selected cases of RMIs and other relevant (country) data were collected through questionnaires administered to country experts. Finally, based on the theoretical framework and the evaluations of the cases, recommendations for prospective RMIs are made.

2   Theoretical framework

2.1   Risk management in an ideal world

Farmers can choose from a variety of risk management instruments. Ideally, farmers compose their optimal portfolio of risk management instruments from a wide variety of possibilities. Possible risk management instruments include on-farm instruments, such as diversification, production flexibility and information gathering, as well as risk-sharing instruments, such as insurance schemes and futures markets (Hardaker et al., 2004). Individual choices are likely to depend on risk attitude and farming circumstances.

Benefits for society
If farmers are able to share (part of) their risk, society may be better off, as discussed by Arrow (1992), Rejda (1998) and Hardaker et al. (2004), among others:
If two individuals freely enter a contract, then both of them must be better off (i.e. there must be an increase in utility for both). The sum of many such contracts makes society better off (unless other individuals are injured in some way).

The possibility of sharing risk permits individuals to engage in risky activities which they would not otherwise undertake. That way, the expected return to society is increased over what would prevail if individual agents were constrained to accept only those risks they could afford to bear themselves. If farmers can trade away part of their risks, so that they can move closer-not fully because there are costs involved-to the point of expected profit maximisation, the result is a more socially desirable allocation of resources.

Trading away risks is likely to result in more stable farmers'incomes. More stable incomes are likely to lead to more stable expenditure on farm inputs and family consumption, thereby implying more stability for rural businesses with possible flow-on benefits for the society as a whole, for example via more rural employment. Moreover, it seems likely that more stable farm incomes may contribute to the viability of rural towns since there appears to be a degree of irreversibility in the provision of retail and service activities in such communities. A downturn in farm incomes and hence in spending by farm families, leads to the closure of some local businesses and to the withdrawal of government and

commercially-provided services, yet these lost facilities are seldom fully re-
placed when farmers incomes recover later.

More stable rural incomes for farmers (and other rural businesses) mean
more reliable repayment of loans. That should be reflected in improved access
to credit and/or lower borrowing costs, implying increased productive invest-
ment in the rural sector.

If farmers are able to trade away (part of) the disastrous risks they face, the
resilience (or sustainability) of farms increases, which may mean less human,
animal and environmental distress after the occurrence of disasters such as se-
vere floods or droughts. This, however, is only true if moral hazard is dealt with
properly. Otherwise, farmers may, for example, pay less attention to the pre-
vention of disease outbreaks, leading to an increase in the number of disasters
occurring. Or, farmers may pay less attention to their stock during droughts,
leading to more - instead of less - animal distress.

No public subsidies

In a commercial market, design and price of risk management instruments can
be expected to be actuarially sound. Introducing subsidies, either for farmers to
lower their premium payments or for private companies to reduce their transac-
tion and reinsurance costs, is likely to bring distortions to the system (e.g., re-
source misallocation, rent seeking, capitalisation, moral hazard and crowding
out):

In economics, rent seeking occurs when an individual, organisation or firm
seeks to make money by manipulating the economic and/or legal environment
rather than by trade and production of wealth. Typical examples include a farm
lobby that seeks an insurance subsidy, tariff protection or income support.
Other examples would be farmers manipulating yields or choice of crop to grow
to maximise receipts from subsidised yield insurance, or commercial insurers
off-loading their worst risk to a government reinsurer.

One fundamental point meriting consideration is the effect of capitalisation
(Browne et al., 1992). Almost all farm subsidies thus also premium subsidies,
tend to get capitalised into asset values (which mainly manifest themselves by
increased land prices or increased costs to require production rights).

Another point is the impact that moral hazard has on the alteration of the
production plan in order to maximise the subsidy at the expense of the overall
welfare (i.e., excessive risk exposure). Governmental support to farmers may
create these perverse incentives. Recent studies suggest that subsidised crop
insurance encourages production in marginal, high-risk, areas (Wu, 1999). If this

is true, subsidies cause losses to become self-perpetuating and society's scarce resources to be misallocated (Barnett, 1999).

Governmental support crowds out demand for private sector risk management tools (Skees and Barnett, 1999) and/or inhibits the development of innovative new RMIs by commercial insurers. The extent depends both on the level of subsidy provided as well as how it is directed.

2.2 Risk management in the real world

Market failure

The theory of market failure is well established. The principal finding of this theory is that, under certain conditions, the production and distribution of a commodity through a competitive market in which all the relevant agents are pursuing their own self-interest will result in an allocation of that commodity that is socially inefficient (see for instance Bator, 1958; Krugman et al., 2006). Two areas of market failure that are often related to agricultural insurance are asymmetric information and systemic risks.

If a pool consists of large numbers of independent risks, the party who pools the risk may be able to estimate average losses and so the amount of money (e.g. an insurance premium) needed for dealing with these losses. Asymmetric information between the risk-sharing parties (such as between insurer and insured), however, can lead to established premiums being insufficient to cover the losses (Harrington and Niehaus, 1999). Asymmetric information includes moral hazard and adverse selection. In insurance, adverse selection means that exposure units most at risk buy more insurance than others but the extent to which this happens is not known a priori to the insurer. With moral hazard, insured entities change their behaviour after having bought insurance in a manner not predicted by the insurer (e.g. by becoming more careless) (Arrow, 1996).

Pooling independent risks reduces the variance of losses. But if systemic (i.e. positively correlated) risks are pooled, the variance of losses decreases less. In pooling completely systemic risks, variance does not decrease at all (Harrington and Niehaus, 1999). Risks that are completely systemic, such as prices and interest rates, generally cannot be commercially insured but can be efficiently dealt with on exchange markets, e.g. by use of futures. Risks that are neither completely independent nor completely systemic, the so-called 'in-between risks', (Skees and Barnett, 1999) are more problematic. Examples include droughts affecting crop yields over a substantial area and widespread epidemics of livestock diseases. Organisations that pool such risks face higher

costs of pooling because of the need to hold substantial reserves in case systemic events occur (Doherty, 1997).

Asymmetric information and systemic risks in agriculture may prevent the emergence of commercial insurance products for significant risks faced by farmers. This argument has often been used to support (some modest level of) government intervention in establishing agricultural insurance schemes, see for instance Arrow (1996).

Institutional environment

Besides the 'market failure arguments' for some government intervention, Georgiadis (2008) argues that current institutional developments further induce the need for some sort of government intervention, as discussed below.

The institutional environment, within which the financial sector will be obliged to operate in the immediate future, is becoming harder. Banks have to work within the Basel II framework. Because the changed regulatory environment may lead to increased capital requirements for banks, they may react by tightening the conditions under which they will offer credit to those farmers who are not protected adequately by an insurance safety net. In that case, farmers may face more expensive and less accessible credit. A combination of restricted and costly credit and no adequate safety net is likely to lead to more bankruptcy. Hence, it might be argued that subsidising farm insurance premiums may increase farmers'ability and willingness to be insured which in turn may improve their access to credit and reduce the possibility of being declared in default in loan servicing and finally bankrupted after a disaster (Georgiadis, 2008).

Solvency II is a new regulatory framework within which the insurers will be forced to operate by the end of 2012 (at the latest). In this type of regulatory framework, insurance products of higher volatility may lead to greater regulatory capital requirements and, therefore, they will be less attractive to insurers. Thus, an insurer will have an additional reason to consider multiple peril crop insurance as less attractive than, for instance, car insurance. Solvency II will contribute to more 'nervous and impatient' markets for high volatility insurance products, such as crop insurance. As a consequence, fewer insurers are expected to write agricultural insurance, and those who do are likely to set higher premiums. Premium subsidies can work as a stabilising factor in those markets, helping to retain in the market both insurers (by assisting them to build a sizeable agricultural insurance portfolio within which they could more efficiently diversify the risk in space and in time) and farmers (by reducing their insurance cost). Insured farmers may have easier and less costly access to credit (Georgiadis, 2008).

Last but not least, the EU regulatory environment related to state aid provided on the basis of articles 87 and 88 of the Treaty is changing according to the Commission Regulation (EC) No 1857/ 2006 and the 'Community Guidelines for State Aid in Agricultural and Forestry Sector 2007-2013'. In article 11 (point 8) of the above regulation it is stated that 'From 1 January 2010, compensation offered must be reduced by 50% unless it is given to farmers who have taken out insurance covering at least 50% of the average annual production…and the statistically most frequent risks…'. In a number of member states agricultural insurance is underdeveloped and most of their farmers have little acquaintance with or are not acquainted at all with crop or livestock insurance. Moreover, they are discouraged from buying insurance due to the perceived high premium rates and low quality services (Georgiadis, 2008).

Government failure
Despite the above-mentioned arguments in favour of government intervention, some (more liberal) economists argue that market failure does not necessarily imply that government should attempt to solve market failures, because the costs of *government failure* might be worse than those of the market failure it attempts to fix. This failure of government is seen as the result of the inherent problems of democracy and other forms of government perceived by this school and also of the power of special-interest groups (*rent seekers*) both in the *private sector* and in the government *bureaucracy*, see for instance Brunner (1976) and Grand (1991).

2.3   Combining the two worlds

Policy goals
In order to evaluate any programme, it is important to consider its (initial) goal(s), efficacy and distortions, which are innate to the methods of production, or other conditions important to the market. Policy makers should not intermingle possibly compelling market failure arguments for government intervention with other goals such as the sustainability of rural communities. Governments may well opt for intervention to support farmers for promoting sustainability and the livelihood of rural areas but it may not be efficient to do this by subsidising RMIs.

Government intervention

Focussing on RMIs, previous sections show that there are arguments against public subsidies in the 'ideal world' and market failure arguments in favour of some sort of government intervention in the 'real world'. So what should governments do? In the field of agricultural risk management, there seems to be some agreement with regard to the following policy options (Cafiero et al., 2005; Berg and Kramer, 2008; Cafiero, 2008).

With regard to *normal on-farm enterprise risk* public policy measures can facilitate the operation of private markets, including insurance as well as other financial instruments. Specific measures can include:

- Education of farmers and extension of personnel in risk management issues, particularly in the functioning and the use of derivative markets.
- Support of the development of private insurance/derivative markets, e.g. index-based insurance or weather derivatives, without paying premium subsidies. Support may include (i) providing the regulatory institutions and informational support; (ii) the development of informational infrastructure such as monitoring equipment and databases; (iii) direct participation in the market during the starting phase, e.g. by offering options based on weather indexes, or by providing public re-insurance; and (iv) other forms of start-up support.
- Support of the development and operation of mutual funds. Public policy could provide matching contributions to those of the farmers and set up the rules for funds'withdrawals. This can be a viable option to securitise production risks in the case of specialty crops or animal diseases.

With respect to on-farm consequences of *crisis risk* two options for public policy are presented:

- In the short term, to provide direct damage compensation after the event has occurred. In this respect, only damages to farm assets, such as buildings, equipment, greenhouses, perennial crop stands and breeding livestock, are to be compensated. Also, rules are set at EU level stating the conditions under which disaster relief will be granted, i.e. type of event, extent of losses, and proportion of the loss that is compensated.
- In the medium and long term, to take preventive actions such as public investments in protective infrastructure or the support of private actions that reduce the extent of damages caused by disastrous events. Preventive actions can also include measures that aim at establishing viable private markets for catastrophe insurance, but without providing premium subsidies.

In the aforementioned options for government intervention, asymmetric information issues are addressed by intervention in the field of education, infrastructural improvements and improved and more transparent data collection and data sharing. With regard to the systemic nature of risks, proposed interventions are financial. Miranda (1991), Skees (1999a), Skees and Barnett (1999) and Miranda and Vedenov (2001) argued that such financial involvement from governments should:

-   only apply to catastrophic events; people generally underestimate 'low-probability-high-consequence risks'resulting in a too-limited willingness to pay.
-   is set up in a very transparent way; ambiguity about the exact involvement of public budgets complicates the opportunities for private markets to take over (part of) this commitment.
-   is limited in scope and time; private stakeholders, i.e. farmers and insurance companies, should have incentives for putting into place appropriate hazard management policies.
-   has a 'healthy start' from the beginning; experience shows that once opaque and extensive subsidy programs are running it is almost impossible for governments to step back.

Literature argues that any financial involvement of governments in agricultural risk management should be evaluated along these lines.

Criteria for evaluating RMIs
With respect to the overall efficacy of (public/private) agricultural insurance schemes, there obviously can be no single criterion that captures the complete information about the achieved effect. (Note that, contrary to efficiency, the focus of efficacy is the achievement of defined objectives of stakeholders, not the resources spent in achieving the desired effects.) Based on criteria of efficacy, quantitative indicators can be derived to evaluate a risk management instrument. Commonly, the proportion of insured production (i.e., penetration), premium subsidies (e.g., measured as a percentage over total premium), and loss ratios (i.e., ratio of losses to earned premiums) are reported to compare and evaluate insurance schemes. It should be noted however that these criteria still provide only a partial analysis since they do not answer questions such as 'who benefits from a subsidised insurance scheme?' and 'do farmers need government-provided risk protection via insurance?' Additional indicators would clarify these matters, such as the effect that insurance has on farm household income fluctuations. Also evaluation criteria dealing with potential or observed distor-

tions from, among others, asymmetric information and rent-seeking behaviour would provide additional insights.

2.4 Framework for analysing the impact of context on government involvement

For both context and resilience six indicators were generated. For each of these twelve indicators, one pivotal hypothesis was designed about how it might influence the existence of the different RMIs. In table 2.1 an overview of the indicators and their hypotheses is given.

Table 2.1	Indicators for context and resilience and their main hypotheses	
Sphere	**Indicator**	**Hypothesis**
Context	Government attitude	The less supportive and more liberal the attitude of the government, the lower the involvement of the government.
	Economic importance	If the agricultural sector is of great economic importance to a country, its government is more likely to heavily support (and subsidise) it.
	Employment	When a large percentage of the population is employed in the agricultural sector, the government is likely to support it.
	Labour intensiveness vs. capital intensiveness	In countries where the agricultural sector is very capital intensive, it is more susceptible to crises and therefore more government support would exist.
	Continuity of involvement	In case of a very supportive government attitude towards agriculture, continuous involvement will be high.
	Additional ad hoc?	In case of a very supportive government attitude towards agriculture, ad hoc support will be high.
	Degree of organisation	A higher degree of organisation means greater government involvement.
	Size (acres) per farm	When farms are larger, need for RMIs by farmers (and participation of farmers in RMIs) becomes smaller.

Resil-ience	On-farm production diversity	The lower the degree of on-farm production diversity (i.e. the higher the degree of specialisation), the greater the need for RMIs.
	Access to capital	Limited access to capital leads to increased need for RMIs.
	Equity (own funds)	When the amount of outstanding loans is high (i.e. low equity), there is a greater need for RMIs.
	History of crises	The more often crises occur, the more government involvement in RMIs.

The indicators for context sector resilience are not independent. The immediate relation between the indicators and either government involvement or the need for RMI was examined first, but because of the interdependency between the various indicators, a more extensive model was constructed (see figure 2.1 and 2.2) to capture the delicate interplay between indicators, and shows whether they positively or negatively impact one another.

Figure 2.1   Indicators for context and their relationship
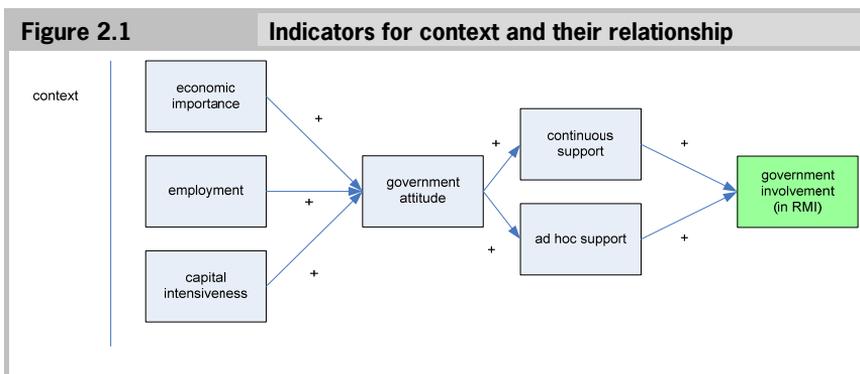
Figures 2.1 and 2.2 provide an overview of the relation between indicators, the formulated hypotheses and their assumed influence on government involvement in RMIs. The relations are supposed to be positive or negative, and also some indicators may be interrelated. In figure 2.1 the relations for context are displayed.

In the sphere of 'context', the relationship between indicators is determined as follows. Economic importance, employment and capital / labour intensiveness influence government attitude, which in turn influences government involvement in the different RMIs. This involvement can take the form of continuous involvement and support, or ad hoc support.

In figure 2.2 the relations for resilience are displayed. Two of the hypotheses, regarding degree of organisation and history of crises are supposed to have a direct influence on government involvement. The other four, regarding size of farm, production diversity, capital access and equity are aimed at the need for RMI from the sector perspective. The relationship between sector needs and government involvement can be assumed to be positive. That means that governments are sensitive to sector needs, but, after all, this is a choice that governments make autonomously.

Figure 2.2   Indicators for resilience and their relationship
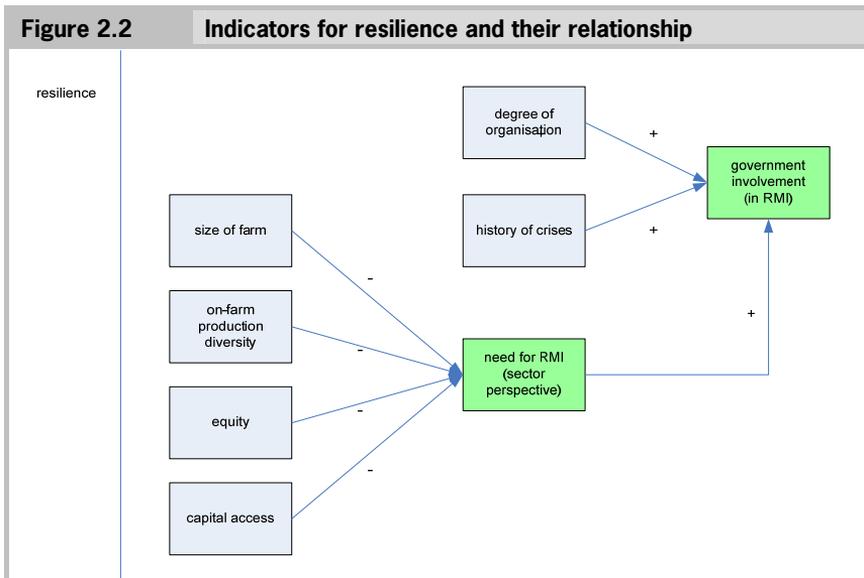
Subsequently these hypotheses were checked against the data compiled in this study by the international experts in each of the seven countries. The countries were weighed per indicator on a relative scale. The country with the highest value was given a rating of 100%; all other countries received a value relative to that. The qualitative and quantitative data supporting these indicator ratings comes primarily from the research done by the international experts, as described in their project sheets. When other sources are used this is mentioned explicitly. This holds for example for the indicators 'Economic importance' and 'Employment'. This data was found in the CIA World Factbook.

3 Factors influencing risk management instruments and government involvement

Based on the described framework in section 2.4 the findings on the hypotheses are elaborated.

Based on the information in the case studies a ranking was developed regarding the degree of government involvement. This presents a subjective overview of the degree to which governments are involved, as per the information provided by the experts in this study. This ranking lists countries from the highest degree of government involvement (#1) to the lowest (#7). This ranking is:
- United States;
- Canada;
- Spain;
- The Netherlands;
- Poland;
- Germany;
- Estonia.

Next, we developed a similar ranking for the need for RMIs from the farmers'perspective. This too was based on the information provided by the experts in the case study. Countries are ranked from the greatest farmer need for RMIs (#1) to the lowest farmer need for RMIs, and is as follows:
1. Spain;
2. The Netherlands;
3. United States;
4. Poland;
5. Canada;
6. Germany;
7. Estonia.

We produced these rankings in order to evaluate the relationship between the individual indicators and either government involvement or the need for RMIs (farmers'perspective).

3.1 Political and socio-economic context

Six indicators were evaluated that may greatly influence both the existence and the success rate of the various RMIs. As said, these indicators were rated relative to the country with the highest value. A visual representation of the results in the sphere of 'context', both socio-economic and political, is displayed in figure 3.1 below.

Figure 3.1	**Country scores for the indicators of context**
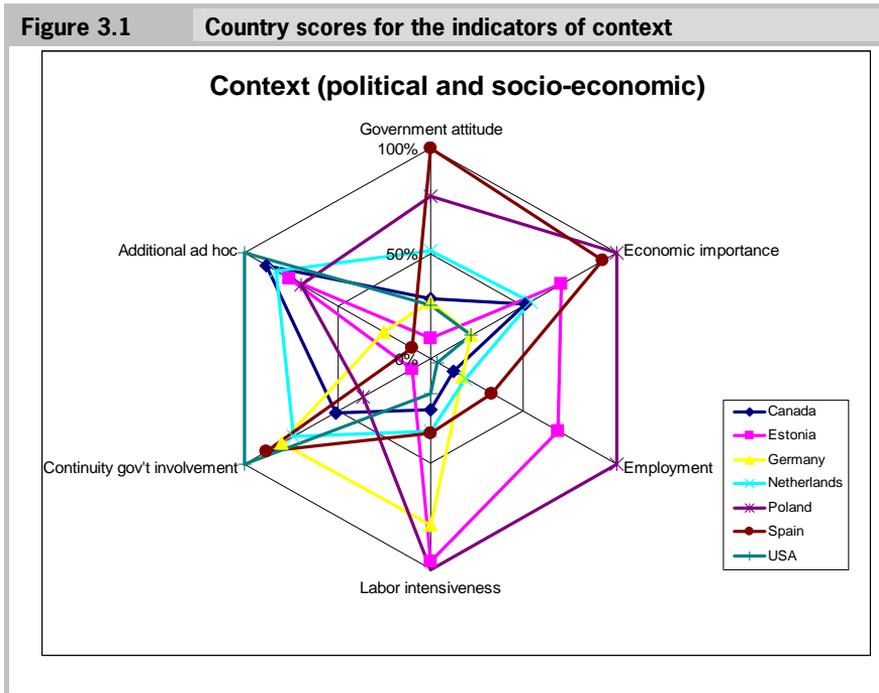
These indicators and their hypotheses will be briefly examined below.

3.1.1 Government attitude

Governments in many countries are in favour of supporting agriculture. In table 3.1 the objectives and perceptions regarding RMI of the national governments that are part of this research are elaborated.

Table 3.1	Objectives/perceptions regarding RMI
Country	**Objectives / perceptions regarding RMI**
Germany	Germany has the ambition to create conditions for liberalisation. National government does not see it as an objective to support the agricultural sector substantially. In times of crises the continuity of business is most important
Spain	In times of crises the sector expects government involvement aimed at compensation, but since 2004, the eligibility for compensation is based on contracting minimum insurance coverage. Besides that, Spain has an extensive insurance system. In a recent debate on March 31, 2008, all farmers'organisations, together with government officials and representatives of the insurance companies, agreed on continuing to work towards achieving more penetration and acceptance of the existing insurance system. Spanish government is willing to support the sector continuously.
Estonia	Estonia is liberal. A public-private system of subsidised crop insurance was launched on 1st of July 2008.
Poland	The policy in Poland is aimed at continuing subsidies. Risk management is relatively new in Poland. Recently it was decided to design an obligatory farm production insurance under which part of the insurance premium is subsidised.
United States	Government support is continuous, also in times of crises. Government makes huge financial reservations for this purpose. The objective in the United States is to protect farmers against production risks and reduce the need for ad hoc support.
Canada	In Canada the objective is to reduce ad hoc support. The RMIs in this study did not succeed in reducing ad hoc payments. One of the explanations is the strategic way in which the sector uses these instruments.
Netherlands	The Netherlands has the ambition to create the optimal conditions for liberalisation.

In May 2008, the Health Check in the European Union, and the new Farm Bill receiving overwhelming support by the US Congress proved government drive to support once more. Yet at the same time, we also see a trend moving away from publicly supported instruments and ad-hoc payments after crises towards a system of public-private partnerships. This general attitude of the government towards the sector could greatly impact which types of instruments are devel-

oped. The various countries that are part of our research were ranked on a scale ranging from a very national, pro-agriculture, close supportive involvement with the sector (high values) to an extremely liberal attitude (low values). The hypothesis is that a more liberal attitude of the government inspires the use of more market-based (low or unsubsidised instruments). This was hypothesised because it stands to reason that a pro-agriculture attitude of government leads to more involvement, and much of this is monetary (in the form of subsidies). The hypothesis is proven for the European countries (Estonia, Spain, Poland, the Netherlands and Germany); it is disproven, however, by the existence of publicly supported programmes in Canada and the US, despite a highly liberal government attitude in these countries.

3.1.2 Economic importance

The next indicator that was examined was the relative economic importance of the sector. Based on data available from the CIA World Factbook, the countries were ranked in terms of the contribution of the agricultural sector to the Gross Domestic Product (GDP) of each country. The reasoning for why this would matter is the hypothesis that if the sector is of great economic importance to a country, the government would have more reason to heavily subsidise and support it, in order to prevent it from collapsing. This hypothesis proves to be relatively accurate in the cases of Poland, Spain, the Netherlands, and Germany. However Estonia is a clear example that a relatively high economic importance of agriculture does not necessarily mean the government offers more support to RMIs (although they do occasionally offer ad hoc support).

3.1.3 Employment

Another major indicator of how important a sector is, is the socio-economic indicator employment. In some countries a far greater percentage of the population works in the agriculture sector than others, and it stands to reason that employment is important enough for most governments to take that into account into their decision for certain RMIs. This leads to the hypothesis that, when a large percentage of the population is employed in the agricultural sector, the government is more likely to support it. For example, in Poland farms are widely regarded as a form of social security for people who lose their job; they can find employment on a farm against low pay but with free boarding. This is a safety net that the government actively supports by heavily funding agriculture. However, this is disproven entirely in the United States, where billions of

dollars are funnelled into a sector in which only 0.6% of the population is employed.

3.1.4 Labour intensiveness vs. capital intensiveness

This is a rather complicated indicator. Labour intensiveness is the contribution of the sector in terms of employment divided by the economic importance. In other words, it is the percentage of the population that works in agriculture (3.1.3) divided by the percentage of the GDP that comes from agriculture (3.1.2). The idea is that a value smaller than 1 means the sector is extremely capital-intensive. On the other hand, the greater this figure, the more labour intensive the sector is in that country. The hypothesis here is that labour-intensive farms are more flexible than capital-intensive farms, which is why the need for government support in case of a crisis would be higher for the countries with more capital intensive farms, and lower for the countries with more labour-intensive farms. Additionally, more capital-intensive agriculture facilitates innovations in agreements and contracts all along the market chain, which enables farmers to externalise part of their risks (Garrido and Bielza 2008, p. 61). Canada and especially the US underwrite this hypothesis, as these are extremely capital-intensive agricultural industries, yet the degree of government support in RMIs is still quite great. Estonia shows rather high labour intensiveness, and the complete lack of government-sponsored RMIs also proves the hypothesis.

3.1.5 Continuity of the government involvement

An indicator that is less easily quantified is the continuity of the involvement of the government. In general, one may observe a trend towards a more continuous involvement, not only as a macro trend (for example, in the aforementioned EU Health Check), but even in those countries that don't have very much continuous involvement right now (like Estonia). Some RMIs are exclusively focused on ad-hoc support, but others provide support for more frequent occurrences of price crises or yield crises (in other words, events that take place on a somewhat regular basis). Governments that have a pro-agriculture (supportive) attitude can be expected to offer much continuous support. No consistent evidence can be found for this in the cases: Spain is a clear example of where the hypothesis is proven (supportive government attitude and great continuous government involvement), and Estonia as well (liberal government attitude and low continuous involvement), yet other cases disprove the hypothesis. The most obvious example of this is perhaps Poland, where the supportive government atti-

tude does not go hand-in-hand with great continuous involvement. For these countries it stands to reason that the pro-agriculture attitude of the government is expressed in a different form of RMI support: ad-hoc support.

3.1.6 Additional ad-hoc support

This means that one must examine the hypothesis that pro-agriculture and supportive government attitudes lead to a greater amount of ad-hoc crisis support. This hypothesis appears to be supported by the case of Poland. But several other cases, most notably Estonia and the United States, disprove it. In these countries, government attitude is rather liberal, and yet ad-hoc support is great.

 This leads one to examine another connection, namely that governments supporting RMIs that offer more continuous support will be less inclined to give additional ad-hoc support in the event of large crises. The data, however, do not demonstrate any consistent correlation supporting this either. In Germany, for example, continuous involvement of the government correlates with offering very little ad-hoc support, yet the US government, which also offers many great continuous means of support, just approved almost USD4bn in farmer relief funds for weather-related disasters.[1]

3.2 Resilience of the agriculture sector

The second sphere of indicators has to do less with socio-economic and political factors than it does with what the sector itself looks like. Seeing as the farmers are the other main player (stakeholder) in these RMIs, there is something to be said for them having an impact on the existence of certain instruments, what form they take, and how well they work. Here another six main indicators were ranked on a relative scale, as indicated in figure 3.2

 The indicators and accompanying hypotheses are discussed in some greater detail below.

[1] Congress sends popular farm bill to Bush - CNN.com
(www.cnn.com/2008/POLITICS/05/15/farm.bill.ap/index.html?iref=newssearch)

Figure 3.2   **Country scores for the indicators of sector resilience**
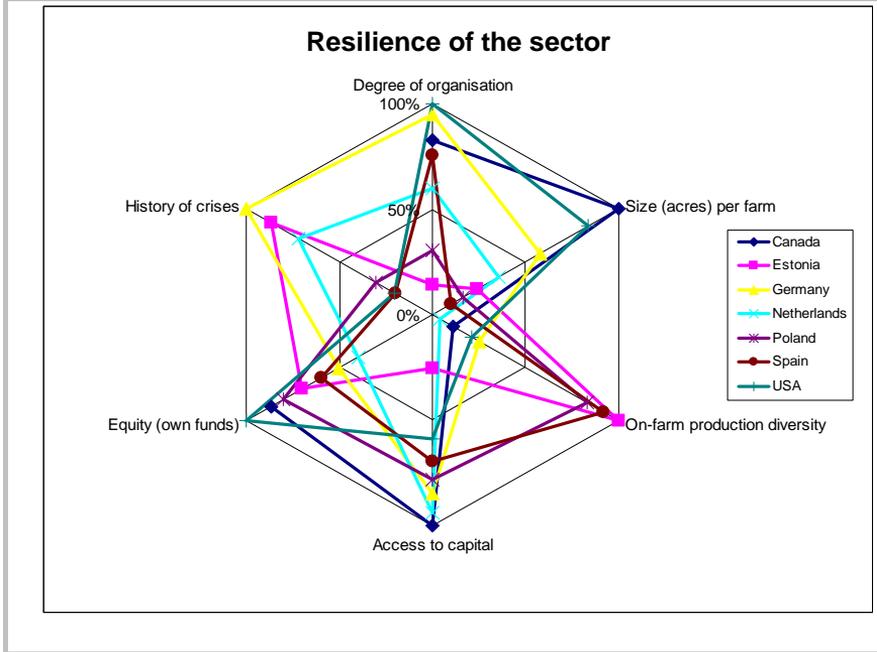
3.2.1 Degree of organisation

Under the degree of organisation of the sector several different phenomena are
included. Not only are branch organisations included, but also cooperatives and
membership of other cooperative groups or unions. One must apply a rather
wide definition because terms like 'cooperation' or 'union' mean very different
things in different countries. When they are all grouped together, the hypothesis
is that a higher degree of organisation among farmers makes for a stronger
lobby, which in turn leads to more government involvement or support.
Stronger lobby is not the only possible reason for farmers to organise them-
selves. Farmers may organise themselves for increased purchasing or selling
power. Yet, power is the keyword here, and economies of scale apply to let the
greater numbers work to the advantage of the individual farmer. It doesn't mean
that the power is only used for political means. But it is likely that a greater
economic force is also one to be reckoned with, from the government's per-
spective. Looking at the relation between the degree of organisation and the
need for publicly supported RMIs, we can conclude that countries where farm-

ers organise themselves, typically receive more government support. The US, Canada, and Spain have a high degree of organisation as well as relatively high government involvement and support. Germany is the main exception to this, since farmers are highly organised (be it for economic or political reasons), yet government support is low.

3.2.2 Farm Size

Another variable that says a lot about the resilience of the sector is the relative size of farms. In Europe there is a scale that takes into consideration the relative differences between the nations (European Size Units, or ESUs), but since two of the 7 countries in our study are not rated on this scale (US and Canada), a more absolute value of acres was taken as an indicator of size. The hypothesis is that the larger the size of a farm, the more entrepreneurial and resilient the farmers. Their business-minded attitude means they are more capable of finding their own way in managing their risks and therefore means that there is a lower need for RMIs and participation in existing RMIs is low. This hypothesis is proven in North America and Canada. Here we see the largest farms, a very entrepreneurial spirit among farmers and generally low use of the RMIs in place. In Spain, on the other hand, farms tend to be rather small. Although participation in traditional programmes is quite high, a few new programmes in recent years have received very low acceptance (<5% penetration rates). This may be due to farm size, cognitive problems or simply that coverage is not demanded.

3.2.3 On-farm production diversity

Increasing more often we see farmers specialising, and the number of mixed farms declining (whether it be mixed crops and animal products, or mixed within either one of these). There is a clear distinction between North America and Northwest Europe on the one hand, where farmers tend to specialise, and the Mediterranean and Central and Eastern Europe on the other, where farmers still tend to have a great diversity of crops. Of the on-farm risk management instruments, production diversity is most useful in enhancing the resilience of an agricultural enterprise when the risks it faces are frequent, and have great impact (Berg and Kramer, 2008). Then the hypothesis is that the need for RMIs would be greater in countries with highly specialised production. This hypothesis is, however, not supported by the data. As mentioned above, the degree of specialisation or diversity correlates closely along geographic lines, yet for the existence of instruments this is much less obviously the case.

3.2.4 Access to capital

This indicator describes the ease with which farmers can get additional funds, such as loans. This again is something that is very hard to compare between countries, if for no other reason than the fact that the economies of the countries in this study are so dramatically different. Therefore, the subjective perception of each of the country experts we consulted for this study is used. Aside from the fact that more money can be borrowed if risks are lower, the hypothesis is that this measure is important because if it was easy for farmers to access additional (external) capital, their need for RMIs would be reduced. The data the experts provided does not prove this, however. Estonian farmers have low access to capital (primarily due to the lack of collateral), yet they're perfectly able to absorb any major blows to their production themselves, with low government involvement.

3.2.5 Equity

Related to the previous indicator, but more quantifiable, is the question of what percentage of the capital of farmers consists of borrowed funds, and what percentage is their own. Farmers who have large outstanding loans can be expected to be less able to deal with major catastrophes on their own, so the very existence of RMIs should be higher in those places. The data shows that countries where farmers have low equity (high loans) also have a lot of publicly supported instruments, such as the Netherlands, Canada, or Spain. And in Estonia and Poland, on the other hand, we see that the rather large equity of farmers there correlates with the existence of very little public support. In sum, equity seems to be a reasonably good indicator of government involvement and the degree of subsidisation.

3.2.6 History of crises

The final indicator of resilience is the amount of historical crises. In other words, how often does a country have to deal with a given peril? While it's fair to say that crises that occur every other year maybe shouldn't be considered 'crises', but simply 'climate', many of these are covered by RMIs all the same, such as drought in Poland. Important to notice here is also the fact that many of these crises appear to be happening more and more frequently, in part due to climate change. That aside, it does seem extremely likely that the past experiences of a country matter a great deal in the selection and success of RMIs, the way they

have been shaped, and the involvement of government. This means that a greater frequency of crises correlates with a greater number of RMIs and involvement of the government. Clear-cut correlations between the historical occurrence of crises or catastrophes and government involvement in RMI are hard to find. In most countries, the RMIs seem to fail, at least to some degree, when crises or disasters happen. The sequence of events is more or less as follows. Programmes do not effectively protect farmers when significant shocks occur. Governments then provide additional ad-hoc support. They are then shocked by the tremendous cost of this support, and they decide to revamp agricultural policies in the hope of reducing cost. Eventually, another disaster follows, and the process starts all over again.

4 Some case studies of risk management instruments

4.1 General description of cases

This section describes in general the cases of the selected RMIs applied in different countries and classifies them according to various characteristics that define the design of each RMI. Furthermore, the studied RMIs are described in terms of basic indicators of the performance of RMIs such as loss ratio and loss adjustment costs.

In this study, the choice of cases was determined by the following considerations: (a) the need to include different EU member states, both the old and new member states, (b) the need to include countries that cover diverse risks (i.e. climatic conditions) and institutional environments, (c) the need of RMIs used in different agricultural sectors, and (d) the need to consider diverse designs of RMIs, with special focus on different forms of public-private partnership.

Table 4.1 shows that, over the years, a range of RMIs have been used to assist farmers in coping with risks related to crop and livestock production sectors. The RMI cases selected for this study (in total 13 RMI cases) include long-existing RMIs and recently introduced new ones designed to improve on the RMIs previously used. Each case is presented along with information to identify and analyse the approaches used in different countries. Furthermore, to provide a better overview of risk management policy in each country, the table also provides information on other RMIs, which exist or existed together with the RMI case(s) in that country.

Table 4.1 illustrates that RMIs may differ by the intended sector (crop and livestock), covered perils (single peril and multiple peril), policy approach (commodity-based and whole-farm), coverage basis (price, yield, price times yield and other losses), partnership (private, public and private-public), type of government support within the RMI (disaster relief, direct payments, excessive loss payments, premium subsidy, interest rate subsidy, guaranteeing the loan, contribution to a farm saving account, reinsurance, administrative and operating expenses, etc.) and participation choice (voluntary and compulsory). The current status of the RMI (in use, phased out, replaced or being reconsidered) is deemed to be an initial performance characteristic of the RMI and therefore is also used for classification in the table.

Table 4.1 Examples of risk management instruments a)

Risk management instrument	Years of operation	Sector	Covered perils	Policy approach	Coverage basis	Partnership	Government support RMI	Participation	Current status
Canada									
1) NISA	1991-2003	crop	multiple	whole-farm	yield*price	private-public	contribution to a farm saving account	voluntary	replaced
GRIP (Canada)	1990-1998	crop	multiple	commodity-based	price/yield, yield*price	private-public	premium subsidy	voluntary	phased out
Crop insurance	since 1939	crop	multiple	commodity-based	yields	private-public	premium subsidy	voluntary	expanded
Subsidized loans		crop	singe	commodity-based		private-public	interest rate subsidy and guarantee-ing the loan	voluntary	in practice
AIDA and CFIP	1998-2003	crop	multiple	whole-farm	price*yield	public	direct payments (disaster relief)	when eligible	replaced
2) CAIS	2003-2007	crop	multiple	whole-farm	price*yield	private-public	excessive loss payments	voluntary	will be replaced

Table 4.1   Examples of risk management instruments a) (continue)

Risk management instrument	Years of operation	Sector	Covered perils	Policy approach	Coverage basis	Partnership	Government support RMI	Participation	Current status
Estonia									
3) Crop insurance	2001-2004	crop	multiple (natural calamities)	commodity-based	not available	private	no involvement	voluntary	phased out
Government support	ad-hoc till 2006	crop	multiple (natural calamities)	commodity-based	losses	public	direct payments (disaster relief)	when eligible	phased out
European Union									
4) CAP direct payments	since 2003	all sectors	multiple	whole-farm	yield*price	public	direct payments	when eligible	in practice
Germany									
5) Animal disease fund	since 2001	livestock	multiple (notifiable diseases)	commodity-based	direct losses	private-public	contribution to the farmers'fund	compulsory	in practice
Complementary insurance		livestock	multiple (notifiable diseases)	whole-farm	business interruption	private	no involvement	voluntary	in practice

Table 4.1   Examples of risk management instruments a) (continue)

Risk management instrument	Years of operation	Sector	Covered perils	Policy approach	Coverage basis	Partnership	Government support RMI	Participation	Current status
Netherlands									
6) Rainfall mutual	since 2004	crop	single (excessive rain)	commodity-based	yield	private-public	reinsurance	voluntary	in practice
7) Animal health fund	since 1999	livestock	multiple (notifiable diseases)	commodity-based	direct losses	private-public	excessive loss payments	compulsory	to reconsider
Complementary insurance		livestock	multiple (notifiable diseases)	whole-farm	business interruption	private	no involvement	voluntary	in practice
Poland									
8) Disaster loans	since 1997	crop	single (drought)	commodity-based	yield	private-public	interest rate subsidy	when eligible	in practice
9) Crop insurance	since 2006	crop	single and multiple	commodity-based	Yield * price	private-public	premium subsidy	compulsory	in practice

Table 4.1   Examples of risk management instruments a) (continue)

Risk management instrument	Years of operation	Sector	Covered perils	Policy approach	Coverage basis	Partnership	Government support RMI	Participation	Current status
Spain									
10) Crop insurance for winter cereals	since 1992	crop	multiple	commodity-based and whole-farm	yield	private-public	premium subsidy	voluntary	in practice
11) Revenue insurance: potato and strawberries	2003-2004 and never introduced	crop	multiple	commodity-based	price	private-public	no involvement	voluntary	experimentally and not introduced
USA									
MPCI	since 1980s	crop	multiple	commodity-based	yield	private-public	premium subsidy	voluntary	in practice
12) GRP	since 1994	crop	multiple	commodity-based	yield	private-public	reinsurance administrative	voluntary	in practice
13) GRIP (USA)	since 1999	crop	multiple	commodity-based	yield, price/ yield*price	private-public	tive and operating expenses	voluntary	in practice

a) Selected cases are numbered, explanation of acronyms is in the text.

Livestock sector

The two selected RMI cases dealing with livestock production issues refer to rather long-existing animal disease funds in the Netherlands and in Germany (cases 5 and 7 in table 4.1). Both of them are funded via compulsory levy systems (specified per type of animal) and involve private-public partnerships where the governments provide payments for excessive losses following an outbreak of a notifiable disease (such as Classical Swine Fever, Foot and Mouth Disease, Avian Influenza, Bluetongue). So far, both schemes have dealt with only direct losses that include costs of controlling epidemics at the farm level (e.g., diagnosis, screening, culling of infected herds and vaccination). However, in both countries changes to the existing schemes are under discussion.

In the Netherlands, possible changes might include: (a) sector retention levels, (b) types of losses covered, i.e. to extend coverage to some of the indirect loss categories, (c) implementation of levy differentiation within sectors, for instance based on farm location and disease status.

Also, in Germany, the issue of indirect costs is attracting attention.

Note that for risks of notifiable diseases, commercial business interruption insurance schemes are in place in both countries. This means that in both countries farmers can insure indirect costs, at least in part. In the Netherlands, however, the insurance coverage provided is rather limited and, furthermore, is only available to cattle farmers (Meuwissen, Huirne and Skees, 2003).

Crop sector

The selected cases of RMI dealing with crop production are more diverse by their design than the instruments studied in the livestock sector. They include: (a) insurance-type mechanisms (such as multiple peril and single peril crop insurance and revenue insurance), (b) subsidised loans, (c) farmer self-insurance funds, (d) government-insurer mechanisms, and (e) direct payments under the CAP of the EU.

The CAP is included in this study as an RMI. The CAP is clearly not an insurance system, but it does affect the security of the income of farms. The CAP payments are independent of the current farm performance (decoupled based on historical entitlements or other criteria). The payments are fixed to a certain level and a farmer expects these payments. Due to the fixed nature of these additional payments, the total income of the farmer is (much) more stable than without these payments. This does not only affect the level of the farmers'income but it can also affect the farming decisions (choosing a more risky crop with potentially high revenues).

Multiple peril insurance
Multiple peril crop insurance design is represented by the cases of crop insurance for winter cereals in Spain (case 10), Group Risk Plan (GRP) in the USA (case 12), crop insurance in Poland (case 9) and crop insurance in Estonia (case 3).

The privately offered crop insurance for winter cereals in Spain (case 10) runs on a voluntary basis and the government subsidises insurance premiums. This insurance started its history in the early 1910 as hail insurance. Since 1978 the scheme has evolved to encompass new risks, which was only possible after a thorough analysis of yield variability at the individual-farm level. Since 1992, the scheme has existed in its current form where droughts can also be insured, based on individual farmers'records. These days, the scheme includes 3 packages: (a) multiple peril (fire, flood, hailstorm and other exceptional damage), (b) zonal yield (including multiple perils, yield losses based on zonal evaluations), (c) individual yield (including multiple perils, yield losses based on individual historical yields). For yield insurance, the coverage involves a specified percentage of the difference between average historical yields and the actual yields. The past drought in 1995 created a serious risk of system collapse; a similar or even worse drought 2005 was much easier to face because of the relatively low importance of winter cereal premia in relation to other crops and livestock premia which were not affected by the drought. In 1995 the system did not have as much diversified portfolio of crops as it has now, i.e. when cereals comprise only a small part (15%) of the total insurance liability.

Area-yield insurance, the GRP (case 12), was introduced on a national level in the USA in 1994. This private-public scheme is eligible for government reinsurance, premium subsidy and subsidised administrative and operating expenses. Under this voluntary programme, farmers are indemnified when county-level yields fall below a certain threshold. County-level data are collected from the National Agricultural Statistics Service (NASS) and are largely available dating to 1956. For the GRP, farmers choose the level of coverage for each crop. They select a dollar amount per acre and choose the payout threshold (a certain percentage of county yields). Dollar amount per acre can be up to 150% above the county average. Expected county yields are reported about 6 months before farmers select insurance coverage for the season (Skees, Black, and Barnett, 1997). GRP indemnity payments are made 6 months after crops are harvested, usually in April (RMA, 2008c). In cases where conditions predict very low county yields during the planting season, farmers may be able to receive some pay-

ment as early as September (Baquet and Skees, 1994). If county yields fall be-low the payout threshold selected by the farmer, indemnities are paid (RMA, 2008c). Payments are based on the percentage decline below the payout trig-ger. Thus, higher indemnities are paid in years with very low county-level yields. For an example of GRP estimates see Skees, Black, and Barnett (1997).

In contrast to the long-existing Spanish and American crop insurance sys-tems, the cases of crop multiple peril insurance in Poland (case 9) and Estonia (case 3) refer to rather recent years. In Poland, subsidised-premium compulsory crop insurance was introduced in 2006 and provides 5 packages: from basic (hail and spring frost) to complete coverage (hail, spring frost, winter losses, excessive rains, storm winds, thunder storm, flood). Farmers can select which package to enrol in. This instrument is supposed to replace disaster (drought) loans, which are described below. Yet this insurance is also meant to fulfil the EU requirements of insuring more than 50% of crop area in order to be allowed to subsidise disaster (drought) loans.

Subsidised-premium natural calamity insurance was available in Estonia in 2001-2004 (case 3). Government support on an *ad-hoc* basis was been pro-vided until 2006 (table 4.1). Currently, the government has established a pre-mium-subsidised crop insurance to cover yield risk caused by natural calamities (also in line with the EU requirements described in the previous section).

Single peril insurance
Single peril crop insurance design is represented by the case of rainfall mutual insurance in the Netherlands (case 6). This private-public instrument was launched in 2004. The government provides a non-proportional reinsurance cover. That is that the government reimburses the mutual for the amount of loss the mutual suffers over a predetermined aggregate limit. This involvement is, however, rather invisible as after the introduction of the insurance there was no financial contribution from the government (losses did not trigger the reinsur-ance contract). This mutual insurance scheme is voluntary.

Revenue insurance
Revenue insurance design includes the cases of private-public Group Risk In-come Protection (GRIP) in the USA (case 13) and two private-public revenue in-surances experimentally designed for potato and strawberries (case 11). These RMIs are supposed to guarantee a given level of revenue rather then just pro-duction to a farmer.

The American GRIP (case 13) was introduced in 1999. It was intended to protect farmers from unexpected revenue losses (at the county level) due to

declines in yields, commodity prices, or a combination of the two. Similar to GRP, this voluntary plan is eligible for government reinsurance, premium subsidy and subsidised administrative and operating expenses. Revenues are measured using expected values for county yields and expected exchange market commodity prices measured at the national level. In the same fashion as for the GRP, GRIP relies on NASS county-level data to determine expected and final county yields (RMA, 2008a). Commodity prices are determined using the February futures price for the commodity in December on the Chicago Board of Trade as the price reference level (Paulson and Babcock, 2007; RMA, 2003). Actual county-level revenues are determined in September by multiplying final county-level yields by the harvest price - the futures price for the commodity at the end of the harvest month (e.g., the September futures price for the commodity in December; RMA, 2008b). Indemnities are paid when revenues are below the trigger level (Paulson and Babcock, 2007). Triggers are the same for GRIP as for the GRP, 70 to 90%, as is maximum dollar coverage of 150% (RMA, 2008a).

4.1.2 Subsidised loans

The mechanism of subsidised loans is presented in the case of disaster (drought) loans introduced in Poland in 1997 (case 8). Under this private-public design the government signs agreements with commercial banks which offer disaster loans. The government covers the costs of the reduced interest rates for credit for investments and for purchase of inputs. It is not clear whether the instrument will be used in the future. As mentioned above, the recently introduced crop insurance is supposed to replace these disaster (drought) loans.

4.1.3 Farmer self-insurance fund

Examples of self-insurance funds include the Canadian National Income Stabilization Account (NISA) program (case 1). When introduced in 1991, NISA covered a small number of field crops, primarily grains and oilseeds; however, with a focus on whole-farm production, coverage quickly expanded to include all primary agricultural commodities, except for products such as dairy, poultry, and eggs (Mussell and Martin, 2001; Stokes, Coble, and Dismukes, 2000; Zahniser, Young, and Wainio, 2005). The NISA is a special type of farm savings account available to producers at local participating financial institutions (Coble, 1995). Under this voluntary private-public scheme, farmers and the government contribute to a farm saving account belonging to the farmer. The government matches the farmer's deposits dollar for dollar. The intention of this programme

was to provide farmers with incentives to smooth income by depositing savings in high revenue years that can be withdrawn when revenues are low. Farmers had to participate for at least one year before being able to withdraw funds from their NISA accounts.

Note that NISA was one of a larger government-supported risk protection approach for agriculture in Canada. In 1990, the Gross Revenue Insurance Plan (GRIP) was created concurrently with NISA. The Canadian GRIP provided revenue insurance on a per acre basis primarily for grain and oilseed crops (Simone and Harwood, 1991; Skelton and Turvey, 1994). To enrol in the Canadian GRIP, farmers paid insurance premiums subsidised by the government. The programme provided commodity support at prices that were above current international market prices (Simone and Harwood, 1991). A historical, multi-year moving average of commodity prices was used as the reference level. Also, the government supported (via subsidised premiums) a traditional crop insurance programme, which made payments based on crop yields if any of the covered commodities experienced yield declines (i.e. a certain per cent below historical farm averages). First established in 1939, this crop insurance programme provided protection from multiple perils including drought, flood, hail, frost, excessive moisture and pests. Besides these programmes, the government subsidised loans to address farmer cash-flow problems in the spring and in the fall (to store crops until they could be marketed), with the government paying the interest and guaranteeing the loan. Furthermore, in 1998-1999, one more component for emergency income support, the Agricultural Income Disaster Assistance (AIDA) program, was added. The programme covered all commodities grown by producers in Canada. Payments were based on farm gross margin (i.e., farm revenues minus operating expenses) and began when the gross margin fell below a specified percentage of historical levels. The AIDA was a temporary RMI to supplement the NISA and crop insurance and it was replaced by the similar Canadian Farm Income Programme (CFIP), which operated from 2000 to 2003 (Zahniser, Young, and Wainio, 2005).

4.1.4 Governmental risk insurer

Canadian Agricultural Income Stabilisation (CAIS) program, which replaced NISA in 2003 (case 2), is an example of another account-based RMI. Within this whole-farm private-public programme, however, the government acts as an insurer, compared to farmers' self-insurance within the NISA program. CAIS was supposed to address problems associated with the NISA program; these problems are discussed in the following sections. Unlike NISAs, CAIS arrangement

does not allow farmers to receive a direct government payment unless they withdraw money in a low revenue year.

Coverage in the CAIS programme is based on the amount farmers deposit in the CAIS account. Farmers with CAIS select a level of protection, determined by a percentage of their reference margins, and deposit that amount in their CAIS account, which is held at a participating financial institution. Reference margins are calculated by taking a 5-year Olympic moving average (which is an average that excludes the highest and lowest value) of the difference between farm revenues and expenses such as fertilizer and pesticides. Compared to NISA, appropriate CAIS coverage begins in the initial year and does not require farmers to build account balances for several years before they are adequately protected (Dismukes and Durst, 2006; Zahniser, Young, and Wainio, 2005). Payments are triggered when the production margin falls below the reference margin in a given year. If farmers experience declines in production margins, they can withdraw from their CAIS account, triggering a government payment. If farmers do not experience a margin decline, the account funds can be rolled over or adjusted to farmers'needs for the following year (Zahniser, Young, and Wainio, 2005). The size of government payments to farmers is based upon the amount in the farmer's CIAS account and the size of the loss. Depending on the loss size, two CAIS components can be specified: a stabilisation component and a disaster assistance component that protect farmers when they experience small to moderate and large losses, respectively.

In July 2007, Canada announced the replacement of CAIS. In the new agricultural policy in Canada (Growing Forward), the business risk management components include AgriInvest - a programme in which farmers and the government contribute to farmer savings accounts for small income declines, intending to make government contributions easier to predict than CAIS and to increase farmer flexibility. Other programmes include AgriStability - a programme providing support when farmers experience more than 15% declines in farm income; AgriRecovery - a natural disaster relief programme that provides more rapid response and addresses gaps in previous programmes; and AgriInsurance - a programme that expands the traditional crop insurance programme to cover more commodities (AAFC, 2008; Canada News Centre, 2007). An emphasis for Growing Forward is to increase the simplicity, responsiveness, and flexibility of Canadian agricultural policy (AAFC, 2008).

4.1.5 Direct payments under the CAP of the EU

The intention of the most recent CAP reform, in 2003, was helping farmers across all sectors to become more market-oriented and competitive on EU and world markets, while receiving reasonable income support (case 4). As for direct payments, the new CAP brought the following innovations: (a) single payment per holding for EU farmers, independent of production ('decoupling' of support in that farmers now receive direct payments as part compensation of income losses, but no price support); (b) linking of these payments to compliance with standards relating to the environment, food safety, animal and plant health and animal welfare ('cross-compliance'); (c) a reinforced rural development policy, with reduction of direct payments to large farms in order to fund the new policy ('modulation'); (d) a financial discipline mechanism (placing a ceiling on market support expenditure and direct aid between 2007 and 2013).

The reform also includes a revamping of the policy of common organisation of markets under the CAP. For more details on different aspects of the latest CAP reform, reference is made to the European Commission (2003a) and (2003b).

4.1.6 Status of other RMIs

Information on other RMIs that exist or existed in a country in parallel with the RMI case(s) indicates that, in general, design of the selected RMI cases should not be interpreted as country specific. For example, the design of disaster loans in Poland (case 8) is similar to subsidised loans in Canada (table 4.1). At the same time, the long-existing crop insurance with subsidised premium is not unique to Spain (case 10). Subsidised crop insurance schemes have been in existence for a long time in Canada and the USA. In those countries it seems that these schemes are not fully satisfactory. As can be seen from the table, new instruments are being developed to complement or replace them. Furthermore, as indicated in table 4.1, most RMI cases were phased out, replaced or are being reconsidered. This indicates that the majority of the studied RMIs have not performed perfectly due to different reasons. The following sections will analyse in depth the pros and cons in performance of the selected RMIs and factors affecting their performance.

4.2 Loss ratios and loss adjustment

Crop sector
Loss ratios (indemnities paid compared to premiums received, expressed as a percentage) fluctuated strongly from year to year depending on the occurrences of events, but over several years the total average should be below 100%. This is necessary for insurance companies, otherwise it is not a viable product.

In the USA, in the period 2003-2006, loss ratios for GRP various from 184% in 2003 to 33% in 2005 (case 12). The RMA (2008d) reports that the total average loss ratio for GRIP (case 13) between 1999-2006 is 81%. For corn and soybeans, two of the primary crops insured by GRIP, loss ratios were 98% and 43%, respectively.

Table 4.2	Basic performance indicators of the studied risk management instruments (Explanation of acronyms is in the text)	
	Loss ratio (%) a)	Loss adjustment costs b)
1) Canada: NISA	-	-
2) Canada: CAIS	-	2
3) Estonia: Crop Insurance	-	2
4) EU: Direct payments under the CAP	-	-
5) Germany: Animal disease fund (notifiable diseases)	100% (balanced over time)	4
6) Netherlands: Rainfall mutual	in the range of 80%-90%.	2
7) Netherlands: Animal health fund (notifiable diseases)	mostly been < 100%	4
8) Poland: Disaster loans (drought)	-	2
9) Poland: Crop insurance (obligatory)	-	2
10) Spain: Crop insurance winter cereals	63% (accumulated 1980-2005)	4
11) Spain: Revenue insurance	0%	3
12) USA: GRP	various from 184% in 2003 till 33% in 2005	4
13) USA: GRIP	81%	4
a) Sources are not clear if administrative and operating costs associated with RMI are included; b) 1 = very high and 5 = very low.		

In Spain (case 10) accumulated loss ratio (1980-2005) in the MCPI for winter arable crops was in 2005, 63%. For the entire insurance system the 2005 drought increase by 2 percentage points the entire loss ratio of the whole agricultural insurance system (1980-2005). Loss ratio was 0 for the revenue insurance (case 11) due to the short history with the potato scheme (only 2 years). In that period no indemnities occurred.

In the Netherlands (case 6) for rainfall mutual official loss ratios are not publicly available but are in the range of 80%-90%. Since it is a mutual, there is no margin for profit. In addition, the government provides a reinsurance cover (not for free but with a low reinsurance premium) and the system operates via assessment premiums.

For most of the weather insurance schemes (cases 3,6,8,9) loss adjustment is relatively expensive. The reasons for this are the high costs of expert commissions visiting or monitoring the losses on each farm or in every county (cases 3,8,9). Besides, this loss adjustment is relatively expensive since crops can recuperate after the adverse event has taken place and therefore need extensive monitoring (on average 1,500 Euro per reported claim) (case 6).

In Spain (case 10) Agroseguro (which is the pooling agency of all agricultural insurance companies, and in charge of running the service of loss adjustment) realises a significant reduction in administration costs. Ratio of running costs over total liability showed decreases of 0.3% in 1993, to 0.25% in 2005. Farmers claiming a loss will receive the indemnity within 2 months from the date of notification. Loss adjustment, claim and final resolution are made within this period. In the case of revenue insurance (case 11) in Spain in the strawberries sector loss adjustment costs were non-negligible, as records of the insurers had to be thoroughly checked to evaluate potential indemnities. In the case of the potato sector, loss adjustment was not needed as the evaluation of the index scheme was performed by University researchers at a cost of 6,000 € a year in total. Since it was an 'index'scheme, its complexity made it quite difficult to be understood by growers.

In the GRP (case 12) farmers purchasing insurance have to provide less information to insurers - limited to the number of acres planted for each crop for which the farmer purchases coverage. Also, indemnity payouts are made automatically and do not require farmers to provide evidence of loss (RMA, 2008c). The structure of GRIP (case 13) reduces administrative costs when compared to MPCI.

Animal diseases

In the German livestock fund (case 5) indemnifications and contributions to the fund are balanced over time. This is done separately for the different livestock species. In the Dutch livestock fund (case 7) loss ratios have mostly been < 100% considered per 5-year period. Exceptions are the years with outbreak of epidemic diseases: 1997/98 situation due to classical swine fever (pigs), the 2003 case of Avian Influenza (poultry) and the 2007 case due to Bluetongue (sheep/goats).

In both funds (cases 5,7) loss adjustment costs are low since all animals that are culled by order or that die from the infection have to be registered anyway. In the Netherlands each herd only needs to be assessed once - although it requires two people to carry out the assessment (one veterinarian and an employee of the Animal Health Service) and strict hygiene protocols need to be fulfilled.

4.3   Efficacy from farmers and government perspective

This section describes the efficacy of RMIs from farmers and government perspective and classifies them according to various characteristics (table 4.3). Efficacy, which is the ability to produce a desired amount of the desired effect or success in achieving a given goal, is used in the current study in a qualitative and quantitative way. In general, efficacy in this study is evaluated from the perspective of an instrument being effective in reducing farmers'income fluctuations and shortfall risks.

Our classification of efficacy from farmers'perspectives is based on data and knowledge provided by international experts participating in this project (see section 1.3) on: premium rates in relation to insured risk, possibilities for premium differentiation (more differentiation is attractive for farmers), level of deductibles (high level of deductibles means less indemnity payments), degree of participation (insured number of farms or insured value in relation to total number of farms or total worth of production).

The classification of efficacy from a government perspective is also based on knowledge and data from international experts participating in this project. Experts evaluated whether the RMI achieved a given goal stated by the government. In this way ad hoc payments could be effective in achieving a given goal. In their evaluation they took into account: the stability of the instrument (not altered frequently), level of participation, number of insurance companies as an indicator for competition between firms.

Table 4.3   Efficacy of studied risk management instruments a)

	Efficacy from farmers perspective	Efficacy from government perspective	Deductible	Differentiation b)	Participation b)
1) Canada: NISA	2-3	1	-	-	4
2) Canada: CAIS	2-3	1	-	-	-
3) Estonia: Crop Insurance	1	1	-	3	1
4) EU: Direct payments under the CAP	-	-	-	-	-
5) Germany: Animal disease fund (notifiable diseases)	3	4	no	4	5
6) Netherlands: Rainfall mutual	2	3	15 or 25% of the *insured amount per crop*	2	1
7) Netherlands: Animal health fund (notifiable diseases)	3	3	no	2	5
8) Poland: Disaster loans (drought)	2	3	no	2	3
9) Poland: Crop insurance (obligatory)	2-3	3	50% of yield losses	4	2
10) Spain: Crop insurance winter cereals	3-4	3	no to 35% in relation with the level of coverage	3	4
11) Spain: Revenue insurance	3	3	no to 30%	3	2
12) USA: GRP	3-4	2	10 to 30%	4	3
13) USA: GRIP	4	2	10 to 30%	4	4

a) 1 = no or limited effective and 5 = very effective; - no information available; b) 1 = very low and 5 = very high.

Insurance for natural calamities Estonia

The subsidised premium of crop insurance schemes in Estonia were mostly insignificant and not effective and, therefore, no longer exist because of too small numbers of policyholders (case 3). The main reason from the perspective of the farmers, was the small basis. The majority of crops are not insured and the level of participation was low. Total insured amount in 2003 was 65,000 euro with approximately 117 policyholders (mainly livestock farms). The insured area was about 1,800ha comprising 0.4% of the total worth of outdoor production. Farmers are not willing to buy the insurance mainly because they do not consider the insurance as being an indispensable expense. In some years even the insured farms did not receive insurance indemnity, although they were confronted with eligible losses.

The efficacy from a government perspective was low, while government provided support with ad-hoc payments. Governmental support helped farmers to survive after the unfavourable 1998, 2002, 2004 and 2005 years. As a wide number of farmers declared the losses in large areas, their losses were covered by the government support scheme. On the one hand, the governmental support could be an alternative if insurance schemes do not work, but, on the other hand, government support prejudices the market performance for real insurance.

Rainfall mutual Netherlands

In the Netherlands the willingness to buy commercial coverage against rainfall is very limited (case 6). The deductible is a high percentage, 15% or 25% of the *insured amount per crop* (in comparison to a percentage of the loss incurred which Dutch hail insurers apply). Additional premium payments were necessary in order to cover the net retention of the mutual. The level of participation is low. The insured area is about 40,000ha comprising 3.6% of the total worth of outdoor production. Premium rates consist of a fixed percentage of the insured amount that does not differ between, for example, regions. Farmers perceive probabilities of losses to be relatively low. Without public support, only a specific group of farmers would be interested. It should be noted that the influence of farming organisations on policy decisions has decreased over the past decades.

From a government perspective, the scheme is developed as a calamity cover, so to prevent bankruptcy of farmers as a result of excessive rain. The scheme is effective when focusing on the insured farms since they were indem-

nified numerous times, preventing large losses (although a high deductible had to be accounted for). Despite indemnification, the level of participation of farmers is low. The Dutch government role lies in the field of reinsurance, the creation of the appropriate preconditions, to allow the market to do its work (independent information, certification, striving for harmonisation within the EU and preferably even the WTO), and the promotion of knowledge and awareness among farmers regarding risks and risk management through education and information.

Disaster loans Poland
The value of real benefits for farmers from the public drought loans in Poland is small and not effective (case 8). More important is easy access to bank loans. The support received by farmers is a difference between the interest rate paid for credit and commercial interest rates (approximately 1,2-1.5%-points). Normally the majority of farmers, who are eligible, participate. Participation differs every year depending on a scale of disasters and number of applications made by farmers. In the most critical year (2006) about 900 thousand farmers (50% of the total number) applied for disaster credits. The general level of satisfaction is rather low, especially if losses are high. In the case of smaller scale losses (yield reduction), real benefits for farmers are low, and administration costs are very high, mainly related to loss assessment.

Crop insurance Poland
Efficacy of the public private obligatory crop insurance for farmers in Poland is doubtful because of high premium rates, especially for more severe sources of risk (drought, spring frosts) and high deductible amounting to 50% of losses (case 9). Basically, in subsidised schemes, the responsibility of the insurer starts if losses exceed 30% of yield reduction and 20% is own participation covered by insured farmer. The responsibility of the insurer in a commercial scheme (without subsidies, at approximate double premium) starts at the level of 8% of yield reduction, but participation is limited. The premium rates vary, depending on the crop, risks covered and the region of the country. Due to the introduction in 2006, less information is available about participation. However, participation rates were low in the first year, this is despite the fact that this is an obligatory insurance of all crops against major disasters. The penalty fee for farmers who do not purchase insurance are €2 per hectare. A survey, although not representative, shows that only about 25% of farmers are interested in purchasing insurance. At this moment it is too early for a solid evaluation.

Crop insurance winter cereals Spain

Only in Spain is the private public crop insurance for winter cereals effective with respect to farmers and government (case 10). Farmers satisfaction rating is 3.5 on a scale of 1-5. The instrument is quite effective in dealing with idiosyncratic, i.e. non-correlated, risks and systemic risks because of the ability to pool risks and provide farmers'indemnities, under the logic of actuarial soundness and techniques. With respect to deductible, farmers have different options which vary from no deductible to 35% in relation with the level of coverage. Over the past years, the participation rates have ranged between 70 and 75% of the eligible production and surface, due to high subsidies from national and regional government (€470m in 2005 for all crops and livestock). Farmers often switch from one type of coverage to the other. Farmers claiming a loss will receive the indemnity within 2 months from the date of notification.

Revenue insurance Spain

For the efficacy of the revenue insurance in Spain, we have to distinguish the scheme for potato growers and the scheme for strawberry growers (case 11).

The scheme for potato growers was quite effective. The scheme was only experimentally available for late potato growers of 5 provinces. The participation was 5% of eligible production in 2003 and 3% in 2004. Losses are fully compensated (no deductible). Further work by Aguado and Garrido (2007), Bielza et al (2007a; 2007b) showed that basis risk was non-negligible and that a stabilisation fund could be a better instrument to ensure similar levels of price floor. Insurers never showed full acceptance, but ultimately they did offer it commercially.

to the fact that Amsterdam future contracts ceased to be traded in 2006, so a similar scheme could never have been simulated. The main flaws were:
- Prices follow a 3-year or 4-year cycle, enabling farmers to exploit adverse selection rents.
- The selection of varieties and models'differential coefficients could be improved.
- Premium calculation was sensitive to key assumptions, such as length of data series.

The scheme for strawberry growers was never introduced, but had a very attractive design. It was made in full compliance with ENESA (Agricultural Spanish Risk Management Agency) and the growers'association and firms, but required some administrative work to be contracted, monitored and supervised. Various deductible levels were evaluated (no deductible to 30%).

NISA Canada

The NISA in Canada was intended to smooth income over time (case 1). Experience with NISA showed farmers tended to either maintain very low balances in their NISA accounts - using them for supplemental annual income, or very large balances that they failed to withdraw in years of shortfalls - using them, instead, as retirement accounts. Thus, NISA was not effectively protecting farmers, and when producers faced low revenues in 1998 and 1999, and producers lobbied policymakers for more support, the government provided emergency assistance. This can reduce farmer incentives to utilise income stabilisation accountants for risk management purposes (Dismukes and Durst, 2006).

By 2000, 80% of eligible farmers participated - over half of all Canadian farmers, and was well-liked by most farmers (Dismukes and Durst, 2006; Ipsos Reid, 2001). Researchers also note that farmers with large farms are the most likely to participate in NISA (Chen and Meilke, 1996; Dismukes and Durst, 2006; Edelman, 2000). In 2001, roughly 33% of small farms - farms with sales receipts totalling less than CAD10,000 - participated in NISA; 57% of medium and large farms - farms with sales receipts over CAD10,000 - participated (Dismukes and Durst, 2006). Additionally, most NISA support goes to larger, wealthier farms (Chen and Meilke, 1996).

CAIS Canada

Policymakers in Canada structured CAIS to address problems associated with the NISA programme (Dismukes and Durst, 2006). For example, appropriate CAIS coverage begins in the initial year and does not require farmers to build account balances for several years before they are adequately protected (Dismukes and Durst, 2006).

Initial evaluations of the programme seem positive, but some concerns exist that CAIS may be too complicated (Dismukes and Durst, 2006). The structure of CAIS (case 2) reduces incentives to use the income stabilisation account for retirement savings, but even with its generous disaster component, farmers and policymakers deemed it inadequate to protect producers during very low revenue years.

Also, income stabilisation account programmes are likely most suitable for large farms that realise large surpluses in some years (Dismukes and Durst, 2006). Households with small to medium-sized farms often rely on off-farm labour for their primary source of income and, thus, are less affected by reduced farm revenues. For relatively poor households that rely on farming as their primary income, the high opportunity costs associated with holding large savings

accounts may prevent them from participating in income stabilisation pro-
grammes. In July 2007, Canada announced that it would replace CAIS.

GRP USA

Overall, the experience with the GRP in the USA has been positive (case 12).
GRP has been an effective programme for insuring farmer yield risk and has had
the potential to be used in a broader context, such as with wrap-around prod-
ucts (Skees et al., 1997). Farmers choose the level of coverage for each crop.
They select a dollar amount per acre and choose the payout threshold (70, 75,
80, 85, or 90% of county yields, RMA, 2008c). From 1994 to 2006, the num-
ber of GRP policies roughly doubled to 21,677 policies sold. At the same time
the net acres insured increased twentyfold to 33.86m acres. In 2006, the GRP
insured roughly 2% (USD1bn) of the total liabilities of the Federal Crop Insurance
Programme (USD1bn; RMA 2008b).

The RMA (2008c) reports the desire to continue to expand the GRP to new
crops and new regions to meet farmer demand. Limitations to expanding the
programme primarily relate to the need for more NASS county-level data -
longer time-series data, more data on minor crops, and data for more regions
(Skees, 1993).

The GRP provides farmers incentives to manage risk to maximise farm pro-
duction. Unlike Multi Peril Crop Insurance (MPCI), whose coverage is based on
farm-level losses, farmers with the GRP can work to reduce the amount of
losses they are likely to incur without reducing the size of the insurance payout
they will receive. Thus, the GRP coverage provides more incentives for effective
risk management than MPCI (Baquet and Skees, 1994). The GRP improves the
amount of coverage farmers can purchase.
Larger farms became more and more likely to purchase the GRP. This finding is
not surprising, as large farms are likely to have plots in more than one area in
the county so that their risk would likely be more highly correlated with county-
level yields.

The primary limitation of the GRP is basis risk - the possibility that a mis-
match will occur between a farmer's loss and county-yield levels. For example,
farmers could experience a loss without receiving an indemnity because there
was no loss at the county level.

GRIP USA

The experience with the GRIP in the USA has been positive (case 13). There has
been a high level of penetration due to the subsidised premiums. By 2005, GRIP
was available in all counties offering GRP for corn and soybeans and was ex-

panded to include grain sorghum (RMA, 2008a). In 2006, GRIP also covered cotton and wheat (RMA, 2008a). In 2006, GRIP covered 11.7m acres (Paulson and Babcock, 2007). GRIP has grown exponentially. For example, in 2003, GRIP insured 2% of corn in Illinois; by 2006, GRIP insured 37%. Paulson and Babcock (2007) note the increasing use of GRIP corresponds with the introduction of the Harvest Revenue Option (HRO), as the acreage insured by GRIP doubled in 2004, doubled again in 2005, and doubled again in 2006. GRIP has an average premium subsidy of 55% of total premiums (Paulson and Babcock, 2007). From 1999 to 2006, the number of policies sold increased fiftyfold to 51,000 policies sold.

Policies have been consistently sold to relatively smaller farms. While the price of GRIP has roughly doubled per acre from 1999 to 2006, subsidies per acre increased tenfold. While the structure of GRIP reduces administrative costs when compared to MPCI, its coverage of yield and price risks has led to increasing premium rates. Indemnities are paid when revenues are below the trigger level (Paulson and Babcock, 2007). Triggers are the same for GRIP as for the GRP (70 to 90%).

Several researchers have made recent suggestions to improve the effectiveness and reduce costs of the USA agricultural risk management policy. First, Paulson and Babcock (2007) note the increasing subsidy per acre cost of GRIP and that the introduction of HRO in 2004 coincides with significant increases in subsidy. They also report that private insurers, not farmers or the government, are capturing many of the profits associated with GRIP. Paulson and Babcock (2007) demonstrate that a nationalised insurance programme, one that no longer offered subsidies to private-sector insurers, could provide an insurance product similar to that of the 1999-2003 GRIP product with better coverage (98%) for comparable government support.

Coble and Barnett (2008) also suggest the possibility of providing a nationalised GRIP-style insurance product that expands on suggestions from Skees et al. (1997) regarding GRP. Coble and Barnett (2008) argue that if the government could assist farmers by addressing correlated risk through an area revenue programme, opportunities exist for private insurers to sell wrap-around products for independent risks such as hail or fire. They demonstrate that an area revenue insurance product addresses the reinsurance problem more effectively than the current combination of premium subsidies, risk sharing subsidies, and administrative and operating subsidies that the government currently provides, showing that this type of wrap-around arrangement lowers the loss cost of insurance products based on individual farm losses.

Despite the introduction of the GRP and GRIP, government expenditures for agricultural insurance including ad-hoc disaster payments have continued to rise.

Livestock sector

Animal health fund Netherlands
The Dutch livestock fund for notifiable diseases can be regarded as being effective for infected farms and not effective for non-infected farms (case 7). For infected farms, the public scheme is effective, as all killed animals are fully compensated (no deductible). The scheme is compulsory for all registered animals. Dead animals are not compensated at all, while sick animals are only compensated by 50%. Levies are specified per livestock sector. There is no further differentiation within sectors.

For non-infected farms the scheme is not effective, i.e. farms with vaccinated herds, farms in restricted areas and farms facing losses due to e.g. export bans, do not receive any compensation from the fund (except for the costs of vaccinating the animals).

Animal disease fund Germany
Also the German system, that is basically similar to the Dutch system, is effective in its domain, not at least due to the fact that it is mandatory for all livestock enterprises (case 5). Premiums differ between species and federal states.

For infected farms only the actual value of animals is covered. This value is assessed by the 'district veterinary officer' and it is limited by the maximum decided by the Animal Disease Act at a national level. In general, the assessed values are considerably lower than the maximum and there is no deductible or coinsurance. Animals that have been dead or culled before notification of the disease are only indemnified by 50%. The assessed value has to take into account the market value on the day of order of the culling or values used by the EU for buying animals out of the market if the regional markets have broken down during the epidemic. Thus, the indemnification for later infections of one epidemic outbreak may be smaller than the compensation for the first infected farms due to price changes on the market. This avoids incentives for farmers of infecting their own herd if market prices decrease considerably after the first outbreak of an epidemic.

Costs for losses on healthy farms in restriction zones are not covered.

The *commercial insurance* in Germany which covers indirect costs is less effective. However losses due to business interruption are gaining importance.

Commercial insurance has its difficulties because of the systemic nature or epidemics.

4.4   Distortions

Distortions of the investigated RMIs are categorised in terms of information asymmetries and other distortions causing welfare losses. As explained in the theoretical framework section, asymmetric information manifests itself as moral hazard and adverse selection problems. A commercial insurance scheme with severe distortions is unlikely to be viable if these problems cannot be dealt with (at acceptable costs). However, it is not something that policy makers need to worry about if the insurer is out of pocket. Nor should the policymaker worry if farmers change their behaviour in response to commercial insurance or other risk-sharing products.

From the point of view of this report, distortions are only important if they are too difficult for commercial insurers to deal with, meaning that a commercial product will therefore not emerge. Moreover, the story is very different when subsidies are provided since any subsidy is distorting, but some more than others.

4.4.1 Adverse selection

The most rigid underwriting approach to eliminate the problems of adverse selection entirely is a mandatory insurance or levy system. An example is the Dutch animal health fund for notifiable diseases (case 7) in which all farms with registered animals must pay compulsory levies. This also holds for animal disease funds for notifiable diseases in Germany (case 5). Both schemes provide a coverage of the value of destroyed animals. Also, the recently introduced subsidised crop insurance scheme in Poland (case 9) is an obligatory insurance scheme. In this scheme the farmers who do not purchase insurance have to pay a penalty fee (€2 per hectare). However, this penalty fee is rather low compared with the production value and the majority of the farmers opted out. The primary reason why many farmers did not participate in the programme is that it is viewed as too expensive. In addition, many farmers expect that the government will help them, as in the past, with any major disasters. Also, some farmers were simply unaware of the new programme. Therefore, in this case, the problem of adverse selection still remains a concern as with other voluntary insurance schemes.

The dilemma of adverse selection is also not relevant for the drought disaster loans in Poland (case 8). The improvement of new credit lines for farms affected by drought (or other disasters such as hail, frost) occurs after the event has taken place. Needless to say, all farmers are entitled to receive direct payments as regulated in the CAP (case 4), i.e. adverse selection is not an issue. This is especially the case in more simplified systems in which the payments are based on a flat-rate system instead of historical entitlements. Although the payments were originally introduced as a compensation for price decreases, they are now considered to provide farmers a certain level of financial security (Fisher Boel, 2008)

Under the Estonian ad-hoc governmental support scheme (see table 4.1) farmers had to declare their losses; then each year the government decided on an individual basis how, how much, to whom, and on which extent the losses will covered. Also, with this ad-hoc disaster scheme there is no inherent adverse selection. There was no certainty from the farmers' side whether or not they may expect the compensation, and on which basis the compensation will be decided. This was sometimes also dependent on the activity of farmers'organisations - how effectively they negotiated and shared the information.

Adverse selection has emerged after several years operating with the income stabilisation instruments NISA (case 1) and CAIS (case 2). These programmes are likely most suitable for large farms that realise large surpluses in some years (Dismukes and Durst, 2006). Households with small to medium-sized farms often rely on off-farm labour for their primary source of income and, thus, are less affected by reduced farm revenues. For relatively poor households that rely on farming as their primary income, the high opportunity costs associated with holding large savings accounts may prevent them from participating in income stabilisation programmes. Thus, describing programmes such as NISA and CAIS as 'safety net' programmes for farmers with small to medium-sized farms is somewhat misleading.

Given the exceptions described above, underwriting is important aspect to control adverse selection in a voluntary insurance contract. Insurers generally impose an obligation of disclosure in the insurance contract, requiring the insured to provide information about any factors that may lead to above normal risk. If the insured fails to disclose relevant facts, the contract can be invalidated. Based on such information, insureds are classified and premiums are differentiated for different classes of risk (Rejda, 1998). When adverse selection is known to be present, and insurers do not have the information to differentiate insureds according to their risk exposure, they will usually set higher premiums.

The level of adverse selection differs between the voluntary risk management tools under investigation. Probably most prone to adverse selection is the Dutch rainfall mutual (case 6) because there is definitely substantial adverse selection in such small pools, and this is magnified if premium differentiation is absent. Moreover, a substantial part of the pool consists of insureds who incurred severe losses in 2002 and had to participate for five years in order to receive disaster relief for past losses incurred. Given the geographical location and soil type of these farms, they cannot be regarded as a normal (i.e., average) risk.

Other indemnity-based insurances are to a lesser extent confronted with adverse selection, like the aborted public-private crop insurance in Estonia (case 3) and the Spanish winter cereal insurance (case 10). For the Spanish case, the diverse set of insured farmers in the pool (comprising, besides winter wheat, many other crops and livestock production) indicate that overrepresentation of risky prospects is of a lesser concern.

Adverse selection is also encountered in the multi-peril crop insurance (MPCI) programmes in the USA. Farmers know more about their farms and means of production than insurers do, are more likely to insure (Skees, Black, and Barnett, 1997). Therefore, besides indemnity-based insurance schemes, also index-based insurance are of interest in the current study. In this insurance scheme, the premiums and payouts are based on some kind of index (Halcrow, 1949). Payouts to a farmer are triggered if the actual outcome, in terms of measurable criterion, is below the certain limits of tolerance. Using an index reduces adverse selection, since information regarding an index is more generally available and more reliable (Miranda, 1991). Because under the GRP, indemnities are based on county-level yields (case 12), farm-level information is not required and information asymmetries no longer apply (Skees, Black, Barnett, 1997). This also holds true for the revenue-based GRIP scheme (case 13), whereby revenue is defined as the product of county-level yields and the commodity price. Moreover, adverse selection is not relevant for the revenue insurance in Spain (case 11) in which the guaranteed price levels are established with a price-index model.

4.4.2 Moral hazard

Coble (1995) reported that income stabilisation programmes (cases 1 and 2) would not be likely to distort farmer incentives to manage risk. Neither are decoupled direct payments under CAP (case 4) and disaster loans in Poland (case 8) distortive. With stabilisation programmes, direct payments and loans farmers

still bear the full consequences of their actions, and therefore do not have a tendency to act less carefully than they otherwise would.

Moral hazard problems are relatively limited for the animal disease funds for notifiable diseases (cases 5 and 7). For example, a form of a deductible is applied in the Dutch variant since the death of animals is not compensated at all, while sick animals are only compensated at 50%. However, compensations are largely based on expert appraisal (not market value) which may lead to moral hazard behaviour (given the situation that reimbursement level exceeds actual market value).

Moral hazard problems are negligible or impossible in case of an index scheme (cases 11, 12, 13), whereby indemnification based on some objective and transparent index. It reduces moral hazard, because an individual farmer cannot influence the magnitude of the index (Miranda, 1991). For example under GRP (case 12) and GRIP (case 13) indemnities are based on county-level yields. Monitoring for moral hazard is unnecessary because the behaviour of an individual farmer is unlikely to affect county-level yields. It provides farmers incentives to manage risk to maximise farm production. Thus, the GRP coverage provides more incentives for effective risk management than an indemnity-based insurance scheme (Baquet and Skees, 1994). This also holds true for the revenue insurance in Spain (case 11) in which the guaranteed price levels are established with a price-index model.

Compensations based on loss appraisal may lead to moral hazard behaviour if indemnified losses are within the control of the farmer (cases 3, 6, 9, 10). These indemnity-based insurance schemes reduce incentives to farmers to manage risk because, if losses occur, they will be reimbursed by the insurer (Skees, 1993). However, it is a challenging task to prove whether there is evidence of moral hazard under an insurance scheme.

Extensiveness of contract specifications and the level of deductibles reveal some information about moral hazard problems. A risk-sharing contract can include 'rules of behaviour'. For sharecropping Stiglitz (1974) states that 'a contract may also specify something about effort, degree of control, and amount of supervision'. Milgrom and Roberts (1992) state in a more general context that monitoring and verification are remedies against moral hazard. With deductibles, insureds pay some specified amount of losses themselves, which reduces fraud and encourages loss prevention (Rejda, 1998). By using deductibles, the extent to which farmers can share risks is reduced. In this regard Arrow (1992) argues that, if without the use of such tools as deductibles there would be a complete absence of risk-shifting, it might be best to use the tools and have at least some shifting of risk (Arrow, 1992).

Table 4.4   Distortions of studied risk management instruments a)

	Adverse selection	Moral hazard	Rent seeking /capi-talisation	Incen-tives for misre-porting	Incentives for excessive risk exposure	Crowding out privately offered instruments
1) Canada: NISA	3	1	3	1	1	3
2) Canada: CAIS	3	1	3	1	1	3
3) Estonia: Crop Insurance	4	4	1	2	2	1
4) EU: Direct payments under the CAP	1	1	4	1	2	5
5) Germany: Animal disease fund (notifiable diseases)	1	2	2	1	2	5
6) Netherlands: Rainfall mutual	5	3	2	2	3	2
7) Netherlands: Animal health fund (notifiable diseases)	1	2	2	1	2	5
8) Poland: Disaster loans (drought)	1	1	2	1	2	2
9) Poland: Crop insurance (obligatory)	3	4	2	2	2	3
10) Spain: Crop insurance winter cereals	2	3	4	2	3	3
11) Spain: Revenue insurance	2	1	3	1	2	4
12) USA: GRP	1	1	3	1	3	3
13) USA: GRIP	1	1	3	1	3	3

a) 1 =no or limited distortions and 5 = relative large distortions.

Of the indemnity-based schemes under study, the Dutch rainfall mutual (case 6) has by far the highest deductible (in table 4.3 the deductibles are provided). Moreover, a pre-specified severe rainfall event must have occurred for insureds to be eligible for compensation. Despite this double trigger system, moral hazard is still present. It may be expected that, therefore, the level of distortion will be more severe for the other indemnity-based schemes.

4.4.3 Rent seeking and capitalisation

Rent seeking is a distortion because there is a misallocation of effort and resources and because it tends to undermine the intended purposes of some policy measure. Some of the schemes under investigation are more vulnerable to rent seeking than others. This not only holds true for farmers, but in public-private partnerships, subsidies create opportunities for rent-seeking behaviour also for crop insurance companies. Those who benefit from those rents, namely farmer-landowners and insurance companies, invest heavily in rent-seeking activities designed to maintain or even expand access to these government-generated rents. For example, Barnett et al. (2005) reports that when the USA federal crop insurance programme began to surcharge the premiums of those who collect indemnities most frequently, policymakers bowed to political pressure from agricultural interest groups. Rent seeking may be encouraged by subsidies but can occur in other ways.

Almost all farm subsidies, such as CAP (case 4), tend to get capitalised into asset values (i.e., land and production rights). Given the other studied RMIs it is most dominant in substantial subsidised schemes with private (re-)insurers. Capitalisation of these subsidies bring no benefits to incoming farmers, so, in the long run, subsidies designed to improve farmers'incomes are self-defeating. Farmers are no better off than they would have been without them and society is worse off because resources are allocated in inefficient and undesirable ways.

Subsidised stabilisation accounts (cases 1 and 2) are vulnerable to rent seeking as they can be deducted from the participation levels. Two groups of participating farmers emerged after several years of the NISA programme having been in operation. First, the majority of farmers maintained very low balances in their NISAs (Dismukes and Durst, 2006; Stokes et al., 2000). The goal of these farmers seemed to be to capitalise on the government matching subsidy, so they tended to deposit the maximum balance on which they could receive a matching subsidy. These farmers withdrew funds whenever eligible, even in years of minor revenue shortfalls (Dismukes and Durst, 2006). Thus,

these farmers treated the government matching contributions as a form of supplemental annual income (Ipsos Reid, 2001). The second group developed very large balances in their NISAs and was unlikely to withdraw funds in low revenue years (Dismukes and Durst, 2006). Instead, this group seemed to be capitalising on subsidised interest rates available with NISAs and treated NISA as a retirement fund.

Subsidised premiums (cases 9, 10) and public reinsurance (case 6) are prone to these perverse incentives of rent seeking behaviour. The extent is more severe in the case of insurance schemes providing basic coverage against income drops than for those providing protection for natural disasters only.

If indemnities are based on an index (cases 11, 12, 13) that is objective, transparent, and easily accessible, opportunities for rent-seeking are greatly reduced. However, Paulson and Babcock (2007) report that in the USA, private insurers, not farmers or the government, are capturing many of the profits associated with GRIP (case 13). They demonstrate that a nationalised insurance programme, one that no longer offered subsidies to private-sector insurers, could provide an insurance product similar to that of the 1999-2003 GRIP product with better coverage (98%) for comparable government support.

Other RMI under investigation, which are stabilisation funds, disease funds or disaster loans, which rely on governmental support are still vulnerable to rent seeking and capitalisation (cases 5, 7, 8). Only the pure private insurances are safeguarded from these impacts (case 5).

4.4.4 Incentives for misreporting

Another negative distortion which may be encountered in indemnity-based insurance (cases 3, 6, 9, 10) is fraud. For example, some farmers may declare larger losses than they really incurred (Garrido et al., 2002). Fraudulent claims results in higher premiums to all insureds if not controlled adequately (Rejda, 1998). With respect to the other RMIs fraud cannot be ruled out as long as one of the agents can benefit from it, but it is not as prevalent as in indemnity-based insurance schemes.

4.4.5 Incentives for excessive risk exposure

Governmental support to farmers may create perverse incentives such as 'excessive risk exposure' in the sense that if crop yields are subsidised, one can expect farmers to grow more of more risky crops in order to harvest more sub-

sidy. Regarding this in a portfolio selection context, the uptake of any risk-sharing instrument is likely to lead to changes in on-farm decisions.

Resent studies suggest that subsidised crop subsidies encourage production in marginal, high-risk, areas (Wu, 1999). When this happens, subsidies cause losses to become self-perpetuating and society's scarce resources to be misallocated (Barnett, 1999).

Although stabilisation funds (cases 1 and 2) rely on governmental support, this phenomenon does not manifest itself that profoundly. The existence of an income stabilisation fund (that works) is likely to stimulate farmers to adopt a more risky programme because some risks are covered. Indeed, that is the reason for having a stabilisation scheme - to induce farmers to operate closer to the point of maximising expected profit.

Also some of the other schemes under investigation are less vulnerable (cases 3, 5, 7,9) to excessive risk exposure than others. The latter cluster contains RMIs with a limited premium differentiation (cases 6) or substantial governmental support (cases 10,11,12,13).

As a result of GATT (General Agreements on Tariffs and Trade) negotiations, the CAP (4) was changed in 1992: intervention prices were stepwise reduced and the farmers received direct payments as part-compensation of the income losses induced by the policy alteration. In the course of this policy change, grain prices dropped by 35 to 40%. While income losses were only partly compensated on average by the direct payments, these payments represent certain income. Since they are independent of actual prices and yields they partly offset production risk. As a consequence, the volatility of income has been significantly reduced due to the CAP reform. Model calculations for typical German arable farms that have shown the standard deviation of income dropped by 35 to 40% from 1992 to 1996, as a result of the McSharry reform (Farwick 2006). Consequently, farmers have assumed more risk in other areas, for instance through specialisation in crops with higher average gross margins. The introduction of direct payments reduces the willingness to pay for insurance by 25% under the assumption that only the fair premium is charged, and by 45% in the case of a 30% premium loading (Berg 2002a, 2002b). These results show that the present CAP significantly affects the risk exposure of farms and still creates an environment in which risk exposure is altered in an excessive way (causing welfare loss). For example, direct payments still encourage production in marginal, high-risk, areas.

4.4.6 Crowding out

Governmental support crowds out the demand for private sector RMIs (Skees and Barnett, 1999). The extent depends both on the level of public support provided as well as on how it is directed. For example, drought disaster loans provided in Poland (case 8) have limited implications on private markets since a minor financial benefit could be achieved.

Private sector investments are not to be expected, given that a mandatory system such as the livestock funds would reimburse the direct losses of a notifiable disease outbreak (cases 5 and 7).

Substantial public support in conjunction with a multi-peril coverage scheme crowds out private investment (cases 9,10,11). To a lesser extent, this holds true for government-assisted stabilisation accounts (cases 1 and 2) and a single-peril mutual (case 6), whereas participation in private or mutual hail insurance schemes is not affected in The Netherlands after launching

Skees, Black, and Barnett (1997) describe the idea of using GRP (case 12) as a component of a 'wrap around' approach. In their example, the government is heavily involved, perhaps the sole provider, of a GRP product sold to farmers. This product addresses the correlated risk problems of insuring agricultural yield and creates opportunities for private-sector insurers to introduce products that pay indemnities on individual farm losses. Thus, public-sector funds address the correlated risk and private sector funds address independent risk providing complementary, comprehensive coverage to farmers.

Prior to the 'McSharry' reform of CAP (case 4) price support was the predominant form of income support to farmers. Variable levies were charged on imports to protect domestic markets. In addition, market intervention took place as soon as domestic prices fell below the administrative (intervention) prices. In the case of exports, subsidies were paid that covered the difference between domestic and world market prices. The intervention price system (besides maintaining a high price level) reduced downside risk. For the commodities covered by the CAP, price risk for farmers as well as for commodity merchants in Europe was therefore much lower than e.g. in the USA. As a consequence, other RMIs, such as futures markets, were largely crowded out. However, there was still a considerable volatility of farm gate prices (e.g. coefficients of variation of cereal prices revolved around 15%). The ongoing liberalisation of markets will inevitably lead to increased price volatility in the future. This and the prospect that the direct payments are likely to be decreased in the course of time (or at least linked to more rigid cross-compliance requirements) will eventually increase the farmers'needs and willingness to pay for additional RMIs. The

increased willingness to pay will then provide the basis to offer such instruments on a commercial basis.

5 Synthesis of theory and cases

Government's will to support

There has been a long history and political will to support farmers. To achieve a fair standard of living for those involved in agriculture has been one of the key goals of the CAP. The initial instruments used to achieve this goal were rather distortive of international agricultural markets (price support, export subsidies etc.). Over the years the CAP has been reformed a couple of times to reduce the market distortions. One of the key elements is the change to decoupled payments which are supposed to have a smaller impact on the functioning of agricultural markets. Besides this price and income support there has also been a long tradition of ad-hoc relief measures to help remediate crises in agriculture. In most countries, farmers have been able to rely on governmental support in periods of crisis. The availability of such disaster relief has had a negative impact on farmers'need for and willingness to apply some other risk management instruments such as commercial crop insurance.

   In this study it was assumed that the will of the various governments to support the RMIs strongly depends on the political and socio-economic context in a certain country and on the resilience of the agricultural sector. The results show that this assumption cannot be confirmed by this study. It is more likely that the historical context (under which conditions an RMI is established and sometimes changed) can explain better the existence of the present RMIs in a country. It is also significant that in, practice, effective RMI for one or more participants (farmers, government or insurance companies) are difficult to change, even if they are not particularly efficient or lead to some distortions.

Governmental support brings distortions

The goal of many governments is to move away from ad-hoc support in case of crises towards other instruments such as various insurance products. The characteristics of agricultural crises and lessons learned from the past make clear that private initiatives for risk sharing off-farm have been very limited and participation levels have been low. On-farm strategies, such as diversification, is an effective way of coping with many of these risks. However, there is a trend in almost all countries for specialisation of agricultural farms, which increases the need for risk sharing off-farm. The cases show that government involvement has generally been necessary to achieve reasonably high farmer participation rates in such schemes. Farmers'enthusiasm for participation ís encouraged by sup-

port from the public budget to the agricultural sector (and the insurance sector). WTO rules allow public support of agricultural insurance schemes. However, depending on the nature of the RMIs used and the level of subsidies, such government participation also distorts markets. Moreover, it is likely to hinder the developments of private markets for RMIs while subsidising premiums could increase the demand for instruments beyond the economic optimum. Some negative distortions of instruments such as rent seeking and capitalisation are, to a large extent, dependent on the extent of government support.

Designing RMIs and the extent of government support is, therefore, a delicate issue, especially because reducing government involvement is very difficult when all stakeholders are satisfied with the situation. The cases show that there is no ideal RMI. The only exception is hail insurance which operates in many countries without government involvement, but this is because of the nature of the risk (uncorrelated, limited information asymmetry etc.). All other case studies show instruments with many negative distortions or instruments that are not effective at all.

No clear relation between context and government involvement in RMIs
The analysis of the 7 countries that formed part of this research did not lead to consistent relations between the six indicators for context and government involvement. High economic importance, for example, does not necessarily lead to more involvement. Similar results were found for each indicator. Also, the relation between continuous and ad-hoc support was explored in more detail. Whereas it can be expected that when continuous support is high, ad-hoc support would be low, the data did not demonstrate any consistent correlation supporting this. Taking a closer look at the objectives and perceptions of different national governments, it can be seen that in some countries new insurance systems have been developed recently or are in the developing stage. Most of these systems are subsidised. Also, countries want to lower their ad-hoc payments, but the cases prove that this is difficult to achieve. The analysis of the 7 countries that were part of this research did not lead to consistent relations between the six indicators for resilience, the need for RMIs (from a sector perspective) and government involvement.

Price risks are of a different nature
This report focuses on production risks (weather and notifiable animal diseases) and revenue/income risks. Price risks were traditionally covered by the CAP and these risks for current year productions can be offset by the agricultural sector itself, at least partly, with such instruments as future contracts, derivatives and

chain contracts or pooling of farmers'produce. They cannot protect farmers against longer run downturns in prices, which is the case with the CAP. Furthermore, price risks show a more complicated relation with crises in agriculture. On the one hand, prices can be a natural hedge for low yields, but on the other hand, price risks are often not the direct consequence of crises in agriculture but of markets responding, generally retrospectively, to changes in production and/or demand.

Plant diseases almost not insurable
In the EU there is a huge list of so-called Quarantine-organisms. Every year one or more of these organisms are detected in Dutch horticulture (Van Wenum, 2008). Contrary to animal diseases where the direct losses are (partly) compensated by EU and national government, this is not the case for plant diseases. There are examples in the Netherlands of financial breakdown of firms because of the detection of such diseases. The consequences can, thus, be huge. There are also almost no private or public-private insurance systems to cope with the financial risks of the plant diseases. Only in the Netherlands some diseases in potatoes (Potato black ringspot virus and brown rot) can be insured (Potatopol). One of the main problems is that farmers are not willing to pay the premiums of the insurance because of underestimation of the risks. In other countries, participating in this research, no examples for coping with plant diseases were found. Given the climate changes and the increasing trade in plant products world-wide the risks are increasing. On the other hand better quality systems and detection system can reduce the risk of introduction and spread of these diseases. The question is whether a better quality system (prevention, control) is enough to cope with plant diseases. Is an insurance system necessary to cope with the financial risks remaining? And is public support necessary to seduce farmers into insuring themselves? Also, the option of a compulsory fund, such as animal disease funds described in this report, is possible.

Addressing distortions
Looking at weather risks, the main instruments used are described in the cases. They range from single crop to multi peril, and differ in the amount of government support, coverage basis on (yield or revenue), and the damage appraisal (regional index or assessment of damage on an individual farm). As illustrated in this report, each of the instruments has its distortions. In designing a risk management instrument that distorts markets as little as possible, it is essential to address these distortions. Furthermore a choice is required how to weigh and

balance the different distortions. Table 5.1 provides a description of the different distortions and how they can be addressed.

With respect to notifiable animal diseases, a large involvement by the government is mandated in the legislation. The main challenge with these instruments is the reduction of moral hazard. For example, how to motivate farmers to do their utmost to prevent the outbreak or spread of contagious diseases.

Table 5.1	Possible distortions and means to minimise them
Possible distortions	**Means to minimise distortions**
1. Adverse Selection	a. mandatory insurance or levy system b. support after an event (e.g. drought loans) c. in case of a voluntary insurance; obligation for insureds to disclose all information about factors that may lead to extra risk, thereby allowing classification of insureds and differentiation of premiums d. for indemnity-based insurance schemes, index-based insurance (county-level yield, price-index model)
2. Moral Hazard	a. use of a deductible b. index-based insurance c. double trigger: severe event and a deductible d. Bonus-malus rebates and overcharge schemes
3. Rent seeking	a. commercial insurance (low or no public subsidy) b. indemnities based on an index that is objective, transparent and easy accessible. c. An active and statutorily stated participation of farmers, insurance companies and public reinsurers.
4. Misreporting	Only relevant for indemnity-based insurance. Controlled by: monitoring, which is expensive or use of mutual insurance
5. Excessive risk exposure	Not relevant for stabilisation funds or disaster loans; For public or public private insurance systems: a. differentiation of premiums b. lower governmental or public support c. re-insurance, securitisation of risk, government stop-loss support
6. Crowding out private initiatives	a. reduce level of governmental support b. limit governmental support to correlated risks leaving opportunities for private sector to insure individual farm losses.

It can be argued that direct income support or income stabilisation schemes to help farmers cope with low income events are less distorting than subsidised farm insurance schemes because of the expected distortions of the latter. The Canadian schemes (NISA and CAIS) show that the distortions are low (relative to other RMIs) but that these schemes were not very effective for (groups of) farmers. In periods of crisis, ad-hoc assistance was still given to support the agriculture sector. The described Spanish system with a public-private insurance scheme for a number of crops is reasonably effective from the perspective of farmers and government but does have moderate distortions in terms of rent seeking and crowding out privately offered instruments, less to adverse selection, moral hazard, and incentives for excessive risk exposure. Compared to the 'good intervention practices' mentioned in section 2.3, it can be argued if the Spanish system only applies to catastrophic events, the support is surely not limited in scope and time.

Defining a crisis or a catastrophe
The definition of a crisis or a catastrophe is not uniform for the described cases. In article 69 of the EU health check an adverse climatic event is defined as an occurrence of a natural disaster such as frost, hail, ice, rain or drought that destroys more than 30% of the average of annual production of a given farmer calculated over the preceding three-year period or a three-year average based on the preceding five-year period, excluding the highest and lowest values. With climate changes, what would have been known as a crisis 10 years ago may become 'normal' in the future. Clearly, different definitions may lead to different degrees of protection for farmers and perhaps significantly different calls on public funds.

Efficiency should also be regarded
A limitation of this study is that efficiency of the different systems was not part of the evaluation. Yet this is a critically important aspect in evaluating RMIs. While risk sharing may increase efficiency by allowing farmers to use their resources more productively, as discussed earlier, subsidised RMIs can lead to large efficiency losses, especially if the level of subsidy is high. Distortions can lead farmers to change their farming systems in ways to 'farm' the subsidies rather than the land. For example, they may be prompted to grow more risky but less productive crops because, in that way, they get higher indemnity payments. Such inefficiencies have been noted, for example, with the USA crop insurance scheme (Skees, 1999b). To have measured such inefficiencies of the

various schemes considered in this report would have required an extensive and data-demanding modelling study, which was not feasible within this project.

6 Conclusions and recommendations

6.1 Conclusions

General
- Within the EU there are different RMI in use for production or yield risks. The schemes vary from private single peril insurance for hail, through to public-private multi-peril insurance in Spain to 'emergency'assistance such as drought loans in Poland. In Estonia, the agriculture sector strongly relies on emergency support in periods of crisis. At this moment no commercial or government-subsidised insurance for adverse weather events is available in Estonia.
- Within the EU there are no RMI in use to cope with price risks. There was some experience in Spain with the use of RMIs for potato and strawberry prices, but these programmes were not carried forward to renewed modes or approaches. Insurers have never been ready to underwrite market risks.
- From the analysis, we can deduce that many instruments today exist not primarily because of the current political context, nor because of the current resilience of the sector. Rather, they are the product of the policies and sentiments of generations past. More specifically, the context at the time the instruments were designed and implemented. It seems to be far easier to introduce a new instrument supporting farmers than it is to take one away, which leads to a belief that these instruments are indeed primarily a product of the countries'historical circumstances and their learning process.
- From an economic point of view, subsidising insurance is not effective as it disturbs markets. However in the real world a long history exists of subsiding agriculture in different ways. This holds for the Western World (USA, Canada, EU). Reasons for this support differ in time and across countries and are not always triggered by crises.

Role of the government
- Within the EU the direct costs of notifiable diseases are indemnified by EU, national governments and in some countries (The Netherlands, Germany) also partly by farmers. The indirect costs such as production interruption can be commercially insured in some countries to a limited degree. In general the participation by farmers in these insurances is low.

- The role and involvement of national governments differs for adverse weather events and for notifiable diseases.
    - For adverse weather events government participation varies from ad-hoc relief in the case of crises to public-private insurance arrangements such as the subsidising of premiums and administrative costs.
    - For notifiable animal diseases, national governments have a role in pre-vention and eradication. In addition, part or all of farmers'direct losses are indemnified by EU and national governments.
- However we do see some trends among all countries that certainly seem to supersede any contextual differences between countries. While all countries have repeatedly expressed a desire to move away from a system of ad-hoc support as needed (due to its unpredictability and cost), the overriding trend is that support in the form of agricultural subsidies is still desirable. In the EU, this may be partially due to the process under the Common Agricultural Policy, whereas in the United States this appears to be a largely political process. Also important in this respect are the international agreements at the WTO level. But there is an undeniable tendency towards a (continued) publicly supported agricultural sector

Efficacy of RMIs
- The efficacy of non-subsidised private insurance instruments is, in general, low for farmers and government, mainly because of the low participation of farmers (hail and thunderstorms being an exception). In periods of crisis, governments often have to support the agricultural sector. Even with the highly subsidised public-private insurance schemes in the USA and Canada, political imperatives mean that the governments still spend substantial amounts on disaster relief for agriculture.
- The Spanish public-private system of multi-peril insurance is effective for farmers and national government but is potentially distorting, and crowds out other privately developed schemes. Most deficiencies encountered in publicly provided crop insurance have been successfully fought since the mid-1990s. However, premium subsidisation is high in percentage terms.
- From the point of view of social welfare, none of the schemes reviewed can be said to be 'optimal'. No public policy is optimal. It is clear that subsidising heavily is suboptimal from a social welfare (i.e. efficiency) point of view. Subsidising insurance systems is distortive due to the change in demand and supply for insurance services. Subsidising insurance results in an in-creased demand from farmers. If the commercial rates for crop insurances

are perceived as being too expensive by farmers it is questionable whether insurance is the proper risk management instrument.
- From the analysis of distortions, some arrangements are likely to be more socially efficient than others.
- The Canadian income systems (NISA and CAIS) are not effective. These systems have less negative distortions but farmers' behaviour does not meet expectations.

6.2 Recommendations

- The choice for any new system (or the revision of an existing one) is a political decision where efficacy, efficiency and distortions (see also table 5.1) must be weighed up. If subsidies are involved, special attention should be given to limiting the potential efficiency losses due to negative distortions
- Government should focus on the correlated risks and should offer opportunities for private sector insurers to introduce products that pay indemnities on individual farm losses (almost uncorrelated losses).
- An interesting addition to this study would be to evaluate the third major stakeholder in risk management: the insurance companies. This was not part of the scope of this study, yet getting them involved in this may offer new opportunities and insights. Questions such as: 'What would move the insurance companies to offer certain types of insurance?' could be very helpful in determining the most appropriate policy when the need for RMIs by the sector is also taken into account. Actuaries at the major insurers have a keen eye for the existing markets, and are able to help determine where the greater chances are.
- In practice RMI are more successful (better participation) if they are subsidised. Furthermore, there is an increasing trend in the willingness of governments to support RMIs. So not only efficiency reasons, but more political reasons are the basics of these decisions. If subsidised RMI are developed, the focus should be on minimising the distortions. However, the risks of large, extensive crises are not insured. It is even the question whether insurance companies can insure them. From this, it can be concluded that the agricultural sector needs a last resort. The government should acknowledge and anticipate that.
- The case studies suggest that ad-hoc support of national governments will remain important in times of crises. To the Dutch government, the recommendation can be made to incorporate ad-hoc relief in its policies, for example by the reservation of financial resources. Furthermore, if the Dutch

government wishes to support farmers suffering from a crisis by means of an institutional ad-hoc relief instrument, this could be conditional upon the farmer's participation in a given private or public-private insurance scheme. This reduces the risk of adverse selection.

References and websites

AAFC (Agriculture and Agri-Food Canada) (2006). Section II: analysis of performance. Departmental Performance Report 2005-2006.

AAFC (2008). 'Growing Forward: Toward a new agricultural policy framework. www4.agr.gc.ca/AAFC-AAC/ (Accessed March 13, 2008).

Aguado Manzanares (2007). S. y A. Garrido. 'Valoración de un seguro agrario mediante opciones reales: Aplicación al Seguro de Ingresos en Patata en España'. *Revista de Economía Aplicada*, aceptado 2007.

Arrow, K.J. (1992). Insurance, risk and resource allocation. In: Dionne, G. and S.E. Harrington (Eds), *Foundations of Insurance Economics*, Readings in Economics and Finance. Heubner International Series on Risk, Insurance, and Economic Security. Kluwer Academic Publishers Group, Dordrecht, pp. 220-229.

Arrow, K.J. (1996). The theory of risk-bearing: small and great risks. *Journal of Risk and Uncertainty* 12:103-111.

Barnett, B.J. (1999). USA Government natural disaster assistance: historical analysis and a proposal for the future. *Disasters: the Journal of Disaster Studies, Policy and Management* 23:139-155.

Barnett, B. J., J. R. Black, Y. Hu, and J.R. Skees (2005). 'Is Area Yield Insurance Competitive with Farm Yield Insurance?' *Journal of Agricultural and Resource Economics,* 30 (2005): 285-301

Bator, F. M. (1958). The anatomy of market failure. *The Quarterly Journal of Economics* 72(3):351-379.

Baquet, A. E. and J. R. Skees (1994). 'Group Risk Plan Insurance: An Alternative Management Tool for Farmers.' *Choices: The Magazine of Food, Farm, and Resource Issues* 9(1994): 25-28.

Berg, E. (2002a): Assessing the Farm Level Impacts of Yield and Revenue Insurance: An Expected Value-Variance Approach. Contributed paper at the Xth Congress of the European Association of Agricultural Economists (EAAE), August 28-31, 2002, Zaragoza, Spain. Online at: www.lbwl.uni-bonn.de/pu/Forschung/Publikationen/EAAE_Berg.pdf.

Berg, E. (2002b): Das System der Ernte- und Einkommensversicherungen in den USA - ein Modell für Europa? Berichte über Landwirtschaft, 80(1): 94-133.

Berg, E. and J. Kramer (2008). Policy options for risk management. In: Meuwissen, M.P.M., M.A.P.M. van Asseldonk and R.B.M. Huirne, R.B.M., *Income stabilisation in European agriculture: design and economic impact of risk management tools*, Wageningen Academic Publishers, Wageningen, in press.

Bielza, M., Garrido, A. y J.M. Sumpsi (2007). 'Finding optimal price risk management instruments: The case of Spanish Potato sector'. *Agricultural Economics* 36(1): 67- 78. 2007

Bielza, M., Garrido, A. y J.M. Sumpsi (2007). Feasibility of a Cash Forward Contract: An Application to the French and Spanish Potato Sectors. *Agribusiness: an International Journal* 23(2) :245-261. 2007.

Browne, W.P., J.R. Skees, L.E. Swanson, L.E., Thompson and L.J. Unnevehr (1992). Sacred cows and hot potatoes. Agrarian myths in agricultural policy. Westview Press.

Brunner, K. (1976). The 1976 Nobel Prize in Economics. *Science*, New Series, 194, 594-596+648.

Cafiero, C., F. Capitanio, A. Cioffi and A. Coppola (2005). *Risks and crisis management in agriculture.* European Parliament document, IP/B/AGRI/ST/2005-30.

Cafiero, C. (2008). Epilogue. In: Meuwissen, M.P.M., M.A.P.M. van Asseldonk and R.B.M. Huirne, R.B.M., *Income stabilisation in European agriculture: design and economic impact of risk management tools*, Wageningen Academic Publishers, Wageningen, in press.

Chen, K. Z, and K. D. Meilke (1996). 'A Reevaluation of Canada's Safety Net Programs for Agriculture.' *Canadian Journal for Agricultural Economics, 44* (1996): 361-368

Coble, K. H. (1995). Canada's NISA program: a strategy for stabilising farm income. *Agricultural Outlook*, May 1995.

Coble, K. H., and B. J. Barnett (2008). 'Implications of Integrated Commodity Programs and Crop Insurance.' Invited paper for presentation at the Southern Agricultural Economics Association Annual Meeting, Dallas, TX, February 2-6, 2008

Dismukes, R. and R. Durst (2006). Whole-farm approaches to a safety net. United States Department of Agriculture Economic Information Bulletin Number 15, June, 2006.

Doherty, N.A. (1997). Innovations in managing catastrophe risk. *Journal of Risk and Insurance* 64:713-718.

Edelman, M. A. (2000). 'Canadian Net Income Stabilization Accounts and Other Options for Achieving Counter-Cyclical Program Payments with Planting Flexibility.' National Commission on 21st Century Production Agriculture Staff Paper 333, January 28, 2000.

European Commission (2003a). The homepage of the European Commission. ec.europa.eu/agriculture/capreform/index_en.htm.

European Commission (2003b). Regulation (EC) No 1782/2002. Brussels: European Commission. eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2003R1782:20060101:EN:PDF. Accessed June 2008.

Farwick, J. (2006): Auswirkungen der EU-Agrarreform auf das Produktionsprogramm und die Produktionsintensität landwirtschaftlicher Unternehmen. Diploma Thesis, University of Bonn.

Fisher Boel, M. (2008), The CAP health check: straight ahead for responsive and sustainable farming, Presentation of the health check proposal to the COMAGRI, Strasbourg, 20 may 2008.

Georgiadis, N. (2008). Epilogue. In: Meuwissen, M.P.M., M.A.P.M. van Asseldonk and R.B.M. Huirne, R.B.M., *Income stabilisation in European agriculture: design and economic impact of risk management tools*, Wageningen Academic Publishers, Wageningen, in press.

Garrido, A. and Bielza, M. (2008). Evaluating EU risk management instruments: policy lessons and prospects for the future. In: Meuwissen, M.P.M., van Asseldonk, M.A.P.M. and Huirne, R.B.M. (eds*), Income stabilisation in European agriculture: design and economic impact of risk management tools*, Wageningen Academic Publishers, Wageningen, forthcoming.

Garrido, A., M. Bielza and J.M. Sumpsi (2002). The impact of crop insurance subsidies on land allocation and production in Spain. OCDE, AGR/CA/APM(2002)16.

Grand, J. (1991). The theory of government failure. *British Journal of Political Science*, 21, 423-442.

Halcrow, H. G. (1949). 'Actuarial Structures for Crop Insurance.' *Journal of Farm Economics* 21(1949): 418-443.

Hardaker, J. B., R. B. M. Huirne, J.R. Anderson and G. Lien, G. (2004). *Coping with risk in agriculture*, CABI Publishing, 2nd ed.

Harrington, S.E. and G.R. Niehaus (1999). *Risk management and insurance*. Irwin McGraw-Hill, New York.

Ipsos Reid (2001). 'NISA Review Consultations Report.' Agriculture and Agri-Food Canada (May 9, 2001).

Krugman, P., R. Wells and A. Myatt (2006). *Microeconomics*. Canadian Edition. Worth Publishers.

Meuwissen, M. P. M., R.B.M. Huirne and J.R. Skees (2003). Income insurance in European agriculture. *EuroChoices* 2:12-16.

Milgrom, P. and J. Roberts, 1992. Economics, Organization and Management. Prentice Hall, New Jersey, 621 pp

Miranda, M. J. (1991) Area-yield crop insurance reconsidered. *American Journal of Agricultural Economics* 73:233-242.

Miranda, M. and V. Vedenov (2001). Innovations in agricultural and natural disaster insurance. *American Journal of Agricultural Economics* 83:650-655.

Mussell, A. and L. Martin (2001). What future for agricultural safety net programs? *Canadian Journal of Agricultural Economics* 49:529-541.

Paulson, N. and B. A. Babcock (2007). Get a GRIP: should area revenue insurance be offered through the Farm Bill or as a crop insurance program?' Center for Agriculture and Rural Development Working Paper 07-WP 440, January, 2007.

Rejda, G.E., (1998). *Principles of risk management and insurance*. Addison Wesley.

Simone, M. and J. Harwood (1991). Canada's GRIP program: a boon for wheat producers? *Agricultural Outlook*, September, 1991.

RMA. (Risk Management Association, U.S. Department of Agriculture).

RMA 'Group Risk Income Protection.' Crop Policies Webpage, Accessed March 27, 2008a. www.rma.usda.gov/policies/GRIP.html

RMA 'Group Risk Income Protection (GRIP) Underwriting Rules (December, 2000).' Crop Policies Webpage, Accessed March 27, 2008b. www.rma.usda.gov/ftp/Policies/2001/grip/pdf/01_gripur.pdf

RMA 'Group Risk Plan.' Publications Webpage, Accessed March 27, 2008c. www.rma.usda.gov/pubs/rme/fsh_4.html

RMA 'FAQ: Group Risk Income Protection (March 22, 2007).' Group Risk Income Protection Help Webpage, Accessed March 27, 2008d. www.rma.usda.gov/help/faq/grip.html

RMA. 'Crop Revenue Coverage: Commodity Exchange Endorsement.' Mandatory Actuarial Document Endorsement, 04-CRC-CEE, October 29, 2003.

Skees, J. R. (1993). 'The Political Economy of a Crop Insurance Experiment.' Paper presented at Cornell University, October 14, 1993.

Skees, J. R., J. R. Black and B.J. Barnett (1997). Designing and rating an area yield crop insurance contract. *American Journal of Agricultural Economics* 79:430-438.

Skees, J.R. (1999a). Agricultural risk management or income enhancement? *Regulation: The Cato Review of Business and Government* 22:35-43.

Skees, J.R. (1999b). Opportunities for improved efficiency in risk sharing using capital markets. *American Journal of Agricultural Economics* 81:1228-1233.

Skees, J.R. and B.J. Barnett (1999). Conceptual and practical considerations for sharing catastrophic/systematic risks. *Review of Agricultural Economics* 21:424-441.

Skelton, C. and C.G. Turvey (1994). On the inclusion of hay in Ontario's Gross Revenue Insurance Plan: a target semivariance approach. *Review of Agricultural Economics* 16:321-333.

Stiglitz, J.E., 1974. Incentives and risk sharing in sharecropping. *Review of Economic Studies* 41:219-255.

Stokes, J. R., K. H. Coble and R. Dismukes (2000). Producer behavior in the presence of an income stabilization program. *Agricultural Finance Review* 60: 33-59.

Van Wenum (2008) Quickscan mogelijkheden risicofinanciering van schade door Q-organismen in de glastuinbouw. VanWenum Advies mei 2008

Wright, B.D., (2006). Why government crop insurance? In: C. Cafiero and A. Cioffi (eds),Income stabilization in agriculture, the role of public policies, Edizioni Scientifiche Italiane, pp 7-10.

Wu, J. (1999). Crop insurance, acreage decisions, and nonpoint-source pollution. *American Journal of Agricultural Economics* 81:305-320.

Zahniser, S., E. Young and J. Wainio (2005). Recent agricultural policy reforms in North America. United States Department of Agriculture Report WRS-05-03, April, 2005.

Appendix 1
Subject index

This subject index is not a list of scientific definitions of the subjects. The goal is to explain the meaning of these subjects as used in this research.

1. Adverse selection
Anti-selection, or negative selection is a term used in economics, insurance, statistics, and risk management. On the most abstract level, it refers to a market process in which 'bad' results occur due to information asymmetries between buyers and sellers: the 'bad' products or customers are more likely to be selected. A bank that sets one price for all its current account customers runs the risk of being adversely selected against by its high-balance, low-activity (and hence most profitable) customers. Two ways to model adverse selection are with signalling games and screening games.

2. Agency problems
In political science and economics, the *principal-agent problem* or *agency dilemma* treats the difficulties that arise under conditions of incomplete and asymmetric information when a principal hires an agent.

3. Asymmetric information
In economics and contract theory, an *information asymmetry* (or state of *asymmetric information)* is present when one party to a transaction has more or better information than the other party. Most commonly, information asymmetries are studied in the context of principal-agent problems. Information asymmetry deals with the study of decisions in transactions where one party has more or better information than the other. This creates an imbalance of power in transactions which can sometimes cause the transactions to go awry.

4. Chain contracts
Chain contracts are legal contracts between members in the food chain where parts of the transaction are regulated for a longer period (more than one transaction). Parts of the transaction are quantity, quality, mean price, price reduction, time of delivery. In practice there is a huge variation among chain contracts. By chain contracts parts of the price risks can be decreased.

5. Crop insurance

A contract of indemnity by which, for a specified premium, one party promises to compensate another for the financial loss incurred by the destruction of agricultural products from the forces of nature, such as rain, drought, hail, frost, or insect infestation.

6. Crowding-out

In economics, *crowding out* theoretically occurs when the government expands its borrowing to finance increased expenditure, or cuts taxes (i.e. is *engaged* in deficit spending), *crowding out* private sector investment by way of higher interest rates. Also in the area of risk insurance a governmental subsidy crowds out other private initiatives to insure the same risk.

7. Derivatives

Derivatives are financial instruments whose value changes in response to the changes in underlying variables. The main types of derivatives are futures, forwards, options and swaps.

8. Distortion

A *distortion* is the alteration of the original shape (or other characteristic) of an object, image, sound, waveform or other form of information or representation. Distortion is usually unwanted. In this report a distortion is defined as the negative side-effects of a certain RMI.

9. Efficacy

Efficacy is the ability to produce a desired amount of the desired effect or success in achieving a given goal, in the current study efficacy is used in a qualitative and quantitative way.

10. Equity

Equity capital is defined as the amount of capital provided by the company's owner(s). This differs from debt capital which requires business owners to pay interest and principal payments to the debt financier at set intervals. Providing new equity (an 'issuance' of new equity) gives the firm new capital and increases owners' equity by the same amount and time needed. An issuance of new shares, to raise new capital, increases shareholders' equity. Formally, owners' equity is also a form of liability, but is deemed separate and different from other liabilities since it is a residual interest, ranked last in the series; equity is generally considered to be an asset.

11. Excessive risk exposure
Excessive risk exposure means that an policyholder takes more risks because (s)he is insured. Examples are crop production in areas with low rainfall.

12. Future contracts
A futures contract is a standardised contract, traded on a futures exchange, to buy or sell a certain underlying instrument at a certain date in the future, at a specified price.

13. Hail insurance
Coverage against hail damage to crops. Coverage is on a proportionate basis; that is, in the event of loss, a farmer will recover an amount based on the ratio of the damaged part of a crop to the entire crop.

14. In-between risks
In-between risks are risks which are neither fully uncorrelated (like hail and thunderstorms) nor fully correlated like market prices. Examples of in-between risks in agriculture are floods, excessive rainfall.

15. Livestock insurance
Coverage for designated horses and other farm animals if they are damaged or destroyed. The insurance includes registered cattle and herds, other farm livestock, and zoo animals. This type of insurance protects the farmer or rancher against the premature death of animals resulting from natural causes, fire, lightning, accidents, and acts of God, acts of individuals other than the owner or employees, and destruction for humane purposes.

16. Loss Ratio
Ratio of losses (indemnity paid) to earned premiums

17. Misreporting
Misreporting is a kind of fraud used by some insurers to get more indemnity from the insurers.

18. Moral Hazard
Moral hazard is the prospect that a party insulated from risk may behave differently from the way it would behave if it were fully exposed to the risk. Moral hazard arises because an individual or institution does not bear the full consequences of its actions, and therefore has a tendency to act less carefully than it

otherwise would, leaving another party to bear some responsibility for the consequences of those actions. For example, an individual with insurance against automobile theft may be less vigilant about locking his car, because the negative consequences of automobile theft are (partially) borne by the insurance company.

19. Multiple-peril insurance

Policy that incorporates several different types of property insurance coverage, such as flood, fire, wind, etc. In its broadest application, the term is synonymous with *all-risks insurance,* which covers loss or damage to property from fortuitous circumstances not specifically excluded from coverage.

20. Notifiable animal diseases

Notifiable disease is any disease that is required by law to be reported to government authorities. This collation of information allows the authorities to monitor the disease, and provides early warning of possible outbreaks. Many governments have enacted regulations for reporting of both human and animal (generally livestock) diseases.

21. Pooling of risks

A risk pool is a method used by insurance companies to reduce their exposure to sudden and severe losses caused by large-scale catastrophic events.

22. Private initiatives

Private initiatives are initiatives fully organised by the market (without governmental interference and without subsidies).

23. Rent seeking and capitalisation

Rent seeking occurs when an individual, organisation or firm seeks to make money by manipulating the economic and/or legal environment rather than by trade and production of wealth. Rent seeking generally implies the extraction of uncompensated value from others without making any contribution to productivity, such as by gaining control of land and other pre-existing natural resources, or by imposing burdensome regulations or other government decisions that may affect consumers or businesses. While there may be few people in modern industrialised countries who do not gain something, directly or indirectly, through some form or another of rent seeking, rent seeking in the aggregate may impose substantial losses on society.

24. Resilience

Resilience is to the capacity to endure stress and bounce back, the capacity that may be available to given farms at some times and not others, under some threats not others. *Survivability* is the quantified ability of a system, subsystem, equipment, process, or procedure to continue to function during and after a natural or man-made disturbance;

25. Revenue insuranc

A contract of indemnity by which, for a specified premium, one party promises to compensate another for the financial loss incurred by the destruction of agricultural products from the forces of nature, such as rain, hail, frost, or insect infestation and *or* by low prices.

26. Socially efficient

Efficiency regarded from a society. RMls are defined as socially efficient if it makes at least one individual better off, without making any other individual worse off.

27. Systemic risks

Systemic risk is a specific term used in finance, it means the market risk or the risk that cannot be diversified away, as opposed to 'idiosyncratic risk', which is specific to individual stocks. It refers to the movements of the whole economy. Even if we have a perfectly diversified portfolio there is some risk that we cannot avoid and this is the systemic risk. However, the systemic risk is not the same for all securities or portfolios. Different companies respond differently to a recession or a booming economy. For example, think of the automobile industry compared to the food industry in case of a recession. Both of them will be affected negatively but food industry not as much as automobile industry.

In insurance it is difficult to obtain financial protection against 'systemic risks' because of the inability of any counter-party to accept the risk. For example it is difficult to obtain insurance for life or property in the event of nuclear war. The essence of systemic risk is therefore the correlation of losses.

28. Transaction costs

A *transaction cost* is a cost incurred in making an economic exchange. For example, most people, when buying or selling a stock, must pay a commission to their broker; that commission is a transaction cost of doing the stock deal.

29. Weather insurance

Business interruption insurance in which the insured is indemnified for loss of earnings and payment of expenses resulting from adverse weather conditions. For example, if a fair, horse race, or boxing match is rained off, this can cause a substantial loss of money for a promoter who may have spent huge sums in advance of the event for rental, advertising, and site conditioning. However, the policy does not cover damage to property because of rain.

30. Yield insurance

A contract of indemnity by which, for a specified premium, one party promises to compensate another for the physical loss incurred by the destruction of agricultural products from the forces of nature, such as rain, drought, hail, frost, or insect infestation.

Sources

www.answers.com/library/Insurance%20Dictionary-cid-10097905
en.wikipedia.org/wiki

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